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Indirect Water Consumption: The Scope 3 of Water? Estimation of This Indicator in Sectors Relying on Agriculture

Grégory Schneider-Maunoury, Nour Emam, Maria Fernanda Estrada Cabeza de Vaca, Anass Fathi, Ricardo Henao Martinez, Kahan Korkmaz, Omar Mghaieth, Christianah Ramanalinjatovo and Syrine Saidi

Department of Economics and Management, Université Sorbonne Paris Nord, 99 Av. Jean Baptiste Clément, Villetaneuse 93430, France

Abstract: The aim of this research project is to assess indirect water consumption, that represents the water consumed in the upstream part of the production life cycle. Estimations are provided for agriculture related companies, as agriculture represents 70% of water consumption on Earth. This consumption varies greatly according to the countries where supply chain is located. The estimation is attempted for 27 European listed companies in sectors relying on agriculture in its supply chain. A data is estimated for 22 companies, showing that indirect water consumption is much more important than direct one. Strategic questions raised through the estimation of indirect water consumption in various subsectors show the interest in this data, which represents the equivalent of Carbon Scope 3 for water issues.

Key words: Water consumption, water footprint, financial materiality, impact materiality, sustainability reporting.

1. Introduction

Despite the existence of ambitious shareholder initiatives, so far there is a problem to assess convincingly water issues in sustainable finance. Data are mainly focused on direct water consumption and there are no available data on water consumption in product life cycle perspective. The aim of this paper is to provide first estimation of the amount of water consumption by European listed companies relying on agriculture [1]. This estimation, called indirect water consumption, is based on the works of the Water Footprint Network. It aims at encompassing the upstream part of the water consumption of these industries based on agriculture supply chain. The indirect water consumption is comparable to the scope 3 carbon emissions, as it puts into perspective the scope 1 and 2, related to the companies' plants and amenities. This estimation of indirect water consumption enables to work and think on water issues over the life cycle of the product, starting with its upstream part.

The first part of this paper explains first the evolution of the corporate disclosure on this issue and second why the evolution of sustainable finance requires further estimations. In the second part, in order to disclose our methodology, we present the tool available for this estimate and the scope of companies. The third part presents the results and draws some recommendations from these results.

2. Literature Analysis

Water is a special topic in sustainable finance as many initiatives by fund managers and shareholders, initiatives have provided many ideas of improvement. Still the necessary tools for a real integration of the water issues in extra-financial and financial analysis are not available yet.

Corresponding author: Grégory Schneider-Maunoury, Ph.D., Associate Professor, Member of CEPN research centre, research field: sustainable finance.

As early as 1998, a thematic water fund has been created (by Pictet). It took ten more years before a flow of water funds. It has generated a specific questionnaire, Carbon Disclosure Project Water, as early as 2009, from Carbon Disclosure Project. This questionnaire, filled by 3900 companies in 2023, is very important in the development of a common knowledge and comparable data on this issue [2]. Within fifteen years, CDP Water has enabled to standardise the following concepts, among other the 3 following ones:

- Water withdrawal: water taken from the river or from groundwater resources
- Water releases: water brought back into river or canal
- Water consumption: the difference of the previous two

CDP has also enabled to better assess the water stress issue. This concept was raised in 2005 around the triangle Cape Town Gibraltar Jakarta. It quickly appeared that it was more a rectangle encompassing large parts of Asia. Today, the water stress is clearly mapped by institutions such as World Resources Institute. CDP Water requires companies to disclose the part of their amenities located in water stress, as an assessment of water related risk.

More recently, CDP Water has started to raise questions related to water use by supply chains, in order to identify the water stress area. CDP Water questions raw materials used by the company that may answer and disclose the raw materials and their geographic breakdown. CDP has also generated a questionnaire on forest asking the companies to disclose the raw materials that may be at risk to contribute to deforestation, among others pam oil, soy, cocoa and beef.

Sustainable finance has been heavily criticised in recent years. Some criticisms are related to political meddling and hide, notably in the United States, the denial of climate change and other issues (biodiversity, poverty, inequality) that may raise awareness on the need of a transformation towards sustainable development [3]. Other criticisms are related to the sustainable methods and notably its measurement methods [4]. A long-range study assessing the measurement methods over 10 years gives an explanation on the measurement difficulties, the lack of connection between the corporate social responsibility, that is measured, and sustainable development, that is aimed at. It also provides two recommendations: integrate long-term assessment, and integrate lifecycle analysis [5]. Applied to the sustainability rating of companies, these recommendations would lead to focus on long-term performance assessment, instead of compliance checking [6].

The aim of the EU (European Union) sustainable finance regulation is to use finance, and notably sustainable finance, as a financing tool of the EU Green New Deal. This regulation package has developed a Green Taxonomy, in order to define what company could be assessed as contributing to the environmental targets of the EU. In this regulation framework, water is one of the six environmental targets of the EU Green Taxonomy. However, contrary to climate change or circular economy targets, water target is not accompanied by quantitative targets. Among other environmental issues, water appears therefore as a secondary issue, where you might develop some water cleaning or water saving technologies, but where you do not have systematic reduction targets to achieve.

EU regulation has also provided a specific regulation on disclosure requirement, called Corporate Sustainability Reporting Directive (CSRD) Water is considered as one of the reporting topics in the European Sustainability Reporting Standards (ESRS): it is the third standard related to environment, therefore called E3 [7]. Beside the disclosure of withdrawal, consumption and water recycling of its own operations, the regulation requires to disclose the material risks and impacts (water stress) following the practice used by CDP Water. Its application guidance specifies in its second point that description of the process shall also include “processes to identify suppliers in the value

chain with material water quantity or water quality related impacts or risks." So, the ESRS 3 standardises the disclosure processes of the CDP Water, but does not extend the understanding of impact materiality to the estimation of indirect water consumption. Only the water quantity or quality that could appear risky for each supplier should be questioned. The analysis stays at the financial materiality step.

In order to assess impact materiality, we need to take into account the whole value chain, not only the water stress on company or its suppliers. Water is specific for companies, and notably listed companies, as 70% of water consumption is related to agriculture. In Europe, there are very few companies active in agriculture. However, in the early 2000s, Hoekstra has developed a concept, water footprint, that focuses on indirect water consumption [8]. This method has been developed from river basins and countries. It provides coefficients to estimate for every agricultural product, vegetal (wheat, soil, palm oil) as well as animal (milk, beef, leather), the indirect water consumption. "The interest in the water footprint is rooted in the recognition that human impacts on freshwater systems can ultimately be linked to human consumption, and that issues like water shortages and pollution can be better understood and addressed by considering production and supply chains as a whole," says Professor Arjen Y. Hoekstra, creator of the water footprint concept.

"Water problems are often closely tied to the structure of the global economy. Many countries have significantly externalised their water footprint, importing water-intensive goods from elsewhere. This puts pressure on the water resources in the exporting regions, where too often mechanisms for wise water governance and conservation are lacking. Not only governments, but also consumers, businesses and civil society communities can play a role in achieving a better management of water resources." [9].

As an example, when the water footprint network is used at national level, its estimate is way larger than withdrawal or consumption, as demonstrated in Table 1 below (Sources: water footprint of France [10], water withdrawal in France [11], water consumption in France [12]).

3. Methodology

In this methodology part, we describe the process and the way to build assumptions that enable the estimations. As already announced in the literature part of this survey, Hoekstra provides for any agricultural raw material a coefficient for all the countries. This coefficient represents the amount the volume per mass produced. It may be expressed in litre per kilogramme or in tons per cubic meter.

Two precisions should be added.

First these metrics had been developed to ensure a better management of the basins. So the calculation is provided by basin, with national average and global average. For animal production, two estimates are provided for intensive or extensive agriculture (literally, grazing or industrial).

Second water may be withdrawn from the river (blue water) or collected from the rain (green water). In the perspective of assessing water stress, this distinction may be useful, between draught and rain changes due to climate change [1].

Fifteen years ago, a first attempt has been realised to estimate the indirect water consumption of three companies: Danone, Unilever, Nestlé. At that time, only the general coefficient was disclosed. No distinction was provided between blue and green water. The amounts of some raw materials (mainly milk, cocoa, tea and coffee) were taken into account. The data on raw materials use are disclosed in Table 2, the Hoekstra coefficients are disclosed in Table 3 and the results are disclosed in Table 4.

Table 1 Water footprint, withdrawal and consumption: the French case.

	Water footprint	Water withdrawal	Water consumption
Liters per capita and per day	4,900	500	149

Table 2 Raw materials cost in % of sales for Nestlé, Danone and Unilever [13].

Company	Raw materials	Raw materials cost in % sales 2008
Danone	Milk	16%
	Milk	6%
Nestlé	Coffee	3%
	Cocoa	2%
	Palm oil	6%
Unilever	Tea	3%
	Cocoa	3%

Table 3 Coefficients [8] (global, with minimum and maximum in brackets) on some raw materials [13].

Product	Litres of water/kg of product	Product	Litres of water/kg of product
Milk	1,000 (600-1,400)	Milk powder	3,000 (2,000-4,000)
Tea	9,000 (7,000-11,000)	Vegetable oils	7,000 (3,000-20,000)
Cocoa	7,000 (5,000-10,000)	Coffee	20,000 (15,000-30,000)

Table 4 Direct water consumption (disclosed) and indirect water consumption (estimated) by Nestlé, Danone and Unilever [13].

2008 disclosures (direct) & estimations (indirect)	Direct water consumption	Indirect water consumption	Specific indirect water consumption
	M m^3/year	M m^3/year	m^3/EUR m
Danone	8	10,000	700
Nestlé	157	40,000	600
Unilever	61	15,370	400

Table 5 Sector breakdown of the sample.

Sectors	Number of companies
Paper	5
Breweries	4
Alcohol	3
Food ingredients	5
Food Big 3	3
Food retail	3
Textile	4
Total	27

At that time there was no disclosure on the geographic breakdown of supply chain. So the calculation was only elaborated to raise awareness on the size of indirect water consumption compared to direct water consumption. The figures are impressive, if you consider a total consumption, it means that direct water represents 0.001% to 1% of the total water consumption of a company. This figure is even more impressive than the results achieved on scope 3 for the GHG (Greenhouse Gases) emissions.

As explained in first of the paper, the disclosure has significantly improved in 15 years. Therefore, the scope of this survey goes beyond these 3 companies. We aim to survey 28 companies from different sectors. Agriculture might not be a sector full of listed companies. But agriculture is the supply chain of the following listed sectors: paper, breweries, alcohol, food ingredients, food major companies, food retail, textile. Table 5 provides the number of companies we attempted the estimation for each sector among the STOXX600 sometimes completed by some smaller companies, on which we had positive information about their transparency levels, notably through the CDP Water disclosure.

For each of these companies, the quantity of different raw materials and the geographic breakdown of raw materials have been searched throughout different internal documents or external surveys: annual financial and sustainable reports, CDP water report, CDP Forest report, Water policy, Corporate Social Responsibility (CSR) policy. The estimation does not pretend to be exhaustive as the companies are still reluctant to disclose all the materials they use as well as their geographic breakdown. However sometimes the different documents enable to make assumptions about the cost of raw materials and we use a world market price to find the quantity or the volume. The information might be deducted from statements such as: "Raw materials come from a local area around the amenities" and an average is made with the countries where amenities are located.

Again, this work aims at raising awareness on the estimation, and the estimation process. But, as explained in the further recommendations section, there are lessons to be taught from the process even if an estimation might not be built for every company.

4. Results

Over 27 assessed companies, 5 do not disclose enough information to enable an estimation of indirect water. However, 2 of these 5 companies provide enough data to understand that they have initiated a robust strategy on indirect water consumption, and notably through the choice of raw materials and the choice of location of the supply chain of these raw materials.

Among the 22 companies providing enough disclosure, 12 companies provide incomplete data that lead the assessment to a dilemma:

1. the data quality is not good enough;
2. the estimation does not seem accurate, notably compared to its competitors.

For instance, some companies do not disclose volume of raw materials that are active in a business unit more than 25% of their sales. Or the estimation shows that there is a problem of strategy formulation.

4.1 Paper

Results are displayed in Table 6. Four out of five companies disclose all necessary information. The ratio between direct and indirect water is the most impressive of the sectors. However, it is mainly green water and it is a very natural process monitored and maintained by companies. It does not represent a pressure on environment in itself. Beyond transparency, an overview of the performance shows that the key issue on this sector is the country selection. And all European paper groups but one have already achieved their geographic transformation, focused on the preservation of the forests of their home countries. This geographic shift notably from southeast Asian forest and paper mills have enabled them to reduce both their financial materiality (no site nor supply in water stressed country) as well as their impact materiality (average indirect water consumption of these countries is lower than the global average). Some countries have also a share of forest in Uruguay as this country had been considered until recently as immune to water stress, which is no more the case in 2023 [14].

Table 6 Results for the paper sector.

Company	Direct water consumption in cubic meter	Green water	Blue water	Indirect water consumption in cubic meter	Indirect water ratio	Financial materiality
Biofore UPM	161 000 000	9 191 270 319	28 602 230	9 219 872 549	57	No country considered as water stressed, no significant use of blue water
Svenska Cellulosa	121 000 000	195 604 589 277	2 036 598 449	197 641 187 725	1 633	
Holmen	71 000 000	126 861 233 663	6 088 114 619	132 949 348 282	1 860	
Stora Enso	503 000 000	20 327 681 822	224 526 912	20 552 208 735	40	
Smurfit Kappa	140 142 000					Up to 10% of sites in water stress

4.2 Breweries

Results are displayed in Table 7. In this sector, all European breweries companies are transparent and their disclosures are sufficient to calculate indirect water consumption. However, the results as such are homogeneous, but not necessarily performing. Water stress is significant among breweries amenities in same proportion. However, a look over water stress among supply chain shows that one company has worse results than the others. This company has also poorer results regarding indirect water ratio (indirect water consumption/direct water consumption).

4.3 Alcohol

Results are displayed in Table 8. Two out the three companies have sufficient disclosure. But their results are significantly different. The company with the worst indirect water ratio has disclosed in the CDP Water report that its strategy is still nascent on this issue. Assessment and prioritization plan is still being formulated. The third company of the sector is a smaller one. It does not disclose all the data to calculate the indirect water consumption, but it aims at providing national and global average. However, the results are deceiving as they are not comparable for two raw materials and for the grapes they are much higher than national and global average.

4.4 Food European "Big 3"

Results are displayed in Table 9. The companies are transparent but not necessarily performing. For one of the three, the data does not encompass all the raw materials. Beyond transparency, one of the three companies has figures that show indirect water coefficient that are systematically higher than the global average. It clearly shows that the water consumption is not taken into account in the country selection sides.

Compared to the figures disclosed and estimated in 2009, we could observe that two companies have strongly decreased their direct consumption, but the estimation of indirect water consumption has rocketed. It shows the need to make this indicator of indirect water consumption popular as some companies might

Table 7 Results for the breweries sector.

Company	Direct water consumption in cubic meter	Green water	Blue water	Indirect water consumption in cubic meter	Indirect water ratio	Financial materiality
Heineken	90 200 000	1 951 364 060	123 040 000	2 074 404 060	23	15% breweries, in water stressed areas
Carlsberg	34 633 000	754 126 000	47 504 000	801 630 000	23	17% breweries in water stressed areas in 2016
AB inbev	149 628 000	3 418 260 000	467 130 000	3 885 390 000	26	14% breweries in water stressed regions
Royal Unibrew	3 800 000			151 866 667	40	with the assumption that all cereals are barley

Table 8 Results for the alcohol sector.

Company	Direct water consumption in cubic meter	Green water	Blue water	Indirect water consumption in cubic meter	Indirect water ratio	Financial materiality
Diageo	17 500 000	661 519 004	43 071 827	704 590 831	40	35% distilleries and plants in water stressed areas, 14% barley comes from East Africa, a water stressed area
Pernod Ricard	22 786 000	406 539 356	26 469 977	433 009 333	19	10% production sites in water stressed areas
Remy Cointreau	237 360					Up to 10% of sites in water stressed areas

Table 9 Results for the European Food Big 3.

Company	Direct water consumption in cubic meter	Green water	Blue water	Indirect water consumption in cubic meter	Indirect water ratio	Financial materiality
Danone	67 759 000			4 829 325 073	71	17% sites in high water risk
Nestlé	97 100 000			45 924 666 667	472	30% sites in high water stress
Unilever	30 087 000			8 310 873 933	276	37% sites in water stressed areas

Table 10 Results for the Food ingredients sector.

Company	Direct water consumption in cubic meter	Green water	Blue water	Indirect water consumption in cubic meter	Indirect water ratio	Financial materiality
Kerry	21 551 000	694 372 195	33 091 450	727 463 645	34	nothing disclosed but a plan to reduce water intensity
Tate & Lyle	33 415 000	729 277 880	159 446 260	888 724 140	27	CDP restricted disclosure but a plan to reduce water intensity, integrated in ESG based remuneration scheme
Barry Callebaut	2 400 000			46 127 808 684	19 220	no geographic tracing yet
ABF	863 685			453 026 704	525	51 to 75% sites in water stress areas; very limited disclosure, estimation too low, not taking into account tea and soy
Glanbia	4 543 000					no disclosure at all

Table 11 Results for the food retail sector.

Company	Direct water consumption in cubic meter	Indirect water consumption in cubic meter	Factor	Financial materiality
Carrefour	12 966 000	2 223 517 923	171	
Sainsbury	2 796 460	1 453 369 582	520	No comment from the companies focused on direct water.
Tesco	6 400 000	2 810 782 208	439	

be tempted to focus on direct water whereas the main issue is indirect water consumption. On the contrary, one of the three companies has defined targets for the reduction by 25% of its indirect water consumption.

4.5 Food Ingredients

Results are displayed in Table 10. This subsector just started its work of identifying the raw materials and geographic breakdown. One does not produce a sufficient disclosure at all. Another does not include in its scope one of its major ingredients (tea), although this company is only one among the five companies to identify water stress among its amenities. The other companies have still difficulty to identify the geographic origin of their raw materials. In such cases, the indirect water consumption has been assessed using global average coefficient of the water footprint network.

4.6 Food Retail

Results are displayed in Table 11. In this subsector, three companies have been tested as they all provide data through CDP Forest about their consumption of palm oil, cocoa, soy, paper and beef. Results are incomplete (with many materials to be taken into account) but they are already alarming. The main reason of these poor results is the consumption of palm oil.

4.7 Textile

Results are displayed in Table 12. This sector has been recently under the light of the investors. Many

Table 12 Results for the Textile sector.

Company	Direct water consumption in cubic meter	Indirect water consumption in cubic meter	Indirect water ratio
Inditex	1 886 900	3 186 510 082	1 689
H&M	333 799 000		
LPP			
Kering	13 410 000	20 500 000	2

disclose under the CDP but no company provides a satisfactory disclosure. Two estimations out of 4 searched companies have been made possible. However, the results are not comparable not interpretable as there are too many assumptions. Indeed, the indirect water ratio amounts to 2 and 1 689. Besides this patchy disclosure, the indirect water estimation raises the question of the strategy. Indeed, ways of improvement are not clearly stated yet regarding water. For instance, organic cotton enables to reduce indirect water consumption by 85%. However, some of the leading companies disclose that organic cotton represents only 1% of the market and therefore cannot be considered as a significant solution for water saving. A few companies disclose they will source more from suppliers involved in the Better Cotton initiative. However, the Better Cotton Initiative has not significant results regarding water consumption, with water consumption reduction ranging from 6% to 15%. A second solution is the use of Tencel, a textile based on low water use process. However, Tencel is 50% to 100% more expensive than cotton. Only one company, the one with lowest disclosure in the table, has disclosed a clear strategy developing a responsible offer using gradually more and more organic cotton and Tencel, with step-by-step and progressive targets being set for short and medium term and with the first sets being achieved in 2022. This example shows that a ratio is not to be searched for itself to assess transparency but as a means to assess long term performance.

5. Recommendations

This estimation of indirect water consumption enables to draw a few recommendations.

1. The estimation of this "indirect water consumption" should become systematic as its level shows its importance relative to the direct water consumption. Given that agriculture is responsible for 70% of water consumption, our figures are a first element of proof that all sectors related to agriculture for their supply should report on this issue.

2. The estimation enables to assess in its results or in the process of estimation the real strategic awareness of the company for the question of water consumption if upstream life cycle is encompassed. By the way it also enables to assess green water, which has been so far under-estimated in usual models.

3. Indirect water consumption is a good example of impact materiality. It makes no harm to the company but in the end, it may lead to massive misuse and protection of water resources in the countries of supply. Questions impacting water issue such as climate physical risk (floods notably) should be classified into climate adaptation. Similarly, the water discharge is not an impact materiality for water issue. As it is already an impact materiality for biodiversity. The CDP Water questionnaire raises important issues about impact materiality. Some of the questions are related to water but might not be considered as impact materiality for water as it might generate double counting of impact materiality. Every environmental issue (among the 6 targets of European Union) should be assigned one financial materiality and one impact materiality.

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