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Turkish Virtual River in Kurdistan Region-Iraq

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Abstract

Growth of population and increased demand on food and water in arid areas like the Middle East is a chronic problem. To overcome water shortage many countries depend on imported virtual water. Kurdistan region, however, is a unique case. The region has more than 30BCM of fresh water for six million people, but it is importing huge amount of virtual water. Turkey has found it's the best and the nearest market for its virtual water exports in Kurdistan region and South Iraq. The aim of this work is to find the size of imported virtual water into Kurdistan market, Turkey contribution to this market and water footprint in Kurdistan region. Methods of analysing, comparing and description were used. The paper has found that Turkey is reducing water flow of Rivers to Kurdistan region and South Iraq; In contrast, it increases virtual water exports into those two markets. The paper has shown that annually Turkey exports about 7.5 BCM of Virtual water into Kurdistan region-Iraq. In addition, the value of each cubic meter of imported virtual water from Turkey has been estimated. And finally, the paper has explored the volume of water footprint-per person in Kurdistan region which is the third highest in the world. This paper can be mentioned as a first step toward scientific work on virtual water, its value and water footprint in Kurdistan region and Iraq.

Keywords: Kurdistan Region-Iraq, Turkey, Virtual Water, Water, Water Footprint, Water security, Virtual water Trade & River

Introduction

Water scarcity is threatening the life of millions of people in the world, especially in the arid areas like the Middle East. Virtual water trade, however, can provide alternative water resource; enhance environment and food/water security. According to Bacon (2018) the MENA region imports 173BCM/Y of virtual water that is equal to 12% of the global virtual water trade. Even some scholars believe, Virtual water trade can make this region be more stable, the food could be abundant.

Kurdistan region of Iraq, however, does not have in water scarcity problem. It has more than 30BCM/Y of available fresh water (KARSO, 2013). It is the richest region for water availability per person in the MENA. Water availability per person in Kurdistan region is about 5800CM/Per-Cap/Year (Hawrami, 2014). Secure water availability per person in Kurdistan is 3267CM/Y. The strange point is that Kurdistan region is mainly depending on Virtual water import to secure its food demand, especially from Turkey. According to officials, Turkey covers 75% of food market demand in Kurdistan region and part of Iraq. My math processes explains that each person in Kurdistan region consumes 1658CM/Y of imported virtual water; whereas, this number in the MENA region level is 700CM/Y (Roson and Sartori, 2015). The cost of each cubic meter of imported virtual from Turkey to Kurdistan region is 1.2$.

This study can be mentioned as a pioneer study about virtual water and water footprint in Kurdistan region, or at least it the first step in this direction. The aim of this work is to explain the

amount of virtual water that is being imported into Kurdistan region and part of south Iraq market, especially from Turkey. In addition, the paper tries to find, water footprint in Kurdistan region. Methods of analysing, comparing and description will be used. In this work, data from the governmental bodies were being used, and many stakeholders have been interviewed. Tables and Figures are giving clear explanation about topics. Firstly, a background about Virtual water and its trade in the Middle East will be explained, then data of imported virtual water to Kurdistan region is going to be showed, then the data will be analysed and compared; and finally, water footprint in Kurdistan region will be discussed.

Methodology

Study Area

Kurdistan Region is an autonomous region in Iraq; it is situated in the North of Iraq. See Figure 1.The total size of the region is 40,643 square kilometers, larger than the Netherlands, and four times the area of Lebanon (KRG 2019). It mainly covered by the mountains in the North and North East and with planes in the South and South West.

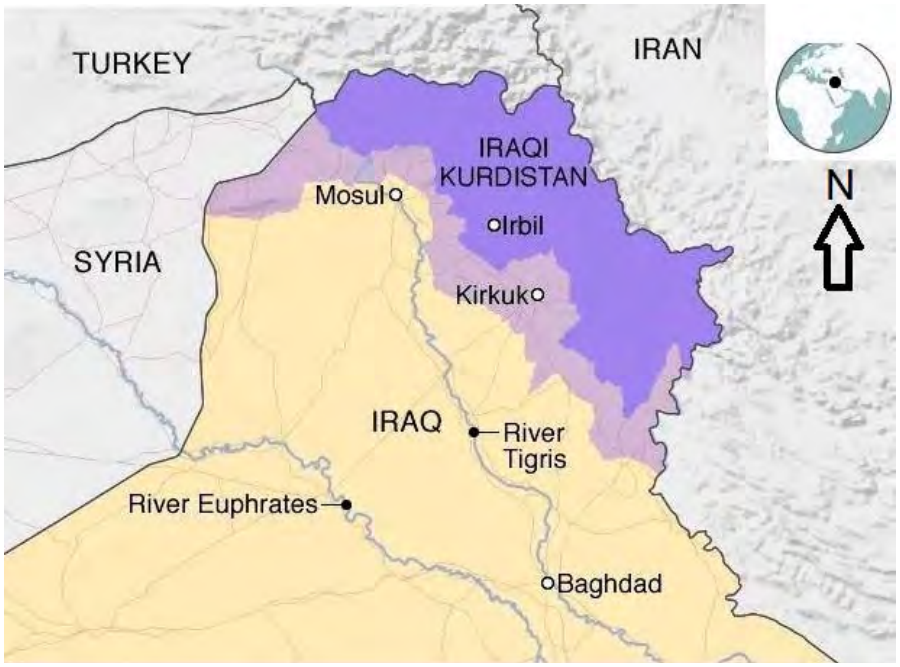

Figure 1. Map of Kurdistan Region of Iraq, Adapted from (BBC, 2017)

The climate of the majority of Kurdistan Region of Iraq is semi-arid continental: dry and very hot in summer, and wet and cold in winter. The average temperature in Kurdistan region is between 13.5c in Penjuen and 21.56 In Erbil (GDOM, 2019). The average rainfall is 633 mm-years. It increases in mountain areas to gets 1308MM/Y in Mergasor in the north of the KRI and becomes 157MM/Y in Taqtaq in the plane area (GDOM, 2019).

Population of Kurdistan region is more than 6 million people (KSRO, 2015). KSRO, explains annually 137,000 people add to this number, the average growth rate of population in this region is 2.5% (KSRO, 2015). It is expected that the size of population in KRI become 15.32 Million people in 2060.

Virtual Water

There are many definitions for Virtual Water, all of them, however, have same/similar concept(s) which is the required amount of water to produce specific amount of product. For example, producing one ton of rice in Canada requires 1000CM of water (Hoekstra, 2003). The 1000CM of water is the Virtual water.

Professor J.A. Allan believes, 'virtual water is the amount of water that embodied in food crops that are traded internationally" (Hoekstra, 2003, & Wichelnse 2001). In addition, Roson and Sartori, 2015; Hoekstra and Hung (2002)) believe "*the water that is used in the Industrial and Agricultural production process can be called the 'virtual water' contained in the product.*" In fact, "*When one good is imported, the water used in its origin country of production is virtually imported*" (Roson and Sartori, 2015)

However, some definitions are ignoring the amount of water that is used to produce non-food products, or the water that is required to produce specific goods. Zhan-Ming and Chen (2013) Believes, more than 57% of the international virtual water flows is embodied in non-food trade. So, I can summerise the definition of Virtual water as the amount of water that has been used to produce specific amount of Food(s) and good(s).

The amount of Virtual water inside each crop can be changed with geographic changes especially the change of climate. For example, for producing one tone of grain, grown under rain-fed and favourable condition of climate, we need between 1000-2000CM of water which is equal to 1-2 Metric tons of water; for the same amount of grain, but growing in an arid region, where there is no favourable climate condition (high temperature, high evapotranspiration) we need 3-5 Metric tons of water (Hoekstra and Hung, 2002). So, the value of blue water and Virtual water is going to change from area to another, depending on geographic conditions, especially climate.

Some believe virtual water trade is a solution to save water in water scarce areas, enhance global trade and support water security. Cari et al, (2013) claim, Virtual water trade can be considered as a good solution to conditions like, water war, malnourishment, over population in regions with limited water resources availability, and water stress. So, part of water security is depending on importing of virtual water. Moreover, it, "enhances equality in the use of water resource" (Cari et al, 2013; Hoekstra; Hung, 2002; and Dalina et al, 2011) and affects international trade level (Roson and Sartori, 2015).

Trade of Virtual Water

Virtual water integration in global trade is remarkable. Its share in international trade is increasing sharply, Dalina et al, (2011) explain, the number of trade connections and the volume of water associated with global food trade more than doubled in only past 22 years. It is important to note that, contribution of Virtual water in non-food products trade is more than the food products trade. Some scientific work shows that 43% of the international virtual water flows is embodied in food trade (Zhan-Ming, & Chen 2013).

Contribution of geographic regions in Virtual Water Trade (VWT) is various, for example, Asia is the biggest VW importer (Dalina et al, 2011; Hoekstra and Hung (2002). It increased its virtual water imports by 170%, switching from North America to South America as its main partner, whereas North America oriented to a growing intraregional trade (Dalina et al, 2011). In contrast, South America continent is the biggest contributor of Virtual water trade (Dalina et al, 2011). However, Hoekstra and Hung (2002) claim, North America continent was the biggest exporter of Virtual water between1995-1999. In addition, West part of Europe is considered as the biggest internal trade region in virtual water (Hoekstra, & Hung, 2002)

Virtual Water in the Middle East and Turkey

Middle East, Generally, has arid or semi-arid or arid climate condition, amount of precipitations are not adequate, temperatures are high, population and water demand are rising sharply. Moreover, the region has water scarcity. So, it depends on imported virtual water to secure its food. According to Hoekstra (2003), the Middle East was importing 20.5BCM of water between 1995-1999, during same period the region exported 5.4BCM. Whereas, fifteen years later Bacon (2018) mentioned, the share of the MENA region for virtual water trade is 173BCM/Y. The size of population of the region is equal to 5% of the global population (Wichelnse 2001). It imports, in contrast, about 12% of the global virtual water (Bacon, 2018). The "virtual water" flows into this region, including Iraq and Kurdistan region, annually and the amount is greater in volume than the water of the Nile River, which enters Egypt and, which is used for agriculture (Wichelnse 2001)

The big part of water resources in the region is using for agriculture sector. The sector cannot maintain the food security of the region. Moreover, the exporting agricultural crops have diverse impact on Environment the economy of the region. Producing one ton of a grain in some parts of the Middle East, can require two or three times more water than producing the same crop in a humid region (Roson and Sartori, 2015). In addition, the Middle East, and the North Africa suffer an opportunity cost of between 293.6 billion USD and 582.8 billion USD per year by exporting their scarce blue water resources (Bacon, 2018).

With regards to internal virtual water trade in the Middle East, Turkey can be mentioned as the biggest exporter of Virtual water. Kurdistan region and South Iraq are the biggest virtual water partner of Turkey in the Middle East. According to official data, three quarter of available food in Kurdistan market is importing from Turkey (MOT-DOP, 2019). Whereas, Bacon (2018) claims, Turkey imports 69.8 BCM/Y of Virtual water from abroad. Part of this virtual water is being re-exported to Kurdistan market. The strange point is that, water availability per capital in Kurdistan region is bigger than Turkey. Water availability per person in Turkey is 2689.9 CM/Y (Bacon, 2018); whereas availability of water per capital in Kurdistan region is 5800CM/Y (Hawrami 2014) and Secure water availability per person in Kurdistan region is 3267CM/Y.

It looks Turkey cuts water flow of Rivers like the Tigris, Euphrates, Khabur and the Great zab, and exports this water as a form of virtual water to the markets of Kurdistan region and South Iraq. In fact, the country itself has changed its plans to export virtual water instead of selling freshwater. One of the Turkish project is Seyhan - Ceyhan River projected 1000-1500MCM year to 2020 may no longer be reliable, because the industrial and agricultural development in around the river made Turkish officials to give their back to the project, the demand of water in arid seasons makes Turks not to export water of the River in four months (York 2013). Now water is economic good Turkey exports it; Kurdistan region and South Iraq buy this water.

Results and discussion

Virtual Water in Local Market

Food security in South Iraq and Kurdistan region is mainly depending on imported Virtual water. Between 75-80% of consumed food in Kurdistan region is importing from abroad especially Turkey (MPT-DOP, 2019). Whereas, 20 years ago before collapsing of Saddam regime the dependency on imported virtual water in South Iraq and Kurdistan region was about 2%. Hoekstra,(2003, 43) explains that Iraq had water efficiency by 97.9% and dependency on imported virtual water was 2.1% between 1995-1999. Nowadays, the imported virtual water in Kurdistan region and South Iraq, mainly, is coming from Turkey or coming through Turkey.

The changes in Virtual water market in South Iraq and Kurdistan region can be linked with many factors like, mismanagement of water resources, water shortage, migration of people from the rural areas to urban area, lack of governmental plan and strategy to protect national products. Moreover, increase in calories consumption. See table 1

Table 1. Calorie consumption in Iraq between1988-2000

Year	1988-1990	1995	2000	2010
Consumption	3400 calories	1700 calories	2197 calories	2580 calories

(USIAD, 2004; & UN, 2010)

The table explains the ongoing increase in calories consumption from 1700 calories in 1995 to 2580 calories in 2010. When the local agriculture cannot cover the demand, Turkish products find its way to export all types of food to Kurdistan region and South Iraq market.

Virtual Water Import in Kurdistan Region Market

Although Kurdistan region has a huge amount of available and secure water resources, but it is, mainly, depending on imported Virtual Water. About 75% of imported virtual water, particularly food products to Kurdistan region market is coming from Turkey or coming via Turkey.

For more explanation, I am showing six different groups of food within six tables each of them represents one category of imported food (Virtual water). See tables 2,3,4,5,6 &7. In addition, the Eights table explains the total amount of imported virtual water.

Table 2. Imported Grain (imported Virtual water from Grain- in CM/Y)

Name of Item/s	Amount of import ton/year	Water requirement liter per KG	Total Water requirement in CM/Y
Rice	320000	2497 litre/kg	799,040,000
Corn(Maize)	22835	1222 litre/kg	27,904,370
Wheat	91000	1827 litre/kg	166,257,000
wheat flour	80000	1850 litre/kg	148,000,000
Total			1,141,201,370

Adapted from (MPT-DOP, 2019; & University of Twente, 2017)

Table 3. Imported Vegetables (imported Virtual water from Vegetables- in CM/Y)

Name of Item/s	amount of import ton/year	Water requirement liter per KG	Total Water requirement in CM/Y
Tomato	140327	214 litre/kg	30,029,978
Cucumber	65447	353 litre/kg	23,102,791
Eggplant	20635	362 L/Kg	7,476,384
Squash	11554	336 L/KG	3,882,144
Okra	5567	576 L/KG	3,206,592
String beans, green	2100	561 liter/kg	1,178,100
Beans green	22991	5053 liter/kg	116,173,523
Green Onion	500	272 l/kg	136,000
Water Milon	45257	235 L/kg	10,635,395

Name of Item/s	amount of import ton/year	Water requirement liter per KG	Total Water requirement in CM/Y
Melon	15666	145m3 per ton	2,271,570
Snake Cucamber	1497	355 l/kg	531.4
Pepper green	11463	379L/kg	4,344,477
Potatos	66536	287 litre/kg	19,095,832
Onion	51981	345 L/KG	17,933,445
Swiss chard	300	300 L/kg	90,000
Fresh haricot	3313	2018 L/Kg	6,685,634
Hot Pepper	2855	379 l/kg	1,082,045
Kidney-bean	3021	5053 litre/kg	15,265,113
Garlic	2032	589 L/KG	1,198,000
Table Beet	2018	132 l/kg	266,375
Carrot	5137	195 l/kg	1,001,715
Lettuce	8738	237 litre/kg	2,070,906
Cauliflower	5073	285 L/Kg	1,445,805
White Cabbage	8314	237 litre/kg	1,970,418
Red Cabbage	7035	237 litre/kg	1,667,295
Vegetables	1500	300 L/kg	450,000
Total			272,660,068

Adapted from (MPT-DOP, 2019; University of Twente, 201; & Lacirignola et al, 2014)

Table 4. Imported Virtual water from Fruits- in CM/Y)

Name of Item/s	amount of import ton/year	Water requirement liter per KG	Total Water requirement in CM/Y
Orange	35033	560 litre/kg	19,618,480
Apple	65273	822 litre/kg	53,654,406
Grape	16000	506 L/KG	8,096,000
Cherrie	20000	1604 L/KG	32,080,000
Peach	6000	910 litre/kg	5,460,000
Pomegranate	15000	1.17 m3 per kg	17,550,000
Pineapple	4500	255 L/KG	1,147,500
Plum and red Plum	3000	2180 l/kg	6,540,000
Pear	3076	922 L/KG	2,836,072
Mandarin	22059	748 L/Kg	16,500,132
Lemon	14081	642 L/KG	9,040,002
Apricots	1300	1287 L/KG	1,673,100
Banana	25000	790 litre/kg	19,750,000
Fig	3400	3350 L/KG	11,390,000
Kiwi	4576	514 L/KG	2,352,064
Beans dry	91800	5053 litre/kg	463,865,400
Total			671,553,156

Adapted from (MPT-DOP, 2019; University of Twente, 2017;& Lacirignola et al, 2014,)

Table 5. Imported Virtual water from Meat, Dairy& Animal products- in CM/Y)

Name of Item/s	amount of import ton/year	Water requirement liter per KG	Total Water re-quirement in CM/Y
Beef meat	55000	15415 litre/kg	847,825,000
Butter	3860	5553 litre/kg	21,434,580
Chees	61,443	3178 litre/kg	195,265,854
Chicken meat	126081	4325 litre/kg	545,300,325
FISH MEAT	10000	5000 l/kg	50,000,000
Egg	105000	3300 litre/kg	346,500,000
Dayri	138000	3600 l/kg	49,680,000
Leather	80000	17093 litre/kg	1,367,440,000
Milk	21000	1020 litre/kg	21,420,000
Milk powder	4000	4745 litre/kg	18,980,000
Total			3,463,845,759

Adapted from (MPT-DOP, 2019; University of Twente, 2017; & Lacirignola et al, 2014)

Table 6. Imported Virtual water from Nuts- in CM/Y

Name of Item/s	amount of import ton/year	Water requirement liter per KG	Total Water requirement in CM/Y
Pistachio	9884	11363 litre/kg	112,311,892
Cashew nuts	3700	14228 litre/kg	52643600
Wall nut	8709	4918 l/kg	42,830,862
Melon seed	3000	5184 L/KG	15,552,000
Almonds	4009	8047 l/kg	32,260,423
Hazelnut	3890	10 515 l/kg without shell	40,903,350
Total			296,502,127

Adapted from (MPT-DOP, 2019; University of Twente, 2017; & Lacirignola et al, 2014)

Table 7. Imported Virtual water Industrial & other Crops- in CM/Y

Name of Item/s	import ton/year	Water requirement L/KG	Total Water requirement/ CM
Sun flower	30000	3366 L/kg	100,980,000
Tobacco	450000	2925 L/KG	1,316,250,000
Olive	11000	3015 litre/kg	33,165,000
Peanut	3000	2782 litre/kg	8,346,000
Sesame	4000	9371 l/kg	37,484,000
Cotton	75,000	10,000 litre/kg	750,000,000
Pasta	323000	1107	357,722,500
Juice	208000*	1350	61828000*
Sugar	200,000*	1782 litre/kg	356,400,000
Tea	40,000*	8860 litre/kg	354,400,000
tomato puree	50,000*	710 litres/Kg	35,500,00
Oil and fat		2900 l/kg	550594000**

Name of Item/s	import ton/year	Water requirement L/KG	Total Water requirement/ CM
Spices		3000 l/kg	1682000**
Alcohol		1150 l/kg***	1392000**
Chocolate	45,000*	17196 litre/kg	63,900,000
Coffe	6000*	18900 Littre/kg	113,400,000
Dates u mango u ananas	20000	2277 litre/kg	45,540,000
Total			4,153,083,500

Adapted from (MPT-DOP, 2019; University of Twente, 2017; & (Lacirignola et al, 2014)
*Adapted from: (Lacirignola et al, 2014)
** Estimation has been done basing on footprint per crop (University of Twente, 2017)
*** All types of alcohol has been collected then divided, the 1150 has been extracted as an average of alcoholic drinks

Table 8. Imported Virtual Water to Kurdistan Region Market in CM/Y

Categories	Total Amount of imported Virtual water in CM/Y	Comparing with the Total Imported Virtual water wate
Vegetable	272,660,068	2.72%
Nuts	296,502,127	2.96%
Fruits	671,553,156	6.71%
Grain	1,141,201,370	11.41%
Meat, Dairy& Animal Products	3,463,845,759	34.642
Industrial & other crops	4,153,083,500	41.53%
Total	9,998,845,980	100%

Adapted from (MPT-DOP, 2019)

Table eight explains that, annually Kurdistan region is importing about 10 BCM of virtual water. This amount is huge comparing with size of Kurdistan region, its population and available water resources. Part of these goods that are importing from Turkey to Kurdistan region is going to South Iraq (DOP-MOT, 2019). In addition, *'a big part of imported virtual water like cigarette, alcohol, tea is smuggling to Iran, South Iraq, and Turkey itself, Even sometimes we smuggle cigarette into Europe countries'* (Bakir, 2019) said.

The big part of imported virtual water is "Industrial crops & other crops" the crops that inter into industry. For example, Olive can be imported as an olive or Olive oil. This category consists of 41.53% of the Total imported food. In fact, the total amount of Virtual water in this category is 4,153,083,500 CM/Y.

The second category is (Meat, Dairy& Animal Products) which consist of 34.6% of the total imported virtual water the amount of imported water with these products is 3,463,845,759 CM/Y. A small portion of those products, particularly dairy products are providing to the local market by Iran. Iran's portion in this category can be accounted between 20-30% (MOT-DOP, 2019).

The integration of Vegetables in the imported virtual water is the smallest, which is 272,660,068 CM/Y that equal to 2.72% of the total imported virtual water. The size of this category in the market can be linked with some reasons; part of vegetables is coming from South Iraq. For

example in the local market and during winter season, tomatoes of Basra can compete Turkish tomato. In addition, local farmer can produce a big part of vegetables inside Kurdistan region.

It is important to explain that according to the Tables, leather, Tobacco, Beef-meat, and rice are the main contributors of virtual water trade into Kurdistan region. The tables show that, about 9.99 BCM/Y of virtual water is being imported. While, only about 22.22% (4.5BCM/year) of secure available water resources in Kurdistan region is being used for agriculture, and 63.72% of secure available water resources in Kurdistan region that equal to12.207 BCM/Y of water is not being used at all.

Finally, my math explains that each person in Kurdistan region consumes 1658 CM/Y of imported virtual water, whereas this number in the MENA standard is 700CM/Y (Roson and Sartori, 2015). It means consumption of imported virtual water in Kurdistan region is more than twice time bigger than the MENA level. Many factors like, the mismanagement of water resources (misallocation of water resources), agriculture sector cannot meet the demand of local market, Kurdistan region has become a transition pathway between Iraq-Turkey, Syria and Iran. In fact, part of imported virtual water is re-exporting.

Turkey is exporting huge amount of virtual water to Kurdistan region. As I explained precisely, 75% of imported virtual water to Kurdistan market is coming from Turkey. It means annually, 7,499,134,485 BCM OF Virtual water imports from Turkey or through Turkey to Kurdistan region. Bacon (2018, 52) explains that, the economic value of one CM of water/Y is 22US$. Whereas, the total value of exports of Turkey to Kurdistan region and South Iraq was 9 BUS$ (WITS, 2019). It means, Turkey obtained 1.2$ for one CM of virtual water that exported to Kurdistan region and South Iraq.

According to official data, Turkey is reducing water flow of the Rivers that enter into Kurdistan region and South Iraq. According to GDOWR (2019), water flow of the Tigris has reduced from more than 20BCM/Y in 2010 to 14.18BCM/Y in 2018. On other words, Turkey has reduced water flow of the rivers. Kurdistan region and South Iraq have lost about 5.2 BCM/Y of the water income of the Tigris River within eight years because of Turkish dams. See Fig two. In contrast Turkey has increased its virtual water exports to get 7.5BCM/Y to Kurdistan region and part of south Iraq market.

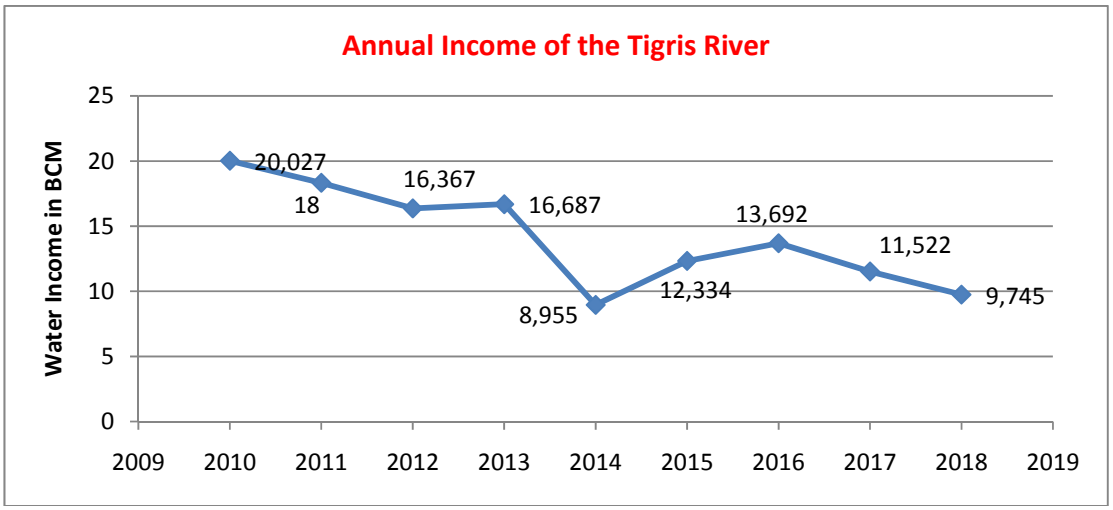

Figure 2. Fluctuation in Annual income of the Tigris River in KRI between2010-2018, adapted from (GDOWR, 2019)

The Figure explains a huge reduction of water flow of the Tigris River from Turkey into the Kurdistan region and South Iraq. Turkish water projects has enormous impact on this reduction especially Illisu dam. Janabi, (2013), & Oktav (2019) explain that the mentioned dam responsible for 50% of decries of water flow of the Tigris River into Kurdistan region and South Iraq.

Water Footprint in Kurdistan Region

Water footprint means the amount of water that is being used by individuals consumed as a food or liquid and used for washing or cooling or so on. *Hoekstra et al (2019) explain*, the water footprint is an indicator of freshwater use that looks not only at direct water use of a consumer or producer, but also at the indirect water use. More widely the water food print can be defined as the volume of water that is being used to produce specific product(s) or services (Boston University, 2019). It is the total freshwater pollution and consumption within the boundaries of specific area (Hoekstra et al, 2011). In fact, water footprint consists of blue water which is using by individuals, or, virtual water that is consuming through Imported or local produced food. "Water footprint, includes local water withdrawal and all virtual water imports, not only agricultural imports" (Bacon, 2018).

Water footprint in Kurdistan region can be found by math the blue water consumption, virtual water and the using water for domestic and productions purposes. My math processes shows that the water footprint in Kurdistan region is one of the highest levels in the world and the Middle East. See table 9

Table 9. Water foot Print In KRI in CM/Y

Type	Agriculture	Industry	Domestic	Imported Virtual water	Total of Water Food Print in KRI	Water foot print per CAP/Y
Amount of water	4.502 BCM	2.05 BCM	0.80 BCM	9,998 BCM	17.44 BCM	2884 CM

Adapted from (GDODR, 2019; & GDOWR, 2019)

The Table shows that, the total level of water Footprint in Kurdistan region is 17.44 BCM/Y. The big part of this amount which is about 10BCM/Y is importing from abroad through Virtual water. The imported virtual water compromises 56.66% of the total water footprint in Kurdistan region, whereas, the local water resources compromises 43.34% of the total water footprint. The level of water footprint per person is more than 2884CM/Y whereas the global standard is 1240 CM/Y. See table 10

Table 10. The highest water footprint countries in the World

Rank	Name of country	Water food print CM/Cap/Y
1-	UAE	3135
2-	USA	3039
3-	Kurdistan Region	2884
4-	Canada	2328
5-	Israel	2328
	Global Standard	1240

Adapted from: (water food print calculator, 2017; &Hoekstra & Chapagain, 2007)

United Arab Emirates has the highest water footprint in the world which is 3135CM per capital in one year, the USA is the second with 3039CM per capital in a year. Kurdistan region can be mentioned as the third highest water footprint in the world with 2884CM per person in one year. Kurdistan situation can be linked with many factors, firstly, as we explained previously a part of imported Virtual water that enters Kurdistan region is re-exporting to South Iraq, Iran, Turkey and Syria. Secondly, Mismanagement of waste-water and freshwater resources; And thirdly, abundance of huge amount of free freshwater which is using without plan and strategy.

Conclusion

Virtual water is an important tool to recast water and food distribution. Although, Kurdistan region has a huge amount of available water but it depends on virtual imported water, especially from Turkey. The paper has found that Kurdistan region of Iraq annually imports 9,998,845,980 BCM of virtual water from abroad. Turkey provides 75% of it, which is 7,499,134,485 BCM/Y. The price of imported virtual water from Turkey is 1.2$ for one CM of Virtual water. Regarding water Footprint in Kurdistan region, it is more than 17.44BCM/Y. In fact, year after year Turkey reduces water flow of Rivers; in contrast, it increases export of the collected water as virtual water to the markets of South Iraq and Kurdistan region. The water footprint per capital in Kurdistan region is the third highest level in the World which is 2884CM. The paper recommends, firstly, using more internal water, and reducing virtual water import. Water resources in Kurdistan region need adequate management. In addition, governmental authorities, and decision makers should take into account the value of internal water resources, and the cost of the imported value water on Kurdistan economy. More scientific work is required about the consequences of imported virtual water on Kurdistan region.

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