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Role of Environmental Management Systems Certification, Corporate Governance and Ownership Structure in Firm's Efficiency: A Comparison of ISO 14001 Certified and Non-Certified Firms in Pakistan

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Abstract

Does Environmental management systems (ISO 14001) certification influence firm's efficiency in an economy which is ranked twelve in top polluted countries in the world as per 2018 Environmental Performance Index? Based on stakeholder and institutional theory perspectives, the study also looks in depth the moderating role of family and institutional ownership. The results showed positive association between EMS and firms' efficiency in Pakistan. In addition to this, the institutional and family ownership moderates the relationship between EMS and firms' efficiency. The results also confirm positive significant association between EMS and firms' efficiency for environmentally sensitive firms. There exists no moderating role of institutional and family ownership for non-EMS sensitive firms. In addition, the gender based and resource dependency theories are also tested and results depicted significance impacts of female presence and board interlock on firm efficiency. The study provides in depts. insight to stakeholder regarding EMS, governance mechanism and ownership structure with respect to firm's efficiency.

Keywords: Environmental management system; Firm's efficiency; Ownership structure; Board interlock; Gender diversity; Tobit model

Introduction

As the environment changes, it becomes increasing important to be aware of the problems that surround it. With the substantial incursion of natural disasters, the awareness about types of environmental problems our planet is facing needs more attention. In the last decades, the active involvement of government and private sector forced a significant change in environmental regulations [1,2]. This significant change caused emergence of Voluntary Environmental programs like ISO 14001, Green Lights, Leadership in Energy and Environmental Design (LEED), and Energy Star Buildings (ESB). Despite of launching improving environmental performance in the course of overt governmental gearshift and regulations, VEPs encourages different firms to have their own set up on environmental ambitions voluntarily which may be ahead of legal compliances and to set their targeted by themselves. It is the key assumption of VEPs that those stakeholders, who do not have direct participation in environmental performance, are however be expectant to recompense environmental action further than officially authorized observance by presentation dogmatic relief, elevated market capitalization, consumer loyalty, goodwill, and competitive prices. In the modern world, VEPs are, thus, designed to achieve both environmental and economic goals [2,3]. In the recent past, it is observed that firms are converting from direct government monitoring to self-imposed regulation practiced in high node throughout the globe [4,5]. The materialization of theses awareness program enticed many researchers to look in depth the association of these VEPs with corporate objectives [2,4-6].

Pakistan as a Case Study

Pakistan has been named as the top environmentally sensitive country of the world. The average PM 2.5 pollution in this country is 101 ug/m³ which makes it the most polluted and the dirtiest air containing country in the world. The country has an approximately population of 200 million people that makes it the sixth largest populated nation on earth. On the hands, the GDP per capita is $4,699 only in 2017

which is quite low in high growing region of Asia. The life expectancy is 63.6 and 65.4 for males and females respectively. Due to increasingly environmental issues, approximately 80,000 people are admitted to the hospitals yearly due to respiratory disorders as per health department report.

Theoretical Background (A Stakeholder Perspective of CSR)

In general, the EMS is generally considered as an activity that enlarges afar firms' pure financial and economic interests to comprise measures wished to yield social benefits [7,8]. The study considers EMS from different stakeholders' perspective and defines EMS as company's deliberate concern of different stakeholder apprehensions both its internal and external operations [7]. For that reason, EMS refers to firms'-controlled behavior that is ahead of merely cost-effective desires [9]. In fact, Stakeholders are proficient of putting forth sway on corporate activities [10]. As per stakeholder theory, shareholders have direct involvement in their firm's operations and its continued existence (like Customers, employees, investors); while secondary stakeholders do not have direct engagement in transactions with the main operations, but indirectly influence the firm [11]. So, the society falls in secondary class of stockholders due to their indirect heap in the firm [12]. The study considers EMS with respect to three stakeholders: employees, customers, and society. These groups have the most

significant contribution firms' market achievements [11]. Therefore, the perspective of CSR towards society is defined as firms' voluntary behaviors beyond their economic interests and it is aimed to affect in all perspectives positively [9]. Similarly, CSR towards employees is defined as firms' voluntary behaviors to address employees interest and concerns [13]; CSR toward customers means firms' voluntary consideration of customer concerns inside and outside of business operations [9].

Literature Review and Hypotheses Development

EMS and firm's efficiency

The study considers environmental management system (ISO 14001) in context of CSR in Pakistani environment. The literature on EMS-performance linkages provides inconclusive results [14,15]. In general, EMS has been identified as positive determinant of firm's efficiency [9]. Ownership structure, corporate reputation and employee satisfaction supported by CSR are valuable resources that cause efficiency [16,17]. In contrast, Zhou et al., [18] found negative association between CSR and firm's performance of family businesses in China. In the similar vein, Julian and Ofori-Dankwa [19] reported negative association between firm's performance and corporate social responsibility expenditure in a sub-Saharan African emerging economy. Though it's a fact that EMS is a multi-dimensional construct, researchers are likely to summative CSR behavior; yet, these behaviors may not be able to distinguish that EMS toward diverse stakeholders' perspectives could be accounted for significant variances in firm's efficiency. This study conceptualizes EMS as firm's specific construct that significantly play a role towards three basics stakeholders (society, employees, and customers) [20].

The research in the efficient market highlighted positive association between CSR on firms financial performance [16,21]. The CSR activities in developed economies fruition financial benefits for firms, as it provides competitive advantage (For instance, Toyota addressed the public concerns about auto emissions and developed environment friendly hybrid Prius showing their engagement in CSR activities toward society; which provides them a competitive advantages in hybrid technology. In the meanwhile, the existing researches on diverse stakeholders' perception are familiar with that stakeholders' expectation and objectives varying relation to organizations [11]. As the competition arises towards intensity, assimilate socially accountable attributes into a corporate trademark to accomplish demarcation is a desirable choice [7]. Academicians failed to explain the linkage between CSR and firm's efficiency [13,22] with only exceptions, the researcher unable to explain the link. The study developed following hypothesis for testing the association.

H1: There is a significant positive association between EMS certification and firm's efficiency.

Gender diversity and firms' efficiency

Regardless of the extensive theoretical justification, the researchers provide mixed evidences with respect to firm's efficiency and board diversity. Agency, resource dependency and gender diversity theories affiliate gender diversity with board effectiveness and performance [23]. As per agency theory perspective, Francoeur et al., [24] reported significance role of women presence on board dealing with complex issues, bringing informational predisposition in policy formulation and crisis resolution. Moreover, females are expected to be more active and participative making their board's efficiency [25]. Resource dependency theory reports that female directors are the source of distinctive and priceless resources and ties with other boards [26,27]. Gender diversity theory portrays their role as more feminine based on compassion and refinement [28]. In contrast, the gender roles are quite silent in male-dominated sphere [29,30]. Many studies reported that females are more expected to raise inquiries [31], argue and carp concerns [32], demonstrate more participative management and alliance skills [33], and normally anticipated to grasp their firm to elevated principled standards [28,34,35]. The study also reported transparent public disclosures, efficient earning management and board advancement assessment and program [36]. As the female members are expected to be prepared in meeting [37] and elevated level spectacles contributes to firm's efficiency is expected to lead to better performance outcomes. The study hypnotized following hypothesis n Pakistani context.

H2: high level of gender diversity contributes significantly in firm's efficiency.

Family ownership and firm performance

The traditional theories mainly focused on negative role of family ownership and viewed family owned firms as relatively unprofitable and inefficient [38-40]. In the recent past, stewardship theory gained interest among family firms' researchers as it uses different models, situational and psychological antecedents to individual behaviors [41,42]. The stewards' managers are gaining relatively superior utility from pro-organizational collectivistic performance as compared to agents who are assumed to be self-serving behavior presumed by agency theory. The kinship ties are more prevalent in family firms and this makes the situation more relevant [43,44]. In family firms, the governance mechanism based on agency-theoretic direction seems to be outmoded to and inefficient as stakeholders' interests are well aligned and stewards is expected to be more advantageous for firms [41,45]. In the recent past, the studies stated that family control firms more efficient and important than their counterpart [46,47]. Moreover, Burkart et al. [48] reported that founding family firms will perform better when agency conflicts are too severe and legal protection are quite poor or even moderate. Therefore, this study follows the stewardship perspective of family firms and hypothesizes, thus:

H3: There is a positive significant association between Family ownership and firm's efficiency.

Institutional ownership and firm efficiency

Enough equity stakes can mitigate the agency cost by performing governance and monitoring roles [38]. The institutional investor having sufficient stakes wields governance mechanism, replace management and instigate film's takeover if required [49,50]. Nevertheless, the literature provides inclusive evidences on the association between institutional investor and firm's performance [51,52]. Some of the studies supported monitoring and governance role of institutional investors. While Davis and Kim [53] reported that institutional investors have insignificant role in firm's performance due to their short-term goals, personal interest and inefficient management. Some of the researchers stated that institutional investors may enhance firm's efficiency from information asymmetry and evade cost of activism. Due to these inconclusive evidences, the study attempts to investigate the association between institutional investors and firm efficiency. The study developed following hypothesis.

H4: institutional investors have positive significant association with firm's efficiency.

Moderating role of ownership structure

It's very important to explore dimensional role of ownership structure with respect to firm's performance [54]. The researchers are unable to test empirically the moderating role of ownership structure and firm's [55]. Zahra [55] stated, "The governance researchers mainly focused to import theories from the fields of anthropology, economics, sociology, psychology, organizational theory, organizational behavior, entrepreneurship, and strategic management". The family firms are more interested to preserve the control-management and the property-ownership-of the company [56]. The institutional investors also maintain a substantial role in business activities and decisions [57]. Hall et al., [58] pointed out that that family firms often exemplify by being conventional, defiant to revolutionize and reclusive [59]. Thus, the ownership structure is expected to create significance level of heterogeneity; resulting, differential behavior in policies and strategies. In this study, the researcher developed following hypotheses with respect to ownership structure.

H5: The family ownership plays moderating role between EMS and firm's efficiency.

H6: The institutional ownership plays moderating role between EMS and firm's efficiency.

Board interlock and firm efficiency

According to Resource-dependence theory, the board interlocking provides the benefits of synchronizing inter-organizational exchange of wherewithal and buffering environmental improbability [60,61]. Moreover, director's interlock provides an opportunity of securing wherewithal and information through their external networks [62,63]. As the benefits of interlocking are more pronounced, the study expects more board interlocking among EMS certified firms. In addition to this, board interlocks reduce enticement for opportunism by synchronizing information among business partners [64]. Based on resource-dependence theory, the study, the study assumed positive association between board interlocking and firm's efficiency.

H7: There is a positive association between average numbers of interlocking directorates on the board firm's efficiency.

Control variables

The association between age and firm efficiency (performance) is one of the debatable issues in literature [65]. The study used age as control variable and expected positive impacts on firm's efficiency [45,66]. The literature provides mixed relationship between firm's size and efficiency. Vijayakumar and Tamizhselvan [67] and Papadognas [68] found positive significant association between firm's size and profitability. In contrast, Majumdar [69] reported evidence that larger firms are inefficient. In the similar vein, Lee [70] found non-linear relationship between size and firm's profitability. Amato and Burson [71] reported both linear and cubic form of the relationship between firm's profitability and size. The study follows Ammar et al. [72] findings who reported negative significant association between size and profitability. Leverage is another determinant that was extensively used in the earlier studies. Some of the researchers reported negative association between leverage and firm's profitability [73]. In contrast, some of the authors reported that debts are used as tool to force the management to use its resources efficiently [37,38]. However, for the specific case of Pakistan, the researchers expect a negative sign of leverage, given higher interest rates for company loans. In literature, R&D strategy of the firms is often considered as a source of above-average profits. The study measures R&D by applying six years averaged to total sales for the entire sample period. The study expected a positive association between R&D and firm efficiency.

Measurement Variables

Basic concepts of DEA

In mathematical programming, DEA (Data Envelopment Analysis) is used as optimization method which generalizes single-input/single-output [74]. It is used as a new tool for operational researchers to measures the technical efficiency. The main objective of DEA techniques is to classify efficient units that make decision that fabricate the prevalent quantity of outputs by using optimum level of inputs [75].

In this study, researchers used Andersen and Petersen's [76] super-efficiency technique, as this ranks efficient firms on the basis of their super-efficiency values [77-85]. In order to measure technical efficiency, the study used the following equation;

$$\theta^* = \min \theta_m \tag{1}$$

$$\text{Like } Y\lambda \geq Y_m \tag{2}$$

$$X\lambda \geq \theta_i X_m \tag{3}$$

$$\check{k}\lambda = 1 \tag{4}$$

$$\lambda \geq \theta \tag{5}$$

In the equation above, θ^* represents the efficiency score for m^{th} DMU, the output matrix for an entire sample is measured by Y, Y_m the output vector of DMU m while X_m represents input vector of DMU m. The input matrix of entire sample is represented by X, $\check{k}$ is the unit vector, and λ the k × 1 are the vector of constants. At the end, a firm is declared as efficient if the efficiency score is equal to are greater than 1. However, in the case of a super-efficiency model, the test firm is dropped from the reference set of firms.

The results of descriptive statistics are presented in Table 1. The variables are used in DEA analysis to test the efficiency of the firms contained in the data set. The mean value, standard deviation, minimum and maximum is presented in the table.

Table 2 presents the correlation matrix of inputs and output. It can be seen that the correlation between output and inputs is statistically significant.

Database and sample description

In order to measure firm efficiency, the study used the data of manufacturing listed firms from data stream for the purpose of analysis. Sample includes ISO 14001 certified and non-certified firms for the period from 2006 to 2016. In order to create homogeneity in data analysis, the 14001 non-certified firms are selected on the basis of their market capitalization. The market capitalization differs with respect to

	Mean	Standard deviation	Minimum	Maximum
Sale	6796.22	1531.241	34.465	29851.65
Salaries and wages	1742.675	1120.56	11.341	9478.574
Capital	2196.17	2289.60	24.256	12641.64
Investment in plant and machinery	1187.09	1231.64	0.9751	16321.60
Raw material	9554.19	1785.720	18.355	31980.13
Power and fuel	374.92	535.292	17.631	1932.646

Table 1: Descriptive statistics of variables used in DEA model (in millions).

each sector, so the firm's market capitalization is divided by total sector capitalization and homogenous firms are selected to avoid selection biasness. The sample consists of 110 green and 100 non-certified firms. The data of input and output variables were culled from data stream. The results were obtained using DEAP 2.1 and EMS software. Table 3 presents the descriptive statistics of select variables. The sample description is presented in Table 3. As the number of ISO certified firms changes on yearly basis, so the percentage also keep changing. In addition to this, the sample is sub-divided into EMS sensitive and EMS Non-sensitive firms. If the firm belongs to oil and gas, cement, construction and pharmaceutical, it is declared as sensitive firms. The EMS certification matters for sensitive firms quite a lot because it has

significant contribution in their images and export as well. Therefore, it is very important to separate such firms from the data set in order to test their efficiency.

The descriptive statistics of variables used in final analysis is presented in Table 4. The sample includes both green and non-green firms for the selected time span. The table showed 63.3330 means value for green firms with minimum 0 and maximum value of 1. Similarly, the family ownership has mean value 28.7840, minimum3.5633, maximum 88.785 and standard deviation 9.7743. The institutional ownership has means value of 38.5632, minimum 6.321, maximum 62.05 and standard deviation 7.8743. The other important variable is gender diversity with mean value 0.07143, standard deviation of 1.854, minimum 0 and maximum value of 0.14286. Board interlock is a dummy variable having mean value 0.07143, minimum 0 and maximum 1.0000. Lastly, the other variables shown in the table represent the control family and their mean, standard deviation, minimum and maximum value.

Table 5 presents the correlation among the variables selected for the regression analysis. There is a positive significant association among ISO certification, family ownership, gender diversity, board interlock, firm age and R and D expenditures. However, size and financial leverage showed negative association with other most of the variables

	Sale	Material	Energy	Labor	Capital	Investment
Sales	1.0000					
Material	0.6754**	1.0000				
Energy	0.676***	0.564**	1.0000			
Labor	0.610**	0.654***	0.318**	1.0000		
Capital	0.276**	0.435***	0.632***	0.506**	1.0000	
Investment	0.432***	0.691***	0.551**	0.616***	0.659***	1.0000

*, **, ***Significance at 10 % (p<0.10), 5 % (p<0.05) and 1 % (p<0.01) respectively.

Table 2: Correlation matrix.

Year	ISO certified firms	EMS sensitive	EMS sensitive (%)	Non-certified firms	Total	ISO certified (%)
2005	88	53	60.2273	62	150	58.667
2006	91	57	62.6374	62	153	59.477
2007	89	59	66.2921	64	153	58.170
2008	89	56	62.9213	64	153	58.170
2009	94	60	63.8298	62	156	60.256
2010	91	58	63.7363	65	156	58.333
2011	96	61	63.5417	64	160	60.000
2012	97	62	63.9175	63	160	60.625
2013	95	61	64.2105	65	160	59.375
2014	99	62	62.6263	63	162	61.111
2015	93	60	64.5161	65	158	58.861
2016	94	61	64.8936	64	158	59.494

Table 3: Sample characteristics.

Variable	Mean	Standard deviation	Minimum	Maximum
ISO certified	63.3330		0.0000	1.0000
Family ownership	28.7840	9.7743	3.5633	88.785
Institutional ownership	38.5632	7.8743	6.321	62.05
Gender diversity	0.07143	1.854	0.000	0.14286
Board interlock	0.14821		0.000	1.0000
Firm age	34.4521	0.8810	14.00	68.00
Firm size	73.1981	11.436	35.30	148.7
R & D	0.37201	3.9200	0.000	7.341
Financial leverage	0.49543	8.4200	0.3261	3.643

Table 4: Descriptive statistics.

Variables	ISO cert	Family own	Institutional ownership	Gender div	Board interlock	Firm age	Firm size	R & D	Financial leverage
ISO certified	1.0000								
Family own	0.2671	1.00000							
Institutional ownership	0.3168	0.69251	1.00000						
Gender div	0.1782	0.61451	0.45326	1.00000					
Board interlock	0.2642	0.18642	0.34451	0.35639	1.00000				
Firm age	0.0672	0.02153	0.03535	0.09733	0.21853	1.00000			
Firm size	-0.332	-0.4621	-0.5467	0.34222	-0.45321	-0.5624	1.00000		
R & D	0.1733	0.27531	0.19536	0.54434	0.23423	0.34637	0.52251	1.00000	
Financial leverage	-0.29	-0.653	-0.26545	-0.3453	-0.54234	-0.4354	-0.1355	-0.1746	1.00000

Table 5: Correlation matrix.

in the study. There is no serious correlation among the variable except institutional ownership and family ownership having correlation near to 70%. In order to remove this fact, the study applied two different tests to address the issues and each test separate these high correlated variables for clarification.

Estimation Models

As the study is based on censoring of data, it is appropriate to use tobit regression model. The firms having efficiency score one or grater have been assigned the value of 1 otherwise 0. The study used undefined data because the data has been truncated or censored. In literature, limited dependent variable or latent variable models have been developed for analyzing truncated or censored data (Tobit, Logit, Probit). The study applied Tobit model or censored normal regression model, the latent variable has linear, destructive term zero mean and constant variance (homoscedastic). Tobit equation may be expressed as follows;

$$y_i^* = x_i'\beta + \mu_i \tag{6}$$

$$y_i^* > 0 \text{ ise } y_i = y_i^* \tag{7}$$

$$y_i^* \leq 0 \text{ ise } y_i = 0 \tag{8}$$

In the above equation, x_i' is the all situation observed independent variable, y_i is the latent dependent variable represented the values one or 0. β represents the estimative factors and μ_i is the error (destructive) term. The destructive term is expressed as under:

$$\mu_i \sim [0.\sigma^2] \tag{9}$$

The destructive term is equal to zero means having same variance and normal distribution. In this way, the destructive term also entails expression of the latent variable y_i^* in the same way $y_i^* \sim [0.\sigma^2]$ Upper censoring Tobit model is the most appropriate in a censored model or upper limit 1 (as in the efficiency scores) may be expressed as follows with y expressing the values of the observed variable.

$$y_i^* = x_i'\beta + \mu_i \tag{10}$$

$$y = \begin{bmatrix} y^* \text{ise } y^* > 1 \\ 0 \text{ ise } y^* \geq 1 \end{bmatrix} \tag{11}$$

In the above equation, firm efficiency is represented by the value based on DEA analysis and it's equal to 1 if the firm is efficient otherwise zero. EMS is emerging management system of the firms and equal to 1 if firm is 14001 certified otherwise zero. Family ownership and institutional ownership represent the number of shares held by the family and institutions in a firm. Board interlock is also created dummy

on the basis of presence if the board members is also a member of ISO 14001 certified firm.

Empirical Results

As the study used different models to test the association between dependent and independent variables, the results are also presented separately. The results of Tobit models are presented in Table 6 below. High correlation between family and institutional ownership made the researchers to regress three different models.

The table shows the coefficient on ISO certification is positive and marginally significant at the 10% level. This indicates the firms with EMS system are efficient in case of Pakistani context in line with earlier studies. Family ownership has significant and positive association with firm efficiency at 1% level. This indicates the families owned firms in Pakistan are efficient in line with the findings of Poza [86]. Institutional ownerships have no significant association with firm's efficiency in case of Pakistani firms. This might be due of lack of interest of institutional investors or high correlation with family ownership. Gender diversity is a quite new variable for association with firm's efficiency and results showed higher gender diversity significantly contributes at 1% level to firm's efficiency in Pakistani context. As the board diversity is considered a mean of better perceptive of the market, boosts add to creativity and innovation, and effectiveness of the board by taking a broader view; hence generates positive outcomes [87]. The board interlock also showed positive significant impacts on firm's efficiency. It means the high management brings expertise, knowledge and techniques that contribute towards firm's efficiency. The results are in line with earlier findings [88-91].

From the control variables, the log of firm age and size showed no impacts on firm's efficiency. This means the maturity and market size do not impact the firm's efficiency in Pakistani context. However, the R and D expenditures showed positive significant impacts on firm efficiency with positive coefficient value. Lastly, the higher the financial leverage, the lower the efficiency of the firms as results depicted in Table 6. The result of financial leverage is line with earlier finding of Pandey [92].

Comparison of EMS sensitive and non-sensitive firms

In order to provide more insight into EMS certification and efficiency, the study further divided the sample into sensitive and non-sensitive firms group. The results are presented in Table 7. The ISO certification has significant positive association with firm's efficiency in case of EMS sensitive firm. This means EMS matters a lot for efficient firms if they are in sensitive firms' bracket. On the hand, ISO certification

Variable	Model 1		Model 2		Model 3	
	Coefficient	Prob	Coefficient	Prob	Coefficient	Prob
ISO certified	0.01543*	0.0613	0.06117*	0.0751	0.047425*	0.0731
Family ownership	0.17653***	0.0043			0.169655	0.1337
Institutional ownership			0.006875	0.1432	0.001235	0.87875
Gender diversity	0.00543***	0.00081	0.012308***	0.0000	0.00144***	0.0000
Board interlock	0.00865***	0.00316	0.015525***	0.0000	0.001775	0.3421
Control variables						
Log firm's age	0.009644	0.4643	0.001522	0.45783	0.006228	0.34566
Log firm's size	0.000647	0.6564	0.00105	0.64993	0.00671	0.16544
R & D	0.000175**	0.0532	0.00173**	0.04673	0.0060**	0.0536
Financial leverage	0.00086***	0.0000	0.00087***	0.00647	0.00687***	0.00331

*, **, ***Significance at 10 % (p<0.10), 5 % (p<0.05) and 1 % (p<0.01) respectively.

Table 6: Determinants of firms' efficiency.

Variable	Results of environmentally sensitive firms				Results of environmentally non-sensitive firms			
	Model 1		Model 2		Model 1		Model 2	
	Coefficient	Prob	Coefficient	Prob	Coefficient	Prob	Coefficient	Prob
ISO certified	0.0962**	0.02132	0.02518*	0.0316	0.00194*	0.0613	0.00861*	0.06101
Family ownership	0.11723***	0.00143			0.09143***	0.0000		
Institutional Ownership			0.00632**	0.0234			0.01875***	0.00000
Gender diversity	0.10554***	0.00000	0.04321**	0.0164	0.03186***	0.00000	0.00948***	0.00540
Board interlock	0.0149***	0.00052	0.02977***	0.0000	0.02865**	0.04833	0.007864***	0.00000
Control variables								
Log firm's age	0.001576	0.1235	0.00073	0.74986	-0.000043	0.8675	-0.00152	0.98631
Log firm size	0.00245*	0.0614	0.00009	0.53461	0.000647	0.6564	0.000943	0.29765
R & D	0.02564**	0.0423	0.00095**	0.05921	0.02141**	0.0362	0.00581**	0.05012
Financial leverage	-0.0321**	0.0710	-0.008751**	0.03647	-0.01087*	0.0654	-0.00362***	0.07647

*, **, ***Significance at 10 % (p<0.10), 5 % (p<0.05) and 1 % (p<0.01) respectively.

Table 7: Comparison of environmentally sensitive firms with that of environmentally non-sensitive firms.

Variable	Results of environmentally sensitive firms		Results of environmentally non-sensitive firms		Results of overall sample	
	Model 1		Model 2		Model 3	
	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
ISO certified	0.0087615	1.23505	0.0006573*	1.65555	0.001964*	1.91432
Family ownership	0.09342***	3.08723	0.09342***	7.36571	0.008673**	2.87435
Gender diversity	0.00367*	1.6862	0.007635*	1.78443	0.016543*	1.78443
Board interlock	0.05367***	3.45886	0.065134***	3.5643	0.065134***	5.89806
Moderating role of family and institutional ownership						
(ISO certified × Family ownership)	0.0909166***	13.2894	0.0002726	1.06543	0.001637*	1.819654
(Institutional investor × Family ownership)	0.0006528	1.2894	0.018765*	1.7986	0.0006573**	2.874861
Control variables						
Log firm age	0.0002827*	1.81972	0.001576	1.1235	0.0007551	0.6235
Log firm size	0.00245*	1.78165	0.002692*	1.6626	0.000765*	0.0614
R & D	0.02564**	2.21513	0.008715**	2.0423	0.02564**	2.70423
Financial leverage	-0.0321**	3.08489	-0.00892**	2.1652	-0.0321**	0.0710

*, **, *** Significance at 10 % (p<0.10), 5 % (p<0.05) and 1 % (p<0.01) respectively.

Table 8: Moderating influence of family and institutional ownership.

is relative significant at 10 % level with positive coefficient value. The results of family and institutional ownership at 1% and 5% respectively in case of sensitive group of firms, while the level of significance for family and institutional ownership at 1%. It means the institutional ownership play relatively more significant role for non-EMS sensitive firms than their counterpart. The role of other corporate governance variables (gender diversity, board interlock) is quite similar for both groups of firms just with minor variations (changes in coefficient values). If we conclude the results for EMS-sensitive and non-sensitive firms, the coefficient value remains uni-directional; however, the level of significance for ownership is changed. Thus, the market behavior is quite similar for sensitive and non-sensitive firms in case of corporate governance role in Pakistan.

Moderating influence of family and institutional ownership

The study also tests the moderating role of family ownership between ISO 14001 certification and firm's efficiency. The study applied Tobit regression analysis on three set of data set. Firstly, model 1 in the Table 8 presents the results of regression analysis on the data set that includes the set of sensitive firms with respect to environment. The results in Table 8 revealed the significant moderating role of family ownership. As per results of model 1, there is no significant moderation role of institutional ownership between EMS and firm's efficiency. In case of Pakistani firms', the family ownership plays more conclusive and significant role in ISO 14001 certification as compared to institutional ownership. Similarly, the moderating effects of ownership

remained justified because the coefficient sign remains same for all other variables included in the study. The model 2 includes the firms which are non-sensitive with respect to EMS firms. As per results of the model 2, family ownership, gender diversity, board interlock and Lerner index are positively significant 1%, 10%, 1% and 5% respectively. However, the moderation effect of family ownership is insignificant with positive coefficient value. In addition to this, the family ownership does moderate the association between EMS and firm's efficiency at 10% level for non-sensitive firms. Lastly, the researcher regressed the moderating effect on entire sample and results revealed that ISO certification, family ownership, gender diversity, board interlock and Lerner index are significant determinant of firm's efficiency at 10%, 5%, 10%, 1% and 5% respectively. In addition to this, family ownership and institutional ownership also moderate the relationship between ISO certification and firm's efficiency at 10% and 5% level respectively with positive coefficient value. The significant level for entire sample is 10% while for sensitive firm, family ownership plays more significant role. The level of significance for moderating effect of institutional ownership is quite significant for entire sample.

Robustness test (endogeneity problems (reverse causality))

There is a potential threat endogeneity problems and unobserved heterogeneity in determinants of board structure. Wintoki et al. [93] empirically examined the dynamic nature of internal board governance structure. In order to overcome endogeneity problems and unobserved heterogeneity, the study applied dynamic panel generalized method of

moments (GMM) estimator. They reported that it is quite appropriate to use dynamic panel GMM model for firm's specific and governance structure as there may be a biasness due to potential effects of lagged governance on present value of efficiency determinants are ignored. For the purpose of analysis, the study used an unbalanced panel data covering the sample period of the study. The utilization of GMM (generalized method of moments) estimator allows researcher to handle the potential threat of reverse causality running from efficiency to ISO of certification. GMM (generalized method of moments) estimator effectively deals with the endogeneity problem and firm-specific fixed effects.

As results showed, the finding of the firm's efficiency remained unchanged in terms statistically significance and direction of effects.

However, the estimated impacts are quantitatively deviated in the estimated impacts. As the deviation is very minor and it may be caused by oversight of the industry specific dummy variables in the models, it is insignificant. Therefore, the results of GMM estimation are reliable and robust. For over-identification restrictions, the J-stat (P value) is the probability value of the Sargan test. The Lag 2 Serial Corr. (P value) represents probability value of the Arellano-Bond test and that shows autocorrelation in residuals of order 2 is zero. To test exogeneity of the dependent variables, the study applied Durbin-Wu-Hausman test statistic. The results are in line with justification of GMM application (Table 9).

Similarly, the researchers also applied robustness test for moderating effect for more clarity and conclusive evidences. Table 10 presents the

	Results of environmentally sensitive firms		Results of environmentally non-sensitive firms		Results of overall sample	
	Model 1		Model 2		Model 3	
Variables	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Efficiency (t-1)	0.5858***	0.00000	0.7901***	0.0102	0.6905***	0.0000
Efficiency (t-2)	0.1254***	0.00000	0.0745***	0.0034	0.0312***	0.00437
ISO Certified	0.0935*	0.06320	0.01600*	0.0743	0.0262*	0.07159
Family ownership	0.0987***	0.00012	0.0040***	0.0024	0.02614**	0.00315
Gender diversity	0.0478**	0.03171	0.03657***	0.0001	0.0446***	0.002913
Board interlock	0.0097**	0.04676	0.0170**	0.0139	0.0172***	0.0020
Control variables						
Firm's age (log)	0.001363	0.5650	0.009621*	0.08082	0.01698*	0.0826
Firm's size (log)	0.005601*	0.0703	0.07018*	0.1462	0.0145**	0.0537
R &D	0.07664**	0.02367	0.05776***	0.0065	0.0082***	0.0028
Financial leverage	-0.0388*	0.0986	-0.0612*	0.0773	-0.05956**	0.0256
Industry dummies	Yes		Yes		Yes	
Diagnostic tests						
J statistic (P-value)	0.7956		0.3741		0.4573	
Lag ( ) 2 Serial correlation (P-value)	0.2867		0.3176		0.2534	
Durbin-Hausman test(P value)	0.4518		0.2291		0.2782	

*, **, ***Significance at 10 % (p<0.10), 5 % (p<0.05) and 1 % (p<0.01) respectively.

Table 9: GMM results (Moderating influence of family and institutional ownership).

	Results of environmentally sensitive firms		Results of environmentally non-sensitive firms		Results of overall sample	
	Model 1		Model 2		Model 3	
Variable	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Efficiency (t-1)	0.5154***	0.0000	0.6901***	0.0000	0.0151***	0.0052
Efficiency (t-2)	0.0918***	0.0000	0.0745***	0.0000	0.0210	0.0166
ISO Certified	0.0035*	0.0644	0.04635*	0.0743	0.3146*	0.0730
Family ownership	0.0437***	0.0067	0.0540*	0.0024	0.3634**	0.2057
Gender diversity	0.0660**	0.0110	0.0607**	0.0532	0.0770**	0.0838
Board interlock	0.0308**	0.0272	0.0270**	0.0039	0.0151***	0.0052
Lerner index	0.0993*	0.0715	0.0547*	0.0723	0.0210**	0.0455
Moderating role of family and institutional ownership						
(ISO Certified × Family ownership)	0.1756***	0.0103	0.1165***	0.0000	0.056637*	0.00043
(Institutional investor × Family ownership)	0.07685**	0.02367	0.09621**	0.0362	0.026573**	0.01541
Control variables						
Log firm age	0.007388*	0.09518	0.0776**	0.0387	0.005756	0.4163
Log firm size	0.0446**	0.02676	0.0002654	0.7673	0.4127**	0.0826
R & D	0.05067**	0.05676	0.0332***	0.0083	0.5003***	0.0082
Financial leverage	-0.05456**	0.01374	-0.006750*	0.0783	-0.0172**	0.0216
Diagnostic tests						
J-stat (P value)	0.3054		0.2846		0.5676	
Lag 2 serial corr. (P value)	0.4574		0.5648		0.3456	
DWH test stat. (P value)	0.1953		0.2757		0.6546	

*, **, ***Significance at 10 % (p<0.10), 5 % (p<0.05) and 1 % (p<0.01) respectively.

Table 10: GMM results (Moderating influence of family and institutional ownership).

results of moderating robustness. The results of GMM model are not significantly changed and the changes are quite insignificant and negligible. The results of GMM specification authenticates that the results of Tobit model estimation are consistent and robust. Hence, the results of Tobit model can be used benchmark to evaluate the impact of the ISI 14001 and governance factors on the firm's efficiency. For over-identification restrictions, the J-stat (P value) is the probability value of the Sargan test. The Lag 2 Serial Corr. (P value) represents probability value of the Arellano-Bond test and that shows autocorrelation in residuals of order 2 is zero. To test exogeneity of the dependent variables, the study applied Durbin-Wu-Hausman test statistic and the results are presented in the table. The results are in line with justification of GMM application.

Discussion and Conclusion

The growing concern of environmental importance and swiftly increasing in corporate governance rules in developing markets have placed considerable concern in literature with respect to firm performance and value. In this field, numerous efforts to identify the basics of the foggy relationship between EMS, corporate governance and firm's efficiency have been but yet to provide conclusive evidences. This study revisits the association between EMS, corporate governance and firm efficiency (in context of input and output measures). The results revealed a relatively significant association between EMS and firm's efficiency. On the other hand, the family and institutional ownership, gender diversity, board interlock and Lerner index showed quite significant influence on firm's efficiency. The results suggested that family owned firms are quite efficient and it plays a moderating role between EMS and firm's efficiency. The firms with higher family ownership are more likely to be efficient when they are EMS certified. In context of gender diversity, the female participation is also very encouraging due to significant impacts of gender diversity on firm's efficiency. Their valuable contribution draws the attention of stakeholders to invest in firms with higher gender diversity. The findings of the current study support the agency theory-based view of interlocking, which are in line the dilemma of busyness, in contrast to resource-dependence view which recommended the repayment of interlocking in terms of improved inter-organizational coordination and uncertainty reduction.

This study has several contributions to the literature. First, the study introduced EMS with respect to firm's efficiency rather than tradition measures of firm's performances. This relation is tested in an economy which is exposed to high level of environmental threats and ranked one of the ten highly polluted countries in the world. Second, the corporate governance concerned is also tested in a developing market where governance rules are quite a concern for investor and their rights are at the mercy of major stakeholders. In addition to this, the study also tested the moderation effects of institutional and family ownership to provide more insight into firm's efficiency and EMS. Lastly, the study also tested the reverse causality and robustness test negated any threat of endogenity or reverse causality.

At the end, it's very important to understand that adoption of several control variables in the study did not limit the effect of firm specific and macroeconomic factors that is expected to constrain strategic choices of EMS adoption, even among efficient firms. Consequently, it is quite important to consider these limitations while interpreting our conclusion. Finally, the study is not concerned to identify all the realms of corporate governance and to classify them into the right range of essential motivations. Although, there are certain limitations of the study, the outcome can endow within sight for future research.

In this vein, new researcher can apply the strength of association between the EMS and the firm efficiency at international level because it's an international phenomenon. This will allow the researchers to examine the effects of different cultural, market structure and diverse social ethics on philanthropic association of EMS and firm's efficiency because philanthropic CSR (EMS) can be and is encouraged to be the social norm in some economies. Moreover, one can consider CSR activities in broader perspectives by taking into account all other CSR investments rather than the EMS only.

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