Global Value Chains and International Water Security: a Critical Study

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This critical study discusses water security within global value chains (GVCs). GVCs refer to the cross-border flow of goods, investments, services, know-how and people involved in international production networks. Considering a descriptive and exploratory perspective, qualitative procedures were used, through a content analysis of a secondary basis in order to complete this work. As the results show, the issues on water security have begun to make headway in international trade; some company-leaders of GVCs have imposed policies for water security in their chains. However, especially in agricultural chains the burden on water has been on the negative side.

1 Introduction

International trade has added new topics to its agenda, such as international protection of the environment (Cao & Wang, 2017). Although this topic is not the main concern of international trade and there is a context of opposing interests (Sullivan, 2013), the environmental issue was introduced in the agreement that established the World Trade Organization (WTO), maybe influenced by the Agenda 21 of United Nations. This document declared that economic growth and environmental protection must be mutually supportive (UN, 1992).

In practice, within the WTO the signs of sustainability are incipient. They are more related to environmental issues that may represent a risk to international trade and eco-labeling. Water has not been considered and perhaps this situation derives from the following aspects: (i) the multiple uses of water; (ii) its process of commoditization; (iii) the legal weakness of the global agreements of fresh water (Carvalho, 2015). On the other hand, the water issue involving international trade has been going through an ever-increasing debate because of the concept of virtual water (Hoekstra, 2010).

In this context, the WTO has gradually lost position due to the expansion of free trade agreements (FTAs), which have proliferated as the exception of the Most Favored Nation clause (Aggarwal & Evenett, 2013). These FTAs grew more than three times between 1990 and 2010, going from around 70 at the beginning of this period to almost 300 at the end. Another fact is that they are increasingly interregional. If in the 1990s almost three quarters of these agreements were concentrated in the same region, in 2010 this proportion had declined to around half (WTO, 2013). More expressive examples include mega trade negotiations, especially the Trans-Pacific Partnership (TPP) and the Transatlantic Trade and Investment Partnership (TTIP).

These agreements not only seek tariff advantages, relatively stable in international trade (Carvalho, 2015), they generally lay the groundwork for product and service flows within global value chains (GVCs) (Blanchard & Johnson, 2016), which respectively represent about 80% of world trade and more than half of developing country exports (WTO, 2014). Through this context, the role that the environment plays for CGVs should be considered more, especially because companies with unsustainable processes possibly are producing in countries with lower levels of environmental protection within their chains (Kellenberg, 2013; Koźluk & Timiliotis, 2016).

Only recently the environmental assessments of GVCs have become an issue of academic attention (Hoekstra & Wiedmann, 2014). This article was structured from the questioning: how can water security be critically discussed in international trade, especially within global value chains? Therefore, this paper seeks to contribute to water security discussions within global value chains from a critical perspective. Specifically, it intends to: (i) problematize the role of international trade in the current scenario of water security; (ii) evaluate Transatlantic and Transpacific Agreements concerning GVCs and potential impacts of these in international water security; (iii) explore the impacts of the virtual water trade in water security within GVCs, discussing good practices for leaders-firms in order to enhance water security.

To reach these objectives, the article is divided into eight sections and three fundamental concepts were used throughout the text: (i) global value chains - represent the cross-border flows of goods, investments, services, know-how and people involved in international production networks (Backer & Miroudot, 2014); (ii) water security - identifies human access to clean and potable water, preservation and protection of ecosystems, water availability for economic development, capacity to cope with uncertainties and risks of water-related hazards and good governance (Cook & Bakker, 2012, UN, 2013); (iii) virtual water - water used in the production process of agricultural and industrial goods (Hoekstra & Hung, 2002).

2 Problematizing international trade and water security

The assessment that nature is one of the inevitable issues in the multilateral trade debate needs to be dimensioned critically. Decisions taken by countries to manage the relationship between trade and environment have a significant impact on the future of international trade (WTO, 2013), but also on the future of nature. However, this discourse has not translated into generalized practices to preserve natural resources.

The water issue finds ample space to express itself in this context. Although the value of trade in agricultural products represents only 14% of manufactured goods trade (UNCTAD, 2014), agriculture's impact on water is worse than in industry because they represent approximately 70% of the water used on the planet (OECD, 2016). The current appropriation of the resource from human activity is between 31-44% of the available water. Considering the percentage allocated to agriculture, this consumption implies that 22-30% of the water present in terrestrial systems is used to produce food (Falkenmark & Rockström, 2004).

Water scarcity has reached 40% of the population of the planet. Together with clime and population growth, trade in agricultural goods is considered the most important global factor for reducing water security. There is a mutual interference between trade and water availability (Lenzen et al, 2013; Vörösmarty et all, 2015). Water scarcity generates significant changes in the flow of international trade. South Asia, Middle East, China and North Africa, for example, have faced increasing water shortages, resulting in the importation of more agriculture products (Lenzen, 2013; Carvalho, 2015).

3 Mega-trade agreements and the possible impacts on water

The WTO has lost its relevance (Matsushita, 2014). The non-completion of the Doha Round has generated regional initiatives. The two main negotiations relating to regional agreements have been the Transatlantic Trade and Investment Partnership (TTIP), between the US and the EU, and the Trans-Pacific Partnership (TPP), which is being formed by Japan, Australia, New Zealand, Malaysia, Brunei, Singapore, Vietnam, Canada, and Latin American countries such as Mexico, Peru and Chile (the US announced their withdrawal from this treaty).

A new arrangement has been drawn in international trade. Non-tariff barriers, in which environmental regulations are inserted as a modality of technical barriers, play a fundamental role for GVCs and for the investment sector. The nexus between free trade agreements (FTAs) and GVCs is expressive. The TTIP and TTP represent two large global "factories", as a system of commercial interconnection never seen before amongst chains (ECLAC, 2013).

If approved, these two agreements will expressively impact the waters of the involved countries. There are clauses in the TTIP that seek to paralyze EU regulations on toxic chemicals, greenhouse gases and other aspects of public health and the environment. Furthermore, it disregards the precautionary approach in order to reduce the use of pesticides and allowing importation of wasting in agricultural products (Center for International Environmental Law, 2014). Regarding the TTP this agreement gives great emphasis to self-regulation in environment, based on voluntary mechanisms and the public-private alliance (Bouzas & Zelicovich, 2014; Carvalho, 2015).

Both the TTIP and the TTP contain clauses that strengthen the rights of the companies before those of the environment. The use of arbitration in the solution of investor-state disputes protects companies without subjecting them to the internal justice system of the countries. This facilitates the non-compliance of the countries' environmental normative base, focusing on the needs of private companies, including those in the water supply sector. Most likely, large investors in transnational chains may force countries to reduce their levels of water protection based on these two mega-agreements.

4 Value chains, leading companies and virtual water. (In) safe waters in global flows

The notion of global value chains involves market-leading firms and their huge supplier networks. The leading company normally delimits strategies and governance of the network (ECLAC, 2013), adopting a set of standards and codes of conduct. In general, these standards generate the need for continuous adaptations in the chain (WB, 2005).

Different authors have observed the nature-friendly practices in GVCs. For leading companies that have water as the main input for the functioning of their transnational chains, such policies are strategic (Larson, 2011; Marchi, Maria & Micelli, 2013; Chen, 2016). GVCs of companies in the food, textile and personal cleaning sector, for example, have developed internal norms for water security. They have also redesigned processes to improve water efficiency (reduce consumption), mandatory ISO 14046 certification (with specific principles, requirements and guidelines for the water footprint), water treatment, re-use, training, participation in watershed management and reforestation. These are just some of the policies that have been adopted (Carvalho, 2015).

On the other hand, the pressure from these chains on water represents a research gap that has been indirectly spotted by the concept of virtual water, or water used to produce goods and its international flow. Consideration of virtual water is growing in countries' economic and trade agenda (Hoekstra & Hung, 2002).

Virtual water circulation grew in a similar rhythm as agricultural exports, after observing the last forty years (Hoekstra, 2010; Szwedo, 2013). It is estimated that approximately 15% of the water used in the world is destined for exporting virtual water; 67% of this is related to international trade in crops (Dalin, 2012). Concerning continents, Africa and South America quadrupled virtual water exports between 1986 and 2015 (Schwarz, Mathijs & Maertens, 2015). From the perspective of countries, China, Brazil, India, the United States and Canada are the largest exporters of virtual water in the world (Feng & Hubace, 2015). Only considering Brazil, this country exports around 112 trillion liters of freshwater in the virtual mode (Globo, 2012).

Most of the virtual water exporters are experiencing severe water crises due to agricultural production, in particular China and India, which respectively, extract 32% and 20% of their available water. This has imposed an irreversible depletion of their water resources (Feng & Hubace, 2015). Even in Brazil, the situation has become critical. Although this country has 13% of the fresh water on the planet, the resource is unequally distributed within the Brazilian territory - the Amazon Basin concentrates 81% of the water (National Agency of Waters, 2014). In the Brazilian regions with the highest agricultural production, water scarcity has been felt significantly.

As a point of analysis, the fruit sector in a specific zone of Brazil was chosen. The global chain of this sector normally involves different steps: inputs, production, packaging and cold storage, processing, distribution and marketing (Fernandez-Stark, Bamber & Gereffi, 2011). International buyers in a vertical relationship lead the CGVs in this segment. They are usually large supermarket groups in the European Union and the United States. These companies normally determine how fruits are produced, harvested, transported, processed and stored, from an interdependent perspective (Hawkes & Ruel, 2011; Henson & Humphrey, 2015).

Even so, consumer markets normally do not know that the exportation of fruits is related to a vast scenario of virtual water production, scarcity and, several times, social and environmental conflicts (Rossi, 2015; Cáceres, 2015; Schwarz, 2016).

5 Method

Taking into account goals, articulation between variables and nature, this study can be classified as descriptive, because it relates variables already known. In addition, it is exploratory, because it investigates a topic that represents a lack in research. The article was developed using a qualitative perspective, from different sources, especially the WTO, the United Nations Conference on Trade and Development (UNCTAD) and the Ministry of Agriculture, Livestock and Supply in Brazil.

A study developed by Carvalho (2015) was also used as a secondary source. This author researched 235 FTAs available in the WTO database, published between 1994 and 2014. From a content analysis, some variables were obtained, involving trade and water security, as showed in Table 1 (Carvalho, 2015: pp. 34-35).

Trade variables		***Water security variables***	
TV1	Intellectual property	***WSV1***	Water in general
TV2	Sanitary and phytosanitary measures	***WSV2***	Water resources management
TV3	Technical obstacles/Labelling	***WSV3***	Wetland Management
TV4	Public procurement	***WSV4***	Management of watercourses / basin development
TV5	Investment	***WSV5***	Impact of agriculture on water / sustainable agriculture practices
TV6	Agriculture	***WSV6***	Desertification
TV7	Fishing	***WSV7***	Waste management (in general)
TV8	Livestock		
TV9	Mining		
TV10	Technology		
TV11	Energy		
TV12	Textiles		
TV13	Chemicals		
TV14	Industry		
TV15	Subsidy		
TV16	Countervailing measures		
TV17	Anti-dumping measures		
TV18	Safeguards		
TV19	Labor		
TV20	Cooperation in general		
TV21	General education		
TV22	Regional integration		
TV23	Transparency		

Source: Carvalho (2015: pp. 34-35)

Table 1: Variables in FTAs – trade and water security

For treating the data, Carvalho (2015) adopted the Pearson's Cui-Square Test (TQP). This test determines the independence between two variables that are presented in a contingency table. The level of significance of 0.05 was considered. This test was used to corroborate or not the hypothesis of association between variables in the examined FTAs.

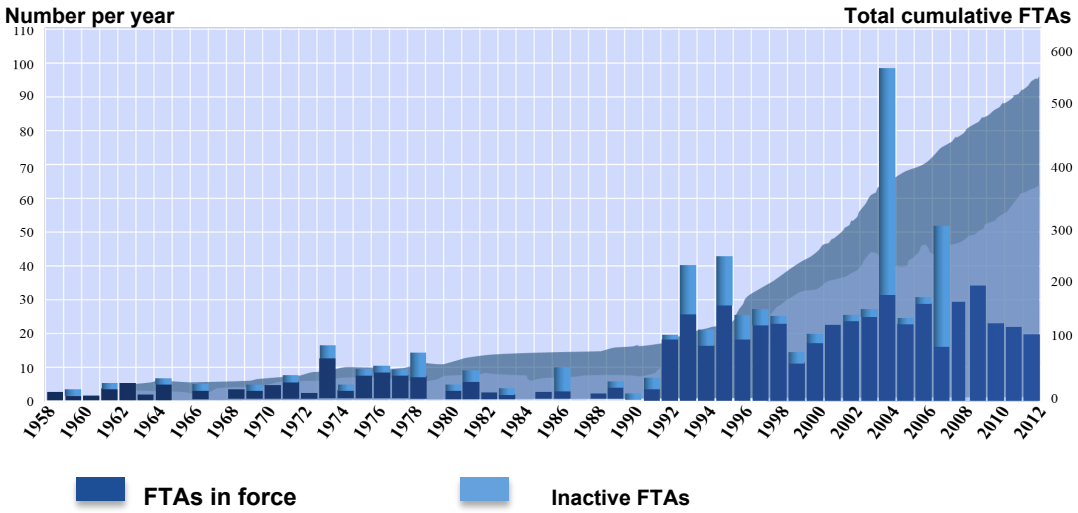
Considering the linkages between water and food security (Smajgl, Ward & Pluschke, 2016) and to better examine the effects of CGVs on water security, the

case of the fruit production in the Salitre River's Basin was observed. This is one of the most important zones in Brazil concerning production of this segment.

6 Results

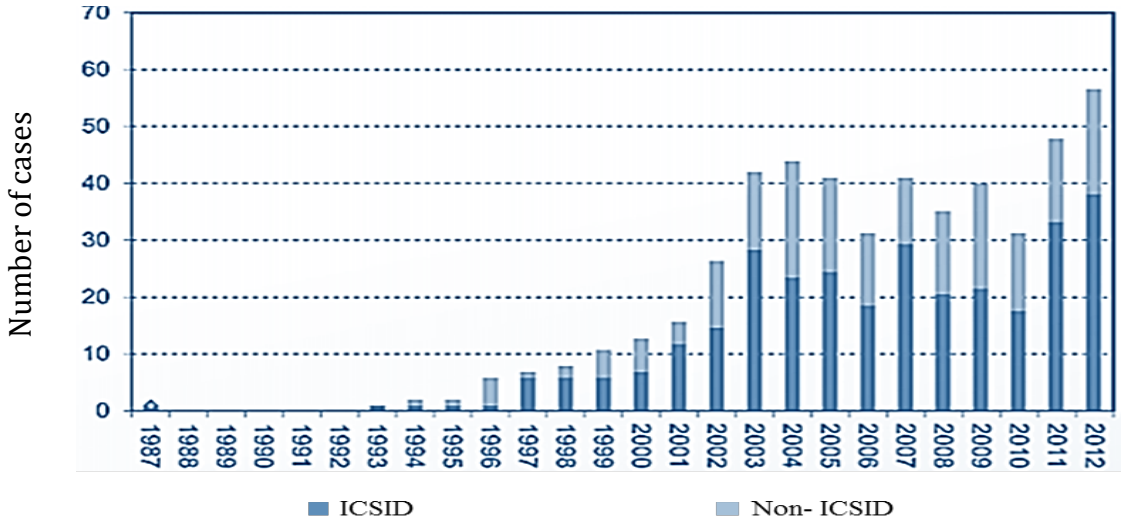
In this section some data generated from the selected secondary sources will be presented.

6.1. Free trade agreements



Source: WTO (2013: p. 61)
Figure 1: Free Trade Agreements in the GATT System (1949 - 2012)

6.2. Evolution of the disputes in the arbitral courts of investment



Source: UNCTAD (2013: p.2)
Figure 2: Evolution of disputes in the arbitral courts of investment

6.3. Associations between water and trade in FTAs

		Water security variables							
		WSV1	WSV2	WSV3	WSV4	WSV5	WSV6	WSV7	WSV8
Trade variables	TV1	0,026	0,010	0,000	0,000	0,000	0,071	0,001	0,127
	TV2	0,492	0,101	0,000	0,000	0,032	0,129	0,018	0,181
	TV3	0,422	0,847	0,000	0,000	0,126	0,505	0,149	0,321
	TV4	0,306	0,033	0,000	0,000	0,000	0,000	0,000	0,847
	TV5	0,012	0,075	0,000	0,000	0,369	0,848	0,356	0,519
	TV6	0,001	0,000	0,000	0,000	0,000	0,001	0,000	0,012
	TV7	0,007	0,002	0,000	0,000	0,007	0,019	0,000	0,229
	TV8	0,280	0,211	0,000	0,000	0,016	0,133	0,021	0,249
	TV9	0,011	0,005	0,000	0,000	0,068	0,086	0,046	0,187
	TV10	0,011	0,005	0,000	0,000	0,021	0,018	0,000	0,047
	TV11	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,016
	TV12	0,000	0,000	0,000	0,000	0,001	0,177	0,000	0,076
	TV13	0,001	0,000	0,000	0,000	0,000	0,002	0,000	0,249
	TV14	0,099	0,015	0,000	0,000	0,000	0,000	0,000	0,333
	TV15	0,321	0,144	0,000	0,000	0,003	0,015	0,002	0,467
	TV16	0,417	0,191	0,000	0,000	0,004	0,020	0,012	0,505
	TV17	0,068	0,023	0,000	0,000	0,023	0,050	0,000	0,640
	TV18	0,078	0,101	0,000	0,000	0,003	0,238	0,000	0,264
	TV19	0,034	0,010	0,000	0,000	0,003	0,012	0,000	0,053
	TV20	0,727	0,742	0,000	0,000	0,742	0,858	0,517	0,932
	TV21	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,122
	TV22	0,063	0,009	0,000	0,000	0,000	0,000	0,000	0,055
	TV23	0,060	0,007	0,000	0,000	0,000	0,000	0,000	0,137

Source: Carvalho (2015: p.330)
Table 2: TCP - trade versus water (Fisher's Exact Test)

7 Discussions

Global value chains and issues such as service, competition policy and investment could be considered some of the most relevant facets of trade regionalization (Carvalho, 2015; Lester & Bartels, 2016) and there are some important consequences to the environmental debate. Concerning water, the issue of investments has a particular importance (Echaide, 2013), mainly because social-environmental framework is not considered in the multimillion-dollar disputes that mobilize this sector. According to Figure 2 (UNCTAD, 2013: p.2), these disputes have grown exponentially, especially in the International Center for Settlement of Investment Disputes (ICSID). Whenever environmental and human issues hurt investors, companies prosecute in ICSID, in stratospheric quantities, to the states that attempt to protect these social and environmental rights (Corporate Europe Observatory, 2013). This has happened before in the water sector involving Tanzania, Bolivia and, more than once, Argentina (Echaide, 2013).

As illustrated in Figure 1 (WTO, 2013: p. 61) and mentioned previously, FTAs have grown under the authorization of Article XXIV of the Marrakesh Agreement. With the TTIP and TTP agreements a large number of countries will be linked to the Investor-State Dispute Settlement System. It most likely means that the regulatory standards of sustainability in the members of those agreements will weaken. This phenomenon also might mitigate the WTO Dispute Settlement Body (DSB) concerning trade and environment issues, because that resolution will follow another set of standards.

Furthermore, it will also reduce the water security orientation expressed by some FTAs in force. Carvalho (2015) identified this approach for water security in some commercial treaties, highlighting the following aspects: waste management (64 agreements); water resource management (34 agreements); agricultural impact on water and sustainable agriculture practices (32 agreements); desertification (17 agreements). 34 agreements considering water in general were identified, without citing sustainability guidance. In accordance with Table 2 (Carvalho, 2015: p.330), there are some statistical associations between variables in those treaties. Subsequently it is possible to assert:

(i) The variables "agriculture", "energy", "chemicals", "industry" and "public procurement" have a statistical link with the variables "water", "water resources management", "sustainable agriculture" and "waste management", expressing the nexus between water, food and energy security;
(ii) FTAs that have investment clauses are not associated with any concern with water security. However, FTAs dealing with these clauses are linked to the water issue in general (perhaps in supply services). This strengthens the concern about environment, investment and the Investor-State Dispute Settlement System within the mega-agreements.

In fact, especially observing item (ii), oppression against water and communities has been an important aspect of investments and CGVs, especially in the agricultural sector. In order to highlight this fact, the impacts of virtual water production in the fruit sector in the Salitre River region was discussed. This river is part of the São Francisco River Basin, located in the state of Bahia, Brazil. This region covers the Petrolina-Juazeiro Pole, which is made up of approximately 20,000 hectares of irrigated areas (Rossi, 2015).

There are two cultures in that region that are included in CGVs, mango and grapes, whose main buyers are The United States and the European Union. These two cultures have experienced an accelerated growth in exports (Globo, 2016). The region of the São Francisco River Valley exported 156,337 tons of mango and 34,384 tons of grapes in 2015, respectively, accounting for 99% and 84% of Brazilian exports. Both mango and grapes are amongst the most exported fruits in Brazil. This production, distributed by a global logistics company, serves international chains mainly in the Netherlands, The United Kingdom and Germany (Ministry of Agriculture, Livestock and Supply, 2013; Gazzeta, 2016).

Considering virtual water exportation in 2015, it is estimated that the region sold about 230,000,000 m3 (1470 m3/ton) in mango production and 14,200,000 m3 (414 m3/ton) in grape cultivation, according to the parameters of Mekonnen and Hoekstra (2011). Such environmental pressure has had a great impact reducing the water availability in the Salitre River basin and has generated conflicts and violence involving poorer communities. These conflicts have been occurring since the first occupations by fruit farmers. These plantations have over-used the local waters, exhausting the availability of the resource for a community known as "Campos dos Cavalos" (Rossi, 2015).

Currently, nine outbreaks concerning social and environmental conflicts have been recorded in this zone, all of them involving the scarcity of water. Certain communities, some of which are even involved in fruit agro-production, have

organized themselves into occupation campaigns known as the "Landless Movement", focusing closely on the lack of access to water (Rossi, 2015).

8 Conclusions

Taking into consideration the question *“how can water security be critically discussed in international trade, especially within global value chains?”*, the water security issue began to make progress in international trade, initially driven by issues more related to agriculture, in which water is most commonly used to produce exported goods. The review of benefits and losses generated by the trade of virtual water is strategic and urgent for numerous countries.

Concepts such as water security and virtual water have turned out to be problematical facets of international trade, especially in agricultural countries. Even with existing examples of company-leaders in GVCs that have imposed policies for water security in their chains. These chains have exacerbated social and environmental problems in different producing regions, such as the Salitre River Basin in Brazil. In other places of South America this matter has also accelerated the process of desertification (Schwarz, Schuster, Annaert, Maertens & Mathijs, 2016). The discourse of water security and corporate social responsibility contrasts with a harsh socio-environmental reality in the regions that feed the fruit chains.

It is not clear yet whether the mega-agreements will be implemented, particularly the TPP (without the US, probably this agreement will fail). The non-implementation of the TTIP and TTP reduces the risks represented by the investor-state dispute settlement mechanisms, present in these agreements. Still, the most critical risk for water security discussed in this paper is the over-use of water by the production agriculture sector in order to attend the demands of the GVCs.

Considering certain speculations for the forthcoming US policies on trade, possibly company-leaders based in the US will reduce their participation within the GVCs in order to enhance domestic production. This discourse would probably mean a reduction in the interregional trade (this country would be the core of the mega-agreements). A possible return to protectionism could strengthen the WTO as a forum of debate. In that scenario, the discussion on food security established by WTO in the Bali Trade Agreement (2013) should be intensified, taking into consideration the Doha Round. There is also a significant void that needs to include "virtual water” and “water security" topics in this discussion. Furthermore, the phenomenon of strengthening the WTO also may strengthen its Dispute Settlement Body, which is inclined towards more sustainable decisions.

On the other hand, there are some signs that the US will reduce their presence in forums on climate change, which will impact negatively on water because it means less investment in green policies. Probably it also means that the US companies that lead global chains (supermarkets, for example) will have less environmental obligations to accomplish in their domestic market, which may reflect negatively the water issue in uncountable trade networks. In short, relating to international trade, global water security still represents a great unknown and this discussion urgently needs to be intensified and refined.

References

Aggarwal, V. K., & Evenett, S. J. (2013). A fragmenting global economy: A weakened WTO, mega FTAs, and murky protectionism. *Swiss Political Science Review*. 19 (4), 550-557.

Backer, K., & Miroudot, S. (2014). *Mapping global value chains*. Frankfurt, European Central Bank, Working Paper Series, no. 1677. Available from: https://www.oecd.org/dac/aft/MappingGlobalValueChains_web_usb.pdf [Accessed 18th June 2016].

Blanchard, E. J., Bown, C. P., & Johnson, R. C. (2016). Global supply chains and trade policy. *National Bureau of Economic Research*. Available from: http://www.nber.org/papers/w21883.pdf [Accessed 10th January 2017].

Bouzas, R. Zelicovich, J. (2014) La Organización Mundial de Comercio, los acuerdos mega-regionales y los usos estratégicos del regionalismo. *Estudios de Economía Aplicada.* 32 (3), 963-994.

Cáceres, D. M. (2015). Accumulation by dispossession and socio-environmental conflicts caused by the expansion of agribusiness in Argentina. *Journal of Agrarian Change*. 15 (1), 116-147.

Cao, B., & Wang, S. (2017). Opening up, international trade, and green technology progress. *Journal of Cleaner Production*. 142 (2), 1002-1012.

Carvalho, K. M..(2015). *International trade and water security: perspectives from the precautionary principle*. Doctoral thesis. Buenos Aires, University of Buenos Aires.

Center for International Environmental Law (2014). *Toward a Toxic Partnership*. Available from: http://www.ciel.org/Publications/ToxicPartnership_Jun2014.pdf [Accessed 20th January 2015].

Chen, S. (2016). Multinational corporate power, influence and responsability in global supply chains. *Journal of Business Ethics*. 1-10.

Cook, C., & Bakker, K. (2012). Water security: debating an emerging paradigm. *Global Environmental Change*. *22*(1), 94-102.

Corporate Europe Observatory (2013). *Controversias relacionadas con tratados de inversión: Un gran negocio para la industria del arbitraje.* Available from: http://corporateeurope.org/es/2013/03/cap-tulo-2-controversias-relacionadas-con-tratados-de-inversi-n-un-gran-negocio-para-la [Accessed 12th December 2016].

Dalin, C., Suweis, S., Konar, M., Hanasaki, N., & Rodriguez-Iturbe, I. (2012). Modeling past and future structure of the global virtual water trade network. *Geophysical Research Letters*. *39* (24), 1-5.

Echaide, J. (2013). *The human right to potable water and reciprocal investment protection treaties.* Doctoral thesis. Buenos Aires, University of Buenos Aires.

ECLAC (2013). Lenta postcrisis, mega-negociaciones comerciales y cadenas de valor: El espacio de acción regional. *Informe Anual sobre Panorama de la Inserción Internacional de América Latina y el Caribe*. Santiago, ECLAC.

Falkenmark, M.; Rockström, J. (2004). *Balancing water for humans and nature: the new approach in ecohydrology*. London, Cromwell Press.

Feng, K.; Hubace, K . (2015). A multi-region imput-output analysis of global virtual water flows. In: Ruth, M. *Handbook of Research methods and Applications in Environmental Studies***.** Cheltenham, Edwar Elgard Publishing Ltd, pp. 159-172.

Gazzeta (2016). *Exportação de manga demonstra força econômica do vale.* Available from: http://www.gazzeta.com.br/exportacao-de-manga-demonstra-forca-

economica-do-vale/ [Accessed 04th December 2016].

Gereffi, G., & Fernandez-Stark, K. (2016). *Global value chain analysis: a primer*. Durham, Center on Globalization, Governance and Competitiveness, pp. 1 – 34.

Globo (2016). *Cresce em quase 121% a exportação de frutas do Vale do São Francisco.* Available from: http://g1.globo.com/pe/petrolina-regiao/noticia/2016/05/cresce-em-quase-121-exportacao-de-frutas-do-vale-do-sao-francisco.html [Accessed 15th November 2016].

Globo (2012). *Brasil exporta cerca de 112 trilhões de litros de água doce por ano.* Available from: <http://oglobo.globo.com/sociedade/ciencia/brasil-exporta-cerca-de-112-trilhoes-de-litros-de-agua-doce-por-ano-6045674#ixzz4TErnj9Z8>. [Accessed 15th November 2016].

Hawkes, C. and Ruel, M.T. (2011). Value chains for nutrition. *Conference Leveraging Agriculture for Improving Nutrition and Health*. New Delhi, February. Available from: http://www.ifpri.org/sites/default/files/publications/2020anhconfpaper04.pdf [Accessed 19th November 2016].

Henson, S., & Humphrey, J. (2015). *Review of Agri-Food Value Chain Interventions*. Lansa Working Paper Series. No 04.

Hoekstra, A. Y., & Hung, P. Q. (2002). *Virtual water trade – a quantification of virtual water flows between nations in relation to international crop trade.* Value of water research report series, no. 11.

Hoekstra, A. (2010). *The relation between international trade and freshwater scarcity*. World Trade Report – trade and natural resources.

Hoekstra, A.Y., Wiedmann, T.O. (2014). Humanity's unsustainable environmental footprint. *Science.* 344 (6188), 1114-1117. Available from: http://dx.doi.org/10.1126/science.1248365 [Accessed 12th November 2016].

Kellenberg, D. (2013). Do weak environmental regulations determine the location of US exports of SLAB and lead waste. In: D'Amato, A. et al (eds.). *Waste management in spatial environments*, Abingdon, Routledge, pp. 137-51.

Koźluk, T. & C. Timiliotis (2016). Do environmental policies affect global value chains?: A new perspective on the pollution haven hypothesis. *OECD Economics Department Working Papers*, No. 1282, OECD Publishing, Paris. Available from: http://dx.doi.org/10.1787/5jm2hh7nf3wd-en [Accessed 17th October 2016].

Larson, E. A. (2011). *Corporate social responsibility and transboundary flows of virtual water: bringing multinational food companies into a political economic discussion of water security.* Master dissertation. London, University of London.

Lenzen, M., Moran, D., Bhaduri, A., Kanemoto, K., Bekchanov, M., Geschke, A., & Foran, B. (2013). International trade of scarce water. *Ecological Economics*. 94, 78-85.

Lester, S., Mercurio, B., & Bartels, L. (Eds.). (2016). *Bilateral and regional trade agreements: Commentary and analysis*. Cambridge University Press, Vol. 1.

Marchi, V. D., Maria, E. D., & Micelli, S. (2013). Environmental strategies, upgrading and competitive advantage in global value chains. *Business strategy and the environment*. *22* (1), 62-72.

Matsushita, M. (2014). A view on future roles of the WTO: should there be more soft law in the WTO. *Journal of International Economic Law*. 17 (3), 701-715.

Mekonnen, M. M., & Hoekstra, A. Y. (2011). The green, blue and grey water footprint of crops and derived crop products. *Hydrology and Earth System Sciences*. 15 (5), 1577-1600.

Ministry of Agriculture, Livestock and Supply of Brazil (2013). *Opportunities for international fruit trade.* Available from: http://www.agricultura.gov.br/arq_editor/file/camaras_setoriais/Fruticultura/41RO/App_Oportunidades_41RO_Frutas.pdf [Accessed 11th October 2016].

National Agency of Waters (2014). *ANA divulga relatório de conjuntura dos recursos hídricos no Brasil*. Available from: <http://www2.ana.gov.br/Paginas/imprensa/noticia.aspx?id_noticia=12683>. [Accessed 17th October 2016].

OECD (2016). *Agriculture and water*. Available from: <http://www.oecd.org/tad/sustainable-agriculture/5_background_note.pdf>. [Accessed 21th October 2016].

Rossi, R. A. (2015). Conflict and regulation of water in Salitre - Bahia (1997-2013). Doctoral thesis. Salvador, Federal University of Bahia.

Schwarz, J., Mathijs, E., & Maertens, M. (2015). Changing patterns of global agri-food trade and the economic efficiency of virtual water flows. *Sustainability*. *7* (5), 5542-5563.

Schwarz, J., Schuster, M., Annaert, B., Maertens, M., & Mathijs, E. (2016). Sustainability of global and local food value chains: an empirical comparison of peruvian and belgian asparagus. *Sustainability*. 8 (4), 344-366.

Smajgl, A., Ward, J., & Pluschke, L. (2016). The water–food–energy Nexus–Realising a new paradigm. *Journal of Hydrology*. 533, 533-540.

Sullivan, S. (2013). Banking nature? The spectacular financialisation of environmental conservation. *Antipode*. 45 (1), 198-217.

SZWEDO, P. (2013). Water Footprint and the Law of WTO. *Journal of World Trade*. 47 (6), 1259-1284.

UN (1992). *Capítulo II de la Agenda 21: dimensiones sociales y económicas*. Available from: http://www.un.org/spanish/esa/sustdev/agenda21/agenda21spchapter2.htm. [Accessed 15th November 2016].

UN (2013). *Water security and the global water agenda*. Available from: http://www.unwater.org/fileadmin/user_upload/unwater_new/docs/analytical_brief_oct2013_web.pdf [Accessed 13th November 2016].

UNCTAD (2013). *Recent Developments in Investor State Dispute Settlement (ISDS).* Available from: http://unctad.org/en/PublicationsLibrary/webdiaepcb2013d3_en.pdf [Accessed 08th Octuber 2016].

UNCTAD (2014). *Key statistics and trends in international trade*. Available from: http://unctad.org/en/PublicationsLibrary/ditctab2014d2_en.pdf [Accessed 10th November 2016].

Vörösmarty, C. J., Hoekstra, A. Y., Bunn, S. E., Conway, D., & Gupta, J. (2015). Fresh water goes global. *Science*. 349 (6247), 478-479.

WB (2005). *Establishing CSR drivers in agribusiness*. Available from: http://www.social-standards.info/news/news_september2005/CSRdrivers_agrobusinessl.pdf [Accessed 10th November 2016].

WTO (2013). *Annual report.* Available from: https://www.wto.org/english/res_e/booksp_e/anrep_e/anrep13_e.pdf [Accessed 21th November 2016].

WTO (2014). *Informe sobre el Comercio Mundial 2014*. Available from: http://www.wto.org/spanish/res_s/publications_s/wtr14_s.htm [Accessed 20th November 2016].

WTO (2014). *Regional trade agreements – data base*. Available from: http://www.wto.org/english/tratop_e/region_e/region_e.htm [Accessed 16th November 2016].