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**FIRM-VALUE EFFECTS OF CARBON EMISSIONS AND CARBON  
DISCLOSURES: EVIDENCE FROM FINLAND**

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ABSTRACT OF THE MASTER'S THESIS

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Abstract  <p>The discussion of the relationship between corporate performance and environmental performance has been ongoing for a very long time with a view to find a balance between what should be the objectives of the firm that guarantees both viability and sustainability. One such discussions has been the effect of carbon emission on the value of the firm. A long held position has been that the cost of reducing carbon emission tend to affect the profitability of a firm hence having a negative effect on the value of the firm however in the last two decades, and with the agreement of various governments and institutions on the need to reduce the global carbon footprint, it is beginning to appear that any effort to reduce carbon emissions by any firm is viewed favorably by the capital markets hence increasing the value of the firm</p> <p>However, the challenge that gave rise to this study emanated from the conflicting results across different jurisdictions as to whether the favourable perception of the reduction of carbon emission is dependent on certain characteristics of a particular jurisdiction. Studies in United States and Shanghai finds that the market impose penalties on the value of any firm with carbon emissions while Korea, Indonesia and Taiwan reward the value of the firm with carbon emissions. We therefore look to Finland-a country that has committed to achieve carbon neutrality by 2035 whether the market rewards or penalizes firms with carbon emissions.</p> <p>The study was based on secondary data, specifically financial statement figures from 2019 to 2021- a period of three years-. The study also adopted an expo-facto research design to analyze 50 companies from Refinitiv database. The secondary data from the Carbon Disclosure Project (CDP) database. The research methodology adopted mixed methods research design. The panel data regression model considers robust estimates, including the pooled Ordinary Least Square (OLS) or fixed effects and random effects models.</p>			

Here we show that the carbon emission and carbon disclosure have a positive but insignificant effect on the value of the firms in Finland.

The study found that there exists an insignificant positive effect of carbon emission disclosure on firm value. With every thousand metric tonnes increase in carbon emission, firm value will increase by €3,833 (which appears very low), and the Pearson correlation coefficient also shows a very low positive relationship between the firm value and carbon emission.

The implication of this study therefore is that policy makers need to introduce an incentive scheme that is driven by regulators and encompasses all the firms both private and public, in order to reward the firms who are actively reducing their carbon footprints as well as those who are voluntarily disclosing their carbon emissions numbers especially as the country has a carbon-neutral target to achieve by 2035. The scheme should also be effective enough in penalizing any firm that does not actively seek the reduction of carbon emissions.

Keywords Carbon Emission, Carbon Disclosure, Firm Value, Finland

Additional information

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## CHAPTER ONE

### 1 INTRODUCTION

#### 1.1 Background to the Study

Climate change is an increasing issue for many corporations, governments, and people all around the globe. The use of fossil fuels such as coal, oil, and gas has increased carbon emissions, which are the primary cause of global warming. Therefore, major efforts have been made to minimize carbon emissions and promote sustainability in corporate activities. Carbon disclosure is one option for businesses to address the problem of carbon emissions. The practice of disclosing a company's greenhouse gas emissions, energy use, and other environmental consequences is referred to as carbon disclosure.

Also there has been significant market interest in non-financial information in the past two decades wherein investors are now constrained to give sustainability concerns some considerable attention in a bid to remain competitive over the long term. As the global population increased, there has been considerable pressure on the use of natural resources and consequently the sustainability of the use of resources in production and according to (Pricewaterhouse, 2012), sustainability-driven shareholder resolutions has led to steady growth in sustainable investment and a positive relationship has been established between environment, social, and governance (ESG) factors on one hand, and financial performance on the other hand. Eccles et al. (2011) analyzing market interest by asset classes between equity investors and fixed income investors, discovered that equity investors show more interest in non-financial information than fixed income investors because downside risk is of more importance to the equity investor.

Fast forward to the year 2019-2021 when there was an outbreak of COVID-19 across the globe, which led to a halt in operations of most firms globally. The period consequently witnessed a significant erosion of the balance sheets of most firms. A logical expectation is that investors will seek to unwind their pre-covid 19 pledges due to the shocks experienced during the lockdown however investors in turn have increasingly made the climate crisis and energy transition a central theme to their investment decision-making process (Ernst & Young, 2021). In a different study, Mzoughi et al. (2020) finds that the lockdown period also witnessed a decline in the levels of carbon emission recorded globally and the attendant effects on the equity value of the firm appears to be

strongly volatile. This finding therefore creates a need to control for covid 19 effects when comparing the relationship between firm value and carbon emissions alongside other financial performance variables.

The effects of carbon emissions and carbon disclosures on firm value have been studied across different jurisdictions in the past decade with conflicting results by Matsumura et al.(2014), Choi et al.(2021) and Sun et al. (2022) in their studies of the US, Australian and Chinese markets, and they find a negative relationship between carbon emissions and the value of the firm whilst Hardinyasah et al.(2020), Han et al.(2022) and (Lee & Cho, 2021) in their studies of the Indonesian, Korean and Taiwanese markets, find a positive relationship between carbon emissions and the value of the firm. The conflicting results may reflect the level of development of the market or its sophistication in the incorporation of carbon emissions into firm valuation. It was also observed in the US, Shanghai, and Australian markets that investors appear to penalize firms for carbon emissions whether the disclosure is voluntary or mandatory.

Korean, Indonesian, and Taiwanese markets however appear to record positive relationships between carbon emissions and firm value which may not be unconnected with the high cost of lowering carbon emissions(Yao, L., Shi, X., & Andrews-Speed, 2018). The increased cost of lowering carbon emissions impacts profitability negatively whereas profitability increases when firms are not under any obligation to lower carbon emissions thereby resulting in an increase in firm valuation.

The study intends to focus on Finland because the country has made a declaration via legislation in 2022 that it intends to achieve net zero with respect to carbon emissions by 2035 and thereafter go negative. Using Finnish companies, this study aims to measure the association between carbon emissions and the value of the firm using empirical evidence 2019 - 2021. The study aims to draw conclusions that will further contribute to the existing body of literature on this relationship. Financial information for 3 years (2019-2021) is used for this study and the data come from Refinitiv database whilst the carbon emissions data are hand-collected from the CDP database. The CDP (Carbon Disclosure Project) is an independent not-for-profit organization acting on behalf of hundreds of institutional investors and holds the largest repository of carbon emissions information.

This is achieved by requesting information using questionnaires from the world's largest companies as measured by market capitalization.

COVID-19 pandemic and the attendant lockdown however has constituted itself as a game-changer in the context of the relationship between firm valuation and carbon disclosure. During the lockdown attending the pandemic, carbon emissions reduced significantly across the globe with an approximate record of 438MT reduction from data collected in 2020 across 184 countries according to Ray et al. (2022). The firm value effects will be an interesting observation because there was no cost incurred in reducing carbon emissions during the pandemic lockdown, so the outcome, whether positive or negative, is a factor in this study.

## **1.2 Statement of the Problem**

The traditional view of corporate value determination suggests the maximization of profit and minimization of any avenue for cash outflow as much as practicable (Friedman, 1970). With the effluxion of time and based on the sophistication of the markets as well as the stakeholder theory of the firm, investors have been refocusing the determinants of preferred investments to include the capacity of the firm to reduce carbon footprints. It would appear that the advanced markets of US, Australia and China seek to penalize firms for their carbon emissions while the developing markets of Korea, Indonesia and Taiwan appear to reward firms for their carbon emissions.

The European Union in its non-financial reporting Directive (2014/95/EU) only requires large public interest entities with over 500 employees (listed companies, banks, and insurance companies) to disclose certain non-financial information, and the guidelines for this disclosure are non-binding. The discretion was given to any company to choose a suitable national, EU-based, or international framework. Companies operating in Finland, however, are required to comply with the responsibility reporting requirement in the amended Accounting Act of 2016 which seeks to ensure the mandatory CSR reporting obligation for firms with more than 500 workers, yearly sales of more than 40 million euros, or a balance sheet worth of more than 20 million euros (Höglund & Metsä-Tokila, 2021). Furthermore, Finland is noted for its political stability, high level of education, dependable infrastructure, and low corporation tax, making it a destination of choice for international investors.



Finland's participation in the annual Carbon Disclosure Project (CDP) study, as a pioneer in carbon emission disclosure, gives useful information to investors about firms' efforts to reduce carbon emissions and address climate change risks (Ministry of Economic affairs and Employment of Finland, 2020). The Ministry also seeks to increase worldwide openness in reporting on climate change mitigation initiatives and progress towards Paris Agreement objectives.

Finland has likewise pledged to enhance renewable energy output while decreasing its dependency on fossil fuels. The extent to which disclosed carbon emissions affect firm value in the Finnish market is unknown, and this study tries to fill that gap. Therefore, this study aims to evaluate firm-value effects of disclosed carbon emissions in Finland.

### **1.3 Objective of the Study**

The broad objective of this study is to evaluate firm-value effects of carbon emissions and carbon disclosures in Finland.

### **1.4 Research Question**

The following question was considered for the purpose of this study:  
What is the effect of disclosed carbon emissions on firm value?

### **1.5 Research Hypothesis**

H<sub>0</sub>: Firm value is negatively associated with carbon emissions.

H<sub>1</sub>: Firm value is not negatively associated with carbon emissions

### **1.6 Significance of the Study**

In numerous aspects, the research is worthy of note because it sheds light on how societal concerns about climate change affect company financial performance. The paper intends to provide a thorough investigation of the relationship between voluntary carbon emissions disclosures to CDP, and financial performance-the study of which has produced conflicting results in different jurisdictions. This study therefore advances the understanding of Finnish companies' voluntary carbon emissions disclosures to CDP and firm value. Also, the findings of this study can contribute to a better understanding of the current state of disclosed carbon emissions in Finland and inform future efforts to promote sustainability and address climate change risks.

Furthermore, the study has practical implications for company executives and government authorities interested in enhancing corporate carbon emission reduction and

reporting strategies. According to the findings, corporations can profit financially by lowering carbon emissions and raising carbon disclosures. Furthermore, the findings may assist policymakers and investors understand how businesses respond to legislative acts related to climate change, as well as providing insights into how businesses manage climate risks that may impact their stock values in the future. Overall, this study adds to the body of knowledge on corporate social responsibility and sustainability by introducing new findings and perceptions in the jurisdiction being studied. It gives vital insights into the link between disclosed carbon emissions, and financial performance, and provides a foundation for future study in this field.

### **1.7 Organization of the Study**

This study will be subdivided into five chapters in the following order. Chapter One titled “Introduction” is concerned with the general background of the area of study and why the research is chosen. This includes an overview of the study, a statement of the problem, the objectives of the study, research questions, research hypotheses, the scope of the study, and the organization of the study. Chapter Two titled “Literature Review” discusses various kinds of literature related to the study. Here, emphasis is placed on the overviews of climate change as well as the Finnish institution environment, the determinants of firm value, and the interactions between carbon emissions and firm value. It incorporates the conceptual, theoretical, and empirical review as well as any gap in the literature. Chapter Three introduces research methodology. This is an important part of the research work; the methods adopted in collecting the data are recognized, which include how the data was obtained and analyzed and model specification. Chapter Four presents data and Data analysis of findings. It entails the presentation and analysis of the data used, the testing of the formulated hypothesis, and the discussion of the results and findings. Chapter Five discusses the findings of the research in detail, provides conclusion, and makes recommendations, contributions to knowledge, and suggestions for further studies.

## CHAPTER TWO

### 2 LITERATURE REVIEW

#### 2.1 Overview of Climate Change

Climate change is a global phenomenon that has been the focus of much discussion, research, and debate in recent years. The most comprehensive assessment of climate change was conducted by the Intergovernmental Panel on Climate Change (IPCC, 2014), which concluded that human activities are playing a significant role in changing the Earth's climate.

Climate change is a term that is used to describe the long-term changes in the Earth's climate. It includes changes in temperature, precipitation, and other weather patterns. Over the past century, the global climate has changed significantly due to human activity such as burning fossil fuels and deforestation (IPCC, 2018). This has resulted in an increase in atmospheric concentrations of greenhouse gases such as carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>). As levels of these gases have risen, so have global average temperatures, known as global warming (IPCC, 2018). Climate change can also be linked to extreme weather events such as droughts or floods caused by changes in atmospheric circulation patterns. In addition, it can cause sea level rise due to melting ice sheets or glaciers.

The Intergovernmental Panel on Climate Change (IPCC) has been studying climate change since its inception in 1988. The IPCC's Fifth Assessment Report released in 2014 highlighted how human activities are "extremely likely" responsible for most of the observed warming since 1950 and that this trend is expected to continue into the future if greenhouse gas emissions continue at their current rate (IPCC AR5 WG1 Summary for Policymakers 2013-2014). The report further found that without substantial efforts to reduce emissions and increase adaptation strategies, there could be serious consequences for society including increased risk of food insecurity exacerbated by rising sea levels or water shortages caused by reduced rainfall amounts or extreme weather events like heat waves (Desai, 2022).

Atmospheric concentrations of greenhouse gases, such as carbon dioxide (CO<sub>2</sub>), are increasing due to human activities, such as burning fossil fuels for energy production and land use changes like deforestation. These gases trap heat within the atmosphere and cause it to warm up faster than natural processes can remove it. As a result, average global

temperatures have increased over recent decades leading to changes in precipitation patterns and extreme weather events like heat waves and floods (IPCC 2014) (Zhang, Liu, Tang & Yang, 2007).

Estimations of the impacts of global warming from Nordhaus and Boyer (2000) are more negative than other studies since they factor in the risk of catastrophic impact. On the contrary, Mendelsohn et al. (2000) and Tol (2002) estimates are largely driven by optimistic assumptions regarding adaptive capacity which result in mostly beneficial impacts as per their review. Moreover, current generation aggregate estimates overlook extreme weather events, underestimate or ignore multiple stressors such as those identified by Schneider (2004) and do not adequately account for transition costs associated with adaptation nor the potential benefits resulting from development that may reduce climate change impacts. From their studies, it is difficult to draw a firm conclusion about the size and direction of adaptation's effect on estimates of climate damages due to our limited understanding regarding adaptive capacity especially among developing countries.

The impact of climate change is wide-ranging and will affect different regions differently based on their current socio-economic development level, population density or geographic location (IPCC 2014). For instance, developing countries with limited resources for adaptation may be more vulnerable than those with greater resources to cope with such impacts (Quirke et al., 2016). Possible effects include rising sea levels due to melting glaciers, decrease in crop yields due to more frequent droughts, increased risk of diseases due to changes in temperature or vector ecology, displacement of populations due to extreme weather events or sea level rise, ocean acidification leading to loss of biodiversity etc. Additionally, Costanza et al. (2014) finds that these consequences may be further amplified if other environmental stresses associated with population growth remain unchecked.

Human activities are responsible for releasing an excess of carbon dioxide (CO<sub>2</sub>) into the atmosphere, beyond what nature can naturally balance out (IPCC, 2021). This compounded with large-scale deforestation has created an imbalance in the global environment (Nunez, 2019). Carbon dioxide traps and stores heat in the air which restricts its escape, thus causing climate change and a rise in global temperature levels (IPCC, 2021). For ease of reference hereafter this gas will be referred to simply as 'carbon'.

The human impact on marine ecosystems is startlingly profound, with climate change being one of the most critical components. According to Bindoff et al. (2007), rising atmospheric CO<sub>2</sub> has caused not only global ocean temperatures to increase but Doney et al. (2009) finds that ocean acidification levels and sea levels have risen, as well as affecting patterns of ocean circulation, precipitation and fresh water input. In a follow up study by the same researchers i.e. Doney et al. (2012), there were remarkable increases in sea surface temperatures, ocean heat content and global mean sea levels whilst there was a sharp decline in summer arctic sea ice-level.

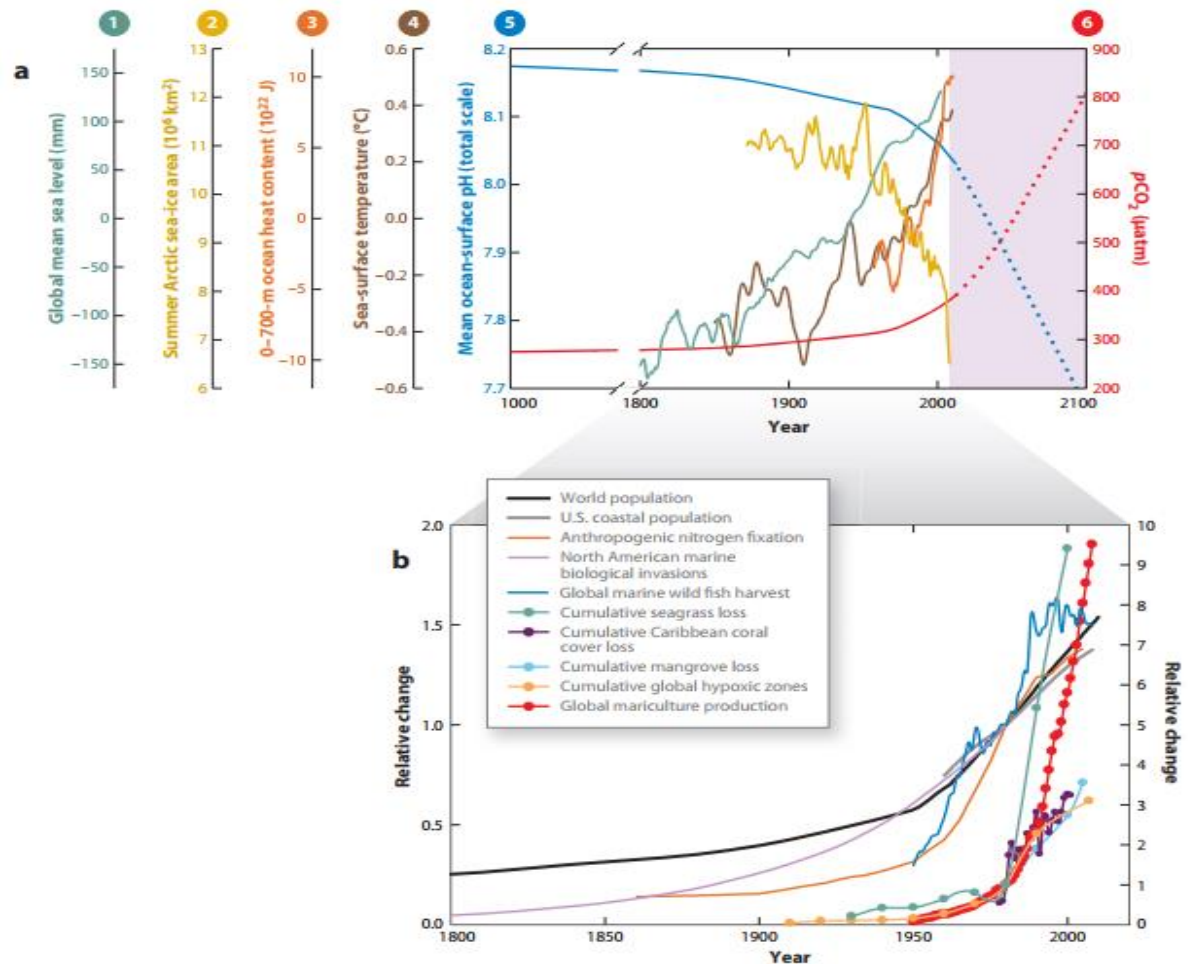


Figure 1: Ocean Physical Changes [Doney et al. (2012)]

Furthermore, in recent decades these changes have been rapid and could surpass some organisms' capacity to adapt; this situation is likely to worsen if immediate and drastic steps for climate mitigation are not taken (Natl. Res. Council. 2011). Indirect effects can also be felt viz the physiological functioning, as well as the behaviour and

productivity of species will be altered by such changes leading to population size structure shifts that alter species interactions further down the trophic pathway according to Keeling et al. (2010). In addition to climate-related stressors on marine ecosystems there are many other factors at play viz the intensive use of fertilizers, coastal degradation, overfishing and aquaculture production all contribute their part in degrading or destroying these habitats according to Halpern et al. (2008) and (Jackson 2010). Hypoxia is also on the increase in coastal areas meanwhile almost half of salt marshes have already been lost or degraded worldwide along with a third of mangroves, a third of coral reefs and seagrasses too - stressing just how necessary it is for us take into account all sources when looking at how we can best protect our marine environment from further decline (Diaz & Rosenberg 2008; Doney, 2010).

The demand for wood processing has led to negative effects on biodiversity and the capacity of forests to absorb CO<sub>2</sub>. This issue has been a topic of debate in the context of the forest-based bioeconomy, as noted by Holz (2023). The conflict between the forest-based bioeconomy and biodiversity has been recognized by the Red List for Finland, with forestry being identified as one of the main causes of declining biodiversity. While this trend has not yet been stopped, the Convention on Biological Diversity (2022) reports that it is slowing down.

Human activities, including emissions from fossil fuels, industrial processes, agriculture, and land use changes have resulted in significant alterations to atmospheric composition. Greenhouse gases, which trap heat, cause global warming on the planet's surface, leading to regional cooling or warming depending on older-lived aerosol emissions. This has been reported by Doney et al. (2012). Models suggest that the temperature growth caused by increased atmospheric CO<sub>2</sub> may have a positive impact on the global forest sector. However, their accuracy is limited by several factors, such as pests, weeds, and soil water, and may potentially overestimate the effects of elevated CO<sub>2</sub> (Kirilenko & Sedjo, 2007).

Various climate change includes seasonal changes, weather conditions, extreme weather events, and climate variability as well as hazards associated with changing climates (Harper, Cunsolo, Babujee, Coggins, Aguilar & Wright, 2021). Greenhouse gas emissions, particularly carbon dioxide (CO<sub>2</sub>) have been identified as the main cause of

climate change Lee and Cho, 2021). Over the last century, global carbon emissions from fossil fuels have increased exponentially, contributing 78% to total greenhouse gas emissions (United States Environmental Protection Agency). This has posed a major threat to nature and humankind on a global scale and should be addressed by businesses in order to avoid considerable economic damage (Clementino & Perkins, 2021).

Climate is the average state of the weather, which is fairly stable and predictable, whereas weather is the day-to-day state of the atmosphere and a chaotic non-linear dynamic system, with climate change referring to any changes in mean or variability of its properties that persist for extended periods (Olaniyi, Ojekunle & Amujo, 2013). The authors further stated that climate change, caused primarily by increases in greenhouse gases such as carbon dioxide (CO<sub>2</sub>) and believed to be contributed to by both natural events and human activities, refers to an increase in average global temperatures (Olaniyi, Ojekunle & Amujo, 2013).

Carbon risks lead to climate change because burning fossil fuels releases carbon dioxide and other greenhouse gases into the atmosphere, trapping heat and raising global temperatures (Wang, Wu, & Zhang, 2022). According to Hoffmann and Busch (2008), carbon risk can be seen as any corporate danger related to climate change or the use of fossil fuels. Ehlers, Packer and de-Greif (2021) took a step further by characterizing it as the potential financial effect of more rigorous carbon emissions regulations. According to Trinks et al (2022) carbon risk could be perceived in the light of regulatory and market risks' exposure by high- emission firms during any migration from a high-carbon to a low-carbon production system. Nguyen and Phan (2020) framed it as an organization's financial susceptibility in light of the move away from a fossil fuel-based to a lower-carbon economy. Moreover, Ongsakul and Sen (2019) insisted that high levels of carbon emissions could bring about potential climate change issues.

The burning of fossil fuels such as oil and coal releases sulphur dioxide into the atmosphere, making it an externality as well as an irritant. Furthermore, thermal energy is generated in these processes by breaking down the chemical bonds formed between carbon and other molecules such as hydrogen (H<sub>2</sub>O), which then turn into carbon dioxide (CO<sub>2</sub>). Methane emissions are also caused in this way during anaerobic digestion, to prevent a build-up of hydrogen. Recent studies by Clarkson et al. (2015) have further

shown that the financial penalty for each additional tonne of carbon emitted increases with a company's relative level of carbon intensity within its sector. This indicates negative economic impacts due to increased levels of CO<sub>2</sub> emission. In addition, research has suggested that mandated disclosures around emissions can lead to real reductions in actual CO<sub>2</sub> output (Matsumura, Prakash & Vera-Munoz, 2014). By providing investors with reliable information about a company's ranking for carbon intensity and total latent liabilities resulting from this activity, it seems clear that transparency around climate change issues can be beneficial both financially and environmentally.

Clarkson et al. (2015) address several design limitations by examining the cost of carbon imposed by the EU cap and trade system and its impact on EU firms. The firms in their study were subject to mandatory Scope 1 emission disclosure requirements, eliminating concerns about self-selection. They also develop a measure of carbon intensity rank relative to sector peers in order to adjust for factors driving the estimated valuation penalty. Finally, they clarify uncertain policy outcomes involving EU versus non-EU emissions for a given EU firm. It is evident from their study that investors impose a valuation penalty on each additional ton of Scope 1 emissions beyond free allowances; that this penalty declines with superior carbon intensity performance; and that this penalty is lower for non-EU emissions than for equivalent EU emissions due to investor probabilities assigned to potential regulatory regimes in those countries.

It is clear that the world is emitting an alarming amount of carbon emissions annually, and it is estimated to be around 50 billion tonnes (Ritchie and Roser, 2020). Additionally, energy sector accounts for the largest share of total emissions – 73.2%. However, there are great differences between countries in terms of carbon footprint per capita. For instance, in 2020 China's carbon emissions were 11680.42 metric tonnes whereas Finland had 40.7 metric tonnes (worldpopulationreview.com, 2022). Thus, when considering environmental impact it is important to keep in mind the pivotal role that population size and density play. Fortunately, with innovative solutions such as carbon compensation and sequestration it is possible to reduce the world's negative impact on climate change (Ympäristöministeriö, 2022). Carbon compensation turns emissions into tradable and priceable items whereas sequestration utilizes natural resources such as trees to absorb CO<sub>2</sub> from Earth's atmosphere (Finnwatch 2021). Nevertheless, these solutions



should be taken only after having reduced as much CO<sub>2</sub> emission as possible (Kanwalroop, 2014). The priority should therefore revolve around reducing global CO<sub>2</sub> emission first before utilizing additional solutions.

## **2.2 Finnish Institutional Environment**

At the start of this millennium, the first sustainable mutual funds in Finland emerged, and their strategies have since evolved. More fund management companies have begun to incorporate sustainable strategies into their investment actions. Although there are not many mutual funds in Finland that focus on sustainability, the OMX Finland Sustainability index, comprising the 40 most sustainable companies from various industries, was founded in 2011, and Kuntarahoitus issued the first Finnish green bond in 2016. In 2010, the establishment of Finland Sustainable Investment Forum (FINSIF) was a significant milestone for the sustainable investing industry in Finland.

FINSIF's establishment sought to promote responsible investment whilst taking into account the factors related to environment, society and corporate governance when considering investment decisions. The number of FINSIF signatories has quintupled in the last decade, and nearly all institutional investors and asset managers in Finland are now members of the organization. The development of corporate social responsibility in Finland has also been supported by other organizations, including Sitra, Yritysvastuuverkosto FIBS, and Nasdaq Helsinki has issued an ESG-reporting framework for listed companies (FINSIF, 2017).

Finnish legislation has indirectly contributed to the growth of sustainable investing in the country by providing guidance for reporting sustainability factors. Since 2017, large organizations, such as financial institutions and insurance companies, have been required to report on non-financial factors critical to their operations, including sustainability factors (FINSIF, 2017). Although there are not many studies on sustainable investing in Finland, FINSIF has conducted two studies in 2017 and 2019, aimed at its members, including institutional investors, asset managers, and service providers. These studies aimed to understand the current sustainable investing market in Finland, how investing organizations practice sustainable investing, how they report on their actions, and the challenges and opportunities related to sustainable investing in the future (FIINSIF, 2020).

Prior to these studies, only the European Sustainable Investment Forum (EUROSIF) had studied the Finnish sustainable investing market in 2012, 2014, and 2018.

The Finnish institutional environment is often praised for its strong legal and regulatory framework, which promotes a culture of fairness and trust (Finnish Ministry of Finance). The country's political system is relatively stable, with a single party in power since the mid-1990s to 2002 (Gilman, 2005). This has allowed the government to focus on long-term policies aimed at economic growth, such as increasing investment in research and development and improving access to educational opportunities. Additionally, Finland is a well-developed welfare state that provides extensive public services to citizens, including free health care and unemployment benefits (Diane, 2018).

Finnish institutional environment provides an ideal backdrop for both domestic companies looking to expand overseas and foreign companies interested in investing within Finland's robust legal framework; fostering innovation through incentives while maintaining equitable taxation rates across different sectors helps create an attractive business climate that encourages entrepreneurship while still providing social security benefits necessary for citizens' quality of life (Finnish Business Environment, 2022).

According to Environmental Implementation Review (2019), Finland is actively participating in Environmental Implementation Review (EIR) country dialogues, multi-country workshops, and peer-to-peer learning to reinforce the implementation of EU environmental policy and law in order to improve air quality and reduce pollution from agriculture affecting water quality. Additionally, it is making progress through eco-innovation and circular economy initiatives, green public procurement targets, introducing a market-based mechanism for biodiversity conservation and including circularity in university curricula.

In order to achieve Finland's goal of becoming the world's first carbon-neutral welfare country by 2035, the country has taken steps to ensure that no public regulations are in place when it comes to voluntary carbon offsetting programs (Ympäristöministeriö, 2022). To help consumers make informed decisions, the Finnish Ministry of the Environment and Finnwatch (a Finnish organization) have both published criteria that can be consulted when choosing a compensation partner. The Ministry's nine criteria and their explanations are presented below, while Finnwatch also includes a criterion on when the

effects of the project will start (Finnwatch, 2021). By using these criteria as reference points while selecting a compensation partner, individuals and companies can ensure they are making an informed decision in their journey towards carbon neutrality.

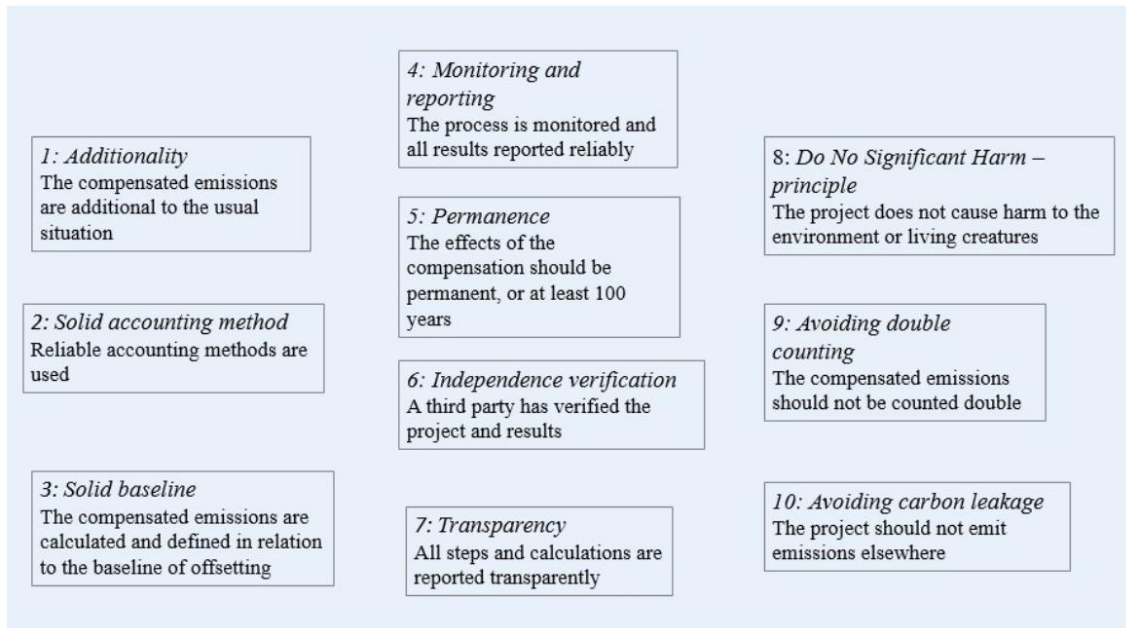


Figure 2: Criteria when choosing a compensation partner (Ympärisöministeriö, 2022)

To ensure that the compensation is reliable, it is essential to have guidelines and information on how to choose the right provider. The Finnish Ministry of the Environment has identified this need in their statement and is currently drafting guidelines on how providers of compensations services should operate, as well as how consumers can assess companies' reliability.

A study conducted by Zhang et al. (2022) revealed that companies in the scope believed that transitioning to carbon neutrality would bring economic benefits. In 2014, the Finnish Innovation Fund Sitra, established under the supervision of the Finnish Parliament (Sitra, 2022), conducted a similar study which suggested that the key drivers of decarbonization were waste reduction, establishing a positive brand image, and legislative requirements (Vahti, 2015). In contrast to Zhang et al.(2022)'s study, Sitra's study reportedly found that the companies in scope did not expect business opportunities or economic benefits to come from carbon neutrality (Vahti, 2015). However, a study conducted by Huovila et al. (2022) on cities pursuing carbon neutrality in line with Finland's collective target of carbon neutrality by 2035 suggests that cities expect

economic benefits to come from carbon neutrality, such as a positive impact on the city's image, attracting businesses, and opening employment opportunities.

Also, the study conducted by Huovila et al. (2022) suggests that pursuing carbon neutrality could ultimately result in economic benefits. A similar study conducted in China by Yan and Li (2023) found that there is an increased demand for high-quality environments, and citizens favor cities that are decarbonized or pursuing decarbonization. However, the research by Huovila et al. (2022) also indicates that the lack of human resources, time, and finances are the main barriers for Finnish cities in pursuing carbon neutrality. Additionally, according to Gössling et al. (2022), greenwashing can also impede efforts to achieve carbon neutrality. The production of misleading or incorrect information by companies can slow down the industry's efforts to reach carbon neutrality, as seen in the Volkswagen emissions scandal of 2015, which is suggested to have brought demotivation to the industry.

Regulatory and intergovernmental agencies in Finland have implemented various interventions to reduce carbon emissions in the country (Salvia et al. 2021; Hafner & Raimondi, 2020), the authors stated that one major intervention is the implementation of a national climate law, which sets ambitious goals for reducing greenhouse gas emissions by 2030. The primary goal of this legislation is to reduce Finland's net greenhouse gas emissions by at least 80% from 1990 levels by 2050. To achieve this goal, Finland has set interim targets for 2030, including cutting emissions of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) by at least 55%, 75%, and 20% respectively. This law also mandates that any new investments taking place in the energy sector need to be designed with sustainability in mind and must comply with regulations which limit their GHG intensity.

The European Union has implemented an Emissions Trading Scheme (ETS) which places caps on allowable emissions from large emitting sectors and incentivizes companies to invest in technologies that reduce their greenhouse gas output by providing them with allowances to buy if they cannot meet their caps, thus putting a price on carbon and encouraging the use of low-carbon energy sources such as renewables or nuclear power (Emissions Trading – Putting a Price on carbon, 2021). The European Investment Bank's Energy Efficiency Financing Facility (EEFF) has provided loans for energy

efficiency investments such as building insulation upgrades or renewable energy installations, thereby reducing GHG emissions across Europe while creating jobs in industries related to those investments such as construction or renewable energy development firms (European Investment Bank, 2023). Finally, Finland has signed up to the Paris Agreement on Climate Change, committing world leaders globally towards further emission reductions beyond what had already been set out within individual nations' own climate laws such as Finland's legislation for reducing GHG output per capita across all signatories' countries (European Commission, 2020).

According to European Commission, the European Union (EU) Framework and the Finnish Framework are two different regulatory systems. The EU Framework is a set of regulations that govern how member countries must operate within the Union, while the Finnish Framework is a national legal system that governs how each country in Finland must act. The EU framework is designed to provide a level playing field for all members of the union by allowing for free movement of goods, services, labour and capital between countries. This means that businesses can trade freely across borders without facing extra costs or obstacles from government regulations. The EU also ensures equal rights for citizens in all member countries by setting common standards and rules governing areas such as public health, consumer protection, environmental protection, and financial services.

In contrast, the Finnish framework is much more specific to Finland's needs as it includes its own laws on topics such as taxes and employment law. It also sets out which types of economic activities should be regulated at what level – either at a regional or national level – so it provides more tailored regulation than what could be achieved on an EU-wide basis. Additionally, Finland has its own specific human rights laws protecting citizens from discrimination based on gender or sexual orientation which are not covered under the general EU laws but are part of its national framework instead.

As stated by the Finnish Ministry of the Environment, the Carbon Neutrality Target of 2035 is an ambitious goal for Finland that will have a major impact on the competitiveness of Finnish firms. The target will require firms to reduce emissions and increase their use of renewable energy sources. It could also lead to higher costs in the form of taxes or other penalties for non-compliance. Additionally, companies may need

to invest in new technologies and processes to meet the target, which could lead to increased costs and reduced profits. Also, the Carbon Neutrality Target could also affect Finnish firms' ability to compete with companies from other nations that don't have similar targets or commitments. For example, if Finnish firms are able to more quickly invest in cleaner technologies that result in lower emissions levels than those of their competitors, they may be able to gain a competitive advantage over countries without similar policies. In addition, the Carbon Neutrality Target will likely require companies operating in Finland to make mandatory disclosures about their carbon footprints by 2035 or earlier if they don't meet the target before then. This could result in greater transparency around environmental performance of Finnish companies compared with those from other countries who are not subject to such requirements - further increasing their competitive advantage over competitors who do not have comparable standards for disclosure and reporting on environmental performance.

### **2.3 Determinants of Firm Value**

Several authors discuss numerous determinants, such as asset characteristics, financial structure, economic conditions, and strategic choices. They provide empirical evidence to support their assertions and clearly explain how each factor can affect firm value. Firm value is largely determined by a company's profitability, which in turn affects investor perceptions of the business. Hardiyansah, Agustini and Purnamawati (2020) asserted further that higher firm value can have a positive effect on the market, as investors view it as an indication that the company is successful and profitable.

The value of a company is perceived to be high when the share price and profitability are both high, as these are seen by investors as indicators of the company's management success (Hardiyansah & Agustini, 2020). The main determinants of firm value can be measured in two ways: through accounting-based performance (Wang, Wu & Zhang, 2022) (Busch & Lewandowski, 2018) and market-based performance (Yan, Li, Huang, Li, 2020) (Trinks et al. 2022). Accounting-based performance includes metrics such as return on assets (ROA) and return on equity (ROE). Market-based performance metrics include stock returns, market value/valuation multiples such as Tobin's Q (Kurnia, Nur & Putra, 2021; Hardiyansah & Agustini 2020) and market to book ratio according to Houque et al. (2022), adjusted stock return according to Matsumura et al. (2014), carbon

emission/sales ratio and total liabilities/sales ratio (Okeke et al 2021). Sun and Wang (2012) also measured firm value using financial ratios comprised of assets, liabilities and leverage. Houque et al. (2022) measured firm value using Tobin's Q and market-to-book ratio.

The authors calculated Tobin's Q as the market value of equity plus the book value of liabilities divided by the book value of assets. Market-to-book is calculated as the market value of equity divided by the book value of equity. Sun and Wang (2022) measured firm value using assets, liabilities, and leverage. In summary the main determinants of firm value are accounting based performance metrics such as ROA or ROE; or market-based performance measures including stock returns or valuations multiples like Tobin's Q or the Market to Book Ratio which consider asset values with respect to liabilities values along with revenue growth rates for economic firms size considered by Okeke et al (2021).

In conclusion, the determinants of firm value can be categorized into two main groups: accounting-based performance metrics and market-based performance metrics. Accounting-based performance metrics include measures such as return on assets (ROA) and return on equity (ROE). These metrics assess a company's financial performance based on its accounting records and financial statements. Market-based performance metrics, on the other hand, are derived from the company's stock market performance and investor perceptions. These metrics include stock returns, market value/valuation multiples such as Tobin's Q and market to book ratio, adjusted stock return, carbon emission/sales ratio, and total liabilities/sales ratio. Other determinants of firm value include financial ratios comprised of assets, liabilities, and leverage, which were used by Sun and Wang (2012) to measure firm value.

#### **2.4 Relationship between Carbon Emission and Firm Value**

Environmental disclosure and firm value are not mutually exclusive in that environmental disclosure represents an important factor in determining firm value. While traditional corporate finance theory states that firms' only goal is to maximize shareholder value, there are several economic mechanisms through which firms can act towards reducing their carbon emissions while still potentially enhancing shareholder returns (Busch & Lewandowski 2018). For example, according to Wang et al. (2022), companies'

proactive efforts to reduce carbon emissions have been associated with improved financial performance therefore, investing in sustainable practices can potentially enhance a company's financial performance as well as its reputation among stakeholders.

Additionally, since 2016 investors have been increasingly concerned about the long-term effects of climate change on corporate profitability therefore many investors now use environmental metrics for decision-making and for assessing potential investments (Busch & Lewandowski 2018), there is now a growing pressure on companies from shareholders regarding environmental disclosures and consequently many large corporations now include sustainability metrics when evaluating investments or issuing debt (Busch & Lewandowski 2018). For example, the Porter hypothesis suggests, according to Yan et al. (2020), that environmental regulation may involve additional costs but also provide an impetus for firms' R&D and encourage them to use new technologies to increase their production and profits.

Furthermore, by engaging in carbon reduction activities, firms can enhance their reputation as socially responsible companies which will give them a competitive advantage in the industry as well as boost financial performance (Lee et al. 2015) (Trinks et al. 2021)(Busch & Hoffmann 2018). It thus appears that taking steps towards reducing carbon emissions represents an opportunity for both environment protection and achieving financial success - a win-win situation for all stakeholders.

Desai (2022) conducted a study on 141 Indian companies over seven years to examine the effect of financial, industrial, and market-based factors on carbon emission disclosure. The study found that size, profitability, leverage, and market value were major determinants of carbon disclosure for the sample firms. The study also suggested that propositions of legitimacy and information asymmetry theory are partly applicable in emerging contexts. The research is expected to assist managers and practitioners in devising their disclosure policy and add value to existing environmental research, especially in emerging economies.

Huayu, Zheng, Jeffery and Bikki (2020) collected carbon information disclosure data for Chinese listed companies from 2009 to 2015 and examined the influencing factors of carbon information disclosure from stakeholders' perspective. The study found that among external stakeholders, pressures from government and customers can improve the



level of firm carbon information disclosure, but the effects of creditor, supplier, and competitor on carbon information disclosure level were not significant. Among internal stakeholders, major shareholders, institutional investors, and employees can improve the level of firm carbon information disclosure, but the effects of foreign investors (QFII) on carbon information disclosure were not significant. Among third-party stakeholders, environmental protection organizations and audit institutions can improve the level of carbon information disclosure for firms. The findings of this study can guide Chinese firms in developing carbon disclosure policies and encourage future research in this subject.

Nguyen (2018) conducted a study on Australian polluters, or firms in carbon-intensive industries, and found that these companies had a higher probability of negative net income, a lower Tobin's Q, and a lower return on equity (ROE). This suggests that the pollution caused by these firms is leading to poorer economic performance compared to non-polluting companies. Lee, Min, and Yook (2015) focused their study on 362 Japanese firms from 2003 to 2010. They found that as carbon emissions increased within these firms, their Tobin's q and return on assets (ROA) decreased. This further supports the notion that businesses with higher levels of pollution tend to suffer economically due to their environmental impacts. Trinks et al (2022) in their study of a global sample of 1572 firms from 2009 to 2017 examined the short-term profitability of carbon-efficient firms and their findings showed that these carbon-efficient firms had superior short-term profitability, as measured by their return on assets (ROA). The results suggested that there is an economic advantage to being environmentally conscious, as it leads to higher returns for shareholders.

Busch and Hoffmann (2018) also studied the relationship between environmental performance and financial performance, focusing specifically on the Tobin's q metric. They confirmed Trinks et al. (2022)'s findings that firms with superior corporate environmental performance have significantly higher Tobin's Q values than those without superior environmental performance. This suggests that companies who are better stewards of their environment are also likely to experience better financial outcomes in terms of market value in addition to higher ROA values.

Benedikt, Sebastian, and Aleksandar (2021) studied the effect of a carbon disclosure mandate on firms' subsequent emissions and financial performance. They found that UK-incorporated listed firms affected by the mandate reduced their emissions by about 8% with no significant changes to their gross margins. This suggests that the reporting mandate had a positive effect on emissions without adversely affecting the financial performance of treated firms. Diah and Efta (2016) investigated how carbon emissions disclosure and corporate social responsibility affect firm value by using Indonesian manufacturing companies as their population sample. Their results showed that carbon emission disclosures were negatively correlated with firm value and corporate social responsibility was positively correlated with firm value.

Hardiyansah and Agustini (2020) found that carbon emissions disclosure has a positive and significant effect on firm value, and that the type of industry can further increase this effect. Kurnia and Nur, Putra (2020) showed that in Indonesia, carbon emission disclosure increases firm value, indicating it brings a competitive advantage for firms to create value. In contrast, there is no effect of carbon emission disclosure on firm value in Australia due to the cost of implementation leading to higher expenses and lower cash flow. Lee and Cho (2021) also find a positive correlation that appears quite significant, between firm value and carbon emissions among the Korean sample affiliates. Houqe et al. (2022) also find in their study that firms with higher carbon emissions experience lower performance as the market tends to react negatively to such high emissions status.

The Kurnia, Darlis, & Putra (2020) study suggested that while there is not a direct relationship between carbon emissions disclosure and good corporate governance on firm value, the financial performance of the firms examined was found to mediate the effect. In other words, it appears that financial performance can be a significant factor in influencing firm value when it comes to disclosures related to carbon emissions and good corporate governance. Contrastingly, Benedikt, Jürgen and Aleksandar (2021) demonstrated that providing a reporting mandate for firms has been found to help reduce carbon emissions without adversely affecting their financial performance. This implies that mandating disclosures can be an effective way of reducing harmful emissions whilst also ensuring corporations are able to remain financially sound. This is an important

finding as it encourages sustainable practices without disrupting businesses' bottom line. Together, these studies suggest that carbon disclosure has implications for company valuations if it is accompanied by improved financial performance.

Hardiyansaha and Agustinib (2021) investigated the influence of carbon emissions disclosure on firm value in the context of corporate responsibility activities, and found that it has a positive and significant effect. They also found evidence that environmental performance could strengthen this relationship, as companies' efforts to participate in these initiatives are responded positively by investors.

Similarly, Gabrielle & Arianto (2019) discovered both greenhouse gas emission disclosure and environmental performances had a positive effect on firm values, with the latter moderating former's relationship. This suggests that companies should not only focus on disclosing their carbon emissions but also strive to demonstrate their environmental performance advocacy as well. Investors would be more likely to reward those firms with higher levels of corporate social responsibility disclosure and higher levels of environmental performance over those firms who only pay lip service towards sustainability initiatives. Debt to equity ratio and net operating income showed positive effects while size had negative effects on firm values as control variables studied.

Mohammad & Aisa (2020) revealed that carbon emissions disclosure has a positive and significant effect on firm value, with the type of industry increasing this effect. Lu, Zhu, & Zhang (2021) revealed that carbon disclosure in carbon-non-intensive industries can significantly contribute to improved financial performance in the current period and carry over to the following period.

Lastly, it appears that there is a direct relationship between the market value of shares and carbon disclosure. Studies such as those conducted by Saka and Oshika (2014) and Akbas and Canikli (2019) have found evidence of this relationship. This is because the management of carbon emissions and the disclosure of such information have been considered to be value-relevant, as highlighted by Andrikopoulos and Krikiani (2012). Therefore, companies that effectively manage their carbon emissions and disclose such information to the public may experience an increase in their market value due to the positive perception from stakeholders, including investors.

As an aftermath of the international climate summits i.e. the Kyoto Protocol of 1997 and the Paris agreement of 2015, the quantification of carbon footprints has become topical with the wide adoption and use of the Greenhouse Gas(GHG) protocol for measuring and reporting direct and indirect gas emissions at the organisational level. In line with the protocol, carbon emissions could either be classified into direct or indirect emissions whilst carbon emission reporting currently distinguishes between three(3) scopes - emissions from owned or controlled resources of a firm being classified as scope 1(direct), indirect emissions from the generation of purchased energy e.g electricity being classified as scope 2(indirect), and all other indirect emissions that occur in a firm's value chain e.g input products, employee travel, distribution etc, being classified as scope 3(indirect) according to Ehlers et al (2020).

The erstwhile studies emphasize inconsistent findings on the relationship between carbon emissions disclosure and firm value. Some studies revealed considerable beneficial benefits on firm valuations in Indonesia and South Korea, while others found no effect in Australia. However, this finding indicates that financial performance can influence the impact of carbon disclosures on corporate value. Mandatory disclosure has been found to minimize carbon emissions without harming financial performance and promoting sustainable practices without impacting corporate operations. Promoting environmental performance is also vital for weakening the link between carbon emissions disclosure and corporate value. Furthermore, there is a strong association between market value and carbon emissions disclosure, showing that better management and disclosure of carbon emissions can improve stakeholders' views and lead to improved market value. It can be suggested that the quantification of carbon dioxide emissions and the establishment of greenhouse gas protocols to measure and report emissions are important topics in light of the worldwide climate conference.

#### **2.4.1 COVID-19, Carbon Emission and Firm Value**

The COVID-19 pandemic brought the world to a near halt in 2020 when the outbreak of a flu strain in China spread across the globe. In a study by Anser et al(2021) to assess the impact of the pandemic on healthcare expenditures, logistics performance index, carbon damages, and corporate social responsibility in a panel of 77 countries, they find that COVID-19 cases substantially increase healthcare expenditures and decrease

corporate social responsibility whilst the increase in the coronavirus testing capacity brings positive change in reducing healthcare expenditures, increased logistics activities, and corporate social responsibility. The study also finds that the cost of carbon emissions increases when corporate activities begin to resume.

The pandemic brought with it amongst other things, decline in energy production and energy demand, decrease in oil production and oil prices, increase in residential consumption, lower electricity cost, economic contraction and loss of revenues, negative impact on firms and financial markets according to Priya et al (2021). The study also finds on the environment front, that the pandemic witnessed a drastic reduction in GHG emissions, reduced waste, growth and/or survival of endangered species, improve environment and cleanliness. It is interesting to observe that the pandemic period may have also failed to increase the global capacity to sustain the reduction in GHG emissions by improving on renewable energy production as contained in the study by Das (2020) wherein there was recorded shortage in manufacturing of solar power components, and overall decline in new energy projects according to Manzanedo et al (2020).

Having settled the realities of the pandemic lockdown period as highlighted earlier, the relationship of carbon emissions and firm valuation during this period was examined by Phang et al (2023) using Australian listed firms, find that companies with sustainability practices performed better during the pandemic when compared with other firms with little or no sustainability practice. Albuquerque et al (2020) provides another interesting angle by regarding COVID 19 as a shock event that tested the ESG-financial performance link from both the customer preference and the investor preference. The study finds that these two theories appear to suggest that stocks with high ESG ratings possess a more accommodating capacity to shocks when compared with other stocks in the rampant stock market sell-off during initial few months of 2020 as firms with high ESG ratings appear to have built capacity to withstand shocks for the longer time either from the customer loyalty perspective or the investor loyalty perspective. A seemingly similar study on the S&P 500 during the same period by Diaz et al (2021) appears to confirm Albuquerque et al (2020)'s position that that firms with high ESG scores outperform the S&P 500 index and firms with low ESG scores underperform the S&P 500 during the Covid-19 window.

Demers et al (2020) however deviates from the ESG resiliency position in their study by suggesting, after controlling for industry affiliation as well as accounting and market-based measures of risk, find that not only is ESG insignificant and offers no positive explanatory power of returns during the Q1 2020 COVID crisis, but ESG is negatively associated with market returns during the Q2 2020 COVID recovery period. Davis et al (2020) rather than present a conclusive position, find that firm-level stock returns during the COVID 19 crisis moved along their exposures and their relative industries. The study further posits that negative COVID 19 news lowers returns for firms with high exposures to travel, traditional retail, aircraft production and energy supply while the same negative news, raises the returns for firms with high exposures to healthcare policy, e-commerce, web services, drug trials and materials that feed into supply chains for semiconductors, cloud computing and telecommunications. In their own study, Engelhardt et al (2021) finds high ESG-rated European firms to be associated with higher abnormal returns and lower stock volatility and that ESG enhances the value of the firm in low-trust countries, and in countries with poorer security regulations and where lower disclosure standards prevail.

## **2.5 Total Assets and Firm Value**

Muvidha and Suryono (2017) did research on the influence of company size on firm value, whereas Husna and Satria (2019) conducted a similar study. The findings of both research demonstrate that company size has a considerable influence on firm value. However, the study conducted out by Tarmiji (2019) and Juhandi et al. (2019) indicated that business size does not have a substantial influence on firm value. To estimate a firm's assets and turnover capability, the assets possessed by the company are measured. Total Asset Turnover (TATO) is used to measure how successfully a firm is managing its assets to create sales or profits. The TATO ratio is the net sales to total assets ratio, which is often employed in corporate operations. According to Widodo (2018), this ratio gives insight into a company's asset ability to create total net sales. Prospective investors view the value of total asset turnover (TATO) as one of the elements when appraising a firm. A corporation is deemed to be efficient in exploiting its assets when the TATO value improves. The greater the TATO ratio, the better the response from investors, which leads to a rise in the company's share value. Utami and Prasetiono (2016) and Firdaus (2020)

did study on the influence of TATO on firm value, and the findings revealed that TATO has a considerable effect on business values.

Frimansah and Suwitho (2017); and Husna and Satria (2019) have offered evidence that profitability has a substantial and favourable influence on business value. However, this conclusion contradicts the findings of research done by Emanuel and Rasyid (2019) and Firdaus (2020), which imply that profitability does not have a substantial influence on business value. Sintyana and Artini (2019) have stated that business size might impact the ease with which a company receives finance from the capital market. Tunggal and Nagatno (2018) have highlighted that bigger enterprises have a better possibility of accessing both internal and external finance sources. It is probable to consider business size as one of the criteria that are significant to evaluating profitability, since the bigger the company, the simpler it is to secure external financing owing to the various assets that might be utilized as guarantees. This investment might then be leveraged to expand corporate operations or enhance market share. In other words, the higher the business size, the greater the market share, and therefore, the more profits made from business may be used as a scale to indicate the profitability or profit that a business will create, since the larger the firm size, the higher its profitability will be. Previous study done by Pratama and Wiksuana (2018) and Kartikasari and Merianti (2016) on the role of business size on profitability have revealed that firm size has a substantial effect on profitability. However, this study contradicts the conclusions of research done by Akhmadi and Ariandini (2018) and Tui et al. (2017), which indicate that business size does not have a major influence on profitability.

On the other hand, inefficient asset use would raise the company's burden in the form of investments that don't generate returns (Hasanah & Enggaryanto, 2018). Increased net sales will follow an increase in turnover (TATO), and an increase in net sales will be followed by an increase in net profit, which will impact the profitability of the business. Total asset turnover (TATO) has no appreciable impact on return on assets (ROA), according to Tan & Hadi (2020) and Irman et al. (2020). The findings contrast with those of Sutrisno & Yulianeu (2017) and Khusnul Armyta et al. (2020), who concluded that TATO had no appreciable impact on profitability. It will be simpler for a corporation with a large firm size to get funding for market growth, and the higher the

firm size, the broader its market share will be. A larger market share will boost sales and earnings, which will boost profitability. This will lead to a rise in firm value.

Prior research by Akhmadi & Ariandini (2018) on the relationship between firm size and firm value and the mediating function of profitability demonstrates that profitability may mediate the impact of firm size on firm value. The study by Pratama and Wiksuana (2018) demonstrates that profitability is unable to moderate the impact of business scale on firm value. Companies with a significant potential for profit will be more appealing to investors. When assets are used proficiently, significant profits may be produced. An increase in net sales will be accompanied by a high total asset turnover ratio (TATO), and an increase in net sales will be followed by a net profit or profitability.

## **2.6 Theoretical Framework**

### **2.6.1 Legitimacy Theory**

The legitimacy theory, which was developed in 1975 by Dowling and Pfeffer, contends that a corporation should maintain its operations in harmony with the larger societal framework. Due to outside constraints from their environment, such as economic, political, and social pressures, this encourages the idea of sustainable behaviours. Corporations must satisfy their stakeholders by adhering to rules in order to meet their expectations (Darus, 2008). Businesses also have a responsibility to assess the local resources, both natural and human (Bashatweh & Jordan, 2018). Nonetheless, it is improper for management to control profits, and they are not obligated to provide information about environmental consequences beyond what is required by law.

Legitimacy theory, which pertains to the social contract between an organisation and the community, is frequently used to explain social and environmental disclosure, according to Deegan et al. (2002). (Mathews, 1993; Patten, 1991). This theory's main assertion is that an enterprise can only be viable if its activities adhere to societal standards (Gray et al., 1996). Organizations must integrate into society in order to accept constructive criticism from it and to address any possible gaps that may exist between them. This may lessen current tensions between businesses and communities according to Deegan et al. (2002).

According to Lindblom (2010), there are four strategies that can be used to counter threats to legitimacy: giving pertinent information about changes in organisational



performance; changing stakeholders' perceptions of performance; diverting attention away from some issues by focusing on others; and finally, attempting to change external expectations about organisational performance. All of these tactics play a significant role in successfully maintaining legitimacy, which may be reinforced by voluntary sharing of information on social and environmental activities (Magness, 2006).

Notwithstanding this, Mobus (2005) and Owen (2008) have criticized the study, arguing that although it provides an explanation for management behaviour, it neglects to take into account how disclosure might increase openness and accountability towards stakeholders besides shareholders.

Legitimacy theory is significant to this study because it provides a framework for analysing how external stakeholders and environmental concerns impact corporations. According to legitimacy theory, organisations that participate in proactive environmental policies may win support from stakeholders, resulting in enhanced financial performance. This means that organisations who can demonstrate a commitment to sustainability goals as well as transparency in their reporting systems are more likely to gain from carbon emissions and carbon disclosure policies. As a result, the legitimacy theory provides an important theoretical framework for investigating the potential firm-value implications of carbon emissions and disclosures.

### **2.6.2 Agency Theory**

The ground-breaking 1976 article "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure" by Jensen and Meckling helped establish agency theory as the dominant theoretical framework of corporate governance literature, by introducing the concept that shareholders are the primary stakeholders according to Lan et al. (2010), and Daily et al. (2003). Zajac et al. (2004) finds that the adoption of this logic increased during the 1980s as companies started to replace managerial capitalism with a perception of managers as agents for shareholders. This new stream of literature moved away from treating firms as black boxes and assuming that they always sought to maximize value (Jensen 1994).

Agency theory, rooted in economic utilitarianism, examines the agency relationship in the context of goal orientation, obligation and reciprocity, risk, and self-interest, with a focus on a contract that minimizes costs and provides logical predictions

about the behavior of rational individuals in such a relationship between a single principal and agent (Lambert, 2006). The separation of ownership from control, different risk preferences, information asymmetry, and moral hazards give rise to conflict of interest and agency cost. Strong ownership control, managerial ownership, independent board members, and committees are among the solutions to help control the agency conflict and its cost (Panda & Leepsa, 2017).

Agency theory addresses the growing concern about managerial opportunism and disregard for shareholder interest, which Michael Jensen referred to as “the systematic fleecing of shareholders and bondholders” (Jensen, 1989). It provides guidance on how principals should control their agents in order to prevent these issues arising (Perrow, 1986) and Daily et al. (2003). Research has shown that agency issues have an influence on managerial attitudes towards risk-taking and hedging (Smith & Stulz 1985), highlighting potential mismatches between shareholder interests, management decisions, and debt holders' earning distributions (Mayers & Smith 1987).

The agency theory also suggests that well-defined policies can have a positive effect on firm value through reducing risk taking behaviour or increasing engagement in positive projects (Fite & Pfliederer 1995), which is consistent with financial theories. Agency theory suggests that managers, in order to keep the cost of capital low, attempt to reduce the perceived risk experienced by investors through carbon disclosures (Andrikopoulos & Krikiani, 2012) and Drobetz et al. (2014). This concept has led many organizations to adopt the practice of voluntary disclosure. Agency theory provides valuable insights into how firms can effectively align stakeholder interests while maximizing value creation. It emphasizes the importance of principals controlling their agents so that any conflicts between them are avoided or mitigated - ultimately allowing firms to make decisions in line with shareholder interests.

### **2.6.3 The Stewardship Theory**

Davis et al. (1997) expanded the stakeholder idea into the stewardship theory. The agency theory, which was proposed by Jensen and Meckling (1976) to address the agency problem, is also addressed by the stewardship theory. According to the notion, managers now serve as stewards who represent the interests of shareholders rather than being actors (Forsyth, 2016) and Krisnawati et al. (2014). In order to accomplish the aims

of the company, managers operate as stewards of the principal and are not driven by personal aspirations. According to Davis et al. (1997), when managers' objectives align with the interests of all stakeholders, the relationship might establish equilibrium. Davis et al. (1997) add that managers may fulfil their objectives by contributing positively to the success of the business and gratifying all stakeholders.

Stewardship theory asserts that managers have "firm-specific knowledge and management competence and are assumed to gain an advantage over company owners who are mostly distanced from the operational part of the organisation," as a result, corporate performance may be accomplished by them (Forsyth, 2016). As a result, managers are trustworthy by nature and unlikely to misuse company funds. A steward acts on behalf of the organisation they work for and accepts its vision, purpose, and goals while being pro-organization, genuinely driven, and identifying with it (Davis et al., 1997; Krzeminska & Zeyen, 2017). Their efforts are focused on achieving goals by performing the necessary chores and assignments, taking pride in the company's accomplishments, and becoming irate when the goals are not attained (Forsyth, 2016; Krzeminska & Zeyen, 2017).

#### **2.6.4 Stakeholder Theory**

The obligation of firms to protect stakeholders as well as shareholders is not only a social responsibility, but also an economic opportunity. Carbon emissions disclosure can help reduce information asymmetry and agency costs between firms and investors, leading to improved access to quality resources. The evidence of this phenomenon leads to the conclusion that voluntary carbon emission disclosure is beneficial for companies' financial performance (Lyon & Maxwell, 2008; Choi et al., 2010; Liu et al., 2016).

It demonstrates that fewer carbon emissions may boost shareholder value and generate profits above the return on a company's physical assets, which is demonstrated to counteract the detrimental effects of corporate carbon emissions on later financial performance (Liu, Zhou, Yang & Hoepner, 2016). Ultimately, it is evident that stakeholder theory provides an imperative approach in increasing sustainability and reducing environmental pollution by encouraging firms to be responsible for all stakeholders including shareholders. Voluntary disclosure of carbon emissions can not only benefit society by reducing environmental costs but also create a win-win situation

for both companies and investors by optimizing the firm's financial performance (Barsky et al., 1999; Kim & Lyon, 2010; Meek et al., 1995).

Furthermore, the evidence presented by numerous research studies supports the prediction of Stakeholder theory that companies engaging in Corporate Social Responsibility (CSR) will experience higher share prices. For instance, Singhal & Subramanian (2010), have both conducted studies which suggest a correlation between CSR practices and improved financial performance. Similarly, Lee et al. (2015), Matsumura et al. (2013), Qiu et al. (2016) as well as Saka & Oshika (2014) found that firms with higher levels of CSR were also yielding better market based financial results than those without such practices in place; an observation also made by Cho and Roberts (2010) and Clarkson et al.(2014). Therefore, it can be concluded that companies with a greater focus on social responsibility tend to benefit from increased shareholder value than those who do not invest in CSR activities.

Stakeholder theory encourages businesses to consider the interests of all parties affected by their decisions and to prioritize long-term outcomes. Non-financial disclosures provide transparency about how companies manage their relationships with stakeholders, enabling investors to measure performance and assess the long-term impacts of a company's actions. Taking into account stakeholder perspectives in this way helps promote responsible decision-making that considers both short-term and long-term goals.

Stakeholder theory suggests that organizations are accountable to all of their stakeholders, not just shareholders. As such, non-financial disclosures such as carbon emissions can be used to show a company's social responsibility and sustainability practices. Research into the effect of disclosed carbon emissions on firm value seeks to determine the potential financial impacts of these practices for shareholders. If research shows that companies with lower carbon emission levels have higher values or fewer risks associated with their investments, it could encourage other firms to reduce their carbon footprints in order to maximize shareholder returns. By considering all stakeholders when making decisions, companies may be able to better manage environmental concerns while also improving financial performance and stakeholder value.

### 2.6.5 Underpinning Theory

The most suitable and applicable theory for analyzing the topic "Firm-Value Effects of Carbon Emissions and Carbon Disclosures" is the Stakeholder Theory. This theory proposes that organizations have a responsibility to balance the interests and expectations of various stakeholders, including shareholders, employees, customers, suppliers, and the environment. This theory examines how firms should interact with their stakeholders to ensure long term sustainability and value creation for both the firm and its shareholders. Since Carbon Disclosure affects stakeholders such as customers, employees, suppliers, governments etc., Stakeholder Theory provides an ideal framework to analyze the effect of carbon disclosure on firm-value.

The theory suggests that by taking into account the interests of all stakeholders, firms can create long-term value and sustainability. In the context of carbon emissions and disclosures, the stakeholder theory would suggest that firms should consider the impact of their carbon emissions on various stakeholders, including the environment, local communities, and future generations. By disclosing information about their carbon emissions and reduction efforts, firms can engage with stakeholders and build trust and legitimacy. This, in turn, may lead to improved firm performance and value.

## 2.7 Conceptual Model

### 2.7.1 Firm Value

Firm value is an important indicator of a company's financial health and market position. It is a comprehensive measure that incorporates the company's market capitalization, as well as its short-term and long-term debt and cash holdings. Firm value has proven to be an effective tool for winning customers' trust according to Lubis et al. (2017). In order to accurately assess firm value, external measures such as Tobin's Q and the market-to-book ratio should be used. These measures are not subject to manipulation like accounting methods are and accurately reflect the market response to a firm's environmental activities (Nishitani & Kokubu, 2012; Wang et al., 2014). Tobin's Q is calculated as the total market value of equity plus liabilities divided by book value of assets. Market-to-book considers only the market value of equity divided by book values of equity (Demsetz & Lehn, 1985; Lee et al., 2015; Nishitani & Kokubu, 2012; Wang et al., 2014). Using these external measures provides investors with more reliable

evaluations of firm values which can help them make informed decisions when dealing in the stock markets or investing in companies they believe have sound environmental practices.

### 2.7.2 Disclosure

Corporate disclosure refers to the practice of companies providing information about their financial and non-financial performance to stakeholders (Cho & Roberts, 2010). The disclosure of such information is essential for building trust and transparency between the company and its investors, customers, employees, and the wider community. Corporate disclosure can take many forms, including annual reports, financial statements, press releases, earnings calls, sustainability reports, regulatory filings as well as on their website or social media platforms (Wang et al., 2014). Carbon emission disclosure has been a subject of discussion since the introduction of Corporate Social Responsibility (CSR) in 1950s (Okoye, 2009). Since then, definitions and debates on its impact on firm value have shifted over time (Friedman 1970). Gray et al. (1995) defined CSR as "the process of communicating the social and environmental effects of an organisation within society".

This definition incorporates aspects such as company activities; employees; consumer issues; public image in terms of community relations; all related to disclosing information about how companies interact with society (Jizi et al 2014; Singh 2016). Over the last two decades, the extent of social responsibility disclosure has increased by large institutions (Gray et al., 1995a); this increase was in terms of disclosures of activities, adopted 16 policies, human resources, community, and products. CSR has received extra attention from both academia and enterprises (Zhu et al, 2016); this increasing attention was given to CSR in order to determine the benefits of adopting such behaviour. Recently, researchers have begun to put more effort into determining whether CSR can improve company's performance or not (Wu & Shen, 2013; Lee et al., 2013). According to Skare and Golja (2012), the leading organisations on CSR, for example the ones on the top 10% of the Dow Jones Sustainability World Index 2009-2010 list reveal improved performance over the other companies in terms of the Dow Jones Global Stock Market Index.

Corporate social responsibility disclosure provides information to stakeholders internally and externally regarding corporate activities, this information is important to

reduce the information asymmetry. The information asymmetry concept comes from the information's gap between stakeholders and managers (Lowe, 2001; Martínez, et al, 2015). Managers have the ability to reach different types of information, while stakeholders do not have this information (Balakrishnan, et al, 2014). Consequently, managers try to give and disclose as much disclosure as they can to reduce this gap. These disclosures might include financial disclosures, social disclosures or any type of disclosures that relates to the company's activities such as improvements of waste management, efforts to protect employees, reducing environmental impact, and being compliant with environmental regulations. Generally, firms tend to engage in CSR activities and disclose this information in order to achieve economic benefits (McWilliams, et al, 2006). However, Barnett (2007) in his study contemplated the possibility of financial benefits to the company providing adequate cover for the costs of its contributions to the welfare of society. If so, CSR can be accepted as an intelligent investment; if not, CSR can be judged as a type of agency problem.

The amount of attention regarding CSR has been increasing in areas of academic, business and society (Mehralian, et al, 2016). The supply of information on products and services, human resource, environmental reporting and contribution in community activities reporting are other examples for such disclosures. Gray et al. (1995) states that "It is not restricted necessarily by reference to selected information recipients, and the information deemed to be CSR may, ultimately, embrace any subject". CSR has been established as a broad concept based on the view of so many studies conducted (Cramer, Jonker, & Heijden, 2004; Polonsky & Jevons, 2006, 2009; Ratajczak & Szutowski, 2016).

The CSR behaviour in the developing countries is still considered limited, because the goals of the institutions are generally profit making, in addition, institutions where activities have implications on the environment focus on the disclosures in that area, in order to maintain their operations and achieve their goal (Desta, 2010). While in developed countries, it is in continuing to improve (Rahahleh & Sharairi, 2008), in fact, the developed countries have moved on from the debate regarding the need of CSR to issue more legislations to support CSR and release white papers in order to mandate these actions (Norwegian Ministry of Foreign Affairs, 2009; Berg & Sheehan, 2014).

The Global Reporting Initiative (GRI) is one of the main organisations that have created a disclosure database, which can be used as a guidance by companies in reporting their environmental, economic and social performance. CSR adoption can lead to many benefits for the company and society, however, not every company engaging in CSR is deemed socially responsible. In fact, some companies such as ExxonMobil's are contributing for environmental conservation causes which amount to \$6.6 Million (ExxonMobil, 2010), while they are paying more than 11 million to fund groups that try to discredit the theories of anthropogenic climate change (PBS, 2012). This duality of behaviour has a special term which is used between scholars as 'Pink washing', this term was invented to describe the behaviour of companies that sell products purportedly deemed contributory to breast cancer, meanwhile they are funding research to eliminate breast cancer (Alhouti, Johnson, & Holloway, 2016).

The decision to disclose carbon emissions is driven by both the potential costs and benefits associated with such a move (Matsumura, Prakash & Vera-Munoz, 2014). The authors stated that firms are motivated to reduce their carbon emissions in order to avoid being on an 'environmental blacklist', and the resulting bad publicity could lower a company's market value. On the other hand, firms can benefit from disclosing their carbon emissions through reduced information asymmetry between themselves and investors; this may lead to increased investor confidence and improved access to capital markets which may reduce cost of capital for firms with superior CSR performance. In addition, voluntary disclosures of carbon emissions can also help companies avoid potential regulatory intervention or costly information searches regarding non-disclosers' emission levels.

Moser and Martin (2012) make a strong case for viewing Corporate Social Responsibility (CSR) activities and related disclosures more broadly as being motivated by shareholders and non-shareholders alike. This view implies that companies have to consider the interests of all stakeholders when making disclosure decisions regarding carbon emissions. The potential costs associated with these decisions, such as proprietary costs on some firms (Li, Richardson, Thornton 1997), compliance costs imposed by government regulators (e.g., the EPA), costly litigation from previously uninformed victims of GHG-related climate change, competitive green-marketing strategies aimed at



environmentally conscious consumers, and ammunition provided to public interest groups can all reduce firm value if not managed properly.

### 2.7.3 Carbon Emissions

Natural and industrial emissions are both parts of the carbon emission/greenhouse gas spectrum (Martinez, 2005). Natural carbon emission is a cycle that may be balanced out by vegetation and the ocean (Kurnia, Nur & Putra, 2021). There are three categories of carbon emission disclosure, according to Hendriksen and Breda (2001): Adequate Disclosure, which gives only the bare minimum of information mandated by the standard. Fair Disclosure, which only reveals the information that is necessary to meet the standard's minimal requirements. The third option, Full Transparency, reveals all data pertinent to the demanded standard.

Ganda and Milondzo (2018) present many aspects of carbon emissions as (Scope 1, Scope 2). Scope 1 emissions, according to Global Reporting (2018), are direct emissions from sources owned or controlled by the organisation, such as fuel combustion for on-site energy generation or car or fleet use. Scope 2 includes indirect emissions from the organization's use of purchased electricity. It is evident from the research of Wei et al. (2020), Kennedy et al. (2009), Shan et al. (2018a), Zhou et al. (2019), Ji et al. (2019) and Downie, John and Wendy (2013) that accounting for all three Scope 1, 2 and 3 emissions when estimating regional electric-related carbon emission will lead to improved efficiency on China's carbon emission mitigation efforts as it will provide a more accurate understanding of the region's carbon footprint, as well as revealing the potential for carbon leakage from other regions or countries imported into the region being studied.

According to Downie, John, and Wendy (2013), Scope 1 emissions are those generated from an organisation's own activities, such as burning fossil fuels and transportation. Scope 2 emissions are indirect GHG emissions caused by purchased electricity or steam. Finally, Scope 3 refer to upstream GHG emissions resulting from the value chain of the organisation's activities; Volkswagen estimates that most of their carbon footprint comes from these sources. However, it may be difficult to acquire data regarding scope 3 sources (Huang et al., 2009b). Consequently, this proves that a thorough assessment of all three scopes is imperative in order to create effective strategies to reduce emissions in China.

To properly assess corporate carbon disclosure, existing literature has relied on CDP data as a proxy for both the prevalence of carbon disclosure and its quality. However, CDP's questionnaire has been subject to change over time, and company responses fluctuate accordingly (Kolk et al., 2008; Liao et al., 2014). Therefore, it is not suitable for longitudinal analysis or comparison. An alternate source is content analysis of annual reports or CSR reports which allows more discretion in assessing climate related disclosures (Dwyer et al., 2009; Eleftheriadis & Anagnostopoulou, 2014; Freedman & Jaggi, 2005; Ieng Chu, Chatterjee, & Brown, 2012; Ferreira et al., 2013; Lee et al., 2015) Penget at. (2014). However, Liesen et al. (2015) found that quantitative corporate carbon disclosures are incomplete as less than a quarter of European firms report GHG emissions of scope 1 and 2 for more than 90% of their operations. This underlines the importance of using content analysis to accurately gauge environmental performance from corporate disclosure statements.

This theoretical model (as seen in Figure 3) links the suggested correlation between the dependent and the various independent variables used in this study.

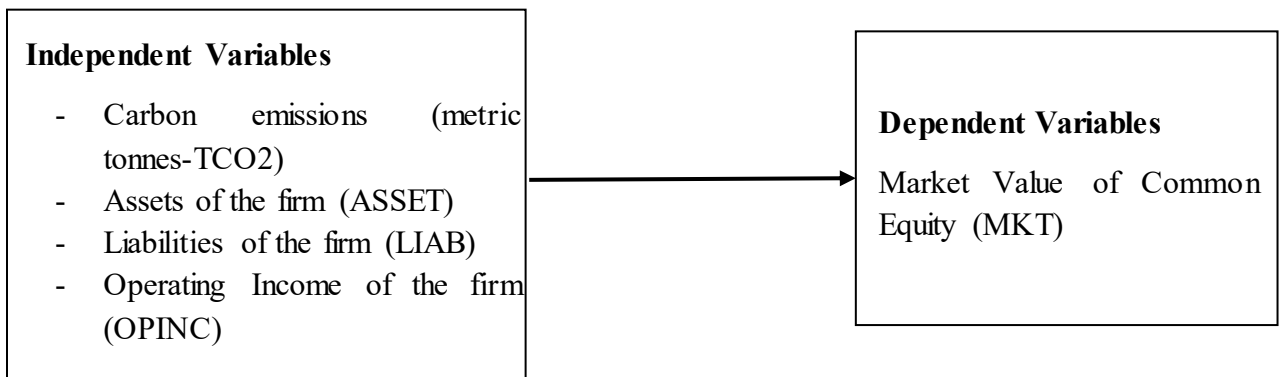


Figure 3: Conceptual Framework of Study

## CHAPTER THREE

### 3 METHODOLOGY

#### 3.1 Research Philosophy

Research philosophy is the term used to describe the underlying presumptions and attitudes that guide the research process. According to Saunders, Lewis, and Thornhill (2019) "a set of beliefs and assumptions about the nature of reality and knowledge that underlie the researcher's approach to the research process," Positivism, realism, interpretivism, and pragmatism are the four primary research philosophies that form the basis of the research procedure. The scientific method lies at the heart of positivism's quest for quantifiable, objective truths about the world. According to realism, reality exists independently of our perceptions and emphasizes the importance of the outside world. However, interpretivism emphasises the emotional perception of the real world as well as the value of personal interactions and points of view. Pragmatism combines elements of all three ideologies and focuses on real-world solutions to problems.

Pragmatism is the research methodology that is typically relevant to the analysis of firm-value effects of carbon emission and carbon disclosures in Finland. This is because the study aims to look at how carbon emissions and disclosures actually affect firm value in Finland. Pragmatism provides a flexible and non-dogmatic approach to research that integrates both quantitative and qualitative methodologies in order to achieve the desired practical objectives.

#### 3.2 Methodological Choices

Methodological choices refer to the approaches and procedures that researchers will employ to gather and analyse data. These choices, which can significantly impact the validity and reliability of the findings, are guided by the study questions, objectives, and overall research design. Methodological decisions are "the choices researchers make about how to conduct their research, what data to collect, and how to analyse and interpret that data," according to Denzin and Lincoln (2017). Methodological decisions might include the study design, such as quantitative, qualitative, or mixed-methods research, as well as particular data gathering strategies, such as surveys, interviews, or observation. The three most important research methodology are quantitative, qualitative, and hybrid methodologies. Because each approach has benefits and drawbacks, the study questions

and objectives should be used as a guide. The evaluation will gather information from various sources, such as monetary reports of publicly traded companies in Finland, maintainability reports, and other pertinent distributions. The use of optional information ensures the unwavering authenticity and quality of the data acquired.

To evaluate the relationship between fossil fuel residues, carbon exposures, and company value, the evaluation will use panel regression analysis. The panel data regression model takes into account robust estimates, time-varying confounding effects, and firm-to-firm unobserved heterogeneity. The study will concentrate on the publicly listed enterprises in Finland that report their carbon emissions. These companies will be selected through a purposeful testing process based on their size, industry, and degree of carbon emissions.

### **3.3 Research Strategy**

According to Sanders et al. (2019), research strategy is the general rules for how experts answer exploratory questions. Research plans are often based on research objectives, questions and theoretical frameworks. To ensure that the assessment is accurate and complete, it is important that the investigative approach is linked to the exploration objectives and hypothesis structure. The research methodology of the study will be a mixed methods research design. This method combines objective and subjective methods to provide a comprehensive and complex understanding of the research question.

### **3.4 Description of data and sources**

Since the data needed for the analysis already exists, this study used an expo-facto research design. This study's population consists of 50 companies from Refinitiv database. This study is based on secondary data, specifically financial statement figures from 2019 to 2021, a period of three years. Market value represent the study's dependent variable, while carbon emissions, total assets, liabilities and operating income are the study's independent variables. Similar to Matsumura et al (2014), this study utilises hand-collected data from the Carbon Disclosure Project (CDP) database for the carbon emissions data made available for Finnish companies. The relevant financial data for firm values used for this study is to be sourced from Refinitiv (formerly Thomson Reuters) database.

### 3.5 Data Analysis Techniques

Descriptive statistics are used to present the findings. The estimation method to be used in this study is the static panel data regression analysis. This involves estimating either the pooled Ordinary Least Square (OLS) or fixed effects and random effects models. The Hausman test which is used to differentiate between fixed effects model and random effects model in panel analysis will be utilized to determine the most appropriate estimates between the pooled Ordinary Least Square (OLS) and fixed/random effects.

### 3.6 Model Specifications

The model of the study established the relationship between the dependent variable of the value of the firm with the use of the market value of the common equity of the firm as a proxy. Independent variables are the Total Carbon Emissions, Assets and Liabilities of the firm, and the Operating Income of such firms. The study's model specification is as follows for each of the company  $i$  at time  $t$ ;

$$MKT_t = \beta_0 + \beta_1 TCO_{2it} + \beta_2 ASSET_{it} + \beta_3 LIAB_{it} + \beta_4 OPINC_{it} + \varepsilon_{it} \dots \dots \dots (1)$$

**Where;**

- i.  $MKT_{it}$ : Proxy for firm value,  $MKT_{it}$ , is the market value of common equity (in millions of euros), calculated as the number of shares outstanding multiplied by the price per share of the firm's common stock at the end of calendar year  $t$ . Data for this dependent variable is to be obtained from Refinitiv database.
- ii.  $TCO_{2it}$ : Independent variable of interest,  $TCO_{2it}$ , denotes carbon emissions in thousands of metric tonnes. Consistent with our hypothesis of a negative association between carbon emissions and firm value, we expect a negative  $TCO_{2it}$  coefficient.
- iii.  $ASSET_{it}$ : Our balance sheet valuation model includes total assets and a positive coefficient expected for  $ASSET_{it}$ .
- iv.  $LIAB_{it}$ : At the end of the fiscal year, the balance sheet valuation model expects a negative coefficient expected for  $LIAB_{it}$ .
- v.  $OPINC_{it}$ : Proxy for the firm's operating income in year  $t$ , Firms with higher operating income are not only valued more highly by the markets, but they are also better able to invest resources for measuring and controlling their carbon

emissions. It follows that firms with better performance are more likely to have both higher market values and lower emissions.

### 3.7 Apriori Expectation

Based on the given model, we can make the following apriori expectations on variables:

1. Assume that there is a negative correlation between  $TCO_{2it}$  and  $MKT_{it}$ . Companies that focus on environmental sustainability may be viewed more favorably by investors, resulting in higher firm value.
2. A positive relationship is expected between  $ASSET_{it}$  and  $MKT_{it}$ . Larger companies with more assets may be viewed as more stable or more likely to grow, resulting in higher firm value.
3. A negative relationship is expected between  $LIAB_{it}$  and  $MKT_{it}$ . This is because companies with high debts are considered to be less financially stable, which can reduce their firm value.
4. A positive relationship is expected between  $OPINC_{it}$  and  $MKT_{it}$ . This is because companies with higher operating margins may be viewed as more profitable, resulting in higher firm value.

## CHAPTER FOUR

### 4 DATA ANALYSIS AND INTERPRETATION

This study examined firm-value effects of carbon emissions and carbon disclosures in Finland. This section of the study details the analysis of the study model utilising relevant variable data and the interpretation of the results gained from the analysis. Data was obtained from a total of sixty-nine (69) enterprises in Finland, however, eleven companies were eliminated owing to incomplete data and also as a result of outliers in some sections of the data. Eventually a total number of fifty-eight companies were used to achieve the goal of this study.

#### 4.1 Descriptive Statistics

Descriptive statistics provide insight into the distributional characteristics and summary measures of variables. Mean and median values help you understand the central trend in your data, while maximum and minimum values define the range of observation. Standard deviation provides information about the spread or variability of the data. The skewness and kurtosis coefficients reveal the shape and symmetry of the distribution. A positive skewness indicates an asymmetric distribution with a right tail, and a negative skewness indicates a distribution with a left tail. Kurtosis measures the degree of peak or flatness compared to a normal distribution. Higher kurtosis values indicate heavier tails and more pointed distributions.

**Table 1: Summary of Statistics**

	MKT	TCO	ASSET	LIAB	OPINC
Mean	0.091754	0.786585	9.140770	8.909624	7.957018
Median	0.080989	1.000000	9.143063	8.941958	7.908210
Maximum	0.452665	1.000000	10.78576	10.67758	9.348110
Minimum	0.001912	0.000000	6.811106	6.808886	5.340444
Std. Dev.	0.067848	0.410973	0.682565	0.695323	0.649507
Skewness	1.630495	-1.398940	-0.119881	-0.066461	-0.288662
Kurtosis	7.742852	2.957032	3.385094	3.123287	4.110779
Jarque-Bera	226.3794	53.50483	1.406185	0.224598	10.70875
Probability	0.000000	0.000000	0.495052	0.893777	0.004727
Sum	15.04765	129.0000	1499.086	1461.178	1304.951
Sum Sq. Dev.	0.750337	27.53049	75.94088	78.80628	68.76297
Observations	164	164	164	164	164

*Source: Author's Computations (2023)*

Descriptive information is provided for the variables MKT, TCO<sub>2</sub>, ASSET, LIAB, and OPINC in the research. MKT, which stands for market worth of normal value in million euros, is a company worth intermediary. A negative coefficient is anticipated to signify a negative correlation between carbon emissions and company value since TCO<sub>2</sub> monitors carbon emissions in thousands of metric tonnes. The balance sheet valuation model takes ASSET into account, and a favourable coefficient is projected. The monetary record valuation model, for which LIAB is also well-known, is predicted to have a negative coefficient. OPINC is a stand-in for the business' operational income. It is anticipated that businesses who invest more in detecting and controlling carbon emissions would have higher market values and fewer emissions. Each variable in the data from the Refinitiv database includes 164 observations.

The mean for MKT is 0.091754, which is the variable's average value within the sample. The median is 0.080989, which represents the midpoint of the variable distribution, and the maximum and minimum MKT are 0.452665 and 0.001912, respectively. MKT measures the spread of variable values around the mean and has a standard deviation of 0.067848. A skewness of 1.630495 indicates that the MKT distribution is positively skewed, with tails extending towards higher values. With a kurtosis of 7.742852, MKT distribution is flat, with advanced tails and spike shapes. The Jarque-bera statistic is 226.3794 with a probability of 0.000000, indicating that there is a significant deviation from the normal distribution. The impact of outliers on the data set was removed by processing the data and logarithms of market value, operating income, total assets, and total liabilities. Consequently, this helps normalize the distribution of the dataset.

TCO<sub>2</sub> has a mean of 0.786585 and a median of 1.000000. The range of variable values is from 0.000000 to 1.000000. The standard deviation is 0.410973, indicating that the data is moderately variable. A skewness of -1.39894 indicates that the distribution is negatively skewed, with one tail extending to lower values. A kurtosis of 2.957032 indicates a plate-shaped kurtosis distribution, with a shorter tail and flatter shape than the normal distribution. The Jarque-bera statistic is 53.50483 with a probability of 0.000000, indicating that there is a significant deviation from normality. The average total asset was 9.14, 8.91 for liabilities, and 7.96 for operating income. Liabilities and operational income



had median values of 8.94 and 7.91, respectively, which were somewhat lower than the mean, while the median value of assets was 9.14, which was close to the mean. In terms of value range, assets had the largest range (6.81 to 10.79), liabilities had the smallest range (6.81 to 10.68), and operating income had the narrowest range (5.34 to 9.35). Each variable's standard deviation values were at 0.69, which was roughly the same. A measure of symmetry for each variable, the values of skewness showed a modest negative skew for assets and liabilities and a substantial negative skew for operating income. Kurtosis readings revealed that all variables' dispersion was leptokurtic, which means that it had heavier tails and a higher peak than the typical circulation. The Jarque-Bera test is used to assess if the data have a normal distribution. Operating income showed a statistically significant p-value of 0.005, however the distributions of assets and liabilities did not appear to depart significantly from normal because their p-values were above 0.05.

**Table 2: Pearson Correlation Analysis**

	MKT	TCO	ASSET	LIAB	OPINC
MKT	1				
TCO	0.098	1			
ASSET	-0.447	0.157	1		
LIAB	-0.451	0.200	0.972	1	
OPINC	0.067	0.234	0.803	0.755	1

*Source: Author's Computations (2023)*

The correlation coefficient between MKT and TCO<sub>2</sub> is 0.098, suggesting a weak positive correlation. However, this correlation is not statistically significant. The correlation coefficient between MKT and ASSET is -0.447, indicating a moderate negative correlation. This suggests that as total firm assets increase, the market value of the firm tends to decrease. The correlation coefficient between MKT and LIAB is -0.451, also indicating a moderate negative correlation. This implies that as firm liabilities increase, the market value of the firm tends to decrease.

The correlation coefficient between MKT and OPINC is 0.067, indicating a weak positive correlation. However, this relationship is not statistically significant. The correlation coefficient between TCO<sub>2</sub> and ASSET is 0.157, indicating a weak positive correlation. This means that there is a slight tendency for both corporate carbon emissions and total assets to increase. The correlation coefficient between TCO<sub>2</sub> and LIAB is 0.200, indicating a weak positive correlation. This suggests a slight tendency for carbon

emissions and corporate debt to rise simultaneously. The correlation coefficient between TCO<sub>2</sub> and OPINC is 0.234, indicating a weak positive correlation. This indicates that both CO<sub>2</sub> emissions and operating income tend to increase slightly. The correlation coefficient between ASSET and LIAB is 0.972, indicating a strong positive correlation. This means that there is a strong correlation between a company's total assets and liabilities. The correlation coefficient between ASSET and OPINC is 0.803, indicating a strong positive correlation. This indicates that there is a strong relationship between a company's total assets and operating profit.

The correlation coefficient between LIAB and OPINC is 0.755, indicating a strong positive correlation. This means that there is a strong correlation between corporate debt and operating income. Overall, the correlation matrix provides insight into the relationships between variables. The negative correlation between MKT and both ASSET and LIAB suggests that the larger the firm's assets and liabilities, the lower its market value. However, weak positive correlations between TCO<sub>2</sub> and other variables suggest less significant associations. It is important to note that statistical significance tests are required to determine the significance of these correlations.

**Table 3: Regression Analysis**

Explanatory Variables	Dependent Variable=MKT		
	OLS	Fixed	Random
TCO <sub>2</sub>	0.003833	0.00278	0.002364
	0.517441	0.372474	0.309328
ASSET	-0.16919	-0.17277	-0.15687
	-8.12862**	-8.21326**	-6.46419**
LIAB	0.027532	0.02957	0.015887
	1.486223	1.588019	0.697462
OPINC	0.127012	0.129074	0.124505
	16.3953**	16.27218**	16.98316**
R-square	0.7175	0.7203	0.7084
No of Observation	164	164	164

Note: \*\*\* sig. at 1%, \*\* 5%, and \* sig. at 10%. In parentheses, robust z-statistics are given

*Source: Author's Computations (2023)*

The carbon emission estimation coefficients are 0.003833 for the OLS method, 0.00278 for fixed effects, and 0.002364 for random effects. Although carbon emission disclosure has positive effect on firm value there was no significant effect observed in the

models. However, the coefficient estimates for total assets are -0.16919 for OLS, -0.17277 for fixed effects, and -0.15687 for random effects. The t-statistics are -8.12862\*\*, -8.21326\*\*, and -6.46419\*\*. This shows that total assets have a negative and significant effect on firm value of companies in Finland. Nonetheless, the coefficient estimates for the company's liability are 0.027532 for OLS, 0.02957 for fixed effects, and 0.015887 for random effects. The T-statistics associated with these estimates are 1.486223, 1.588019, and 0.697462 respectively. No significant effect was found between models.

The coefficient estimates for the company's operating income are 0.127012 for OLS, 0.129074 for fixed effects, and 0.124505 for random effects. The t-estimators for these estimates are 16.3953\*\*, 16.27218\*\*, and 16.98316\*\*, respectively, meaning that the three models are significant. Operating income has positive and significant effect on firm value of companies in Finland. The R-squared values in the table indicate the proportion of the variance in the dependent variable MKT that can be explained by the explanatory variables. The R-squared values are 0.7175 for OLS, 0.7203 for fixed effects, and 0.7084 for random effects.

## 4.2 Test of hypothesis

### Hypothesis

H<sub>0</sub>: Firm value is negatively associated with carbon emissions.

H<sub>1</sub>: Firm value is not negatively associated with carbon emissions

The results revealed that carbon emission estimation coefficients are 0.003833 for the OLS method, 0.00278 for fixed effects, and 0.002364 for random effects. Although firm value has positive effect on carbon emission disclosure exists but no significant effect was in the models because for every metric tonne of carbon emission, the firm has a negligible increase of €3,833 in the value of the firm. Therefore, we reject the null hypothesis that firm value is negatively associated with carbon emissions.

## 4.3 Discussion of Findings

Matsumura et al. (2014) in conducting a similar study with the same hypothesis were not expecting the null hypothesis to hold because of the notion that any cost associated with carbon emissions may be passed to customers and trading partners or the capital markets may choose to disregard the effect of carbon emissions when pricing such firms. The result however showed that the markets were willing to penalize firms with

carbon emission. In this study however, it would appear that either the cost of emissions is being transferred effectively to customers in such a way that it does not affect the value of the firm, or the markets have chosen to disregard the effect of carbon emissions on the value of the firm.

The study revealed that carbon disclosure has positive effect but insignificant ( $p > 0.05$ ) on firm value in Finland companies. In related and comparison to the findings, according to Wang et al., (2022); Busch and Lewandowski (2018), investments in sustainable practices can improve firm financial performance. Shareholders are putting pressure on corporations to disclose environmental information, and many large corporations are taking sustainability metrics into account when evaluating investments and bond issuance. Environmental regulations can increase costs, but they can also stimulate company R&D, encourage the use of new technologies, and lead to increased production and profits (Yan et al., 2020). This lends credence to the notion that environmental regulations can spur innovation and improve a company's financial performance.

Carbon reduction activities can boost a company's reputation as a socially responsible organisation, provide a competitive advantage, and improve financial performance (Lee et al., 2015; Trinks et al., 2021; Busch & Hoffmann, 2018). This means that measures to reduce CO<sub>2</sub> emissions can benefit both the environment and the economy. Oshika and Saka, 2014. Nguyen (2018); Akbas and Chanikri (2019); Hardyancer and Agustini (2020); Gabriel and Arianto (2019); Mohammad and Aisa (2020). According to Lee, Min, and Yook (2015), companies with high carbon emissions have poor financial performance. Companies with positive business environmental performance have significantly higher Tobin Q scores (Busch & Hoffmann, 2018). According to Benedikt, Sebastian, and Aleksandar (2021), reporting requirements can promote sustainability without jeopardising financial results. Diah and Efiti (2016), on the other hand, discovered a negative relationship between carbon emissions disclosure and firm value.

In relation to the findings that COVID-19 affects firm value negatively, Haidere et al. (2021) found that COVID-19 cases substantially decreased corporate social responsibility. Demers et al. (2020) found that Environmental, social and governance

(ESG) was not significant and offered no positive explanatory power for returns during the Q1 2020 COVID crisis. They also found a negative association between ESG and market returns during the Q2 2020 COVID recovery period. Davis et al. (2020) found that firm-level stock returns during the COVID-19 crisis moved along with their exposures and relative industries. Firms with high exposures to travel, traditional retail, aircraft production, and energy supply experienced lower returns, while firms with high exposures to healthcare policy, e-commerce, web services, drug trials, and materials that feed into supply chains for semiconductors, cloud computing, and telecommunications experienced higher returns.

COVID-19 affects carbon emission disclosure and firm value positively. Anser et al. (2021) found that the increase in coronavirus testing capacity during the pandemic brought positive changes in reducing healthcare expenditures, increasing logistics activities, and corporate social responsibility. Also, Phang et al. (2023) found that companies with sustainability practices performed better during the pandemic when compared with other firms with little or no sustainability practices. Albuquerque et al. (2020) found that stocks with high ESG ratings possess a more accommodating capacity to shocks, and firms with high ESG ratings appear to have built capacity to withstand shocks for a longer time, either from the customer loyalty perspective or the investor loyalty perspective. Diaz et al. (2021) found that firms with high ESG scores outperformed the S&P 500 index during the COVID-19 window. Lastly, Engelhardt et al. (2021) found that high-ESG-rated European firms were associated with higher abnormal returns and lower stock volatility. They also found that ESG enhances the value of the firm in low-trust countries and in countries with poorer security regulations and lower disclosure standards.

The study revealed that disclosing carbon emissions has a significant negative effect on total assets in Finland. The publication of carbon emissions may be viewed as a key aspect that has a detrimental effect on the entire value of a firm, according to study done by Sun, Wang, and Li (2022). Their research goes on to suggest that after exposing the fossil fuel leftovers, it causes a reduction in the organisations' overall resources. Furthermore, the research by Saka and Oshika (2014) and Wibowo, Suhendro, and Amelia (2023) provides evidence in support of the claim that publishing a firm's carbon emissions

may have a detrimental effect on the value of the company as a whole and its assets as a whole. This might therefore have a negative financial impact on the businesses.

Research conducted in Korea by Lee and Cho (2021) found a link between corporate value and carbon disclosure. Additionally, guidelines and partner pressure were identified by Prado-Lorenzo et al. (2009) as other factors that affect the exposure to ozone depleting agent emissions in organisations throughout the world. They discovered that companies that voluntarily report their emissions had better reputations, which may benefit financial performance. In any event, it is very important to note that not all analyses have found a positive impact of the disclosure of fossil fuel byproducts on working remuneration. Borghei & et al. (2018) examined Australian enterprises in detail and found no measurably significant correlation between exposure to ozone-depleting chemical discharge and accountancy-based execution metrics like profit from resources and return on value. Voluntary disclosure may enhance a company's worth and reputation, even if there is conflicting information regarding how it improves operating income.

## CHAPTER FIVE

### 5 CONCLUSION AND RECOMMENDATIONS

#### 5.1 Study Overview

The broad objective of this study is to evaluate firm-value effects of carbon emissions and carbon disclosures in Finland. The underpinning theory for the study is the stakeholder theory. The Stakeholder Theory proposes that organizations have a responsibility to balance the interests and expectations of various stakeholders, such as shareholders, employees, customers, suppliers, and the environment. By taking into account the interests of all stakeholders, firms can create long-term value and sustainability. This study used an expo-facto research design to investigate 50 organisations from Refinitiv (previously Thomson Reuters) database. It was based on secondary sources, specifically financial statement figures from 2019 to 2021. The dependent variable is market value, while the independent variables are total carbon emissions, assets and liabilities, and operating income.

This study used descriptive statistics and Pearson correlation coefficients to determine the nature and validity of the data for the analysis, and static panel data regression analysis to the pooled OLS, fixed and random effect models to determine the effect of the carbon emission on firm value. The study found a positive but non-significant firm value effect of carbon emission which was proxied by carbon emission disclosure in Finland.

#### 5.2 Conclusion

This study has found that carbon emission has a positive but insignificant effect on firm value of Finnish companies. This means that the Finnish capital market has either not tightened the incentivization framework for the disclosure of carbon emissions with respect to the value of the firm or the companies have been able to effectively transfer the cost of carbon emissions to their customers and trading partners according to Matsumura et al(2014). The study also demonstrates that disclosing carbon emissions has a significant negative effect on total assets, however, disclosing carbon emissions positively and significantly affect operating income. In the context of this study, stakeholders such as investors, customers, trading partners and the environmental activists may all have interests in a company's carbon emissions and disclosure practices. While the findings

suggest that company value may not be significantly impacted by carbon emission disclosure, it is still important for companies to consider the interests of these stakeholders and prioritize sustainable and environmentally responsible practices. Ultimately, prioritizing stakeholder interests can lead to long-term success and sustainability for companies in Finland and beyond.

### **5.3 Implications**

The results imply a positive relationship between firm valuation and carbon emissions disclosure in Finland, which was found to be statistically insignificant. This suggests that corporations publishing their carbon emissions may be seen more positively by stakeholders, but the effect is not substantial enough to be considered important.

This implies that firms in Finland can be encouraged to disclose more of their carbon emission and in exchange for an incentivization scheme from the Government of Finland, the effect may be significant on the long run with more disclosure by firms as there is incentive to disclose and the disclosure will ultimately lead to the prosperity of their firms.

For researchers, the study suggests the need for a study on the long run effect of carbon emission on firm value. This means that studies with longer time frame should be carried out to see how carbon emission in past times affected the present firm value with the findings to predict what would happen in the future and what line of action to be taken for long run impact.

The significant negative influence of total assets on firm value shows that as total asset increases, firm value decreases. This could be attributable to a variety of factors, including the disposal of assets and reduced asset demands due to efficiency gains.

On the other side, the significant positive influence of operational profit on firm value shows that as operational profit improves, so does firm value. This could be owing to more investor confidence and access to cash, higher economies of scale, or an enhanced capacity to negotiate lucrative contracts.

### **5.4 Recommendations**

Based on the results of the study, the following recommendations can be made:

1. Policy makers need to introduce an incentive scheme that is driven by regulators and encompasses all the firms both private and public, in order to reward the firms who are actively reducing their carbon footprints as well as those who are voluntarily disclosing



their carbon emissions numbers especially as the country has a carbon-neutral target to achieve by 2035. The scheme should also be effective enough in penalizing any firm that does not actively seek the reduction of carbon emissions.

2. Finnish companies should prioritize the disclosure of their carbon emissions as this has a positive influence on firm value. Companies can strengthen their reputation and attract socially responsible investors by revealing their carbon footprints.

3. Finnish firms should monitor the negative effect of decreasing their overall assets and its severe impact on their company worth.

4. Finnish companies should focus on boosting their operational income since this has a positive and significant impact on company value. This can be done by introducing cost-saving initiatives, enhancing operational efficiencies, and developing new revenue streams.

### **5.5 Limitations and Suggestion for Further Studies**

In term of limitations, the study only covers 50 companies from Refinitiv database, which may not be representative of all companies in Finland. The study did not consider other factors that may affect firm value, such as industry-specific characteristics and governance practices. The study only uses financial statement figures from 2019 to 2021, which may not reflect the long-term effects of carbon emissions and disclosures on firm value. This study further suggested that a longitudinal research design should be embarked upon to track the firm value effects of carbon emissions and disclosures over a longer period of time. Also further research should consider additional independent variables that may affect firm value, such as corporate social responsibility initiatives and environmental regulations.

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