**Abstract**

 This paper aims to examine the relationship between environmental management and SMEs performance. In order to investigate this relationship, the study adopts General Methods of Moments (GMM) on a sample of 201 quoted Small and Medium Enterprises (SMEs) on the United Kingdom (UK) Alternative Investment Market (AIM) from 2011 to 2016. Consistent with our prediction based on contradictory results of existing studies, the study documents that corporate investment channel through which efficient environmental management translates into superior SME performance. In particular, we find a non-monotonic (inverted U-shaped) relationship between environmental management and financial performance, which suggests that SMEs have an optimal environmental management level that maximises their performance. We find the predictability to be stronger among small firms, and relevant on only internal performance, Return on Assets (ROA).

1. **Introduction**

Environmental sustainability is an area of increasing concern for governments, corporations, policymakers and consumers throughout the world (Gregory-Smith, Manika and Demirel, 2017). Climate change is seen as a threat to environmental sustainability and sustainable environmental practices such as reduction of greenhouse gas (GHG) is considered a significant part of mitigating climate change (Andersson, 2020). Accordingly, the Office for National Statistics (2015) the adoption of sustainable environmental practices contribute over £23.6 billion and 357,200 to the UK’s GDP and employment, respectively. It is argued that businesses that integrate environmental objectives into their organisational strategy are considered as implementing sustainable business models (Lüdeke-Freund and Dembek, 2017; Dijkstra, van Beukering and Brouwer, 2020). However, while the contribution of sustainable environmental practices in many developed economies such as the UK has been tremendous, over the previous and current decade, business practitioners and researchers have debated over the potential impact that proactive environmental practices can have on businesses (Conlon and Glavas, 2012).

Ilinitch, Soderstrom and Thomas (1998) stated that environmental performance comprises both internal and external efforts and principles regarding environmental issues. They indicated that internal systems, external stakeholder relations, minimising external impacts and compliance with environmental regulations are environmental performance indicators to deal with environmental issues. Emphasising on stakeholder integration of environmental performance, Perez and Sanchez (2009) indicated that environmental reporting provides a useful avenue for organisations to communicate their environmental policies and achievements. In terms of approaches toward environmental performance, Endrikat, Guenther and Hoppe (2014) identified both reactive and proactive approaches. Whereas reactive approach which involves making efforts to comply with regulations and minimising the cost of compliance occurred in the 1980s during the 1990’s proactive approach emerged where corporations recognised the need to anticipate the environmental impact of their business practices and take measures to reduce negative impact ahead of regulations. Whereas in some countries such as China the approach to deal with environmental issues are pursued from institutional and governance point of view, in Western countries such as the UK, companies are empowered to take a proactive approach towards the environment (Guttman *et al.*, 2018; D’Souza *et al.*, 2020). Corporations in advanced countries are now incorporating environmental management practices as part of their strategy to enhance financial performance. Cutting-edge firms are going beyond pollution prevention and exploring new opportunities to develop green products and services to improve financial performance. Thus, corporations are promoting sustainability practices intending to enhance their financial performance (Gallego-Álvarez, Segura and Martínez-Ferrero, 2015). This development has been emphasised by Miroshnychenko, Barontini and Testa (2017) that the past few decades have witnessed the adoption of new environmental solutions by many corporations in an attempt to obtain competitive success or external legitimacy through the adoption of sustainable environmental practices.

The debate on the potential impact of proactive environmental practices on business performance has emerged from both theoretical and empirical point of view, and the results have been contradictory (Gallego-Álvarez et al., 2015). While some arguments support the view that proactive environmental practices can enhance economic value, others have argued that it instead generates an extra cost to the business. The advocates of a negative relationship between environmental and financial performance mainly originate from neoclassical economists such as Friedman, (1970). They argued that environmental legislations, including technological standards, environmental taxes, and emission permits compel firms to allocate resources such as labour and capital for pollution control. From a business point of view, this is considered unproductive and hence argued for a negative relationship between environmental and financial performance.

 The negative relationship arguments have also been elucidated by Ambec *et al.* (2013) that technological standards, for instance, limits the flexibility of technology or inputs into the production process. They indicated that taxes as well as emission permits are additional costs to the firm and hence proposed negative relationship between environmental and financial performance. These theoretical arguments have been supported by some empirical finding (e.g. Freedman and Jaggi, 1992; Cordeiro and Sarkis, 1997; Wagner, 2005; Qiu et al., 2016) which found a negative relationship between proactive environmental practices and financial performance in line with the neoclassical arguments.

On the other hand, the revisionists, including Porter (1980), argued that proactive environmental practices enhance financial performance. Porter (1980) explained that one best way for organisations to achieve a competitive advantage in pursuing a low-cost strategy. Where environmental performance has a significant impact on costs should result in an increase in profitability realised through internal accounting-based performance measures such as ROA. It is argued that improved standards of environmental performance reduce operational and regulatory cost such as regulatory scrutiny, emission charge and enhance financial performance in the long-term (Porter and Linde, 1995; Sambasivan, Bah and Ho, 2013; Lee and Min, 2015). Where environmental issues are integrated into the development of new products, it results in the creation of new opportunities such as opening new technologies, new and product arenas (Dangelico, Pontrandolfo and Pujari, 2013; Miroshnychenko et al., 2017). In support of this view, many studies have confirmed that proactive environmental performance enhances financial performance (e.g. Russo and Fouts, 1997; Christmann, 2000; Clemens, 2006; Trummp and Guenther, 2017).

 The aforementioned conclusions drawn from the above studies naturally raises some questions. Is the relationship between proactive environmental practices always linear (positive or negative relationships)? To what extent do proactive environmental practices impact on financial performance? Are there any differences between environmental and financial performance of small, medium and large companies? The rationale for this paper is to answer these questions.

To address these research questions, the study adopts a dynamic panel regression on a sample of 201 quoted SMEs on the UK Alternative Investment Market (AIM) from 2011 to 2016. In this paper, we argue that the contradictory evidence on the relationship between proactive environmental practices and financial performance suggests the possibility that the relationship could be virtualised as non-linear, with the expected relation positive for lower of environmental engagement and negative at high levels. Consistent with our prediction, the study documents that corporate investment channel through proactive environmental management translates into superior SME performance. Specifically, the study found a non-monotonic (inverted U-shaped) relationship between environmental management and financial performance, which suggests that SMEs have an optimal environmental management level that maximises their performance. Specifically, the results show that an additional pound (£) invested in environmental engagement is significantly worth more at the lower level but worth less at, the higher level due to the inherent cost. An excessive level of environmental commitment reduces firms' performance. Therefore, a reduction in cost is expected to results in increasing returns. It has been found that excessive level of environment engagement or complex pollution-reducing devices and processes may reduce overall production efficiency and thus raise costs and thereby experiencing decreasing returns (Bosch et al., 1998). However, in the case of the market-based measure of performance, Tobin’s q, we found a significant negative relationship with an environmental performance for smaller companies. The lack of a significant relationship between environmental management performance (EMP) and FP could represent theoretical inconsistencies (stakeholder mismatching). It is argued that there is no theoretical underpinning that explains why stakeholders would reject or not invest in firms that are highly ranked in pollution control (Wood and Jones, 1995; Albertini, 2013). Also, larger firms may face stakeholder pressure to invest in proactive environmental practices. In the case of SMEs, there is limited regulatory scrutiny and less pressure from stakeholders hence limited reaction from the market in response to the disclosure of sustainable environmental practices by SMEs.

The study, therefore, makes the following contributions. First, the paper contributes to studies on environmental and financial performance relationships by demonstrating that the relationship between environmental management practices and financial performance could be non-linear. Given that, the existing literature has both reported potential benefits and cost of proactive environmental engagement on firm performance; the study argues that the relationship may be complicated than just reporting positive and negative association according to extant studies (Wagner, 2005; et al., 2016). Like studies by Trumpp and Guenther (2017), this study complements existing studies by providing a possible explanation for the contradictory results on the relationship between proactive environmental practices and firm performance. However, unlike Trump and Guenther (2017) findings which related to only large listed companies in manufacturing and service industries, this study extends the non-linear relationship argument to SMEs engaged in different sectors. To the best of our knowledge, no study has demonstrated such a relationship among SMEs.

Second, the paper for the first time established the level of environmental engagement that is most financially beneficial for AIM listed firms to engage in proactive environmental practices. Although Ramathan (2016) and Trumpp and Guenther (2017) recognised that companies that engaged in a higher level of environmental practices experienced increased returns, they did not establish the maximum point that is the maximum level that it is most beneficial to engage in proactive environmental practices. However, it is unlikely that continuous improvement in sustainable environmental practices will generate increasing returns in perpetuity. Therefore, establishing the point where it will be most beneficial to engage in proactive environmental practices will assist AIM listed firms particularly SMEs who is known to face resource poverty, policymakers and business practitioners to determine the extent to which resources could be deployed in pursuance of sustainability to enhance value.

Third, the paper also for the first-time sheds more-light on the level of heterogeneity that exists between small, medium and large firms in the UK Alternative Investment Market (AIM) when pursuing sustainable environmental practices. This is unlike the existing studies which either focused on only SMEs or large listed companies without drawing any distinction between the two.

The rest of the study is organised as follows: The next section discusses the two main theories that underpinned the studies, the Natural Resource-based View and the Stakeholder theory. This is followed by a discussion of the empirical literature and the research hypothesis in the third section. The fourth section deals with the sample selection technique, the variables and the regression models. Section five presents the research findings, and discussions from an empirical and theoretical point of view while the last section discusses conclusions, contributions and the limitations of the study.

1. **Literature Review and Research Hypothesis**
	1. **Theoretical Review of Environmental and Financial Performance**

The study has adopted two main theories, the natural resource-based view (NRBV) and the stakeholder theory to explain the relationship between environmental and financial performance. The resource-based view (RBV) assumes that the resources of a firm are divergently distributed, and the distribution is also long-lasting (Wernerfelt, 1984; Barney, 1991). Firm resources have also been classified by Russo and Fouts (1997) and Wernerfelt *et al.*, (2010) as both tangible and intangible, namely physical capital, human capital as well as organisational capital. The (RBV) is based on the predictions that valuables and costly to imitate resources of the firm provide key sources of sustainable competitive advantage (Hart, 1995). Extending the RBV, Hart (1995) introduced the natural environment to the resource-based view. Hart (1995) argued that considering the scale of ecological problems over the last 40 years, the omission of the natural environment from RBV has made the theory incomplete hence need to insert environment into the resource-based view.

Hart (1995) suggested three ways in which the natural environment could be used to create sustainable competitive advantage as pollution prevention, product stewardship and sustainable development. He advocated that pollution prevention minimises emissions and waste, results in continuous improvement and lowers costs. In terms of product stewardship Hart (1995) averred that it reduces the life cycle cost of the products, enhances stakeholder integration and prevent competition whereas sustainable development may involve pursuing an environmental strategy that severs the negative links between the environment and economic activity such as a reduction in the consumption of materials and energy.

 Following Hart (1995), Russo and Fouts (1997) documented that resources that are unique, valuable and inimitable should meet the societal demands and therefore resources that address a cleaner environment will establish legitimacy with the society. Once legitimacy is found, it will improve their competitiveness due to higher patronage of their products and consequently impact positively on profitability. Establishing more link on how resources influence environmental and financial performance relationships, Russo and Fouts (1997) reiterated that environmental policy that depends on pollution abatement through short-term end-of-pipe approach usually fails to achieve regulatory compliance and improve profitability. However, when firms go beyond compliance mode to focus on pollution prevention by employing efficient methods that concentrate on resource reduction and process innovation it affects the firm ability to generate profit. It is argued that in order to respond to the natural environment and achieve long-term success, corporations must accumulate resources and also manage capabilities with a focus on the longer term and not just focus on short-term profits at the detriment of the environment (Lee and Min, 2015).

 Concerning stakeholder theory, it has been argued that stakeholders can influence the activities of an organisation by exerting pressure on them and as competition increases improved stakeholder relationships could also be beneficial to the firms (Kassinis and Vafeas, 2006). Freeman (1984) strong advocate of stakeholder theory postulated that companies usually generate externalities which affect both internal and external stakeholders. The externalities cause the stakeholders to exert pressure on companies to reduce negative environmental impacts and increase positive ones. Responding to stakeholder pressure helps the organisation to establish legitimacy with the stakeholders which enhance the firm reputation and help gain a competitive advantage with a consequence of improved financial performance. It has been argued that meeting the economic and legal responsibilities of shareholders may be anchored through corporate social and environmental responsibilities (Fassanya and Onakoya 2013). As indicated by Freeman (1984), an organisation’s commitment to operating in an economically and environmentally responsible manner while acknowledging the interest of its stakeholders will, in the long run, enhance financial performance. It has been suggested that businesses that pursue better sustainable environmental practices improve their brand image, are trusted by the stakeholders, achieve higher efficiency and enhance reputation which may result in improved performance ((Fasanya and Onokoya, 2013).

In line with Wood and Jones (1995), Trumpp and Guenther (2017) also indicated that when firm practices reduce environmental impacts, it is observed by stakeholders, it enhances the firm’s reputation. Firms with good environmental reputation may not only attract environmentally conscious consumers or stakeholders but listed firms may also benefit from green investors and drive share prices and market value of the firms. Brouwers, et al. (2014) have also confirmed that firms can enhance their financial performance by meeting stakeholder’s needs through the implementation of sustainable environmental practices. They argue that whilst regulations only offer a benchmark through which environmental performance are measured, the disclosure of proactive environmental practices reinforces positive stakeholder effect of environmental sustainability practices

Therefore, a combination of the natural resource-based view and stakeholder theory provides a strong theoretical basis to understand the association between environmental and financial performance relationships.

* 1. **Environmental Management Practices and Firm Performance**

Two main views have been expressed by the studies on environmental and financial performance relationships. Those that support positive relationship argument aver that proactive environmental measures provide cost-based competitive advantage which influences financial performance. Porter (1980) explained that one best way for organisations to achieve a competitive advantage in pursuing a low-cost strategy. Where environmental performance has a significant impact on costs, it should result in increased in profitability realised through internal accounting-based performance measures such as ROA. It is argued that improved standards of environmental performance reduce cost as regulatory scrutiny, emission charge, community pressure, and regulatory sanctions are reduced.

 Hart (1995) indicated that pollution prevention and product stewardship could result in competitive advantage through “first-mover” strategy in emerging green-oriented products. In the view of Hart (1997) whereas pollution prevention enables significant cost savings to be achieved in terms of pollution control, environmental and financial performance relationship is also largely enhanced through efficient input and energy consumption as well as reuse and recycling. Positive advocates for environmental and financial performance relationships found environmental stewardship derive greater benefits than those that only aimed at complying with regulations. The benefits are derived through personnel benefits (higher staff morale, higher staff retention and improved communication), operating efficiency (avoidance of fines, reduce waste, lower insurance, higher energy efficiency). External benefits such as enhanced corporate image, competitiveness, the attraction of investors and customer loyalty are also derived by pursuing environmental stewardship (Cordeiro and Sarkis, 1997).

Arguing from how proactive environmental practices can be used to create competitive advantage, Butler et al. (2011) emphasised that sustainable environmental practices may increase product differentiation in the marketplace thereby enhancing organisational image to customers and as a result increase profitability. Such arguments have been confirmed in many empirical studies. Notably, Russo and Fouts (1997) drawn on the resource-based view on a sample of 243 firms observed over two years using independently developed environmental ratings and concluded that firms that invest in pollution prevention, although adding to risk also have a higher prospective return.

Similarly, Christmann (2000) also used the resource-based view argument and revealed that competences for process innovation and implementation are complementary assets that moderate the relationship between best practices and cost advantage which is an important factor in determining performance. Carter et al. (2000), however, used the perception-based study to test the relationship between environmental purchasing and firm performance and revealed that environmental purchasing is positively associated with firm performance. Melnyk et al. (2003) concentrated on SMEs and used ISO 14001 certification as an environmental performance measure and survey questionnaire as data collection methodology. It was found that firms that have formal EMS certification experience achieved a greater impact in many dimensions of operational performance. Clemens (2006) study was also conducted on SMEs focussing only on the scrap yard industry in the US. The study established that there is a significant positive relationship between green economic incentives and financial performance.

Montobon et al. (2007) employed content analysis and regression analysis to test the win-win hypothesis of Porter. They confirmed that pollution is a sign of inefficiency as better environmental performance is beneficial for firms. López-Gamero et al. (2009) also concentrated on small and medium-sized hotel industries in Spain and using perception-based. Their study concluded that resources are relevant to competitive advantage and financial performance, but whereas cost-based competitive advantage influences the financial performance of high polluting firms, the influences on the service sector relates to differentiation competitive advantage.

 A more recent study by Trumpp and Guenther (2017) based on a sample of 2361 international firms found a non-linear relationship between environmental and financial performance. It concluded that environmental and financial performance relationships might be positive, negative or neutral, depending on the explanatory variable, environmental performance. Whereas the study confirms U-shaped relationships between environmental and financial performance for companies in both the manufacturing and service industries based on accounting-based measures, the U-relationship between carbon performance and stock market performance was only significant in the manufacturing industries. Thus, there is a negative relationship between environmental and financial performance for companies with low environmental performance and positive relationships for companies with high environmental performance. Martínez-Ferrero and García-Sánchez (2017) also used a sample of 1410 international firms from 2007-2014 that attached assurance statements to their sustainability reports. The study found that companies that attached voluntary assurance to their sustainability reports have significantly lower costs than those firms with no assurance statements.

 While many theoretical arguments and empirical findings have supported the view that proactive environmental management practices may result in “win-win” situation by reducing environmental pollution and at the same time improve financial performance, others have expressed a contrary view. Building on Friedman’s (1970) trade-off hypothesis they argue that when firm pursue proactive environmental practices, it impacts negatively on financial performance because the economic benefits that are generated are lower than the costs (Preston and O’Bannon, 1997). Moreover, Trumpp and Guenther (2017) explained that stakeholder expectation, on the one hand, can generate improved company’s reputation through better stakeholder responsiveness and improve financial performance. However, they emphasised that enhanced environmental performance for the satisfaction of stakeholders can generate extra costs as it is not likely to economically internalise all benefits from sustainable environmental practices and negatively affect the link between environmental and financial performance.

 The link between environmental and financial performance could also result from the lack of understanding on the part of the investors on the potential social consequences (Gilley *et al.*, 2000). They suggested that investors may be interested in product-driven environmental initiatives which directly impact on cost and profitability rather than embracing process-driven initiatives which could be achieved through the spillover effect from the product-driven initiatives. Proactive environmental measures may also take time for the benefits to be realised, thereby increasing uncertainty about outcomes on the part of the investors (Khanna and Damon, 1999; Aiyub *et al.*, 2009). Furthermore, Hart and Milstein (1999) emphasised that the resulting impact of sustainable environmental practices on financial performance pertains in many cases to long-term competitiveness.

 Findings from many empirical studies have also supported the negative relationship arguments. Freedman and Jaggi (1992) study disclosed a negative association between pollution performance and economic performance. It explained that the market ignores the expected better performance in the long-run resulting from the effects of pollution reduction activities. Similarly, Cordeiro and Sarkis (1997), based on a sample of 523 US firms, concluded that there is a negative relationship between environmental proactivism and industry analyst’s earnings per share performance forecasts. Also, Khanna and Damon (1999), based on panel data from 1988-1993, revealed a negative relationship between environmental and financial performance based on a short-term measure of financial performance return on investment. Their findings support the view that investment in efficient environmental practices may only be realised in the long-term, as the costs may not be fully offset in the short-term.

 Showing more support for the negative relationship between improved environmental practices and financial performance is Wagner's (2005) study was concentrated on firms in four European countries involving UK, Italy, Germany and Netherlands in the pulp and paper industry. Based on two environmental strategies, end of pipe pollution prevention strategies (input-based index) and emission-based index, it was discovered that for emission-based index there is a predominantly negative relationship between environmental and economic performance, but in the case of the input-based index, there is no significant link. This study, therefore, provides strong indications that the choice of strategy towards proactive environmental activities is a strong determinant of the relationship between environmental and financial performance and this has been confirmed in many studies (e.g. Busch and Hoffmann, 2011)

 Adding to the negative or no relationship argument based on market-based measures is Qiu et al. (2016). Whereas Hart and Ahuja (1996) argued that environmental disclosures could confer competitive advantage such as strong reputation to a firm, Qui et al. (2016) study which was based in the UK covering FTSE 350 index from 2005-2009 showed that environmental disclosures have no effect on financial performance, but rather it is social disclosures which matter most to investors.

Based on the conflicting evidence, positive and negative findings, a non-linear relationship is expected, which could be u-shaped or inverted u-shaped. The hypothesis below is, therefore formulated:

**H1:** There is a non-linear relation between environmental and financial performance: A positive relation at a lower level of environmental management and negative relation at a higher level of environmental management.

However, whereas it is expected that in the in case of internal measure of performance (ROA) moderate level of environmental engagements may generate a positive impact on financial performance, in the case of market-based measure (Tobin’s q) we do not expect similar results for both SMEs and larger companies. First, it is asserted that to develop pollution prevention strategies that can generate investors’ attention and significantly impact on financial performance require a substantive investment which SMEs are unlikely to afford. Qui et al. (2016) argued from the resource-based view and social disclosure theory that firms with greater resources make more extensive disclosure which generates net positive economic benefits. Larger companies make enhanced environmental disclosure and most cases engaged in environmental management systems such as ISO 14001, which is more visible and has a higher tendency to signal environmental conscious investors.

Aside from the argument from natural resource-based view, others have also argued based on the stakeholder view on why proactive environmental practices of smaller companies are not likely to enhance the market value. Hoejmose et al. (2012), for instance, indicated that SMEs are a heterogeneous community of firms and suggest that environmental engagements between small and medium and large firms are significant. They emphasised that large firms significantly engage more with environmental initiatives, particularly with respect to corporate and marketing. Medium firms also, to a greater extent, promote their environmental practices both internally and externally, while smaller firms are only embedded with their local community. Therefore, while it is likely for environmental efforts of a larger firm to be visible to investors due to enhanced communication, this may not be the case for SMEs. Their environmental efforts may only be recognised by the local community, which is unlikely to participate in the stock market.

Larger companies also face more intense regulatory and stakeholder pressure to improve their environment than smaller firms. For instance, while Defra (2013) guidance makes it mandatory for large listed companies to disclose their emissions from Greenhouse Gases (GHG), this is not mandatory for SMEs. It has also been emphasised that SMEs typically have not been subjected to the same regulatory scrutiny as larger firms and only react to intense external pressures from external stakeholders whom they have relationships (Spence et al., 2012).

Proactive environmental measures may also take time for the benefits to be realised, thereby increasing uncertainty about outcomes on the part of the investors (Khanna and Damon, 1999; Aiyub *et al.*, 2009). Freedman and Jaggi (1992) study, for instance, disclosed negative association between pollution performance and economic performance and explained that the market ignores the expected better performance in the long run resulting from the effects of pollution reduction activities.

Therefore, while we expect that the environmental activities of larger companies will have a significant positive impact on the market, we do not expect to achieve the same for smaller and medium-sized companies, and therefore the hypothesis below is formulated.

**H2**: The size of the firm positively moderates the relationship between proactive environmental practices and firm performance.

1. **Sample construction and empirical methods**
	1. **Definition of SMEs**

In line with the research objective to measure the corporate environmental performance and financial performance of companies listed on AIM, all the three categories of companies, small, medium and large companies were selected from the Alternative Investment Market (AIM) from 2011 to 2016. Although many definitions of SMEs have been proposed, the European Commision (2015) definition which is mainly based on the number of employees was adopted because of universality, and in line with many other studies on environmental and financial performance relationships (e.g. Aiyub et al., 2009) This is indicated on table 1 below:

|  |  |  |  |
| --- | --- | --- | --- |
| **E Enterprise Category** |  **Number of** **Employees** | **Annual Turnover**  | **A Annual Balance** **S Sheet Total** |
|  **Medium-sized** |  < 250 |  ≤€50 million |  ≤€43 million |
|  **Small** |  < 50 |  ≤€10 million |  ≤€10 million  |
| **M Micro** |  < 10 |  ≤€2 million |  ≤€2 million |

Source: European Commission (2015)

**3.2 Sample Selection**

Out of a total of 1049 companies listed on AIM as at February 2016 spread across 26 different industries, 201 firms that consistently disclose their environmental performance were selected. This resulted in 1206 firm-year observation for the 6-year panel from 2011 to 2016. Less polluting firms, mainly banks, financial services, real estate investment trusts and real estate investment services were also not included (Konar and Cohen, 2001). Ntim and Soobaroyen (2013) also indicated that such companies should be excluded as they are subject to different disclosure and regulatory requirements. Firms that were also included consistently disclose their environmental performance. This is in line with disclosure theory that there is a positive link between environmental performance and environmental disclosure as inferior firms are unlikely to disclose their lack of environmental engagement (Gómez-Bezares et al., 2017).

**3.3 Variables**

 **3.3.1 Dependent Variables (Corporate Financial Performance)**

Existing studies on environmental and financial performance relationships have used different measures of financial performance with no consensus on appropriate standards of financial performance (Cochran and Wood, 1984). However, the wide range of financial performance falls into two categories, accounting returns and investor returns (market-based measures). Under the accounting-based measures, ROA was employed in the study as it is considered as the most effective and broad measure of performance (Hagel *et al.*, 2013). Afrifa and Tauringana (2015) have also argued that ROA is widely used as a measure of profitability because they provide a strong indication of management performance in relation to a given resource.

In the case of market-based measure, Tobin’s q was employed as it provides additional information relating to risk face by shareholders identifies whether the shares of the company are overvalued or undervalued. Tobin’s q was also employed in line with many studies on environmental and financial performance relationships (e.g. Trumpp and Guenther, 2017). These financial performance data were obtained from the Amadeus and Fame Database. Although, SMEs do not usually disclose such financial data, listed SMEs similarly to firms listed on the main markets are required to produce audited financial statements from which such financial data could be extracted. The financial data from Amadeus and Fame were also confirmed with the audited financial statements contained in the annual reports of the selected companies.

**3.3.2 Independent Variables (Environmental Performance of Measures)**

The importance of well-defined environmental performance measures helps business to implement strategies by linking the various levels of the organisation business with clearly defined targets and benchmarks. On the contrary, many of the existing studies have used one or a few environmental performance measures instead of well-defined performance guidelines such as Ilinitch et al. (1998) and Defra (2013) indicators. For instance, Clemens (2006) survey questionnaire on environmental performance only relates to green investment. Similarly, Earnhart and Lizal (2007) and Wagner (2005) used only pollution rating as an environmental performance measure. Klassen and McLaughlin (1996) also used only environmental awards, whereas Filbeck and Gorman (2004) and Naila (2013) used only environmental regulations. Based on Defra (2013) guidelines, environmental performance measures (independent variables) used in the study is a composite of Energy, Waste, Greenhouse gases, Material and Resource Efficiency, Compliance and Stakeholder Engagement. This is summarised in appendix 1. The reason for using multiple environmental performance indexes as the performance assessment tool is to offer a broader framework, which could be adopted for future studies. Unlike most of the existing studies which employed one or few performance measures (e,g. Filbeck and Gorman, 2004; Earnhart and Lizal, 2007; Naila, 2013).

Content analysis was used to obtain environmental management performance measures (independent variables) as seen in the case of Montobon (2007). Content analysis is a technique of coding content or text of a piece of writing into categories based on selected criteria. The criteria used in the content analysis is in line with Aburaya, (2012), which is sentenced on ensuring that disclosure item is expressly stated and properly classified. Five performance criteria were expected from each environmental performance indicator listed above and dichotomous process in which an item score 1 if it is disclosed and zero if it is not disclosed in line with Cooke (1989) was adopted. While this approach is consistent with many studies on EMP and FP relationships (e.g. Chithambo and Tauringana, 2014), Cooke (1989) argued that this method is more appropriate because unlike scale disclosure no weight is attached to disclosure item and the subjective weight of user groups will average out. The process of screening different variables is shown in appendix 2.

 **3.3.3 The Control Variables**

 Variables that are held constant to estimate the relationship between the other variables is termed as control variables. The control variables selected which are in line with existing studies and their justifications are outlined: Control of firm size is relevant due to the possible existence of economies of scale inherent in socially and environmentally oriented investment (Clemens. 2006; Elsayed and Paton, 2009). Clemens (2006) argued that control of size is essential as differences could exist between the sizes of small firms. Industry effect impact on profitability (e.g. Hart and Ahuja, 1996; Russo and Fouts, 1997; Horváthová, 2012).The degree of financial leverage impact on earnings (Cordeiro and Sarkis, 1997). In the case of liquidity, it is argued that shortening the cash conversion cycle can improve profitability (García-Teruel and Martínez-Solano, 2005).

 Aside from company-specific factors used as control variables, corporate governance variables, namely Board size, the number of non-executive directors and CEO remuneration, were also employed. Large board size affects coordination and negatively affect performance (Shakir, 2008). Outside non-executive directors assist objective evaluation of management and help control and monitor opportunistic behaviour which improves performance. Mura (2007) found that a large proportion of non-executive directors has a significant positive impact on performance. Executives are motivated most when their compensation is closely tied to performance indicators (Walker, 2010). A table which presents the definition of the dependent, independent and the control variables is shown in appendix 1.

**3.4 Regression Model and Specification**

**3.4.1 Econometric Specification**

The study employed dynamic panel models using the generalized method of moments (GMM) approach (Arellano and Bond, 1991) to estimate the relationship between environmental management performance and financial performance. This estimation approach which uses system GMM estimator has the benefits of controlling for the endogeneity of the individual explanatory variables, control for the non-observable constant heterogeneity arising out of the specific features of each firm that remain over time. Additionally, it also improves the efficiency of econometric estimates as it allows the introduction of more relevant instruments. The study adopted the first difference GMM approach to control for firm-specific, time-invariant effects and the possible endogeneity of the regressors. For the GMM estimates to be valid there should be no second-order serial autocorrelation in the residuals and on the validity of the instruments analysed: In view of that, the study reports both the first- (AR1) and the second-order (AR2) test for serial correlation, which is asymptotically distributed as a standard normal under the null of no serial correlation of the differenced residuals. Additionally, the study also reports the Hansen test for over-identifying restrictions that confirms the validity of the selected instruments. All these conditions have been satisfied in all our estimations. The model is given below:

$γ\_{i,t}=β\_{0}+β\_{1 }γ\_{i,t-1}+β\_{2 }X\_{i,t}+ β\_{3}Z\_{i,t}+ λ\_{t}+V\_{i}+ ε\_{i,t}$

$γ\_{i,t}$ represents a firm performance measured by ROA and Tobin’s;Xi,t is a matrix of the main independent variable, Environmental Management Performance. Z is a vector representing the control variables (Firm Size (Size), Liquidity (Liquidity), Financial Leverage (Gearing), Board Size (BoardSize), Board Independence (NEDS) and CEO Remuneration (CEORem). The$ V\_{i}$ is the unobserved firm effects (fixed effects), the parameter $ λ\_{t} $is the time dummy variable; $ ε\_{it}$ is the error term.

1. **Empirical Results**
	1. **Descriptive Statistics**

 Table 1 shown below provides summary statistics of all companies listed on Alternative Investment Market in the UK and table 2, 3 and 4 also provide summary statistics for small, medium and large companies respectively. In the case of all companies listed on AIM mean ROA was 0.07 (7%), while the Tobin’s q was 1.835. Also, whereas smaller companies have mean ROA of 0.00036 (0.0365%) medium and large companies have ROA 0.0139 (1.39%) and 0.133 (13.3%) respectively.

 **Table 1 Descriptive Statistics - Aggregate 2011 - 2016 for all Sampled Companies**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) |  (6) |  (7) | (8) |
| VARIABLES | N | mean | Sd | min | Max | Median | Skewness | Kurtosis |
|  |  |  |  |  |  |  |  |  |
| ROA | 1,044 | 0.0700 | 0.158 | -0.920 | 0.835 | .0659  |  -.823 | 6.774 |
| TBQ | 897 | 1.835 | 2.821 | 0.120 | 40.58 | .63  |  7.266 | 79.518 |
| EMPS | 1,184 | 7.421 | 5.604 | 0 | 28 |  6 |  1.204 | 4.0768 |
| Energy | 1,184 | 0.854 | 1.425 | 0 | 5 |  0 |  1.721 | 4.885 |
| GHG | 1,183 | 0.884 | 1.427 | 0 | 5 |  0 |  1.696 | 4.979 |
| Waste | 1,182 | 0.799 | 1.208 | 0 | 5 |  0 |  1.689 | 5.462 |
| Stake | 1,183 | 0.570 | 0.943 | 0 | 5 |  0 |  2.070 | 7.960 |
| Materials | 1,183 | 1.149 | 1.553 | 0 | 5 |  0 |  1.166 | 3.145 |
| Compliance | 1,183 | 3.172 | 1.485 | 0 | 5 |  3 |  -.369 | 2.307 |
| Size | 1,090 | 460.7 | 795.2 | 1 | 5,611 | 139  |  3.031 | 13.532 |
| Liquidity | 1,147 | 3.705 | 8.907 | 0.0100 | 170.3 | 1.33 |  8.968 | 129.041 |
| Gearing | 1,122 | 47.29 | 70.42 | 0 | 844.3 | 25.85 |  4.572 | 35.677 |
| Board Size | 1,107 | 6.034 | 1.936 | 0 | 13 |  6  |  .332 | 3.442 |
| NEDS | 1,107 | 3.333 | 1.494 | 0 | 11 |  3 |  .751 | 4.196 |
| CEO Rem | 1,064 | 336,710 | 280,220 | 12,000 | 3731302 | 254447.5 |  3.771 | 31.781 |

**Table 2 Descriptive Statistics 2011 - 2016 for Small Companies**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| VARIABLES | N | mean | sd | min | Max | Median | Skewness | Kurtosis |
|  |  |  |  |  |  |  |  |  |
| ROA | 233 | 0.00336 | 0.179 | -0.750 | 0.455 | 0 | -.542 | 4.542 |
| TBQ | 251 | 2.655 | 4.172 | 0.168 | 40.58 | 1.32 | 4.796 | 34.877 |
| EMPS | 346 | 4.971 | 3.684 | 0 | 22 |  4 |  1.850 |  7.828 |
| Energy | 346 | 0.283 | 0.769 | 0 | 5 | 0 | 3.521 | 16.401 |
| GHG | 346 | 0.353 | 0.856 | 0 | 5 | 0 | 2.807 |  11.490 |
| Waste | 345 | 0.409 | 0.845 | 0 | 4 |  0 |  2.158 | 6.746 |
| Stake | 346 | 0.434 | 0.818 | 0 | 5 | 0 | 2.392 |  9.783 |
| Materials | 345 | 0.478 | 0.997 | 0 | 5 | 0 | 2.191 | 7.091 |
| Compliance | 346 | 3.017 | 1.383 | 0 | 5 | 3 | -.241 | 2.500 |
| Size | 318 | 21.90 | 15.08 | 1 | 74 | 19  | .735 | 3.003 |
| Liquidity | 329 | 7.229 | 14.10 | 0.0100 | 170.3 | 2.54  | 6.057 | 59.577 |
| Gearing | 317 | 40.34 | 95.78 | 0 | 844.3 |  12.99 |  5.177 | 34.066 |
| Board Size | 342 | 5.143 | 1.888 | 0 | 11 | 5 | .122 | 3.070 |
| NEDS | 342 | 3.012 | 1.516 | 0 | 7 | 3 | .622 | 3.334 |
| CEO Rem | 329 | 218,027 | 154,142 | 12,000 | 908,363 | 174981.6 | 1.562 | 5.745 |

**Table 3 Descriptive Statistics 2011 - 2016 for Medium-sized Companies**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| VARIABLES | N | mean | Sd | min | Max | Median | Skewness | Kurtosis |
|  |  |  |  |  |  |  |  |  |
| ROA | 398 | 0.0439 | 0.156 | -0.920 | 0.423 | .0539 | -1.344 | 8.168 |
| TBQ | 325 | 1.419 | 1.496 | 0.130 | 12.13 | .916 | 3.113 | 16.451 |
| EMPS | 423 | 7.203 | 5.670 | 0 | 25 | 5 |  1.319 |  4.217 |
| Energy | 423 | 0.870 | 1.454 | 0 | 5 | 0 | 1.690 | 4.737 |
| GHG | 423 | 0.934 | 1.515 | 0 | 5 | 0 | 1.664 | 4.698 |
| Waste | 422 | 0.822 | 1.254 | 0 | 5 | 0 | 1.815 | 5.955 |
| Stake | 422 | 0.436 | 0.767 | 0 | 4 | 0 | 1.732 | 5.337 |
| Materials | 423 | 1.161 | 1.566 | 0 | 5 | 0 | 1.167 | 3.172 |
| Compliance | 422 | 2.991 | 1.478 | 0 | 5 | 3 | -.240 | 2.331 |
| Size | 410 | 168.3 | 163.1 | 1 | 1,475 | 130.5 | 4.156 | 26.211 |
| Liquidity | 410 | 3.119 | 6.622 | 0.0600 | 93 | 18.585 | 8.684 | 101.609 |
| Gearing | 402 | 39.78 | 59.98 | 0 | 495.9 |  6  | 3.291 | 17.728 |
| Board Size | 392 | 6.235 | 1.865 | 3 | 13 |  3 |  .594 |  3.592 |
| NEDS | 392 | 3.293 | 1.477 | 0 | 10 | 3  | .988 | 4.602 |
| CEO Rem | 380 | 312,628 | 266,490 | 42,568 | 3731302 | 240668.3  | 6.656 | 75.902 |

**Table 4 Descriptive Statistics 2011 - 2016 for Large Companies**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| VARIABLES | N | mean | Sd | min | Max | Median | Skewness | Kurtosis |
|  |  |  |  |  |  |  |  |  |
| ROA | 413 | 0.133 | 0.120 | -0.268 | 0.835 |  .1087  |  .688 |  5.370 |
| TBQ | 321 | 1.614 | 2.382 | 0.120 | 37 | 1.29  |  10.927 | 155.38 |
| EMPS | 415 | 9.684 | 5.955 | 0 | 28 |  9  |  .701 | 3.125 |
| Energy | 415 | 1.313 | 1.634 | 0 | 5 | 1 | 1.082 | 2.919 |
| GHG | 414 | 1.278 | 1.574 | 0 | 5 | 1 | 1.155 | 3.286 |
| Waste | 415 | 1.099 | 1.323 | 0 | 5 | 1 | 1.201 | 3.857 |
| Stake | 415 | 0.819 | 1.135 | 0 | 5 |  0 |  1.757 | 6.227 |
| Materials | 415 | 1.694 | 1.700 | 0 | 5 | 1 | .620 |  2.085 |
| Compliance | 415 | 3.484 | 1.526 | 0 | 5 | 4 | -.673 | 2.434 |
| Size | 362 | 1,177 | 1,047 | 23 | 5,611 | 1474 | 1.730 | 5.796 |
| Liquidity | 408 | 1.453 | 1.925 | 0.0300 | 17.85 | 1.025  | 5.248 |  35.070 |
| Gearing | 403 | 60.25 | 52.60 | 0 | 376.5 | 49.074 | 2.038 | 9.007 |
| Board Size | 373 | 6.641 | 1.754 | 3 | 12 | 6 |  .692 | 1.754 |
| NEDS | 373 | 3.670 | 1.422 | 0 | 11 | 4 | .824 | 4.938 |
| CEO Rem | 355 | 472,479 | 324,879 | 40,000 | 2634262  | 371000  | 2.292 |  12.121 |

 The profit trend identified clearly supports the assertions that profitability is influenced by the firm size and that larger companies are more profitable than smaller ones (Tingbani, 2015). In the case of Tobin’s q, the mean value was 1.83, with a minimum value of 0.120 and maximum of 40.58 suggestion variations in the market value of the firms listed on AIM. The environmental management performance (EMP) measures also follow a similar trend as the ROA as environmental practices of large companies as given by the mean value was higher than both small and medium-sized companies. This supports the arguments advanced by Martínez-Ferrero and García-Sánchez (2017) that large companies are likely to adopt higher assurance system of environmental practices as they are more susceptible to public scrutiny and institutional pressures.

 In relation to the control variables, there were considerable variations in the size of companies represented by the number of employees which gives a minimum of 1 to a maximum of 5611. In the case of liquidity, although all the companies revealed a strong liquidity position of more than 3 times, the summary statistics revealed that smaller companies tend to have a stronger liquidity position, with larger companies showing the weakest liquidity position. In the case of risk tolerance represented by gearing, it was lower for the SMEs than the large companies.

 Table 5 also presents the bivariate correlation between all the variables employed in the study. In all circumstances, although the correlation between most of the variable revealed a significant relationship, there was no case where correlation co-efficient exceeded 0.80 between dependent and independent variable or between independent variables. This suggests that multicollinearity was not an issue as VIF computed gives the highest value of 1.93 with a mean value of 1.

**Table 5: Correlation Matrix**

Table 5 reports the correlation coefficients for all continuous variables adopted in estimating the relationship between environmental management performance and financial performance. Variables are defined as follows: return on assets (ROA), Tobin’s q (TBQ), Environmental Management Performance (EMP), Energy Efficiency Practices (Energy), Greenhouse Gases (GHG), Waste Management (Waste), Stakeholder Engagement (Stake), Material and Resource Efficiency (Mat), Compliance to environmental regulations (COMP), Firm Size (Size), Liquidity (Liquidity) Board Size (B Size), Number on non-executive directors (NEDs) CEO Remuneration (CEO Rem), Firm Growth (Growth) and Cash and Cash Equivalents (Cash).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ROA |  TBQ |  EMPS | Energy | GHG | Waste | Stake |  Mat | Comp |  Size | Liquidity | Gearing | B Size | NEDS  | CEO Rem | Growth | Cash |
| ROA | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TBQ | 0.116\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EMPS | 0.493\* | -0.036 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Energy | 0.372\* | -0.032 | 0.748\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| GHG | 0.396\* | -0.017 | 0.797\* | 0.585\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| Waste | 0.354\* | -0.023 | 0.719\* | 0.443\* | 0.516\* | 1 |  |  |  |  |  |  |  |  |  |  |  |
| Stake | 0.303\* | 0.019 | 0.546\* | 0.269\* | 0.534\* | 0.293\* | 1 |  |  |  |  |  |  |  |  |  |  |
| Mat | 0.379\* | 0.009 | 0.780\* | 0.552\* | 0.537\* | 0.544\* | 0.285\* | 1 |  |  |  |  |  |  |  |  |  |
| Comp | 0.240\* | -0.09\* | 0.544\* | 0.190\* | 0.276\* | 0.214\* | 0.291\* | 0.227\* | 1 |  |  |  |  |  |  |  |  |
| Size | 0.253\* | -0.048 | 0.335\* | 0.242\* | 0.283\* | 0.223\* | 0.210\* | 0.212 | 0.184\* | 1 |  |  |  |  |  |  |  |
| Liquidity | -0.137 | 0.115\* | -0.117 | -0.14\* | -0.11\* | -0.11\* | -0.003 | -0.13\* | 0.018 | -0.18\* | 1 |  |  |  |  |  |  |
| Gearing | 0.05 | 0.046 | 0.054 | 0.054 | 0.047 | 0.001 | -0.001 | 0.059\* | 0.044 | 0.163\* | -0.14\* | 1 |  |  |  |  |  |
| B Size | 0.167\* | -0.026 | 0.138\* | 0.132\* | 0.119\* | 0.071\* | 0.148\* | 0.073\* | 0.044 | 0.125\* | -0.12\* | 0.053\* | 1 |  |  |  |  |
| NEDS | 0.092\* | 0.016 | 0.088\* | 0.047 | 0.026 | 0.061\* | 0.069\* | 0.034 | 0.129\* | 0.076\* | 0.03 | -0.008 | 0.697\* | 1 |  |  |  |
| CEO Rem | 0.175\* | -0.026 | 0.222\* | 0.208\* | 0.259\* | 0.097\* | 0.117\* | 0.168\* | 0.048 | 0.334\* | -0.07\* | 0.059 | 0.270\* | 0.196\* | 1 |  |  |
| Growth | -0.022 | 0.036 | -0.024 | -0.019 | 0.001 | -0.214 | -0.017 | -0.012 | -0.022 | -0.018 | 0.074\* | -0.04 | 0.026 | 0.034 | 0.046 | 1 |  |
| Cash | 0.001\* | -0.001 | 0.105\* | 0.104\* | 0.169\* | 0.025\* | 0.058 | 0.046 | 0.023 | 0.314\* | 0.036 | 0.019 | 0.124\* | 0.107\* | 0.230\* | 0.099\* | 1 |

Significance levels (\*) are designated between 1% and 10%.

**4.2 Environmental Management Performance and Financial Performance**

 This section examines the impact which proactive environmental practices have on financial performance by employing both accounting and market-based measures. Dynamic panel regression model (GMM) was employed to model the relationship. The results for the relationship between environmental management practices and financial performance is presented in Table 6.

**Table 6: Dynamic (GMM) Panel Regression of Environmental Management Performance**

 **and Financial Performance**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |   |   |
| VARIABLES |  | (ROA) | (Tobin’s q) |
| EMP |  | 0.0182\* |  0.301\* |
|  |  | (1.94) |  (1.93) |
| EMP2 |  | -0.000711\* |  -0.0118\* |
|  |  | (-1.72) |  (-1.83) |
| L.ROA |  | 0.253\*\*\* |   |
|  |  |  (3.28) |  |
| L.Tobin’s q |  |  |  -0.132 |
|  |  |  |  (-0.92) |
| Size |  | -0.0569\* |  1.430\* |
|  |  | (-1.97) |  (-1.79) |
| Liquidity |  | -0.000174 |  0.00826\*\* |
|  |  | (-0.29) | (2.37) |
| Gearing |  | 0.0696 |  0.145 |
|  |  | (0.69) | (0.74) |
| Board Size |  | 0.0237\* |  0.0121 |
|  |  | (1.73)  | (0.74) |
| NEDS |  | -0.0165 | 0.0600 |
|  |  | (-0.89) | (0.37) |
| CEORem |  | -0.00921 | 0.755 |
|  |  | (-0.29) | (131) |

 AR (1) test (p-value) 0.000 0.000

 AR (2) test (p-value) 0.943 0.110

Hansen Test of Overidentification (p-value) 0.229 0.935

Number of Observations 503 622

The AR(1) and AR(2) tests for first-order and second-order serial correlation in the first differenced residuals. The null hypothesis is no serial correlation. The Hansen test of over-identifying restrictions is a test with the joint null hypothesis that instrumental variables are valid, i.e. uncorrelated with error terms. Robust z-statistics are used. \* Denote significance at the 10% level, \*\* Denote significance at the 5% level, \*\*\*Denote significance at the 1% level. All variables are defined in table 1 of the appendix.

 Both model 1(ROA) and 2 (Tobin’s q) confirmed hypothesis 1 that proactive environmental practice is value-enhancing as it revealed a significant positive relationship between environmental management practices and financial performance. This is in line with many studies on environmental and financial performance relationships (e.g. Russo and Fouts, 1997; Christmann, 2000; López-Gamero, Molina-Azorín and Claver-Cortés, 2009; Martínez-Ferrero and García-Sánchez, 2017) that also confirmed a significant positive relationship between environmental and financial performance. In addition, both model 1 and 2 confirms the prepositions that proactive environmental practices and financial performance could be non-linear. It revealed an inverted u-shaped relationship where improve level of environmental engagement enhance the economic value of the firm until it reaches the maximum where any further improvement results in declining profits. This finding is in line with Trumpp and Guenther (2017) study which also found a non-linear relationship for large international companies.

 Regarding the control variables, whereas size negatively impacts on ROA, it has a significant positive impact on Tobin’s q. Also, while higher liquidity did not reveal any significant influence with ROA, it indicated that investors are very interested in firms with good liquidity hence significant impact with Tobin’s q. Large board size also has a significant positive effect on the internal measure of performance ROA but seemed to have no significant influence on the market value.

**4.2.1 Reason for the Non- Linear Relationship**

The increasing portion of the inverted U-shaped curve confirms stakeholder acceptance of sustainable environmental management practices and in line with the assertion of a win-win situation (Lankoski, 2000). Firms that can organise their resources more efficiently may be able to achieve higher returns than comparing to less organised firms. Barney (2001) indicated that the differences in firm’s performance result from the heterogeneity of its resources. A firm that can develop unique and innovative environmental resources is likely to achieve superior financial outcome associated with the competitive advantage that is derived from those unique resources. Although reactive and moderate level of sustainability practices may result in some improvement in financial performance, Hart (1995) provided three key sources of competitive advantage from sustainable practices that can help the firm to achieve improved financial performance. These are pollution prevention, product stewardship, and sustainable development. Pollution control measures are considered as simple end-of-pipes solutions, which are usually provided by third parties and can be easily implemented. Action from pollution prevention, for instance, may reduce cycles times as unnecessary steps in the production process are removed. Hart (1995) again, argued that pollution prevention strategy has the potential to bring emission well below legal requirements and as a result, reduce a firm’s compliance and liability costs. Therefore, we argue that pollution prevention action may lead to sustain competitive advantage and assist the firm in achieving increasing returns. However, basic end-of-pipe environmental technologies aim at pollution control rather than prevention may be quickly competed away and reach their maximum benefit, thereby resulting in decreasing returns.

 **Similarly,** Ramanathan (2016) indicated that pollution prevention measures involving redesigning of the manufacturing process could lead to less consumption of energy and have a significant effect on financial performance than simply end-of-pipe technologies. Endrikat et al. (2014) also aver that a strategic approach in dealing with environmental issues significantly determines EMP and FP relationships. In line with King and Lennox’s (2002) arguments, they documented that proactive approach to environmental sustainability practices is more likely to be linked with superior financial performance, hence increasing returns, than end-of-pipe approaches.

 Vijfvinkel, Bouman and Hessels (2011) also reiterated that some of the key motivations for firms to engage in sustainable environmental management practices are financial opportunities, the threat of financial loss, and intrinsic motivation to contribute to the sustainability. Vijfvinkel et al. (2011) argued that green practices are valued by society and therefore, willing to pay a premium for them, thereby creating business opportunities. However, they explained that the link between environmental performance and financial performance is not expected to be linear as opportunities to improve financial performance from environmental sustainability practices should be limited to some point. They indicated that becoming more sustainable may negatively affect the financial position of the firm as opportunities that are derived from proactive environmental engagement might be exhausted.

**4.3 The extent which Sustainable Environmental Practices influence Financial Performance**

 The computation and figure 1 presented in the appendix shows the extent to which proactive environmental management practices can positively impact financial performance. Although some existing studies (e.g. Nollet et al., 2016; Trumpp and Guenther, 2017) have identified a non-linear relationship between proactive environmental practices and financial performance, they do not indicate the actual level where sustainable environmental practices might be beneficial. This study provided additional evidence by establishing maximum or minimum levels, where it is more beneficial to engage in proactive environmental practices. Based on the results from the regression model, integral calculus is used to establish the maximum or minimum points.

**ROA = β1EMP + β2EMP2 + Controls**

EMP\* = β1/[2\*β2]

 =0.0182/ [2\*0.000711]

 = 13 (12.79)

As the β2 is negative, this involves establishing a maximum point. Therefore, the optimal point where further addition to environmental management performance falls is 13. The shape of the curve under the accounting-based measure of performance for the AIM-listed firms is, therefore, inverted U-shaped.

 

The results which confirm our hypothesis 1, indicates that the optimum benefits for proactive environmental practices for AIM listed firms are derived at 13 out of the maximum of 30. Firms listed on Alternative Investment Market, engaging a higher level of proactive environmental practices may, therefore, be wasting resources as moderate level seemed to be generating the maximum benefits.

**Tobin’s q = β1EMP + β2EMP2 + Controls**

EMPS = β1/[2\*β2]

 =0.301/ [2\*0.0118]

 = 13 (12.75)

As β2 is negative, the maximum point under Tobin Q for AIM listed companies is 13. Similarly, to ROA, which was also inverted U-shaped, implying proactive environmental management practices for AIM listed companies initially increases until it reaches the maximum of 13 where any further improvement in environmental practices results in decreased market value. Thus, a moderate level of environmental engagement is required to establish a positive link with financial performance for both internal measures of performance and market value. This is presented in fig 2 in the appendix.

 

**4.4 Implications of firm heterogeneity: size**

 To test our hypothesis 2, we conducted a further analysis by determining the implications of firm heterogeneity in terms of firm size on the relationship EMP and FP. In order to achieve this, we split the data into small, medium and large companies and employed GMM to analyse the relationships. The results support our hypothesis 2. Thus, while results revealed a positive relationship between EMP and Tobin’s q, for larger companies, it did not identify any significant relationship between EMP and the market value (Tobin’s q) of smaller companies. In the case of medium-sized companies, similar to larger companies, also revealed a significant positive relationship between EMP and the market value. Regarding the accounting-based measure of performance, small, medium and large companies all revealed consistent results and in line with all companies listed on AIM indicated that proactive environmental management practices positively impact on internal measures of performance.

 **Table (7) Dynamic (GMM) Panel Regression of Environmental Management Performance and Financial Performance of Small, Medium and Large Companies**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | ROA |  Tobin’s q | ROA | Tobin’s q | ROA |  Tobin’s q  |
| VARIABLES |  (Small) | (Small) | (Medium) | (Medium) | (Large) |  (Large) |
| EMP |  0.00658\* | -0.01 | 0.0714\*\* |  0.0267\*\* | 0.00744\* | 0.0327\*\* |
|  |  (1.86) | (-0.40) | (2.20) |  (2.26) |  (1.98) |  (2.52) |
| L.ROA |  0.551\*\*\* |  | 0.552\*\*\* |   |  0.306\*\*\* |  |
|  |  (6.97) |  | (7.19) |  |  (3.05) |  |
| L.Tobin’s q |   |  0.663\*\*\* |  |  0.708\*\*\* |  | 0.466\*\*\* |
|  |  |  (4.85) |  | (8.57) |  |  (4.68) |
| Size |  0.000189 | 0.00744 | -0.00165 | 0.106 |  0.0155 |  0.00333 |
|  |  (0.02) | (1.16) | (-0.12) |  (1.09) |  (1.56) |  (0.05) |
| Liquidity |  -0.00807 | -0.00801 | -0.000917\*\*\* |  0.161\* |  0.00706 |  0.00674 |
|  |  (-0.99) | (-0.47) | (-2.59) | (2.05) | (1.25) |  (0.11) |
| Gearing |  -0.000404 | -0.00821 | 0.0000278 | -0.00522 | -0.00971 |  -0.0782\* |
|  |  (-0.24) | (0.71) | (0.17) | (-1.49) | (-0.81) |  (-1.70) |
| Board Size |  0.00126 | -0.0437 | 0.00735 | -0.0555 | 0.0452\*\*\* |  0.118\* |
|  |  (1.31) | (0.35) | (0.82) | (-1.10) | (3.09) |  (1.91) |
| NEDS |  -0.0122 | 0.196 | -0.119 | 0.0616 | -0.0269 |  -0.104\* |
|  |  (-1.00) | (1.27) | (-1.09) | (1.02) |  (-1.50) |  (-1.65) |
| CEO Rem |  0.000501 | -0.163 | 0.00163 | 0.00000377 | -0.0303 |  0.148\* |
|  |  (0.22) | (-0.68) | (0.074) | (-1.03) | (-1.29) |  (1.65) |
|  |  |  |  |  |  |  |

AR (1) test (P-value) 0.000 0.000 0.001 0.007 0.003 0.002

AR (2) test (P-value) 0165 0.094 0.096 0.486 0.660 0.618

Hansen Test of Overidentification 0.806 0.761 0.801 0.999 0.961 1.00

Number of Observation 267 180 286 208 256 214

The AR(1) and AR(2) tests for first-order and second-order serial correlation in the first differenced residuals. The null hypothesis is no serial correlation. The Hansen test of over-identifying restrictions is a test with the joint null hypothesis that instrumental variables are valid, i.e. uncorrelated with error terms. Robust z-statistics are used. \* Denote significance at the 10% level, \*\* Denote significance at the 5% level, \*\*\*Denote significance at the 1% level. All variables are defined in table 1 of the appendix.

 The results also support the initial argument of the study that there is likely to be some heterogeneity of environmental and financial relationship between small, medium and large companies. The findings also support the conventional arguments from the existing studies that SMEs lack resources to pursue sustainable environmental management practices and therefore unlikely to benefit financially, (Aragón-Correa *et al.*, 2008). This may not be particularly true in all areas of performance. As revealed by the results of the study, although the relationship between EMP and Tobin’s q is negative, the link is positive in the case of EMP and ROA. Therefore, SMEs that implement superior environmental management practices may also improve their financial performance through strategic characteristics of SMEs (Aragon-Correa *et al.*, 2008).

 Clemens (2006) also discovered that higher levels of environmental engagements are linked to the superior financial performance of small firms. Clemens (2006) explained that smaller firms could achieve competitive advantage by pursuing certain environmental improvements that could lead to other spin-off benefits to their operations. It is emphasised that while decreasing waste could generate many cost savings, in line with stakeholder theory, Clemens (2006) echoed that marketing of green-oriented products might improve the relationship with larger customers and enhance financial performance as well.

 Similarly to the findings of Aragon-Correa et al. (2008), the study provides support to the natural resource-based view by showing that SMEs can also employ superiors environmental management practices as a unique resource to enhance their financial performance. Therefore organizational capabilities are censorious for both small and large firm’s strategies. Confirming the position of Aragón-Correa *et al.* (2008), Hamann *et al.* (2017) emphasised that small and medium-sized firms can relate their personal environmental proclivities as they have direct control on operations and as a consequence able to adopt pollution abatement measures to enhance financial performance.

 The analysis of environmental management practices and financial performance relationship for AIM listed firms based on the size of the companies also show that in the case of smaller firms, the strength of the relationship is weak compared to larger companies. Concerning the Tobin Q, a significant negative relationship was identified between environmental management performance and financial performance of smaller firms, although medium and larger firms revealed significant positive relationships. This result may be explained from both the theoretical and empirical point of view. Based on the resource-based view, Barney (2001) emphasized that the differences in firms’ performance come from resource heterogeneity. As larger firms have different assets with unique features, they are in a position to exploit the financial benefits from sustainable environmental practices in contrast to smaller firms which are normally constraint by resources. Leonidou, Christodoulides and Thwaites (2016) aside revealing a positive relationship between environmental management and financial performance of SMEs, the study also emphasised that the link between EMP and FP is stronger when the firm has adequate resources and capabilities. On a similar study on SMEs’ environmental management practices and financial performance, Aiyub *et al.* (2009) discovered that although smaller companies obtain financial savings similarly to medium and larger firms, the smaller the firm, the lesser the financial savings. Rasi, Abdekhodaee and Nagarajah (2010) also cited instances where environmental engagements by smaller and medium-sized firms may not have a significant impact on financial performance. They reiterated that although most SMEs undertake environmental management practices, including the adoption of ISO 14001, these environmental practices are not translated into operations. Rasi et al. (2010) noted that both product-based and process-based environmental management approaches are lower than, and not fully reflected in their operations. Outsiders, particularly investors, may not realise the financial benefits of such environmental intervention and therefore may not react positively.

**4.3 Robustness Test**

 Finally, as a robustness check, the study employed different financial performance measures. Earnings Per Share (EPS) and Market Value were as used proxy for accounting-based and market-based, respectively instead of ROA and Tobin’s q. The results presented in table 9 revealed significant positive impact between EMP on both internal measure of financial performance (EPS) and market-based measure of performance (Market Value). This results, which is consistent with our initial results, also support our hypothesis 1. Thus, the findings of the study provide strong support for the various empirical findings and theoretical arguments that have advocated that proactive environmental practices enhance the economic value of the firm ((Porter and Linde, 1995; Clemens, 2006; Aragon-Correa *et al.*, 2008; López-Gamero, Molina-Azorín and Claver-Cortés, 2009).

**Table 8 Dynamic (GMM) Panel Regression of Environmental Management Performance**

 **and Financial Performance**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |   |   |
| VARIABLES |  | (EPS) |  (Mkt Value) |
| EMP |  | 0134\*\* |  0.145\*\* |
|  |  | (2.34) |  (2.34) |
| EMP2 |  | -0.00456\*\* |  -0.00513\* |
|  |  | (-2.18) |  (-1.74) |
| L.EPS |  | -0.0675 |   |
|  |  |  (-0.50) |  |
| L.Mkt Value |  |  |  0.0358 |
|  |  |  |  (0.38) |
| Size |  | -0.422 |  0.490 |
|  |  | (-1.12) |  (1.62) |
| Liquidity |  |  -0.00839\*\*\* |  0.292\*\*\* |
|  |  | (-3.84) | (3.31) |
| Gearing |  | 0.0206 |  -0.166\* |
|  |  | (0.29) | (-1.72) |
| Board Size |  | 0.0940 |  0.0558 |
|  |  | (0.90)  | (0.52) |
| NEDS |  | 0.0868 | -0.0926 |
|  |  | (0.85) | (-0.67) |
| CEORem |  |  0.779\*\*\* | -0.0658 |
|  |  | (2.80) | (-0.23) |

 AR (1) test (p-value) 0.003 0.006

 AR (2) test (p-value) 0.767 0.809

Hansen Test of Overidentification (p-value) 0.992 0.453

Number of Observations 212 444

The AR(1) and AR(2) tests for first-order and second-order serial correlation in the first differenced residuals. The null hypothesis is no serial correlation. The Hansen test of over-identifying restrictions is a test with the joint null hypothesis that instrumental variables are valid, i.e. uncorrelated with error terms. Robust z-statistics are used. \* Denote significance at the 10% level, \*\* Denote significance at the 5% level, \*\*\*Denote significance at the 1% level. All variables are defined in table 1 of the appendix.

1. **Conclusions, Implications and Suggestions for Future Research**

 A various argument on environment and ozone layer depletion suggest that proactive environmental practices have taken centre stage in many governments and corporate discussions (Gregory-Smith et al., 2017; Andersson, 2020). Climate change is considered a threat to environmental sustainability, and corporations, governmental and non-governmental institutions are encouraged to pursue sustainable environmental practices in an attempt to save the environment. Various theoretical arguments including RBV and NRBV suggest that financial performance could be enhanced by incorporating environmental sustainability practices into firm’s production process or as part of its business strategy (Dijkstra et al., 2020). However, evidence from existing empirical studies on sustainable environmental practices and financial performance relationships have reported mixed findings, positive relationships (e.g. López-Gamero et al., 2009; Trumpp and Guenther, 2017) and negative relationships (e.g. Wagner, 2005; Qiu et al., 2016). We argue that the existence of positive and negative findings suggests that there could be a non-linear relationship. Therefore we tested EMP and FP relationships based on a non-linear model from companies selected from the Alternative Investment Market in the UK which has not been considered by the existing studies.

 Based on a sample of 201 listed companies from the Alternative Investment in the UK, the study found that companies that employed sustainable environmental management practices improve their financial performance based on both accounting and market-based measures. Specifically, an inverted u-shaped relationship between environmental management performance and financial performance for both accounting-based and market-based were discovered. Thus, in line with the arguments from Vijfvinkel et al., (2011), we conclude that moderate level of environmental sustainability practices is likely to enhance financial performance than the excessive level of environmental engagement. EMP and FP relationships were also found to be stronger for larger firms than the smaller firms, similarly to Aiyub *et al.* (2009).

 Evidence from our GMM estimation suggests that proactive environmental practices improve financial performance. As shown by Lopez-Gamero et al. (2009), proactive environmental measures provide cost-based competitive advantage which influences financial performance. Similarly, Earnhart and Lizal (2010) opined that improved measures of environmental performance reduce cost as regulatory scrutiny, emission charge, community pressure, and regulatory sanctions are reduced. The study in line with Trumpp and Guenther (2017) contributes to the stakeholder theory by showing that the positive influence of environmental and financial performance is depicted by stakeholder’s expectation as sustainable environmental practices beyond mere compliance improved fulfilment of stakeholder’s expectation. Porter (1980) also explained that one best way for organisations to achieve a competitive advantage in pursuing a low-cost strategy. Where EMP has significant impact on costs should result in increased profitability realised through internal accounting-based performance measures such as ROA. Butler et al. (2011) emphasised that sustainable environmental practices may increase product differentiation in the marketplace, thereby enhancing organisational image to customers and as a result, increase profitability. Among small, medium and large companies, we found that environmental and financial performance relationship strengthens with size. This confirms the findings of Hoejmose et al. (2012) that larger and medium-sized firms receive significantly greater commercial payoffs for engagement with proactive environmental practices that arise from long-term financial benefits and increased market share than those that are derived by smaller companies.

 However, evidence from the study suggests that continuous improvement of sustainable environmental performance is not expected to generate financial benefits in perpetuity as they should be a limit on the level of environmental sustainability practices to enhance financial performance. This has been reiterated by Vijfvinkel et al. (2011) that sustainable practices are valued by society and willing to pay a premium for sustainable products, thereby creating business opportunities. However, they argued that the relationship between environmental sustainability is not expected to be linear as opportunities to enhance financial performance from sustainable environmental engagement should be limited to some point. This is because becoming more sustainable could be detrimental to the financial position of the firm.

 The study offers both practical and theoretical implications. In relation to the practical implications, the study revealed that medium and larger firms which possess higher resources enhanced both the market value (Tobin’s q) and profitability (ROA) through the implementation of sustainable environmental practices. In contrast, smaller firms only improved their internal measures of financial performance (ROA) which only required a moderate level of environmental engagement. This findings emphasis the various assertions that lack of resources affect SMEs ability to undertake sustainable environmental practices (Aiyub *et al.*, 2009; Hillary and Burr, 2011; Spence, Agyemang and Rinaldi, 2012). Hillary and Burr (2011), for instance, discovered that SMEs has low participation in environmental certification such as ISO 14001 due to financial constraints. However, Clemens (2006) found that green incentives moderate the environmental sustainability practices and financial performance relationship of small firms. This study, therefore, offers a practical guide particularly to policymakers on the need to motivate SMEs with economic incentives to encourage them to improve their behaviour towards environmental practices. The study also shows the level of environmental engagement that is expected to achieve an optimal financial benefit on environmental management and financial performance. The inverted U-shaped relationship between EMP and FP revealed by the study implies that moderate level of environmental engagement is required to establish optimum financial benefits. Therefore, it creates an awareness for management that excess allocation of resources to become the most sustainable firm may not yield the expected financial benefits.

 The study also makes an important contribution from a theoretical point of view. The study was mainly built on NRBV and the stakeholder theory. The findings of the study confirm that resources are relevant to developing environmental sustainability practices that improve profitability. This is based on the argument from NRBV that pollution prevention strategies, for instance, should encourage the development of unique, valuable, and inimitable resources that can lead to a cleaner environment and establish legitimacy with the society. Such unique resources would improve competitiveness due to high patronage of products and services, and consequently impact on financial performance (Russo and Fouts, 1997). The positive association of sustainable environmental management practices and financial performance recorded by the study, therefore, confirmed the natural resource-based view that development of unique resources through efficient implementation of sustainable environmental practices can impact positively on the financial performance of a firm.

 The study also signals that the application of stakeholder theory on environmental management and financial performance relationships may not be appropriate for smaller entities. Theoretical and empirical evidence suggest that proactive environmental practices may improve financial performance as it enhances the firm relationship with key stakeholders. Key stakeholders such as investors, for instance, may increase their level of investment as a result of good environmental practices adopted by the firm and this may enhance the market values of the firm (Trumpp and Guenther, 2017). Although, in relation to medium and larger firms, the study has confirmed the assertion that good environmental practices can enhance financial performance as EMP and Tobin’s q for both medium and large firms were positive, that link could not be established in the case of smaller firms that recorded negative relationship between EMP and the market value. Drawing lessons from theoretical arguments by Hoejmose et al. (2012) that SMEs are a heterogeneous community of firms, the differences in environmental practices between small, medium, and large firms could be very significant. It is argued that large firms significantly engage more with environmental initiatives, particularly in relation to corporate PR and marketing. Also, medium firms, to a greater extent, promote their environmental practices, both internally and externally. However, smaller firms are only embedded with their local community. Therefore, it is more likely that medium and larger firms can signal their sustainability practices to investors through enhanced communication. This, however, may not be possible in the case of smaller firms whose environmental efforts may only be recognised by the local community, which is unlikely to participate in the stock market. Therefore, we argue that it may be more appropriate for smaller firms to increase the benefits of sustainable environmental management practices through social capital theory which addresses the benefits of networks of SMEs. An attempt by SMEs to improve their corporate environmental image through stakeholder theory might not be succesful.

 The results should, however, should be interpreted in the light of a number of limitations. First, the study employed content analysis to obtain information on environmental management indicators; this information was restricted to the annual reports and other sustainability reports that were disclosed on the companies’ websites. Thus, information on environmental management indicators that were not in the annual report or the companies’ website were not captured by the study. However, to ensure consistency with other environmental data, it is expected that future studies will include all other sustainability data or projects that the firms are involved so that other useful lessons could be drawn. The study also employed a six-year panel to model the relationship between EMP and FP, and this period is also considered short compared with other econometric studies that use over ten years. Although the six-year panel period is consistent with most studies on EMP and FP relationships (Hart and Ahuja, 1996; Earnhart and Lizal, 2010; Horváthová, 2012; Trumpp and Guenther, 2017), it is expected future studies can be extended to at least ten years.

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**APPENDICES**

**Appendix 1: Definition of Regression Model for Dependent, Independent, and Control Variables**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| VariablesFinancial performance | Measurement ROA and Tobin’ q are financial performance indicators |
| ROATobin Q | Return on assets is calculated as net income divided by thetotal assets at the end of the financial year.Market Value of Firm divided by the total assets (logarithm of this figure was taken) |
| EMP | This is the composite of all environmental management variables measured (Energy + Waste + Materials + GHG + Compliance + STAKE). It is calculated by adding all items retained under each construct. |
| Energy | Number of energy-efficient measures such as a reduction in energy use, cost, use of alternative energy, using lightweight cars and plants disclosed in the annual report or standalone reports |
| Waste | Number of waste management measures such as a reduction in waste, improved waste prevention, creating a market for waste disclosed in the annual report or standalone reports |
| Materials | Number of material and resource efficiency measures such as the use of light materials resources, cost savings in material usage, improved packaging, recycling disclosed in the annual or standalone reports  |
| GHG | Number of Pollution reduction measures such as a reduction in the use of toxic materials, improved chemical handling, cost savings from reduced emissions disclosed in the annual or standalone reports |
| Compliance | Number of environmental compliance measures and policies such as obtaining environmental certification, environmental compliance policies, staff with environmental responsibilities, absence of fines and penalties disclosed in the annual or standalone reports |
| STAKE | Stakeholder engagement. Joint environmental projects with the community, regular communication with stakeholders on environmental issues, collaboration with customers and suppliers, Involving employees on environmental issues |
| Size | The logarithm of the total number of employees. |
| LiquidityGearingIndustry | Current assets divided by current liabilitiesLevel of risk measured by total liabilities divided by total assetsThe industry represented by 1= Knowledge Service, 2= Other Service, 3 Medium-High Tech Manufacturing 4 = Low – Medium Tech Manufacturing, 5 = Other Manufacturing |
| Board Size | Board Size |
| NEDS | Number of Non-Executive Directors (Board Independence) |
| *CEORem**G**Cs**Ɛi* | CEO RemunerationGrowth in AssetsCash and Cash EquivalentsThe error term |

 |

**Appendix 2: Summary of Sustainable Environmental Practices for one AIM-listed firm**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Company: 600 Group** |  |  |  |  |  |  |  |
| **Case ID: 1 Size: Large Company** | **2016** | **2015** | **2014** | **2013** | **2012** | **2011** | Notes/Page No |
| **Energy Efficiency Measures (Energy)** |   |   |   |   |   |   |   |
| Reduction in energy use/savings | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Cost savings in energy use (Gas and electricity) | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Fuel savings for using light weight cars and plants | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Efficient use of energy/energy saving devices | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Improved use of alternative energy/Others | 0 | 0 | 0 | 0 | 0 | 0 |   |
| **Total** | 0 | 0 | 0 | 0 | 0 | 0 |   |
|  |  |  |  |  |  |  |  |
|  | **2016** | **2015** | **2014** | **2013** | **2012** | **2011** | Notes/Page No |
| **Greenhouse Gases (GHG)** |   |   |   |   |   |   |   |
| Reduction in emission | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Reduction in the use of toxic materials in place of non-toxic and reduction of dust | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Cost savings from reduced emissions | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Procedure to monitor emissions | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Others | 0 | 0 | 0 | 0 | 0 | 0 |   |
| **Total** | 0 | 0 | 0 | 0 | 0 | 0 |   |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  | **2016** | **2015** | **2014** | **2013** | **2012** | **2011** | Notes/Page No |
| **Compliance** |   |   |   |   |   |   |   |
| Existence of Environmental Policy | 1 | 1 | 1 | 1 | 1 | 1 | p13/9,13/p13/p13/p12 |
| Environmental Certification e.g. ISO, EMAS, Permits approval | 0 | 0 | 0 | 0 | 0 | 1 | p7 |
| Absence of fines/penalties, benchmark, improvements | 0 | 1 | 1 | 1 | 1 | 1 | p8,13/13/p13/p13/p12 |
| Identification of Environmental Risk | 1 | 1 | 1 | 1 | 1 |   | p13/9,13/13/p13/p12 |
| liaising with employees/other stakeholders on compliance issues/Others | 1 | 1 | 1 | 1 | 1 | 1 | p13/p13/p13/p13/p12 |
| **Total** | 3 | 4 | 4 | 4 | 4 | 4 |   |
|  |  |  |  |  |  |  |  |
|  | **2016** | **2015** | **2014** | **2013** | **2012** | **2011** | Notes/Page No |
| **Waste** |   |   |   |   |   |   |   |
| Reduction in waste generated | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Cost savings in waste disposal | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Proper waste disposal | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Creating market or increase revenue for waste products | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Reduction in disposal to landfills and/Others | 0 | 0 | 0 | 0 | 0 | 0 |   |
| **Total** | 0 | 0 | 0 | 0 | 0 | 0 |   |
|  |  |  |  |  |  |  |  |
|  | **2016** | **2015** | **2014** | **2013** | **2012** | **2011** | Notes/Page No |
| **Materials and Resource Efficiency** |   |   |   |   |   |   |   |
| Cost savings in material usage/resource efficiency/recycle | 0 | 1 | 1 | 1 | 1 | 1 | p5,13/p1/p1/p3/p3 |
| Reduce material input (light weighing) | 0 |   |   |   |   |   |   |
| Increased use of alternate raw material with lesser waste | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Improved product quality, packaging/reuse/design | 0 | 1 | 1 | 1 | 1 | 1 | p3,13/p3/p13/p13/p3 |
| Improved raw material handling/shorter lead times Others | 0 | 1 | 1 | 1 | 1 | 1 | p3,13/p3/p1/p13/p3 |
| **Total** | 0 | 3 | 3 | 3 | 3 | 3 |   |
|  |  |  |  |  |  |  |  |
|  | **2016** | **2015** | **2014** | **2013** | **2012** | **2011** | Notes/Page No |
| **Stakeholder Engagement** |   |   |   |   |   |   |   |
| Increased alliances with other firms or stakeholders to jointly work on environmental projects | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Improved communication of environmental quality with stakeholders including collection and use of feedbacks | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Increased collaboration with suppliers in terms of new product design, environmental standards for suppliers and environment audit of suppliers | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Collaborating with employees and customers on environmental issues | 0 | 0 | 0 | 0 | 0 | 0 |   |
| Others | 0 | 0 | 0 | 0 | 0 | 0 |   |
| **Total** | 0 | 0 | 0 | 0 | 0 | 0 |   |
|  |  |  |  |  |  |  |  |
| **Composite of GP (Energy + GHG + Waste + Compliance + Materials + Stakeholder)** | 3 | 7 | 7 | 7 | 7 | 7 |   |
|  |  |  |  |  |  |  |  |

**Coding Process and Unit of Coding**

In appendix 2 above we used one of the selected firms and Environmental Management Performance (EMP) were divided into six environmental performance variables (sub measures) made up of energy, greenhouse gases (GHG), waste, materials and resource efficiency, stakeholder relationship, and compliance. Under each sub-measure (e.g. energy), five different indicator variables are added together to obtain a total in the sub-measure. We employed a binary coding system to identify items under each sub-measure and 1 is recorded where an item in the sub-measure is disclosed in the annual report or other sustainability reports. 0 is also recorded where the item under the sub-measure is not disclosed in the sustainability report. The number of items disclosed under each sub-measure is added together to obtain the value for the sub-measure. The EMP is the composite of all the sub-measures.