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Original Article

Ecological Design Practice and Sustainable Performance of Multinational Tea Firms in Kenya

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Ecological Design, Sustainable Performance, Climate Change, Global Warming

The performance of firms has remained a global issue based on climate change that has caused global warming. Most countries have adopted green strategies so as to reduce the effects of climate change on business sustainability. Climate change affects agricultural-processing firms directly, leading to poor performance. Ecological design is one of the concepts introduced by businesses as a measure of solving the problem of sustainable performance. This study aimed to determine the relationship between green ecological design and the sustainable performance of multinational tea firms in Kenya. The study was anchored on ecological, sustainable, and institutional theories. Correlational and cross-sectional research designs were adopted. A sample of 225 managers was selected using a stratified sampling technique from a target population of 512 from the three multinational tea firms of James Finlay, George Williamson and Ekaterra with primary data being collected using a questionnaire. The content, face, criterion, and construct validity of the instrument were achieved through interrogation of the instrument by supervisors and experts. Reliability was examined using the Cronbach Alpha coefficient, where a score of 0.801 was realised. Linear regression and correlation analysis were used to establish the coefficient of determination and correlation coefficient. The results of the study established that there was a significant but weak ($R^2 = 0.034$, $F = 7.411$; $p < 0.05$) relationship between eco-design and sustainable performance, implying that whenever multinational tea firms invested in eco-design as a green supply chain practice, there was adequate improvement on their sustainable performance. The study recommends that multinational tea firms in Kenya should put resources into the development of eco-design methods. The findings of this study are expected to baseline information that may assist in developing sustainable performance strategies in the tea sector.

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INTRODUCTION

Complexity in the business environment with climate change is one of the problems that need a multidimensional approach since it affects environmental, social, operational, and economic performance (Qorri et al., 2018). Garza (2013) argues that creating appropriate green supply chain practices would guarantee long-term sustainable development that would take care of future generations. Green supply chain practices mitigate the effects of rising population, depletion of natural resources, increase in pollution, and wastage and regulate high carbon emissions from large manufacturing companies (Younis et al., 2015).

For decades, environmental issues have been increasing and spreading faster than forest fire, country to region, region to world level territory, which is a serious cause of climate change and global warming. In addition, scarcity of natural resources coupled with air and water pollution badly affects fauna and flora and human life with different diseases such as ischemic heart disease, lung cancer, chronic obstruction pulmonary disease, stroke, Dracunculiasis, Cholera, Hepatitis, Typhoid fever, and Norovirus (Sar et al., 2017). The green supply chain practices occur to mitigate environmental degradation and control air, water, and waste pollution through the adoption of green practices in business operations.

Undeniably, the basic ideology behind the green concept is to enhance environmental sustainability, but firms adopt the green concept as "kill two enemies with one bullet". Green supply chain practices can reduce environmental pollution and production costs, and they can also

spur economic growth, create competitive advantage in terms of greater customer satisfaction, positive image and reputation and provide better opportunities to export their products in pro-environmental countries (Khan & Dong, 2017). The definition of green idea is expanding with new innovations and techniques focused on enhancing environmental sustainability, which can be recognised by corporate social responsibility, green manufacturing, waste reduction, recycling and remanufacturing sustainable/environmentally friendly and green supply chains.

Green supply chain practices envisage eco-design, environmental regulation, and green purchasing, among others (Padash et al., 2015). The process of eco-design has been used by industries as green supply chain management to design products and packaging that reduce waste, reusable packages, recyclable packages, and products. The organisation that focuses on green supply chain management have developed environmental regulation that governs the implementation and management of environments (Elmagrhi, Ntim, Elamer & Zhang, 2018).

According to Monteiro et al. (2019), eco-design practice entails green packaging, which eliminates the pollution of packages through recycling, reuse, or use of bio-degradable. Rosen and Kishawy (2012) emphasise that the eco-design of products ensures that the end use of the product reduces pollution and improves the environment. It is therefore, important to evaluate product development and the environmental impact of the product through examining the product life assessment and recycling material (Thoo et al., 2015).

Eco-design practices have also become crucial where firms through institutional pressure, have been able to use reusable packaging, product eco-design and resource-saving. According to Monteiro et al. (2019), eco-design of package reduce environmental pollution, which leads to environmental performance. This is possible if the firm adopts green technology in operation and manufacturing (Rosen & Kishawy, 2012). According to Thoo et al. (2015), process design, green product and environmental practices is important in ensuring eco-design and achieving performance. Aslam et al. (2019), in a study on green supply chain practices, pointed out that eco-design plays a role in ensuring products and packages are designed with a focus on sustainability at consumer end-use. The current study focused on the gain achieved by eco-design in the tea processing industry, where it examines green packaging, product eco-design, product life assessment and recycling material as discussed by studies that focused on eco-design.

Sustainability is a global issue in today's world of business; firms therefore, have to be careful about environmental issues in order to maintain a good image in today's competitive environment (Khan *et al.*, 2020). Gotschol *et al.* (2014) argued that businesses should give more focus to green supply chain management (GSCM) for better and sustainable performance. Thus, it has become more challenging for firms to deal with several internal and external changes at the same time. The sustainable performance of firms is a multidimensional concept that ensures environmental, social, operational, and economic performance. Younis et al. (2015) used economic, operational, social and environmental dimensions to measure corporate performance.

Sustainable performance is trending globally as a means of reducing strains in natural resources, social improvement, and increasing economic benefits and environmental gains. This has become essential in ensuring the future community benefits socially, economically and environmentally. Therefore, the current study evaluated the relationship between green supply

chain practices and the performance of multinational tea companies in Kenya.

Tea is grown in the highlands of Kenya within the West and East of Rift Valley and at higher altitudes of between 1,500 metres and 2,700 metres above sea level. The highlands are spread across 19 tea-growing counties that include Nakuru, Narok, Kericho, Bomet, Nyamira, Kisii, Kakamega, Bungoma, Vihiga, Nandi, Elgeyo Marakwet, Trans-Nzoia, Kiambu, Murang'a, Nyeri, Kirinyaga, Embu, Tharaka-Nithi, and Meru (Tea Directorate, 2019). According to Monroy et al. (2013), multinational tea firms are facing challenges in their performance. These are the high cost of production, climate change, political uncertainty, and fluctuation of international tea prices. The relationship between green ecological design and the performance of multinational tea firms in Kenya must therefore be determined to establish if it has some influence.

Problem Statement

Ecological design aims at reducing environmental degradation and enabling the performance of firms along the supply chain. Multinational Tea firms are major economic drivers in Kenya, providing employment to the society and acting as a source of foreign exchange. The tea sector, which heavily depends on the manufacturing of commodities, is among the target sectors for the improvement of the environment. However, despite the adoption of ecological design methods, sustainable performance to date has not been fully achieved; it is also unclear whether these methods can positively influence the performance of tea firms. The symptoms of poor sustainable performance are poor performance of tea produce in the global market, an increase in unemployment in multinational firms, and global warming effects resulting in drought, frost, and floods. Kenya's tea performance on the global market, with earnings for the product dropped by 9.1% as indicated in the third quarter of 2021 compared with a similar period in 2020. The Ministry of Agriculture was forced to intervene in the price of tea due to the alarming rate at which one of Kenya's top exports was losing value.

There is an outcry due to the failure to find ways of conserving the environment and use of natural resources resulting from deforestation, land and environmental degradation in the tea sector. To address these challenges, there is a need to balance between economic, ecological, and social benefits in many agricultural manufacturing firms, especially the multinational tea firms. Despite the adoption of ecological design methods, sustainable performance is yet to be fully achieved. Therefore, this study sought to address the aforementioned problems by investigating the relationship between ecological design and the sustainable performance of multinational tea firms in Kenya.

Hypothesis:

There is no significant relationship between the eco-design and sustainable performance of multinational tea firms in Kenya.

LITERATURE REVIEW

The study was anchored on ecological, sustainable, and institutional theories. Maoris created the ecological modernisation theory in the 1800s. According to the theory, preventive innovation, state planning and coordination, and technological advancement can be used to jointly accomplish industrial development and environmental protection (Iles, 2019). Green technology adoption in supply, procurement and purchasing, manufacturing, logistics and distribution would enable the greening of the supply chain (Kouhizadeh & Sarkis, 2018). Hence, these would enable environmental as well as socio-economic benefits to the organisation. This theory therefore, supports environmental regulation, which is entailed in green supply chain practices and treats the practices as fundamental aspects of creating economic development.

Brundtland introduced the sustainable theory also known as Brundtland theory in 1984. The theory proposes successful sustainable performance through achieving the present goals of the organisation without affecting the future generation (Ditlev-Simonsen, 2022). Therefore, sustainability has three concepts: environment,

society and economy. Due to changes in climate, organisations are nowadays involved in taking measures that ensure carbon emission, resulting in a greening supply chain. In order to ensure sustainable development, green supply chain practices employ green technology and green strategies in green manufacturing, green logistics, and green energy use (Nureen et al., 2023). The factors that can affect the implementation of green strategies are ethics, people, technology, innovation, environment and climate change.

Institutional theory explains the role of institutions in the adoption of new concepts of management. According to institutional theory, the researchers discovered that firms' adoption of green practices and supply chain practices were influenced by external factors. The development of clean mechanisms, clean energy regulation, and restrictions on toxic emissions resulting from the production of electronic components were all cited as factors or drivers for the adoption of green supply chain activities (Garai, Mondai & Roy, 2018).

Eco-Design Practices and Performance of Firm

Eco-Design or 'Green' Design also widely known as 'design for the environment', consists of designing products for reduced consumption of materials/energy, reuse, recycling, recovery of materials or components and reduced use of hazardous products (Aital & Vijai, 2016). Further on, Wanyoike and Lagat (2015) defined ecological design as "any form of design that minimises environmentally destructive impacts by integrating itself with living processes." thus, procurement of eco materials is the starting stage for manufacturing green products within a supply chain.

Ecological design is an integrative, ecologically responsible design discipline. (Ingari *et al.*, 2018). It helps connect scattered efforts in green architecture, sustainable agriculture, ecological engineering, ecological restoration, and other fields. The inchoate developing nature of ecological design was referred to as the "adding in "of environmental factors to the design process,

but later it was focused on the details of eco-design practices such as product systems or individual products or industry as a whole.

Wakulele et al. (2016) did a study on the effect of eco-design practices on the performance of manufacturing firms in Mombasa County, Kenya. The result findings indicate that by taking all other independent variables constant, a unit increase in design for raw material practice would lead to a 0.328 increment in environmental cost saving. The study by Wakulele *et al.* (2016) used a probit model and targeted 65 firms, while the current study employed multiple linear regression and only targeted three multinational tea firms.

Monteiro et al. (2019) investigated eco-design in relation to the strategy of packaging in Asia. The study was based on the survey design of packaging manufacturers. The results indicated that most packaging companies have adopted environmental concepts through packaging's life cycle that are bio-degradable. The eco-design package has drastically reduced environmental pollutants packaging and brought about global environmental biodiversity. Packaging is crucial in eco-design as well as package design. The current study adopted eco-design in relation not only to sustainable performance but also to economic and social performance. Eco-design was in terms of green packaging, product eco-design, product life assessment and recycling material. The study by Monteiro et al. (2019) used a survey design, while the current study employed correlational and cross-sectional research designs.

Needs, practices and concepts of sustainable design and manufacturing were examined by Rosen and Kishawy (2012). The study used an empirical review of the literature where it compared manufacturing and design. Life cycle assessment and design for environmental and environmental practices were examined in relation to environmental development. The study pointed out that an increase in technology and operation advancement in manufacturing in the future would improve performance and environmental stewardship. The study recommends that improved designing through

technological improvement and the development of culture in companies would enhance eco-design.

Momanyi (2013) did a study on the adoption of green manufacturing practices by food processing firms in Mombasa County, Kenya; the results indicated that the least perceived benefits from the results were improved innovation performance, a decrease in fine for environmental accidents, and the cost of saving for environmental projects with mean scores of 3.53, 3.34, and 3.32 respectively. This means that these firms have not invested in a long-term strategy of adopting green manufacturing practices. The overall indication from the study was that there are significant benefits to adopting green manufacturing practices.

Mohammed (2012) did a study on green supply chain management and performance of manufacturing firms in Mombasa, Kenya; the study targeted ten manufacturing firms with a target population of 91. The results indicated 0.6678 at a 5% confidence interval, implying that GSCM has a positive impact on most manufacturing firms in Mombasa.

Babu (2013) did a study on green supply chain practices and the operational performance of personal care manufacturing firms in Nairobi. From the findings, 33.33% of the respondents indicated that a good image was created by CSR, 17.46% of the respondents indicated an increase in output against the same cost of material, 15.87% of the respondents indicated brand enhancement, 17.46% indicated a reduction on logistics costs, 15.87% indicated that manpower could be utilised to increase output. This shows that the operational performance of these firms is dependent on GSCMPs.

Aslam et al. (2019) examined the impact of green supply chain practices on corporate image. The study also examined the mediating role of green communications. Investment recovery, internal environment management, eco-design, customer cooperation, green communication and green purchasing were examined in relation to the

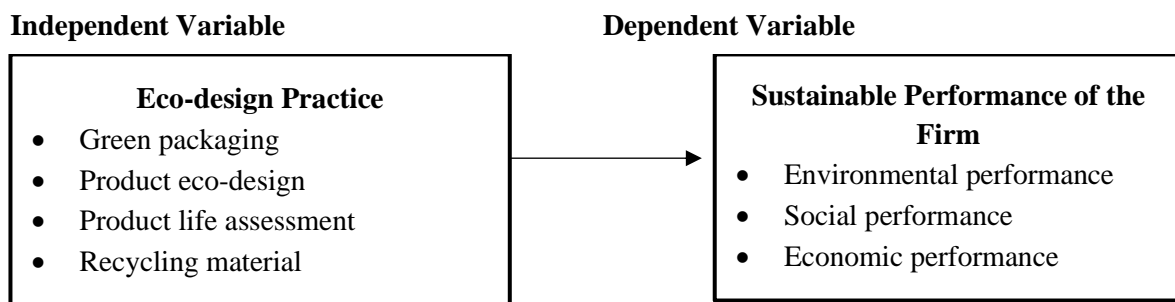
development of corporate brand image. A sample of 120 Pakistan manufacturing firms listed on the stock exchange were selected through a cross-sectional study. The study found that corporate image was significantly shaped by customer cooperation, internal environment, green supply chain, inventory and eco-friendly activities. Green communication acted as a mediating role in the relationship between green supply chain practices and corporate image.

Thoo et al. (2015) investigated green supply chain practices and the performance of the firm. The role of green supply chain management is to reduce wastage as a result of solid waste, energy, emissions and hazardous chemicals. Findings revealed that process design, green products, internal environmental practices and environmental practices had a positive relationship with tenable performance. Process design and green products were the leading predictors of performance. At the same time, supplier evaluation and selection had no significant effect on performance. Green products and process design remain an important aspect of eco-design that ensures that eco-design products and packages.

Sustainable Performance of Firms

Performance is a multidimensional concept that entails operational, social, economic and

Figure 1: Conceptual framework



MATERIALS AND METHODS

Area of Study

The study focused on Kericho and Bomet Counties. The two counties are part of the South Rift region. Kericho County lies between

environmental performance. However, some green supply chain studies put a focus on environmental performance, and this still remains one dimension of performance. According to Younis et al. (2015), who examined green supply chain practices (Padash et al., 2015; Ahmed et al., 2020). Economic, social and environmental performance remained to be the main indicators of tenable performance (Alnoor et al., 2019; Qorri et al., 2018). Other measures of performance are green performance and corporate tenable performance, as employed by Chen et al. (2014) and Widisatria and Nawangsari (2021), respectively.

Environmental biodiversity has gained more concern globally, with environmentalists and nations passing policies that would incorporate the public as well as private sectors (Gajendrum, 2017). Social and environmental dimensions have remained crucial in modern society and are significantly affected by green and tenable supply chain management, mainly in emerging economies (Gamboa-Bernal et al., 2020).

Conceptual Framework

The conceptual framework below gives the interplay between eco-design as a practice and the sustainable performance of multinational tea firms in Kenya.

longitudes 35° 02° West and 35° 40° East and also between the Equator and latitude 0230 South. The county is bordered by Nandi South to the north, Nakuru to the northeast, Kibatech northwest and Nyando to the West, Nyamira and Rachuonyo to

the southwest and Bomet to the south. The county has an area of 1,125.1 km².

Bomet County borders the County of Kericho to the North and North Eastern, Narok County to the South Eastern, Nyamira County to the North West and Nakuru County to the East. It covers an approximate area of 2,037.4 Kilometers square, where 1,716.6 Kilometers square of this land is suitable for farming (Bomet County Development Profile 2018). Bomet County is divided into five sub-counties, namely Sotik, Chepalungu, Bomet East, Bomet Central and Konoin (Bomet County Development Profile 2018).

Data was collected from multinational tea companies within Kenya including James Finlays, George Williamson and Ekaterra Tea Limited. The three multinational companies have extensively established in other countries

producing tea, such as Sri Lanka, India and China. However, in Kenya, they are mainly situated in Kericho and Bomet County, where tea is the main cash crop. The three firms have vast land of tea plantations and extensive tea factories distributed in the two counties.

Target Population

The study targeted 512 top, middle and lower-level managers from tea plucking to tea product distribution from the three multinational companies. The managers were appropriate for the study because they have knowledge of green supply chain practices, green transformative leadership and economic development.

The population framework is presented in *Table 1*.

Table 1: Population framework

Stratums	Management level			Sub-Total
	Top	Middle	Lower	
James Finlays	12	43	181	236
George Williamson	8	24	87	119
Ekaterra Tea	10	38	109	157
Sub-Total	30	105	377	512

Source: Jame Finlays, George Williamson and Ekaterra Tea HR (2022)

Sample Size and Sampling Procedure

The study used Taro Yamena’s (1974) formula to calculate the appropriate sample size. This is given by the formulae;

$$n = \frac{N}{1+N(e)^2} \tag{1}$$

$$n = \frac{512}{1+512(0.05)^2} = 225$$

Sampling Procedures

Kothari (2011) explains the sampling procedure as the process of selecting portions of an aggregate or totality from which a judgment or conclusion is made. By concentrating only on a small portion of the population, it is the process of learning details about the entire population. According to Copper & Schindler (2011) and Mugenda and Mugenda (2012), inferential statistics frequently use sampling to make

predictions about population behaviour. A researcher can be certain that the sample accurately reflects the characteristics of the population by using sampling techniques.

In order to obtain the desired sample, a multistage sampling procedure was adopted. In the first stage, a stratified random sampling procedure was used to obtain the sample of the respondents from each multinational company. The area under study has three multinational companies which formed the strata for this study. In the second stage, a proportionate sampling procedure was used to select the respondents from each management level. A list of top, middle and lower management was obtained from the Human Resource manager for each of the multinational tea firms. The names of the management were serially numbered first and then randomly ordered and picked using a simple random sampling technique. This technique gave each respondent

an equal opportunity to be selected, and therefore, this increased the chances of obtaining an appropriate and representative sample size. This was advantageous in the sense that the sample

frame was already available in the form of a list (Kothari, 2004). The sample framework is in *Table 2*.

Table 2: Sample framework

Stratums	Details	Management level			Sub-Total
		Top	Middle	Lower	
James Finlays	Total	12	43	181	236
	Sample	5	19	80	104
George Williamson	Total	8	24	87	119
	Sample	4	11	38	52
Ekaterra Tea	Total	10	38	109	157
	Sample	4	17	48	69
Sub-Total	Total (N)	30	105	377	512
	Sample (n)	13	46	166	225

Source: Author’s Computation from James Finlays, George Williamson and Ekaterra Tea HR (2022)

Data Collection Instrument

This study used both primary and secondary data. Primary data was collected directly from the management using structured questionnaires. Structured questionnaires were used for data collection. According to Taherdoost (2016), semi-structured questionnaires are appropriate since it has open and close-ended questions, which allow the researcher to extract both qualitative and quantitative data without affecting the respondents. This allows independence between the researcher and the study, resulting in the acquisition of information from the subjects with manipulation.

The questionnaire consisted of four sections. Section A represents general information, and sections B, C and D represent green supply chain practices, green transformational leadership and sustainable performance, respectively. The questionnaires adopted a five-point Likert Scale, which was appropriate in obtaining mean and standard deviation. The Likert scale measured 1 as strongly agreed and 5 as strongly disagreed.

Data Collection Procedures

Data collection is the process of obtaining details about a research topic from primary, secondary, or both data sources (Babbie, 2015). A clearance letter was sought from the University of Kabianga, which was used to apply for a research permit from the National Commission for

Science, Technology, and Innovation. Prior to requesting permission from the three multinational tea companies in Kenya, permission was sought from the County government, County Commissioner, and Ministry of Education. Then, the researcher, with the help of research assistance, distributed the questionnaires to the respondents and requested a time frame of two weeks to pick them back.

Data was collected after seeking consent from the respondents. The questionnaires were self-administered and collected within a duration of two weeks. Once all questionnaires had been responded to and collected, the researcher cleaned and coded the questionnaires ready for analysis.

Data Analysis

Simple linear regression analysis was appropriate based on its ability to test the effect of independent variables on dependent variables. This took into consideration the individual predictor significant effect testing at 5% level as well as a measure of the coefficient of determination (R²) individually on the dependent variable. Therefore, simple regression models were adopted to determine the relationship between eco-design practices and the performance of the firm.

$$y = \beta_0 + \beta_1 X_1 + \varepsilon \tag{2}$$

Where Y = Sustainable Performance of multinational firms, β_0 = Constant, β_1 = Beta

coefficient of X_1 , X_1 = Eco-design, ε = Error coefficient.

FINDINGS AND DISCUSSION

Eco-Design and Sustainable Performance of the Firm

The respondents indicated the extent to which eco-design influenced the sustainable performance of multinational tea firms in Kenya. The variable had seven indicators. Descriptive results of the seven variable indicators are summarised and presented in *Table 3*.

Table 3: Eco-Design

Eco-Design Indicators	N	Min	Max	Mean	Std. Dev.
The firm has developed green packaging for tea products that are biodegradable and reusable	212	1.00	5.00	3.717	1.586
The firm has developed green packaging for tea products that are biodegradable and reusable	212	1.00	5.00	3.589	1.264
We have developed eco-design products that reduce waste	212	2.00	5.00	4.273	0.695
We have developed dissolvable tea products to reduce environmental degradation	212	1.00	5.00	3.542	1.350
Our firm has ensured resource saving is achieved	212	2.00	5.00	4.325	0.855
We ensure that waste production is reusable to ensure zero wastage of resources	212	3.00	5.00	4.438	0.542
We have differentiated product that ensured product development	212	2.00	5.00	3.764	0.779
Aggregate Score				3.949	1.010

Source: Research Data (2023)

The respondents agreed ($\mu = 3.717$, $\delta = 1.586$) that tea multinational firms had developed green packaging for tea products that are biodegradable and reusable; it also revealed that the respondents agreed ($\mu = 3.589$, $\delta = 1.264$) that the firm had developed green packaging for tea product that is biodegradable and reusable, they agreed ($\mu = 4.273$, $\delta = .695$) that tea multinational firms have developed eco-design products that reduce waste. Further, the respondents agreed ($\mu = 3.542$, $\delta = 1.350$) that the firms have developed dissolvable tea products in an effort to reduce environmental degradation on whether multinational tea firms have ensured resource saving is achieved ($\mu = 4.325$, $\delta = .855$), this is an indication that majority of them agreed.

Multinational firms ensure that waste production is reusable; this has led to zero wastage of resources, according to the respondents who agreed ($\mu = 4.438$, $\delta = .542$). Lastly, the respondents agreed that ($\mu = 3.764$, $\delta = .779$) their firms have differentiated products that ensured product development.

The aggregate results show that Eco-design influences the sustainable performance of multinational tea firms to a great extent ($\mu = 3.949$, $\delta = 1.010$). The data revealed that the tea multinationals are putting efforts to ensure that the eco-design practices in place lead to the sustainability of multinational firms' operations.

The Current study is almost similar to that of Monteiro et al. (2019), who investigated eco-design in relation to the strategy of packaging in Asia. The results indicated that most packaging companies have adopted environmental concepts through packaging's life cycle that are biodegradable. The study is also convergent to that of Rosen and Kishawy (2012), who emphasised that the eco-design of products ensures that the end use of the product reduces pollution and improves the environment.

The study is also concurrent to the study by Babu (2013), who did a study on green supply chain practices and operational performance of personal care manufacturing firms in Nairobi. From the findings, 33.33% of the respondents indicated that a good image was created by CSR, 17.46% of the

respondents indicated an increase in output against the same cost of material, 15.87% of the respondents indicated brand enhancement, 17.46% indicated a reduction on logistics costs, 15.87% indicated that manpower could be utilised to increase output. This shows that the operational

performance of these firms is dependent on GSCMPs.

Hypothesis Ho₁ stated there is no significant relationship between the eco-design and sustainable performance of multinational tea firms in Kenya.

Table 4: Eco-design and sustainable performance of multinational tea firms

Variable	Unstandardised Coefficients		Standardised Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	30.688	.567		58.131	
Eco-Design	.051	.023	.065	2.722	.007

$R = .185$; $R^2 = .034$; $F = 7.411$; $*p < 0.05$

Source: Research Data (2023)

The regression analysis in *Table 4* indicates a weak linear relationship ($R^2 = 0.034$, $F = 7.411$; $p < 0.05$), which indicates that 3.4% of the corresponding change in sustainable performance can be explained by eco-design with a large proportion of variation in sustainable firm performance (96.4%) was explained by other factors not captured by the study model. The Durbin-Watson ($D = 1.897$) value is within the established range of 1-3, indicating that there was no autocorrelation in the sample.

The correlation between eco-design and sustainable firm performance was found to be positive and significant ($r = 0.185$, $p < 0.05$), meaning there was a significant relationship between eco-design and sustainable performance. Whenever multinational tea firms in Kenya invested in eco-design, there was a significant rise in sustainable performance.

The results further showed that eco-design predicted sustainable performance ($\beta_1 = .051$, $t = 2.722$; $p < 0.05$); this means a unit increase in eco-design in the multinational tea firms in Kenya produced a 0.051 change in their sustainable performance. The hypothesis that there is a significant relationship between eco-design practices and the sustainable performance of multinational tea firms in Kenya is therefore supported.

Away from confirming the emphasis of eco-design literature in explaining sustainable performance in different industries, of particular

interest is the finding that eco-design only accounts for 4% of sustainable firm performance in multinational tea firms in Kenya. This submits that sustainable performance in the industry may not necessarily be attributable to eco-design practices alone but could also be centred on how firms uniquely employ different green supply chain practices to develop sustainable strategies that will help firms realise performance.

The findings are similar to those of Wakulele et al. (2016), who established that design for raw material practice would lead to cost savings; Monteiro et al. (2019) asserted that eco-design package has reduced drastically environmental pollutant packaging and brought about global environmental biodiversity. Similarly, a study on needs, practices and concepts of sustainable design and manufacturing by Rosen and Kishawy (2012) found that improved designing through technological improvement and the development of a tenable culture in companies would enhance eco-design.

The research findings on eco-design are also supported by empirical studies of Momanyi (2013) and Mohammed (2012), who affirmed that adopting green manufacturing practices was beneficial to firms; Babu (2013) who established that eco-design is one of the practices of GSCP; Aslam, Waseem and Khurram (2019) affirmation that corporate image was significantly shaped by customer cooperation, internal environment, green supply chain, inventory and eco-friendly

activities and Thoo et al. (2015) through their study that documented that process design and green product were the leading predictor of performance.

An empirical study by Borchardt et al. (2011) revealed that green efficiency has a significant, positive, and direct effect on the operational cost of selected fast-moving consumer goods companies, thereby giving support to the findings that eco-design has an influence on firms' sustainable performance.

Diagnostic Tests

Table 5: Multicollinearity Test

Variables	Collinearity Statistics		Comments
	Tolerance	VIF	
Ecological Design	0.204	4.911	Acceptable

Source: Research Data (2023)

Table 5 indicates that factors in the independent variables had VIF values less than 10, hence confirming the absence of multicollinearity.

Normality Test

Table 6: Normality Test

	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
Ecological Design	-.435	.167	-1.547	.333

Source: Research Data (2023)

The test results showed that all variables had values between the recommended ranges. Therefore, the study variables had a normal distribution, as shown in Table 6.

Heteroscedasticity Test

Heteroscedasticity refers to instances where the variance of the residual term is not constant but varies with changes in explanatory variables (Gujarati, 2003). Since the data for this research is

A diagnostic test was necessary for the adoption of a simple linear regression model. Multiple linear regression models must achieve normality, linearity, and homoscedasticity with no autocorrelation or multicollinearity (Hair, 2014).

Multicollinearity Test

For this study, a multicollinearity test was performed to check for the correctness of the estimates of the variables using the Variance Inflating Factor (VIF). It is the most widely used measure with independent variables. VIFs between 1 and 10 suggest that there is no multicollinearity among independent variables.

Normality was examined using the Skewness and Kurtosis test, which examines whether the variables are normally distributed or not for large and small samples, respectively, where the skewness and kurtosis values, according to Creswell (2012), should be between -2 and +2.

a cross-section of multinational tea firms in Kenya, this raises concerns about the existence of heteroscedasticity. The Simple Linear Regression Model assumes that the error term is homoscedastic; that is, it has constant variance. If the error variance is not constant, then there is heteroscedasticity in the data. According to Field (2009), a heteroscedasticity problem is absent if the p-values of independent variables are greater than the significant value of 0.05.

Table 7: Heteroscedasticity Test

Variables	Unstandardised Coefficients		Standardized Coefficients Beta	t	p-value
	B	Std. Error			
(Constant)	4.231	2.137		1.980	.000
Ecological Design	.035	.030	.179	1.181	.239

Source: Research Data (2023)

Table 7 indicates that all p-values for all the variables are greater than 0.05, indicating the absence of heteroscedasticity.

CONCLUSION AND RECOMMENDATION

The study concludes that eco-design as a green procurement practice contributes to a minimal variation in the sustainable performance of multinational tea firms in Kenya and is unlikely to be responsible for any success if pursued alone. For ecological design to minimise environmental destruction, it must address all the processes involved, such as procurement of eco materials to manufacturing green products within the supply chain.

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