Providing optimal model for water resources management based on trade approach in virtual water

Nima Tavakoli Shirazi *[1], Gholam Hossein Akbari [2]

[1.] M.Sc. Civil Engineering Student, International Campus of University of Sistan and Baluchestan, Chabahar, Iran, P.O. Box 1946953316
Email: n.tavakoli.sh@mail.usb.ac.ir
[2.] Assistant Professor, Department of Civil Engineering, Faculty of Engineering, University of Sistan & Baluchestan, Zahedan, Iran, P.O. Box 98164-161
Email: gakbari@hamoon.usb.ac.ir

Abstract: This study explores the relationship that is between water resource management and virtual in terms of maximization to get the best desired results. Water resource management is defined as the process of ensuring that the water resources are not misused and depleted. On the other hand, virtual water is defined as the amount or volume of water that is required for the production of a given commodity or service, though it is widely employed in relation to water needed for the production of agricultural produces. The study aims at coming up with a model that can maximize water resource management in relation to virtual water. This will help in answering the research questions. The study will mainly employ the use of secondary data collection methods. The nature of the study required the application of the inductive approach to research, and come up with the accurate and relevant information. This will be the best method as the collection of primary data would be impractical because of visiting all the regions that are arid and semi-arid. The findings show that the adoption of virtual water concept is highly significant, regarding the conservation of water resources in the areas that are highly affected by water scarcity. It also promotes trade and the specialization in the production of products that are best suited for the conditions in a given country.
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1. Introduction

The current water crisis is largely based on the exploitation of water resources without any consideration into the use of agriculture, domestic and industrial use. In many different areas, both the ground and surface water have disappeared thus; there is an impendent danger of global water crisis which will lead to undesired effects unless it is properly managed. This study is going to focus on how water and its resources, can be managed to use a conceptual model based on trade approach in virtual water. Water resources can be defined as sources of water that are considered to be potentially useful or non-useful. Therefore, water resource management can be defined as the process of ensuring that the water resources are not misused and depleted (Chapagain, 2006).

The virtual-water content of a given commodity is made of three components, these include; blue, green and grey components. The green component in relation to virtual water content of a given commodity is said to be the amount of rainwater, which may have evaporated during the process of production (Ramirez-Vallejo, 2004). This is primarily associated with agricultural products, and refers to the overall rainwater evaporation while the products were still growing in the fields (Rijsberman, 2006). Moreover, it also includes transpiration and any other type of evaporation that is experienced by the plants.
The blue component in relation to virtual water content of a given commodity is said to be the amount of ground or surface water, which evaporated during the production process of the product. In relation to crop production, it can be said to be the overall evaporation of water used for irrigation in the fields, in the artificial storage reservoirs and the irrigation canals. On the other hand, in relation to domestic water supply and industrial production, the blue water content is considered to be equal to the water that was drawn from surface or ground water and evaporated (Wichelns, 2005).

The grey component in relation to virtual water content of a given commodity is said to be the amount of water that is polluted during the process of production. It is arrived at by calculating the amount of water that is needed to dilute the pollutants, which are emitted to the natural water system at the time of production to a given point where the quality of water remains at a state that is over the minimum standards of water quality (Lenzen, 2002).

This study seeks to determine an optimal model and its concept in relation to water resources

management based on trade approach, in virtual water mainly in the countries that have scarcity of water. According to the study it is evident that water crisis has been a paramount concern and this resulted in the establishment of virtual water. This was largely based on some of the countries that largely depend on the importation of food because there is no adequate water to provide for food production. Therefore, it is essential to come up with a model that can maximize the aspect of water resource management in relation to virtual water globally.

2. Research methodology

Saunders viewed research as a method of collecting information in a systematized manner with the objective of increasing knowledge. This definition emphasize on systematic manner of inquiry into the unknown. This is among the prime pillars of scientific research. To establish this systematic manner, there needs to be a methodology of carrying out a research project. Methodology is the theory of how research should be conducted. This explores the procedure of a research activity, the scientific principles that inform the research activity and strategies that are employed to objectively answer the research questions. The data involved in this research is of qualitative and qualitative nature.

There are various methods adopted for each type of data while in certain cases, a mixed approach has been adopted. The researcher noted that there was little practicality in collecting primary data this being in a sense that it would take an extremely long period of time and money. Also, it might end up leading to biased data or information since the work would be done in a hurry so as to save time. Therefore, researcher had to largely rely on secondary data.

2.1 Data collection

As earlier stated, this study will primarily rely on secondary data. The data was mainly used to evaluate how a conceptual model can enhance water resource management in relation to virtual water. Publication on the conceptual aspect of virtual water trade in relation to dealing with the challenge of water crisis will also be used to evaluate what possible solutions that can be adopted by countries which are facing water scarcity. This will also come up with ways of optimizing the given situation that they are in without overlooking any aspect.

This study in its effort to achieve its set objectives it had to apply the use of various data sources, which were available in relation to coming up with a conceptual model that would fully optimize the aspect of water resource management in relation to virtual water. The various sources came largely from secondary data so as to help in coming up with the necessary knowledge and information that is based on the subject of the research. These sources included government and international organizations publications. The researcher analyzed different and numerous number of publications mainly by other scholars, world bank and the united nations in relation to water scarcity.

3. Research objectives and focus issues

1. To explain how an optimal model for water resource management and its application to the aspect of virtual water works
2. To explain how the importance of water resource management in relation to trade approach in virtual water trade affects countries
3. To explain how to come about with the best way to maximize virtual water in countries that are highly affected by water crisis
4. To explain why virtual water is significant

4. Research questions

1. How has the significance of virtual impacted the world in relation to water crisis?
2. Why is having a model that optimizes water resource management in relation to virtual water important?
3. How can virtual water be best put into use to help in dealing with water crisis?

5. Research hypothesis

The research hypothesis in this study is; how can the best conceptual model that can maximize the effect of water resource management in relation to virtual water trade be put into use?

Type of relationship / Variable	Negative relationship	Positive relationship	Lack of relationship
Virtual water trade and water resource management		Has a positive relationship that results in better use of water and taking care of the water sources.	
Virtual water and arid and semi arid regions	Are highly dependent on the virtual water trade	Results in the saving of water and the production of food that does not take up much water.	

6. Literature Review

Since the establishment of the concept of virtual water, there have been numerous studies, debates and research conducted on the subject. Virtual water is considered to be both politically silent and economically invisible (Neubert, 2008). Hence, this is believed to have made it possible in the past for countries which have water scarcity to be able to deal with water shortage by importing food from other countries with better water resources without the establishment or development of a policy discourse that is directly linked to national water scarcity (Bouwer, 2000).

The term virtual water is believed to have been developed in mid 1990s and has over the years received considerable attention among scientific communities, policy makers and the general public (Zimmer, 2003). The debates on virtual water are highly intense and largely focus on the importance of the concept of virtual water, and the feasibility of importing virtual water to deal with the issue of local water scarcity.

According to Yang (2002), the volumes of overall cereal import in countries which are in the southern Mediterranean were correlated inversely to the available water resources. For instance, in countries such as Libya and Israel where water resources is highly scarce, an estimate of over 90 percent of the domestic supply of cereals is largely based on importation (Craswell, 2007). According to Allan (2011), over the past few decades, there have been numerous challenges that come up in relation to management and allocation of water mainly in the semi-arid and arid regions, where the demand for water regarding social uses and economic uses has been on the rise.

A given nation can preserve its domestic or local water resources through the importation of product that are considered to be water intensive, rather than trying to produce them domestically (Gleick, 2002). These methods of water saving can be employed in the production of alternative, higher value agricultural products, to promote environmental services or to deal with some of the other growing domestic needs (Ioris, 2005). Over the recent years, the concept of virtual trade water to help deal with water scarcity in countries which are affected by this has gained recognition, both in the political aspects and in the scientific aspects (Hoekstra, 2005).

However, there are some scholars who believe that the idea of the concept is highly ambiguous and thus; should be worked on more critically. This is in the sense that the concept varies between an analytical, descriptive concept and a political influenced strategy. In relation to being an analytical concept, virtual water trade refers to an instrument or tool that creates room for the assessment and identification of policy options that are not only based on the scientific aspects, but also in the political aspect (Fraiture, 2003). On the other hand, in relation to a political influenced strategy, it raises questions as to whether virtual water trade can be established in a manner that is considered to be sustainable, whether the establishment can be managed in an ecological, economical and social manner, and which are the countries that the concept of virtual water provides a meaningful option (Rockstro¨m, 2001).

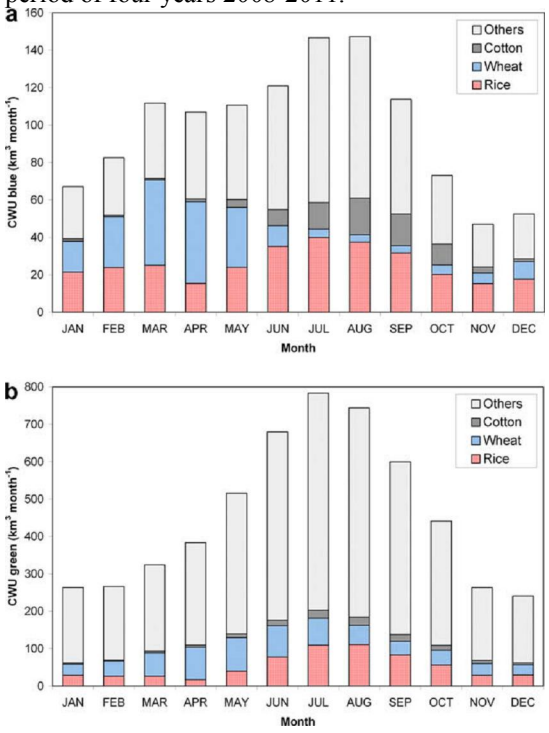
The virtual water measures are believed to have some of the following demerits; it relies too much on the given assumption that all the water resources such as rainfall or irrigation system have the same value (Falkenmark, 2006). It does not act as an indicator of potential harm to the environment, or does not give any form of information of whether the water resources are being employed within sustainable limits of extraction (Rahman, 2008). Another limit is that it is based on the assumption that the volume of water that would be saved by reducing a high water use activity can be used in other activities that require less water (Merrett, 2003).

7. Findings

Virtual water volume and crop water productivity are both directly and indirectly linked to crop water usage in relation to crop production in different parts of the world. This has in turn resulted in dependence largely on the given fraction of crop biomass that can be produced or harvested and is usually termed as harvest fraction. Crops that are considered to have a huge harvest fraction such as fodder grasses, forage crops, sugar beets and sugar cane have low virtual volume and huge large crop water productivities. This shows that there is a direct relationship between the two concepts. On the other hand, crops that have low harvest fraction such as spices, coffee or cocoa have large virtual water volumes and low crop water productivities.

Countries that have challenges of water scarcity through the global crop water model have shown to rely largely on virtual water trade for food production. The significance of virtual water trade has helped in the coming up with crops that can be grown in areas that have water scarcity, and these has in turn ensured that water resource management is effective and efficient. Different crops have different water usage in relation to their production. The global crop water model has acted as a guiding tool in distinguishing these crops, and has proved to be the best in relation to water resource management. In addition to this it has helped in the great promotion of the concept of virtual water.

The graph below shows the global average monthly consumption of water use in relation to blue water and green water top and bottom respectively regarding crops such as cotton, wheat and rice in km2 in accordance to the global crop water model for a period of four years 2008-2011.



8. Conclusion

The semi-arid and arid areas in relation to water scarcity have been a topic that has brought about numerous debates on how best to come up with a solution, which will ensure they get water and methods of how to manage their water resources. Having the knowledge and understanding of the concept of virtual water and its value is critical. Through the use of the global crop water model the concept of virtual water has greatly been improved, but there is still question of how best the model can be improved to more efficient and effective to both developed and developing countries.

Differentiating the water consumption and usage of crops has acted as the guiding principle in the effective application of virtual water trade. In addition to this, it has largely been based on different models that are applied in association with the concept of virtual water trade. Currently the model of global crop water is proving to be the most effective in terms of optimizing the aspect of water resource management, and is being adapted by many of the countries globally.

Corresponding Author:
Nima Tavakoli Shirazi
M.Sc. Civil Engineering Student, International Campus of University of Sistan and Baluchestan, Chabahar, Iran, P.O. Box 1946953316
E-mail: n.tavakoli.sh@mail.usb.ac.ir

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