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EFFECT OF GREEN SUPPLY CHAIN PRACTICES ON PERFORMANCE OF MANUFACTURING FIRMS IN KENYA: A CASE OF EAST AFRICA PORTLAND CEMENT

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ABSTRACT

The subject of Green Supply Chain Management (GSCM) practices attracts a growing interest in academic and professional circles. GSCM involves achievement of economic, economic and social goals in the systematic coordination of critical inter-organizational business processes to improve performance in long-term for an enterprise and its partners in the supply chain. This research is a cross-sectional study that explores to establish the effects of Green Supply Chain Practices on the Performance of Manufacturing firms in Kenya, A Case of East Africa Portland Cement in Athi River. Further, the study adopts a conceptual framework that exhibits the causal relationship between independent variable and dependent variable. The independent variable of the study is; eco-design and labeling, which has a cause and effect relationship with the performance of manufacturing firms, the dependent variable. This study adopted a descriptive research design, the population under study was drawn from manufacturing companies. Also, the study used a structured questionnaire as the primary data collection instrument. For reliability and validity of the data collection instrument, pilot test was conducted at Savanah Cement. Data collected from the pilot study was expunged when analyzing the data. Questionnaires were self-administered by the researcher. The data was checked for completeness, coded and analyzed with the aid of Statistical Package for Social Sciences SPSS version 23. Descriptive statistics was presented in the form of frequency tables, and percentages. The inferential statistics included Pearsons' correlation and regression analysis.

Keywords*: Green Supply Chain Management, Eco-design and Labeling*

I. INTRODUCTION

Manufacturing refers to the process of transforming raw materials, components, or parts into merchandise with aid machines for use or sale purpose. Green Supply Chain Management (GSCM) is gaining popularity among organizations and research communities. Globalization impels industries to implement the GSCM practices to be competent in the global market; it also provides opportunities for manufacturers to export (Semen *et al.*, 2012). GSCM practices also extend to the entire value chain from supplier to customer when organizations inform buyers of ways to reduce their impacts to the natural environment (Handfield *et al.*, 2008; Miemczyk *et al.*, 2012). Organizations that purchase inputs from a specific supplier also acquire waste from each supplier up the supply chain. These distinctions are essential because agencies that adopt GSCM practices evaluate the environmental impacts of their first-tier suppliers (Handfield *et al.*, 2008). The pressure and drive accompanying globalization have prompted enterprises to improve their environmental performance (Zhu and Sarkis, 2016). Consequently, corporations have shown growing concern for the environment over the past ten years (Sheu *et al.*, 2015).

The pressure on corporations to improve the environmental performance comes from globalization rather than localization (Sarkis & Tamarkin, 2013). Increasing environmental concern has gradually become part of the overall corporate culture and, in turn, has helped to re-engineer the strategies of corporations (Madu & Madu, 2012). Globalization provides opportunities for business extension simultaneously it introduces the challenge of GSCM implementation to reduce emissions from the industries. Different drivers influenced industries to initiate green practices as a result of environmental concerns become a part of the industrial culture which helped industries to reformulate their strategies (Madu & Madu, 2012). Currently, enterprises are practicing GSCM or initiating GSCM practices in their operation. During last decade most of the research was done to analyze the impact of drivers toward the implementation of GSCM practices. Beyond this definition with adding the "green" component, it refers to green supply chain management (GSCM) which is defined as "green procurement+ green manufacturing+ green distribution+ reverse logistics". The idea of GSCM is to eliminate or minimize waste (energy, emissions, and chemical/hazardous, solid wastes) along supply chain (Hervani, Helms & Sarkis 2005). Environmental issues under legislation and directives from customer especially in the US, the European Union (EU), and Japan become an important concern for manufacturers. As a more systematic and integrated strategy, GSCM has emerged as an important new innovation that helps organizations develop "win-win" strategies that achieve profit and market share objectives by lowering their environmental risks and impacts, while raising their ecological efficiency (Hock, 200). Recent studies of GSCM can be separated into two ways: framework for GSCM, and performance measurement. Some frameworks propose how to improve the collaborative relationships between manufacturers and suppliers, to explore the gaps between the framework and the present state, to aid managerial decision making, or to develop general procedure towards achieving and maintaining the green supply chain (Salam, 2008).

STATEMENT OF THE PROBLEM

The manufacturing industry is vital for both emerging and developing economies to improve the quality of life of the citizenry. The limited natural resources and the increasing demand for energy are slowing down the pace of development in developed countries. On the other hand, the manufacturing sector of the developing nations is attracting global attention because of untapped potential for growth in terms of natural resources and human capital, in addition to relatively less stringent environmental legislation (Ganiyusufoglu, 2013).

At the same time, the growth of the manufacturing industry in the developing nations has brought in some challenges. These challenges include fast depleting natural resources, soil, and water and air pollution and severe health hazards to humanity; the waste and emissions caused by manufacturing firms have become one of the leading sources of environmental problems including global warming and acid rain. For instance, according to US researchers, in 2015, 14% of Africa's CO_2 emissions were accounted for by the exports to the US (BBC, 2007). These challenges are posing a risk to the sustainable development of the planet (Mittal & Sangwan 2013). Also, developing nations lead the total emissions and emissions per capita tables worldwide (IEA, 2007).

The need of achieving higher economic prosperity with least environmental impact has led to a new manufacturing paradigm of green supply chain management which involves designing, manufacturing, delivering and disposing of products that produce a minimum adverse effect on environment and society and are economically viable. In the wake of the above, manufacturers have been on the spotlight over the way their supply chain practices, both upstream and downstream impact the environment, the community, the economy, the government among other stakeholders. GSCM is an approach to improve the performance of the process and products according to the requirements of the environmental regulations (Hsu & Hu, 2008), it is recognized as a direct and effective mechanism to address environmental problems along with global supply chain.

GENERAL OBJECTIVE

To determine the effects of Green Supply Chain Practices on the Performance of Manufacturing firms in Kenya; A Case of East Africa Portland Cement.

SPECIFIC OBJECTIVE

To determine the effect of Eco-design and Eco-labelling on performance of EAPC in Kenya.

RESEARCH QUESTION

What are the effects of Eco-design and Eco-labeling on the performance of EAPC in Kenya?

II. LITERATURE REVIEW

Conceptual Framework

Independent Variable **Dependent Variable**

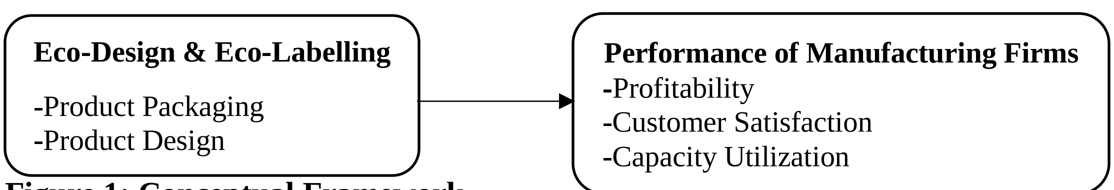

Figure 1: Conceptual Framework

REVIEW OF VARIABLES

Eco-Design and Eco-Labels

Eco-design is a practice that integrates environmental concerns in a product or process design, and as such, it influences the entire life-cycle of a product. Kleindorfer *et al.*, (2015) notes that product design is often complicated by the inherent evolution of environmental trends and regulations. Characteristics such as functionality, product safety, comfort, efficiency and aesthetics and R&D teams are required to consider the impact of the product/process on the natural environment. Karlsson and Luttropp (2016) argue that eco-design also ought to include concepts such as sustainable consumption, reduction of the volume of 'desire" and aims to enable human satisfaction in concert with a positive role in sustainable product development.

Sarkis, (2008) argue that Eco-design has numerous functional sub-components; design for reusability, recyclability and remanufacturing, design for reassembly and design for disposal. Successful implementation of Eco-design practices to have a combination of customer needs and desires concerning environment, aimed at bringing satisfaction and functionality. Also, communication across an organization's functional areas and avoiding concentration and isolation of R&D teams (Books & Sandstrom, 2006). The interaction, communication, and commitment of people outside R&D can avoid a non-feasible idea from going to implementation causing higher costs.

Barth and Fischer (2013), define an eco-label as a certification indicating that a product meets certain requirements regarding how environmentally sound its production process or the materials used to create it is. Consumers can make purchasing decisions based on the ecolabel it has. Thus, an ecolabel is a label that a company can put on its products and services and this label shows that the products and services meet certain environmental criteria. A company needs to be certified by a third-party to use a certain ecolabel on its products (European Commission, 2011). Often, manufacturers choose to adopt the use of ecolabels as part of their overall marketing strategy, since the environmental aspects of the products can be used as a competitive advantage (ISO, 2012). The International Standards Organization (ISO) created the 14020 series of standards, which provides businesses worldwide with a set of international benchmarks with which they can create their environmental labeling (ISO, 2012).

The current environmental labels have been classified by ISO into three typologies; Type I, Type II, and Type III (UNOPS, 2009). ‘Type I environmental labels Ecolabels labeling' also referred to as ISO 14024:1999 is the identity given to the ‘classic’ eco-labelling schemes (ISO, 2012). These ecolabels take into account the life-cycle impacts of products and services (UNOPS, 2009). ‘Type II self-declared environmental claims' also referred to as ISO 14021:1999 are claims made by manufacturers and businesses. These environmental claims are voluntary and, though the claims often placed on the packaging of products (or on the products themselves) in the form of a label, they also include all other types of environmental claims. However, they were made, such as in advertising, on the Internet, or in services such as tourism. ‘Type III environmental declarations' also referred to as ISO 14025:2006 may be described as, "quantified environmental data for a product with pre-set categories of parameters based on the ISO 14040 series of standards. These standards provide the principles and frameworks for Life Cycle Assessment (ISO, 2010), but not excluding additional environmental information" (ISO, 2012).

Amongst eco-labels, Salzman (1998) explains that there are three basic types. The first basic type is the single-issue voluntary label. These types of labels are the largest class of ecolabels. Examples of these labels include "recyclable" and "CFC [chlorofluorocarbon]-free". These labels are placed on the products by the manufacturers and typically face few legal constraints provided the labels are verifiable and accurate. The second type is a single-issue mandatory label. These types of labels are required by law in many national and sub-national governments. Examples include "flammable" and "eco-toxic." Finally, the third type is the third-party voluntary label. Third-party voluntary labels look at the overall environmental quality of a product from a holistic view. These labels identify the product as being environmentally superior to its competitors. This environmental seal of approval is given to products that prove their superiority via their life-cycle (i.e., the environmental impacts of their life-cycle). The goal of ecolabels is to provide the end customer accurate information concerning the environmental qualities of a product including information about its life-cycle. Examples of well-known eco-labels are the Blue Angel in Germany, Nordic Swan in Scandinavia, and the Green Seal in the USA. Such eco-labeling programs are either government-sponsored or private and can be found all over the world – in more than 25 countries. Within these programs, a committee agrees on the category of products (for example copying paper) and the objective criteria that the products must meet to meet the criteria (for example the product contains 100% recyclable content and is chlorine-free). Manufacturers then voluntarily send their products to the program for consideration, and if the products meet the specifications, then the manufacturers can purchase the license to put the label on their products (Salman, 1998; European Commission, 2011).

Additionally, eco-labels are used within certain product categories where there is a variety of alternatives available. This is done so that it is possible to scientifically compare the different products, and so that manufacturers can have a competitive advantage by differentiating their "green products" from alternatives in the market. Unfortunately, specialist or innovative products such as medical equipment do not often have eco-labels. Instead, product groups such as foods, household appliances, and paper products have a wide variety of eco-labels (UNOPS, 2009). Eco-labels are often used in green procurement in various ways, such as criteria that suppliers' products and services must meet, though a company cannot discriminate by requiring their suppliers to have a specific eco-label. Should a specific eco-label scheme be mentioned, then it should be followed by the words "or equivalent" in the technical specifications (UNOPS, 2009). When assessing the eco-labels provided by suppliers, it is important to ascertain that they are genuine and provide accurate information. Surveys worldwide have shown that some eco-labels may be scientifically inaccurate, such as a label stating, "Was made with care for the environment" without any concrete information on its environmental impact. (European Commission, 2011). In Africa, the majority of eco-labeling schemes currently in use are international ones which are relevant to a specific sector (such as fisheries and forestry). There are, however, a few sectoral eco-labelling schemes being implemented in certain regions in Africa (Janisch, 2007).

Performance of Manufacturing Firms

Psomas and Kafetzopoulos (2012) argue that performance contributes to providing the competitive advantage to the firms in cut-throat competition in the market. The company takes advantage of its competitors and performs better in business. One of the most prominently discussed elements of firm performance is logistics costs. Cost performance is considered a key part of the firm performance, for example by Beamon (2009), Morgan (2004), Schramm-Klein and Morschett (2006) and Whicker, Bernon, Templar, and Mena (2009). Depending on the source and measurement technique used, the share of logistics costs of the total costs may vary significantly but is estimated to be around 10% of sales in industrialized countries. In addition to the frequently discussed cost performance, different measures of service performance are also considered to be a crucial part of the firm performance. Beamon (2009) lists fill rate, on-time deliveries, stockout, and customer response time, manufacturing lead time, shipping errors and customer complaints as measures of output performance. Gunasekaran *et al.* (2014) include similar types of measures as part of the operational level performance in source and deliver activities. In addition to service performance, asset utilization in some form or another is often mentioned among the important performance metrics to the firm (Stewart 1995; Gunasekaran *et al.*, 2001; Johnson & Templar 2011).

EMPIRICAL REVIEW

Many studies showed that consumer have less or limited knowledge about the type of Eco-labels (D‘Souza, Taghian & Lamb, 2006b, p.164; Nilsson, Tunçer & Thidell, 2004, p.519). Consumers can hardly name environmental labeling scheme and the differences between them. This part of overview provides general knowledge of environment labels: from classification to definition. There are many ways of classifying environmental label. Three key attributes were pointed out by US environment protection agency (EPA) as the main components of environmental labeling scheme. They are: Third party: be known as labeling is independent of manufactures and seller; Participant can be voluntary or mandatory; Labeling can be positive or negative in promoting positive effect toward environment or warning about negative impact of the product. (EPA, 1998, cited in D‘Souza 2004, p.182) In general, the most common way to category the environmental label is based on whether the label is mandatory or voluntary. Horne (2009, p.176) defined that mandatory environmental labeling was authorized by law, and dominated in some specific area such as water or energy consuming. On the other hand, voluntary labeling scheme includes three main types: type I, type II, and type III. Type I label refers to the use of logo, which associates with certified products by third-party. Type II label is self-claim of stakeholders, who directly participate on product life cycle (includes manufactures, importers, distributors, and retailers). Type III is less used for comparing with type II, and I. It is the one to ―provide quantitative life cycle environmental data in a more extensive format‖ (Horne, 2009, p.176). Figure 3 in the next page presents about the categorization of environmental label in detail. The term Eco-label in literature mostly implies about type I of environmental label scheme. According to ISO 19024 (1999, cited in Thidell 2009, p.19), Type I scheme was define in more detail as: "Voluntary, multi-criteria-based third party programme that awards a license which authorizes the user of environmental labels on products indicating overall environmental preferability of a product within a particular product category based on life cycle consideration" There are different requirements of product environmental performance towards different types. Type I is required to have product environmental performance in the whole product life cycle. It differs with other environmental labeling scheme (Thidell, 2009). The product life cycle consideration is delimited as:" the objective of reducing environment impacts …is best served by considering the whole life cycle when setting the product environmental criteria. Life cycle is stages to be taken into account when developing the product environmental criteria should include: extraction of recourse, manufacturing, distribution, use and disposal relating to relevant cross-media environmental indicators."(ISO 14024, 1999, cited in Thidell 2009).

CRITIQUE OF EXISTING LITERATURE

The theory of green operations does not offer a standardized classification on environmental practices. Different terminologies are usually found in the field causing confusion and difficulties to build a robust classification. For instance, some studies include Eco-Design as part of Green Supply Chains. Also, Green Supply Chains are also known as closed-loop supply chains, which include Reverse Logistics. Considering the differences from practice, drivers for implementation and the nature of their activities, these green operations practices were considered distinct from each other, hence, the choice of having the forward logistics as part of Green Supply Chains but Reverse Logistics and Eco-Design as a separate practice. It does not mean they do not interact in reality though as the scope of these may overlap in some companies.

Reverse Logistics is considered in many publications as part of green supply chain management, but in this work, it is treated as a separate tool from green supply chain practices. The main reason for this is because different skills and ways of thinking are needed to run a programme of Reverse Logistics. De Brito (2013) noted that traditional logistics uses forward thinking; nevertheless, product recovery approach is a vital condition for the future.

Reverse logistics is an expensive undertaking hence any firm that wants to undertake reverse logistics needs to critically evaluate the cost and benefits of it. Also, eco-designing is a process that if not properly implemented, it is bound to fail. More-so, there is a little demarcation between the definition of green designing and Eco designing. Some scholars use these terms interchangeably.

RESEARCH GAP

Earlier works and reviews have a limited focus and narrow perspective. They do not cover adequately all the aspects and facets of GSCM practices. For example, Bey (2001) presents a critical appraisal of developments in the field of industrial ecology only, while Zhang *et al.,* (1997) focus only on green design. Much of the work is empirical and does not focus adequately on green supply chain practices in manufacturing firms. Most researchers used manufacturing industry as their sample of study in order to investigate the GSCM adoption and implementation either in developed and developing countries. Manufacturing is believed to be the main causes to the emerging environmental problems due to its traditional business operation. Various industries in manufacturing companies such as manufacturers in paper; textile and dyeing; chemicals, plastics and rubbers;

metals; machinery and equipment manufacturing; electronics; automobile; printing; construction and others. Traditional polluting industries such as manufacturers in chemical, electrical and paper industries generally experience higher environmental pressure. Therefore, the manufacturing industry as traditional polluters tend to be the potential sample of study as they tend to implement GSCM practices.

III. RESEARCH METHODOLOGY

This study employed a descriptive research design. This study focused on manufacturing firms in Kenya; A Case of East Africa Portland Cement. The samples size of this study was 70 since the population is highly heterogeneous, stratified random sampling was used to select the respondents from East Africa Portland Cement. The main data collection instrument was a questionnaire. The data collection instruments was pilot tested in Savannah Cement also based in Athi River. To increase the reliability of the questionnaire, this study used Cronbach alpha for separate domains of the questionnaire rather than the entire questionnaire. For construct validity, the questionnaires were divided into several sections to ensure that each section assesses information for a specific objective. Content validity was ensured through subjecting the questionnaires to professionals in supply chain who checked the completeness, relevance and appropriateness of the questionnaire before subjecting it to the respondents. Upon obtaining data from the field, through questionnaires, was coded and keyed in using SPSS (version 23). Descriptive statistics was presented in the form of frequency tables, pie charts, and percentages. The inferential statistics will include Pearsons' correlation and regression analysis; the dependent variable was correlated with the independent variables to show the relationship between the variables. To establish statistical significance, of the independent variables, on the dependent variable, multivariate ordinary least squares regression was employed. The regression equation adopted the following form;

Y= β0+β1X1+é

Where Y= Performance of Manufacturing Firms

X1= Eco-Design & Eco-Labelling

In the model, β0= the constant term while the coefficient β_ii= 1…4 was used to measure the sensitivity of the dependent variables to unit change in the predictor variables. é is the error term which captures the unexplained variations in the model.

IV: RESEARCH FINDINGS AND DISCUSSION

Eco Design and Eco-Labelling

The following values gives the Likert scale; (1.0<Not considering>2.5), (2.5<Carrying it to some extent>3.5), (3.5<Carrying out fully>5). The study sought to find out the respondents' extent of agreement of statements on effect of eco design and eco-labeling on performance of manufacturing firms. Table 4.7 shows the study findings, most respondents agreed that EAPC designs products for reduced materials and energy consumption as shown by a mean of 3.9074 and a standard deviation of 4.17661; that EAPC designs products for reuse, recycle, recovery of materials components and parts as shown by a mean of 3.5769 and standard deviation of 1.10872; that EAPC designs products to avoid or reduce use of hazardous products or their manufacturing process as shown by a mean of 3.6604 and a standard deviation of 1.31476.

Table 4.1: Extent of agreement of statements on effect of Eco Design and Eco Labeling on performance of manufacturing firms

Statements	N	Mean	Std. Deviation
EAPC designs products for reduced materials and energy consumption	54	3.9074	4.17661
EAPC designs products for reuse, recycle, recovery of materials components and parts	54	4.0000	4.15274
EAPC designs products to avoid or reduce use of hazardous products or their manufacturing process	53	3.6604	1.31476

Performance of Manufacturing Firms

The following values gives the Likert scale; (1.0<Not considering>2.5), (2.5<Carrying it to some extent>3.5), (3.5<Carrying out fully>5). The study sought to find out the respondents' extent of agreement of statements on performance of manufacturing firms. Table 4.9 shows the study findings, most respondents agreed that there has been reduction of air emission as shown by a mean of 3.8519 and a standard deviation of 1.05806; and that there have been reduction of disposal cost as shown by a mean of 3.7358 and a standard deviation of .90194; that there has been optimal design with a mean of 4.4444 and standard deviation of .98759 that Capacity Utilization with a mean of 3.7222 and a standard deviation of .97935.

Table 4.2: Performance of Manufacturing Firms

Statements	N	Mean	Std. Deviation
Reduction of air emission	54	3.8519	.85578
Reduction of disposal cost	53	3.7358	.90194
Optimal design	54	4.4444	.55815
Capacity Utilization	54	3.7222	.97935
Improved Quality	54	4.0370	.95093

Regression analysis

A linear multiple regression analysis was used test the relationship between the independent variables and the dependent variable. The researcher applied the statistical package for social sciences (SPSS) to code, enter and compute the measurements of the multiple regressions for the study. Coefficient of determination explains the extent to which changes in the performance of manufacturing sector in Kenya can be explained by the change in the independent variable (Eco-design and Eco-labeling).

Table 4.3: Model Summary

Model	R	R Square	Adjusted R Square	Change Statistics	
				F Change	Sig. F Change
1	.897[a]	.805	.8025	7.567	0.029

According to the findings in the table above, the value of adjusted R^2 is 0.8025. This indicates that there was a variation of 80.25 % of performance of manufacturing sector due to the four independent variables at a confidence level of 95%. In addition other factors that were not studied in this research contribute to 19.75%

of the performance of manufacturing sector in Kenya. Therefore, further research should be conducted to investigate the other factors which contribute to that 19.75% performance in manufacturing sector in Kenya. The significance value was 0.029 which is less than 0.05 thus the model is statistically significance in predicting how the independent variables (Eco-design and Eco-labeling) vary on the dependent variable (performance of manufacturing sector). The F critical at 5% level of significance was 2.789. The F calculated (value =7.567) was greater than the critical value (7.567> 2.789) which indicates that the independent variables (Eco-design and Eco-labeling) performance of manufacturing firms in Kenya with reference to East Africa Portland Cement Ltd.

Table: 4.4 ANOVA[a]

	Model	Sum of Squares	df	F	Sig.
1	Regression	4.120	4	7.567	0 .029[b]
	Residual	50.048	78		
	Total	53.168	82		

$\mathbf{Ys = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon}$ become:

$Y= 0.164+0.047X_1$

Where Y is the dependent variable (performance of manufacturing sector) X_1 is the Eco-design and Eco Labeling. Taking all independent variables constant at zero, the performance of East Africa Portland Cement ltd will be will be 0.164. The data findings also showed that taking all other independent variables at zero, a unit increase in the Eco-design and Eco-labeling will lead to a 0.491 increase in performance of manufacturing sector.

Table 4.5 Multiple Regressions

Model		Unstandardized Coefficients		Standardized Coefficients	Sig.
		B	Std. Error	Beta	
1	(Constant)	.164	.472		.029
	Eco-design & Eco-labeling	.047	.083	.141	.024

V. SUMMARY

The study established that Eco-design and Eco-labeling affect performance of manufacturing firms to a great extent. Eco-design and Eco-labeling is independent factor that influence performance of manufacturing firms. The study showed that EAPC designs products for reduced material and energy consumption; EAPC designs products for reuse, recycle, recovery of materials and parts.

VI. CONCLUSION

The study concluded that investment in Eco-design and Eco-labeling can make a statistically significant positive contribution to business performance as it enhances sustainability of an enterprise. Further, this study concludes that green supply chain practices are important for sustainability.

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VII. RECOMMENDATIONS

The study suggested that the effectiveness of green supply chain practices should be advocated to ensure sustainability of not only the current generation but the future generation. There should be availability of adequate supply of people who are educated in the philosophy of green supply chain practices to improve the performance of the firm. This study recommends that firms practice an array of green supply chain practices but not limited to eco designing and eco labeling. More so, it recommends that East Africa Portland Cement to invest more on green supply chain practices for sustainable manufacturing of their cement.

VIII. AREAS FOR FURTHER RESEARCH

The objective of the study was to assess the effect supply chain practices on performance of manufacturing firms in Kenya. It recommends that a similar research should be conducted in processing firms and other sub-sectors of manufacturing sector. This will help validate this finding. This study further proposes a qualitative research to be conducted to explore the field of green supply chain practices since it is a grey area with limited literature. Further research should be conducted to account for the 19.75% change in the performance of manufacturing firms that is not accounted by the four independent variables.

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