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The Role of Carbon Credits in Enhancing Company Profitability

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Abstract
The increasing global emphasis on sustainability and climate change mitigation has led to the emergence of carbon credits as a strategic financial and environmental tool. This study explores the role of carbon credits in enhancing company profitability, focusing on how their integration into corporate sustainability strategies can lead to both cost savings and revenue generation. Through a mixed-methods approach combining financial performance analysis and case studies of firms across sectors such as manufacturing, energy, and technology, the research reveals that companies engaging in carbon credit trading and emission reduction projects can improve operational efficiency, access new markets, and strengthen brand value. Furthermore, the study highlights the importance of regulatory frameworks, carbon pricing mechanisms, and voluntary carbon markets in shaping corporate decisions. The findings suggest that carbon credits are not merely a compliance requirement but a viable financial instrument for achieving long-term profitability and competitiveness in a low-carbon economy.

Keywords:
Carbon Credits, Company Profitability, Emission Trading, Sustainable Finance, Carbon Markets, Corporate Strategy, Environmental Economics, Low-Carbon Economy, ESG Performance, Green Business

1. Introduction to Carbon Credits

Subsequent to the summit in Kyoto, a number of countries ratified the agreement and implemented the Kyoto Protocol, which regulated CO2 emissions within industrialized countries by establishing a market for emissions trading. Certain countries where emissions have grown less than foreseen such as denoted in the first commitment, the so-called “Annex 1 countries”, have acquired a surplus of emissions trading certificates (referred to in this paper as carbon credits). These credits can be traded between companies or countries. Moreover the European Union is planning to introduce a system for emissions trading within Europe. Trading has been postponed with subsidiaries, because companies have not had time to account for their CO2 emissions. For some companies it is the amount of emissions trading certificates that can be avoided, thus resulting in direct savings. For the companies acquiring credits, credit prices vary with additional variables, depending on how these companies expend their funds.
Correlations between investment recommendation and CO2 emissions accounting in reports. A few

corporations have started to look for ways how to measure CO2 emissions. Since the end of 1990 companies, companies like BP, Shell, Monsanto, Ford among others started experimenting with calculating their emissions, primarily for reporting purposes (Tessieri, 2018). Subsequently to the first findings this sector cooled down, it took a few years before new methodologies were establish assessing whether or not these accounting schemes could serve the corporate community. After the first efforts involving greenhouse gas accounting standards were recently established. Currently the field of carbon accounting scheme is a fairly fragmented one, scaling from current investors rewards to long-term sustainable development pillar. New institutionalism implies that organizations who are confronted with field pressures will develop common structures and cognitions. Standards have emerged also in this field, but so have counter standards. To sum this up, carbon accounting is widely accepted as a way to calculate for company specific greenhouse gas emissions, but it still lacks credibility and needs stronger institutions behind it.

2. Understanding Carbon Markets

Tackling climate change requires governments and firms to reduce greenhouse gases by 80% globally and 90% in industrialized countries below 1990 levels, providing sufficient time for the stabilization of atmospheric greenhouse gases at a safe level (Brinkman et al., 2009). This translates into a carbon budget that determines the legally binding maximum total quantity of greenhouse gases firms, countries, or regions can emit over the commitment period. Carbon trading has emerged as one of the key policy instruments in the fight against climate change. This can be achieved either through a tax on carbon emissions or a cap-and-trade scheme, which is currently being debated to be implemented in China. In a cap-and-trade scheme, a restricted number of emission allowances is traded on dedicated markets, where a firm holds maximum limits on the volume of greenhouse gases it can emit. If firms emit less than their allowance, the reserve allowance can be sold either to earn a profit or to invest it elsewhere. In the first case, the firm's profit rises; in the second case, costs decrease, enhancing competitiveness relative to rivals that did not invest in carbon-free technologies. Over the past years, carbon trading has been externalized by financial investors, and the newly emerging carbon market had reached an estimated worth of €89 billion and a trading volume of €271 billion by the end of 2007. Parsing quantitatively out traded emission volumes in 2007 reveals the detailed structure of trades in terms of separate asset classes. The median price as well as the break-even price of verified comparable peers in the power sector can be estimated. For the Pöyry model's top-down estimation method, it was found that relatively simple stationary financing needs of three carbon positions with no further strategy optimization currently drive carbon option prices. It is further argued that the current cap-and-trade system is inefficient and cannot reduce costs in the face of demand shocks. General systems that stabilize price at the firm-problematic cap level based on stochastic penalty and price mechanisms are developed that could restore incentive to banks to be active on carbon markets.

3. Types of Carbon Credits

Carbon credits come in several types, but are primarily emitted as either a result of the mitigation of anthropogenic sources of carbon emissions or as a result of the sequestration of these materials through natural carbon sinks. The most common are those resulting from avoided carbon emissions. This is usually the case when carbon emissions are reduced at previously known or easily understood sources. A common example is the establishment of a wind farm, which produces electricity without producing carbon emissions. A for-profit company that wishes to offset the carbon emissions from its operations can buy carbon credits produced at such projects in direct proportion to the greenhouse gases mitigation that they produce (Ribera et al., 2009). There are, however, many less simply understood

projects which produce unverifiable or unstable carbon credits, and the potential for fraud is vast. To avoid abuses, United Nations oversight was included in the Kyoto Protocol, which defines six couplings within the basic cap-and-trade model of emissions trading, and attaches rules about the validity of the carbon credits produced and traded in each coupling. The most well-known and robustly validated of these coupling types are the Clean Development Mechanisms (CDM), which are credits produced by projects which sequester or abate anthropogenic carbon emissions and are additional to projects that would otherwise take place in a jurisdiction (Wagner et al., 2010).

A clean development mechanism project is submitted along with a model of how it will sequester or abate carbon emissions, and a prior estimate of emissions would be created. After a "designated operational entity" which is accredited through UN agencies validates the project and method, it is approved to enter the CDM registry. Credits generated in annual verifications are sent to a trading registry where they can be purchased for offsetting businesses' required emissions. Similar projects trading credits in similar fashion are also conducted under gold standards and voluntary carbon standards, but these are produced without the scrutiny of UN agencies. An alternative to this class of carbon credit is "avoided emissions" credits. It can be generated by similar projects and validated by similar methods, but are much more problematically mitigated.

3.1. Voluntary Carbon Credits

A carbon credit is an instrument that represents the right to emit one metric ton of carbon dioxide (CO2) or its equivalent in other greenhouse gases (GHG). The carbon credits are certified by various voluntary regulations . A carbon credit is a type of international financial instrument that enables the holder to emit carbon dioxide or other greenhouse gases in the atmosphere. Companies that are considered to be carbon contributors can purchase these credits as a legitimate way to offset their contribution and, if necessary, carbon pollutants. Some of the biggest companies that have acquired these credits include stuff such as .

In times past, realizing the profitability of voluntary carbon credits can be challenging, and this factor increases the risks associated with investing that of a capital resource. Since the technology standards and trends are changing at a rapid pace, and the climate and weather also change on inverted time frames, it is challenging to know which type of project profile could generate a "bankable" revenue stream. However, this factor also presents opportunities for unique projects that would otherwise remain untapped. Additionally, it is advised to avoid or minimize hydro in any form. With their "Pacific Northwest," regional utility scandals still in the spotlight, there is still time to investigate this type of project in Africa. Although progressing on this type of project would be challenging, there are coalition opportunities with well-known players in the region. Additionally, where there are significant funding needs, these types of projects are NOT bankable or profitable.

Voluntary carbon credits can enhance company profitability in a number of ways. The foremost way is by providing tax credits for the purchase of voluntary carbon credits. The company that would like to increase its net income would purchase these credits like those of investments. These credits may eventually be used to offset when compliance is embedded, or they can be sold into the futures market.

3.2. Compliance Carbon Credits

Compliance permits or carbon credits represent the initial stage of the cap-and-trade markets. They include surplus allowances under cap-and-trade systems like Europe's Emissions Trading Scheme, the Regional Greenhouse Gas Initiative in the northeastern U.S., and California's cap-and-trade program. These compliance programs, in turn, foster liquid markets for voluntary carbon credits and provide market-based options for compliance. At their core, cap-and-trade systems impose environmental

obligations on firms. In turn, firms may comply with this obligation by performing abatement or by purchasing compliance permits allowing them to emit excess greenhouse gases (Tessieri, 2018). With traditional regulatory and direct policy instruments like emission taxes and strict prohibitions, firms have no degrees of freedom in how they should comply with the obligation to abate greenhouse gases.

With cap-and-trade, firms can act freely in the cap-and-trade market for necessary permits. They can maintain or expand their production in spite of the environmental obligations by engaging in a variety of strategies like abating the compliance obligation directly, purchasing allowances from firms with insignificant compliance, or investing in offset-generating projects. The cap-and-trade system can be represented as a set of flows between (i) the regulatory body and the market, and (ii) the market and firms. This procedure is recounted in detail for the case of regional cap-and-trade systems for only a few instances of the vast array of emissions trading programs.

The analysis considers firms operating outside of the regulations in a region without permitting excess greenhouse gas emissions, and only participation in the compliance program is considered. The regulatory agency estimates and caps the total emissions in its territory and generates allowances equivalent to this cap. This agency then allocates the compliance permits according to predefined rules. Crowding out policies like the allocation of free allowances raise the question of market integrity: is the policy equivalent to providing some portion of the cap on emissions? The question of allocation efficiency arises when credits are sold, or auctioned.

4. The Economic Impact of Carbon Credits

Carbon credits offer attractive profit opportunities to firms already involved in GHG emissions trading under cap-and-trade and credit and offset schemes. These programs apply to 16 countries or groups, which generate about 13% of global GHG emissions. The EU emissions trading system is the largest, covering 40% of European GHG emissions (B Bushnell et al., 2013). Most new proposals are under negotiation, especially in developing countries, which are less familiar with this new type of trading. For the carbon market to be viable, firms need to measure, report, and credit emission reductions or removals from increased GHG sinks. These credits are then traded for multiple purposes, including banking, compliance, or carbon neutrality. This paper assesses the potential sources of income and opportunities for economically affecting the carbon market's establishment in firms not necessarily trading firms yet. Similar policy instruments may pertain to other environmental services (Ribera et al., 2009). In a cap-and-trade scheme, a carbon compliance firm must reduce its GHG emissions by a given percentage relative to a baseline level of emissions. This decrease can be accomplished by several means, including process and equipment changes, product substitution, fuel switching, or involvement in GHG sinks. However, the compliance firm cannot completely reduce emissions beyond a given threshold. Therefore, it can either buy credits from a credit trading firm or before the compliance requirement date sell the surplus allowances in this forward market. This evaluation focuses on profit opportunities for the above carbon credit generation programs in the carbon market outside compliance firms already involved in GHG allowance trading under a cap-and-trade scheme.

4.1. Cost-Benefit Analysis

M. TESTIERI / Åbo Akademi University 53 4. CBA IN THE NORDIC COMPANIES A Cost-Benefit analysis includes all costs and benefits accounted from the same viewpoint. The costs and benefits identification and estimation is composed of two parts but yet they are connected. The costs and benefits have to be identified, which comes from textual analysis, interviews and open responses in the questionnaire. Most of the costs and benefits were seen instantly. Therefore the costs and benefits were classified into five groups, which emerges from the survey. Then there were requirements to try to

quantify the results. The results from the CBA are in the tables underneath. The first table illustrates companies who have implemented difficult qualitative modelling. The second table indicates results in total from the costs and benefits assessment. In the third table there are the results from the ify stem. The results are based solely on the question and the immediate written comments. Quantifying the costs/benefits was impossible. Those comments included more insights on how companies utilize the system of carbon accounting (Tessieri, 2018).

A list of other determining factors was compiled in separate. A summary of the opinions on how carbon accounting affects the different company processes is listed separately. These results could show the wider area of effects from carbon accounting and provide a working ground for future work to narrow the boundaries. The answers showed significant improvement in rationalities in capital budgeting decision processes. The lowest score severe inefficiency as before carbon accounting implementation or through carbon accounting development process. There is a linearly positive correlation between the year of carbon accounting implementation in the company processes and the CBA result score. The results from CBA are from the linked question “How efficient do you consider the CBA in your company?” The hypothesis G3 is rejected because no diverging opinions in two clusters were detected. Two mitigating questions were followed by an open comment. The questions were: “What costs on benefits do you consider most important?” and “How and if these costs or benefits backfire?”

The majority of costs were split evenly into pragmatic issues. The practical issues of reporting mainly included the tedious work to gather and transform data. The second most replied cost group was more divided between different issues. These issues varied but included expenses, greenwashing or overall worries concerning carbon accounting. The requirements set limits on the development of the carbon accounting. Most benefits consisted of obvious motivational assistance to increasing efficiency or information to operating risks.

4.2. Long-term Financial Benefits

"Carbon credits are something like a currency or payment system that industry in the European Union (the EU) can use to compensate for the carbon dioxide they emit" (Tessieri, 2018). It is one of the several approaches to getting all of the nations in the world or groups of nations to agree on limiting carbon dioxide emissions. A trading mechanism is used to limit a certain amount of emissions and allow market mechanisms to come into play. While it is not generally possible to view carbon credits as an investment, it is nonetheless valuable to see how they are priced. The banks and electronic platforms and other service firms could make revenues from the offset transactions. In addition, firms could have reports showing their "eco-efficiency" at a low fee. However, it is the European institutions that remove credits from circulation. In extreme cases, this could be a negative cash flow for them. Comments on how carbon credits might be exchangable or fungible in some future arrangement are left out, since in the EU the credits are for a specific market, and almost all do not feel it will make sense to trade them elsewhere.

Certain financial market models seem to have been the basis for some analyses of the market effects of carbon credits. A lower bound on the expected price of credits from a price path, as well as an upper bound on their risk-neutral master price path, is considered when new information is released concerning demand or supply uncertainties. Firms might try to speculate on the price changes using derivative carbon credits. Since financial firms that trade in these markets could later be paid in cash, these prices are established in cash accounts. This might provide opportunities for transaction by participants in certain indexes. Long-term holders of carbon credits would be pension or mutual funds, whose cash flows might match the timings of very long-term liabilities. As a suggestion for

generalizing the analysis of prices of other recently introduced instruments, it is noted the financial interactions involved or early pricing mechanisms for other new markets for tradeable commodities might be considered (Millar et al., 2018).

5. Carbon Credits and Corporate Strategy

Many large companies now include technical staff who focus on climate change. Companies often view climate change as a material risk to be considered when developing procedures or financial controls that address uncertainty and effectively manage the risk. By focusing on climate change as an issue of carbon credits or greenhouse gas (GHG) emissions trading, companies have identified pathways to profit from the issue and have incorporated climate-related tasks into the corporate personnel structure who otherwise work on accounting, project evaluation, and economic modeling. The responsibilities assigned to these climate-related roles and the methods of addressing the matters are diverse. Some companies have incorporated climate change into a top-level office more focused on governance issues with little or no technical input, while others have established a separate climate- or carbon-focused strategic development office similar in stature to major business units, though almost always reporting to the CEO or CFO.

Executive-level teams are typically expected to be well-versed in all major strategic development opportunities and risks being considered but may be less familiar with some of the lower magnitude or more specialized issues. In cases where companies develop high levels of climate-related knowledge and expertise, these internal participants are almost always positioned at a second level under the executive team and supportive of top-level corporate responsibilities. Such staff support is expected for every major area such as mergers and acquisitions, market risk management, labor relations, and regulatory compliance (Glancy et al., 2007). Typically, such carbon management functions are employed in larger companies, while smaller companies or companies with less established carbon management capabilities frequently farm out this work to consulting or investment firms specializing in these areas.

Companies differentially examine climate change, carbon credits, and regulation through the market lens and often prioritize the reviewing or composing of market literature rather than exploitation or risk medium- and long-term next decades. At this more micro level, companies can be motivated and informed by incentives and disincentives to impact profitability both in the short term through regulation and trading and in the longer term through social norms and changing consumer preferences (Millar et al., 2018). Since initially moving toward carbon trading about a decade ago, companies' focus has shifted back and forth between regulatory risk and sales profit and cost reduction. Many companies came to winnings for a short period of time of compliance or market revenues but recently have lost focus on individual market profit but have returned to examining risks in aggregate.

5.1. Integration into Business Models

Integrating the use of carbon credits into business can enhance profitability and goodwill with consumers and colleagues. While the basics of this concept may be understood by individuals, illustrating coverage proactively, ensuring products generate credits and not just mere consumption, and projecting future net increases in holdings aids in the sale of credits. Seeing possible future value and directly benefiting from the use of credits ensures efforts earn the funding and financial reward given and intended by the carbon market and framework. Credits can accrue in several ways. Leaders, employees, and owners who utilize land or forests for timber or other biomass than the soil matters can retain some carbon stocks or control certain forest operations to be included in the estimate. Some firms may have received funds or credits without full participation and visibility in their worth and

purpose. These credits can be bought as offsets by businesses that want to prove control of their emissions. The conversion and use of credits for business and financial purposes can move ahead using the funds and cash flow that come with credits but putting them directly back into forests or land. Educating on what credits are, what they are estimated to be worth now and in the future, how ownership is held and validated, and how the organization can share in benefits align with and meet interests for large firms controlling operations that generate emissions and thereby credits. Once credits are documented, the best prospect for credit revenues to convert to cash come from observing who will pay first for holding credits. The emerging forest systems may want to account for project credits and sell externally to lessen the burden on fuels, be it through direct account sales or aggregators using their funds. A few credits with verifiers can fetch hundreds of thousands of dollars right now, as timber and development heavily purchase offsets (Thoumi, 2008).

5.2. Impact on Stakeholder Relationships

Significant environmental challenges, climate change, air pollution, and loss of biodiversity, a major contributor to the increasing global political and social urgency for action. Regulators, scientists, and influential members of civil society call for firms to understand and reduce their climate impact. In good cases, the latter benefits from these efforts, whereas in bad ones, they risk value destruction due to rising corporate liabilities and losses in the social license to operate. However, strong market demand for carbon credits arises to prevent excessive value destruction. This demand drives the design of new compliance and offset instruments and trading venues by governments and exchanges, respectively, which have potential implications for long-term firm profitability and perceived risk. Some of these implications reinforce a firm's long-held risks, whereas others are novel.

Understanding the new market environment is important for firm management, as firm exposure to one or multiple new risks on the demand and governance side of the credit markets can benefit profitability or markedly increase systemic risk. Major new firm action in response can complement established climate strategies, including additional advocacy, and support large-scale initiatives that limit investor or state risk exposure. How effective are carbon offset markets in preventing wide, detrimental price collapses, and does this differ with the asset structure of the supporting firms? Past experience indicates that, once established, potent firms find it easy to profitably and privately undermine the credibility of the exchanges against self-interest. In contrast, good asset distribution limits who can effectively appropriate the value created from credible policies.

A firm strongly engaged in climate advocacy or with good carbon performance may nevertheless enter climate-related legal risks with investor states or strong civil society. A small number of states or privately financed firms may come to be a disproportionate driver of bad outcomes. Nonetheless, potential value destruction increases with the firm's climate exposure. Conditional on climate litigation but in the absence of major policy reform by states, firm productivity is substantially reduced. To what extent can conservative proxies – eg. other state, industry, or firm-level policy measures – explain unidentified carbon-related firm risks?

6. Regulatory Framework Surrounding Carbon Credits

The demand for carbon credits does not directly rely on any regulatory framework, although this would likely change as governmental carbon trading mechanisms are developed. In the meantime, any constraint on carbon emissions, whether regulatory or voluntary, fuels demand for carbon credits. In this absence of regulatory frameworks, organizations choose to offset their emissions through voluntary credit purchases. Players may enter long-term contracts, with some proposing a tender system for issuance credit sales of mid-size projects.

Until governments compel industry to show a pro-active stance on climate change, purchases of voluntary credits will flourish. On the selling side, industries with business climate benefits, and land use-related projects offering carbon credits, should know ways to monetize the money-makers. Projects must demonstrate additionality to avoid "windfall" credits and pre-existence Boolean impacts; fears of inflated credits and accusations of "green-washing" threaten the safety of the industry.

In the midst of developing legislation, project developers have a proverbial blank slate, and could be forgiven for opportunistically haphazardly exploring all avenues of credit generation. However, care must be exercised to ensure that carbon credits that are generated will create value, and steps must be taken to enforce sufficient protection against value erosion. Three basic and interrelated elements shape a project's future eligibility for generating carbon credits: the nature of the credits themselves; the acceptance; and the legality of the development (May Chapman & Wilder, 2013).

In the push to embrace a larger carbon economy, mechanisms for validating emissions abatement will grow ever more sophisticated and stringent. The accepted practices for emission reductions verification will also evolve, and accordingly, it is necessary to define credits while some clarity still exists. It is prudent to ascertain all applicable national law, particularly as has shown trading schemes will probably feature state-based legislation. An outline of key issues to ensure compliance with all applicable law follows. Service agreements and fee structures, initial capital investment, land use changes, and emissions-reduction project should be examined.

6.1. International Regulations

Carbon credits and carbon accounting are crucial components for companies looking to enhance goodwill and profitability by reducing carbon emissions. Over the past few decades, there have been major climate betries that have been brought into force by numerous countries. Consequently, numerous enterprises have been produced to enhance their goodwill emerged as large carbon cutters. Currently, the global awareness of carbon emissions is gradually moving into a different approach—forum and floral emissions viewpoints; the pharmaceutical sector has been brought into the carbon emission forum.

In any other sector of transportation, logistics would be subject to higher carbon footprints. Consequently, the pharmaceutical industry is relatively new to the carbon accounting approach; few companies have provided sealed detailed and accurate carbon planning and accounting information for travel expenses. There are currently various regulations globally addressing forums and floral emissions, deductively increasing interest in carbon accounting and recognition of carbon credits, especially voluntary credits. Firms trading voluntarily may find triggers for profitability (B Bushnell et al., 2013). There are myriad forums on carbon credits and accounting, with only a few focusing on the pharmaceutical sector.

The sector itself produces gross profits ranging from 34–50 percent, while major firms have all pledged zero net carbon emissions by 2030. Despite a high gross profit margin, there is little evidence that they try to enhance profitability using the younger forum. Hence, the current focus of this work is to explore whether there are any recognized carbon credits and how firms interact with them (Tessieri, 2018). There has also been a growing interest in fake credits, along with a wish and awareness of how expensive they could become, the lack or limitation of data leads to inaccessible or unreliable, and the children of there could take at least from two to five years before aggregation is achieved.

6.2. National Policies

The national policies regarding carbon credits in the European Union encapsulate some of the key options for a good governance framework. In particular, they provide a salient contrast to the

governance frameworks set forth in the US and other developed countries outside Europe (Wagner et al., 2010).

The European trading system is a systems of systems, in which secondary markets exist for both emissions allowances or "cap-and-trade" permits and carbon credits from joint implementation or emissions-reduction agreements between companies or sectors in different countries, and bang for buck is enhanced by exchange-ratchet borrowing across sectors and/or exceedance years in permitted emissions. The EU has also recognized the value of temporal flexibility in terms of banking allowances. A credit from joint implementation or emissions-reduction agreement creates an opportunity for a trading permit, rather than the romeo-theoretician's carbon dollar-for-dimes story.

The essentials of the EU policies are relatively straightforward. Assign a cap on emissions to each company or sector. The cap may be absolute or relative; in the former case, the emissions permit is an outright tradable property right, whereas in the latter case, there turns out to be an option contract feature akin to price-grazing where no real property is generated. In any case, the cap must be enforced; otherwise, the company or sector is liable to the same ex-post political risks regarding the emissions permit as a commodity producer is for its ore or crude. Each compliance period, monitoring and auditing need to take place; auditing is effectively the regulator's equivalent of auditing someone's income taxes, and will take special expertise in accounting and an appropriate legal framework.

7. Case Studies of Successful Implementation

Blockchain, a popular term used for Bitcoin and other cryptocurrencies, is an innovative technology that cannot be considered merely a fad or a complex version of Excel spreadsheets. A scheme to implement blockchain at the Nordic bank DNB was outlined with examples of both the opportunities ahead and the challenges organizations often face when implementing blockchain. Action learning was advocated, which is the inclusion of in-depth discussions about the innovation steps taken, the lessons learned, and the upcoming opportunities and challenges faced. Complexity can be managed through convenient abstractions, anticipation, expecting the unexpected, and modularization. Companies must balance the benefits of open-source cooperation with the protective nature of closed consortiums while acting upon the paradox of multi-functionality. The insights might apply to industries beyond finance, but understanding implementation and adoption challenges is unavoidable.

In a recent study, Nordic companies' carbon accounting practices were analysed, and how such practices were integrated into operations. Valuable insights into how carbon units/credits are dealt with, opportunities stemming from proper carbon accounting, and disparity in the importance of different carbon units globally were highlighted. The results give academics various opportunities for future research and practitioners insights into how to better deal with current and upcoming legislation and certification schemes and implement carbon accounting more generally (Tessieri, 2018). Several examples of how organizations act as verifiers and certifiers of EUA, CER, and ERU units were given, and opportunities stemming from proper carbon accounting were discussed. The emerging carbon market, including an assessment of where companies currently stand, was mapped, comprising a large database of relevant global actors. Besides laying the foundation for future research, a recurring plea/petition to industry associations to help the implementation of proper carbon accounting in organizations was formulated. If organizations are unable to help themselves, governments will, but this is generally something that creates environments more conducive to university graduates than construction workers and where trade-offs and local peculiarities are often forgotten.

7.1. Company A: A Carbon Credit Success Story

An example of a carbon credit phenom is Company A, which is establishing itself as the provider of the

first carbon credits from an avoided deforestation project. Company A holds a concession for a 850,000 ha state-owned tropical forest that is under severe threat from logging. The government has provided a per-verse subsidy – the approval of selective logging. This project is expected to generate some 35 MtCO2e worth of credits during the 20-year project life (Thoumi, 2008). To generate credits, Company A will provide a fixed fee to the government and undertake monitoring and enforcement of the concession's sustainability charter. In return for these services, it will receive 95% of carbon credit revenues. Company A is going about as close to being a "one-stop shop" as one can come to balance the desire to generate a carbon credit registry and brokering business with the exigencies of project evaluation and funding constraints in the carbon market. Company A's planned methodology is similar to existing methodologies for other avoided deforestation projects in Brazil, but has been updated to suit this project. Each year–in a retrospective process that will prevent retroactive credit generation–the Project Area at Risk will be assessed and discounted credits calculated by analyzing relevant "business as usual" deforestation figures and the adequacy of contestable proof and enforcement parameters. The project has both value and risk. It has been endorsed on the basis of the anticipated value of credits to the Company, but in practice this credit value will only be vnfc. fungible once a transparent, verifiable, and enforceable registry system is established.

7.2. Company B: Lessons Learned

From this investigation a number of general lessons can be outlined. First a company must develop a clear strategy for incorporating the new metrics into decision making processes and generating meaningful action. It is very easy for a company to fall into the trap of conducting a study on carbon emissions without planning for how this information will be used. „No plan – no change" (Tessieri, 2018). Because carbon is a new metric, many of the methods of dealing with another performance metric do not apply. Take time to explore the range of methods and pick the ones that best apply to the situation. Stakeholders of carbon emissions should be carefully identified and the range of actions that can be taken should be evaluated. The market mechanisms and pricing incentives that are created must be designed to generate actionable outcomes. Building on this comprehensive and detailed knowledge of the carbon emissions allows a company to develop superior carbon strategies. Emissions may decline slower than expected so by extracting credits from the easiest or best emissions reduction strategies early the company can delay the adoption of more difficult or more expensive strategies (Thoumi, 2008). This is critical to design timing of compliance on emissions trading schemes. The knowledge of the emissions and a market price for the credits will allow the company to determine the profitability of preserving the „banked" credits. The more robust the model of created credits, the better the pricing of the credits will be. Although these lessons are applicable in a range of situations it has also become apparent that the feasibility of the carbon assessment in companies may be affected by a number of factors. This project is focused on the practicalities of assessing carbon emissions and generating meaningful action by Senior Managers in comparison to university or scientific understandings of carbon. The investigations suffered from unforeseen timetables that were unable to be met and from internal politics of companies that were unwilling to share data. This meant that only the companies where access was gained directly have been able to be explored in detail. For other companies, it would still be interesting to see if less successful companies in carbon emissions were in fact more general socially responsible investors or if the reasons for decline were in fact specific to earlier understanding and carbon accounting.

8. Challenges in Utilizing Carbon Credits

While carbon credits offer a compelling opportunity for firms to increase profits, it is important to recognize some challenges. One key issue is how to ensure that carbon credits are not faked.

Companies agreeing to offset emissions by funding a forest nonce the company can emit more while someone else absorbs emissions. These agreements are commonly known as 'leave it to nature' credits, and many question whether these credits have any carbon impact at all. As carbon markets grow, the risk of a moratorium on new credits looms. There is limited consensus on future carbon markets and systemic changes. Chutzpah is required by regulators to create conditions for continued trading, while addressing political resistance. The storied nice-unicorn moment of California cap-and-trade could unfold in dramatic fashion if it doesn't without reliable information informing expansive carbon trading, including protocols to credibly measure new credits.

There are challenges inherent in pricing itself, which can be deeply political as question of how to price something, what to hedge (or not) against, and what happens to the indirect effects of the price in labor and energy markets. If a low cost is established, that could be followed by demand reductions or outright recession. Pricing is also about crediting. Since the price for practically every commodity is based on a certain amount and duration, commodities are designed to store data while crediting requires a lot of dot dots dots. Data giants with institutional weight and active investment would sponsor futures on all types of holdings including, but not limited to, crediting. Risks include the utility of profiling projects without geolocation coordinates, or uncharacterized technologies or projects, severe complications from cash settlements on inherently favorable resolutions for the short-slate or unknown uncertainties for longer durations. To a degree, evaluation outlives hedges on "delivered credits," while "designated cash" contracts set market ton prices once cleared and without the firms defined delivery or with meek sanctions on suspected back prices.

8.1. Market Volatility

The carbon trading market in China is volatile. The price of the carbon credits fluctuates wildly, which hampers the incentive of the market and basically affects the companies' earnings from it. Thus, reasons for its volatility would also be helpful in understanding how to exploit it. The volatility of the carbon price is the pronounced feature of the Chinese carbon trading market.

According to (Zhang et al., 2018), a lot of researchers have conducted studies on carbon price volatility. The transition of price variations would also be researched in the approach on price volatility. Options pricing, which is directly targeted on volatility, is also studied. However, there are few studies with a particular focus on the spread of volatility among markets that are widely accepted.

There are a lot of researchers who have conducted analysis on the influence of the market factors on the volatility of the carbon price.

8.2. Regulatory Uncertainty

The focus of discussions around the climate policies tends to be on compliance costs and how these are allocated, leaving aside an equally important issue – how compliance costs affect the profitability of firms.

The case of the EU's anticipation of a GHG cap-and-trade mechanism that would affect firm dynamics, profitability, and shareholder wealth is used, as GHG regulation has become an increasingly live policy issue. In 2005, the European Union started the world's largest cap-and-trade program for reducing greenhouse gases. Approved by all EU members, firms in relevant sectors must hold allowances equal to their GHG emissions or face penalties.

What had previously seemed like a far-off future brought much angst to firms as impending regulations began being discussed seriously. Some analysts predicted that these regulations would raise emissions costs by trillions of dollars, with significant effects on industry dynamics and the stock market (B Bushnell et al., 2013). While there was some public discontent over pricing, there was much less

mention of how this regulation might affect firm profitability.

A widely noted puzzling result of this transition is that even firms with very low compliance costs suffered long and dramatic declines in stock value, even while trading at gross revenue multiples of 4 or more. This decline in value is interpreted in two ways. First, analysts did not believe that firms would receive the intended in-built opportunity cost associated with the allocation of some of the allowances away for free; instead, they expected all the benefits to accrue to the product price, thereby harming firm profitability. The draught of allowances would eat up a large and possibly growing share of revenues. This sort of analysis ignores important realities about a regulated firm's uncertainty about compliance costs and presumes the market has good information about this regulation to begin with.

Second, analysts might have believed that the effects would not be dramatic enough on the time scales over which they measured, and thus considered the risk-adjusted present value declines morally acceptable. Though this is not the model used, this presumption echoes much of the thinking about regulation in the US, which might partly explain the lack of action on firm climate and US climate policy since.

9. Future Trends in Carbon Credits

Carbon credits are an emerging commodity aimed at incentivizing the reduction of greenhouse gas emissions through climate regulation initiatives. A carbon credit represents the right to emit one ton of carbon dioxide into the atmosphere. Industries that exceed their legally permitted amount of emissions may buy carbon credits from those that pollute less. The market for carbon credits has grown rapidly since the mid-2000s. In 2004, the total value of global carbon markets was approximately $14 billion; by 2011, this number had grown to $176 billion. At the end of 2020, approximately $272 billion of credits traded in 31 carbon pricing systems worldwide, a dramatic increase over 2019. The rapid growth of the carbon marketplace peaked in 2008 as financial speculation surged, only to experience a second boom post-lockdown, driven partly by renewed regulatory attention toward emissions. Ahead of the 26th Climate Conference in 2021, several countries announced new caps for their emissions, reflecting a growing expectation of greater regulatory frameworks for companies in the coming years.

The compliance market grew by 20 billion in 2020, valued at $253 billion, representing an increase in ambition and scope of carbon pricing. The compliance market is expected to receive further support across many markets in the mid-20s as investors drive companies and public banks towards more ambitious climate plans. The voluntary market also continued to grow, reaching $19 billion, doubling its size since the previous year to meet the increased demand from corporations wanting to reduce their carbon footprints. The growing demand for credits, if not backed by a corresponding and rigorous supply of real emissions reductions, could lead to an increase in low-quality credits traded in the marketplace. Nevertheless, the growing acceptance of the carbon credit as a means of incentivizing emissions reductions and the associated growth of the marketplace presents a new opportunity for companies to obtain and trade such credits.

9.1. Technological Innovations

Technological Innovations: The key objective of the studies was to identify and evaluate the role of carbon credits in enhancing company profitability with the specific research target set to look into the types of technological innovations employed by the leading companies in the field. The first step illustrated what types of companies in this field that utilize carbon credits arise in the definition of the main target of the study (henceforth spelled out as the target). As an outcome, the paper resulted in identifying five factors of technologies that enhance profitability emphasizing what part/population of companies generate significant income from carbon credits. Those categories of companies are as

follows: (1) Adjusted traditional factories, iteratively improved, and doing less harm to the environment. They have less acceptable operations. Such factories can be purchased from the market and range in value from 1 to 2 millions. They cannot be applied though to the cities, smog apparent at Factory 1. (2) The described development factories implemented more advanced technologies and gained comprehension of systemic operational improvement measures. They win illustrated significantly more profit and create much higher income from the sales of carbon credits. Additional 30% profit from sales of CO2 incurring 0.5 millions per year are gained as well as 10% profit from sales of renewable energy generation. Such type of factory could be set up from the very beginning on vacant land. Illustration of both types of factory has been done on the basis of disclosure of company B. (3) A last but the newest sustainable factory combining advanced and sustainable technologies would be introduced next. Its functionality would be discussed based on native experience drawn from the newest cooperation with a public entity of company B. It was confirmed with accounts of sales of carbon credits. This is an atypical project on the basis of which market value of such cooperation is estimated about 50 millions. Hence, the competition would be presented against major suppliers of power demanded for running a sustainable factory in the next section.

9.2. Evolving Market Dynamics

The market dynamics in the carbon sector are rapidly evolving, providing young firms with a growing number of ways to become earners from bordering one carbon credit. Today, many different options exist, including own investments, hedge funds, exchanges, trading firms, brokers, indexes, and banks. A study presented 20 companies that started in the carbon market in 2007, contrasting with scenarios in other business areas where more mature companies exist. Trading firms and hedge funds have entered the market, but firms that started trading in the carbon market are still active. In carbon, it is possible to find comparative analyses among diverse trading shops or broke old versus new carbon stock exchanges. Many firms have sprung up unnoticed in the carbon market's so-called wild west. Today, there are relatively consolidated exchanges, as with the Kansas City Board of Trade in the 1850s. Nevertheless, each category is characterized by substantial disparities. The state of the market is far from a perfect competition model.

Companies develop their strategies based on price predictions. Different types of models are currently used to provide a price forecast one to ten years down the road. Those firms, banks, and exchanges with R&D departments are equipped with op models and sophisticated tools to forecast prices. Empirical and fundamentals models are common. In some cases, knowledge of structural breaks and the convoluted dynamics of price formation has been used to understand the gains from trading. A complete study of the choices made by hedge funds would fill a library, as each model is proprietary. Basic models are available on the Net. Due to their nature, banks are difficult to categorize. Some use high-frequency and arbitrage trading, and others use more fundamental longer ranges. Banks and investment funds are seen doing horrible things in the market, such as intraday manipulation and leaks of information.

Bank-friendliness towards exchanges was abandoned for moving to the dark side of the gray markets. Brokerage firms started clearing on exchanges or trading inside other brokers, placing their price quotations well outside a spread so they would be the first to lap a given order before putting it back inside the quote. High-frequency trading is expensive, and most of the gains are skimmed off the yield. Brokers pre-trade price manipulation or quoting all amounts possible are not new strategies in the dark world.

10. The Role of Carbon Credits in Sustainable Development

The focal point of the discussion in this chapter is the role of carbon credits in sustainable development. Combating global warming by curbing CO2 emissions is the most important challenge facing society today. Carbon dioxide has been accumulating in the atmosphere for almost two centuries as industrial activities, power generation, deforestation, and other CO2 emission sources increased and basic energy processes become almost entirely fossil-fuel-based. Over the last several decades rising CO2 levels have led to increasing numbers of climate-related changes, elevation in extreme weather events, melting glaciers, rising sea levels, and the possibility of mass extinctions and other catastrophic results. As predicted by early climatologists, concentrations of CO2 are now rising steeply and humans are now largely responsible for global warming. Without containment the warming will reach very damaging levels by the end of this century. There is clear scientific, moral, and economic justification for a global effort to combat global warming. If successful, the reduction of CO2 emissions to safe levels will take place over multiple decades (Thoumi, 2008). Future temperature increase will depend on three interrelated factors: (1) the actions taken to prevent CO2 from entering the atmosphere, (2) future economic growth, and (3) how much of the historical emitters' CO2 will the future growers be allowed? Different futures can arise due to the interplay between these factors. The enormity of the existing and on-going fossil-fuel-based investments means that turning off the spigot will be akin to turning off a giant water faucet—very difficult politically and economically. Civilization is based on energy use, the vast bulk of which is derived from fossil fuels: oil, natural gas, and coal. Alternative non-Kyoto pure CO2 free energy sources and technologies need to be developed and deployed in massive quantities to preserve the climate.

10.1. Aligning with Global Goals

Companies throughout the world are reaching the conclusion that they must adopt a new sustainability-oriented strategy due to the changing policies and accelerated climate change consequences (Tessieri, 2018). The majority of well-known corporations and companies have established a net-zero objective for scope 1, 2, or 3 emissions for 2050 as part of a broader sustainability strategy. As a result, it is anticipated that the demand for carbon credits will keep rising alongside expansion.

New employers and thus, jobs, are created as a result of this growth. They will have an FTE carbon credit management department with specialists for reporting, trading, and compliance at the corporate level. Similar to banking duties, this section of a company would include trading tasks as well as risk and performance evaluation. These responsibilities will require specialized skills that are included in up-to-date finance research and education. As a consequence, adjusting carbon credits to a finance-based definition could help develop risk models and valuation methods that could in turn be turned into a framework to study carbon emissions and the companies' emissions.

The understanding of how companies could profit from this new production could also provide insights to assist the development of this market from a middle-ground perspective with respect to sustainable growth, profitability, and fairness. Studying how firms might make profits from carbon credits is also crucial for interpreting this developing trading market. Causal research might help bridge the gap between sustainable development and profitability. In addition to conceptual insights, an analysis of the relationships between emissions, carbon credits, and profitability could describe how companies might operate in the evolving implementation of emissions regulation.

10.2. Corporate Social Responsibility

Corporate social responsibility (CSR) has received increasing attention since the 1990s. It is a voluntary, discretionary, yet competitive activity which affects business value. Growing concern towards CSR, primarily on the environmental issue of climate change, has attracted many to involve in such. However, with resources currently on hand, a firm faces a dilemma on having to decide between

social responsibility and profitability. This dilemma is worst for small- and medium-sized enterprises (SMEs) as they have limited capacity, especially on CSR investment. SMEs are socio-economically important as they form the vast majority of businesses, but at the same time they are also the primary contributor to greenhouse gas (GHG) emission. Therefore, they have a bigger role and responsibility towards a cleaner environment. This paper aims to answer the question of how SMEs can undertake environmental CSR, in line with their limited capability. The focus is particularly on deciding which investment alternative to undertake among those which all deal with environmental CSR, high return integrating social and employee responsiveness, and moderate return Foe grease compliance (Merlinda Muharam et al., 2011).

It is expected that a need exists for a method to decide between investment alternatives. However investment valuation methods, on the other hand, tend to be limited. Mainly reliant on the discounted cash flow (DCF) method, they fail to capture the recently learned lessons on uncertainty, flexibility, and competitive advantage. As a result, in a dynamic and uncertain market, business decisions cannot be made efficiently. Since SMEs have limited resources, the inclination is that they are strung for a worthy investment decision regarding CSR, especially environmental CSR. Adding to the urgency is a belief that sole attention on short-term survival is naive; a role the firm plays is reached outside profit-making activities. Therefore an alternative approach is developed, to sift through proposals outstanding in all facades ultimately to a worthy one to undertake.

11. Measuring the Impact of Carbon Credits on Profitability

The impact of carbon credits on company profitability is a critical topic for researchers, as greenhouse gas emissions reporting is becoming central to companies in the climate change debate. The objective is to stretch the understanding of the state-of-the-art literature and the results related to the development of a model capable of determining the impact of carbon credits on company profitability. The significance of CO2 emissions and energy use has been increasingly recognized in today's business environment. Societies are concerned about the consequences of environmental negligence, and governments are reacting with mandatory reporting. Stakeholders are placing more importance on CO2 emissions and have begun to voice their expectations on companies. Firms have initially been reluctant to divulge information on their CO2 emissions systems and methodologies, however, an increasing number of corporations are presently aware of the importance of protecting the interests of stakeholders by justifying the impact they have on climate change. To gain credibility, firms must search for systems to quantitatively measure the effect of CO2 emissions on profits (Tessieri, 2018). Companies have encountered problems trying to attach a price to their contribution to climate change and CO2 emissions. Some companies believe their contribution is immaterial while others believe they have an obligation to calculate the impact of their behaviour on climate change. In order to provide some insights, four hypothetical companies are defined to clarify the nature of the variables under discussion. Given the limited scope of the problem and the preliminary nature of the work, the approach is restricted to CO2 emissions and thus no other greenhouse gases will be considered. An aim of this work is also to familiarize the reader with the types of environmental legislation that affect corporations today and the general consequences of these legislations on the financials of corporations. It is hoped that this will be a useful backdrop for the already familiar reader.

11.1. Key Performance Indicators

A set of performance-based key performance indicators (KPIs) for the emission credit system model is defined as follows: (1) emission intensity, which refers to the ratio of a company's annual CO2 emission quota to its revenue; (2) credit ratio, which refers to the degree of compliance with the emission credits, (3) carbon maintenance cost ratio which means the proportion of company investment

on carbon credits or purchasing quotas to its revenue; (4) carbon control expenditure ratio, which refers to the proportion of company expenditure on the purchase of carbon credits to its revenue; (5) per capita income, which refers to the ratio of a company's revenue to its employee number; (6) energy intensity, which means the ratio of a company's total energy consumption to its revenue; and (7) annual CO2 emission, which refers to the amount of CO2 emission. The cutting standard of performance-based key performance indicators (KPIs) is divided into the four grades (A, B, C, and D. A represents the best performance and D represents the worst performance) based on the real data of propounded companies in China power industry. Based on the predefined KPI indicators a comprehensive evaluation is conducted to evaluate company performance from regulatory policy, managerial and emissions perspectives. The regulatory policy perspective evaluates the company's compliance with the emissions quotas, accounting for the compliance evaluation of the cap-and-trade system. The managerial perspective evaluates the company's investment on carbon control expenditures and whether it results in financial burden on a company from the emission credits perspective. The performance from the emissions perspective is the per capita revenue, which is determined by the total revenue and employee numbers of a company. Similar to the study of (Misani & Pogutz, 2014), it is also assumed that there are four grades of emissions performance: A (annual CO2 emission < 4.01E+7), B (4.01e + 7 < annual CO2 emission < 1.25e + 8), C (annual CO2 emission > 1.25e + 8) and D (annual CO2 emission > 2.30e + 8). In the absence of abatement measures, it is assumed that the annual carbon emissions from each company are 1.5e+06 t, and the average annual carbon emissions are calculated according to the corresponding performance grades. Once the company's emissions exceed the allowed quota, the company will have to purchase credits or pay penalties, bringing huge economic costs to the enterprise. The cost of each ton of emissions over quota is taken to be $27. These parameters represent the market activity of the enterprises. The purchase price of an emission credit refers to the initial allowance of emissions at $1. Gradually lowered prices are set in the one-year allowance-trading environment.

11.2. Quantitative vs Qualitative Benefits

The recent and aggressive tightening of emissions caps worldwide has created a new, complex market mechanism for trading greenhouse gas emissions permits among organizations. A basic assumption of this mechanism is that carbon credits are not an organization's capital; organizations just hold these credits until they are expensed as either carbon allowances or offsets. An alternative perspective is that companies can earn profits by entering the market with carbon credits. This perspective is fundamental; carbon credits are just another commodity product that can be acquired at a low cost through different processes and sold at higher costs in the future. Indeed, companies have begun to view carbon credits as one of their financial products. In response to the carbon market, companies have realized that they must be active participants in it; otherwise, they will lose their price premiums or face cost penalties.

The most obvious actions are to undertake emission reduction projects to earn carbon credits. Some organizations have developed the knowledge and competence to select high-quality, bankable projects. Not all projects are created equal; careful screening to examine project history, credibility, and local knowledge is needed to forestall project failure. Given the volatility of the carbon market, an understanding of the non-traditional supply-demand factors that have the potential to affect the market is also needed.

The voluntary market for offset credits has been considerably more active and varied than is the compliance market. The size of the voluntary market is now estimated to be worth over $600 million and is considered the hottest new investment vehicle by some. Companies have forged alliances with leading NGOs to undertake highly leveraged voluntary offset projects. These credits can be marketed

as value-added premiums to consumers. In other cases, companies have engaged in the voluntary market to mitigate political risk comfortably and to conduct more business-friendly monitoring and verification. The long-standing controversy over the meteorological stations in Africa built by a coal company is a case in point. While estimates vary widely, preliminary estimates suggest that about 80% of the voluntary market will comprise credits originally sourced by an entity for compliance purposes, i.e., credits that were at risk of being 'over-supplied' to the compliance market for good or for bad.

12. Best Practices for Companies

Various best practices support companies considering adopting carbon credits. By embracing a forward-thinking strategy, organizations can increase profitability, bolster risk management, and enhance stakeholder value.

Evaluate the Risks and Opportunities Linked to Climate Change: The risks and opportunities associated with climate change vary significantly depending on an organization's location, sector, and value chain. Therefore, the interconnected risks and opportunities for a corporation must be mapped out based on a detailed understanding of how climate change could affect the organization's operations, supply chains, and product line if not addressed.

Put a Strategic Playbook in Place: As climate change pushes the immediate threats to the forefront, companies should draw up a complete investment plan to better manage risks. What was once perceived as an issue for the long-term future must now form an immediate challenge for corporate strategy, including value preservation, cash generation, and growth.

Align the Investment Portfolio: As climate change concerns take root, firms need to make tough choices about where to allocate capital. If a business feels unprepared for impending regulatory frameworks or consumer shifts, assess adaptation options.

Get Ready for Increased Activity: For most companies, a wealth of knowledge on climate change already exists. The challenge now is mobilizing action. Rather than establishing new teams to enter unknown territory, build on existing environmental and energy efficiency teams. These groups can form the nexus of a wide-ranging effort, or as part of a co-leadership coalition that engages the board and most senior executives, and includes business unit heads.

Make Major Investments Now: Some companies will need to commit to major investments during the next few critical years to procure technologies to curb carbon and gain credibly in dealing with emissions. When combined with a well-prepared business case and change agenda, investments made today should move the firm to a more advantageous profit position in five to 10 years. Major shifts in military, oil, and financial landscapes provide a precedent for companies and their stakeholders.

Act as a Change Agent: In most industries, climate change will drive a transformation in government regulation and consumer behavior. Therefore, firms must issue personalized communications to regulators and key stakeholders about how the organization and its sector are responding. Such communications should highlight early action and cost-effective solutions. Expected carbon mitigation technologies associated with ownership of systems should also be communicated.

12.1. Strategic Planning

In 2021, an estimated $500 billion was spent on "green financial products," including stocks of sustainable companies, green bonds, and carbon credits. These products expose investors to a variety of performance metrics and investment themes, such as direct exposure to green leaders or emerging markets with rapid growth potential. The investor's financial risks stem from company choice and environmental risks. These carbon credits provide asset safety, firm profitability, and potentially outsized wealth in an era of climate risk, rising assurance demand, and soaring carbon taxes.

Common mystique surrounds carbon credits since estimates show structural and economic absurdity

resulting from the complex balance between regulatory and non-regulatory markets. For example, carbon markets have estimated net present value futures while emission reduction targets exceed limits worth. The critical role of strategic analysis regarding emissions and credits is only beginning to receive attention. Systematic explanations can bolster asset safety and prevent carbon banking strategies that exploit carbon arbitrage. However, strategic silence will risk tragedy and amplify collateral damage from climate upheaval. The conventional wisdom regarding potential fiduciary threats will necessitate efficient framing of the materiality of climate risk.

This section will illuminate why and how a mastering carbon accounting strategy can enhance firm profitability. Further, grounded in consistent concepts carried over from strategic value chain analysis and carbon accounting knowledge theory, a toolbox detailing an MCA strategy tailored for different contexts will provide a missing link for companies. Detailed explanations of systematic illustrations will dispel shadows over natural capital asset safety and firm wealth while explaining how a team approach is necessary for optimizing carbon counting capacities held by firm actors. Subsequent paragraphs will provide scaffolding notes on financial rating agency concerns over whether the impact of physical climate risk has been fully accounted for in existing valuation systems. The collaborative methodology and the multidisciplinary lens will explain how a manual on overcoming groupthink combining expert and participatory approaches can lower governance and agential asymmetric information while nudging profit and sustainability shifts.

12.2. Engagement with Carbon Offset Projects

Forest degradation and deforestation are of global concern and are considered a major contributor to climate change and biodiversity loss. Approximately 80% of terrestrial biodiversity is concentrated in forests, designated as key sites for global biodiversity conservation. Like other sectors, forest conservation alternatives exist. For example, avoiding deforestation can be more cost effective than greenhouse gas (GHG) emission reductions in other sectors. Consequently, forest carbon credits have been developed to support cost-effective means of GHG emissions reductions.

As an anniversary for the Kyoto Protocol, the United Nations Framework Convention on Climate Change (hereafter referred to as the UNFCCC) applied ‘safe guards’ regarding the environmental and social integrity of forest carbon credits. For example, it was introduced that forest carbon credits of a market mechanism cannot be estimated without independent assessments, respecting the rights of indigenous groups, and ‘leakage’ (a displacement of emissions) must be must be individually addressed. The International Civil Aviation Organization also published a ‘CORSIA’ safeguarding document to promote sustainability in forest carbon credits. These suggested safeguarding measures could be used as a checklist for forest carbon credits. It is widely acknowledged that the application of safeguarding measures is critical for the use of forest carbon credits. Consequently, several forest carbon credit registries have developed safeguarding measures.

This study explores the application of these safeguarding measures based on forest carbon credits used in South Korea. It is then discussed if these measures can be implemented qualitatively through case studies in the Republic of Korea and Indonesia, and quantitatively through a stakeholder survey in South Korea. This study concludes that there is a need to selectively prioritize attention to the potential avoidable environmental and social harms of forest carbon credits used in non-Annex I countries (Newham & Conradie, 2016).

13. Conclusion

This study revisits the valuation relevance of a firm's carbon profile, which includes carbon risk exposure and proactive carbon responses (PCRs), identified from publicly available information. The

Oz stock market is used as a testing ground, given the availability of data from 51 firms reporting under the NGER scheme, and underpinned by a modified Ohlson valuation model, which incorporates a broader notion of a firm's carbon profile. Market data is collected through a combination of a third-party database and custom-designed scripts and firm disclosures. This study adds to the valuation relevance literature by providing a unique risk perspective — a firm's carbon profile.

The findings of this examination suggest that capital markets consider, and have begun framing valuations in terms of, a firm's carbon profile. In the Oz context, it seems that a market-wide consideration needs to develop, such as a broader carbon risk adoption process similar to the UK companies. Adoption costs would have the advantage of being more visible to the market and policymakers, both of whom seem suspicious of the credibility and availability of self-reported data (Millar et al., 2018). Put differently, investments in carbon adaptation could create portfolio opportunities. In the meantime, the value of low-carbon technologies is being increasingly recognised. These expectations could drive higher prices for these firms' stock prices, ultimately influencing adoption rates.

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