Examining mediating role of Environmental Performance and Green Purchasing between Green Eco Design and Green Information Systems with Performance, Supported Renewable Energy

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Abstract- **Overview – Mining sector of Indonesia is very Important and contributes a lot in the GDP of the economy. It is important for mining industry to improve their financial performance along with improving environmental performance. Purpose–The aim of current study is to investigate the impact of eco-design and environmental performance on organizational performance. Moreover, the study has examined the impact of green information system and green packaging towards organizational performance. Analysis approach – For this study we have used the survey-based method for data collection and the questionnaire was collected from 500 target population. Partial least square (PLS) method is used for data examining and providing empirical support for the developed hypotheses. Findings – The research findings have proved that all of the proposed hypothesis have shown significant results. Research implications – The study has several implications as it provides literature based on empirical evidence regarding the high influence of green sustainable practices on the ultimate performance goal of organizations.**

Keywords: *Organizational performance, green purchasing, environmental performance, eco-design, green information system*

1. Introduction

The main focus of a number of organizations in recent past is to gain competitive advantage because the global market is getting very complex and competitive. A number of different strategies are adopted by the organizations so they can become leaders in the marker and gain competitive advantage [2]. As the main purpose of strategic management is to include the evaluation of strategic actions after the formulation and implementation of strategic action plan is taken as serious opportunity by the organizations to develop and sustain competitive advantage so the long-term goals can be achieved [1]. Thus, supply chain management is considered as the main strategic tool to so the organization can achieve the set goals of the organization. the organizations which adopt these tools successfully are able to enhance their organizational performance on the long as well as short term period [3].

The fundamental as well as main focus of the organization should be organizational performance. To guarantee the growth and success of the organization, focus on the performance of organization is important and critical [5]. In order to increase the goodness of the organization among the stakeholders including the customers and increase the organizational effectiveness, focus on organizational performance is necessary. Several studies hold that organizational performance is overall outcome reflecting organizational efficiency or effectiveness regarding image of the company or OP [4].

The main focus of the organizations is to find the ways to and determine different options by which they can survive on the earth for the longer period of time. The way human is currently living on earth is consuming the resources a lot. Moreover, the way human is using the resources, the environment is being altered. The environment is being changed a lot which is bringing scarcity to the resources of land, energy, mineral and water. For all these reasons, it is need of time that organizations should focus on the way human is using technology, services and products so human can survive on earth for the longer period of time [6].

The coordination and integration of the strategy alignment and business process is required by the supply chain management throughput the supply chain. The main purpose of SCM is the satisfaction of the consumer [8]. Under the supply chain management, the processes of the business which must be coordinated and integrated are information systems, logistics, marketing, manufacturing and purchasing. Some recent researchers have included environmental sustainability under the belt of supply chain management as well [7].

Among organizations there exist competition at the level of the supply chain, therefore organizations must focus on the needs of the customers along with identification and practices of SC that can help in the development of competitive advantage which in turn has impact on the improvement of the performance of the organization [9].

Consideration of environmental performance, social performance and economic performance is required under the sustainable SCM.

Under the past studies, the research stream impact of the strategies of management on the organizational performance is well established. The focus of research is investigation and development of model environmental sustainability with try to find out the best way to improve the performance of organization [10].

Problems related to environment are the major factor that impact the sustainability of society and economy. Environmental performance means the production performance that consider the factors of the environment. It's been revealed by the number of researchers that in order to measure the sustainability of the production process, environmental sustainability should also be considered [11]. Therefore, it is required to improve the performance of the environment so the organization can compete with other competitors [12].

Through the implementation of green technologies and eco-design, organizations must bring the innovative processes and products so they can satisfy the green demands of the stakeholders [13]. It is the process that is proactive which is very entailing and detailed. All stages of the product lifecycle are covered in it from the stage of extraction of raw material, manufacturing, distribution and packaging, usage and recycling after recovery. Basically, under the product design it is the new approach and identification of environmental aspects ate involved in it. There exists connection of the product with the environment which is included in the design stage of the product. Reduction of the impact on the environment by the design of the product is the main aim eco design which is usually faced during product lifecycle. All this is composed of final usage, distribution, production and raw material [14].

In past literature, researchers have treated purchasing as the main component of the production process. Under the business practices, the purchasing department holds the key in modern business under the supply chain category. Under the supply chain, a firm is connected with the supplier through which raw material is purchased [15]. With the passage of time, all stake holders are aware of the environmental and global warming issues due to which organizations and stakeholders shows concern regarding green purchasing. Under the purchasing process, organizations must consider the social as well as environmental consideration [16].

The organizations use information system in order to enable society, organizations, groups and individuals so they can achieve the goals of eco- sustainability [18]. Due to this reason, the phenomena of green information system have gained the importance under the research and is used currently to support the practices of eco-sustainability. The beliefs of the organization and individual to improve the economic and environmental performance are also shaped by the information system [17].

In the research of fields regarding environmental development, environmental performance, eco-design, green purchasing and green IS research, is studied as a "practice" perspective which might act as a useful lens to gather deeper and complete understanding of the practices that are important to maintain a sustainable green environment and thus, help to improve long-term performance of organizations. Current study has developed an integrated framework of above mentioned (environmental performance, eco-design, green purchasing and green IS) green variables that is helpful to improve organizational performance.

Mining sector of Indonesia is very Important and contributes a lot in the GDP of the economy. In the global mining industry Indonesia is the important player. It is important for the organizations of the mining industry to improve their performance by keeping in view the environment and improving environmental performance as well. Therefore, the objective of current study is to investigate the impact of eco-design and environmental performance on organizational performance. Moreover, impact of green information system and green packaging is examined on organizational performance [19].

2. Literature review

Organizational Performance is defined by the researchers as the outcome of the procedure or process. Later the process is modified to maximize, effectiveness, efficiency and the output of the organization. Different type of organizations uses different mechanisms as well as parameters. Under the qualitative measure, most common are job satisfaction and under the quantitative parameters earning per share, operating costs, and profit are included. Due to different kind of organizations, managers must try the parameters which best suit the organization [20].

Environmental Performance of the organization have positive impact upon the natural environment because it reduces amount of environmental accident frequency, reduction of resources, emission reduction, and waste in terms of liquid and solids in compliance with the standards of environment [21].

There is growing concern among the leaders of business regarding the sustainability of the environment as due to advent of environmental management. Moreover, managers are now more concerned natural resources and natural environment. From 1990's organizations realized

that they can create value by giving importance to the environment through management of the environment. For this purpose, organizations must take actions voluntarily to minimize the harmful activities of the environment, pollution and waste. As a result, organizations have adopted a number of different systems and approaches related to environmental management through the initiatives regarding product design, materials related to less pollution, minimum material for packaging and minimum consumption of energy [22].

Among the organizations dealing in business, the initiatives of the environmental management are expected to impact the environmental performance which is one of the main indicators of the organizational performance along with the financial performance. Apart from financial indicator of a firm, one of the essential indicators for performance is deemed EP for environmental management initiative in business organization and expected to deliver EP. To create synergy out of the resources of the firm to outperform its competitor in order to superior return, firm deploy value creating strategies according to the resource-based view [23]. An extent to which the company is involved in environmental programs implementation is indicated by EP to minimize the negative impact of its manufacturing waste, processes and products on the natural environment [24].

Eco-design Green design or the called as the environment design referring the environmental aspects and identification of the product over its life cycle and for the product development integration of these aspects. Minimizing the consumption of energy and material is required by eco-design. This eco-design facilitates the recovery, reuse and recycle of component parts and material, and within the manufacturing process this design helps in the reduction of hazardous products use. Eco-design requires the products internal attributes changes during the manufacturing for attaining the environmental attributes initiatives of GSC that are internally focused, with cooperation that is little [25]. Green supply chain initiative is therefore differing externally from eco-design, such as green purchasing and this type of impact is used for minimizing the impact on the whole life cycle of product from environment. Minimizing the impact starting from, manufacturing by material, to use and ultimate final disposal. Without compromising important criteria of the other product, function, performance, legal, , or aspects related to technique. Thus, product design process is integrated by the eco-design aspects, Considering the entire supply chain flow of the product. As most of the environmental impacts arises from the production, disposal and consumption of the product so this consideration is very important therefore direct consequences of decisions made in the design stage [26].

Green purchasing (GP) for developing the products sustainable to the environment green purchasing focuses on cooperating with suppliers. Due to constantly changing and growing demand and product innovative designs green purchasing is widely recognized for recycling and dissembling. For supply management of greener products green practices are related to green purchasing said by [27]. Furthermore, for the delivery of the green performances, ISO certification, waste reductions selected green suppliers are involved to improve environmental performance, such as programs for the supplier development and joint planning activities. Integrating environmental consideration into actions, purchasing policies and programs refers to the environmental purchasing. LCA life cycle analysis is also involved purchasing in supply chain management. In making decision about the suppliers green purchasing practices help the firms and create the grounds for the working together for the supply of the parts, equipment, services or materials for a specific product of the company and helpful in achieving the environmental goals [28].

Green information systems (GIS): Systems used for monitoring the environment outcomes and practices GIS are developed and been modified. The role of IS is not developed sufficiently within the context Sustainability of environment [29] stated that to improve environmental performance there is very little research focusing on these systems. To share the information our purpose is to establish the empirical relationship towards the information system development and amount to which firm has changed the IS for the environmental concerns and improve Ep of firm [30].

By meeting the reporting needs for various stakeholders and the internal firm's management environmental management systems are used as the backbone for the Green information systems. In terms of production, disposal, scrap ratio, recycling, transportation and packaging the eco-design are developed and provided by the green information system [31].

Information sharing, through the employment of inexperienced info systems, could be a key enabler for provide chain management in terms of integration and coordination. Material flows along the supply chain and managing the basic information logistical integration concept is used and proposed by several researches. Green info systems offer the data necessary to form selections concerning eco-design, in terms of fabric and energy consumption, reuse, exercise and recovery of materials [32].

2.1 Environmental performance (EP) and Organizational Performance (OP)

Past researchers conducted empirical studies to find the relationship among organizational performance and environmental performance. The studies conducted by [33] and King and Lenox (2001) and found that there exists positive relationship among environmental performance and organizational performance. Researchers

argued that the efforts of the organization towards the environment will result in reduction of cost which will eventually increase their performance.

In order to improve the efforts towards the environment, organizations are taking some serious steps. For this reason, they are focusing on technology adaption, get better physical assets and improve the process of delivering the product. The reason for the shift of the focus of organizations is that customers are more concerned about the environment. The organizations which focus on the environmental performance of the organization are more concerned about their reputation of the organization. The organizations with better reputation results in the improvement of sales and revenue. Overall, performance of the organization is enhanced because of the focus of organization towards the environmental performance [34].

Hence, it is hypothesized that:

H1: EP has significant relationship with OP.

2.2 Green purchasing and OP

It's been realized by the organizations that they must include the purchases while improving the supply chain's environmental performance. Moreover, it is also very important to address the issues related to purchasing in the supply chain that can impact the environment. The design specifications can be provided by the organizations to the suppliers through the adoption of principles of green purchasing. while following the green purchasing, the organizations have to fulfil the requirements of the environment.

Past researchers have mentioned that green practices are very important to improve the environmental performance of the organization. Green purchasing enhances the performance of the organization as well as the environmental performance is improved as well [35].

So, current research proposes that:

H2: GP has significant relationship with OP.

2.3 Eco-design and Environmental performance

Environmental aspects are included in the designing of the packaging by the firms that are having focus on the environmental performance. They try to make the product that the re-usable and recyclable as well the basic aim is to complete the process as well as product life cycle of the product.

Practices of the green supply chain includes the investment recovery, eco-design, customer cooperation and green purchasing which will have impact on the improvement in the economic and environmental performance.

It's been revealed in the studies in manufacturing sector. They found that there exists positive relationship among environmental performance and eco-design [36].

H3: eco-design has significant relationship with environmental performances

2.4 Green Information Systems (GIS) and GP

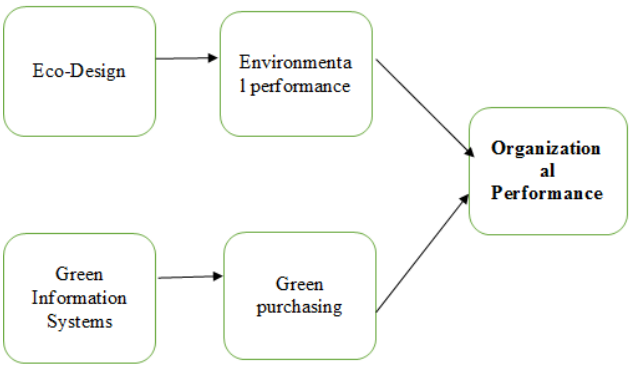
The capability of the information system of the organizations is the reason for the success of the supply chain management practices that are green. [37] mentioned that necessary information required for the development of environment performance via the decision required for the designing the product that is eco-friendly. Researchers empirically tested the relationship among Green information system and performance and found it to be positive. Thus, hypothesized:

H4: GIS has significant relationship with GP.

H5: EP mediates the relationship between eco-design and OP.

H6: GP mediates the relationship between GIS and OP.

2.5 Research Framework



3. Methodology

In the current study, 500 individual researchers were targeted for data collection and these individual researchers are the respondents for the questionnaire.

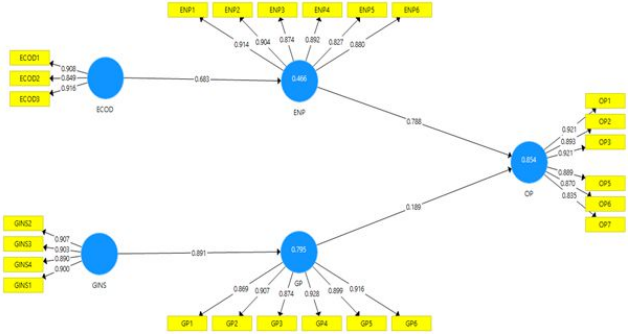


Figure 1. Measurement Model

From a total of 500 questionnaires, the researcher received 204 questionnaires, indicating a 40.85% response rate. The researcher discarded three questionnaires due to

incomplete questionnaires, therefore, a total of 201 questionnaires were regarded as usable for this research.

Considering the data collection method used in this study, a non-response bias test cannot be performed. The data for this study is gathered through self-administered method and the questionnaires were handed over to each respondent with a one-week time. Given the methodology used in present research, the deviations test between non-respondents and respondents could not be performed, since all the questionnaires were received back within the expected time.

The current research employed PLS technique for data analysis, because, 1) unlike other methods, like AMOS, the PLS technique does not involve any strict requirement concerning sample size [38]; 2) this technique is suitable to be applied for complex model estimation, such as for the estimation SEM models involving several constructs, and it also does not require normally distributed dataset; 3) PLS is useful and provides meaningful outcomes when SEM is mainly applied for predicting and describing a construct [39].

4. Study Results

Partial least square (PLS) method is used for data examining and providing empirical support for the developed hypotheses. Studies suggested PLS to be a causal modelling approach that aims at maximizing the explained variance of the latent constructs. In order to apply PLS, a two-staged approach is employed, where the first stage involves assessing validity and reliability of outer model, and second stage involves determining the inner or structural model.

With respect to SEM-PLS, measurement model is also referred as the outer model, and the structural path-modelling is classified into formative measurement model and reflective measurement model, although choosing an outer model is dependent upon the theoretical support available for the research [40].

Table 1. Outer Loading

	ECOD	ENP	GINS	GP	OP
ECOD1	0.908				
ECOD2	0.849				
ECOD3	0.916				
ENP1		0.914			
ENP2		0.904			
ENP3		0.874			
ENP4		0.892			
ENP5		0.827			
ENP6		0.880			
GINS2			0.907		
GINS3			0.903		
GINS4			0.890		
GP1				0.869	
GP2				0.907	
GP3				0.874	
GP4				0.928	
GP5				0.899	
GP6				0.916	
OP1					0.921
OP2					0.893
OP3					0.921
OP5					0.889
OP6					0.870
OP7					0.835
GINS1			0.900		

Table 2. Reliability

	Cronbach's Alpha	rho_A	CR	(AVE)
ECOD	0.870	0.876	0.921	0.795
ENP	0.943	0.944	0.955	0.778
GINS	0.922	0.923	0.945	0.810
GP	0.953	0.953	0.962	0.809
OP	0.947	0.949	0.957	0.790

Afterwards, in order to ascertain the reliability and validity of the measuring items, the goodness of fit was analysed for the measurement model.

The latent construct's quality or construct validity can be determined by assessing its convergent and discriminant validity. The construct validity shows how well a variable's operational definition actually explains that concept's true theoretical meaning. Confirmatory Factor Analysis (CFA) was used for analysing the convergent and discriminant validity of the constructs.

[41] referred convergent validity as the consistency among the measures of the same construct. Convergent validity shows that one and the same underlying construct is explained by a set of indicators, which can be expressed by using indicators' uni-dimensionality criterion. The convergent validity of the measuring items can be established by examining the AVE, factor loadings and

composite reliability (CR) criteria. The average variance extracted (AVE) refers as an extent that an item's variance is explained by a latent construct. Studies have suggested AVE as a powerful convergent validity criterion. Therefore, if AVE > 0.50, then it shows that more than half of the indicator's variance can be explained by the respective latent variable [39].

Table 3. Validity

	ECOD	ENP	GINS	GP	OP
ECOD	0.891				
ENP	0.683	0.882			
GINS	0.871	0.675	0.900		
GP	0.890	0.662	0.891	0.899	
OP	0.723	0.813	0.664	0.711	0.889

Another important criterion that should be observed while determining the construct validity is the discriminant validity, which shows the extent that a construct fails to correlate to other different measures. Discriminant validity refers to a situation where no correlation exists between two or more unique concepts. Therefore, it discusses the uniqueness of distinctively different constructs [41]. The researchers [39] have proposed methods for assessing the discriminant validity, these are, the Fornell-Larcker criterion and cross-loadings.

For testing the proposed set of hypotheses, path analysis was employed. In addition, the inner model or structural model is also determined. PLS is assumed to be a variance-based and prediction-oriented approach, which is considered as an appropriate approach for theory building and for estimating the hypothesized relationships. Thus, the structural model for this study was assessed through running bootstrapping method and PLS-SEM algorithm. The assessment of the structural model was carried out for testing the structural relationships between the variables. Although, this test can only be carried out if the analysis of the measurement model satisfies the recommended criteria.

Furthermore, in order to determine the significance of estimates, bootstrapping procedure, was employed, which is a non-parametric re-sampling method. The current research used this procedure to obtain t-values for the tested model [42]. Therefore, this study used 5000 resamples for carrying out the bootstrapping procedure.

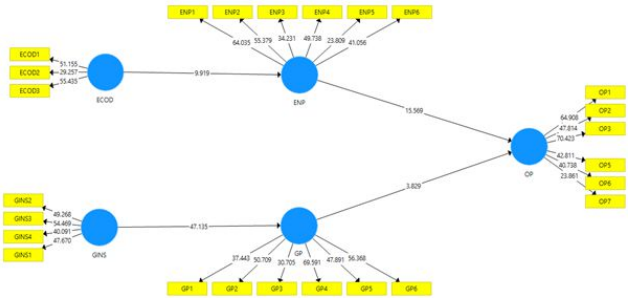


Figure 2. Structural Model

Table 4. Direct Relationship

	(O)	(M)	(STDEV)	(|O/STDEV|)	P Values
ECOD -> ENP	0.683	0.684	0.069	9.919	**0.000**
ECOD -> OP	0.538	0.533	0.045	11.919	**0.000**
ENP -> OP	0.788	0.782	0.051	15.569	**0.000**
GINS -> GP	0.891	0.892	0.019	47.135	**0.000**
GINS -> OP	0.168	0.174	0.043	3.926	**0.000**
GP -> OP	0.189	0.195	0.049	3.829	**0.000**

Table 5. Mediation Analysis

	(O)	(M)	(STDEV)	(|O/STDEV|)	P Values
ECOD -> ENP -> OP	0.538	0.533	0.045	11.919	**0.000**
GINS -> GP -> OP	0.168	0.174	0.043	3.926	**0.000**

The value of R^2 falls within 0-1, i.e. R^2=1 represents perfect predictive accuracy and vice versa.

Table 6. R-square

	R Square
ENP	0.466
GP	0.795
OP	0.854

The values such as, 0.25, 0.50 and 0.75 represent weak, moderate and substantial predictive accuracy.

5. Conclusion

It is very important for the organizations to regularly monitor the performance. By this way the organizations can make the future moves. It is also critical for them to regularly monitor the environmental performance and take steps by which they can keep the environment safe.Study findings demonstrates that there is a positive influence of several environmental performance measures on the performance of organizations. The aim of the study was The aim of current study is to investigate the impact of eco-design and environmental performance on organizational performance. Moreover, the study has examined the impact of green information system and green packaging towards organizational performance. The data was collected via survey and PLS SEM was adopted to analyse the data. According to the findings There is a significant impact of green and environmentally friendly practices on organizational performance.

Also, current study has provided a deep concept of how the companies have to develop the mechanism of sustainable practices within their supply chain procedures for the improvement of form's profitability and overall efficiency.

The study has several implications as it provides literature based on empirical evidence regarding the high influence of green sustainable practices on the ultimate performance goal of organizations. It also provides idea to the business executives and managers to focus on sustainable supply chain practices. Therefore, they should adopt eco-friendly ways in their overall supply chain procedures.

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