VIRTUAL WATER THE CHALLENGE OF EGYPT WATER MANAGEMENT PLANS

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ABSTRACT

Virtual water refers to the volume of water needed to produce crops, vegetables, fruits and animal meat production, or service. So, trade in virtual water means the amount of water 'embedded' in the above-mentioned goods and transported from one place to another as a value of trade. Data on agricultural water use in Egypt are not precise and often contradictory. In 2010, total water withdrawal was estimated at 78 billion cubic meters, including 67 billion cubic meters for agriculture (86%). Virtual water must be the limiting factor in water policy management especially in agriculture sector, because it alone consumes the majority of the water resources in Egypt, and if it can be reduced to about 50%, there will be about 20 billion cubic meters of water saved annually.

This has brought about flawed estimates of virtual water 'flow', thereby limiting the usefulness of the virtual water concept as a tool for informing water policy. These can be conducted through replacement of heavy water consumption crops by low water consumption once totally or partially, as well as decrease the large animals breeding with the poultry production. In this paper, an example of Waste of Piece of bread per day for each family in Egypt leading to a crisis in water as well as economy.

Keywords: virtual water, water footprint, global virtual water, water resources, bread

1 INTRODUCTION

Water is one of the most important natural resources globally. The increase in water use was twice faster than that of population throughout the last century FAO and UN (2007). The future increase by 2025, is estimated to be about 50% in the developing countries, while it will be only 18% in the developed countries (WWAP 2006).

What about a meal composed of a mug of cola or beer and a burger sandwich with egg and cheese, you just consumed enough water to fill a bathtub in your bathroom, it amounted about 2825 liters most of this water came from faraway places in form of imported goods.

(Allan 1993) proposed the concept of virtual water and defined it as the water resources consumed in the cultivation of crops or production process of commodities.

Before proposing concept of Virtual Water, Embedded Water was the concept of expressing the same idea, but it didn't draw attention, but the synonym of Virtual Water has now become a general concept in the economic science.

By the end of the 1990th, the concept of virtual water was pursued and proposed as a mechanism for economic transactions by selling virtual water in one production process through virtual water transactions to other areas.

Importing high water consuming yields from high water resources demand countries is a proposal to substitute the rising of food yields in the middle-east area could reduce the water scarcity in the

area. The efficient use of water resources helps to solve the problems of water resources distribution, yields, and economic security (Allan, 1997); (Allan, 1998).

The methodology to quantify the virtual water transaction for yields was proposed by Hoekstra and Hung (2003). Based on the irrigation and drainage references as well as crop yield data from FAO, a quantification model for the virtual water of crops was established, and the global virtual water of major crops in the transaction balanced areas were compiled. Yahia Elasraag (2015) find that the average feddan Productivity for wheat in Egypt was 7.06 ton/hectare (19.77 ardab/faddan)

The total amount of water that would have been required in the importing countries if all imported agricultural products were produced domestically is 2,407 billion cubic meters per year. These products where are, however, being produced with only 2,038 billion cubic meters per year in the exporting countries, saving global water resources by 369 billion cubic meters per year (Mekonnen and Hoekstra, 2011) . This saving is equivalent to 4% of the global agricultural production of 8,363 billion cubic meters per year).

2 PRESENT MODEL

2.1 Introduction

Complicated processes occurring during the preparation of the bread especially in the subsidized bread system. When a portion of this bread go directly to the trashcan directly, that means a huge amount of water wasted. Water "manly in our model" and other economic parameters.

In the present work a model which used for regulatory purposes is considered. Most of the techniques used in this model are based on data and assumptions common to subsidized bread system. These assumptions, number of families registered in the subsidized bread system and weight of loaf of bread, are constants. Therefore, type of flour, number of loaves per capita per day and extraction do not vary with along the study.

2.2 Model Assumptions, Data used in the study

Ministry of Supply & Trade (2017)
The following data and assumptions are used in the present model:
Number of families registered in the subsidized bread system = 17.071.434.16 family
Number of people using subsidized bread system through the supply cards = 68.968.594
Family size = 4.04 individual
Number of loaves/capita/day = 5 loaves Ministry of Supply & Trade (2015)
Number of baked loaves/100 kg wheat flour = 1.160.00 loaf
Weight of flour per loaf = 100 /1160 = 0.0862 kg = 86.206 g flour/loaf
Extraction rate = 82%
Wheat grain productivity = 2.97 tonne/faddan
Irrigation water (m^3)/faddan/season = 1962 m^3/faddan
Virtual water of wheat grains = 900 m^3/tonne
Local price of wheat grains/tonne = 4.666.67 LE/tonne
Global price of wheat grains/tonne = 161 $/tonne
Energy consumed/ton of bread = 551 kWh.

From Bakery sites specific energy consumption the average specific energy consumption (SEC) defined as ‘delivered energy per tonne of product produced for the sector (across all sites)’ is estimated to be 551 kWh per tonne of product for Fossil fuels (predominately gas) Industrial Bakery report (CTG034), which mainly used in the subsidized bread system in Egypt.

2.3 Data Studied:

Under assumption of bread loss rates during consumption valued as half loaf, one loaf, one and half loaf and two loaves per family per day, the following characteristics were estimated/calculated

- Number of lost loaves/day= number of families registered in subsidized bread system * bread loss rate. (1)
- Quantity of lost flour equivalent of lost loaves (tonne/day) = Number of lost loaves/day * weight of flour (86.206 g/loaf) Then converted to tonne/day. (2)
- Quantity of lost wheat grains equivalent of lost loaves (Tonne/day) = Quantity of lost flour equivalent of lost loaves (tonne/day) * (100/82). (3)
- Quantity of lost wheat grains equivalent of lost loaves (Tonne/year) = result of equation 3 * 360. (4)
- Land area equivalent of lost wheat grains (faddan/season) = result of equation (4) / wheat grain productivity (2.97) faddan/season. (5)
- Volume of irrigation water equivalent of lost wheat grains (m^3/season) = result of equation (5) * irrigation water (m^3/fad. /season) i.e. 1962 (m^3/fad. /season). (6)
- Virtual water equivalent of lost wheat grains (m^3) = result of equation 4 * virtual water of wheat grains, i.e. 900 m^3/tonne. (7)
- Value of local price equivalent of lost wheat grains (LE) = result of equation (4) * local price of wheat grains /tonne i.e. 4666.67 LE. (8)
- Value of global price equivalent of lost wheat grains (dollar $) = result of equation 4 * global price of wheat grains / tonne i.e. 161 $/tonne. (9)
- Energy lost equivalent of lost loaves (kWh) = (Energy consumed/ton of bread/number of loaves per tonne) * result of equation 1. (10)

3 RESULTS AND DISCUSSION

Table (1) show loss of bread and their equivalent loss of flour, wheat grains, land area, irrigation water, virtual water, local price, global price and energy, in case of losing half or one loaf per family per day.

Losing of half or one loaf per family per day from their daily ration of subsidized bread system caused losing of 8.535.717.08 and 17.071.431.16 loaves per day represents 0.0247 and 0.0495% of the daily bread production (344.842.970.00) respectively.

Table 1. loss of bread and their equivalent loss of flour, wheat grains, land area, irrigation water, virtual water, local price, global price and energy, in case of bread losing rate of half or on loaf per family per day

	half loaf/family/day	one loaf/family/day
Number of lost loaves	8,535,717.08	17,071,434.16
Quantity of lost flour equivalent of lost loaves (tonne/day)	735.84	1,471.68
Quantity of lost wheat grains equivalent of lost loaves (tonne/day)	603.39	1,206.77
Quantity of lost wheat grains equivalent of lost loaves (tonne/year)	220,236.22	440,472.43
Land area equivalent of lost wheat grains (fad/season)	74,153.61	148,307.22
Volume of irrigation of water equivalent of lost wheat grains (m3/season)	145,489,379.98	290,978,759.96
Virtual water equivalent of lost wheat grains (m^3)	198,212,595.66	396,425,191.31
Value of local price equivalent of lost wheat grains (LE)	1,027,769,748.64	2,055,539,497.28
Value of global price equivalent of lost wheat grains ($)	35,458,031.00	70,916,062.00
Energy lost equivalent of lost loaves (kWh)	405,446.56	810,893.12

These amounts of bread go nothing, that lesion expanded and causes immense impair such as quanity of lost flour equivalent of lost loaves which valued 735.84 and 1471.68 (tonne/day) in case of losing half and one loaf/family/day in respective order.

The previous amount of bread that went for nothing, could be converted into quantity of lost wheat grains as shown in Table (1), it amounted 603.39 and 12.6.77 tonne/day of wheat grains as well as it valued as much as 220.236.22 and 440.472.43 tonne/year in case of losing half or one loaf per family per day, respectively.

It's worthy to note that quantity of lost wheat grains equivalent of lost loaves (tonne/year), were produced from sowing wheat, but who many acreages were occupied by wheat plants? the land area equivalent of lost wheat grains was 74.153.61 and 148.307.22 faddan per season, in case of losing half or one loaf per family per day, (faddan = 4200 m^2) in the same order.

Under the view of limited water resources in Egypt, it's worth to conclude the volume of irrigation water equivalent of lost wheat grains. As shown in Table (1) that volume of lost irrigation water valued 145.489.379.98 and 290.978.759.96 m3 due to losing half or one loaf per family per day.

The concept of virtual water (VW) was introduced by Allan in (1993) [**Error! Bookmark not defined.**] as an economic tool for assessing the globalization of water resources through trade (Allan 1977), (Allan 1998). Regarding the virtual water equivalent of lost wheat grains, Table (1) sustained that it valued as much as 198.212.595.66 and 396.425.191.31 m^3 in case of losing half or one loaf per family per day, along a year.

From the money point of view, losing bread disclose value of both local and global price equivalent of lost wheat grains which valued 1.027.769.748.64 and 2.055.539.497.28 LE, as well as 35.458.031.00 and 70.916.062.00 $ due to losing half and one loaf per family per day, respectively.

Losing of minor portion of the family daily ration of subsidized bread system was concomitant with losing energy, which used in bread making and baking processes. Energy lost equivalent of lost loaves amounted to 405.446.56 and 810.893.12 kWh, in case of losing half or on loaf per family per day all over one-year Table (1).

Loss of bread and their equivalent loss of flour, wheat grains, land area, irrigation water, virtual water, local price, global price and energy in case of bread losing rates of one and half loaves or two loaves per family per day, are presented in Table (2).

Results in Table (2) show that, loss of one and half loaves or two loaves per family per day, caused losing of 25.607.151.24 and 34.142.868.32 loaves per day. That amounts of daily lost loaves represents 0.074 and 0.099 % of daily bread production 344.842.970.00 loaves/day, in the same order.

Table 2. loss of bread and their equivalent loss of flour, wheat grains, land area, irrigation water, virtual water, local price, global price and energy, in case of bread losing rate of one and half or on two loaves per family per day

	One & half loaf/family/day	tow loafs/family/day
Number of lost loaves	25,607,151.24	34,142,868.32
Quantity of lost flour equivalent of lost loaves (tonne/day)	2,207.51	2,943.35
Quantity of lost wheat grains equivalent of lost loaves (tonne/day)	1,810.16	2,413.55
Quantity of lost wheat grains equivalent of lost loaves (tonne/year)	660,708.65	880,944.87
Land area equivalent of lost wheat grains (fad/season)	222,460.83	296,614.43

Volume of irrigation of water equivalent of lost wheat grains (m3/season)	436,468,139.93	581,957,519.91
Virtual water equivalent of lost wheat grains (m^3)	594,637,786.97	792,850,382.63
Value of local price equivalent of lost wheat grains (LE)	3,083,309,245.92	4,111,078,994.56
Value of global price equivalent of lost wheat grains ($)	106,374,093.00	141,832,124.00
Energy lost equivalent of lost loaves (kwh)	1,216,339.68	1,621,786.25

These amounts of bread go for nothing, that lesion expand and causes immense impair as quantity of lost flour equivalent of lost loaves which amounted to 2207.51 and 2943.35 tonne per day due to losing one and half or two loaves per family per day, respectively.

Egypt, a country with a 104 million people, is mostly arid and semi-arid, in addition water resources are limited, from that point of view, it is worth to know the volume of irrigation water equivalent of lost wheat grains. As recorded in Table (2), that volume of lost irrigation water valued as 436.468.139.93 and 581.957.519.91m^3 when one half and two loaves were lost per family per day, through a year, in respective order.

Virtual water was defined as the amount of water used to produce a given good or service. Table (2) show the virtual water equivalent of lost wheat grains, it valued 594.637.786.97 and 792.850.382.63 m^3 in case of losing one half and two loaves per family per day, throughout the year.

From the money point of view, losing bread disclose the value of both local and global prices equivalent of lost wheat grains which valued as much as 3.083.309.245.92 and 4.111.078.994.56 LE, as well as 106.374.093.00 and 141.832.124.00 $ due to losing on half and two loaves per family per day, throughout a year, in respective order.

Making and baking bread processes consumes energy, so losing minor portion of the family daily ration of subsidized bread system resulted in losing energy. Energy equivalent of lost loaves amounted to 1.213.339.68 and 1.621.786.25 kWh, in case of losing on half and two loaves per family per day, throughout a year in the same order, Table (2).

4 CONCLUSIONS AND RECOMMENDATIONS

Virtual water is a measure of the aggregate water utilized as a part of generation of a decent or administration. In a few quarters the advancement of virtual water gauges has been elevated to manage arrangement creators' choices on these issues. Be that as it may, as this paper illustrates, the virtual water idea offers no compelling direction to arrangement producers with respect to either water utilize effectiveness, or the maintainability of water utilize.

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