# Role Play on Globalization of Water Management[1]

Interactive Learning about Water Footprint and Virtual Water Trade

## Facilitator's Guide

The aim of the role play is to convey one main message: **wise water resources management is not simply a national matter, but to be understood in a global context**. Global water use efficiency can be increased through wise trade in water-intensive commodities. The result of trade, however, is that national water footprints are externalized (contributing to increased water scarcity elsewhere) and that water is becoming a geopolitical factor (through international resource dependencies).

To keep it simple and to facilitate effective learning, this role play focuses only on water management in a global context, and does not include many water resources management issues, such as upstream-downstream conflicts in a river basin in either a national or trans-boundary context.

**This facilitator's guide**

This document is meant as a guide to the facilitator, in addition to the "handout to participants". The facilitator should:

1. Read the Handout to participants.
2. Study the excel file that contains the computer model that facilitates the role play.
3. Read the book Globalization of Water by Hoekstra and Chapagain (2008).

**Design of the role play**

Country setting. Distinguishing different countries that fundamentally differ in terms of climate, development status, water availability and water productivity is key to this game. Although every country in the world is unique, for simplicity, we have classified countries using two axes: **developed versus developing** and **water-abundant versus water-poor**. So, we have four countries, which is sufficient for the role play purpose.

Development status and water availability per country are both expressed on a per capita basis. For simplicity we assume that the four countries have the same population size (50 million). This number is not needed during the play, because all calculations are done on a per-capita basis. Although the four countries are hypothetical, they represent more or less real countries: e.g.

Country A: France, wet parts of USA and Australia, Japan
Country B: Spain, Western USA
Country C: Indonesia, Brazil, Southern China, the Philippines
Country D: Kenya, Mexico, Mali, Northern China, Sudan

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Economy/production and environmental flow requirements. Given that agriculture water use is a major water sector, the role play selects five categories of products as illustration: food grains, vegetables/fruits, meat/dairy products, cotton clothes and bio-energy. The first three are food related. All five products require extensive amount of water input during their production and all are traded internationally, as the case in reality. Water needs to be allocated over the five sectors of economy and what is remaining is left to nature. Although the five production sectors do not include industries and household uses, they are sufficient to illustrate the point that water allocation choices have to be made. The sectors fundamentally differ in terms of water intensity. Water needs per kilogram greatly increase from vegetables/fruits, through grains to meat/dairy products. Including cotton is relevant because of the fact that cotton is a typical water-intensive product and a typical internationally traded product as well. Including bio-energy is relevant because of the debate about 'water for food' versus 'water for energy', which also includes a poor-versus-rich country dimension.

Different types of water use. The role play distinguishes between the use of "green water" and the use of "blue water". Green water use refers to the use of rainwater (in rain-fed agriculture); blue water use refers to the use of groundwater or surface water (in irrigated agriculture). This distinction is made because the issue of rain-fed versus irrigated agriculture is generally considered as an important element in the global freshwater debate. The difference between ground- and surface water and the issue of seawater desalination are not included as those issues are beyond the objective of this game. The issue of water reuse is not an explicit parameter but is implicitly included in 'water productivity' (i.e. an increased level of water reuse is represented as a greater water productivity).

**Explaining the parameters**

Water availability. The two water-abundant countries (A and C) have a total precipitation of 5000 $m^3$/yr/cap, of which 3000 $m^3$/yr/cap is available in the form of green water, and 2000 $m^3$/yr/cap in the form of blue water. The two water-poor countries (B and D) have a total precipitation of 3000 $m^3$/yr/cap (2000 $m^3$/yr/cap in green water and 1000 $m^3$/yr/cap in blue water). (Table 1).

Environmental flow requirements. In all countries, it would be ideal if at least 50% of the green water is reserved for natural vegetation and at least 40% of the blue water is reserved for maintaining aquatic river systems and groundwater systems. These numbers are guidelines. Your country will have to make the tough choices. Reduced environmental flows lead to reduced biodiversity, which is to be traded off against the possible profit of increased production.

**Table 1. Water availability and environmental flow requirements**

| | **Green water** | | | |
|---|---|---|---|---|
| | Country A | Country B | Country C | Country D |
| Green water availability ($m^3$/yr/cap) | 3000 | 2000 | 3000 | 2000 |
| Environmental flow requirements (%) | 50 | 50 | 50 | 50 |
| Green water availability minus EFR ($m^3$/yr/cap) | 1500 | 1000 | 1500 | 1000 |
| | **Blue water** | | | |
| Blue water availability ($m^3$/yr/cap) | 2000 | 1000 | 2000 | 1000 |
| Environmental flow requirements (%) | 40 | 40 | 40 | 40 |
| Blue water availability minus EFR ($m^3$/yr/cap) | 1200 | 600 | 1200 | 600 |

Water productivities. Water productivities are expressed in terms of kg of commodity produced per $m^3$ of water. They vary along five dimensions:

- Water productivities vary as a function of the commodity. The productivity for vegetables/fruits is on average five times higher than the water productivity for food grains. When we compare all the

time to food grains, the productivity for meat/dairy products is 10x lower (as a global average!), the productivity for cotton is 2.5x lower, and the productivity for energy crops is 2x higher.
- Water productivities in developed countries have been taken 5 times the water productivities in developing countries (in average).
- Water productivities in water-poor countries have been taken 1.7x the water productivities in water-abundant countries (in average), because high water scarcity has led to use of better techniques.
- Water productivities of blue water are 1.7 times those of green water (as a global average).
- Water productivities vary as a function of climate. In case of a good climate for a certain commodity we have increased the water productivity for that particular commodity by a factor two (compared to the world average). In case of an unsuitable climate we have reduced the productivity by a factor 2.

Above assumptions have resulted into a list of water productivities as shown in Table 2.

**Table 2. Water productivity per country and commodity**

| | **Green water productivity (kg/m$^3$)** | | | |
|---|---|---|---|---|
| | Country A* | Country B | Country C | Country D* |
| Food grains | 0.4 | 0.2 | 0.04 | - |
| Vegetables &fruits | 0.5 | 0.8 | 0.3 | - |
| Meat & dairy products | 0.01 | 0.06 | 0.002 | 0.01 |
| Cotton | - | 0.06 | 0.03 | - |
| Energy crops | 0.5 | 0.3 | 0.15 | - |
| | **Blue water productivity (kg/m$^3$)** | | | |
| Food grains | 0.6 | 0.3 | 0.06 | 0.05 |
| Vegetables &fruits | 0.8 | 5 | 0.3 | 1.1 |
| Meat & dairy products | 0.04 | 0.03 | 0.003 | 0.005 |
| Cotton | - | 0.1 | 0.03 | 0.1 |
| Energy crops | 0.5 | 0.5 | 0.3 | 0.1 |

* Country A cannot produce cotton. Country D cannot apply green water for crop production; the pastures fed by green water can be used for producing meat and dairy products.

The participants of the role play receive information only about the productivities within their own country, although they can simply ask the numbers for the other countries from their fellow-participants. But even if they have the full table of productivities as shown below, one cannot immediately see what explanatory factors are behind all those numbers. Determining factors are: type of commodity, development status, water scarcity, type of production system (rain-fed or irrigated) and climate.

Comparative advantages. For most commodities, both in rain-fed and irrigated agriculture, the two developed countries (A and B) have an absolute advantage in production (i.e. higher water productivity) over the two developing countries (C and D). However, if one looks at the relative productivities, one can conclude that each country has some clear comparative advantages and disadvantages. It goes too far to explain here the theory of comparative advantage (which is part of international trade theory), but the essence is that all countries can profit by focusing on the production and export of commodities for which they have a comparative advantage and import commodities for which they have a comparative disadvantage. These comparative advantages and disadvantages of the four countries are hidden in Table 2. In Table 3, they are made explicit. Part of the learning during the game is that the participants discover how they can profit by making use for

their national comparative advantages and wise trade. Depending on how smart the participants are in discovering this themselves, the facilitator can decide to disclose the information shown in Table 3.

**Table 3 Comparative advantages (++) and disadvantages (--) per country**

| | **Comparative advantage for green water** | | | |
|---|---|---|---|---|
| | Country A | Country B | Country C | Country D |
| Food grains | ++ | -- | Neutral | Not applicable |
| Vegetables &fruits | -- | -- | ++ | Not applicable |
| Meat & dairy products | -- | ++ | -- | ++ |
| Cotton | Not applicable | -- | ++ | Not applicable |
| Energy crops | ++ | -- | ++ | Not applicable |
| | **Comparative advantage for blue water** | | | |
| Food grains | ++ | -- | Neutral | -- |
| Vegetables &fruits | -- | ++ | -- | ++ |
| Meat & dairy products | ++ | -- | -- | -- |
| Cotton | Not applicable | -- | Neutral | ++ |
| Energy crops | -- | -- | ++ | -- |

Development status. In principle, the two developed countries are intrinsically evenly rich (whether the participants make this into reality depends on their choices). The two developing countries are intrinsically evenly poor. When we consider the two developed countries, the parameters have been chosen such that: (i) the water-abundant country has 1.7x more water than the water-poor country, but (ii) the average water productivity in the water-poor country is 1.7x larger. As a net result, the two countries can achieve the same volume of production. The same idea applies to the two developing countries. Comparing the developed versus the developing countries, one can see a difference in productivities of about a factor 5, which means that the intrinsic richness of the two developed countries (as built into the role play by choice of the fixed parameters) is five times the intrinsic richness of the two developing countries.

Demand for commodities. Table 4 shows indicative figures for the commodity demand per capita for the four countries. These figures give guidance to the participants on what should reasonably be produced. The more is supplied, the better (apart from the maximum level that holds for the three food commodities).

**Table 4. Commodity demand per capita**

| | Indicative figures for the commodity demand per capita (kg/yr per capita) | | | |
|---|---|---|---|---|
| Commodity | Country A | Country B | Country C | Country D |
| Food grains | 160 | 160 | 160 | 160 |
| Vegetables &fruits | 150 | 150 | 110 | 110 |
| Meat & dairy products | 80 | 80 | 5 | 5 |
| Cotton | 25 | 25 | 5 | 5 |
| Energy crops | 100 | 100 | 100 | 100 |

The above parameters are chosen so that without trade, no country can produce enough to meet its commodity demands without damaging the environment. Through smart trade, countries can increase their welfare and at the same maintain domestic environmental flow requirements and reduce their water footprint. However, they may become more dependent on imports or outside resources, which

may or may not be desirable. Specialisation of domestic production and smart trade can reduce both the national water footprint and increase the national welfare.

**Extending the role play with additional variables**

*Changing climate and productivities*
To make it easy for the participants to see how their choices affect the various development indicators, the various parameters in the system are kept constant all the time. Each country has the same water availability every round (year). Water productivities are kept constant. In this way, there are no factors that influence the outcome of the game other than the choices of participants.

In reality, however, water availability varies from year to year (possibly even more so with climate change). Water productivities may increase due to technology improvement. The set-up of the role play and the computer model allow for changes in water availability and water productivities during the play. The facilitator can announce, for example, in round 4 that a drought has come over country D, which can be implemented by providing less water to that country at the start of round 4. Also one can allow a water productivity increase for a country. [When playing with money – see below – one could make productivity increases dependent on investments made.]

However, we do not recommend these kind of additional changes during the game because it moves away the attention of the participants from the key questions of the game (i.e. how to make trade-offs between water use for economy and nature and what choices to be made with respect to production and trade) to other questions that are not key to this role play (how to deal with climate variations and drought).

*Stocking produced commodities for next year*
It is possible to allow countries to stock commodities in one round for use in the next round. They could do so when they have produced a certain volume of a commodity that they do not want to consume and cannot trade with other countries (e.g. no buyer country). They can keep the commodities at the end of a round for consumption or trade in the next round. However, this brings a new dimension in the play, viz. the issue of stocking. The risk is that countries start focussing on making certain stocks, where stocking becomes part of their development strategy. Since this again draws the attention of the participants away from the key objective of the game, we do not recommend it.

*Introducing money*
One can easily introduce money in the game. Commodities can still be traded through barter, but there is also the possibility to exchange commodities for money. One should introduce a World Stock Bank - a role that can be taken by the facilitator. Countries can trade with each other, but there is also the possibility to sell to or buy from the World Stock Bank. The price of commodities in terms of another commodity or in terms of money is to be negotiated between the trading countries. When trading with the World Stock Bank, commodity prices are fixed as shown in Table 5. Alternatively you can have fluctuating prices based on perceived scarcity in a certain round. Also you can differentiate between buying and selling price.

It is in the advantage of countries to meet with other countries to discuss trade, because a country can import a particular commodity only when other countries export that commodity (or if the World Stock Bank has some stock available from a previous round). When money and fixed prices by the World Stock Bank are introduced, this will affect barter trade as well. When exchanging commodities through barter trade, countries will now tend to use the exchange rates as applied by the World Stock Bank. However, there can be reasons for countries to deviate from those exchange rates. For example, to secure its domestic supply, a country can be willing to pay more for a certain commodity than another country and this country can offer a higher price for this commodity. Another example: when a developed country has a production surplus for a certain food commodity, it can decide to sell it cheaply to a developing country in the form of ‘food aid’. Countries do not have money to start with.

They can only earn it by selling exports to the World Stock Bank. Initially, the World Stock Bank has no commodities in stock. The Bank has commodities in stock only after a country has sold some of their export commodities to the Bank. They loose their stocks when other countries buy them. So there is always a balance between the value of commodities in stock with the Bank and the amount of money that is with the participants. When testing the role play with money we experienced that participants tend to focus on the money they can gain. However, the purpose of the play is not to start accumulating money, because the purpose of introducing money is only to facilitate easy trade by offering a means for that. If you would decide to use money in the play you should be aware of that and explain to the participants. Having money left at the end of a round is useless because development is only measured in real terms (food supply, welfare, etc.). Due to the complication, this variation is not recommended.

**Table 5. Fixed commodity prices**

| Commodity | Price (euro/kg) |
|---|---|
| Food grains | 1.00 |
| Vegetables & fruits | 0.20 |
| Meat and dairy products | 10.00 |
| Cotton | 2.50 |
| Energy crops | 0.50 |

**Playing the role play**

Preparatory training. Preferably, before the role play, a half-day course on the topic of 'Globalization of Water' is given to participants. If there is no time for this course, one could give a condensed introduction into the topic of 30 minutes, on the main concepts.

Logistic preparations. Before the role play, make copies of the Hand-Out to Participants, which can be given to participants prior to the training for familiarization. Arrange several small tables with three chairs in the room – each table is for one country. Alternatively, use one big table for twelve people (one world). Put the four game boards on the table – one game board for each country.

Finally install your pc or laptop and link it to a printer and a beamer. The printer can print out the results per country after each round, as feedback. But it is not strictly needed, because one can quickly write down the results on a form after each round (reading the outputs from the pc) and give this form to the participants. However, printing is easier for large groups. The beamer can be used to give plenary feedback during or at the end of the role play, showing graphs from the pc.

Playing. Reserve 2.5 to 4 hours. Four hours is best when playing is not constrained by time. Two and a half hours is minimum and can be done when playing with executives that have very limited time.

1. Use 20 minutes to introduce the aim, the concepts, and practicalities of the role play. Allow for questions, but remember that there are always participants that want to know everything before hand, including things that they are supposed to discover themselves during the role play. Don't provide details that you purposely want to keep for yourself in this stage. Let the participants read the Handout if they did not have that opportunity earlier.
2. Run the role play in a few rounds. Three rounds is minimum. Often, in round 1, countries focus on domestic production. In round 2, they consciously apply trade. In round 3, they optimize production and trade, using their comparative advantage. In subsequent rounds, skills are perfected.
3. The facilitator should make sure that learning takes place. When it does not happen automatically, the facilitator needs to help by providing some guidance on how improvements can be made. Don't fall in the trap of providing too much guidance in the beginning, because this undermines

the functionality of the role play. It is perfectly fine if in the first round the participants just aim to produce welfare by domestic production without any trade. Each round takes about 30 minutes:

- 10 minutes for making the required decisions on water allocation and production;
- 10 minutes for international trade and establishing final consumption;
- 10 minutes for looking back at the round and feedback from the facilitator.

Round 1 is likely to take more time. Halfway the play, if time allows, you can suggest participants to organise a World Water Conference (10-15 minutes) to let countries discuss and make international agreements.

4. After having finalised the last round, use 30 minutes to give plenary feedback to the participants. First, ask the participants what they have learned. Ask questions like: What did we learn about wise water management? What did we learn from the interactions between the countries? What would you do better the next time? To which extent does the role play represent reality and where does it contain simplifications? How did your country jointly decide what to produce and what not? Or ask after each round one country to explain its decision/rationale. Take turn for participants to learn from each other.

Running parallel worlds. When the group of participants consists of more than twelve people, the group is split into two or more subgroups, each of which can play its own world. The advantage here is that at the end of the role play you can compare the performance of the different parallel worlds.

Who are the winners? You can distinguish between individual country performance and global performance. Individual countries have done well if they have shown improvements over the course of the play: increased welfare, reduced water footprint and meeting domestic environmental flow requirements. Comparing the different countries doesn't make a lot of sense, because the developed countries are intrinsically richer than the two developing countries, so the latter will in this play not be able to outcompete the former. However, the global performance can be evaluated, particularly when you have parallel worlds. Global performance can be measured by aggregating the national development indicators into global indicators. When you have run parallel worlds, one can compare the two or three worlds. In many cases it will not be obvious which world has done better. However, what can be shown is how different worlds have made different trade-offs, for example between self-sufficiency and specialisation in combination with trade, and between welfare and meeting environmental flow requirements.

**Materials**

- Hand-out to participants – give a copy to each participant
- Country data – give each participant only the data sheet for his/her own country
- Facilitator's guide – for facilitator only
- Powerpoint-presentation – containing a brief intro to the role play and a slide with lessons learned.
- Excel-file with the underlying computer model – Only for facilitator
- 4 game boards – one game board for each country
- 4 sets of water and commodity units – one set for each country
- 4 sets of role descriptions (Head of State, Minister of the Environment, Minister of Trade & Foreign Affairs) – one set for each country

**Reference**

Hoekstra, A.Y. and Chapagain, A.K. (2008) Globalization of water: Sharing the planet's freshwater resources, Blackwell Publishing, Oxford, UK.
http://www.waterfootprint.org/?page=files/GlobWat_page