

**Accounting for Sustainable Development:
The Challenges in Recording Water Usage in Companies' Business Activities**



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Abstract

Water as natural capital for business has its role in contributing to companies' business activities. Many companies are now trying to record the accountability of using natural capital by disclosing their sustainability report for the purpose of legitimize themselves to stakeholder. However, there is an underlying issue in trying to integrate the information within the report with the management decision making. Hence, the goal of this research is to find the challenges in recording water usage in companies' business activities by explaining the importance of water and focusing on two different methods of accounting for water that is available for businesses to use. By focusing on these two methods, the author also hopes that it will give companies perspective on how can these two methods can help companies account water in their business records. The author used literature reviews in this study by analyzing various scientific journals and books to finish the thesis. In addition, the author also uses field study to find research that tries to implement the two methods as a comparison to give a clearer picture of how does these methods are used in reality. The author hopes that the findings and conclusion of the research could help companies by giving them a clearer picture of accounting for water and also help future research for accounting for sustainable development.

Keywords: Accounting for water usage, Sustainable development.

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Chapter 1

Introduction

1.1. Problem Description

In recent years, more companies are being pressured by the public to conduct their business activities responsibly. Due to these stakeholders' demand, companies are trying to prove their existence in a responsible and ethical business organization (Ernst & Young, 2014). To meet this demand, companies are trying to disclose their responsibility action by publishing their corporate responsibility reports. For example, companies that are sensitive to environmental risk and accident tends to increase their environmental information and press release to show the reason of accidents or shows their corrective measures to reduce accidents to stakeholders (Mata, Fialho, & Eugenio, 2018). According to a survey by KPMG (2017), there is an increasing trend of companies publishing their corporate responsibility report. Up to 86% of companies in the S&P 500 index published their sustainability reporting in 2018 (Governance & Accountability Institute, 2019). This indicates that there is an increasing number of companies involved in sustainable reporting. However, this report mostly only justifies what companies do. According to Mata, Fialho, and Eugenio (2018), the motivation for publishing a corporate responsibility report is predominantly because of external factors such as community expectation, media pressures, and critical social or environmental development. The report only consists of descriptions of what have the companies have done to justify their business activities. This is because companies use their corporate responsibility report as a strategy to legitimize company activity instead of promoting accountability (Meta, Fialho, & Eugenio, 2018). Due to this reason, the information provided cannot be linked clearly to company decision making. Hence, there is a problem in connecting information in CSR to company decision making. The problem of integrating this information may lie in our accounting methods.

Accounting is defined as a tool that can help collect information for company decision making. However, the accounting tools are only concerned with financial information rather than environment and social information. As stated by Solomon J. and Solomon A (2004), the current financial reporting framework is focused on the recognition and measurement of legally owned or control assets or liability. Hence, the accounting tools exist today do not support the recognition and measurement of

environment and social information because the principle in the area of recognition and measurement in the accounting tools only focus on legally owned or controllable assets. This pose a problem because the company will face difficulties in the recording of environment and social information since the environment and society cannot be controlled or owned in the same way as financial assets. Hence, there is a gap in applying the traditional accounting tools with the environment and social information. In the end, this could become a problem because the decision taker could be oblivious to any social or environmental impact that their decision may have because they could not integrate the available social information with the company decision. The company can even neglect any environmental and social information, making them unable to make a sustainable decision.

Many researchers have argued what the best approach is to measurement and recognition of environmental information. One of the most appropriate is by looking at the element of air, water, land, and sound. The most important element, according to research, is water. According to Solomon J. and Solomon A (2004), water is considered the most important natural capital. Water is crucial because it considered as an essential resource for human activities, environmental ecosystem, and economic values (Muller, 2012). However, the recognition and measurement of water are proven to be difficult for many companies. For instance, because there is an overall complexity in recognizing water due to its challenge as a common pool of resource, as water is obviously not a public or private asset (Muller, 2012). Hence, the goal of the research is to determine the difficulties in recording and measuring water usage in the company's account. In addition, the author hopes that the result of this research could give companies more understanding on the available methods that companies can use and recommendation on how to implement accounting for water in the company's account.

1.2. Research Questions

What are the challenges that companies may face when recording water usage in their account?

1. How does the information on water usage can help companies in making a sustainable decision?
2. What are the different methods of accounting in water usage there is currently used?

3. What are the barriers for companies in implementing the accounting tools to record water usage?

1.3. The Methodology

In order to answer the research questions, the research will focus on literature studies and a field study.

1.3.1. Literature Review

1.3.1.1. Identification of Keywords

In order to retrieve the relevant articles, the following keywords and abbreviation are used in various combination: *Sustainable development, sustainable reporting, social and environmental accounting, water accounting, accounting methods, environmental accounting, water management, corporate environmental management, corporate sustainability report, water reporting, water disclosure, accounting for water usage, accounting measurement and recognition.*

1.3.1.2. Selection of Search Engines

The following search engine was used to identify abstract summaries of articles:

- Google Scholar
- Science Direct

1.3.1.3. Article Search Method

The following journals provided that are included in this research:

- Journal of Cleaner Production
- Journal of Environmental Management

1.3.2. Field Study

The author includes field study in the research data collection to compare and analyze the reality of using accounting in water usage. The aim of the field study is to know how far does accounting for water usage is being adopted in real business life. By looking on how far does the adoption has been done, the author

hopes that it could give a clearer picture on how do the methods could offer companies a way to integrate water usage information for companies' business activities.

1.4. The Objectives

The objective of the research is to determine the difficulties that companies may face when record and include water usage information in their accounting account. By determining the difficulties in recording water usage information, it could contribute to companies by giving them information on the factors that are needed to consider when they wanted to record water usage information in their financial statement. It could also help them decided the best methods available to use and what challenges companies may face when using the specific available methods. In addition, it could help other future research to find a new approach and perspective on accounting.



Chapter 2

Theoretical Framework

2.1. The importance of water for business

In this chapter, the writer will explain the research topic by dividing the section of the chapter by four parts. The first section will explain the importance of water for business, which explains why water needs to be considered by businesses. The second section will explain the accounting for water usage, specifically why accounting for water will help businesses in making water-related decisions. In the third section, the writer will provide two examples of water accounting methodologies that are relatable for businesses. And lastly, in the fourth section, the writer will give a practical example of water accounting methods.

2.2. Water-related business risk

According to Burritt & Chris (2017a), water has a two-way relationship with business; physical supplies of water is important for a successful business operation while on the other hand, business activities can have negative impacts when the water quality is questionable. Organization and companies such as the one who use water in their supply chain will most likely influence by the use of water. Among this sector, the most at risk of intensive water user are companies that related with high-technology, power suppliers, agriculture, forestry, mining, food and drink, and pharmaceuticals (Earnst & Young, cited in Burritt & Crist, 2017a).

Companies can face water risk in terms of water availability. This problem could impact the company supply chain and also the other companies which they are doing business with. This problem is especially prominent for companies that are associated with supply chain collaboration in the water-stressed region. According to Burritt & Chris (2017b), there is a major concern for management in accessing the quantity of water in the water-stressed region. This is because companies associated with the supply chain in water-stressed region has a higher probability of losing their water resource in their supply chain. If companies do not have a substantial amount of water resources, their production process could be jeopardized. Those companies will have a harder time finishing their goods on time which will result in losing their customer,

which will then affect the companies' profits. Companies could have the option to find another water resource somewhere else. However, this will incur another cost for the companies.

Another risk companies could face regarding water is related to the quality of water. Water is considered as a shared resource with activities by one user may have negative impacts on the other users (Burritt & Chris, 2017b). This means that because water is considered as a common pool of resource, every activity that affects water quality will affect the others. According to Burritt & Crist (2017a), supply chain activities can impact the quality of water because suppliers could pollute the water during their production cycle. Because water is a shared resource, when the resource is polluted, it will affect other things that used these resource. In addition, if the quality of water is exposed, there might be a legal and social expectation in using the water. Companies may have to do another process to determine whether the quality of water meets its quality standard, which will incur more cost to the company. As it is stated by Burritt & Chris (2017), water quality becoming a concern for business and it is often required for them to assess the treatment of poor-quality water before it can be used for production purposes.

2.3. The importance of accounting for water usage

According to Momblach, Pedro-Monzonis, Solera and Adreu (2019), water is considered as a key factor for the economic development of diverse sectors, especially for those who have conflict interest with water usage. This is because water itself has its own opportunities and risk for businesses. "In the light of perceived contemporary crisis, water presents both opportunity and risk for business" (Burritt & Chris, 2017a). Water has its long list of potentials economics, environmental and social business to be considered. Hence, it is considered important for businesses to address water-related issues. It is commonly said that accounting is the language of business. Accounting is used as a tool for companies to interpret information for businesses decision making. This makes accounting an important part of businesses decision making. Water itself is considered a natural capital and businesses have their own interest in recognizing this natural capital. By using accounting for water usage, companies can try to measure the use of water and thus manage these resources. Hence, accounting for water usage is giving companies opportunities to measure and account their water usage. By having

the ability to manage the use of water, companies can reduce a certain water-related risk. According to Morrison, Schulte, & Schenck (2010), the main interest companies consider corporate water accounting is the desire to reduce water-related business risk and seize business opportunities. The purpose of corporate water accounting serves four general purposes (Morrison, Schulte, & Schenck, 2010).

These purposes include:

1. Operational efficiency, product eco-design, and sustainable manufacturing.

The basic purpose of corporate water accounting is related to internal management and decision making. This is because by having the report itself, internal management can use the report to make a decision related to operational efficiency, product eco-design, and sustainable manufacturing. According to Morrison, Schulte, & Schenck (2010), there are many practices demanded by law and regulation in many developed countries for companies to measure the amount of water they used and discharge in their own operations. These trends have been largely driven by the desire to maximize operational efficiency. According to Morrison, Schulte, & Schenck (2010), there are key questions that companies ask in regards to the accounting for water use and discharge for their internal management purposes. These questions include:

- How much water is used in their own operation facilities?
- How efficient is the use of water in normalized the product?
- How much is the water waste being discharged to the environment and what quality is it when it leaves the facility?
- How much water does the supplier use? How efficient they use water? How much waste do they discharge and what quality of it?
- In which segments of the company supply chain does the use or discharge most water?

2. Water risk assessment or identification

It is well known that global freshwater is becoming more scarce. In addition, most major companies are now becoming more global in their supply chain. This arises concern for major companies regarding their access to water resources. In addition, companies also realized that their own water practice

might create a certain type of business risk. According to Morrison, Schulte, & Schenck (2010), water risk is dependable on the local variable context in which companies and suppliers operate their business. By understanding the water-related business risk, companies can consider the risk they will probably face in a certain local context and prioritize those areas to reduce the risk. Some key question that companies ask regarding their water business risk are (Morrison, Schulte, & Schenck, 2010):

- Which are their facilities that are located in water-stressed region?
- What is the nature of the water use and discharge in various location?
- What is the percentage of available water that their facilities use?
- What is the percentage of available water that is used for human purposes and the allocation for other sectors?
- Which area does the government and management concern regard the water capacity?
- How secure is their legal access to water in those regions?
- Which location where companies will face a high level of reputational risk due to insufficient water flows and service to local communities?
- How can the company expect that the exposure to water-related risk changes due to climate changes, population growth, economic development and other factors?

3. Managing the impacts of water-related social and environmental responses.

This purpose is included as one of the generic purposes of corporate water accounting but also the most complex component. This is because it is not quite easy to determine the actual impacts of water on watersheds, ecosystems, and communities. According to Morrison, Schulte, & Schenck (2010), "impact" in this term refers to the extent in which volume of water affects the availability of water for others to use or harms the human health and ecosystem. Some questions that companies ask regarding their water impacts include (Morrison, Schulte, & Schenck, 2010):

- Which one of their facility poses the greatest social and environmental impacts?
 - Which part of their supply chain generates the most impact?
 - How do their water activities affect the ecosystem function or water streamflow?
 - How do their water activities affect the ability of communities to access or afford water services?
 - How do their water activities affect human health?
 - How can these various impacts expose them to business risk?
4. Communicating the water risk and performance to the stakeholders.

After the water assessment is done, companies will be required to disclose this information to stakeholders. By disclosing this information, companies will become more transparent and can be held accountable for their water use. According to Morrison, Schulte, & Schenck (2010), several question companies ask regarding their disclosure of water-related information are:

- Is there any well-established metrics in which consumers, investors, and affected communities expect them to report regarding their water-related data?
- What accounting methods are well understood to non-technical audiences?
- What is the most helpful information for consumer purchasing decision? Are the available methods offer this information?
- What is the most helpful information for investors that assessing the water-related risk or in investing their funds in an “ethical” company? Are the available methods offer this information?
- What is the most helpful information to reassure potentially affected communities and supporting their social license to operates? Are the available methods offer this information?

2.4. Water accounting methods and tools

Currently, there were different kinds of water accounting methods and tools made by many organizations. In this section, two common methods will be explained due to its significant availability to the public and its special design to account for water

that is relevant to businesses. In addition, this method is chosen because of its applicability to a wide variety of geographical locations and industry sectors. This suggestion is based on a research done by Jason Morrison and Peter Schiltr of the Pacific Institute and Rita Schenck of the Institute for Environmental Research and Education.

2.4.1. Water Footprint (WF) Accounting

2.4.1.1. The concept of water footprint

Water footprint accounting is a water accounting method that is developed by researchers at the University of Twente, Netherlands and is being managed by the Water Footprint Network. It focuses is to measure the amount of water being used to produce goods or do services. It could also indicate how much water is being consumed in a particular area. According to Morrison, Schulte, & Schenck (2010), water footprint was originally developed as an accounting tool for water resource management that is intended for entities to understand their relationship with water. In water resource management, water footprint is currently considered as a well-established management in this methodology. It is used by policymakers, planners, and managers to map various water use in a system. In water resource management, the volume of water used is considered as a critical information for decision-maker because it can, for example, indicate on how much water is being used in the supply chain and how it is allocated among users.

One of the interesting concepts of water footprint lies in its consideration to measure water in the supply chain. It is because water footprint does not only look in the direct use of water but also the indirect use of water. According to Hoestra, Chapagain, Aldaya, & Mekonnen (2011), “the water footprint is an indicator of freshwater use that looks not only direct water use of a consumer or producer, but also at the indirect water use”. This means that the measurement does not solely focus on how much water do companies use directly such as drinking water, bathing, or cooking, it also considers the used of virtual water, which refers to all of the total volumes of water used in the production cycle. It could also be considered as a “hidden” water behind a product. One example of virtual water is by looking at the virtual water

used to produce meat. According to Food & Water Watch (n.d.), a hamburger uses approximately 2,400 litres of virtual water. In its supply chain, water is consumed during the entire process of making a hamburger from the growing feed crops for the cows to its slaughtering and the processing of the meat. Hence, the water footprint focuses on providing information that helps decision-makers understand all volumetric needs and use those needs to better prioritize the use of water, based on its scarcity.

2.4.1.2. The scope and structure of water footprint

The water footprint focuses solely on measuring how much water is used and discharged. According to Hoestra, Chapagain, Aldaya, & Mekonnen (2011), the goal of water footprint is to analyze the use of water in human activities or specific products and relate it to the scarcity of water and the issue of water pollution. It is a tool used to give an insight for companies to understand how their activities can contribute to the scarcity and quality of water. Because it is only a tool, it does not exactly tell companies what to do but rather tell companies what can be done for a more sustainable water usage.

There are four distinct phases of water footprint

1. Setting goals and scopes
2. Water footprint accounting
3. Water footprint sustainability assessment
4. Water footprint response formulation

In order for companies to have an objective decision when undertaking the water footprint study, it is important for companies to first establish their goal and scope of implementing water footprint. This is because water footprint can be done for many reasons. For example, pharmaceutical companies may take an interest in water accounting because they want to know how much water it is used to make a certain medicine in their supply chain or even in their entire supply chain. Hence, water footprint implementation is dependant on what is

companies want to find out related to their water usage. In the second phase, it is the phase in which data are collected and accounts are developed. The data scope and details are dependable on the decision made in the previous phase. The third phase essentially talks about the impact of water used in comparison with the local availability data. It is a phase in which water footprint is being evaluated in the environmental, social, and economic perspectives. In the last stage, companies then decided what response should be made from the evaluation process. This response could be in the form of strategies or policy.

Because water footprint captures the water use and discharges, it considers the volume, location, and timing of water. Hence, the measurement is divided into three separate components; the blue, green, and grey water. All of these components are recorded in terms of volume of water. It is considered as both separate components and as a whole component. The definition of three separate components is explained as follows.

1. The green water footprint – it refers to the consumption of water that comes from the soil. It also could come from evaporated, transpired or incorporated by plants. It is particularly connected with agricultural, horticultural, and forestry products. The example of green water is rainwater stored in the soil.
2. The blue water footprint – it refers to the consumption of water derives from fresh surface and groundwater such as rivers and lakes. It also includes water that has evaporated or been incorporated into another product or returned to another. It is particularly connected with irrigated agriculture, industry, and domestic water use.
3. The grey water footprint – it refers to the consumption of water being used to dilute pollutant to meet a specific water quality standard. The grey water footprint is usually related to water that is used to treat industrial discharges, agricultural runoff, untreated municipal wastewater and other dilute pollutants.

2.4.1.3. *The applicability of water footprint in corporations*

In applying water footprint in corporations, there are several questions that companies need to consider. These questions include:

1. What is the ultimate target?
2. Is there any particular focus on a particular phase?
3. What is the scope of interest? Direct or indirect water footprint?
4. What water footprint measurement that corporation wants to take? The green, blue, or grey water footprint?

These questions could determine how can companies conduct their water footprint study. In the corporate water footprint measurement, companies usually related their total volume of water used directly and indirect in their business process. However, in practice, a complete comprehensive supply chain assessment of water footprint practice is not widely practised due to its difficulty in obtaining data (Morrison, Schulte, & Schenck, 2010).

According to Morrison, Schulte, & Schenck (2010), the applicability of water footprint has its general strength and weaknesses. The strength of this concept is that it is used as a general strategic planning purpose that could give companies a big picture in identifying companies consumptive water use and source of water data. This is because when companies use this concept, they will ultimately think about the scope of their water footprint. This means that the companies need to think its water usage in their own supply chain. They will think whether water is being used in each step of their production cycle. Hence, this could increase the awareness of water usage because companies will now know how much water is being used directly and indirectly in their supply chain. It is especially conducive in conveying water information to stakeholders and also use this information with water resource managers because it could help mapping and understanding the water-related business risk and impacts. According to Chapagain & Tickner (2012), the application of water footprint can help companies understand their water-related risk. Even so, this concept also has its own weaknesses. Because water footprint is just a tool which is used to understand the companies water-related risk, it

does not offer certain information on what action should be made to address this risk. Companies itself needs to determine the action that needed to be taken. Water footprint does not offer information on what course needs to be taken to address this risk (Chapagain & Tickner, 2012). Hence, this could lead to a wrong action which will result in a riskier result for the company.

2.4.2. Life Cycle Assessment (LCA)

2.4.2.1. *The concept of life cycle assessment*

Life Cycle Assessment (LCA) is a systematic analysis tool that is used to measure the environmental sustainability of products and service in its components of the value chain. “LCA methodology aims at quantifying potential environmental impacts generated by human activities on a wide range of environmental issues” (Boulay, Hoekstra, & Vionnet, 2013). Because it measures the environmental sustainability of products, LCA itself can be used in many different kinds of environmental issues such as climate change, land use, water use, noise, and etcetera. According to Rebitzer et al. (2004), LCA is a framework for estimating and assessing the environmental impacts of the life cycle of a product. It is a “life cycle” because every product has a “life”, starting with the design and development, resource taking, production, consumption of the product, and finally the end-life activities such as collecting, reuse, dispose, and etcetera. All of these activities that relate with the product “life cycle” will affect the environment due to the consumption of resources, emission in making the product, waste from making the product and other environmental exchanges.

A concept that is surrounded LCA is the methods of product-focus. According to Boulay, Hoekstra, & Vionnet (2013), the methodology focus of LCA is on the sustainability of products in which LCA water is one area focus among others. This is why LCA is considered as an input-output tool because it measures the resources used in a particular product. If the analysis of LCA is properly done, it can even be used to make a comparison among products or services.

According to Morrison, Schulte, & Schenck (2010), LCA has been primarily used for three kinds of decisions which are engineering decision for products or process improvement, policy decision at the company governmental level, and environmental purchase and sales decisions.

2.4.2.2. The scope and structure of life cycle assessment

LCA is designed to enable evaluation and comparison for many different types of environmental resources, emission, and their impacts. The core value of LCA lies in its ability to assess impacts across many ranges of environmental categories.

The LCA consist of four basic strategies:

1. Goal and scope.

The goal and scope are talking about the intended application of LCA. This includes the boundaries of the assessed system and the functioning unit of the assessed products.

2. Life cycle inventories.

The life cycle inventories concern about the collection of environmental inputs and outputs. This is the process of collecting the data that is necessary for the assessment. The data that is collected is related to activities which have an impact on environmental issues. For environmental issue in water, this stage is related to the volume, timing, types, location of use, and the volume of contaminants mass released to waterways.

3. Life cycle impact assessment.

In the life cycle impact assessment, it is the process where the inputs and outputs of environmental data are being translated into impacts.

4. Interpretation.

Interpretation which is the final stage of LCA further translates the impacts determined in the previous stage into a conclusion

and recommendations to improve the environmental performance of the product or services.

2.4.2.3. The applicability of life cycle assessment in corporations

Compared with the other water accounting tools, LCA is not characterized by companies and practitioners as a water assessment tools. LCA is considered as a management decision support tools. This is because LCA has a different approach to addressing risk. For example, in water footprint, the focus was to understand how can their activities can contribute to the scarcity and quality of water. Compared it with LCA, the key focus on this method is to understand the company efficiency in using their resource such as water. For LCA, the company use of water and discharge may pose some risk such as the inefficient use of water which could lead to the negative impact of the ecosystem and the communities in which creates a potential reputational risk for the company. Thus, “LCA can help identify “hotspots” whereby product design and technical improvements can be seen as a risk mitigation effort” (Morrison, Schulte, & Schenck, 2010).

The applicability of LCA itself has its own strength and weaknesses. According to Morrison, Schulte, & Schenck (2010), LCA is well suited for cross-media environmental assessment and its used mature science-based method for assessing the water impacts. LCA can identify which “hotspots” in the production cycle that can be environmentally improved. In addition, it can also assess the impact of changes in the related product life cycle. However, LCA also has its own weakness which is there is no universally accepted method right now to assess the water use impact and the result of LCA itself can be quite difficult to communicate to a non-technical audience. It is true that LCA can identify which “hotspot” that can be environmentally improved, but it may be difficult to interpret this information to non-technical audiences because they did not have a full understanding of the technical process of the product. This is also the reason why LCA is considered as a management decision supporting tool rather than the water assessment tool.

2.5. The application of the water accounting methods in real practice

In this section, the author will give a real example of a research study that applies the 2 mentioned water accounting methods. The research was done in 2012 with the title of *water footprint and life cycle assessment as approaches to assess potential impacts of products on water consumption: key learning points from pilot studies on tea and margarine*. This research was conducted by Donna Jefferies, Ivan Muñoz, Juliet Hodges, Vanessa J. King, Maite Aldaya, Ali Ertug Ercin, Llorenç Milà i Canals, and Arjen Y. Hoekstra.

2.5.1. The goal of the research

Jefferies et al. (2012) present two case studies for applying Water Footprint (WF) and Life Cycle Assessment (LCA) approach to tea and margarine. The assessment of both approaches includes water accounting and impact assessment. The goal of the research is to present a practical comparison of these two approaches. In addition, it also aims to find the strengths and weaknesses of both approaches and also learn whether these two approaches can learn from one another.

2.5.2. Data, methods, and assumptions

2.5.2. 1. *Water Footprint (WF)*

The WF assessment is calculated based on the methodology presented by Hoekstra et al. (2009) and Ercin et al. (2010) (Jefferies et al., 2012). The water components included in this study is only the blue and green water footprints. The operational and supply chain water footprint consists of two parts which are the direct inputs applied for the production of the products and the overhead water footprint. The overhead water footprint refers to the water used in the supporting activities and materials used in the business.

2.5.2. 2. *Life Cycle Assessments (LCA)*

The LCA aim is to quantify the impacts of water consumption. The life cycle of the system includes:

- Production and processing of raw materials.
- Packaging production.

- Transport of materials.
- Product manufacturing
- Transport to regional distribution centre
- Use
- Waste management (packaging and product leftovers).
- Production of auxiliary materials and energy carriers.

The data that is used for margarine is a model from a previous LCA study made by Nilsson et al. (2010). For the tea, it uses the same primary data resources in the WF study. All of the background processes were modelled by ecoinvent database and for the electricity production is used both ecoinvent database and also country profiles obtained from the International Energy Agency Statistics (IEA, 2010).

2.5.3. Comparison of Water Footprint (WF) and Life Cycle Assessment (LCA)

WF and LCA has a different set of background and used for different purposes. According to Jefferies et al. (2012), LCA focuses on producing a single number for each category and seek to describe the potential impacts across the life cycle. On the other hand, WF is developed from a water resource management approach and strongly addressing the local and temporal nature of the water-related impacts. In addition, both methods also have different data sources such as explained by Jefferies et al. (2012) that WF uses green water in their calculation while LCA does not includes or even accounts for it differently.

Both methods show their own strength and weaknesses. According to Jefferies et al. (2012), the calculation for blue and green water for WF is quite well established and also works for individual factories while LCA also has a robust system analysis foundation. According to Jefferies et al. (2012), from the product level perspective, LCA and WF are both assessing the life cycle impact of water usage. It is evident in their research when they were using similar data sources, it actually leads to a similar result in the accounting and inventory stage. The small different happens due to a slight difference in boundary conditions of both approaches due to applying the 'standard' method. According to Jefferies et al. (2012), the fundamental differences for

both LCA and WF is its inclusion of characterization factors in LCA while WF simply providing the volumes of water.

Even so, both method also has its own common weaknesses. It is explained by Jefferies et al. (2012) that both WF and LCA approaches require to know where the process is involved because water scarcity is local. This is especially difficult to apply when the products are complex since many supply chain is global and dynamic. This makes tracing back all process is not really feasible. In other words, the overall problem lies in the availability of data. It is explained by Jefferies et al. (2012) that when they conducted the research, both WF and LCA has the same challenges in the assessment of products. When conducting the impact assessment, the data that is needed is not available at the time of the study, making them have to make various improvement for their indicators.



Chapter 3

Conclusion

Many companies are trying to be more transparent by disclosing their environmental and social actions in their corporate responsibility reports. However, the problem that lies in these reports is that there is a problem in integrating the environmental and social issues into companies' decision-making process.

Water is considered as a natural capital that is essential. Furthermore, water is considered as a common pool of resource, connected with human activities, environmental ecosystem, and economic values. Water could be considered as an asset because, in some way, it could be controlled and owned, but it should be noted that it cannot be controlled and owned in the same way as financial assets. This poses a problem because there are difficulties in recording this kind of asset due to gaps in recognizing, recording, and measuring water compared with the common financial asset. Even so, many companies realize that water is important for their business because it has its own opportunities and risks that needed to be considered. Due to this reason, many companies are interested in an accounting method that could reduce water-related risk and seize water-related opportunities.

Currently, many organizations have proposed different kinds of accounting methods and tools to account water in companies' business activities. Two methods that are common and relevance to business according to researchers are Water Footprint (WF) and Life Cycle Analysis (LCA). Both methods have a similar goal, which is to integrate water information in companies' business activities. However, both have different ways in trying to account this information and make the information relevant for businesses. For WF, the goal is to have a better understanding of the company relationship with water. It focuses on providing how much direct and indirect water used and needed in making a product. This information can be relevant for business because it provides information that helps decision-maker in prioritizing their water used. On the other hand, LCA main goal was to measure and to assess the environmental impact of a product life cycle. It is designed to assess whether the usage of water in a life cycle is efficient. In LCA, this information can be relevant because decision-maker can use the assessment to find "hotspot" where a product can be environmentally improved as a risk mitigation effort.

There are common challenges and barriers in applying WF and LCA. It should be noted that both methods do not have a proper standard in account for water. Even though the methods are proposed, the appropriate standard to apply this method is still under development. Thus, there is not exactly a “right or wrong” situation in applying both methods. In addition, there is also information barriers in applying these two methods. If the companies do not have sufficient water information, it will be difficult for them to finally assess water in their business activities. Hence, companies need to establish a good database to record their water-related business activities in order to apply both methods.

For the different challenges for both methods, in WF, it is true that this method offers companies to understand their business relationship with water. However, it should be noted that WF is only a tool to understand the companies water-related risk by mapping the use of water in their supply chain and thus does not offer a measurement of economic, social, and environment impact of the water usage. In other words, WF will give volumetric information about the company’s water usage, but the company itself will have to decide how to take action. This is because water consumption is region-specific and thus, the decision cannot only be dependent on the volumetric information of water. On the other hand, LCA is considered a management tool that companies can use to find hotspots that can be improved in a product lifecycle. Because it is considered as a management tool, this method is more comprehensive than WF and thus making it more difficult and complex compared to WF. In addition, due to its complexity, it is much more difficult to disclose this information to stakeholders whom most of the time, do not understand a company business process in detail.

Chapter 4

Policy

In this section, the writer will give recommendation for companies who wants to apply a water accounting method in their business activities. This section includes elements that companies need to be aware of and prepare them when they want to account for water in their business activities. The policy will be divided into four key areas. In addition, each section will explain why companies need to be aware of and prepare for their future application of accounting for water usage.

4.1. The goal and objectives of accounting for water usage

When companies want to implement accounting for water usage, companies firstly must establish their goal and objectives of accounting for water usage. It is because these steps are crucial in later on to determine the scope and limitation for the corporate water accounting. By having a clear goal and objective of accounting for water usage, companies can determine which data they needed to collect and which methods that are relevant for them to use. However, it should be noted that the overall goal and objectives of accounting for water usage should be related to the companies' relationship with water. It is true that both methods, WF and LCA, help companies understand more about their relationship with water. In addition, there is actually “no best” method between those two because both can complement each other. However, WF and LCA offer different outcomes for companies, and these outcomes can be used to determine a suitable method for them to be used. For example, if a company is looking for water information for mapping the water used, WF is preferable because it offers this kind of information. On the other hand, if a company wants to environmentally improve their business process, LCA is preferable.

4.2. Data Collection

One of the common problems in account of water in companies' business activities is the data collection process. This is because many corporate water accounting efforts are insufficient due to external watershed data. This means that there is not enough data out there for companies to assess water in the first place. Adjustment then usually need to be made when facing this situation, such as being done by Jeffery

et al. (2012) research. In addition, Jeffry et al. (2012) research in practically applying the accounting water method shows that the researcher faces difficulties in making the water assessment due to information shortage. Hence, an improvement in making a robust information system and database is needed to help companies obtaining a reliable water assessment. Companies can do this by using information technology to measure the water usage of businesses in real time and stored this information in their own database. In addition, to help companies address the external watershed data, companies can try to collaborate their information system with their supplier to match the water information needed for the assessment.

4.3. Assessment of supply chain

Companies need to address their supply chain system. It should be noted that the methods that are available right now are still under development. Hence, there will be difficulties in assessing a complex supply chain system. Companies need to make an innovative way to communicate supply chain information. This is not only included the internal communication system but also the external communication system such as information from suppliers. This is because one issue in dealing with accounting for water usage is actually related to how to address supplier's water issues. It is sometimes difficult for companies to assess corporate water accounting because they do not have sufficient information on supplier water usage. In addition, companies also need to have a good understanding of their own supply chain. It is important for them to know their supply chain process deeply so that it is easier for them to determine the key areas where water is involved in their supply chain. By knowing the key areas where water is involved, companies can decide what action they need to take to reduce the problem.

4.4. Water accounting information disclosure

In order to support the assessment of water-related business risk, it should be noted that the information that will be disclosed should be able to determine the companies water risk, impacts, and performance. Such information needs to be relevant to the related industries and region. In addition, it also needs to be valuable to the companies itself while at the same time, address the stakeholder's issues. Such information could be related with the location of water-stressed region, water quality, the social dimension of water such as the accessibility and affordability of water resources, and also the use of water in a specific area of company's supply chain. By

knowing this information, companies can better address the water issues to stakeholders. In addition, companies can also have a better understanding of their relationship with water which will then help them make a sustainable decision.



References

- Boulay, A., Hoekstra, A. Y., & Vionnet, S. (2013). Complementarities of water-focused life cycle assessment and water footprint assessment. *Environmental Science & Technology*. 47, 11926 – 11927.
- Burritt, R. L., & Christ, K. L. (2017a). The need for monetary information within corporate water accounting. *Journal of Environmental Management*. 72-81.
- Burritt, R. L. & Christ, K. L. (2017b). Water management accounting: A framework for corporate practice. *Journal of Cleaner Production*. 152, 379-386.
- Chapagain, A. K., & Tickner, D. (2012). Water footprint: Help or hindrance?. *Water Alternatives*. 5(3), 563-581.
- Ernst & Young. (2014). Sustainability reporting – the time is now. Retrieved at December 20th, 2019, from EY: [https://www.ey.com/Publication/vwLUAssets/EY-Sustainability-reporting-the-time-is-now/\\$FILE/EY-Sustainability-reporting-the-time-is-now.pdf](https://www.ey.com/Publication/vwLUAssets/EY-Sustainability-reporting-the-time-is-now/$FILE/EY-Sustainability-reporting-the-time-is-now.pdf)
- Food & water watch. (n.d.). Virtual water. Retrieved at March 5th, 2020, from: <https://www.foodandwaterwatch.org/insight/virtual-water>
- Governance & Accountability Institute. (2019). FLASH REPORT: 86% of S&P 500 index companies publish sustainability report in 2018. Retrieved December 19th, 2019, from Globe News Wire: <https://www.globenewswire.com/news-release/2019/05/16/1826306/0/en/FLASH-REPORT-86-of-S-P-500-Index-Companies-Publish-Sustainability-Reports-in-2018.html>
- Hoekstra, A. Y., Chapagain, A. K., Aldaya, M. M., & Mekonnen, M. M. (2011). *The water footprint assessment manual*. London: Earthscan.

Jefferies, D., Muñoz, I., Hodges, J., King, V. J., Aldaya, M., Ercin, A. E., Canals, L. M., and Arjen Y. Hoekstra. (2012). Water footprint and life cycle assessment as approaches to assess potential impacts of products on water consumption: key learning points from pilot studies on tea and margarine. *Journal of Cleaner Production*. 33, 155-166.

The KPMG survey of corporate responsibility reporting 2017. KPMG. Retrieved December, 2019, from KPMG: <https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/10/kpmg-survey-of-corporate-responsibility-reporting-2017.pdf>

Mata, C., Fialho, A., & Eugenio, T. (2018). A decade of environmental accounting reporting: What we know?. *Journal of Cleaner Production*. 198, 1198-1209.

Momblanch, A., Pedro-Monzonis, M., Solera, A., & Andreu, J. (2019). Water accounting for integrated water resource management: Experiences and recommendations. *Advances in Chemical Pollution, Environmental Management and Protection*. 3, 1-34.

Morrison, J., Schulte, P., & Schenck, R. (2010). *Corporate water accounting: An analysis of methods and tools for measuring water use and its impacts*. Pacific Institute: Oakland.

Muller, M. (2012). Water accounting, corporate sustainability and the public interest. 203-220.

Rebitzer, G., Ekvall, T., Frischknecht, R., Hunkeler, D., Norris, G., Rydberg, W. ... & Pennington, D. W. (2004). Gofe cycle assessment part 1: Framework, goal and scope definition, inventory analysis, and application. *Environmental International*. 30, 701-720.

Solomon, J. & Solomon, A. (2004). *Corporate governance and accountability*. England: John Wiley & Sons, Ltd.