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Contemporary Approach to Reverse Logistics and Environmental Sustainability the Moderating Role of Government Support

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Abstract

Purpose: Reverse logistical methods are becoming more popular among corporations as a means of promoting environmental sustainability, raising concerns about environmental sustainability. Therefore, the study aims to assess the relationship between reverse logistics, environmental sustainability, and government support.

Methodology: The study employed a quantitative research approach and descriptive research design. The study used a sample of 102 employees from firms in Accra Metropolis. The study adopted a purposive sampling technique in selecting the participants from the various firms in the Accra metropolis. A structured questionnaire was used as a data collection instrument. Descriptive statistics such as mean and standard deviation were used to test the reverse logistics, environmental sustainability, and government support. Multiple regression test was used to analyze the impact of reverse logistics practices on environmental sustainability, the impact of government support on environmental sustainability and the moderating role of government support with reverse logistics practices on environmental sustainability.

Findings: There is a positive and statistically significant impact of reverse logistics practices on environmental sustainability.

Unique contribution to theory, practice and policy: The study recommends that organizations should focus on optimizing product returns, recycling, remanufacturing, and waste reduction processes through adopting reverse logistics and government support.

Keywords: *Reverse, Logistics, Environmental Sustainability, Government Support*

Introduction

Background to the study

Sustainability contributes to a company's profitability, growth, and even survival, it has become a strategic goal for practically all firms in the twenty-first century (Corbett, 2009). Recognizing and addressing social forces toward environmental sustainability require effective reverse logistics. The link between environmental management and operations has greatly increased in response to growing worries about climate change, local and regional effects of air, ground, and water pollution from industrial activities (Bourlakis et al. 2014). Investigating modern methods for environmental sustainability and reverse logistics is therefore necessary. Reverse logistics refers to the process of managing the flow of goods from the point of consumption to the point of origin, for the purpose of recovery, reuse, or proper disposal (Rogers & Tibben-Lembke, 2001). This process involves various activities, including product collection, sorting, inspection, refurbishment, and recycling, among others (Guide & Van Wassenhove, 2009). Reverse logistics practices can have significant benefits for businesses and the environment, as they can reduce waste and pollution, conserve natural resources, and minimize greenhouse gas emissions (Li, et al 2016).

According to the Sustainable Procurement Charter of the United Nations Logistics (2023), procurement sustainability is the process of making purchases of goods and services that maximize value for money, reduce adverse environmental, social, and economic effects, and produce favorable social and environmental outcomes. However, according to research by the Reverse Logistics Association, controlling reverse logistics procedures has become one of the top priorities for modern businesses. The justification is that companies have long understood that they must reduce their environmental footprint, and that doing so has advantages for their bottom line and reputation. For instance, the MIT Center for Transportation and Logistics discovered that businesses could cut expenses by up to 10% by prioritizing sustainability in their reverse logistics procedures (Gibbon, & Dey, 2011). Companies can employ various tactics to make their reverse logistics operations more sustainable. These include putting product return policies in place, running their operations on renewable energy sources, and using recycled materials for packaging. However, despite the varied strategies and potential benefits of reverse logistics, many businesses have been slow to adopt and implement these practices. Several challenges hinder the implementation of reverse logistics practices, including lack of resources, expertise, and support (Blome, Hollos, & Paulraj, 2014).). For instance, businesses may lack the necessary infrastructure, technologies, and knowledge to implement effective reverse logistics practices. Additionally, they may face financial constraints or lack incentives to invest in reverse logistics.

According to Luthra, et., al (2017), one critical factor that can influence the adoption and implementation of reverse logistics practices is government support. Governments plays a vital role in promoting sustainable practices, including reverse logistics, providing policies, regulations,

and incentives that create a favourable environment for businesses to adopt and implement these practices (Ke,et al., 2011). For instance, regulations that require businesses to comply with environmental standards can encourage the adoption of reverse logistics practices, while incentives such as tax credits can reduce the costs associated with implementing these practices.

Regardless of the growing importance of reverse logistics practices and environmental sustainability, there has been little attempt to explore this relationship. Liu et al. (2021) undertook a systematic review of government support for sustainable supply chain management and found that eventhough there has been numerous attempt to study reverse logistics; however, few studies have focused on the relationship between government support and reverse logistics practices. This paper fills the scientific gap by drawing empirical evidence from reverse logistics and environmental sustainability by developing contemporary approach based on descriptive statistics, regression analysis, and hypothesis testing. This study defines the mediating role of government support in promoting the adoption and implementation of reverse logistics practices. In addition, the study examines the impact of reverse logistics practices on environmental sustainability so as to provide recommendations for businesses and policymakers. In a broader scope, the relationship between reverse logistics and social, economic, and environmental sustainability procurement.

Brief literature review

This research explains the transformative impact of such assistance on environmental sustainability goals by examining the impact of government policies, regulations, and incentives on businesses' decisions to implement reverse logistics methods.

The circular economy concept

The idea of the "Circular Economy" has arisen as a revolutionary method for managing resources. It aims to abandon the conventional "take, make, and dispose" linear paradigm in favor of a regenerative one that encourages sustainability and reduces waste. At the heart of the Circular Economy lies the principle of reducing resource consumption, maximizing product lifespan, and promoting efficient recycling. This approach minimizes the extraction of raw materials and the generation of waste.

Also, products are designed with durability in mind, ensuring longer lifespans and ease of repair. This counters the prevailing "throwaway culture" and encourages responsible consumption. One of the foremost missions of the Circular Economy is to preserve the value of materials and products over their lifecycle. This involves re-manufacturing, refurbishing, and re-purposing to extract maximum utility from resources. The idea proposal encapsulates a system closed-loop networks where goods and resources move continually throughout the economy. These systems encourage resource efficiency and reduce environmental impact by eliminating waste and pollution from their design.

In terms of economic, environmental, and sociological elements, the circular economy concept has broad significance:

1. Resource Conservation: The Circular Economy lessens the burden on scarce resources by extending product lifecycles and optimizing resource use. This is crucial in a society where concerns about resource depletion and environmental damage are growing.
2. Waste Reduction: The Circular Economy tackles the problem of waste by preventing its generation in the first place. This leads to reduced landfill waste, lower energy consumption, and diminished greenhouse gas emissions.
3. Economic Growth and Innovation: The transition to a Circular Economy fosters innovation in product design, materials, and business models. This can stimulate economic growth through the creation of new markets, jobs, and revenue streams.
4. Sustainable consumption: By focusing on dependability and responsible consumption, consumers are moving away from disposable behavior and toward value-based decisions. Because consumers value quality over quantity, society uses less resources.

We may reshape the relationship between consumption, production, and environmental preservation by switching from a linear to a circular strategy. This idea offers a realistic route to a future that is more resilient, effective, and equitable, where resource scarcity is lessened, waste is reduced, and the welfare of both people and the environment is given priority. Although the Circular Economy concept stands as a visionary response to the unsustainable practices that have prevailed for decades, its implementation presents challenges, including technological barriers, behavior change, and overcoming established linear models. Businesses must adapt their practices to embrace circular design, reverse logistics, and closed-loop systems. Government policies, financial incentives, and public awareness campaigns play crucial roles in driving the transition.

Moving on to the local scene, Ghana struggles to meet the world's objectives for sustainability while also dealing with its own unique set of environmental problems. Ghana, a nation with abundant natural resources, has struggled with problems like deforestation, poor waste management, and pollution. Initiatives like the National Climate Change Policy Framework and the Ghana Shared Growth and Development Agenda (GSGDA) are examples of how the government is making an attempt. These laws demonstrate Ghana's dedication to advancing green energy, environmental preservation, and sustainable land use.

When global and local perspectives are compared, it is clear that although the core ideas of environmental sustainability are constant, how they are applied is affected by context-specific factors. Similar to other developing nations, Ghana must strike a careful balance between economic expansion and environmental protection. Its difficulties are special, necessitating individualized solutions that combine conventional wisdom with cutting-edge methodologies.

In a bid to ensure that the matter of environmental sustainability is progressively dealt with, a number of well-tailored initiatives have been rolled out over the period. For instance, Ghana has submitted its NDCs in accordance with the Paris Agreement, stating its promises to cut greenhouse gas emissions, support renewable energy sources, and improve climate resilience. Another policy is Ghana's Renewable Energy Master Plan, which focuses on diversifying the energy portfolio through the adoption of various renewable sources, including solar, wind, hydro, biomass, and

geothermal energy. We also have the One District, One Factory (1D1F) Initiative geared toward industrialization and job creation; this initiative promotes the establishment of factories across various districts, focusing on value addition and reducing reliance on imported goods. Other policies include Plastic Waste Management Policy, National Biodiversity Strategy and Action Plan (NBSAP), National Climate Change Policy Framework, Ghana Cocoa Forest REDD+ Program among others.

Reverse logistics

Optimizing Sustainability through Efficient Resource Management.

Reverse logistics involves the efficient management of the movement or transport of goods from their final destination back to the manufacturer, distributor, or recycling facility for product returns, repairs, remanufacturing, refurbishing, recycling, or disposal (Rogers & Tibben-Lembke, 1998). Reverse logistics involves a range of tasks, including managing product recalls, disposing of products at the end of their useful life, and retrieving valuable materials from discarded items (Guide & Van Wassenhove, 2001). It represents a complex process that engages different parties and actions, all with the goal of maximizing resource efficiency and lessening the environmental consequences of discarded goods (De Brito et al., 2003). It involves the flow of products backwards through the supply chain as opposed to traditional logistics, which concentrates on moving products forward through the supply chain to maximize value, reduce waste, and encourage sustainability (Fleischmann et al., 1997).

Products that are returned can be in anything from like-new to severely damaged condition. To establish the best course of action for each item, this complexity demands effective sorting and assessment methods (Stock et al., 2009). Some key strategies and methods include:

I. Automated Inspection Systems: Automated systems, such as optical scanners and sensors, can quickly assess the condition of returned products based on predefined criteria. These systems can identify defects, damages, or wear, enabling efficient sorting and decision-making.

II. Manual Inspection: Trained workers can visually evaluate returned products to determine their condition. This strategy is excellent for things with different features that may not be easily detected by automated systems.

III. Grading and Categorization: Products can be graded based on their condition and given to different categories (e.g., like-new, slightly used, seriously damaged). This classification aids in making informed choices regarding the resale, repair, or recycling of each object.

IV. Diagnostic Testing: For electronics and appliances, diagnostic testing can identify functional issues. This method involves running diagnostic tests to identify defects or malfunctions that might not be immediately apparent.

V. Sampling: Instead of inspecting every returned product, a statistically significant sample can be assessed to make generalizations about the entire batch. This is particularly useful when the volume of returns is high.

VI. Consumer Feedback: Encouraging customers to provide information about the reason for returning a product can aid in the assessment process. This feedback can help in identifying common issues and patterns.

These are effective methods of handling this complexity of varied conditions of states of products. Organizations can efficiently sort and evaluate returned goods with varying conditions in reverse logistics by combining these techniques, and then they can make decisions regarding the best course of action for each item.

Also, effective reverse logistics require accurate data collection and tracking systems to monitor returned items' conditions, locations, and value. Inadequate data management can lead to inefficiencies and increased costs. Limited insight into reverse logistics processes can impede effective decision-making, creating challenges in efficiently allocating resources and maximizing the recuperation of value from returned products (Guide & Van Wassenhove, 2001).

Effective reverse logistics often requires collaboration among various stakeholders, including manufacturers, retailers, logistics providers, and recycling facilities. Ensuring alignment and cooperation can be challenging. Sharing relevant information among stakeholders is crucial for smooth reverse logistics operations. However, concerns about data privacy and competition can hinder transparent communication. To ensure effective reverse logistics operations, technological expertise and market demand must be well invested in, as the success of the procedures are contingent on such (Fleischmann et al., 2003). The viability of remanufactured products is influenced by market demand. Ensuring that these items are competitively priced and uphold quality standards poses a challenge (Stock et al., 2009). Worthy of notation is the place for customer loyalty and satisfaction as well. Maintaining client loyalty rests on fulfilling expectations for speedy returns and replacements. Negative brand perception and unhappiness are two outcomes of poorly managed returns (Rogers & Tibben-Lembke, 1998). Positive customer experiences are directly influenced by how easy the returns process is. Customers may be discouraged from making further purchases by too complicated return policies (Stock et al., 2009).

Impact on environmental sustainability

By limiting waste, preserving resources, and lowering the overall environmental imprint of products, reverse logistics is essential in promoting environmental sustainability (Stock et al., 2002). Reverse logistics enables the recovery of valuable materials from returned or discarded items through procedures like remanufacturing, refurbishing, and recycling, which lowers the demand for virgin resources and the energy and environmental costs associated with their extraction (Guide & Van Wassenhove, 2001; Fleischmann et al., 2003).

Reverse logistics also helps to lower the amount of garbage transported to landfills or incineration facilities by prolonging the lifespan of products by remanufacturing and refurbishment (Fleischmann et al., 2003). This reduces the release of potentially toxic compounds and greenhouse gases related with garbage decomposition, as well as preserves important landfill space (Rogers & Tibben-Lembke, 1998).

Efficient reverse logistics practices contribute significantly to the reduction of carbon emissions by optimizing transportation routes and minimizing unnecessary movements of goods. Effective management of returns and repairs leads to consolidated shipments, resulting in fewer trips and decreased emissions (Rogers & Tibben-Lembke, 1998). This reduction aligns with the core principles of environmental sustainability and aids in curtailing the adverse effects of transportation-related carbon emissions on the ecosystem.

Methodology

A positivist world view was adopted to answer the question regarding the relationship between variables, thus making this a deductive study. A quantitative approach was followed in the study, which is in line with the selected paradigm. Questionnaires were used to collect data from respondents using quantitative research design, focusing on the collection and analysis of numerical data to explore the connections between reverse logistics practices, environmental sustainability, and the moderating influence of government support. The study used a sample of 102 employees from firms in Accra Metropolis. The study adopted a purposive sampling technique in selecting the participants from the various firms in the Accra metropolis. A structured questionnaire was used as a data collection instrument. Descriptive statistics such as mean and standard deviation were used to test the reverse logistics, environmental sustainability, and government support. Multiple regression test was used to analyze the impact of reverse logistics practices on environmental sustainability, the impact of government support on environmental sustainability and the moderating role of government support with reverse logistics practices on environmental sustainability.

Gender of Respondents

The gender of respondents helps to identify the divergent views of both sexes. The sex of an individual is very important in determining his or her perception of issues. For this reason, the researchers sought to identify the sex categories of the employees who took part in the study. This is represented in Table 2 below.

The distribution of gender in the population as depicted in Table 1 shows that the female population outnumbered the male. Statistically, there were 43(42.2%) males and 59(57.8%) females as illustrated in Table 1.

Table 1: Gender of the Participants

0	Frequency	Percentage (%)
Male	43	42.2
Female	59	57.8
Total	102	100

Ethical considerations

In this study, participation was voluntary, and the participants were informed that they would remain anonymous, and that confidentiality would be maintained. The researchers got permission to conduct the study from the office of the individual organizations understudied. Furthermore, ethics clearance was obtained. The researchers observed **e**thical guidelines, including informed consent and data confidentiality, will be strictly followed throughout the research process to protect the rights and privacy of participating organizations. Data were anonymized and securely stored.

Results and discussions

The study analysed the reverse logistics practices, government support and environmental sustainability using descriptive statistics such as mean and standard deviation. The study uses a composite score as a guide in generating the scores for each statement. To get the composite score for reverse logistics practices, government support and environmental sustainability, responses 'Neutral' and 'Disagree' to all questions were combined to be 'Disagree'. The average scores which were found to be 3.0 and below score were considered to be poor reverse logistics practices, government support and environmental sustainability and those who scored above 3.0 were considered to have a good reverse logistics practice, government support and environmental sustainability. The results of the study have been presented in Table 2 showing the various statements and the descriptive statistics such as mean and standard deviation of the reverse logistics practices, government support and environmental sustainability.

Table 2: Descriptive Statistics of reverse logistics practices, government support and environmental sustainability

Statement	Mean	Std. Deviation
Reverse logistics practices		
Our organization actively implements reverse logistics practices to minimize waste and environmental impact	3.07	1.29
Reverse logistics practices such as recycling and remanufacturing are integral to our sustainable operations	3.39	1.08
Adopting reverse logistics practices has improved our overall supply chain efficiency	3.37	1.09
The incorporation of reverse logistics practices has reduced our environmental footprint	3.34	1.10
Our organization continuously seeks innovative ways to enhance reverse logistics practices for environmental benefits	3.33	1.15
Grand Total	**3.30**	**1.14**
Government Support		
The promotion of sustainable business practices is significantly aided by government rules and initiatives	3.12	1.25
Enhancing environmental sustainability in our company operations requires the use of government incentives	3.22	1.29
Government assistance has successfully pushed companies to adopt environmentally friendly procedures	3.25	1.11
Government programs offer detailed instructions on how firms can support environmental sustainability	3.37	1.09
Government initiatives have a favourable effect on our company's dedication to sustainable business practices	3.28	1.15
Grand Total	**3.25**	**1.18**
Environmental sustainability		
Our environmental effect has significantly decreased as a result of the deployment of reverse logistics techniques	3.11	1.18
Reverse logistics techniques support our company's dedication to environmental sustainability	3.17	1.13
Because to the use of reverse logistics techniques, we see improvements in our carbon footprint	3.20	1.09
The use of reverse logistics techniques has benefited our attempts to protect the environment	3.38	1.09
Environmental issues related to our operations are effectively addressed through reverse logistics strategies	3.32	1.17
Grand Total	**3.24**	**1.13**

Table 2 shows a reserve logistic practice in firms at Kumasi Metropolis of Ghana. The study results indicated that most of the respondents agree their organization actively implements reverse logistics practices to minimize waste and environmental impact (M= 3.07; SD= 1.29); reverse logistics practices such as recycling and remanufacturing are integral to their sustainable operations (M= 3.39, SD= 1.08); adopting reverse logistics practices has improved their overall

supply chain efficiency (M= 3.37, SD= 1.09); the incorporation of reverse logistics practices has reduced our environmental footprint (M=3.34; SD=1.10) and their organization continuously seeks innovative ways to enhance reverse logistics practices for environmental benefits (M=3.33; SD=1.15). Overall, most organizations informally practiced reversed logistics (M=3.30; SD= 1.14) (Table 6).

The results relating to government support in Table 2 discovered that most participants agreed that, the promotion of sustainable business practices is significantly aided by government rules and initiatives (M=3.12; SD=1.25); enhancing environmental sustainability in their company operations requires the use of government incentives (M=3.22; SD=1.25); government assistance has successfully pushed companies to adopt environmentally friendly procedures (M=3.25; SD=1.11); government programs offer detailed instructions on how firms can support environmental sustainability (M=3.37; SD=1.09); and government initiatives have a favourable effect on their company's dedication to sustainable business practices and actively engage with study groups or tutoring opportunities (M=3.28; 1.15). Overall, government support firms' sustainability environment in the Kumasi Metropolis (M=3.25; SD=1.18) (Table 2).

The findings relating environmental sustainability of firms indicated that the participants agreed that their environmental effect has significantly decreased as a result of the deployment of reverse logistics techniques (M= 3.11; SD= 1.218); reverse logistics techniques support their company's dedication to environmental sustainability (M= 3.17, SD= 1.13); when using reverse logistics techniques, they see improvements in their carbon footprint (M= 3.20, SD= 1.09); the use of reverse logistics techniques has benefited their attempts to protect the environment (M=3.38; SD=1.09) and environmental issues related to their operations are effectively addressed through reverse logistics strategies (M=3.32; SD=1.17). Overall, respondents agreed that their firms sustained in firly good environment (M=3.24; SD= 1.13) (Table 7).

Measurement of the Study Variables

The evaluation of the effect of reverse logistics practices, and government support on environmental sustainability measurement involved conducting four types of tests, conducting four types of tests, namely indicator reliability, internal consistency reliability, convergent validity, and discriminant validity (Price et al., 2015). The factor loadings, composite reliabilities, Cronbach alpha, and average variance extracted (AVE) are presented in Table 8, and they surpassed the 0.50 threshold, confirming the reliability of the indicators. Moreover, the composite reliability and Cronbach's alpha values met the minimum requirement of 0.70, indicating the achievement of internal consistency for all latent variables in our study.

Table 3: Reliability Test

Variables	Indicators	Loadings	Composite Reliability	Cronbach Alpha	AVE
Government support					
		.766	0.740	0.923	0.619
	GQ1				
	GQ2	.797			
	GQ3	.882			
	GQ4	.802			
	GQ5	.773			
Reserve logistic practice					
		.716	0.791	0.916	0.622
	RQ1				
	RQ2	.822			
	RQ3	.777			
	RQ4	.774			
	RQ5	.847			
Environmental sustainability					
		.813	0.818	0.920	0.644
	EQ1				
	EQ2	.864			
	EQ3	813			
	EQ4	757			
	EQ5	.727			

Source: Field Data (2023)

Impact of Reverse Logistics Practices on Environmental Sustainability.

The first objective assesses the impact of reverse logistics practices on environmental sustainability. Therefore, the study uses a simple linear regression analysis to assess the impact of reverse logistics practices on environmental sustainability. In using simple linear regression, the following assumptions were tested; Correlation and ANOVA test.

Correlation, and ANOVA Test for independent variables.

Table 9 however, depicts the correlation among the variables using a correlation matrix. According to statistics and econometrics, when the correlation level between the independent and dependent variables is relatively high, it can cause spurious regression results analysis. Table 9 shows a correlation between the reverse logistics practices and environmental sustainability.

Correlation Matrix for dependent and independent variables

Variables	1	2
(1) Environmental sustainability	1.000	
(2) Reverse logistics practices	(0.550) *	1.000

**Correlation is significant at the 0.05 level (2-tailed).*

Table 4 indicates the correlation coefficient between the reverse logistics practices and environmental sustainability. The results indicate that there is a moderate correlation between the reverse logistics practices (COR= 0.550) and environmental sustainability. Overall, there is a moderate correlation between reverse logistics practices and environmental sustainability. This is an indication that there is an expectation of an effect of the independent variables on the dependent variable (environmental sustainability).

ANOVA Test

More so, for the estimates and findings of the study to be consistent and reliable, we must make sure that the distribution of the predictor value is significant to make the study's estimator a feasible estimator to be used in estimating the model (Wooldridge, 2011). One of the main assumptions for the use of estimation techniques is about the significance of the predictor variables. The predictor values must be significant so as to make a good prediction. Table 10 shows the ANOVA test for reverse logistics practices and environmental sustainability. It shows in each case the model sum of squares, degree of freedom, mean square, F-test and significance value.

Table 4: ANOVA Test of Reverse Logistics Practices and Environmental Sustainability

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	743.052	1	743.052	43.358	.000[b]
Residual	1713.771	100	17.138		
Total	2456.824	101			

a. Dependent Variable: Environmental Sustainability

b. Predictors: (Constant), reserve logistic practices

Results in Table 10 present the diagnostic statistics of the linear regression. Table 10 indicates that at the 0.000 significance, there is a joint significance of the variables and that the model was good in explaining the dependent variable. Again, the Analysis of Variance (ANOVA) table shows that the independent variables under consideration are significant at (p = 0.000< (0.05) 5%) significant

level, given an indication that the data collected were not manipulated but a true representation of what is actually the situation at the firm.

Model Summary

Table 4 presents the model summary, indicating regression, regression square, adjusted regression square and standard error of the estimate.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.550[a]	.302	.295	4.13977

a. Predictors: (Constant), government support

From Table 4, explains the amount of variation that exists in the dependent variable caused by the independent variables. The results indicate that there is a 30.2% variation in environmental sustainability as the dependent variable explained by the independent variable (reverse logistics practices).

Table 4 provides the regression analysis for the impact of reverse logistics practices on environmental sustainability. It presents in each case the variables for the model, standardized and unstandardized coefficient, t-statistics and the significance of the model.

Table 5: Linear regression analysis for the impact of reverse logistics practices on environmental sustainability

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	7.027	1.449		4.851	.000
Reverse logistics practices	0.554	0.084	0.550	6.585	.000

a. *Dependent Variable: environmental sustainability*

From Table 5, it was discovered that there is a positive and statistically significant impact of reverse logistics practices on environmental sustainability (Beta=0.554; p=0.000: p<0.05). It can be deduced that an improvement in the firm's reverse logistics practices causes a 55.4% significant increase in the environmental sustainability of firms.

The Impact of Government Support on Environmental Sustainability

The second objective looks at the impact of government support on environmental sustainability.

Also, the study uses a simple linear regression analysis to assess the impact of government support on environmental sustainability. In using simple linear regression, the following assumptions were also tested; Correlation and ANOVA test. The findings are presented in Tables 5.

Correlation, and ANOVA Test for Independent Variables.

Table 6 however, depicts the correlation among the variables using a correlation matrix. According to statistics and econometrics, when the correlation level between the independent and dependent variables is relatively high, it can cause spurious regression results analysis. Table 6 shows a correlation between government support and environmental sustainability.

Table 6: Correlation Matrix for dependent and independent variables

Variables	1	2
(1) Environmental sustainability	1.000	
(2) Government Support	(0.432) *	1.000

**Correlation is significant at the 0.05 level (2-tailed).*

Table 7 indicates the correlation coefficient between government support and environmental sustainability. The results indicate that there is a weak correlation between government support (COR= 0.432) and environmental sustainability. Overall, there is a weak correlation between government support and environmental sustainability. This is an indication that there is an expectation of an effect of the independent variables on the dependent variable (environmental sustainability).

ANOVA Test

More so, one of the main assumptions for the use of estimation techniques is about the significance of the predictor variables. The predictor values must be significant so as to make a good prediction. Table 13 shows the ANOVA test for government support and environmental sustainability. It shows in each case the model sum of squares, degree of freedom, mean square, F-test and significance value.

Table 8: ANOVA test of government support and environmental sustainability

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	980.101	1	980.101	66.370	.000[b]
Residual	1476.723	100	14.767		
Total	2456.2284	101			

a. Dependent Variable: Environmental Sustainability

b. Predictors: (Constant), government support

Results in Table 8 present the diagnostic statistics of the linear regression. Table 14 indicates that at the 0.000 significance, there is a joint significance of the variables and that the model was good in explaining the dependent variable. Again, the Analysis of Variance (ANOVA) table shows that the independent variables under consideration are significant at ($p = 0.000 < (0.05)$ 5%) significant level, given an indication that the data collected were not manipulated but a true representation of what is actually the situation at the firm.

Model Summary

Table 9 presents the model summary, indicating regression, regression square, adjusted regression square and standard error of the estimate.

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.632[a]	.399	.393	3.84281

a. Predictors: (Constant), government support

From Table 9, explains the amount of variation that exists in the dependent variable caused by the independent variables. The results indicate that there is a 39.9% variation in environmental sustainability as the dependent variable explained by the independent variable (government support).

Table 16 provides the regression analysis for the impact of government support on environmental sustainability. It presents in each case the variables for the model, standardized and unstandardized coefficient, t-statistics and the significance of the model.

Table 10: Linear regression analysis for the impact of government support on environmental sustainability

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	6.376	1.262		5.053	.000
Government support	0.603	0.074	0.632	8.147	.000

a. *Dependent Variable: environmental sustainability*

From Table 10, it was discovered that there is a positive and statistically significant impact of government support on environmental sustainability (Beta=0.603; p=0.000: p<0.05). It can be deduced that an increase in the firm's government support causes a 60.3% significant improvement in the environmental sustainability of firms and vice versa.

The Moderating role of Government Support of Reverse Logistics Practices on Environmental Sustainability

The third objective assessed whether the government supports moderate reverse logistics practices on environmental sustainability. In order to achieve the above objective, multiple regression analysis was used to analyse the Data. In using multiple linear regression, the following assumptions were tested; multicollinearity and normality test using One Way Analysis of Variance (ANOVA). The findings are presented in Tables 17 to 18. Table 17 gives a clear indication of

diagnostic checks for linear regression analysis. It shows the indicators for government support, reserve logistic practices and collinearity statistics (tolerance and VIF).

Table 11: A Multicollinearity Test of the Independent Variables

	Collinearity Statistics	
Variables	**Tolerance**	**VIF**
Reserve logistic practices	0.629	1.927
Government support	0.613	1. 691

a. Dependent variable: environmental sustainability

Source: Field Survey (2023)

Table 17 reveals that the largest value of VIF is 1.927 which is less than 10. This means that the independent variables are fit to be used for the study. Also, it is evident in the Tolerance values since none of the values is below 0.01, so all the indicators fit the data.

Table 18 assessed whether the government supports moderate reverse logistics practices on environmental sustainability. It shows the variables for the independents, the variable unstandardized coefficient (*b*), t-statistics and the significant value (p-value) less than 0.05 of the study variables. It further shows the variables summary of regression (R), regression square (R^2), adjusted R^2 and standard error estimate.

Table 18: Regression Results

Variables	**Model 1**	**Model 2**	**Model 3**
Independent variables	*b*(t-value)	*b*(t-value)	*b*(t-value)
Reverse logistics practices (R)	.554(3.585) *		
Moderator			
Government supports (G)		.603(8.147) *	
Interaction effect			
G ⟶ R			.451(4.914) *
R^2	.302	.399	.439
Adjusted R^2	.295	.393	.428
Standard error	4.140	3.843	3.731
F-value	43.358	66.370	38.770
Degree of freedom	1/100	1/100	2/99

Note: *p=0.05, Dependent Variable= Environmental sustainability

The R-squared in Table 18 for the moderating variable accounts for 45.1% of the variation in the dependent (environmental sustainability) variable as explained by the independent variables (interaction of government support and reverse logistic practices) in the study.

The results in Table 18 reveal that, generally, the government supports moderate reserve logistic practices on environmental sustainability. The results show that there is an interaction effect

between government support with reserve logistic practices on environmental sustainability. The results indicated that the interaction of government support with reserve logistic practices has a positive and significant impact on environmental sustainability (b=0.451, p<0.05). This indicated that a combination of government support and reserve logistic practices in firms will significantly improve environmental sustainability. The interaction between government support and reserve logistic practices suggests that well-coordinated supply chain strategies, coupled with government assistance, can contribute significantly to reducing the environmental impact of supply chain activities. Therefore, it is suggested that businesses should consider re-evaluating their supply chain partners, exploring alternative transportation methods (such as rail or waterways), and adopting advanced technologies like real-time tracking to enhance efficiency and sustainability.

Conclusion and recommendations

The study brought to light that there is a positive and statistically significant impact of reverse logistics practices on environmental sustainability. Again, the findings of the study indicate that there is a positive and statistically significant impact of government support on environmental sustainability. With regards to the impact of reverse logistics practices on environmental sustainability, the study concludes that there is a moderate correlation between reverse logistics practices and environmental sustainability. Additionally, there is a positive and statistically significant impact of reverse logistics practices on environmental sustainability. The study further concluded that government support moderates reserve logistic practices on environmental sustainability.

In determining whether the government support moderate reverse logistics practices on environmental sustainability, it can be concluded that the government supports moderate reserve logistic practices on environmental sustainability. The results suggest that government support plays a crucial role in influencing environmental sustainability outcomes when combined with reserve logistic practices. This implies that proactive policies, regulations, and incentives provided by governments can amplify the positive effects of sustainable logistic practices. Policymakers consider enhancing support for companies that adopt environmentally friendly logistics while also encouraging the adoption of such practices through regulations and incentives. The study recommends that organizations should focus on optimizing product returns, recycling, remanufacturing, and waste reduction processes. Implementing effective reverse logistics can lead to reduced waste generation, lower energy consumption, and decreased emissions, contributing to a greener supply chain. Also, the government should design clear policies and incentives in place for businesses that may feel more accountable for their sustainability practices and report their progress more openly.

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