

# The Role of Carbon Accounting in Managing the Climate Change Risks: Literature Review

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**Abstract:** *Carbon accounting creates a competitive advantage for companies; henceforth, policymakers in companies and institutions nowadays are relying on carbon accounting to take decisions regarding climate change and environmental conservation. The development of carbon accounting would add economic value to companies and public institutions. The importance of this study is to demonstrate the significance of carbon accounting and how it relates to climate risk management. Besides, this study shows the impact of carbon accounting disclosure on raising the awareness of investors.*

**Keywords:** Accounting; Carbon Accounting; Risk Management; Climate Change

## 1. Introduction

At the end of the last century, the world began to pay attention to issues related to climate change, especially after the industrial revolution and the resulting air pollution from factories and big companies and the emergence of the effects of global climate change. And started talking about the obligation of companies to contribute to the preservation of the environment and reduce pollution the need to account for climate change has therefore emerged. So countries today are seeking to limit global climate change, whose danger is increasing day by day, as climate change greatly affects the environment and daily life of people in addition to its danger to economic development. (XU, Y.S. (2019), There is increasing empirical proof that the key cause for global change is carbon emissions, which significantly affects the nature of human lives. Howard-Grenville et al. (2014) argue that growing organizations and industrialized production have amplified the climate change process. So how to successfully minimize carbon emissions has been the priority of all businesses.

The federal law of the United States of America considered the problem of environmental pollution and climate change that arises directly from companies or caused indirectly, the companies have responsibility for this through the fund of social responsibility of those companies, also it was not only the United States that passed laws to protect the environment, but many countries around the world have enacted many laws, legislation, principles, and instructions to achieve this goal. In addition, carbon accounting has had a significant impact on carbon reduction when incorporated as part of corporate strategic processes as confirmed by the (Bui & Fowler. 2019) study. Also, (Hahn, Reimsbach&Schiemann, 2015) (Schiemann, & Sakhel 2019) Discussed the consequences of carbon divulgation and associated policy concerns such as optional and compulsory disclosure. They also discussed related topics, such as assurance and hazards. In addition, carbon transparency lets investors quantify the legislative and natural climate change-related uncertainties of a business (see, e.g., McLaughlin, 2011), and also (Albertini 2013) reported a favorable association between environmental exposure and corporate

financial results. Proactive climate-related initiatives and reporting of emissions, as well as creating climate-friendly goods, will boost the reputation of an organization (Sullivan & Gouldson, 2012)

In fact, the pressure to report pollution will contribute to improved carbon control and thus to lower energy use and energy costs (Matisoff, 2013). The (Qu& Ma & Yan 2019) study concluded that companies have a scattered carbon disclosure and that carbon detection evolves from year to year by studying 10 coal producers in China.

Many studies show that companies do not disclose full carbon information, depending on company management policies (e.g., Berthelot & Robert, 2011; Wegener, Elayan, Felton, & Li, 2013; Peters & Romi, 2014; Yunus, Elijido-Ten, & Abhayawansa, 2016; Rankin, Windsor, & Wahyuni, 2011; Stanny, 2013;). Also (Ascuí. 2014) understand how carbon accounting has been tackled in the social and environmental accounting and he reviewed several previous studies in the field of carbon accounting and concluded that the need to increase research in this area and attract researchers to social and environmental accounting to expand the research circle.

Economic thinking has therefore tended to measure the environmental costs of decontamination resulting from the operations of the project or company as well as the costs of preventing pollution by incorporating these costs into the cost of the corporate end product.

Therefore, attention to environmental pollution calculations, especially carbon accounting, it will make the accounting profession able to provide more important information about the environmental pollution and climate change to managerial and productive decision-makers in particular, where the problem is the lack of information provided to decision-makers, resulting to some decisions that have had no impact in reducing environmental pollution and climate change.

From the above we can say that the accounting profession should have an active role in mitigating the risks posed by climate change, especially accounting for carbon emissions,

we will highlight in this research on carbon accounting and its role in the disclosure of information on climate change and environmental pollution and the role of carbon accounting in managing the risks posed by climate change and the role of carbon accounting in managing the risks posed by climate change.

### 1.1 Importance of Study

In light of the global interest in climate change and its implications, there is a need to use all methods and techniques that mitigate climate change, so it was developed a new method it is carbon accounting and disclosure. The importance of this study is to demonstrate the importance of carbon accounting and how it relates to climate risk management, this study also shows the impact of carbon accounting disclosure on raising the value of the company to investors in light of the awareness of those who continue in the importance of reducing climate change.

### 1.2 Objectives of the Study

The objectives of this study are as follows:

- 1) To present the concept and need for carbon Accounting.
- 2) To present the review on risk management and carbon accounting.
- 3) To present the review on carbon accounting in the management and disclosure of climate change risks.

## 2. Concept of Carbon Accounting

Organizations and governments press companies to disclose carbon and reduce their emissions. Therefore, companies under this pressure are forced to respond to this in order to preserve their interests by registering carbon and contributing to reducing it. (Okereke, 2007; Lash & Wellington, 2007).

The term "carbon" can be used to mean some many separate stuff by itself: by scientists in a conventional sense referring to elemental carbon; more popularly referring to both the main greenhouse gas, carbon dioxide, alone or as a shorthand for all greenhouse gases (see Bebbington and Larrinaga-Gonzalez, 2008).

Accountancy is intended in theory (in accordance with standards of practice) only to reflect "economic reality" and societal preferences and practices, but can eventually influence them in practice (Power 1994; Miller 1994; Miller and O'Leary 1994). Accounting and literary criticism on society are therefore valuable as a correction to the underlying assumption that accounting is governed by rules in the non-accountancy academic literature on climate change policy, politics, and markets. (MacKenzie & Lovell, 2011).

Carbon accounting has its roots in the philosophical context of social accounting, which explores the position of accounting science not within an organization's limited borders but as an enabler in social process development (Hopwood and Miller, 1994).

The study of Stechemesser & Guenther (2012) mentioned several definitions of carbon accounting, the most important of which are:

Hespenheide et al. (2010), a broad definition of "carbon accounting" is given by "who indicate the measuring of emissions and removals on the one hand and the implications for finances on the other hand. This definition means that they include nonmonetary as well as monetary aspects from an organizational perspective, and they also describe the internal and external application of carbon accounting".

Ascuri and Lovell (2011) also present a rather broad definition, "which further emphasizes that carbon accounting can take place for mandatory or voluntary purposes and, for example, on a global, national or organizational scale at different scales". Kolk et al. (2008) "definition refer in particular to carbon emissions measurement and trading". Ratnatunga (2007) "specifies the carbon emissions calculation measurement as follows: The CO<sub>2</sub> quantity calculation mechanism either emitted by a source or sequestered in a biomass sink is referred to as carbon accounting, they refer instead to carbon emission and sequestration (CES) accounting".

In the foregoing, carbon accounting is the material value of the negative impact that companies cause through carbon emissions that affect climate change, which companies must commit to disclose through special reports.

## 3. Climate change in light of international laws and protocols

Carbon reporting rules have defined specific emissions control requirements, methods for monitoring them, and time for reporting carbon, and formulating rigorous guarantees for the system, which has greatly enhanced corporate disclosure of carbon accounting information. (XU, Y.S. 2019)

As countries began to pay attention to carbon disclosure and to encourage companies to disclose information related to carbon accounting by setting laws and regulations that require companies to conserve the environment and reduce climate change resulting from air pollution. The following are countries' efforts to limit climate change:

- 1) Many countries have established standards to limit climate change and disclose carbon accounting information, most notably the United Kingdom, Japan, France, and Canada. In 2001 France issued new economic regulations, which required companies to disclose environmental indicators such as carbon emissions, and Japan was one of the countries that interested in this field early. In the nineties, Japanese companies began issuing environmental reports and disclosing environmental investment of companies and other information.
- 2) In 2010, carbon guidelines were approved by the Supreme Education Council of the United States of America, which were seen as guidelines for listed companies, and these principles are the first Climate Change Awareness Regulation and Identification of Threats in the US Economic Framework.

3) The United States has sought to establish rules and laws to regulate the disclosure of information related to carbon accounting. FASB, AICPA, and other institutions have issued 152 provisions related to disclosure of carbon accounting in American companies. The system of disclosing carbon accounting in the United States is ideal and distinctive in terms of Disclosure. Therefore, American companies are distinguished by being more active in disclosing information related to carbon accounting, because there are mandatory rules from the government to detect carbon emissions because the system in the United States seeks to show a good image of American companies and the disclosure is from during financial reports or Social Responsibility and Sustainable Development Reports

Also, several international agreements and protocols have been concluded to mitigate climate change that has played a role in bringing carbon accounting to global markets. They are as follows:

#### 1) The Kyoto Protocol (2005)

The Kyoto agreement was signed in Japan by 175 countries around the world in addition to the European Union countries (CPA Australia, 2008; JeeHoon, 2010), where the implementation of the agreement started in 2005, which includes two phases to preserve the climate and reduce carbon emissions, as the first phase, which begins in 2008 and ends on December 31 of 2012 (UNFCCC, 2015), As the goal of the protocol was to bind participating countries to reduce carbon emissions, and the most important 37 industrial companies representing the largest proportion of carbon emissions signed the agreement (CPA Australia, 2008; Jiang, Sharp & Sheng, 2009).

#### 2) Al Doha Conference (2012)

When approaching the end of the first phase of the Kyoto Protocol, the United Nations sought to meet the industrialized countries of the world by inviting a conference in the Qatari capital, Doha, in November 2012, to agree on the second phase of the Kyoto Protocol on reducing carbon emissions and preserving the environment, and it was decided to start the second phase of The Kyoto Protocol, which starts from 2013 to December 31, 2020 (UNFCCC, 2015), and also agreed upon previously agreed mechanisms the Agreement establishes three frameworks for stability, namely the Sustainable Development Mechanism (CDM), Joint Implementation (JI), and the Kyoto carbon trading system, i.e. ETS (CPA Australia, 2008; UNFCCC, 2015) Various countries (e.g. EU ETS or European ETS, Australian Carbon Tax, NZ ETS, etc.) have widely adopted ETSs of these emission reduction mechanisms. The pollution trade systems have accounting and transparency consequences for the businesses involved as a formerly costless practice has now become expensive, thereby generating a carbon market by marketable allowances (Cook, 2009)

#### 3) Paris Agreement (2015)

Negotiations to develop steps to modify the Kyoto Protocol after 2020 contributed to the Paris Agreement being reached and implemented in December 2015. (Bodansky, 2016). In 2016, 175 world heads of state signed the UN climate

change conference in New York under the name of the Paris Convention Climate Change, At the 2015 Paris Conference, it was stressed for the second time that developed countries should commit to mobilizing 100 billion dollars annually in favor of climate issues until 2020.

The Paris Agreement aims to contribute to addressing and minimizing climate change caused by humans and human-managed companies and factories, as well as treating the resulting pollutants. The Paris Agreement is more global and independent than the Kyoto Agreement, as stipulated in the United Nations Framework Convention on Climate (Bodansky, 2016; UNFCCC, 2016a).

The signatories to the agreement must show their national contribution to mitigating climate change, as the Paris Agreement entered into force after it was ratified by 55 of the most parties involved in air and environmental pollution, where their contribution exceeds 55% of the total global pollution (UNFCCC, 2016b; Bodansky, 2016).

The Paris Agreement still supports the mechanisms established by the Kyoto Protocol, but classifies them into two market mechanisms, namely 'Internationally Transferred Mitigation Outcomes' (ITMOs) and 'Sustainable Development Mechanisms' (SDM), a hybrid of CDM and JI (Bodansky, 2016).

From the above, it is clear how much global attention is being paid to climate change issues and the extent of international encouragement to mitigate environmental pollution. These agreements have resulted in many recommendations, the most important of which is the need to calculate the environmental cost of companies, especially accounting for carbon emissions of companies and the use of carbon accounting. In particular, these agreements resulted in the obligation of governments and companies to invest \$ 100 billion to mitigate the negative effects of climate change.

#### 4. The Risks of climate changes' on organizations (current and future)

Research and scientific studies conducted in the world have proven that climate change is a reality we live in and that it is occurring and its effects are clear and represent a very real and important threat, as the reports of the Intergovernmental Panel on Climate Change (IPCC) show that the effects of climate change such as global temperatures rise, changes in the ice and snow cover as well as the change in sea level can be observed already (Casti, 1997)

Because of the significant change in climate, it is expected that the effects resulting from it will increase significantly in the future, and that is characterized by these changes is the intensity of the change and the spatial extent and the severity of severe climate changes such as heatwaves or very hot days (IPCC, 2012). Businesses may have weaknesses That makes them not ready for such sudden, not gradual, changes (Wilbanks et al., 2007).

Consequently, these harsh changes will have major harmful effects on the institutions and economic sectors (Hertin et

al., 2003; Wilbanks et al., 2007; Keef and Roush, 2005), and often these changes will have negative effects on the vital infrastructure (Wilbanks et al., 2007).

Statistics in recent decades show great losses due to unusual weather, and the causes of these losses can be several underlying drivers (industrial expansion and its impact on increasing risks in coastal areas and cities, an increase in population growth, adverse climate impacts due to extreme weather events) (Munich Re, 2009).

So, the effects depend on the different economic sectors in terms of location and stakeholders, with increased susceptibility to influence the sectors as well as areas that are more sensitive to climate change and some economic sectors that depend on stable environmental conditions, here we can ask the extent of readiness and response of companies and organizations to such change, and the extent of The ability of these organizations to adapt to climate change, so the best way to avoid major climate change is to take measures and policies to reduce this change and reduce carbon emissions (Kates, 2000).

Although there are international efforts to mitigate climate change, progress in this area is very slow so far and many countries are not fully committed to climate change reduction agreements, so it is unlikely that the effects of climate change will be successfully mitigated, Therefore, researchers and policymakers attach great importance to developing strategies to adapt to climate change, so these strategies are known as (adaptation) as well as reducing the causes of climate change (Dow et al., 2013).

Economic institutions must adapt to climate change and diversification of investments in order to manage the risks resulting from climate change, Strategies can be applied to adapt to climate change. These measures and strategies take many forms (structural or material changes such as infrastructure upgrade, ecosystem-based measures, and financial mechanisms such as insurance) (Noble et al., 2014).

In sum, climate change has become a reality in our current world that must be dealt with by adapting to these changes and taking the necessary measures to manage its risks. In addition, companies must strive to reduce the causes of pollution and the trend towards alternative energy to preserve life on the planet.

## **5. Risk Management and Carbon Accounting**

Having examined the risks faced by organizations and companies due to climate change, we review now the role of risk management in companies and the relationship of carbon accounting to mitigate these that may be exposed to companies. All companies operating in the market, whether industrial or service companies are exposed to many risks and these risks may be reflected on their financial performance, where the risk can be defined as:

Risk means the possibility of a direct or indirect threat to the achievement of objectives (Pritsker&Sigal, 1983: 352). Also the COSO Committee definition “the risk is that events that

a negative effect prevent an entity from generating value or decreasing existing value”, In management, the concept of risk means the possibility of uncertainty in completing a particular work and the possibility of different outcomes than planned or disappointing (Moorhead, 1995).

Consequently, the company has to take the necessary precautions to face the risks that may be incurred, and therefore companies have tended to manage the risks through which the negative effects of the risks to the company may be reduced.

Risk management is defined “as a set of financial or operational activities that maximize the value of a company or a portfolio by reducing the costs associated with cash flow volatility”. (Stulz, 1996, 2003)

The corporate risk management aims to deal with the risks resulting from the uncertainties by establishing a frame of reference for the companies, the risks are present in all the financial and economic activities of the companies. The identification, evaluation, and management of risks is part of the strategic development of companies that must be designed and planned at the highest level in the Board of Directors (Dionne, 2013).

Hedging and diversification using various tools, including derivatives, market, and structured products, self-insurance, and self-protection, are risk management activities.

In accounting pursuant to the Conservatism Principle, the accountant does not recognize revenue until the moment of occurrence. As for liabilities, they are taken into account and therefore calculate reserves and provisions. Consequently, as long as the risk is an unforeseen and unpredictable event and must be accounted for concerning the environment and climate change, as long as the activities of the company have an impact on polluting the environment.

By law, the unit expects to incur additional costs in the future to either eliminate or reduce the effects of pollution. This increases the financial burden of economic unity. CO2 emissions have recently been subject to increasingly rigorous legislation in several nations, giving businesses no choice but to tackle the problem. Though the subject's significance is still on the rise (McKinsey 2007).

Therefore, enterprise-scale carbon accounting includes calculating carbon pollution in industrial ventures, carbon emissions removed by project execution (emissions offsetting), quantitative measurement of such emissions, and estimation of the appropriate offset credits. The goal of the carbon accounting project is to create measurement methodologies for carbon offsets and to educate project developers and investors about the importance of such offsets. As for organization-wide carbon accounting, the reviewers differentiate between carbon management accounting and carbon finance accounting. Carbon management accounting is based on enterprise-level monetary and physical carbon accounting. Given that climate change presents considerable economic risk, and evaluation of a company's vulnerability to climate change is of paramount significance to managers and investors.



Measuring and tracking CO2 emissions is also essential for the implementation of carbon management strategies.

## 6. The role of carbon accounting in the management and disclosure of climate change risks

Under the strict laws adopted by some countries to reduce climate change and reduce carbon emissions in compliance with the international conventions and protocols signed and to preserve the environment. It has become necessary for companies to disclose carbon pollutants to air, especially as some countries impose a carbon tax following policies to reduce carbon emissions, which makes companies exposed to some risks in the absence of carbon disclosure, and also some governments incentivize companies to use alternative energy and reduce Contaminants through some tax facilities, bonuses, and loans in order to preserve the environment. In addition, the state of awareness among investors in companies has led to the formation of pressure on boards of directors to reduce carbon emissions. Investment in companies that preserve the environment has become better for investors. And also the disclosure of carbon through the use of carbon accounting and corporate contribution to reducing emissions has become a competitive advantage that encourages investors to invest in the company's shares.

Thus, companies working in markets that are more prone to carbon pollution are most likely to implement open transparency practices, because this could mitigate the risk for additional oversight by regulatory authorities and may minimize governmental sanctions (Deegan & Gordon, 1996).

Considering their parallels in understanding the disclosure phenomenon, the hypotheses of signaling and voluntary disclosure that be extended to understand the disclosure of carbon. Effective carbon risk control activities at the organization provide opportunities for communicating such positive practices to the capital market. Another motivation is the willingness of companies to share this knowledge to minimize issues of information asymmetry (signaling theory). For example, certain businesses may want to reveal details regarding their exposure to climate change threats, and whether they are equipped to minimize such threats in order to draw more investors and therefore raise their share price. In fact, by disseminating this information, superior firms aiming to differentiate themselves from inferior firms in terms of carbon risk management and thereby achieve economic advantages (voluntary disclosure theory). Where discrimination can be accomplished by corporate reports (hard reports) (Clarkson et al . 2008), whereby superior firms more efficiently communicate their carbon risk reduction goals than inferior firms do. For eg, businesses with a low carbon image, or have energy-efficient technology, reveal details on such facts to improve their strategic edge and market equity. It is possible to obtain competitive advantages and advantages because investors consider companies that disclose carbon less risky (Cormier & Magnan 1999; Sengupta 1998; Botosan 1997).

In addition, companies can enhance their current value by providing information about their ability to compete in the carbon market (Richardson, Welker & Hutchinson 1999). Thus signaling and voluntary disclosure expect a favorable association between environmental success and transparency of the results. This forecast may be expanded to expect a favorable relationship between handling and reporting the carbon risk. The stronger the methods in carbon risk management, the higher the quality of information regarding such activities is published.

From the above, it is clear how carbon accounting plays a role in carbon disclosure and how it contributes to the management of carbon risks. Carbon accounting is the practical aspect of protecting the environment and mitigating climate change, especially its mission is to measure the carbon emissions of companies and calculate the contribution of companies in the cost of removing the effects of carbon pollution and contribute to the reduction of climate change.

Carbon accounting by disclosure creates a competitive advantage for companies, and reduce the risk of corporations being penalized by governments, Carbon disclosure may even contribute to the company getting some government facilities. In addition, carbon accounting helps decision-makers in companies to build policies that reduce climate change by seeking alternative energy or products that are free of polluting emissions. It helps researchers measure the contribution of companies to climate change as well as their contribution to decontamination.

## 7. Conclusion

In summary, it is clear from the foregoing how important carbon accounting is and how much it needs to mitigate the effects of climate change. Where the interest in climate change began at the end of the last century. Governments and international organizations that have an interest in the environment and climate change have taken a keen interest in this area. To mitigate global climate change, it was necessary to use methods that would help calculate carbon emissions and calculate the cost of eliminating the effect of carbon pollution. The world has turned to a new and innovative type of accounting, carbon accounting, which was the product of many global conferences and conventions on climate change, the most important of which were (Kyoto 2005, Doha 2012, Paris 2015), As a result of these agreements, investment of 100 billion dollars annually to mitigate climate change because of its impact on companies and organizations, both now and in the future.

Companies and organizations are becoming more concerned with managing the risks of climate change and carbon emissions under international strict laws, where companies must disclose how much pollution they cause, it is clear from the foregoing the important role that carbon accounting plays in managing carbon risks and reducing the effects of climate change through carbon disclosure and the cost of removing its effects. This led companies to turn to alternative energy, to use air purifiers or to use low carbon emission devices, carbon disclosure also reduced the risk of corporations being penalized by international institutions or

government. This shows the validity of the first hypothesis of this study, there is a relationship between carbon accounting and risk management of climate change.

As shown by studies conducted on some companies such as study (Herold and lee, 2018; Botosan, 1997; Cormier & Magnan, 1999, and Sengupta, 1998) investors tend to invest in companies that disclose carbon accounting (carbon emissions). Carbon disclosure has become a competitive advantage for companies. This conclusion proves the validity of the second hypothesis of this study in the existence of a relationship between carbon disclosure and the existence of competitive advantage to invest in these companies.

Finally, carbon accounting is one of the tools that are used in decision-making today in companies or institutions that are interested in climate change and environmental conservation, the development of this type of accounting would add economic value to companies and public institutions.

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