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Article

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Factors Affecting Firm's Energy Efficiency and Environmental Performance: The Role of Environmental Management Accounting, Green Innovation and Environmental Proactivity

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ABSTRACT

Environment degradation is a global issue for which every individual or entity has to play their role. For an organization there are several ways by which their contribution to the environment can be improved. For said purpose, the present study was conducted in which the role of green innovation, environment proactiveness and environment management accounting was studied on environment performance and energy efficiency. Moreover, to meet the goal, the present study employs quantitative research approach where data was collected from 367 respondents and PLS-SEM was employed. The results revealed significant impact of the aforementioned independent constructs on dependent variables. Based on the findings, recommendations were given whereas limitations and barriers of the research and guidelines for the future researches are also discussed.

Keywords: Environmental Management Accounting, Green Innovation, Environmental Proactivity, Energy Efficiency, Environmental Performance

JEL Classifications: O13, R11, O31

1. INTRODUCTION

Organizational environmental sustainability emerged as an important emerging area which have taken great attention among the researchers, academicians and practitioners across the world (Schaltegger and Csutora, 2012; Christ and Burritt, 2015; Ahmed et al., 2019; Schaltegger et al., 2016). For practitioners, the said area is important for their continuous market competitiveness, not just in the present but also for the future (Rodrigue et al., 2013; Burritt and Schaltegger, 2010; Bennett et al., 2003). However the reason for researchers and academicians attention for the said area is due to the rapid change in the market which makes their role important as solutions provider for the possible market oriented problems and solutions (Latan et al., 2018; Li et al., 2018). Moreover, for an organization to adopt green initiatives in a present scenario is becoming an important decision (Shu et

al., 2016). Adoption of such green initiatives is due to numerous reasons including scarcity of resources, regulatory pressures, societal influences and consumer preferences etc. (Tang et al., 2018; Ahmed and Najmi, 2018).

In addition to this, if an organization willing to have an efficient environmental management, so one can sustain competitive gain in the business field, they need to implement environmental centric approach which includes strategies related to environment management and most importantly, an implementation of environment management accounting (EMA) (Sands et al., 2015; Lisi, 2015; Wagner and Schaltegger, 2004). By the help of EMA, an organization can efficiently manage the monetary issues, quality information related to environment and most importantly the possible consequences that organization can have in terms of finance whenever they take nay environment related decision

(Latan et al., 2018; Schaltegger et al., 2003; Spencer et al., 2013). Researchers urged that by the help of EMA, an organization can further strengthen their environment performance and hence required proper attention (Schaltegger et al., 2012; Derchi et al., 2015; Parker, 2011; Hart and Dowell, 2011).

For an organization to achieve environment sustainability, they need to bring-in green innovation in their existing operations (Li et al., 2018). Green innovation is defined as formulation and development of operations including products, services and processes which leads to less deterioration to the environment as compare to the available alternatives (Rennings, 2000; Klemmer et al., 1999; Zeng et al., 2017). In order to attain green innovation, a firm need to bring innovation in two areas broadly, i.e., product innovation and process innovation, by which a firm is able to eliminate waste from their existing operations by maximising the utilization of resources and preventing more environment pollution, which further complement the philosophy of organizational sustainability (Chang, 2011; Chen, 2008; Woo et al., 2014; Dangelico and Pujari, 2010). In other words, to improve an organizational environment, ecological and energy performance and efficiency, a firm need to adopt operations complementing green innovation (Li et al., 2018).

On the other hand, for an organization to survive in a fierce competition in a rapidly changed business environment, proactiveness is of significant importance (Claver et al., 2007; Hart, 1995). Similarly, in order to be and remain a green and environment friendly organization, organization need to develop their level of environmental proactiveness which helps them in timely anticipating the trends and the possible reaction accordingly (Steger, 2004; Bramoullé and Olson, 2005; Arda et al., 2019). Moreover, being an environmental proactive organization, an organization is able to mobilize their resources for improving environmental performance, spreading awareness among the employees so that they can maximize their resources, reduce waste and prevent pollution (Morrow and Rondinelli, 2002; Rondinelli and Vastag, 2000).

For an organization, it is important to understand that other than the organization there are some other stakeholders as well which plays their role in inducing firms to take certain decision. For instance, for an organization, regulatory bodies, competitors, suppliers and customers are the stakeholders which urge firms to take green initiatives (Ahmed et al., 2019). At on hand, organizations are responsible for their products and the possible threat that products are posing to the environment (Khan et al., 2019) and on the other hand, the organization is also responsible to follow the whole value chain of the product and services and the force the relevant parties to take environment friendly initiatives (Ahmed and Najmi, 2018; Najmi et al., 2019). Therefore, organization need to devise strategies in such a way that it start complementing the other relevant stakeholders.

Several researches have been conducted to explore the potential drivers and key enablers of environmental performance and energy efficiency. However, the findings are found to be inconclusive. Moreover, the role of EMA, green innovation and environmental

proactivity altogether have not yet been studied to explore and explain environmental performance and energy efficiency. Therefore, the objective of the present study is to explore that to what extent environmental management accounting, green innovation and environmental proactivity explain environmental performance and energy efficiency.

Later in the present study, review of related literature is presented followed by the discussion related to methodology, after that estimations and results of the statistical analysis were reported, discussed and concluded, whereas recommendations for policy makers and future researchers are also summarized and discussed.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

In the present study, natural resources-based view (NRBV) is utilized as theoretical foundations which were proposed by Hart (1995). NRBV is of view that an organization can still generate profits and maintain competitive advantage in the market, by efficient management of resources, which further helps in eradication of waste, deterring pollution, introducing environment friendly products and continuous mitigation of process that deteriorate the human health and environment (Sharma and Vredenburg, 1998; Hart and Dowell, 2011). In similar line, there are other researches also that utilize the NRBV and enriched the literature which further provide motivation of using NRBV for the present study (Darnall and Edwards, 2006; Hart and Dowell, 2011; Hofmann et al., 2012; Journeault, 2016; Wijethilake, 2017).

2.1. EMA, Environmental Performance and Energy Efficiency

EMA refers to management of both financial and non-financial information that a company accounts in order to evaluate the possible consequences of the environment related decision on financial health of the organization (Latan et al., 2018). For an organization to maintain the environment sustainability, researchers are in agreement that implementing the proper EMA leads an organization in sustaining their competitive advantage and termed EMA as an important driver (Sands et al., 2015; Lisi, 2015). According to Burritt et al. (2010), EMA complement an organization to fulfil and play their role for the betterment of environment and helps in generating economic, financial and environmental related benefits. Moreover, when a firm discloses, disseminate and share environment related information in their financial disclosures, it helps the organization to increase visibility for generating future economic benefits, whereas the environmental performance will also improve (Lisi, 2015; Rodrigue et al., 2013; Journeault, 2016; Guenther et al., 2016). On the other hand, having proper EMA supports decision makers and managers in their efficient decision making through which they can simply improve their energy efficiency (Journeault, 2016; Christ and Burritt, 2013; Henri and Journeault, 2010). Therefore, based on the aforementioned researches and discussions following hypotheses are proposed:

- H₁: EMA has a significant impact on environmental performance.
- H₂: EMA has a significant impact on energy efficiency.

2.2. Green Innovation, Environmental Performance and Energy Efficiency

Green innovation majorly deals with the green initiatives that are being taken in terms of product innovation and process innovation (Tang et al., 2018). Precisely, in product innovation, organization works in order to design, manufacture and launch new green products so that they are set to affect the environment less whereas process innovation deals with the innovation ideas through which the existing operations and process are transform into more environment friendly (Wong et al., 2012; Tang et al., 2018). Researchers have reported contrasting evidences with respect to green innovation and organizational performance in terms of economic, ecological and financial (Tang et al., 2018). For instance, researches by Driessen et al. (2013); Aguilera-Caracul and Ortiz-de-Mandojana (2013) and Liu et al. 2011 have reported negative relationship of green innovation with performance, either they deteriorate the performance directly or indirectly due to increasing costs of the green initiatives taken by the organization (Doran and Ryan, 2016). Nevertheless, it is normally assumed that green initiatives require huge financial investments which increase the cost of the organization and hence have an adverse effect of organizational economic, ecological and financial performance (Lee et al., 2016; Palmer et al., 1995). In any case, it is presumed that green innovation are intended to implement for the sake of improving environment performance, whereas product innovation and process innovation maximize the utilization of resources the eventually improve the energy efficiency of the organization (Papagiannakis and Lioukas, 2012; Dangelico and Pontrandolfo, 2015; Przychodzen et al., 2016). Therefore following hypotheses are proposed:

- H₃: GINN has a significant impact on environmental performance.
H₄: GINN has a significant impact on energy efficiency.

2.3. Environmental Proactivity, Environmental Performance and Energy Efficiency

Environmental proactivity refers to the tendency of an organization of being proactive while dealing with the environment oriented initiatives and actions. Through this, an organization is in a better position to proactively evaluate the future environment, ecological oriented development which makes an organization to plan and manage accordingly (Klassen and McLaughlin, 1996; Garcés-Ayerbe et al., 2012). Deploying and taking environment oriented initiatives by the help of efficient environment management is because of the environmental proactivity which eventually improves environment performance (Henriques and Sadorsky, 1999; González-Benito and González-Benito, 2006). Researchers have termed environmental proactivity as one of the most important determinant of environment performance (Dangelico, 2015; Lee and Klassen, 2008). Moreover, environmental proactivity is also helpful in managing human resources so that they comply with the environment friendly approaches and initiatives taken by their respective organization (Russo and Fouts, 1997; Arda et al., 2019). In addition to this, environmental proactivity also helps in achieving energy efficiency. For instance, if an organization decides to minimize the emission of CO₂ by replacing raw material with green, making manufacturing process more environment friendly and distributing with an objective to mitigate the environment degradation, then this environmental proactivity is

helping organization to improve energy efficiency (Lannelongue et al., 2015; Arda et al., 2019). Furthermore, according to Banerjee (2001), for an organization to improve their any kind of performance, there is a need to incorporate environmental proactivity within the strategic decision making and problem solving. Therefore following hypotheses are proposed:

- H₅: Environmental proactivity has a significant impact on environmental performance.
H₆: Environmental proactivity has a significant impact on energy efficiency.

The hypothesized framework of the present study is shown in Figure 1.

3. METHODOLOGY

In accordance with the objective of the present study and hypotheses proposed summarized in Figure 1, the present study utilizes the quantitative research approach with the correlational research design, which is a deductive approach and helps in further explaining the relationships among the constructs. Moreover, in quantitative research approach survey research design was employed as it helps in collecting, analysing and interpreting the quantitative data, collected through a research questionnaire, and analysed with the help of any statistical technique. Moreover, the survey is comparatively more time saving approach, which further helps in generalization of the findings by the help of small sample size (Tharenou et al., 2007). Therefore, following the discussions and directions by Tharenou et al. (2007), a research questionnaire was developed based on the scales adapted from the existing literature. The reason for adapting is that the scales are already tested and hence can generate good reliability and validity. The developed questionnaire was presented to a team of 5 experts who were asked to validate the face and content validity. After incorporating the suggestions given by the experts, the questionnaire was addressed to the respondents. The sources from where the measuring items were adapted are summarized in Table 1.

Figure 1: Framework of the study

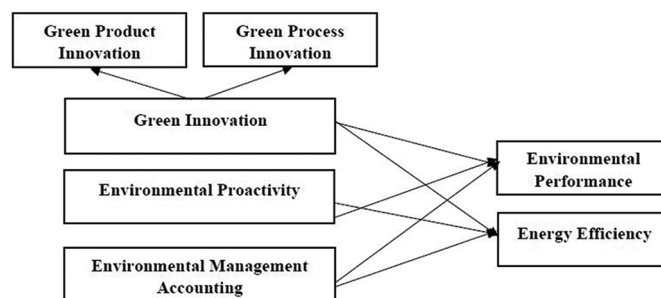


Table 1: Source of instrumentation

Construct	Source
Green innovation	Lee et al. (2016)
Environmental proactivity	Arda et al. (2019)
Environmental management accounting	Latan et al. (2018)
Environmental performance	Latan et al. (2018)
Energy efficiency	Latan et al. (2018)

The developed questionnaire were addressed to 600 potential respondents who have relevant experience and has the tendency to understand and respond the objective of the present study. Out of 600 questionnaire circulated, 421 were returned. After data cleaning, excluding questionnaire having missing values, and eliminating univariate and multivariate outliers, the final data comprised of 367 respondents. Out of 367 respondents, 143 respondents (39%) were female, whereas 224 respondents (61%) were male. Moreover, 84 of the respondents (23%) belongs to the age group of 20-30 years, 156 of the respondents (42%) belongs to the age group of 31-40 years, 73 of the respondents (20%) belongs to the age group of 41-50 years, and 54 of the respondents (15%) belongs to the age group of 51 years and above. In addition to this, 96 of the respondents (26%) were having experience of 1-5 years, 142 of the respondents (39%) were having experience of 6-10 years,

87 of the respondents (24%) were having experience of 11-15 years, and 42 of the respondents (11%) were having experience more than 15 years. Lastly in terms of education 57 of the respondents (16%) were undergraduates, 103 of the respondents (28%) were graduates, 89 of the respondents (24%) were postgraduates, and 118 of the respondents (32%) were having other academic background. The demographic of the sample is summarized in Table 2.

4. STATISTICAL ANALYSIS AND RESULTS

In order to analyse the collected data and to test the proposed hypothesized relationships, Partial Least Square-Structural Equation Model (PLS-SEM) was used. According to Hair et al. (2019), PLS-SEM is a variance based SEM which has the tendency to generate results even if the data in not normal. Moreover, PLS-SEM has the tendency to also explain more variation from the endogenous construct as compared to the other kind of SEM techniques, whereas it is also helpful when the model of the study is relatively complex (Hair et al., 2016). Therefore, PLS-SEM was found to be more suited as per the research framework of the present study. Moreover, Hair et al. (2016) suggested two way approach for the evaluation of a PLS-SEM model which includes examining measurement model and structural model. The further evaluation of the PLS-SEM model is discussed as follows:

4.1. Measurement Model

According to Hair et al. (2016), for the evaluation of the measurement model, the convergent validity and discriminant validity should be examined. Through this, the outer model of the

Table 2: Descriptive statistics (n=367)

Items	Frequency	Percent
Gender		
Female	143	39
Male	224	61
Age (years)		
20-30	84	23
31-40	156	42
41-50	73	20
51 and above	54	15
Working experience (years)		
1-5	96	26
6-10	142	39
11-15	87	24
More than 15	42	11
Education		
Undergraduate	57	16
Graduate	103	28
Post graduate	89	24
Others	118	32

Source: Authors estimation

Table 3: Measurement model results

Variables	Items	Factor loadings	Cronbach's alpha	Composite reliability	AVE
Green innovation	GINN1	0.743	0.910	0.878	0.634
	GINN2	0.796			
	GINN3	0.854			
	GINN4	0.747			
Environmental proactivity	EPRO1	0.726	0.846	0.818	0.595
	EPRO2	0.736			
	EPRO3	0.745			
	EPRO4	0.847			
Environmental management accounting	EMAC1	0.734	0.874	0.859	0.574
	EMAC2	0.757			
	EMAC3	0.743			
	EMAC4	0.784			
Environmental performance	ENPR1	0.786	0.894	0.876	0.584
	ENPR2	0.744			
	ENPR3	0.787			
	ENPR4	0.747			
Energy efficiency	ENEF1	0.771	0.859	0.799	0.588
	ENEF2	0.773			
	ENEF3	0.745			
	ENEF4	0.749			

Source: Authors estimation

Table 4: Discriminant validity Fornell-Larcker criterion

	GINN	EPRO	EMAC	ENPR	ENEF
GINN	0.796				
EPRO	0.247	0.771			
EMAC	0.346	0.215	0.758		
ENPR	0.357	0.355	0.244	0.764	
ENEF	0.378	0.453	0.446	0.465	0.767

Source: Authors estimation

Table 5: Results of HTMT ratio of correlations

	GINN	EPRO	EMAC	ENPR	ENEF
GINN					
EPRO	0.541				
EMAC	0.464	0.544			
ENPR	0.546	0.344	0.443		
ENEF	0.659	0.443	0.665	0.354	

Source: Authors estimation

Table 6: Results of path coefficients

Hypothesized path	Path coefficient	C.R	P-value	Remarks
ENPR←GINN	0.313	7.151	0.000	Supported
ENEF←GINN	0.351	5.311	0.000	Supported
ENPR←EPRO	0.113	4.654	0.000	Supported
ENEF←EPRO	0.513	3.565	0.000	Supported
ENPR←EMAC	0.163	5.643	0.000	Supported
ENEF←EMAC	0.132	7.454	0.000	Supported

Source: Authors estimation

PLS-SEM is evaluated as it deals with the internal consistency and reliability of the data.

4.1.1. Convergent validity

Convergent validity is defined as propensity of the measurement scales of a construct to congregate within (Mehmood and Najmi, 2017). If it does not congregate then it violates the presence of convergent validity. In the present study, convergent validity is examined by four criteria namely factor loadings, Cronbac' alpha, composite reliability (CR) and average variance extracted (AVE). For factor loadings, Cronbac' alpha and CR, Hair et al. (2016) suggested the edge of values >0.7 . Table 3 shows the successful examination of the measurement model by showing that all the aforementioned stated criteria meet the stated edge.

4.1.2. Discriminant validity

Discriminant validity is defined as propensity of the measurement scale of a construct to be dissimilar with the measurement scale of the other construct (Mehmood and Najmi, 2017). In the present study, the discriminant validity was examined by two criteria. Firstly Fornell and Larcker (1981) criteria according to which the correlations among the construct should not exceeds the square root of the AVE of a construct, which is shown in Table 4.

As shown in Table 4, the bold values represents square root of the AVE of a construct which is greater than the values of the inter construct correlations. Moreover, the discriminant validity is also examined through the correlation ratios of Heterotrait-Monotrait (HTMT) which is newly proposed discriminant validity evaluation criteria proposed by Henseler et al. (2015). According to this criteria, the HTMT ratio should not exceeds the threshold values of 0.85. As shown in Table 5, all HTMT value are less than stated thresholds.

4.2. Structural Model

In examining structural model, hypotheses testing was done. Since the present study has employed PLS-SEM, therefore after applying it the results revealed significant positive relationships among the constructs. The hypotheses testing is shown in Table 6.

As shown in Table 6, the green innovation was found to have a significant impact on environmental performance ($B=0.313, P<0.001$) and energy efficiency ($B=0.351, P<0.001$). It means that by bringing both product innovation and process innovation, firm is capable enough to improve their environment performance, whereas innovation can only be done by maximising utilization of resources therefore energy efficiency will also improve. In addition to this, the environment proactiveness was found to have a significant impact on environmental performance ($B=0.113, P<0.001$) and energy efficiency ($B=0.513, P<0.001$). It means that when firms started handling environment related decision more proactively then it will accordingly improve its environment performance and energy efficiency. Lastly, the environment management accounting was also found to have a significant impact on environmental performance ($B=0.163, P<0.001$) and energy efficiency ($B=0.132, P<0.001$). It means that when a firm efficiently

manage environmental oriented decisions, proper documentation is being done and accounting disclosures are regularly been shared, it leads organization to improve their environment performance and energy efficiency.

5. CONCLUSION AND RECOMMENDATIONS

Environment degradation is a global issue for which every individual or entity has to play their role. For an organization there are several ways by which their contribution to the environment can be improved. For said purpose, the present study was conducted in which the role of green innovation, environment proactiveness and environment management accounting was studied on environment performance and energy efficiency. Moreover, in order to meet the objective, the present study employs quantitative research approach where data was collected from 367 respondents and PLS-SEM was applied. The results revealed significant impact of the aforementioned independent constructs on dependent variables. Based on the findings, it has been recommended that organization need to manage their resources more efficiently, by bringing in the green innovation which helps them in waste elimination, and maximizing utilization of resources. Moreover, organizations should bring proactiveness in their planning and decision making which will improve the quality of their decisions and helps them in timely execution. Lastly for the stakeholders concern, the green initiatives should also be monitored and documented which not helps organization in managing their operations but also increase visibility among the stakeholders with respect to the organization decision making.

During this study, there were several limitations found which limit the present study and give directions for the future researchers. Firstly, future researchers need to go for exploratory research approaches which helps them in inducting the new insights in the literature. Moreover, sample of the present study was collected from a single region therefore cross-cultural study should be performed which helps in understanding the cross cultural difference if any. Lastly, the literature is filled with many other determinants of improving organizational contribution to the environment and hence need to be studied and explored.

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