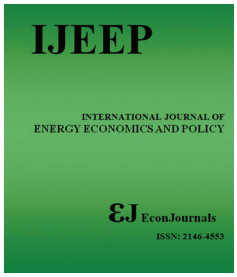

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Nexus between Profitability and Environmental Performance of Indian Firms: An Analysis with Granger Causality

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ABSTRACT

Sustainable development enhances the human life, with good eco facilities. The way to move toward the sustainable development is by giving best solutions to the issues of unbalanced ecological, environmental and economic development. This paper investigates the relationship between the environmental performance and the profitability variables such as return on assets (ROA), return on equity (ROE), return on capital employed (ROCE), and return on sales (ROS) of the sample firms in India. Granger causality test was used to examine bidirectional causality running from energy intensity (EI) to profitability of the firm. The study identified causal relationship that existed among the environmental performance and profitability of the firm. Further, it is found that there was an inverse relationship between ROCE and EI of the firm while direct relationship existed among ROA, ROE, ROS and EI. It is suggested that the practitioners, policy makers etc. may adopt the environment friendly technologies and encourage the Indian firms to use more energy efficient technology.

Keywords: Environmental Performance, Firms' Profitability, Energy Intensity, Causal Effect
JEL Classifications: L25, M14, Q51, Q01, Q4

1. INTRODUCTION

In the current era of globalization and industrialization, the number of industries are increasing in all over the world. The new players play a vital role in the improvement of economic position of country. The major issue in this situation is the attitude of earning profit by the company. Every company wants to increase the profit year by year because the profitability of the firm is considered to be an important index for the future development of the company and business. Also, it is one of major determinants for the success or failure of the firms. The profit earning attitude of the corporates, creates many problems to the environment by ignoring sustainability and social responsibility of firm. In the race for earning profit, the environmental resources are devoured around the world. Many studies proved that due to the development of the economy, problems like diminishing natural resources, degradation of environment, increasing levels of pollution etc. keep on increasing constantly (Wen and Chen, 2008). It is to be noted that due to increasing use of energy, the natural resources are gradually exhausted. Singh et al. (2009) reveals that the industrialization and globalization created enormous amount of changes which affected the ecological functions. One of the major reasons for the global warming is industry pollution, carbon dioxide release and pollution of natural air. The changes in environment conditions and increasing levels of pollution, particularly from industries, mainly create negative impact on the environment. It may lead to unavailability of natural resources for production. Again, this trend creates difficulties for firms to achieve financial performance as they need to spend huge money to acquire resources.

This situation claims the corporates to take immediate measures for the optimum utilization of energy without affecting the profitability of the firm. Hence some researchers urge the corporates to consider the environment in their internal and external decision making (Vinayagamoorthi et al., 2012). There is a strong need to strike a

balance between industrial development and environment so as to reduce the intensity of pollution. This is one of the means to attain the desirable level of sustainability and to overcome the problems of unbalanced ecological, environmental and economic development. This development enhances the quality of life of the human beings while the ecosystem provides good facilities to the people (Ringold et al., 2013). Further, the improvement in the financial position leads to increase Research and Development activities towards improvement of environmental quality (Frankel and Romer, 1999). Few studies exhibit the relationship between economic development and energy efficiency in macro level (Leitao, 2015; Sinha, 2015; Dogan, 2014; Shaari et al., 2014). In the race for economic richness, many countries felt the importance of environmental performance. The policy makers in India keenly observe the level of environmental degradation and increasingly quantify its harmful effects on climate change. Many countries have already initiated appropriate steps to frame proper policies and guidelines to control the environmental degradation.

These situations urge the researcher to study the environmental performance of the firm. This study investigate the existence of relationship between profitability and environmental performance of the firm. Also it examines the direction (bidirectional/ unidirectional) and causal relationship between the profitability and environment performance of the firm. This would help the researchers, corporate decision makers, regulating bodies and other stakeholders of the companies to understand the level of relationship between environment and financial performance of the firm. By the findings of the study the corporates may take appropriate steps to reduce the cost of production by ensuring optimum utilization of energy, raw materials, and by reducing the waste. Further, caring about environmental performance would help the companies to get subsidies from the Government for implementing green techniques in production. Also this study may guides the corporates to use modern plants and machineries which save energy, generate low CO_2 emission and ensure water conservation for the better environmental performance. This practice would help the business to achieve sustainable practice and increase the competitive advantage of the firm. The development of the environmental performance of the company would attract the socially responsible investors across the globe to invest their money and create investment opportunity. In the light of this background, this study is considered important for the sustainable development of firms.

2. REVIEW OF LITERATURE

The summary of the existing literatures relating to present research is briefly discussed below.

Vinayagamoorthi et al. (2015) analyzed the impact of financial performance on the environmental performance of sample Indian firms, listed in BSE 500. It was found that there was significant impact of financial performance on the environmental performance of the sample firm during the period. Zhao et al. (2014) examined the energy consumption and efficiency of manufacturing industry in Japan and China. It was found that in the manufacturing industries in Japan and China, the level of energy intensity (EI) had significantly decreased over the period. Meng et al. (2014) observed the effects of corporate environmental performance in Chinese companies and found the nonlinear relationship between environmental performance and its disclosures. This study also concluded that the disclosure in respect of ecological performance may not be considered as a valid signal to differentiate the firms into good and poor performers. Qi et al. (2014) studied the relationship between corporate environmental performance and financial performance. For the purpose of this study, Chinese firms were analyzed by using statistical tools like descriptive statistics, correlation and regression. It was found that there was significant impact of environmental performance on financial performance. Zeren and Koc (2014) analyzed the relationship between energy consumption and financial development among the newly industrialized seven countries. The study explained that there was two way relationship between the development in finance and energy consumption in India. Shahbaz et al. (2013) explored the relationship between the CO_2 emission and financial performance at the macro level. This study used the financial development, economic growth, coal consumption and trade openness and confirmed that there was long run relationship among the selected variables. The study proved that the level of emission would be increased corresponding to economic growth. Sahu and Narayanan (2011) examined the determinants of energy in Indian firms. With the help of statistical tools like descriptive, correlation and regression, it was found that the size of the firm and ownership nature were the major elements of EI. Sueyoshi and Goto (2010) investigated the connection between the environmental, financial and operational performance in manufacturing industries, listed in Tokyo Stock Exchange, Japan. It was found that only the large firms improved the environmental and operational performance due to the managerial capabilities. Makni et al. (2009) assessed the causality effect among the corporate social and financial performance in Canadian firms. It was found that there was no causal relationship between social and financial performance. Brammer and Millington (2008) described the linkage between the corporate social and financial performance. In the short run, poor social performers earned good financial return, but in the long run, good social performers did better performance.

It is to be noted that the above cited literature covered the relationship between the environmental and financial performance. But no detailed research focused on firm level. Hence an attempt has been made in this study to explore the direction and level of relationship between the environmental and profitability of the firms in India.

3. VARIABLES ADOPTED AND ESTIMATION TECHNIQUES

3.1. Variables Adopted in this Study

The main purpose of this study was to analyse the relationship between environmental performance and profitability of the firm. For this purpose the necessary data years from 1st April 2004 to 31 March 2014 (10 years) were collected from the PROWESS online corporate database, provided by CMIE. This study covers the companies listed in S&P BSE 500 index. However on the

basis of availability of data, the final sample size was fixed as 191 companies. As discussed in the previous literature, this study adopted the variables as detailed below.

3.1.1 Environmental performance of the firm

Horvathova (2010) identified environmental performance by ratio of toxic wastes, penalties paid for the violations of environmental regulations, adoption of ISO 14001 and environmental efficiency score. Qi et al. (2014) adopted the emission intensity to measure the environmental performance. It is found that the environmental impact of the firm can be measured by rating, index or environmental score. Tung et al. (2014) pointed out that the efficient use of material is the best metrics to measure the environmental performance of the firm. Sahu and Narayanan (2011) mentioned that in industry, the consumption and demand for the energy is measured effectively by considering the EI of the firm. In the light of these literatures**,** the present study used the EI of the firm as the proxy for environmental performance. The EI is measured as the ratio of the power and fuel expenses to sales**.**

3.1.2 Profitability of the Firm

The profitability was measured by a financial metrics which explains the ability of the firm to generate income over expenditures. It could be measured by different variables. These measures may provide detailed information in respect of earning profit. For the multi-dimensional measures, this study adopted four variables, namely, return on assets (ROA), return on equity (ROE), return on capital employed (ROCE), and return on sales (ROS) (Hart and Ahuja, 1996; Elsayed and Paton, 2005; Iwata and Okada, 2011; Qi et al., 2014).

3.2. Estimation Techniques

To fulfill the objectives of this study, the null hypotheses like there is no linear relationship between the profitability and environmental performance of the firm (NH_1) and there is no cause and effect relationship between the profitability and environmental performance of the firm (NH_2) are tested. This study employed the descriptive statistics, correlation and regression coefficient to estimate the relationship between the environmental and financial performance (Qi et al., 2014; Sahu and Narayanan, 2011). Besides in line of Makni et al. (2009) granger causality test was applied to analyse of cause and effect relationship.

3.2.1. Descriptive statistics

In this study, the values for mean and standard deviation (SD) were obtained through descriptive statistics. The nature of the variables in terms of average was understood by the result of mean and the percentage of variation in the mean value was observed by using SD.

3.2.2. Correlation analysis

Correlation Analysis was used to measure the degree of association between the select variables. It measures the strength and direction (negative or positive) of relationship among the variables. The value of relationship is measured by the result of correlation coefficient. If the result shows that there is a correlation between X and Y but fails to explain X to predict Y or fails to explain Y to estimate X, 'Granger Causality' could be used to identify the causal relationship.

3.2.3. Granger causality

The granger approach tests the causal relationship among the tested variables. This analysis fulfills the gap in correlation test. Y is said to be granger - caused by X if x helps in the prediction of Y. Granger Causality measures precedence and information content but does not explains the value of changes caused by the relationship. Hence the value of variation resulting from other variables are measured by the coefficient of regression.

3.2.4. Regression

The regression analysis was used to estimate the unknown parameters and explain a function with the data. The main purpose of this study is to measure the direction of relationship among the financial and environmental performance of the firm. For this purpose the regression coefficient was used to explain the value of changes occur in one variable by another variables.

For the purpose of analysis, the SPSS - 20 and E-views - 7 were used in this study.

4. RESULTS AND FINDINGS OF THE STUDY

4.1. Descriptive Statistics for the EI and Profitability of Sample Firms

The results of descriptive statistics for the EI and Profitability of the sample firms, during the study period from April 1, 2005 to March 31, 2014, are given in Table 1. It is to be noted that for the purpose of analyzing the nature of sample variables, mean and SD were used. The mean value reflects the average value in the set of variables and the value of SD indicates the measure of the dispersion from its mean value of variables. To know the environmental performance, the variable, namely, EI was used, while variables like ROA, ROE, ROCE, and ROS were used to understand the profitability of sample firms.

It is clear that the lowest mean value of 0.0383 for EI was recorded in the year 2008 while the highest mean value of 0.0497 for EI was registered in 2014. The highest variation (SD) of EI was recorded in 2014 while the lowest value of SD was registered in 2007 as 0.0471.

With reference to four sample profitability variables, one variable namely ROA earned the highest mean value of 0.1165 in 2007 and the lowest mean value of 0.0938 in 2013. But at the same time, the highest (0.0851) and the lowest values (0.0657) of SD were registered in 2012 and 2009 respectively. Another profitability variable, namely ROE recorded the maximum mean value of 0.2559 in 2007 and the minimum mean value of 0.1613 in 2012. Besides, the highest value of SD (0.2889) for ROE was found in 2005 and the lowest value (0.1280) occurred in 2014.

The Table 1 also reveals the analysis of ROCE and ROS of the sample firms during the study period. The highest value of ROCE was recorded in the year 2008 (0.1956) and the lowest value (0.1320) was recorded in 2013. The maximum variation (SD - 0.1819) of

Table 1: Results of descriptive statistics for energy intensity and profitability of the sample firm

Year with result	Variables				
	EI	ROA	ROE	ROCE	ROS
2005					
Mean	0.0415	0.0993	0.2382	0.1714	0.1083
SD	0.0546	0.0711	0.2889	0.1819	0.0845
2006					
Mean	0.0400	0.1051	0.2336	0.1757	0.1237
SD	0.0487	0.0721	0.1624	0.1597	0.1184
2007					
Mean	0.0385	0.1165	0.2559	0.1897	0.1505
SD	0.0471	0.0730	0.1521	0.1354	0.2097
2008					
Mean	0.0383	0.1149	0.2551	0.1956	0.2408
SD	0.0499	0.0733	0.1838	0.1774	0.9884
2009					
Mean	0.0411	0.0950	0.2086	0.1608	0.1837
SD	0.0551	0.0657	0.1661	0.1615	0.7997
2010					
Mean	0.0402	0.0966	0.2015	0.1605	0.1376
SD	0.0553	0.0662	0.1582	0.1599	0.1650
2011					
Mean	0.0407	0.0958	0.1945	0.1575	0.2048
SD	0.0565	0.0794	0.1623	0.1569	1.1266
2012					
Mean	0.0437	0.1001	0.1613	0.1380	0.1138
SD	0.0658	0.0851	0.1981	0.1382	0.1747
2013					
Mean	0.0459	0.0938	0.1699	0.1320	0.1021
SD	0.0664	0.0817	0.2069	0.1618	0.1692
2014					
Mean	0.0497	0.1098	0.2126	0.1766	0.1356
SD	0.0720	0.0731	0.1280	0.1188	0.1032
Overall					
Mean	0.0459	0.1027	0.2331	0.1817	0.1637
SD	0.0125	0.0406	0.0674	0.0525	0.0597

Source: Compiled from prowess and computed using SPSS 20. EI: Energy intensity, ROA: Return on assets, ROE: Return on equity, ROS: Return on sales, ROCE: Return on capital employed, SD: Standard deviation

ROCE happened in 2005 and the minimum value of variation (0.1188) was recorded in 2014. Likewise, the minimum value (0.1021) for ROS was registered in 2013 and the maximum value (0.2408) happened in 2008. The SD for ROS was at its minimum value (0.0845) in 2005 and maximum value (1.1266) in 2011.

It is clear that during the study period (from 2005 to 2014), the mean values (overall) of 0.0459, 0.1027, 0.2331, 0.1817, and 0.1637 were recorded for EI, ROA, ROE, ROCE, and ROS respectively. Likewise, values of SD (overall) were 0.0125 (EI), 0.0106 (ROA), 0.0674 (ROE), 0.0525 (ROCE), and 0.0597 (ROS) during the study period. The results of descriptive statistics clearly reveal the nature of variables like EI and profitability variables (ROA, ROE, ROCE, and ROS) in respect of mean and variance. In order to determine the relationship among the environmental and profitability of the firm, strong evidence through correlation analysis is necessary.

4.2. Correlation Analysis between EI and Profitability Variables of the Sample Firms

Table 2 shows the results of correlation analysis for EI and profitability variables like ROA, ROE, ROCE, and ROS, during the study period from April 1, 2005 to March 31, 2014. The correlation analysis was used for the four sets of variables namely ROA - EI, ROE - EI, ROCE - EI, and ROS - EI in respect of sample firms, to identify the relationship between the environmental performance and financial performance during the study period. It is to be noted that the negative correlation value indicates the inverse relationship between these variables while positive correlation value reveals direct relationship between these variables (Aron et al., 2009; Steinberg, 2011).

Table 2: Results of correlation analysis for EI and profitability of sample firms

Year	Variables			
	EI - ROA	EI - ROE	EI - ROCE	EI - ROS
2005	−0.162*	−0.043	−0.149*	−0.064
2006	−0.094	−0.062	−0.146*	0.085
2007	−0.104	−0.086	−0.205**	0.122
2008	−0.091	−0.104	−0.172*	0.104
2009	−0.108	−0.116	−0.174*	0.03
2010	−0.180*	−0.166*	−0.212**	0.008
2011	0.001	−0.210**	−0.235**	0.002
2012	−0.238**	−0.203**	−0.264**	−0.12
2013	−0.262**	−0.178*	−0.239**	−0.11
2014	−0.101	−0.182	−0.238	−0.168
Overall period	−0.029	−0.131**	−0.201**	0.016

Source: Compiled from prowess and computed using SPSS 20. **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed). EI: Energy intensity, ROA: Return on assets, ROE: Return on equity, ROS: Return on sales, ROCE: Return on capital employed

The correlation analysis clearly shows that out of 10 years of the sample period, from 2005 to 2014, negative relationship was found for the set ROA - EI, during all the sample years, except 2011. This indicates the fact that there was an opposite relationship among EI and ROA. It means that the increase (decrease) of ROA by one unit, may lead to decrease (increase) correspondingly in EI, if other variables remained the same during the study period.

It is understood from the analysis of two sets of sample variables, namely, ROE - EI and ROCE - EI that there was negative correlation (with negative value) during the entire study period of 10 years from 2005 to 2014. This result reveals the fact that the sets of variables, namely, ROA and EI and ROCE and EI negatively influenced each other during the study period.

At the same time, positive association was found between a variables set, namely, ROS and EI. The analysis of correlation results, as given in the Table 2, it reveals that for a set of variables namely, ROS - EI, there was positive relationship in respect of sample firms for six years (2006, 2007, 2008, 2009, 2010, and 2011) out of 10 years. The result explains that both the variables, namely, ROS - EI entered into direct relationship with each other with reference to sample firms considered for this study.

The correlation analysis, as given in the above Table 2, also showed the fact that there was negative (value) relationship with reference to three set of variables, namely, EI and ROA, EI and ROE, EI and ROCE. It explains the fact that changes in the value of EI may create changes in the values of ROA, ROE and ROCE. The negative

correlation vividly indicates the inverse relationship among these sample variables. It is to be noted that the inverse relationship leads to increase (decrease) in the value of profitability variables and it reduces (increases) EI (proxy of environmental performance) and vice versa. At the same time, the other set, namely, EI and ROS, recorded positive relationship during most of the sample period. This reveals direct relationship between these two variables, namely, EI and ROS. The overall analysis of the Table 2 shows the fact that the values of correlation were not significant at 95 % and 99% confidence levels during the study period. But the years - 2005, 2010, 2012, and 2013 recorded significant results in respect of sample firms. Hence the null hypothesis (NH_{01}) - There is no linear relationship between profitability and environmental performance of the firm is accepted.

4.3. Granger Causality and Regression Coefficient for the EI and Profitability of Sample Firms

The results of granger causality and regression coefficient for EI and profitability of sample firms, during the study period from April 1, 2005 to March 31, 2014, are exhibited in Table 3. It is to be noted that Granger causality analysis was used to examine the cause and effect of relationship between the environmental performance and financial performance, while regression coefficient indicates the level of variation among the sample variables considered for this study.

In order to examine the cause and effect relationship between environmental and financial performance, the sample variables were classified into eight groups, namely, ROA and EI, EI and ROA, ROCE and EI, EI and ROCE, ROE and EI, EI and ROE, ROS and EI, and EI and ROS. The values of F statistics for sample variable sets, namely, ROA and EI (2.6499), EI and ROA (2.2385), ROCE and EI (5.8515), EI and ROCE (3.7731), EI and ROE (9.8564), ROS and EI (1.2742), and EI and ROS (2.9156) were recorded at various significance levels during the study period. From these results, bidirectional relationship between sample profitability variables (ROA, ROCE, ROE, and ROS) and EI of the sample firms was noticed during the study period. It is to be noted that bidirectional relationship explains the changes in the values of selected profitability variables with EI. The deviations in the value of EI may induce the selected profitability variables to vary in its value. The high p value (significance level) denotes the chances of occurrence (influence of one variable on another variable) is low.

Table 3: Results of granger causality and regression coefficient for EI and profitability of sample firms

Direction of causality	Granger causality			Regression coefficient
	F statistics	*P* value	Significance level (%)	
ROA causes EI	2.6499	0.0709	8	0.2815*
EI causes ROA	2.2385	0.1069	10	0.0152*
ROCE causes EI	5.8515	0.0029	1	−0.7983*
EI causes ROCE	3.7731	0.0232	3	−0.057031*
ROE causes EI	0.1646	0.8482	84	0.199212*
EI causes ROE	9.8564	0.001	1	0.015555*
ROS causes EI	1.2742	0.2799	28	0.448612*
EI causes ROS	2.9156	0.0544	6	0.090396*

Source: Compiled from prowess and computed using E views 7. *P<0.05 (Significant at 95% confident level). High value of significance denotes the chance for the occurrence is very low. EI: Energy intensity, ROA: Return on assets, ROE: Return on equity, ROS: Return on sales, ROCE: Return on capital employed

The result of the Table 3 clearly explains that if other things remains same, one percent growth of ROA was directly linked to the increase of 0.2815% in EI of sample firms. Likewise, the environmental performance i.e. EI created positive effect on ROA i.e. 10% increase in EI was related to 0.152% rise in ROA. From the analysis, it is inferred that the increasing value of ROA contributed to the increase in value of EI and vice versa of sample firms during the study period.

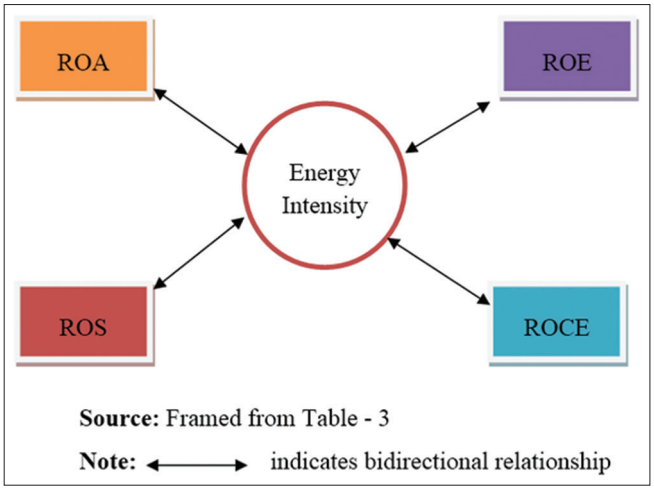
At the same time, ROCE exercised negative influence on EI and this indicates the fact that a change of one unit in ROCE would lead to decrease in EI by 0.7983 units. Similarly, EI also shows the negative value of changes on ROCE i.e. 1% increase in EI would lead to decrease in ROCE by 0.057%. In other words, the variables set, namely ROCE and EI witnessed bidirectional relationship with inverse effect.

The Table 3 clearly indicates that there was cause and effect relationship between ROE and EI. There was variation of 0.199% in EI while there was one percent change in ROE during the study period. Likewise, during the study period, one percent rise in EI was linked with 1.56% increase in ROE. It reveals the existence of direct link between EI and ROE.

The overall results of regression coefficient indicate that one unit of change in ROS raised EI by 0.449 unit in respect of sample firms. This indicates that the ROS was the reason for changes in EI. From the analysis, as given in the Table 3, it is inferred that there was a cause and effect relationship among EI and ROS. It means that 10% rise in EI was reason for 0.9% increase in ROS of sample firms. Hence the null hypothesis (NH_{02}) - There is no cause and effect relationship between the profitability and environmental performance of the firm, is rejected.

The relationship between profitability variables and environmental performance (EI) of sample firms, during the study period, is displayed in Figure 1. The double headed arrows were used to indicate the bidirectional relationship between the

Figure 1: Model showing the direction of relationship among selected profitability variables and energy intensity



variables while single headed arrows indicate unidirectional relationship between the financial and environmental performance variables.

According to the Figure 1, all the four profitability variables, namely, ROA, ROE, ROCE, and ROS experienced bidirectional relationship with EI (proxy variable of environmental performance) of sample firms of BSE 500 during the study period. This indicates that by controlling the level of EI, the profitability position of the sample companies could be increased. In other words the level of environmental performance could be promoted by controlling the profits of the firm.

5. CONCLUSIONS AND FUTURE DIRECTIONS

This study investigated the nexus between EI and profitability (ROA, ROE, ROCE, and ROS) of the firms during the study period of 10 years. For this purpose, the descriptive statistics, correlation coefficient, granger causality, and coefficient of regression were applied.

The study found that there was a relationship between profitability variables (ROA, ROE, ROCE, and ROS) and EI of the firm. In short, only three profitability variables (namely ROA, ROE, and ROS) experienced positive relationship with EI of the firm while negative relationship was registered for only one set of variable, namely, ROCE and EI. This validates the contribution of profits towards better environmental performance of sample firms during the study period. In other words, the environmental performance of sample firms was also one of the reasons for changes in profitability of the sample firms. Our results affirm the findings of Zeren and Koc (2014), Qi et al. (2014), Dobler et al. (2014); and Cronin et al. (2010) who identified the casual and significant relationship between environmental and financial performance. But the findings of this study contradict the results of Makni et al. (2009) and Salama (2005).

In the light of the above findings, it is suggested that policy makers, practitioners etc., can take appropriate measures to improve the environmental performance by controlling the level of EI without affecting the profitability of the firm. Corporates may focus on the allocation of funds to adopt environment friendly technologies and encourage the firms to use more energy efficient technology for production purpose. This may save environment from degradation. For the sustainable growth of the firm, this study could be considered useful.

However, the results and suggestions of this study based on the sample companies and adopted estimation techniques. Also, the present study contributes a platform for the future research in this area. Similar studies may be conducted by considering other profitability measures like liquidity and leverage ratios, stock market performance variables etc. Studies can be conducted by developing environmental performance metrics that can be used in future research. Similar study could be conducted by extending the coverage of sample firms.

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