A New Approach to Evaluate Environmental Strategy under Balanced Scorecard Framework: Evidence from Selected Petroleum Companies

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ABSTRACT

The main part of this thesis is to empirically investigate the environmental strategy under the terms of CO2 emission reductions from managers' and investors' perspectives. Data employed for seventeen international petroleum companies for the period 2005q1-2016q4. According to the information available in the sustainability reports of chosen companies, strategy map and the Balanced scorecard constructed to determine the relationship between key performance indicators (KPIs). Panel dynamic regression analysis employed to evaluate the strategy by testing the impact of eco-innovation on CO2 emission reductions and financial performance for both short and long periods. The results point out that the environmental strategy has a significant and positive impact on CO2 emission reductions in the short-term whereas there is a direct and indirect significant and positive impact on financial performance in the long term. The findings of this thesis also add a new contribution to the BSC as an evolution framework where perspectives of strategy can be testable for both short and long periods, which provide a guideline to managers for strategy evaluation purpose, optimize the allocation of resources, and enhance both environmental and financial performance with long-term objectives.

Keywords: Environmental Strategy, The Balanced Scorecard (BSC), The Porter Hypothesis, CO2 Emissions, Petroleum Companies, Dynamic Regression Analysis

ÖZ

Bu tezin ana kısmı, çevre stratejisini yöneticilerin ve yatırımcıların bakış açısıyla CO2 emisyon azaltımları açısından ampirik olarak incelemektir. Veriler onyedi uluslararası petrol şirketi seçilerek 2005 birinci çeyrek ile 2016 dörtüncü çeyrek arası dönem için kullanılmıştır. Seçilen şirketlerin sürdürülebilirlik raporlarında yer alan bilgilere göre, anahtar performans göstergeleri (APG'ler) arasındaki ilişkiyi belirlemek için strateji haritası ve dengeli sonuç kartı oluşturulmuştur. Panel dinamik regresyon analizi kullanılarak Eko-inovasyonun CO2 emisyon azaltımı ve finansal performans üzerindeki etkisini hem kısa hem de uzun dönemler için test ederek ilgili stratejiyi değerlendirmektedir. Sonuçlar, çevresel stratejinin kısa vadede CO2 emisyonlarının azaltılmasında önemli ve olumlu bir etkiye sahip olduğunu, uzun vadede ise finansal performans üzerinde doğrudan ve dolaylı olarak anlamlı ve pozitif bir etkisinin olduğunu göstermektedir. Ayrıca, bu tezin bulguları strateji perspektiflerinin hem kısa hem de uzun dönemler için test edilebildiğini, strateji değerlendirme amacıyla yöneticilere rehberlik eden, kaynakların tahsisini optimize eden ve geliştirilen çerçevede DSK'ya yeni bir katkı sağlamasıdır. Bu katkı uzun vadeli hedeflerle hem çevresel hem de finansal performansı sağlamaktadır.

Anahtar kelimeler: Çevresel Strateji, Dengeli Sonuc Kartı (DSK), Porter Hipotezi, CO2 Emisyonu, Petrol Firmaları, Dinamik Regresyon Analizi

DEDICATION

TO MY FAMILY

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INTRODUCTION

1.1 Brief introduction

In recent decades there has been increased awareness of the negative impact of Carbone dioxide emissions (CO2) on the environment due to increased pressures from stakeholders who are a benefit or harm from companies' activities (e.g., Porter and Kramer 2006; Chao and Hong,2018). Stakeholders are persons or groups which include managers, investors, societies, and governments (Donaldson and Preston, 1995). These pressures are considered from managers as a global problem that has a complex effect on their financial performance especially with poor environmental performance (Cucchiella et al., 2017). Consequently, these days evaluating companies' performance is measured in terms of environmental performance (Schaltegger et al., 2012). For example, according to environmental regulations and standards companies that failed to improve their environmental performance (more pollution) are taxed and fined. These taxes are considered as losses from managers' and investors' point of view. Traditionally, managers believe that a reduction in CO2 emissions is an option to reduce additional taxes and penalties for the company. The logic behind this that companies can reduce CO2 emissions and at the same time maximize their business opportunities by conduction long-term environmental investment which in turn enhances both environmental and financial performance (Hsu and Wang, 2013).

The most significant sector of the economy that causes pollution is the petroleum sector, where its operations harm the environment in the form of greenhouse gas (GHG) emissions. The petroleum sector is responsible for 37% of global GHG emissions, which attributes to burning and flaring, failing in equipment and venting (Wang and Li, 2018). Consequently, petroleum firms become aware of the environmental issue and changed their behaviour voluntarily in a strategic way to raise the economic value by reducing risk and making significant cost savings through improving processes and usage sources more efficient (Reinhardt,2000: Kolk and Levy, 2001). Among these, companies are being forced to implement an environmental strategy to manage their business operations aimed at the prevention of the negative impact of pollution and make their operation more efficiency for both the short and the long-term (Henri et al., 2016; Martensson and Westerberg, 2016; Cucchiella et al. , 2017).

Environmental strategy is defined as processes that used to mitigate pollution wastes (Freeman et al., 1992). Also defined as the planning of actions and manage the business under consideration of environmental standards to reduce negative impacts on the environment (Rodrigue et al., 2013, P. 303). The said strategy also defined form comprehensive point of view as urgent and profitable dealing with environmental through improving internal operations of companies that controlled and managed by employees, where the main goal of the strategy is reducing a negative impact on environmental, reducing costs, and improving gains through efficient usage of resources (Velcu, 2010).

Applying environmental strategy at the company level can play a vital role in both negative impact reductions and enhance financial performance (Iwata and Okada, 2011). As has been supported by many studies that indicated environmental strategy at the company level positively affects both environmental and financial performance (Brammer and Millington, 2008; Jacobs at al., 2010). The environmental strategy really on eco-innovation as a major factor to achieve the goal of said strategy (Aragon-Correa, 1998; Porter and Kramer, 2006; Dangelico and Pujari, 2010). Eco-innovation involves developing new ideas, applying new technologies, and introducing efficient processes to reduce the company's negative impacts on the environmental (Rennings, 2000). Theoretically, inspiring eco-innovation has positive effects on business and environmental performance where the cost-saving of eco-innovation exceeds environmental costs (Porter and Van der Linde, 1995). Thus, eco-innovation is an efficient approach to improve environmental performance, and operational efficiency as well as promoting future profitability (Aggeri, 1999; Aguilera-Caracuel and Ortiz-de-Mandojana, 2013).

The ability of companies to meet demand and improve their performance is referred to as the Porter hypothesis or win-win scenario (Porter, 1991). The Porter hypothesis (Win-Win strategy) states that conducting eco-innovation activity successfully at the company level can benefit environmental in short term and enhance the financial value of a company in long term (Porter and Van der Linde, 1995). The Porter hypothesis aims to understand how companies use eco-innovation to reduce their negative impact on the environment and improve company performance (Ramanathan et al., 2017). Although the Porter hypothesis indicates that conduction eco-innovation activity at firm level can benefit both private and public, implementing environmental strategy requires changing in routines, human skills, investment in technical and heterogeneous resources, planning and controlling operation processes (Amit and Schoemaker, 1993: Aragon-Correa et al., 2008; Rangarajan and Mishra, 2014). Studies indicated that firms can avoid risk and gain profit by implementing an environmental strategy to reduce pollution impact at the source rather than at the end due to capability and ability to conduct eco-innovation (Christmann, 2000; Hart and Milstein, 2003).

Having strategy not enough to be successful, where implementing strategy successfully depends on some factors such as how these resources are employed and combined to exploit them fully (Mahoney and Pandian, 1992: Hart, 1995: Youndt et al., 2004). How the strategy is expressed in terms of targets and measurements to be well known for employees who respond to implementing it (Kaplan and Norton, 1996 a). How targets of strategy are linked to operation meeting gaols. (Rangarajan and Mishra, 2014). Therefore, the strategy must be evaluated where failing the strategy has a negative impact on a company for both the short and long term (Kaplan and Norton, 1992; Aragon-Correa and Rubio-Lopez,2007).With respect to financial performance measurements (ROA, ROE, net income, etc.), these measures are known as a good measure just in short term (Kaplan and Norton, 1992; Namazi and Abhari, 2010). Consequently, managers try to enhance short-term financial performance on the account of long-term sustainability which creates a gap in strategy evaluation (Porter and Kramer, 2006; Kotler and Caslione, 2009). As a result, any success in the short-term will be at the expense of long-term sustainability, which will be illusory and ultimately temporary (Porter and Kramer, 2006). Therefore, integrating both long-term environmental and financial performance measures are important and required, which may threat companies (Eccles et al., 2014).

The most popular tool that has been used to evaluate strategy is the Balanced Scorecard (BSC). The BSC introduced by Kaplan and Norton (1992) as a strategic evaluation tool that provides a balance between long-term and short-term strategy's objectives, financial and nonfinancial measures, and external and internal performance perspectives to evaluate operation aspects in an integrated fashion (Kaplan and Norton, 1996; Al-Zwyalif, 2017). It contains outcome measures and performance drivers of outcomes, in which the relationship between them linked in cause and effect way (Kaplan and Norton, 1996a; Kaplan and Norton, 1996b). The BSC translates the strategy into actions, objectives, and measures in four perspectives: financial, customer, internal, and innovation to help mangers to answers four basic questions: can we continue to improve and create value through innovation and learning to make our vision is true? What are the processes that we must excel at to satisfy our customers? How do our customers see us? How do we look to Shareholders? (Kaplan and Norton, 1996a; Norreklit, 2000). The cause and effect relationship among perspective assumed to be oriented towards financial perspectives, where the measures of innovation driver the measures of internal processes, measures of internal processes driver measures of costumers, finally measures of costumers driver measures of financial (Kaplan and Norton, 1996a; Kaplan and Norton, 1996b; Norreklit, 2000; Krivokapic and Jovanovic, 2009). The casual and effect assumption in the BSC improves direct and indirect measures that link the current activity with its long-term success (Kaplan and Norton, 1996b; Kaplan et al., 2001; Tayler, 2010).

Recently, there are some survey studies integrated environmental indicators in the BSC to see whether this link affects companies' performance and control, these studies suggested that using the BSC is useful to understand the link between objectives and measures to improve performance and implement a strategy. However, previous balanced scorecard studies have focused solely on using the BSC for strategy measurement and the majority of these studies are allege which reflect the policy rather than the actual performance (Tayler, 2010). Although studies have been advocated to use the BSC as framework to measure the performance of environmental strategy such as Bennett and James (1998), Epstein and Wisner, (2001), Bieker and Waxenberger (2002), and Li and Leigh (2010), to date, these studies don't provide evidence that applying environmental strategy at company level improve both environmental and financial performance (He and Loftus, 2014), and integrating actual environmental indicators in the BSC to measure environmental strategy still missing (Kaplan, 2009: Hoque, 2014). Therefore, it is unclear whether the environmental strategy improves the performance of companies in both the short and long-term which requires more exploration studies. Thus, the purpose of this study is to fill this gap in research literature by evaluating the environmental strategy under the term of CO2 emission reductions. Specifically, this research considers actual strategic indicators to see whether the environmental strategy improves both environmental and financial performance through the assumption of the BSC. All indicators are specific by chosen companies to achieve the aim of the strategy. This analysis is carried out on seventeen international petroleum companies for the period 2005-2016. To achieve the aim of research actual environmental variables that response to implement the said strategy will integrate into the BSC, and the relationship between them will test statistically as assimilation to the assumption of casual and effect in the BSC.

Furthermore, this study applied the Porter hypothesis that the ability of companies to engage in environmental strategy improves business operation in short-term and financial performance in the long-term.

1.2 Purpose and objective

1.2.1 Research purpose

The purpose of this thesis is to evaluate environmental strategy under the terms of CO2 emission reductions by linking the Porter hypothesis with the balanced scorecard (BSC) as a framework for both the short and long-term. To achieve this purpose, first, extrapolation the sustainability reports are used to understand and determine the actual strategy process within selected petroleum companies. Second, the strategy map will be set that determines the relationship among the four perspectives of said strategy. Third, actual environmental indicators will be integrated into a balanced scorecard. Finally, the relationship between them will be tested statistically accordingly to the casual and effect assumption in the BSC. The BSC as a strategy evaluation tool has been undergoing continuous development, therefore, in this thesis, I do not evaluate the basic assumption of the BSC rather evaluate applied environmental strategy in both the short and long-term.

1.2.2 Research objective

The main motivation for this thesis comes from the fact that CO2 emissions have become an important task in new modern business, where the reaction of companies to the CO2 emissions task becomes an as important task of the daily operation and sustainability. Consequently, there is a need for an appropriate approach that enables companies to consider the environmental issue when they evaluate their business. To achieve the objective of the study the following question can be answered: How does the performance of environmental strategy within the petroleum companies for both the short and long-term? To answer this question, the researcher has first to answer the following questions: (i) What activities are used in petroleum companies during implementing the environmental strategy? (ii) What are the key indicator factors for applied strategy? (iii) How does the relationship exist between key indicator factors of strategy within the BSC? (iv) How can the relationship be tested between the perspectives of the BSC?

1.3 Contribution of the thesis

This research is a response to the call of Kaplan and Norton (2009), He and Loftus (2014), and Hoque (2014). As far as the literature is concerned, this study is the first empirical study that integrates actual strategy indicators into the BSC to evaluate environmental strategy for both the short and the long-term. Thus, contribution of this thesis will be significant to the current literature in several ways. First, findings significant results by integrating actual environmental strategy indicators into the BSC for strategic evaluation purpose will support the assumption of the BSC, as well as the proponents of some researchers to the importance of tying performance measures in causal and effect to be testable. Second, environmental issue has become an important research area in the last decades, and researchers indicate that implement strategy is inadequate to be successful, therefore this study may provide a guideline to managers to consider the environmental issue in strategy evaluation to enhance performance. Finding new empirical evidence on the using of the BSC as a strategic evaluation tool may encourage companies to use it to optimize the allocation of their resources to enhance both environmental and financial performance with long-term objectives.

The rest of this thesis is planned as follows. Chapter 2, firstly started with a literature review regarding the brief introduction. The second part discusses the impact of global warming and environmental regulation on the business of companies. Last part discusses of consideration of companies on the impact of environmental issue. Chapter three includes an environmental strategy that was started by the definition of strategy. The second part of this chapter discusses the demand for environmental strategy. The third part discusses the environmental strategy as a mitigation tool. The fourth part includes environmental strategy as an opportunity to enhance performance and the last part discusses the strategy evaluation. Chapter four includes the Balanced scorecard (BSC) framework. First part of the chapter four explains conceptual of the BSC where the second part discusses the development of the BSC in the research literature. The last part in the same chapter describes integrating the performance indicators into the BSC. Chapter five includes research design and the first part explains the data collection and methodology. The second part enlightens the characters of petroleum companies. The last part discusses the response of petroleum companies to an environmental issue. The first part of chapter six includes evaluating the effect of the eco-innovation perspective on the internal perspectives. The second part contains evaluating the effectiveness of an internal perspective on customer perspectives. The last part has the effect of eco-innovation on financial performance. Chapter seven highlights the concluding remarks of this thesis.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

Due to the environmental regulation and social demand, companies engaged voluntary into an environmental strategy that aims to improve its operation processes, environmental performance and reduce risks of heavy regulation and penalties (Cetin and Ecevit, 2017; Gonenc and Scholtens, 2017; Wang and Li, 2018). The traditional point of view is that strategy has positive effects on the environment but negative effects on companies' operations (i.e., more costly, less competitive) (Costa-Campi et al., 2017) was moved away by Porter and Van der Linde (1995) , where they indicated that companies could benefit from their strategy by using their resources in an ecologically innovative way in order to make operational processes more efficient and enhance financial value (Porter and Van der Linde, 1995, Cucchiella at el., 2017). In the last few decades, many studies have focused on the impact of strategy on both environmental performance and financial performance, but the debate concerning their relationship ongoing, because the majority of these studies are a survey and qualitative studies, and only reflect the policies rather than the actual performance of the said strategy (Schultz and Trommer, 2012).

However, the recent arguments suggest that the Porter hypothesis is not precise about the definition of innovation, and how does eco-innovation affects companies' operations and reduces their negative impact on the environment (Orlitzky et al, 2003; Lee and Min, 2015). Others suggest that some factors such as recourses, managerial obligation, and ability of companies to conduce eco-innovation are important to improve business and environmental performance (Lopez-Gamero et al, 2010).

2.2 Environmental regulation and eco-innovation

There has been great attention to global warming, where the most important factor has been attributed to an increase in CO2 emissions into the air. To reduce emissions, governments regulate standards that make companies in a challenge to make the balance between the adaptation of valid strategy and the cost adoption of said strategy. Environmental regulation is a relevant law, and standards related to the environment that aimed to reduce pollution (You et al, 2019). According to the Porter hypothesis, environmental regulations are important factors for companies to engage in strategic eco-innovation activities to protect environmental and economic performance (Porter and Van der Linde, 1995). The ability of companies to meet environmental regulations to improve both environmental and financial performance is referred to as the 'Win-Win scenario (Porter, 1991). Eco-innovation refers to developing operation processes, new equipment, and engaging in new technology to reduce the negative impact on the environment and gain economic benefits to the company (Kemp and Pearson, 2007). Such eco-innovation may help companies to improve their performance and meeting environmental regulation pressure.

Consequently, Environmental regulation is challenging the company's managers to address it by adaptation successful eco-innovation strategy to gain private and public benefits. Moreover, such a strategy that relies on eco-innovation may present a new opportunity for the company to reduce environmental cost and risk.

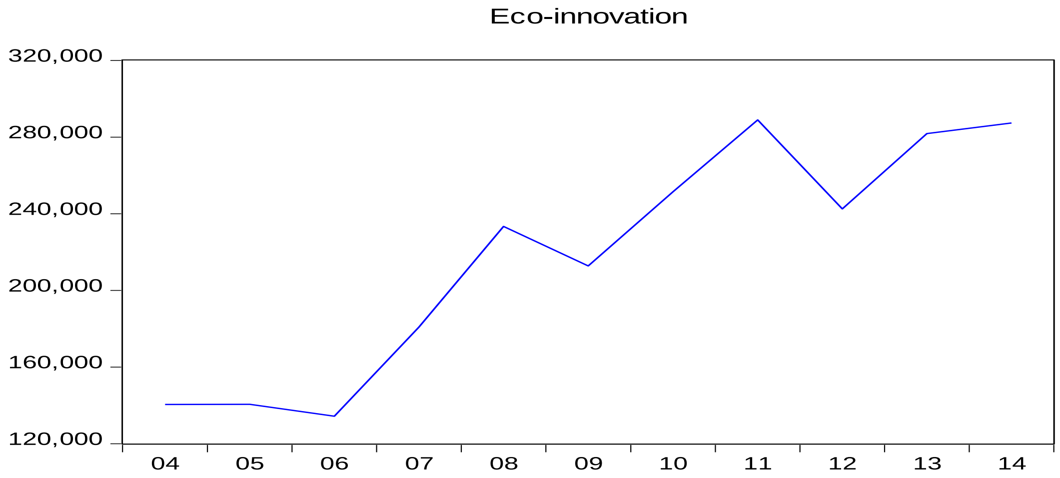

Figure 1: Total investment in eco-innovation from 2004 to 2014 [Sustainability and annual reports, 2004-2014].

2.3 The effect of environment regulation on petroleum industry

The petroleum industry has been growths about 34.9% due to increase in world demand of energy requirements for other sectors, which makes it as a third highest growing industry in the 2009 (Hughes and Rudolph, 2011: Ismail et al, 2013). Increasing in demand is shaped as an opportunity for petroleum companies to increase profit. For example, the chosen companies developed their own resources to meet this demand through increasing sales (see Figure2).

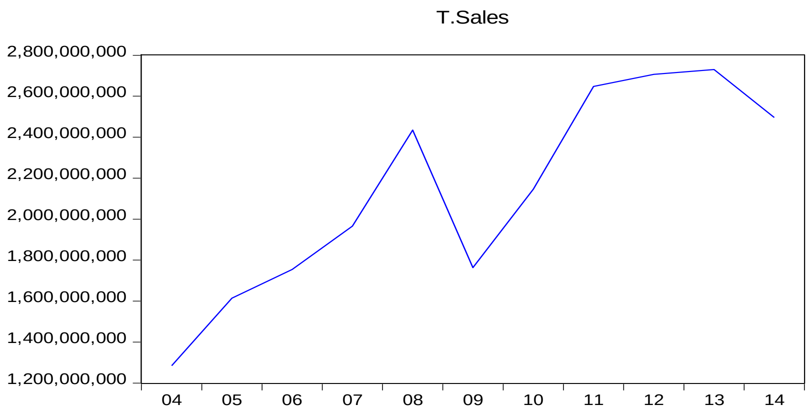

Figure 2: Total sales for period 2004-2014[Annual reports, 2004-2014].

At the same time, they have an important negative impact on the environment in nature such as CO2 emissions, which make this opportunity faced a high level of risk. Environmental taxes and penalties imposed on CO2 emissions are a good example of the environmental relevant regulation impact on companies' operations. For example, in 2014 ENI, EXXON, HESS, and GAZPROM paid about 237, 18, 84, and 46 million USD as environmental penalties.

2.4 Environmental strategy in petroleum companies

Petroleum companies realize that strategic behavior is an essential part to deal with an environmental issue, where invested a huge amount in eco-innovation. For example, the investment growth in eco-innovation for chosen companies about 104.95% in 2015 calculated based on 2004 (see Figure), and took actions to assess the negative impact of operation processes on environment by developed their reports, and assessed strategy measures to determine the impact of strategy actions on their performance (Jung et al., 2001). Petroleum companies recognized the importance of environmental strategy and investment in eco-innovation as a critical indicator of strategy. These companies increased dramatically to develop new and existing activities such as R&D, clean technology, education, and new equipment (Ismail et al, 2013; Hassani et al, 2017). The negative impact of petroleum companies’ activities put them at challenges to meet environmental regulation and creates the needs to meet these challenges with the economic benefits of such a strategy.

2.5 Empirical evidences

In recent decades the environmental issue takes great attention in research literature, where studies have been focused on the eco-innovation as the main factor of environmental strategy, and its impacts on both environmental and financial performance. These studies can be analyzed into two categories. First, category includes surveyy studies such study such as Doran and Ryan (2012) where he examined the impact of eco-innovation factors on company performance by using data from an Irish company and found that companies with eco-innovation activity have better performance. Ramanathan et al., (2017) also examined the relationship between environmental regulations, eco-innovation, and sustainability benefits in terms of pollution reduction and environmental impact by studying British and Chinese companies, and found that companies rely on their resources and capabilities, which improves their sustainability through a reduction in pollution and improved performance.

The second category consists of empirical studies which can be divided into two types: the first type of studies focus on the impacts of eco-innovation on Carbone dioxide emission reductions such as Zhang et al., (2017) who measured the effect of eco-innovation variables on carbon emissions in China for the period 2000–2013and found that most eco-innovation variables have positive effects on the reduction of carbon emissions. Alam et., al (2019) investigated the impact of R&D investment on the company's environmental performance in G-6 countries and found out that the investment in R&D has a positive and significant impact on energy consumption as well as CO2 emission reductions. In addition to this, they indicated that the R&D and knowledge of innovation play a vital role in the reduction of Carbon emissions. The second type of empirical studies focuses on the impact of eco-innovation on both environmental and financial performance such as Eiadat et al., (2008) investigated the relationship between eco-innovation strategy and business performance for twenty-two sectors in Jordan and estimated positive and significant relationships between eco-innovation strategy and companies' performance. Iwata and Okada (2011) examined the effects of environmental performance on financial performance by using the data of Japanese manufacturing and points out that CO2 reduction has a positive and significant effect on financial performance in the short-term. Horvathova (2012) examined the effect of environmental performance in terms of CO2 emissions on a company's financial performance (ROA) by using data from the Czech Republic. He mentioned that improvement in environmental performance enhances performance in the long-term. Lee and Min (2015) examined the relationship between environmental and financial performance in the short-term by using green R&D as a key factor of eco-innovation strategy and CO2 emissions as a measure of environmental performance. In their study, they used Japanese manufacturing as a sample in the period 2001–2010 and found that R&D has a significant and positive impact on both carbon emission and financial performance at the company level. Gallego-Alvarez et al (2015) used data for 89 companies from 21 countries for investigating the impact of CO2 emission reductions on financial and operational performance in the short-term. They found that the reduction in CO2 emissions has a positive impact on financial performance while fail to find significant evidence for operational performance. Nishitani et al (2017) investigated whether improvement in the Indonesian company's environmental performance enhances financial performance, and they found that improvement in environmental performance enhances financial performance (Profit and sales).

2.6 Conclusion

Although there are several studies have enriched our standing about the performance of the environmental strategy. The majority of these studies are survey studies that reflect the policy of strategy Regardless of the actual performance. Also, empirical studies related to this field focused on the relationship between environmental and financial performance by using one or two actual indicators of strategy Regardless of all indicators of said strategy. However, evaluating strategy's performance should consider all indicators that response to strategy implementation, which is missing in empirical research (Kemp and Pearson, 2007; Garica-Granero et al., 2018: Tayler, 2010). Several studies advocated to use the BSC as strategy evaluation tool such as Bennett and James, (1998), Epstein and Wisner, 2001, Bieker and Waxenberger, 2002; Li and Leigh, 2010). Up to date, these studies do not provide empirical evidence about the benefit of applying environmental strategy at company level (He and Loftus, 2014), and integrating actual environmental indicators in the BSC to measure environmental strategy still missing (Kaplan, 2009: Hoque, 2014), Therefore, the actual performance of an environmental strategy is not clear, which requires more empirical studies.

Chapter 3

ENVIRONMENTAL STRATEGY

3.1 Introduction

There has been increasing concern about the negative impact on the environment, which may occur as a result of the natural company's activity. One consequence, companies are likely to be affected by environmental as a result of stakeholder pressures. For example, a carbon tax that posed through environmental regulation is a part of these pressures which may increase cost and risk. Ignoring these impacts putting companies in difficult to enhance their objectives through improving its operational processes to enhance environmental performance and gaining financial benefit (Jensen, 2001). According to the Porter hypothesis, a company can gain benefit from environmental regulation. Such regulations can play a vital role in changing the behavior of companies to be in a strategic way when regulations successfully could reduce a negative impact on environmental, cost, and improve financial performance and reputation (Porter and Van de Linde, 1995). Thus, the success to meet this pressure, companies can easily achieve their objectives. Porter and van der Linde (1995) indicate that companies have the opportunity to take action to protect the environment and gain economic benefit simultaneously. Environmental strategy unavoidably needs to be supported by managers to reduce the negative impact on the environmental. Mangers usually considered this issue through adopting a new policy and activity to meet these pressures, so this consideration can be emerged as a strategy (Henri and Journeault, 2010). Environmental strategy is a continuum actions and practices that deal with environmental through adopting eco-innovation activity into operational processes to reduce the negative impact on environmental (Aragon-Correa et., al 2008, p 90). Therefore, it integrates the impacts of stakeholders into operational processes. Appling environmental strategy at the company level can enhance both environmental and financial performance (Iwata and Okada, 2013). Many studies indicate that the conduction of environmental strategy at the company level has a positive effect on both environmental and financial performance (Orlitzky et al, 2003; Al-Tuwaijiri et al, 2004; Hsu and Wang, 2013). It should be noted that a negative impact on the environment will occur even if the environmental strategy applied. Consequently, applying strategy at business processes will increase the sensitivity to strategy evaluation.

The environmental issue has been emphasized by scholars such as Porter and Kramer (2006), Porter and Reinhardt (2007) and Aragon-Correa et al (2008), in which all indicate that companies should change their behavior into a strategic way to meet the environmental challenge. Considering environmental issues should be embedded in strategy design and implementation (Zingales et al, 2002). Strategies as abatement policies that concern negative impacts on the environment such as decreasing CO2 emissions, improving operation processes, moving to new technologies, and improving employee's morals are put in place but the significant negative environmental impact still occurs.

Consequently, the strategy needs to be supported by management and integrated into the daily operation process for limiting the negative impact on the environment, costs, and associated risk. Besides, there is a need to design and apply strategy to decrease the negative impact on the environment (Pinkse and Kolk, 2009).

Unfortunately, applying environmental strategy at the company level is neglecting because these companies expect the effect of strategy will happen in the long-term (Pinkse and Kolk, 2009). Thus, most companies are reactive to the environmental issue rather than strategic (Porter and Reinhardt, 2007).

On the contrary, companies that implement the environmental strategy will be more survives and have at an early recognized to an environmental issue. This strategy that considers environmental issue into operation processes become a company imperative (Esty and Winston, 2006).

3.2 Environmental strategy as a tool to mitigate risks

In the research literature, environmental strategy refers to a series of targets, objectives, actions, and measures aimed to reduce the negative impacts on the environment through eco-innovation practice. These practices link the factors of strategy together into the causal association. Therefore, mitigation strategy is actions for reducing negative impacts on environmental such as reducing CO_2 emissions. Mitigation strategy usually includes the following processes:

- Redesigning the operation processes to be more efficient.
- Promotes efficient use of current assets.
- Avoiding costs and risks through low CO_2 emissions.
- Investment in new technology for low CO_2 emissions.
- Creating environmental leadership compared to other companies.

3.3 Environmental strategy as a transformative opportunity

Environmental strategy is an unusual solution to the environmental issue. It refers to practices that present additional costs for the company and there are some arguments that environmental strategy improves environmental performance in the short-term (Schwartz et al, 2007).

Although, there no empirical evidence in the research literature that environmental strategy improves financial performance in the long-term. Some scholars such as Porter and Kaplan (1996) indicate that a successful strategy at the company level has a positive and significant impact on competitive, reputation, and profit. Therefore, companies can get economic opportunities arising from the environmental issue by reducing risk and cost (Reinhardt, 2000; Laszlo and Zhexembayeva, 2011).

3.4 Environmental strategy evaluation

Since the 1990s, companies have been compelled to implement their strategy to enhance environmental performance. The debate about whether the environmental strategy is enhancing environmental and financial performance is still ongoing (Solovida and Latan, 2017). In this filed scholars indicate that implementing an environmental strategy at the company level means additional cost. (Porter and Van der Linde, 1995). In contrast, other scholars indicate that improving environmental performance will lead to cost reduction because of companies' process innovation (Hui et al, 2001). The resource-based view theory argues that the company's performance depends on own resources which may have a potential impact on improving operation process and environmental performance (Shrivastava, 1995). On the other hand, the Porter (1991) hypothesis indicates that environmental regulation pressures can trigger the company to develop its operation process into strategic innovation which may offset the cost through improved operation processes (Porter and Van der Linde, 1995). For instance, implementing an environmental strategy at the company level may have a positive impact on pollution reduction as a result of adopting efficient environmental strategy (Eiadat et al, 2008). Nonetheless, Environmental strategy is risky, and the economic benefit is uncertain, where it depends on the company's resources and how these resources are strategically linked. A failing strategy may result in a long-term economic negative impact, such as losing customers, reputation, and competitive (Aragon-Correa and Rubio-Lopez, 2007; Wijethilake et al, 2016). Therefore, this creates the question is how the adoption of environmental strategy does successfully? This means that there is a need to evaluate the success of an environmental strategy to achieve its aim. To evaluate environmental strategy, companies should use different indicators. These indicators should be linked with internal and external goals, such as CO2 reduction, compliance cost, taxes, and earnings (Searcy, 2012: Arjalies and Mundy, 2013).

However, consistent with the economic theory, a company's environmental strategy that aimed to improve environmental performance will be based on the association relationship between cost and benefit (Nishitani et al, 2017). There are some tools introduced to evaluate the strategy such as the BSC. The BSC uses non-financial performance indicators that help the company to make alignment between strategy targets and its performance such as customer satisfaction, operation development, and innovation (Kaplan et al, 2001). This makes the BSC is the most important tool which has been used due to its ability to make a balance between short-term and long-term strategy's objectives, financial and non-financial measures, and internal and external perspectives (Kaplan and Norton, 1992; Kaplan and Norton, 1993) (see Chapter 4 for more details about the issue).

Chapter 4

THE BALANCED SCORECARD (BSC)

4.1 Conceptual of the BSC as framework

Since 1850 the economic evaluation system of companies has been riled on financial measures in the short-term. The performance evaluation system has focused on how profit can be generated or increased, and how costs that generate profits can be reduced. In recent years, companies moved from the age of manufacturing to the age of customer and information. Therefore, scholars argue that financial measures that focused on past events for short-term are not sufficient to measure current and future performance. Therefore, there is a need to consider nonfinancial measures to evaluate their performance for both short and long-term to give a holistic over of view about current and future performance of strategy (Anthony and Govindarajan,2001; Werner and Xu, 2012). Recently, Kaplan and Norton (1992) introduce their idea as a framework that combines financial and nonfinancial performance strategic measures, which called the Balanced Scorecard (BSC). The BSC as a strategy evaluation tool is an integrated set of strategy's performance measures. It translates the vision of strategy into continuous actions (See Krivokapic and Jovanovic, 2009, p 263). Thus, the BSC takes into account traditional financial measures and nonfinancial measures for future performance. These measures clustered into four groups called perspectives financial, customer, internal, and innovation and learning (see figure3) (Kaplan and Norton, 1996b; Janes, 2012).

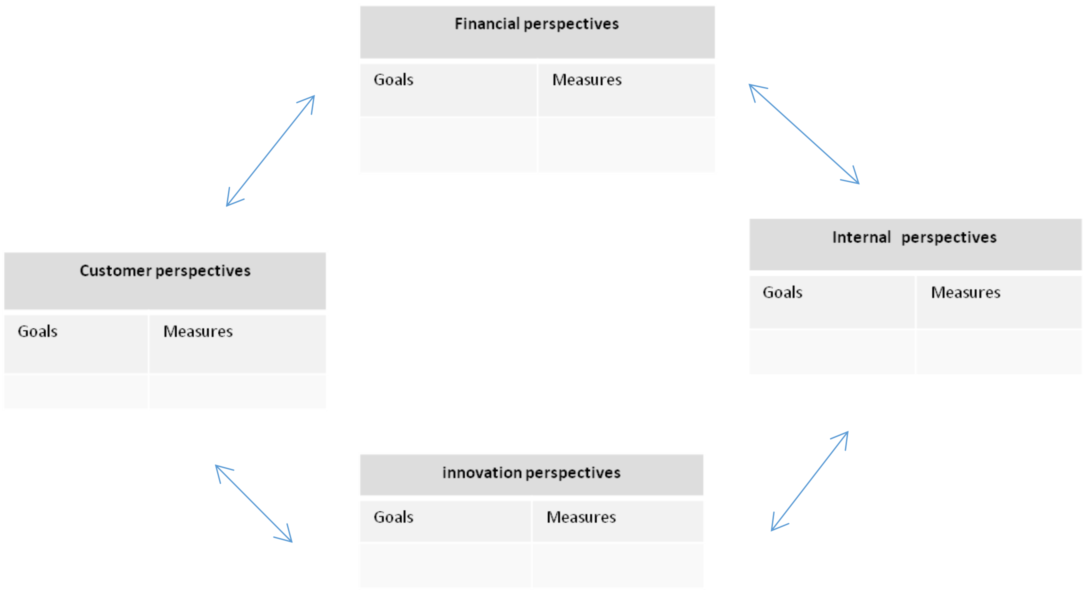

Figure 3: The Balanced Scorecard [Kaplan, R. S., & Norton, D. P., 1996b].

The financial perspectives focus on the success of strategies such as earning per share, earnings growth, earnings before interest rate, and return on investment. The perspectives of customers focus on what their customers demand. Internal perspectives focus on the ability of companies to manage their business processes and which one should be improved to meet customers' needs. Innovation and learning perspectives focus on how the company should be developed and improved to make its vision true. Measures of strategy should be derived from strategy implementation and tied together in a cause-and-effect relationship, which passes through perspectives. The cause-and-effect link relationship provides information about the mechanism of strategy and how can create value for stakeholders (Kaplan et al, 2001). The measures of innovation and growth assumed to affect measures of internal operation, measures of internal operation effect measures of customers, finally, measures of customers affect financial measures. The cause and effect relationship among all perspectives of strategy is critical because non-financial measures can be used to evaluate future financial performance. Therefore, the validity of the BSC comes from the assumption of the cause-and-effect relationship among strategic measures and becomes not just an evaluation system, but also a monitoring system. The BSC as a strategy evaluation tool has some advantages such as limiting the propensity of mangers that influenced by their motivations (Ditto and Lopez, 1992) , its ability to connect strategic objectives that to be achieved in causal relationship, its ability to describe objectives and activities of strategy in a logical way to create long-term value from short-term actions, and it helps companies to convert their resources into desired outcomes (Kaplan and Norton, 1996; Kaplan and Norton, 2004).

4.2 Developing the BSC for strategy evaluation

Since its inception, the BSC took great attention from authors and developed for many times as follows:

First-generation of the BSC: The original BSC that introduced in 1992 was termed as the first generation of the BSC. This generation presented from authors as an integrative device that helps mangers for evaluating performance by using both financial and non-financial measures. This generation suggests helping mangers by using the non-financial measures that driven by implementation strategy. They indicate that with better information, managers have more ability to improve the performance of strategy (Kaplan and Norton, 1992; Rangarajan and Mishra, 2014). The BSC was introduced as a framework that generates its value from an efficient communication system within companies.

The second generation of the BSC: The authors recognized that there are difficulties associated with choosing specific strategic measures and how linked together. In the period between 1992 and 1996, they try to link the perspectives of strategy in a casual relationship. Linking the perspectives of strategy becomes an important task of the BSC design, where it becomes a diagram illustrating the linkage among the objectives of the strategy. These diagrams that show link relationships among objectives were called ‘strategy maps’. This generation improved the BSC from the evaluation system to the management system.

The third generation of the BSC: The third generation of the BSC is based on the improvement of the second generation to be more reliable for strategy implementation. The development of the BSC comes from the difficulties that face managers to choose to validate objectives, targets, and measures. In this generation, the authors integrated strategic objectives and targets with measures into a casual relationship. They argue that this will help managers to create, and relate activity and objectives within the simply causal association. Consequently, the first step of design the BSC was creating a casual linkage among perspectives. Further, it was found that by creating casual association among objectives of the strategy, the objectives selection was easier (Cobbold and Lawrie, 2002).

4.3 Developing the BSC for environmental strategy evaluation

Increasing pressure to the environmental issue from different sources such as environmental regulation, governments, and societies, scholars take great attention to develop the BSC for environmental performance evaluation. This development includes integrating environmental aspects into the BSC for measuring environmental performance (Veleva and Ellenbecker, 2001; Azapagic, 2004). Some scholars into their studies advocate incorporating environmental aspects into the BSC for evaluating strategy (e.g., Figge et al., 2002; Hubbard, 2009; Kaplan & Wisner, 2009; Alewine & Stone, 2013). By conducting the BSC, companies can determine the relationship between environmental objectives, targets, and measures (Butler et al., 2011). On the other hand, the important task when the company conducts their BSC for the environmental issue is how to select and incorporate environmental measures into their BSC. For this purpose, managers must choose the manner that guarantees in which the environmental aspects will be integrated into its BSC (Malina & Selto, 2001: Kaplan & Norton, 2004). Developing the BSC in the relevant literature for environmental evaluation can be discussed in the following three options:

1- **Integrating environmental indicators into the four perspectives:**

   In this approach, scholars advocate that environmental aspects can be integrated into the four perspectives, where objectives, targets, and measures of environmental strategy can merge with the whole strategy. Therefore, aspects of environmental strategy become a part of conventional BSC that Integrated into a causal relationship. Therefore, environmental aspects linked to the market system. Based on this, this approach is especially relevant for the whole strategy that includes environmental aspects.

2- **Adding a fifth perspective**:

   In 1996 Kaplan and Norton indicate that a company can create or add a new perspective into the BSC (Kaplan and Norton, 1996). Many scholars add one perspective related to environmental issue such as AL-Khatatneh and Al-Sa’aydeh (2010), and Al-Zwyalif (2017), in which they indicate that adding a fifth environmental perspective into the BSC is useful for a company to take into account both inside and outside aspects for strategy evaluation, plan and control environmental activities . However, as Kaplan noted that integrating actual environmental indicators into the BSC to reflect a market system is still missing.

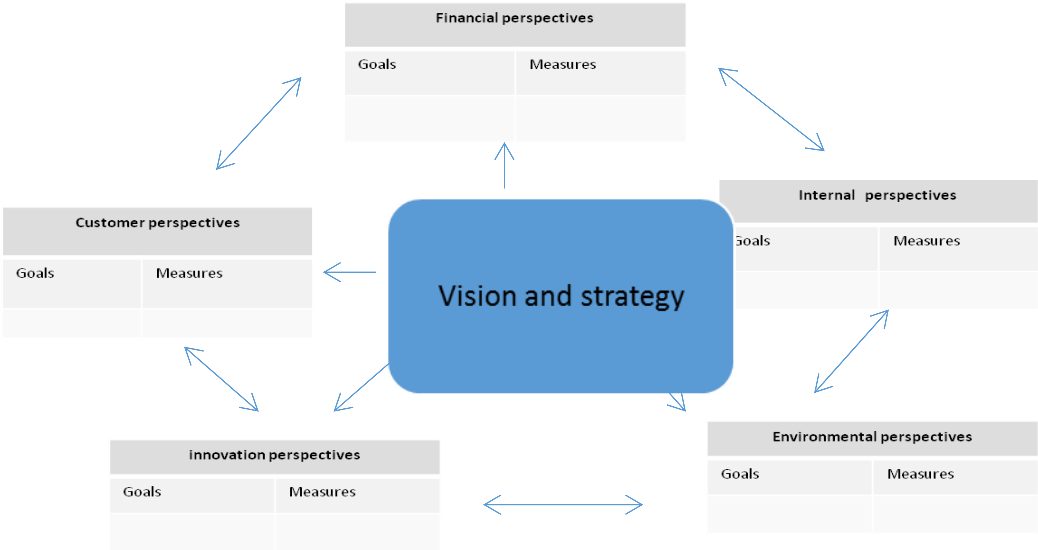

Figure 4: Environmental Balanced scorecard [Krivokape and Jovanovic , 2007].

3- **Constructing a separate BSC**:

This approach advocates creating a new and a separate of the BSC that includes just the environmental perspectives. The design of a new BSC should be according to a standard of BSC (casual-and-effect). This creation can be linked with the BSC which may achieve good results relating to environmental strategy evaluation. Moreover, creating a new BSC for the environmental strategy purpose may be useful to link environmental perspectives to improve the environmental evaluation system (Johnson, 1998; Hockerts, 2001).

Chapter 5

RESEARCH DESIGN AND METHODOLOGY

5.1 Data collection, Methodology and related petroleum companies

5.1.1 Data collection

To investigate the aim of research which is an evaluating the environmental strategy in terms of CO2 emission reductions that should take into account all practices that response to implantation of strategy (Gonenc and Scholtens, 2017). For this purpose, I try to gain deeper insights into the environmental activities of the 17 international petroleum companies troughs their sustainability reports that published into their websites. The sustainability reports are a rich source of information and help to get a better understanding of the relevant information about actual environmental activities. Self-reports are read and analyzed which focus on actual activities for applying the environmental strategy. In particular, this approach is helpful to construct a strategy map that provides critical information about strategic activities, the link between objectives, and key performance indicators (Kaplan and Norton, 2004: Barnabe, 2011). This map was used as a core to determine the main aim of the said strategy (CO2 emission reductions) and related activities to enhance its aim. Then, the strategic activities are linked together into a cause-effect relationship towards the strategic aim.

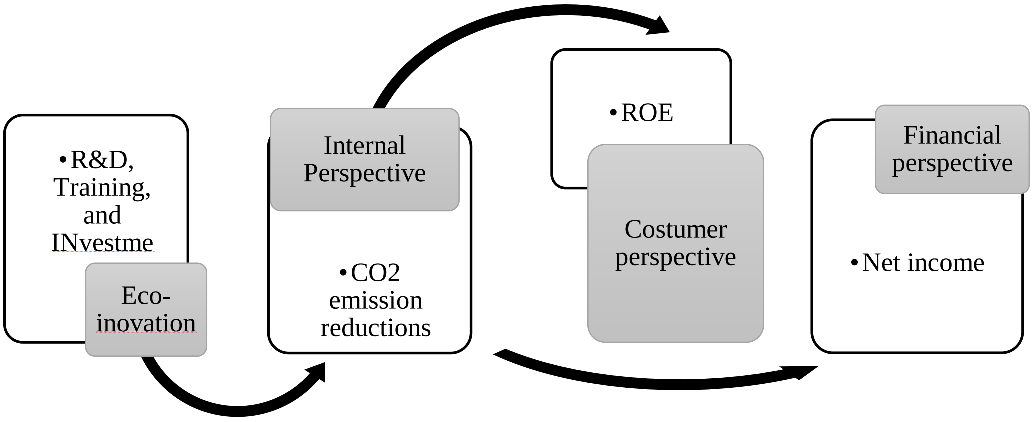

Figure 5: The strategy map [Kaplan, R. S., & Norton, D. P., 1996b].

To evaluate strategy, measures of strategy should link the strategic objectives (Johnson, 1998: Bennett and James, 1998: Dias-Sardinha and Reijnders, 2005). This required help to determine the main environmental factors that companies try to minimize. The result presented six environmental indicators that R&D, training, environmental investment, CO2emissions, ROE, ROA, and net income. These indicators are found across seventeen chosen companies and determined as main factors used to evaluate said strategy. Based on the previous studies, the environmental indicators that undertaken by the companies are integrated into the BSC as shown in figure 5.

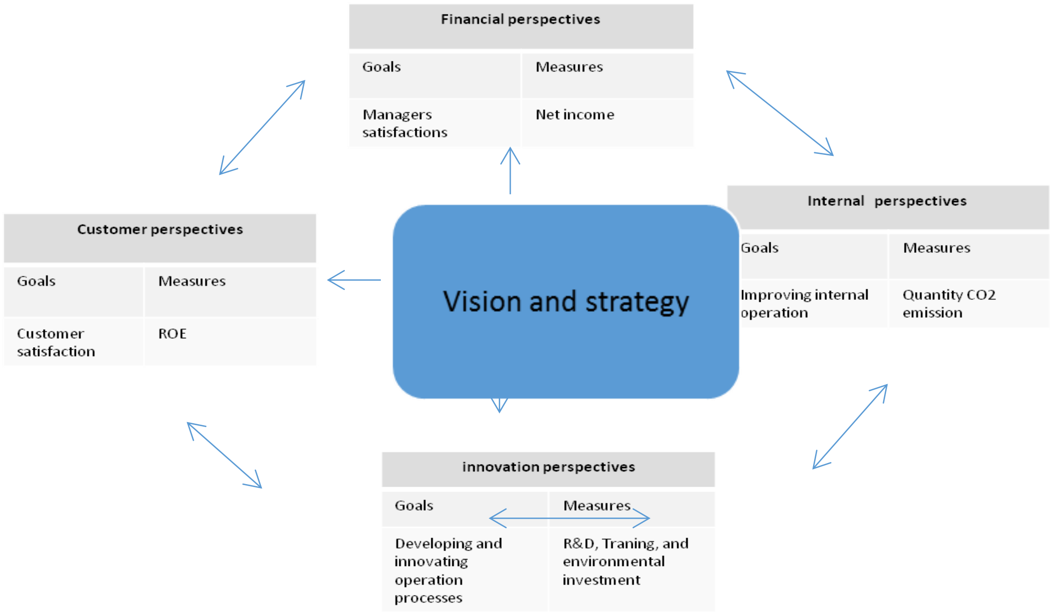

Figure 6: The Balanced Scorecard for environmental performance evaluation [Kaplan, R. S., & Norton, D. P., 1996b].

The relevant data collected from their own annual and sustainability reports and categorized under the term of the objective of the activity for the period between 2005q1 and 2016q4. Employed KPIs are assumed to reflect the actual performance of the strategy based on the availability of information in their sustainability reports. Choosing a sample was under consideration the availability of data, where information discloser remains voluntary at a low level (Solovida and Latan, 2017). To control for heterogeneity all variables are expressed in natural logarithmic form.

5.1.2 Measures

Due to the limitation of public data related to implementing environmental strategy, all data are collected manually from sustainability and annual reports. In my research, this was an appropriate approach since the relevant data available on petroleum companies' sustainability and annual reports. Based on the BSC's cause-effect assumption between perspectives, it's appropriate to separate the measures of research into the following four categories (Figge et al., 2002; AL-Zwyalif, 2017): First, measures of innovation and learning: I use three measures research and devolvement (R&D), training and investment as a proxies for innovation measures. Second: measrures of internal operation: I employ the quantity of CO2 emission as a measure for CO2 emission reductions. Third, I conduct the ROE to measure the costumers' perspectives. Finally, Net income is used to measure the financial perspectives.

5.1.3 Econometric models

To evaluate the environmental strategy under the terms of CO2 emissions, I consider Porter's scenario that environmental strategy has a positive effect on the operation processes, pollution reduction and economic value stimulatingly. Also, I follow some researchers in which all indicate that improvements in environmental performance are a moderate relationship between eco-innovation and financial performance (see, Iwata and Okada, 2011; Horvathova, 2012; Rokhmawati et al, 2015; Gonenc and Scholtens, 2017). The BSC assumption as a framework to measure strategy that links the strategy perspectives in cause and effect way also followed. Therefore, the following models are developed:

Model 1: $CO2 = F(R\&D+TR+INV)$ (1)

Model 2: $ROE= F(R\&D+TR+INV+CO2)$ (2)

Model 3: $NI = F(R\&D+TR+INV+ CO2)$ (3)

Where CO2 is quantity of carbon oxide emissions, R&D is research and development, TR is the cost of training, INV is investment in environmental, ROE is the return on equity, NI is net income.

5.2 Method

The aim of this research is an evaluating the environmental strategy. For this purpose, I empirically evaluate the relationship between perspectives of the BSC through the layout of the strategy map with panel dynamic regression models. Firstly, cross-sectional dependence test should be conducted to avoid superior regression (Engle and Granger, 1987: Gujarati and Porter, 2003). The second step, Dickey-Fuller (CADF) and (CIPS) unit root tests will be appropriate to determine the order of integration (Pesaran, 2007). If all variables are integrated in the same order I(1) then I conduct Co-integration according to the Westerlund approach method to determine the long association between vairables. The environmental strategy is a long-term commitment and its activity happens in both short and long-term (Roome, 1994; Martensson and Westerberg, 2016). Therefore, the second-generation panel co-integration test will be appropriate to determine whether or not the variables have a long-run relationship. The variables might not be stationary at the same order. The autoregressive distributed lag (ARDL) approach, proposed by Pesaran, Shin and Smith (1999) can be applied for some reasons, it's appropriate in case if exist cross-sectional dependence, its applicability to a mixed order of co-integration, and its more significant approach to determine the co-integration relationship among variables in a small sample (Pesaran et al., 1998). The ARDL model can be conducted in the following form:

$$\Delta yj,t \ = \ \o ECj,t + \sum_{j=0}^{q-1} \beta i,t\Delta \quad Xi,t - j + \sum_{j=1}^{p-1} \lambda i,j \, \Delta yi, \ \ t - j + \epsilon j,t \qquad (4)$$

Where: y is CO2 emissions, ROE, and NI, $EC\ j,t = yi,\ t\text{-}1 - X\ i,\ t - \theta$, ϵ is the error correction, θ is the long-term coefficient, $\emptyset$ is the adjustment coefficient , X is a vector of independent variables; R&D, INV, and CO2 emissions, β is the short-term coefficient of independent variables, λ is the short-term coefficient of dependent variable, i and t are represent company and time respectively, q is the number of lag for independent variables ,P is the number of lag for dependent variable, ϵ is the disturbance term.

5.3 Basic information about petroleum companies

Since its origins, petroleum companies play a vital role in economics, where their production has been driving the world industry and economic growth, (generation of wealth, enhancing prosperity, and pushed the living standards) (Duch-Brown and Costa-Campi, 2015). In spite of substantial penetration of energy, oil and gas remain the main sources available to mankind. Oil and Gas companies cover about 33.2% and 21.1% of total demand respectively, which present about 80% of the energy used in the world (Yanez et al., 2018). For instance, the energy required for transport, raw mater Oil and Gas companies has invested great money in capital expenditure to update their operation production to meet and keep their production in line with demand (Bevilacqua and Braglia, 2002). For example, the Chosen sample had growth rapidly to meet the demand, where the growth of their assets from 83.3 billion in 2004 to 2363.5 billion in 2016 (see Annual reports). At present, this will remain these companies as the backbone of every industry in the world for current and future time and the key factor of economic (Hughes and Rudolph, 2011; Hook and Tang, 2013). Meeting the demand is not free where comes with a risk for both companies and environmental. Therefore, Oil and Gas companies are faced a big challenge to meet energy demand and minimize the negative impact on the environment such as pollution, accidents and global warming. The chosen companies are faced with international and national environmental regulations and standards such as the Kyoto Protocol. This makes them in a challenge to address the environmental issue with a company's operations. Due to the capacity of these companies, they have developed their daily operation practices by making environmental goals as the main part of business operation. To address environmental issue, chosen companies are developed their visions and practices to match internal value with external views of companies. Chosen companies have invested large recourses to prevent pollution as well as hedge themselves against environmental regulation (Gonenc and Scholtens, 2017). The chosen sample is international petroleum companies that work in Oil and Gas exploration and production. All of these companies are large in term of production, sales, and number of employees.

5.4 The response of chosen companies to environmental risk

Although Oil and Gas companies have vital resources that will remain a foreseeable future, these companies have an important negative impact on the environmental. For instance, Carbone dioxide emissions that discharged to the air are most pollutants produced by petroleum companies. For example, investigated companies contribute to the environmental about (604) million tons of Carbone oxide emission (See sustainability companies' reports). Co2 emissions are costly to environmental and companies . Increasing the pressures from government and society to protect the environment may have a significant risk on their operation especially with the poor environmental operation. This makes these companies in the challenge to make a balance between increasing the production to meet demand and reduce environmental risk simultaneously.

Consequently, these companies are generally realized the need to improve their business operation. They undertake activities for environmental and linked them to future production. These companies are developed their behavior that related to social and environmental through various activities (Ford at el, 2014). For example, in 1996BP is first company conducted a proactive environmental strategy and followed by Shell and Exxon in 1998 (Saeverud and Skjaerseth, 2007). Investigated companies are currently taking action to standardized sustainability reports and eco-efficiency measures, which represent key environmental indicators and measures that published in their own websites(Jung et al, 2001; Van and et al, 2001).

As evidenced by investigated sustainability reports, companies had already took action on environmental by conducting their own strategy by allocating some recourses such as establish new assets with high quality to reduce accidents, research and development on technologies to produce efficient hydrocarbon that reduce emission on the source, developing employees' skills to reduce accidents and fast response to events that have negative impact on environmental (Nashitani, 2017). This strategy is dedicated not only to reduce the negative impact on the environment such as Carbone oxide emission reductions but also as an opportunity to increase economic benefit, reputation and competitive. In alignment with their strategies, these companies had shown long-term investments to protect the environment and make their business operation more efficient.

Chapter 6

THE IMPACT OF ECO-INNOVATION ON CO2 EMISSION REDUCTIONS

6.1 The impact of eco-innovation on CO2 emission reductions

6.1.1 Introduction

There is evidence that implement of proactive environmental strategies is playing a vital role in the reduction of pollution and enhance their overall environmental performance for both short and long term (Hart and Ahuja, 1996; Liou, 2015; Iwata and Okada, 2011; Wu et al., 2012). In addition, studies indicate that the major factor that helps to achieve the goals of various environmental strategies is eco-innovation in the form of various processes, products, and operations (Aragon-Correa, 1998; Porter and Kramer, 2006; Dangelico and Pujari, 2010). Eco-innovation involves developing new ideas, applying new technologies, and introducing efficient processes to reduce a company's negative impact on the environment (Rennings, 2000). Thus, eco-innovation is an efficient approach to improve environmental performance and operational efficiency as well as promoting future sustainability (Aggeri, 1999; Aguilere-Caracuel and Ortiz-de-Mandojana, 2013). Theoretically, some survey studies indicate that inspiring eco-innovation has positive effects on business and environmental performance, resulting in a win-win scenario (Porter and Van der Linder, 1995). The ability of companies to meet demand and improve their performance is referred to as the Porter hypothesis or as a win-win scenario (Porter, 1991).

However, despite existing studies in the research literature have enriched our standing of how eco-innovation affects CO_2 emission reductions, the task of actual reducing CO_2 emissions by utilizing eco-innovation is an unsolved problem (Ghisetti and Rennings, 2014; Wijethilake et al., 2018; Zhang et al., 2017), because a majority of these studies are survey studies that observe the policy rather than the actual performance (Garica-Granero et al., 2018).

In addition, empirical studies related to this field deal with one or two actual performance. Therefore, determining the impact of eco-innovation on CO_2 emissions should consider all implemented eco-innovation indicators with an environmental benefit. Such considerations are missing in empirical research (Kemp and Pearson, 2007; Garica-Granero et al., 2018).

In this chapter, I attempted to investigate the impact of actual eco-innovation on CO2 emission reductions using seventeen petroleum companies for both the short and long-term. To achieve the aim of this chapter, I faithfully follow the Porter hypothesis which suggests that inspiring eco-innovation on company level reduce the negative impact on environment, and other researchers who suggests that eco-innovation improves operation process and reduce negative impact on environment (see Kaplan and Norton, 2004; Tello and Yoon, 2008; Thoumy and Vachon, 2012; Antonioli et al., 2013; Ramanathan et al., 2017, You et al., 2019).

6.1.2 Cross-sectional dependence test

The research deals with panel data and relying on the assumptions of cross-sectional independence that they may lead to inaccurate estimation if the panel data are crosssectionally dependent[1]. Accordingly, cross-sectional dependence test is conducted and the result of the CD test, as shown in Table 1, indicates that the associated *p* values reject the null hypothesis of independent cross-sections for panel data. Henceforth, the second generation of panel unit root tests will be robust and sufficient for cross-sectional dependence issues.

Table 1: Cross-sectional dependence tests.

Variables	Breush-Pagan LM	Pesan-scaled LM	Perasan CD	df(n= 816)
LCO	1631.29***	90.665***	2.395**	136
LRD	1977.238***	111.641***	19.134***	136
LTR	1070.357***	56.653***	4.282***	136
LINV	1214.514***	65.394***	2.013**	136

Note: ***, ** denote statistically significant at 1%, 5% respectively.

6.1.3 Panel unit root test result

Taking into consideration the result of the CD test, the CADF and CIPS models test the null hypothesis whether or not the variables contain a unit root. The results of the panel unit root tests are reported in Table 2 and indicate that all variables except LTR are stationary at their first differences, or equivalently, I (1) at 1% significance level. The LTR variable is stationary at theirs levels, or equivalently, I (0) at 1%, 5% significance level for the CADF and CIPS tests, respectively. This finding justifies that the ARDL approach can be employed for co-integration relationship, because the variables are in a mixed order of co-integration. This means that the results are consistent with the general characteristics of most macroeconomic and financial variables, thus we are in a position to carry out a co-integration test to check for the presence of a long-term relationship between the variables.

[1] If the number of observations (N) is large and the time-series (T) is small, we need to conduct cross-sectional dependence test to avoid inaccurate estimation results (Hsiao et al, 2012).

Table 2: Panel unit root tests.

Variables	CADF		CIPS	
	Constant	Trend	Constant	Trend
LCO	-2.026	-2.542	-1.479	-1.903
LRD	-1.989	-2.433	-1.682	-2.003
LTR	-2.581***	-3.063***	-2.687***	-2.687**
LINV	-1.692	-1.953	-1.279	-1.760
ΔLCO	-4.609***	-4.705***	-4.569***	-4.578***
ΔLRD	-3.570***	-3.763***	-4.531***	-4.537***
ΔLTR	-4.094***	-4.132***	-4.409***	-4.465***
ΔLINV	-3.263***	-3.495***	-4.334***	-4.526***

Note: ***, ** denote statistically significant at 1%, 5% respectively. Δ indicates first deference.

6.1.4 Panel co-integration test

Consideration of the results of the cross-section dependence test as well as the unit root tests, leads us to apply the second generation of co-integration developed by Westerlund and Edgerton (2007). The second-generation test has the power for identifying the co-integration among panel time-series data in case of cross-independence issues, whilst assuming that the null hypothesis has no co-integration. The results shown in table 3 demonstrate that the null hypothesis of no co-integration can be rejected in the model; LCO, LR&D, LTR and LINV when the P test shows that the *p* value is (0.034). This finding suggests that there is a long-term relationship due to the adoption of eco-innovation activity between the eco-innovation variables and CO_2 emissions at the 5% level. This result supports that the eco-innovation variables have long-term and short-term impacts on CO_2 emissions in an ARDL model.

Table 3: Error-correction panel co-integration tests.

Statistic	Value	Z-value	P-value
Gt	-1.911	-0.811	0.209
Ga	-5.708	1.388	0.918
Pt	-7.817	-1.821	0.034
Pa	-6.051	-1.163	0.122

Notes: All tests are applied constant and with trend. This table indicates the tests where p-values are asymptotic normal distribution values.

6.1.5 Estimation the impact of eco-innovation on CO2 emissions

Table 2 shows the RDL estimation of Equation 1 the effect of eco-innovation perspectives on internal operation perspectives under the terms of CO2 emission reductions. The Akaike Information Criteria (AIC) and Schwarz criterion were used to select the appropriate model. The result shows that there is a negative and significant long-term relationship between LINV and LCO, at a 1% significance level. This means that, in the long-run, a 1% increase in investment improve environmental performance in terms of CO2 emission reductions by 6.7%. This finding suggests the benefits of environmental investment in the long-run. The short-term estimation shows that the lagged error correction term is negative and significant, at 1%. The coefficient of -0.104 suggests that the deviation from the long-term equilibrium of environmental performance in one quarter is corrected by 10.4% over the following quarter. The elasticity of R&D and LTR is negative and significant at 1%. This result indicates that a 1% increase in R&D and LTR increase environmental performance by 7.5 and 21.5% respectively. Practically, this result shows that the three eco-innovation indicators that applied in environmental strategy are important to improve environmental performance through improving the operation processes. This situation is consistent with the Porter hypothesis, where companies with environmental strategy can improve their environmental performance in the short-term and in the line with arguments of Kaplan and Norton which indicate that the eco-innovation activities affect the internal operational processes. These findings also consist of arguments of some scholars such as Sharma and Vredenburg (1998), Aragon–Correa, and Sharma (2003), Bhupendra and Sangle (2016) and Nishitani et al., (2017), which in all indicate that the environmental strategy has a positive impact on environmental performance.

It should be noted that the contribution of TR is stronger, which may due to the fact that selected companies are relying more on human resources in strategy' implementation (see Bevilacqua and Braglia, 2002), or the combined knowledge makes employees more sensitive to the environmental negative impact (CO2 emissions) on their health, which in turn makes their response to environmental accidents is faster (see Lee et al., 2015).

Table 4: Estimation the effect of eco-innovation perspectives on internal perspectives

Dependent variable	CO2	
Variable	Coefficient	t-Statistic
	Long Run Equation	
LRD	0.1510***	3.5963
LTR	0.1663***	5.8011
LINV	-0.0671***	-2.9823
	Short Run Equation	
COINTEQ01	-0.1041***	-3.7642
D(LCO(-1))	0.3238***	7.0532
D(LRD)	-0.0507	-0.8059
D(LRD(-1))	0.051	1.2413
D(LRD(-2))	-0.0754***	-3.3079
D(LTR)	0.4889**	2.5258
	-	
D(LTR(-1))	0.215311**	-2.361141
D(LTR(-2))	-0.100182	-0.841363
D(LIN)	0.078875	1.320383
D(LINV(-1))	-0.044773	-0.792994
D(LINV(-2))	0.005976	0.188813
C	0.056947**	2.072273

Note: ***, ** denote statistically significant at 1%,5% respectively

Figure 7 and table 2 show the diagnostic test of confidence ellipse and coefficient confidence intervals which dominate that the confidence ellipse is captured in the center of the ellipse which imply that the estimation coefficients of the model are stable with significant confidence level at 1% to explain the change of CO2 emissions in the future. This result suggests that the environmental strategy has a positive and significant impact on environmental performance at the company level in the short-term (see Ekins 2010). This can be mainly attributed to improving into operation process. Based on the findings, eco-innovation activities play a vital role in the implementation of an environmental strategy, which has positive effects on improving environmental performance (CO2 emission reductions). Thus, considering environmental issues into strategic behavior at the company level could help companies in several ways, such as improved internal operations trough using sources more efficiency, and improved environmental performance (CO_2 emission reductions).

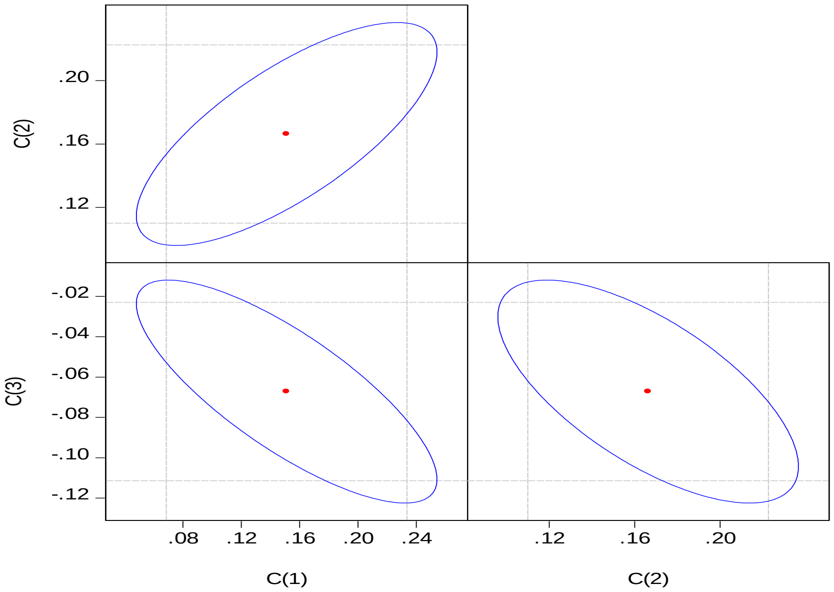

Figure 7: Coefficient diagnostic with confidence interval [Author's own calculations and plotting].

Table 5: Coefficient confidence intervals

Variable	Coefficients	Low	High
LRD	0.151033***	0.042517	0.259548
LTR	0.166326***	0.092242	0.240411
LINV	-0.067171***	-0.125369	-0.008973

*** donate to significant at 1%.

Chapter 7

THE IMPACT OF CO2 EMISSION REDUCTIONS ON FINANCIAL PERFORMANCE

7.1 The impact of CO2 emission reductions on financial performance

7.1.1 Introduction

In recent decades there has been increased pressure on firms' activity to control environmental performance from different sources such as environmental regulations, community, and market (Zhang et al., 2017). These pressures are considered by companies as a global problem, which has a complex effect on their financial performance especially with poor environmental performance (Cucchiella et al., 2017).

According to the Porter hypothesis (Win-Win strategy), environmental strategy benefits the environment in the short-term and enhances the financial value of companies in the long-term (Porter and Van der Linde, 1995). Empirically, studies indicated that firms can avoid risk and gain profit by exploiting their capability into a strategic way to reduce pollution at the source rather than at the end (Christmann, 2000; Hart and Milstein, 2003). Having strategy not enough to be successful, where implementing strategy successfully depends on some factors such as how these resources are employed and combined to exploit them fully (Mahoney and Pandian, 1992: Youndt et al, 2004: Hart, 1995). How the strategy is expressed in terms of targets and measurements to be well known for employees who respond to

implementing the strategy (Kaplan and Norton, 1996). How targets of strategy are linked to operation meeting gaols (Rangarajan and Mishra, 2014). Therefore, the strategy must be evaluated, where the failing strategy hurts the firm for both the short and long-term (Kaplan and Norton, 1992; Aragon-Correa and Rubio-Lopez, 2007).
The Balanced Scorecard (BSC) as the most popular tool has ability to translate the strategy into actions, objectives, and measures in four perspectives: financial, customer, internal and innovation. The cause and effect relationship among perspectives assumed to be oriented towards financial perspectives. Measures of innovation driver measures of internal processes, measures of internal processes driver measures of customers, and finally measures of customers driver measures of financial (Kaplan and Norton, 1996a; Kaplan and Norton, 1996b; Krivokapic and Jovanovic, 2009; Norreklit, 2000).

Recently, there are some survey studies integrated environmental indicators in the BSC and suggested that using the BSC is useful to understand the link between objectives and measures, improve performance, and implement the strategy (Dias-sardinha and Reijnders,2005; Krivokapic and Jovanovic, 2009; AL. Zwyalif, 2017).
However, previous balanced scorecard studies have focused solely on using the BSC for strategy evaluation and the majority of these studies are alleged which reflect the policy rather than the actual performance (Tayler, 2010). Thus far, studies integrated actual environmental indicators in the BSC to evaluate environmental strategy, but this part is still missing (Kaplan, 2009; Hoque, 2014). Therefore, it is unclear whether or not the environmental strategy improves the financial performance of companies (Solovida and Latan, 2017). Thus, the purpose of this chapter is to see whether the environmental strategy has positive impact on financial performance

from both investors and managers point of a view in terms of CO2 emission reductions for short and long-term. This analysis is carried out by using data for seventeen international petroleum companies for the period 2005-2016. The relationship between strategy indicators will be tested statistically as assimilation to the assumption of casual-effect in the BSC.

Furthermore, this study applied Porter's hypothesis that the ability of companies to engage in environmental strategy has a positive effect on environmental and financial performance and other researchers who suggests that eco-innovation improves operation process and reduce negative impact on environment which in turn improve financial performance (see Kaplan and Norton, 2004; Tello and Yoon, 2008; Thoumy and Vachon, 2012; Antonioli et al., 2013; Ramanathan et al., 2017, You et al., 2019). Based on the relevant discussions in the literature, the following model can be developed:

$$LCO_{2,\tau} = \beta_0 + \beta_1 \, LRD_\tau + \beta_2 \, LTR_\tau + \beta_3 \, LINV_\tau + \varepsilon_\tau \quad (5)$$

Where: y are ROE, and NI, $EC\ j,t = yi,\ t\text{-}1 - X\ i,\ t - \theta$, ϵ is the error correction, θ is the long-term coefficient, $\emptyset$ is the adjustment coefficient , X is a vector of independent variables; R&D,TR, INV, and CO2 emissions, β is the short-term coefficient of independent variables, λ is the short-term coefficient of dependent variable, i and t are represent company and time respectively, q is the number of lag for independent variables ,P is the number of lag for dependent variable, ϵ is the disturbance term.

7.1.2 Cross-sectional dependence test

The result of the CD test, as shown in Table 5 (in the previous chapter), indicates that the associated *p* values reject the null hypothesis of independent cross-sections for panel data. Henceforth, the second generation of panel unit root tests will be robust and sufficient for cross-sectional dependence issues.

Table 6: Cross-sectional dependence tests.

Variables	Breush-Pagan LM	Pesan-scaled LM	Perasan CD
LCO	1631.29(0.000)***	90.665(0.000)***	2.395(0.0166)**
LRD	1977.238(0.000)***	111.641(0.000)***	19.134(0.000)***
LTR	1070.357(0.000)***	56.653(0.000)***	4.282(0.000)***
LIN	1214.514(0.000)***	65.394(0.000)***	2.013(0.0441)**
LROE	2489.927(0.000)***	142.7278(0.000)***	44.1828(00.000)***

Note: ***, ** denote statistically significant at 1%, 5% respectively.

7.1.3 Panel unit root test result

With consideration the result of the CD test, I employed the CADF and CIPS tests. The null hypothesis whether the variables contain a unit root or not is tested. The result of the panel unit root tests is reported in Table 6 where shows all variables except LTR are stationary at I (1) at a 1% significance level. The LTR variable is stationary at I (0) at 1%, 5% significance level for the CADF and CIPS tests, respectively. This finding justifies the ARDL approach for co-integration because the variables are in a mixed order of co-integration. This means that the results are consistent with the general characteristics of most macroeconomic and financial variables. Now I am in the position to carry out a co-integration test to check for the presence of a long-term relationship between the variables.

Table 7: Panel unit root tests.

Variables	CADF		CIPS	
	Constant	Trend	Constant	Trend
LCO	-2.026	-2.542	-1.479	-1.903
LRD	-1.989	-2.433	-1.682	-2.003
LTR	-2.581***	-3.063***	-2.687***	-2.687**
LROE	-2.721	-2.993	-1.61	-1.235
LIN	-1.946	-2.063	-1.836	-1.760
ΔLCO	-4.609***	-4.705***	-4.569***	-4.578***
ΔLRD	-3.570***	-3.763***	-4.531***	-4.537***
ΔLTR	-4.094***	-4.132***	-4.409***	-4.465***
ΔLROE	-4.496***	-4.508***	-4.526***	-5.577***
ΔLIN	-3.263***	-3.495***	-4.334***	-4.526***

Note: ***, ** denote statistically significant at 1%, 5% respectively. Δ indicates first deference.

7.1.4 Panel co-integration test

Considering the result of the cross-section dependence test as well as the unit root tests, this leads to apply the second generation of co-integration developed by Westerlund and Edgerton (2007). The second-generation test has power in identifying the co-integration among panel time-series data in case of existing the cross-independence issue whereas it assumes that the null hypothesis has no co-integration. The results shown in table 7 demonstrate that the null hypothesis of no co-integration can be rejected in the two models where the P test shows that the p-value is (0.03 and 0.028) perceptively. This finding suggests that there is a long-term relationship running among the indicators of strategy at the 5% level. This result supports to interpret the coefficients of the strategy variables for both the long and short-term impacts by using the ARDL model.

Table 8: Panel co-integration tests

Statistic	Value	P-value	Value	P-value
	Model2		Model3	
Gt	-2.009	0.452	-1.935	0.57
Ga	-8.039	0.857	-3.008	1
Pt	-10.094	0.003	-9.095	0.028
Pa	-10.603	0.006	-7.628	0.197

All tests are applied constant and with trend. This table indicates the tests where p-values and bootstrap p-values are asymptotic normal distribution and bootstrap values. In this study, 800 bootstrap repeats are used.

7.1.5 Estimation the impact of CO2 emission reductions on ROE

Table 8 shows the evaluation of the impact of CO2 emission reductions on costumer perspectives (ROE). The Akaike Information Criteria (AIC) and Schwarz criterion were used to select the appropriate model. The result shows CO2 has direct positive impact on the ROE in long-term, while R&D and TR and have indirect a positive effect on the ROE in the long-term. This finding suggests that the increase in ROE is influenced by improvement in operational processes and the reduction in environment cost (tax, penalty) that related to CO2 emissions. This means that, in the long-run, a 1% increase in spending on R&D and TR increase ROE by 40 and 59.9% respectively, while reduction in CO2 emissions by 1% increase ROE by 67.3%. This suggests that the environmental strategy in terms of CO2 emission reduction has a significant benefit on ROE in the long-run. In spite of the decline in carbon emissions in the short term, its impact on ROE has occurred in the long-term because these companies, when they recognize that they will fail to met environmental standards, create a new item called deferred taxes which paid after compliance with the government.

The short-term estimation shows that the lagged error correction term is negative and significant, at 1%. The coefficient was -0.129 which suggests that the deviation from the long-term equilibrium of R&D, TR, and CO2 in one quarter is corrected by 12.9% over the following quarter.

This situation is consistent with Kaplan and Norton (1992), Porter hypothesis, Sharma and Vredenburg (1998), Aragon–Correa, Sharma (2003), Bhupendra and Sangle (2016), and Nishitani et al (2017), in which they indicate that applying environmental strategy at the company level improves financial performance in the long-run. Finding positive impacts running from R&D and TR to ROE, in the long run, because these companies invest a huge amount into eco-innovation and getting back the original investment may take a long time (see Kaplan and Norton, 1992). It should be noted that although the reduction of CO2 emissions happened in the short time, it impacts a cure in the long-term where these companies obey before paying CO2 taxes which may take time and its effect may happen in the following financial periods (see financial reports of chosen companies).

Table 9: Estimation the impact of CO2 emission reductions on ROE

Dependent variable		ROE
Independent Variables	Coefficient	t-Statistic
	Long Run Equation	
RD	0.400***	2.817856
TR	5.992***	4.551326
INV	-0.355	-1.76896
CO	-0.673***	-2.2865
	Short Run Equation	
COINTEQ01	-0.129***	-3.12712
D(RD)	0.191	0.378594
D(RD(-1))	-0.154	-1.07888
D(RD(-2))	0.227	1.22174
D(TR)	-1.905	-1.33026
D(TR(-1))	-0.727***	-2.28738
D(TR(-2))	-1.903	-1.62807
D(INV)	-0.034	-0.16
D(INV(-1))	-0.132	-1.28122
D(INV(-2))	-0.066	-0.34221
D(CO)	-0.102	-0.23067
D(CO(-1))	0.0644	0.256182
D(CO(-2))	-0.388	-0.68449
C	-0.937***	-3.1802

Note: ***, denote statistically significant at 1%.

In figure 8 and table 10, the diagnostic test of confidence ellipse is capture within the center of ellipse at 1% significant of level. Therefore this result is robust and can be served as the central part of a policy to reduce the negative impact on the environment in the short-term as well as enhance financial performance in the long-term.

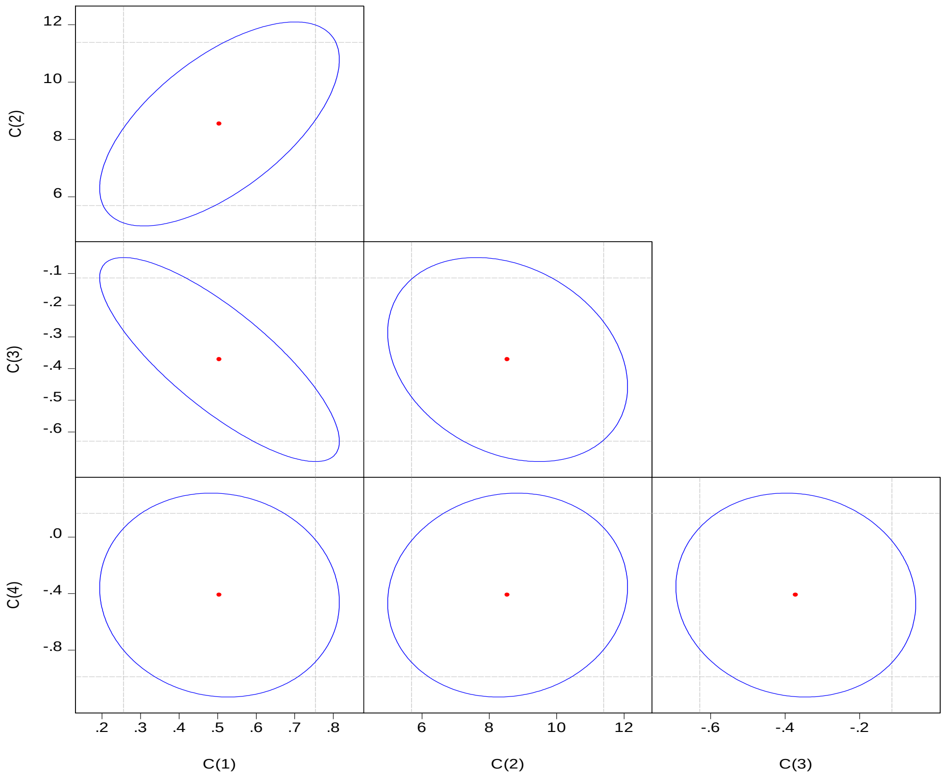

Figure 8: Coefficient diagnostic with confidence interval [Author's own calculations and plotting].

Table 10: Coefficient confidence intervals

Variable	Coefficients	Low	High
LRD	0.504766	0.177308	0.832223
LTR	8.541794	4.793932	12.28966
LINV	-0.371392	-0.710512	-0.032273
LCO	-0.410138	-1.619984	-0.349709

The estimated coefficients are calculated within the maximum and minimum points.

7.1.6 Estimation the impact of CO2 emission reductions on net income

The ARDL model is applied to estimate the variables in Equation 3. Table 4 shows the result of the estimation, which indicates that there is a positive and significant long-term impact running from TR and INV to NIN, at a 1% level whereas negatives and long-term relationship exists between CO2 and NIN, at a 1% significance level. This means that, in the long run, a 1% increase in spending on R&D and TR increase NIN by 13.5 and 2.5 % respectively, whilst a reduction in CO2 emissions by 1 percent increases NIN by 12.67 % in long-term. These findings suggest that financial benefit from environmental strategy in the long-run stems from improvement of internal operation in the short-run. The short-term estimation of RDL indicates that the lagged error correction term is negative and significant, at 1%. The coefficient of –0.157 which suggests that the deviation from the long-term equilibrium of environmental investment in one quarter is corrected by 15,7% over the following quarter. These findings support the Porter hypothesis and consist with arguments of Sharma and Vredenburg (1998), Aragon–Correa, and Sharma (2003), Bhupendra and Sangle (2016) and Nishitani et al., (2017) where they indicate that applying environmental strategy at company level improve financial performance in the long-run. Both R&D and TR have a negative and significant impact on NIN in the short-term. This situation is consistent with Kaplan and Norton (1992) which indicates that companies may need time to get back initial investment.

Table 11: Estimation the impact of CO2 emissions reductions on net income

Dependent variable		NIN
Independent Variables	Coefficient	t-Statistic
	Long Run Equation	
LRD	0.255	0.488659
LTR	13.545***	5.434383
LINV	2.583***	6.898688
LCO	-12.673***	-7.60363
	Short Run Equation	
COINTEQ01	-0.157**	-2.4359
D(LRD)	1.836	0.537713
D(LRD(-1))	-0.494	-0.24289
D(LRD(-2))	0.340	0.426961
D(LRD(-3))	-0.651	-0.31957
D(LRD(-4))	10.540**	2.118707
D(LRD(-5))	-3.764**	-1.72716
D(LTR)	-6.802	-0.63037
D(LTR(-1))	-16.652**	-2.55577
D(LTR(-2))	-2.816	-1.10919
D(LTR(-3))	-3.030	-1.67773
D(LTR(-4))	6.821	0.561696
D(LTR(-5))	4.963	0.623483
D(LINV)	-1.898	-1.02283
D(LINV(-1))	2.762	2.290517
D(LINV(-2))	-0.654	-0.92607
D(LINV(-3))	1.261	1.440063
D(LINV(-4))	-5.401	-1.332
D(LINV(-5))	2.590	1.570791
D(LCO)	0.010	0.001045
D(LCO(-1))	10.600	1.238021
D(LCO(-2))	-2.483	-0.87502
D(LCO(-3))	-0.345	-0.16824
D(LCO(-4))	-7.605	-2.15847
D(LCO(-5))	0.196	0.026408
C	-2.387	-2.20752

Note: ***, ** denote statistically significant at 1%, 5% respectively.

As shown in figure 9 and table 12, the result of the ARDL estimation shows that coefficients (R&D, TR, and CO2) are suitable for explaining the impact of environmental strategy on NIN, where captures within the center of the ellipse at 1% significant level. Hence, this implies the important of eco-innovation activity to explain the reduction of CO2 emissions in the short-term which in turn enhance financial performance in the long-term.

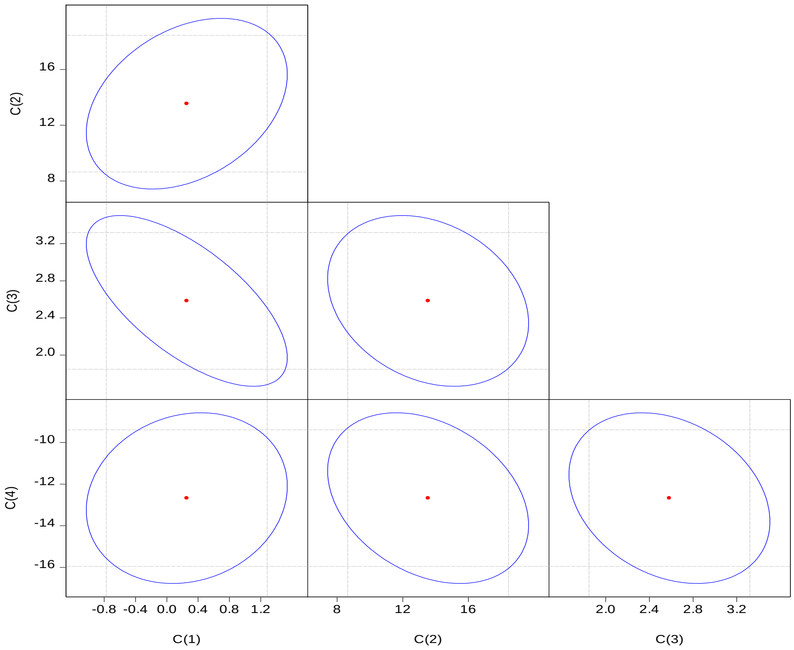

Figure 9: Coefficient diagnostic with confidence interval [Author's own calculation and plotting].

Table 12: Coefficient confidence intervals

Variable	Coefficients	Low	High
LRD	0.255348	-1.097628	1.608325
LTR	13.54582	7.091986	19.99965
LINV	2.583261	1.613724	3.552798
LCO	-12.67345	-16.98901	-8.357898

The estimated coefficients are calculated within the maximum and minimum points.

Chapter 8

CONCLUSION, POLICY IMPLICATION AND LIMITATION

8.1 Conclusion

The implement environmental strategy at the company level has a positive effect on both environmental and financial performance as the results of good operation processes (Porter and Van der Linde, 1995). The studies that analyze the actual performance of an environmental strategy still missing (Garica-Granero et al., 2018). In this thesis, I argue that implementation of environmental strategy under the terms of CO2 emission reductions at the company level can improve both actual environmental and financial performance through the role of both the Porter hypothesis and the BSC assumption. Based on dynamic analysis of panel data for seventeen international petroleum companies over the period 2005–2016, the findings of this thesis support both the Porter hypothesis and the BSC assumption, which indicate that environmental strategy has a direct and positive impact on environmental performance on short-term whereas an indirect and positive impact on the financial performance in long-term. These findings consist with the Porter's arguments that environmental strategy improves environmental performance in the short-term which reflects the improvement of financial performance in the long-term (Porter and Van der Linde, 1995). The findings are also consistent with the argument of Kaplan and Norton (2004) which shows that implementing strategy improves operational processes in short term and this improvement takes longer time to improve financial performance because these companies need some time to get back the initial investment in eco-innovation activities (Kaplan and Norton, 2004).

The empirical analysis of this thesis provides strong evidence that eco-innovation activities as a critical factor of strategy (R&D, TR, and INV) improve environmental performance in the short-term trough improving operational processes. Improving environmental performance leads to improve in financial performance in the long-term.

The first empirical study in this thesis considers all indicators of the strategy that provide a deep understanding of the mechanism of the strategy and how petroleum companies can improve both environmental and financial performance. Furthermore, this study reveals that investment in training has high rates of impact on environmental performance. Such a finding has good implications for human resource departments planning their training budgets as well as for top management in prioritizing budgetary resources for eco-innovation initiatives.

Due to data limitations, this thesis focused only on seventeen petroleum companies and seven indicators were used to evaluate environmental strategy in terms of CO2 emission reductions. This may provide only limited insights into the evaluation of environmental strategy.

However, findings of the study highlight that implementing an environmental strategy at the company level has positive impacts on companies' performance. Consequently, these findings could be a good reference for both policy implications as well as environmental strategy since it provides new empirical evidence on the importance of implementing environmental strategy at the company level to improve both environmental and financial performance. The finding of the research could be used as a reference for implementing an environmental strategy to encourage companies to integrate environmental issues into operation process planning for continuous improvement. More importantly, the implementation of environmental strategy could be applied in other sectors that emit to improve their performance.

Considering the research's findings, future researchers may be conducted to investigate the existence of causality between various indicators of strategy to determine the contribution of each indicator for continual improvement in both environmental and financial performance. This study could have been done on other sectors that aimed to improve their environmental performance with consideration of the differences in the sector that may lead to different indicators that response to strategy implementation.

8.2 Policy implication and limitation

Considerations should be made of the limitations of this study when applying its recommendations and when designing future studies on the subject. Initially, due to data limitations, this thesis focused only on seventeen companies within the petroleum sector that aim to reduce CO2 emissions from the operation process. This may provide only limited insights into the effects of eco-innovation on CO2 emissions and our result cannot be easily extrapolated to other industries that aim to reduce pollution emissions. So, further studies are more likely to replicate this research in this thesis when they employ different strategy's key indicators in the different sectors or industries. This kind of differences in industries or sectors should be considered otherwise the policymakers may be misguided about the implications.

Second, this thesis does not create a link between the reduction of CO2 emissions and the strategic target. Thus, it’s not clear whether the strategy is successful or not and future research may establish a link to target a successful strategy.

The findings of the thesis support the Porter hypothesis and BSC assumptions, which mention that applying the environmental strategy at the company level has positive impacts on CO2 emission reductions in the short-term, which in turn enhances financial performance in the long-term. This means that increased investment in environmental strategy activities leads to a lowered impact on the environment at the same time improves financial performance. There for, thesis results provide new empirical evidence for the importance of spending on eco-innovation at the company level to improve both environmental and financial performance. Consequently, these findings have significant policy implications for petroleum companies where the past strategy should be followed with more investment in the future for more improvement in both the environmental and financial performance, by reallocating and controlling their resources optimally in the beginning stages. Additionally, the findings are encouraging in terms of justifying the decisions of giving companies a wider breath when it comes to environmental laws, which may harm the company’s financial performance. More importantly, the implementation of a CO2 reduction strategy could be applied in the other polluted sectors that emit large amounts of CO2. This thesis also suggests that there may be a possible link between Porter's hypothesis and the EKC framework, warranting further investigation by researchers and policymakers and there is a possibility to link between the reduction of CO2 emissions and the strategic target in the future investigation’s research.

However, it is interesting to note that our findings highlight the significance of implemented the environmental strategy's activities which have positive impacts on CO2 emission reductions in the short-term, which in turn enhances financial performance in the long-term. Consequently, these findings have significant policy implications for petroleum companies' managers to allocate and control their resources optimally to achieve the aim of said strategy since it provides new empirical evidence for the importance of spending on eco-innovation at the company level to improve both the environmental and financial performance. More importantly, the implementation of a CO2 reduction strategy could be applied in the other polluted sectors that emit large amounts of CO2. This thesis also suggests that there may be a possible link between the Porter's hypothesis and the EKC framework, warranting further investigation by researchers and policy makers.

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