Journal of Economics, Management Sciences and Procurement *Volume 3, Issue I, 2024*

pp. 95-108

Effect of Green Manufacturing, Informational sharing on Performance of Manufacturing Firms in Nairobi County, Kenya

Article history: *Revised format: 17th June 2024, Available online: 5th July 2024*

Edwin K. Tarus[1]; Dr. Edwin K. Kimitei[2]; Dr. Collins Kapkiyai[3]

Abstract:

Purpose: *The purpose of the study is to determine the effects of green manufacturing on the performance of manufacturing firms in Nairobi County, Kenya. The study is guided by the ecological modernization theory.*

Material/methods: *An explanatory research design was employed for the study. The target population consisted of 650 manufacturing firms in Nairobi County, categorized into different sectors based on their production activities. A sample size of 242 firms was selected, with the unit of inquiry being the purchasing or logistics managers of firms registered with the Kenya Association of Manufacturers. A stratified sampling technique was used. Data was collected using a structured questionnaire administered to the managers in the procurement departments. Data analysis was conducted using descriptive and inferential statistics with the aid of SPSS version 24. Descriptive statistics included measures of standard deviation and mean, while inferential statistics comprised Pearson correlation and multiple regression analyses.*

Findings: *The findings indicated that green manufacturing has a positive and significant effect on the performance of manufacturing firms in Nairobi County, Kenya ($\beta = 0.244$, $p<0.05$). Additionally, information sharing was found to positively moderate the relationship between green manufacturing and firm performance ($\beta = 0.42$, $R^2\Delta = 0.109$, $p<0.05$).*

Conclusion*: The study concludes that green manufacturing positively affects firm performance, with information sharing being a crucial moderating factor. It is recommended that manufacturing firms in Nairobi County should prioritize green manufacturing practices to enhance performance.*

Value: *The study provides valuable insights for manufacturing firms in Nairobi County, highlighting the importance of adopting green manufacturing practices. Emphasis should be placed on collaboration, the use of eco-friendly materials, and transparent communication mechanisms to achieve sustainable growth, gain a competitive edge, and foster responsible business environments.*

Keywords*: Information Sharing, Green Manufacturing, Firm Performance*

Paper Type: *Research Article*

Recommended citation: Tarus, E. K., Kimitei, E. K., & Kapkiyai, C. (2024). Effect of green manufacturing and information sharing on performance of manufacturing firms in Nairobi County, Kenya. *Journal of Economics, Management Sciences and Procurement, 1*(1), 95-108.

[1] **MBA student, Moi University**

[2] **Senior Lecturer,** Department of Marketing and Logistics School of Business and Economics, Moi University

[3] **Lecturer,** Department of Accounting and Finance**,** School of Business and Economics, Moi University

1. Introduction

In today's highly dynamic environment, organizations strive to improve their firm performance to encounter the speed of change in technological advancement, customer demands and global competition. Attaining a sustainable firm's performance to enable long term survival is a major aim for managers in every organization. Nevertheless, the smaller firms have major problems surviving under hostile environmental conditions than larger firms Hosseini et al., (2018). Firms can boon from innovation strategies as it enhances the companies to optimize their competing power by increasing their performance and efficiency in terms of its operations Goksoy (2013). Apparently, firms can achieve the possible performance by creating more economic value compared to the marginal (break-even) of the competitors (Angus and Nellis 2019). Wenhao et al (2020) expounds that the objective of green supply chain management (GSCM,) is actually to reduce damages to resources, capabilities and the environs with which businesses transact, and in relation to the supply chain while engaging economic interests for the purpose of attaining the substantial development element of the public.

Several researchers in developed countries for instance Europe Otago (2009) and Muruli, (2008); Zailani, S, Jeyaraman; K, Vendadasan; G, & Premkumar R 2012 and Das (2018), have reinforced the claim that green practices positively influences the firm performances In Africa manufacturing sectors are putting more emphasis on the supply chain practices undertakings which offer optimum performances on income, time, used for manufacture and the value of the manufactured goods or services. The problem has changed from "whether" to "how" to incorporate social, environmental and economic effects of green supply chain management into daily managing choices when executives at all heights have substantial motivational pressures to enhance short- term incomes Mani, Gunasekaran, Papadopoulos, Hazen and Dubey (2016). Majority of firms have full-fledged on undertakings on the supply chain but are thoughtful further so as to enhance the effect of greening. Green supply chain management, according to Seok-Beom; Choi et al., (2017), green supply chain management entails manufacturing of product life management. Green manufacturing, according to Seith et al., (2018) & Rashid Abdul (2017), green manufacturing is a strategy that requires the firm whether small or large to figure out what should be conducted in relation to its negative environmental effects that results to increases in cost, reduces productivity and results to efficiency reduction.

Gunasekaran et al., (2004). Stated that, business competition nowadays is eminent between supply chains of firms. According to Archer and Elliott (2021stipulated that information sharing is a key element influencing firm supply chain performance. According to Dubey et al., (2018), stated that information sharing effects positively as it fosters alignment and adaptability and also improves on the level of visibility in manufacturing firms, hence securing and managing information within supply chain is a crucial aspect achievement in regards to the evolving business environment. Firm performance goals can be attained through proper environmentally managed information sharing between customers and suppliers and also supply chain partners. Yang & Zhang (2016) and Jabbour (2015). Bullwhip effect is as a result of uncertain information sharing that alters the entire supply chain negatively, therefore the essential factor for improving supply chain performance is the efficient information sharing.

Manufacturing firms in Nairobi County perform poorly which could be as a result of poor integration of green practices in the supply chain activities as a means of ensuring

better performance. Despite the efforts made by manufacturing firms to attain firm performance, they face numerous challenges, (Bhanot, Rao & Deshmukh, 2015) and Ghazilla, Sakundarini, Rashid, Ayub & Olungu (2015), which inhibit them from implementing green practices this includes general challenges that affect the implementation of green practices amongst manufacturing firms. These challenges includes; firm barriers which involves weak firm structures, poor employee empowerment, internal politics, inadequate skills and underdeveloped green practice culture. Environmental knowledge barrier; which involves inadequate access to green manufacturing knowledge and expertise. Manufacturing sector in the Kenyan context has been limping in relation to other sectors as evidenced from Kenya national bureau of statistics (KNBS, 2016), 3.5 % growth rate in manufacturing sector with 4.4% in agriculture, 7.2% transport, energy 6.5% and building 9.2%. The sluggish improvements in performances can be due to waste prevalent in overall supply chain and heightened costs of operations that needs to be redressed through greening mechanisms in place. The gap of this study is based on moderating relationship information sharing and firm performance. Prior studies on the relationship between green manufacturing practices and firm performance were done and disregarded moderating factor relationship, therefore, it's of essence to examine and explore research gap from existing literature by establishing the moderating effect relationship of information sharing on the relationship between green manufacturing and firm performance from developing economies perspective such as Kenya economy.

2. Theoretical and Literature Review

The theory of ecological modernization came into existence among the class of intellectual philosophers in the early 1980's at the social science research centre in Berlin Germany and Free university. According to Gouldson & Murphy (2000) and Janickle (2008). The theory of ecological modernization states that collective achievement and environmental management can be attained by way of state planning, preventive innovation, technological development and subsequently coordination, not foregoing product innovation, management and technology process. Ecological modernization theory is a macro level theory that needs to be integrated with level theories to expound green manufacturing concept. Scholars for instance, Basu and Modest, (2014) advocated that centric innovation approach technique should be a perquisite entrenchments of green management practices including, green manufacturing. The theory of ecological modernization guarantees human beings a functioning responsibility to dwell on in for the purpose of enhancing the environment capacity which entails adopting and enabling green manufacturing in place.

2.1. Empirical Review

According to Seith et al., (2018) & Rashid-Abdul et al., (2017) Green manufacturing is defined as the procedures and techniques in place that permit the firm regardless of its structures to acknowledge the tendency of the essentiality of the negative impacts which renders efficiency reduction, reduces productivity and more so increases the cost elements. While, Vrchota et al., (2020), anticipated that the aspect of green manufacturing entails the accountability in matters appertaining to green production. The concept of green manufacturing is an emerging model of manufacturing that factors in sustainable environment, Deif (2011). Maximization of resource to ensure efficiency while curtailing the negative effects of the surroundings while at the same note realizing the full potentiality of both social and economic privileges and gains is centred to the

philosophy of green manufacturing. The concept of green manufacturing asserts on reducing environmental impacts by enabling reduced recycling, reuse not foregoing remanufacturing since it marshal resource consumption optimization, source reduction and fostering use intensity Shang; 2010, Mbohwa & Fore (2014). According to Wei & Orji (2016), green manufacturing entails waste reduction, environmental protection, compliance regulatory and pollution management.

Green manufacturing encompasses four substantive dimensions, this dimension includes; sustainable supply chain management, sustainable product design, sustainable end of life management and lastly but not least sustainable process, Eltayeb (2019). According to Lindhqvist & Johansson (2005), green design is fostered by means of design for the environment, thus enabling producers to design materials and products that ensures specifications of the ecology objectives are adhered to. A closed lope is the dimensionality that the designers at the design stage review in the manufacturing which initializes from the point of management product recovery, Deif (2011). The significant elements of green product development includes, waste minimization, elimination of hazardous components and materials designing products and components with reuse and recycling elements and designing materials, products and components for remanufacturing with design volume and shapes for space utilization while transporting and storing, (Udin & Khor 2013).

Several studies on green manufacturing has been made for instance, Shivastava & Shivastava (2016), stated that embracing the green concept in the production perspective incorporated with coherent, systematic and structured energy use, the manufactures of cement in India lower the expenditure as well as minimizing the impacts of production to the surroundings while factoring in reliability elements, quality dimensions and performance factors. Mbohwa & Fore (2014), opined that archaic methods were applicable for most industries for instance manufacturers of cement in South Africa adopted the methods since it was a requisite for the stated industries to advance in control process innovations and subsequently process optimization for the sole requirements of waste minimization while reducing the ecological influence on production lime. Manufacturing firms which embraced methods and processes that are green including bucket transportation enabled minimal leakage and thus rendering curtailment in raw material waste and more so environment emissions. Housekeeping practices including optimal inventories are the essential features of curtailing the costs associated with production.

A study by Digalwar et al., (2017), suggested that enabling green manufacturing practices contrary enhances production costs and enhance quality trilogy on the same note, Zhang & Li (2018), anticipated that green manufacturing effects positively to the surrounding environment since it reduces gases emissions and waste prevalent in production process. According to a study conducted by Eshikumo (2017), green manufacturing practices including efficient use of energy processes and reduced waste that poses an impact of curtailing production cost element in the cement manufacturing which at loggerheads improves firm performance. Firms that embrace green manufacturing practices on this perspective were able to curtail the cost element while at the same point controlling the adverse environmental pollution. A study conducted by, Wei & Orji (2016), stated that the comprehensive cost in production of green manufacturing in firms is largely less as compared to the cost element in conventional firms.

Studies on green manufacturing performance on simply a sole manufacturing firms were conducted by researchers including, Wei and Orji (2017), notable elements that are essential are the requisite diversification of research studies to broaden and bring on board the diverge firms since the results may not be hypothesized to all firms. Mbohwa and Fore (2014), advocated that majority of manufacturing firms in developing countries including Kenya are unable to settle the cost element associated with acquisition of machines and manufacturing equipment and thus unable to modernize and refurbish archaic methods applied in production line, thus it raises an alarm in the shift to adopting and implementing the green manufacturing concept in place to ensure efficiency and effectiveness in the production in the manufacturing firms.

H_{01}: *Green manufacturing has no significant effect on performance of manufacturing firms in Nairobi County, Kenya*

Further empirical studies on information sharing has been done by researchers for instance; Dubeyet et al., (2018), stated that enhancing the visibility, alignment, agility and magnitude levels in supply chain in firms has proved positive while information sharing is the determinant factor in place, so information regulation within the logistical perspective is a perquisite aspect inconsideration of the prevailing environment. While a study conducted by Khan et al., (2021), opined those green practices commitments by firms depends on information essential elements which constitutes to enhancing and improving both economic and environment prevalent. Deployment and employment of sophisticated information and communication technologies by variety of firms can however constitutes to advance in communication within the overall supply chain Singh & Rezaei (2019). Similarly, Bag et al., (2020), stated that there exists technologies that fosters and enhance communication for instance; RFID tags, HMI, ERP, PLC, SCADA, information global systems, warehouse management systems, moving shelf robots and automated guided vehicles. This communication technologies tends to improve and enhance the supply chain context while fostering in the aspect of information efficiencies and effectiveness in place. Moberg et al., (2002), stated that the quality element of information within the supply chain is crucial and significantly necessary. While on the same note, Lin & Lin (2006), opined that quality aspect of information has an influence that can directly impacts firm performance. Therefore, improving the quality of information that is shared enhances the capacity and value of information shared amongst the firms.

H_{02}: *Green manufacturing has no significant effect on performance of manufacturing firms in Nairobi County, Kenya*

Based on the above the following conceptual framework was developed:

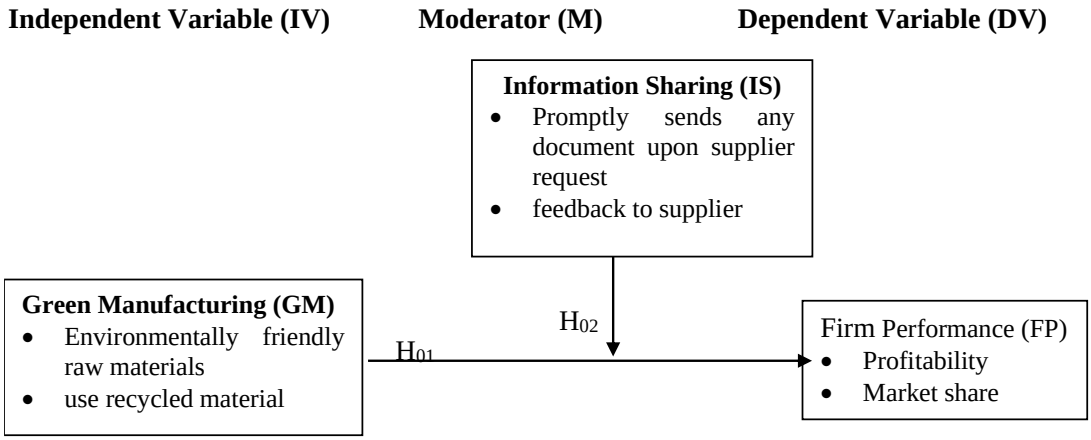

Figure 2.1: Conceptual Framework

3. Material and methods

3.1. Sampling

From the 650 manufacturing firms registered with the Kenya Association of Manufacturers in Nairobi County, Kenya (KAM 2021), a sample size of 242 was determined by adopting the formula proposed by Naing et al. (2006). Consequently, one manager from the procurement or logistics department was selected to fill out the questionnaires, serving as the unit of analysis. This was justified as an adequate sample size as advocated by Morgan & Van Voorhis (2007). The unit of inquiry consisted of purchasing or logistics managers from the procurement department, as they are middle to senior-level managers with a strong practical understanding of supply chain operations. Naing et al.'s (2006) formula was adopted for determining the sample size. Daniel & Naing et al. (2006) and Macfarlane (1999) suggested that to attain a large sample size, the anticipated population should be 50%. Similarly, a 95% confidence level and a precision of 45% to 55%, or a 5% statistical error, were used in accordance with prior empirical research by Naing et al. (2006) and Macfarlane (1999). The study utilized stratified and random sampling techniques to select the firms and managers. Of the 242 questionnaires distributed, 225 (92.98%) were returned, and 205 (84.71%) were valid and usable, while 20 (8.27%) were incomplete and excluded from further analysis to avoid distorting the results (Lindner & Wingenbach, 2002). This resulted in a valid response rate of 84.71%. According to Caslyn and Winter (1999), a lower response rate increases the likelihood of non-response bias; however, Lindner and Wingenbach (2002) suggest a minimum response rate of 50% for surveys, and Sekaran and Bougie (2010) consider even 30% acceptable. Therefore, the response rate of 84.71% in this study indicates that non-response bias was not a concern.

3.2. Measurements of Variables

Firm Performance; was measured by the use of five item point scale that measured the performance by providing questionnaires to respondents to evaluate the firm performance on the perspective whether, total sales have grown faster than that of their main competitors, whether there is a higher level of customer loyalty with our customers, whether the firm has achieved new product development than our main competitors, market share has increased faster than that of their main competitors, whether the firm has achieved better customer satisfaction on product quality compared with those of our competitors

Green manufacturing was measured through providing questionnaires to respondents based on whether the firm collaborate with supplies in designing products which are environmental friendly, the firm use recycled material in their manufacturing process, the firm has effective mechanisms that control emission of harmful gases to the environment during process of productions, the firm recycles internal waste generated during manufacturing process, reduction in pollution by contracting firms that observe environmentally friendly principles or EMS certified, the firm contract firms who adhere to environmental rules and are EMS certified during manufacturing process, the firm practices Safe disposal of non-recyclable waste (especially hazardous waste).

Information Sharing Five-point Linkert scale was used as a measurement level for the variable Boorne (2012). Respondents were asked to give a rating of information sharing on a five- point rating level, consequently 1 entail "Strongly Disagree" whereas 5 entails "Strongly Agree". Respondents were required to evaluate the manufacturing performance of the firms by taking forth sequence of accounts manifestations drafted categorically for instance; whether the firm regularly shares accurate and integrated information with our suppliers, the firm promptly sends any document upon supplier request, our supplier easily share information with us upon request, the firms' gives immediate feedback to supplier on products delivered, the firm ensure their regular and effective communication with its suppliers, the firm conducts periodic meetings with suppliers to address their views and or problems, the firm ensures that both parties are regularly informed about events or changes that may affect the other party.

3.3. Data Analysis and model specification

Information gathered was analysed in two levels for instance: descriptive and subsequently inferential statistics in aid of SPSS version 24.0 Matthes & Hayes (2009). On descriptive statistics it involves the application of standard deviations, median, use of means, kurtosis not foregoing skewedness and minimum and maximum values. Charts and tables were used during presentation of data. Parsons Product Moment correlation (PMPMC) was used to ascertain correlation analysis by testing the linear relationship and usability of variables in regression analysis. Hierarchical regressions and multiple regression has been deem as a better statistical technique especially on the aspects of research approaches which is associational and has various dependent and independent variables. The hierarchical model used in this study is given as;

$$FP = \beta_0 + \beta_1 \mathrm{GM} + \varepsilon_1 \ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

$$\mathrm{FP} = \beta_0 + \beta_1 \mathrm{GM} + \beta_2 \mathrm{IS} + \varepsilon_2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

$$\mathrm{FP} = \beta_0 + \beta_1 \mathrm{GM} + \beta_2 \mathrm{IS} + \beta_2 GM * IS + \varepsilon_3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iii)$$

Where Y = Firm performance. , $\beta_1 \ldots \beta_2$ = Represents the slope which shows the extent to which firm performance changes as a result of a subsequent deviation of independent variable by one variable unit. GM=Green Manufacturing. e = Represents the error term.

4. Findings and Discussion

4.1. Preliminary Analysis

The study employed the Principal Component Method to investigate components that were highly connected with green manufacturing practices, information exchange, and firm performance in order to increase the trustworthiness of the data. During the analysis, weak or negative correlation components were eliminated. The validity of the tool was further evaluated using the Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin Test of Sampling Adequacy. To extract components from each construct, all variables underwent a component factor analysis using varimax rotation. Following the advice of Hair et al., items with a loading factor of less than 0.50 were removed, while those with a loading factor of more than 0.50 were kept.

Table 1: Factor Analysis

		loadings	Total Variance Explained Cumulative %
Firm Performance (KMO=.799, eigne value=3.355, Cronbach's Alpha= 0.826)	Total sales have grown faster than that of our main competitors	0.897	67.096
	There is a higher level of customer loyalty with our customers	0.901	
	We have achieved new product development than our main competitors	0.878	
	Market share has increased faster than that of our main competitors	0.825	
	We have achieved better customer satisfaction on product quality compared with those of our competitors	0.535	
Green Manufacturing (KMO=0.559, eigne value=2.71, Cronbach's Alpha= 0.847)	The firm collaborate with supplies in designing products which are environmental friendly	0.758	60.261
	The firm use recycled material in their manufacturing process	0.753	
	The firm uses green energy in its manufacturing process	0.718	
	The firm has effective mechanisms that control emission of harmful gases to the environment during process of productions	0.814	
	The firm recycles internal waste generated during manufacturing process	0.711	
Information Sharing(KMO=0.753, eigne value=4.105, Cronbach's Alpha= 0.840)	The firm promptly sends any document upon supplier request	0.842	58.636
	Our supplier easily share information with us upon request	0.854	
	The firms' gives immediate feedback to supplier on products delivered	0.869	
	The firm ensure their regular and effective communication with its suppliers	0.883	

	The firm conducts periodic meetings with suppliers to address their views and or problems	0.857
	The firm ensures that both parties are regularly informed about events or changes that may affect the other party	0.56

the firms in Nairobi County have a relatively high level of green supply chain management practices in their manufacturing processes with low variation among these practices (3.967, SD=0.468). All values for skewness value were less than 3 indicating a perfectly symmetrical distribution. Kurtosis was less than indicates a normal distribution. the findings show that information sharing among Nairobi's manufacturing firms is characterized by trust, cooperation, and effective communication (mean = 4.135, SD = 0.599), promoting overall business success and supply chain efficiency. the findings on firm performance, with a mean score of 3.958 and a standard deviation of 0.725, demonstrate the firms' superior performance and competitive edge in the market, which can lay the groundwork for future growth and success. All values for skewness value were less than 3 indicating a perfectly symmetrical distribution. Kurtosis was less than indicates a normal distribution. Positive kurtosis values indicate a distribution with heavier tails and a more peaked shape, while negative kurtosis values indicate a distribution with lighter tails and a flatter shape. Table 2 also illustrates the correlation results. From the findings the relationship between green manufacturing and firm performance was found to be positive and significant, $\rho = 0.519$, p-value < 0.01. Furthermore, there was positive and significant correlation between information sharing and firm performance, $\rho = 0.707$, p-value < 0.01).

Table 2: Descriptive and Correlation Analysis

	Mean	Std. Deviation	Skewness	Firm performance	Green manufacturing	Information sharing
Firm Performance	3.958	0.725	-1.36	1		
green manufacturing	3.967	0.468	-0.739	.519**	1	
Information sharing	4.135	0.599	-1.47	.707**	.620**	1

** Correlation is significant at the 0.01 level (2-tailed).

4.2. Hypotheses Testing (Hierarchical Regression Analysis)

The model summary of the regression model is presented in table 3. Based on the model, the green manufacturing accounted for approximately 66.1% of the total variation in firm performance (R^2 = .661, Adjusted R^2 = .656.

Hypothesis 1(H_{o1}) stated that green manufacturing has no significant effect on performance of manufacturing firms in Nairobi County, Kenya. Findings showed that green manufacturing had coefficients of estimate which was significant basing on β_1 = 0.244 (p-value = 0.000 which is less than α = 0.05). The null hypothesis was thus

rejected, and it was concluded that green manufacturing had a significant effect on firm performance. This suggested that there was an up to 0.244 unit increase in firm performance for each unit increase in green manufacturing. In Model 3 The model's R-squared value is 0.629, indicating that approximately 62.9% of the variance in the dependent variable (Zscore(FP)) is explained by the GM. Moving to Model 3, an additional interaction variable that is GM*IS is introduced with a positive and statistically significant coefficient of 0.42 and standard error of 0.8. The R-squared value increases to 0.747, meaning that approximately 74.7% of the variance in Zscore(FP) is now explained by the combined effect of four variables and the interaction term GM.

H_{02} stated that information sharing does not moderate the relationship between green manufacturing and firm performance. However, the findings indicated that information sharing moderate the relationship between green manufacturing and firm performance (β =.42, ρ< .05). So, the null hypothesis was rejected. This was also confirmed by $R^2\Delta$ of .109 which indicate that information sharing moderates the relationship between green manufacturing and firm performance by 10.9%. The implication is that the more information is shared within the firm about green manufacturing practices, the stronger the relationship will be between green manufacturing and firm performance.

Table 3: Moderating Effect of Information Sharing on Green manufacturing Practices and Firm Performance.

	Model 1 B(S.E)	**Model 2 B(S.E)**	**Model 3 B(S.E)**
(Constant)	0.00(.04)	0.00(.07)	0.00(.01)
Zscore(GM)	0.24 (.05)	0.24(.03)*	0.31(.06)*
Zscore(IS)		0.26(.05)*	0.75(.04)*
Zscore(GM*IS)			0.42(.08)**
Model Summary Statistics			
R	0.793	0.799	0.864
R Square	0.629	0.638	0.747
Adjusted R Square	0.624	0.632	0.742
S.E of the Estimate	0.611	0.605	0.506
Change Statistics			
R Square Change	-	0.009	0.109
F	148.381	6.515	112.717

a Dependent Variable: Zscore(FP)

Source: *(Survey Data, 2023)*

The research employed modgraph, as suggested by Jose (2008), in order to demonstrate both antagonistic and enhancing moderating effects. The findings in figure 1 indicate an enhancing moderation effect where increased levels of information sharing result to increased effect of green manufacturing on firm performance.

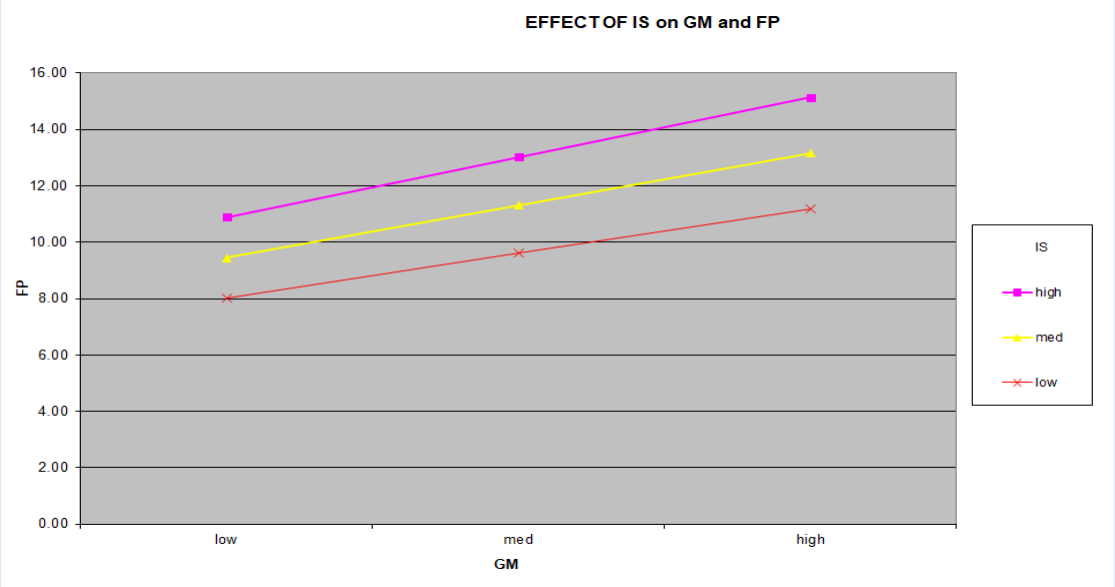

Figure 1: Modgraph for Moderating Effect of Information Sharing on Green Manufacturing and Firm Performance

5. Discussion of Findings

Regarding the regression findings, there was a positive relationship between green manufacturing and firm performance, with a 0.244 unit increase in firm performance for each unit increase in green manufacturing. Consistently, Shivastava & Shivastava (2016) established that adopting structured energy use and eco-friendly production practices in India not only reduced costs but also minimized negative environmental impacts. In the same way, Mbohwa & Fore (2014) found that manufacturing firms that implemented green methods and processes, such as bucket transportation, experienced a reduction in raw material waste and environmental emissions. The study findings also align with those of Eshikumo (2017) which revealed that green manufacturing practices, such as energy efficiency and waste reduction in cement manufacturing, contribute to lowering production costs and enhanced firm performance. Notably, the extant literature supports the notion that eco-friendly practices lead to reduced costs, minimized environmental impacts, and improved overall performance. Regarding the regression findings, there is a positive relationship between marketing crisis management practices and organizational performance. The result aligns with the studies by Sing et al. (2016) and Hasan (2013), which emphasize the benefits of reusable packaging systems and minimizing packaging waste. These practices have been widely adopted by firms to reduce product damage, solid waste, and safety issues while also enhancing environmental sustainability and overall firm performance. These highlight the importance of environmentally friendly practices for overall business success.

The findings from the hierarchical regression indicated that information sharing positively moderates the relationship between green manufacturing and firm performance. This implies that when companies foster a culture of information sharing regarding green manufacturing practices, they can experience improved performance outcomes. Consequently, effective communication and collaboration within the company on sustainability practices in green manufacturing play a crucial role in enhancing firm performance. The study's findings are consistent with Chen et al.

(2000), who highlighted the importance of information sharing in minimizing ambiguity in demand and supply, consequently enhancing the competitiveness of firms in the supply chain.

6. Conclusion

In conclusion, the study indicated that green manufacturing positively influences firm performance, with information sharing playing a critical role in enhancing this relationship. The adoption of green supply chain practices, such as collaborating with suppliers, using recycled materials, implementing green energy, and working with environmentally compliant contractors, significantly contributes to this positive impact. However, addressing the challenge of controlling harmful gas emissions remains essential to further improving this relationship. The findings suggest that increased information sharing within the firm about green manufacturing practices strengthens the positive impact on firm performance, making it a vital strategy for firms aiming to enhance their sustainability and overall performance.

7. Managerial and Policy Implications

Based on the findings, manufacturing firms in Nairobi County, Kenya should prioritize adopting green manufacturing practices and enhance information sharing among stakeholders. This includes strengthening collaboration with suppliers, increasing the use of recycled materials, implementing green energy, and working with environmentally compliant contractors. Additionally, firms should actively develop effective strategies for controlling harmful gas emissions. By focusing on these recommendations, manufacturing firms can achieve sustainable growth and enhanced performance and contribute to overall industry improvements. Enhancing information sharing involves creating robust communication channels and platforms that facilitate the dissemination of green manufacturing knowledge and practices among employees, suppliers, and other stakeholders. By focusing on these recommendations, manufacturing firms can achieve sustainable growth, enhanced performance, and contribute to overall industry improvements. These steps not only boost firm performance but also align with global sustainability goals, making firms more competitive and resilient in the long term.

8. Theoretical Implication,

Findings resonate with the ecological modernization theory, which emphasizes the importance of integrating environmental concerns into economic and industrial processes. By actively sharing information and knowledge related to green practices, manufacturing firms can accelerate their ecological transformation and align their operations with sustainability goals. The study's conclusions highlight the significance of green manufacturing, for enhancing firm performance and sustainability. It suggests that manufacturing firms in Nairobi County should prioritize these practices to improve their financial and operational performance.

9. Further Research Recommendations

The primary objective of this study was to establish the moderating effect of information sharing on the relationship between green manufacturing practices and the performance of manufacturing firms in Nairobi County, Kenya. Future research should focus on the role of government policies and incentives in promoting the adoption of green manufacturing. Additionally, research could explore the impact of other green

supply chain practices, such as green purchasing, on consumer preferences and behavior, as well as investigate the effectiveness of various communication strategies in enhancing collaboration and awareness of environmentally friendly practices. Finally, scholars could examine how the integration of digital technologies and supply chain transparency can contribute to improved environmental sustainability and operational efficiency.

References

Angus, A. J., & Nellis, J. G. (2019). Sustainability in Business Economics. In *Incorporating Sustainability in Management Education* (pp. 55-81). Palgrave Macmillan, Cham.

Khan, S. A. R., Razzaq, A., Yu, Z., & Miller, S. (2021). Industry 4.0 and circular economy practices: A new era business strategies for environmental sustainability. *Business Strategy and the Environment*, *30*(8), 4001-4014.

Archer, M., & Elliott, H. (2021). 'It's up to the market to decide': Revealing and concealing power in the sustainable tea supply chain. *Critique of Anthropology*, *41*(3), 227-246.

Bag, S., Luthra, S., Venkatesh, V. G., & Yadav, G. (2020). Towards understanding key enablers to green humanitarian supply chain management practices. *Management of Environmental Quality: An International Journal*, *31*(5), 1111-1145.

Basu, P., & Modest, W. (2014). Museums, heritage and international development: A critical conversation. In *Museums, heritage and international development* (pp. 1-32). Routledge.

Bhanot, N., Rao, P. V., & Deshmukh, S. G. (2017). An integrated approach for analysing the enablers and barriers of sustainable manufacturing. *Journal of cleaner production*, *142*, 4412-4439.

Das, D. (2018). The impact of Sustainable Supply Chain Management practices on firm performance: Lessons from Indian organizations. *Journal of cleaner production*, *203*, 179-196.

Digalwar, A. K., Mundra, N., Tagalpallewar, A. R., & Sunnapwar, V. K. (2017). Road map for the implementation of green manufacturing practices in Indian manufacturing industries: An ISM approach. *Benchmarking: An International Journal*, *24*(5), 1386-1399.

Dubey, V. K., Chavas, J. P., & Veeramani, D. (2018). Analytical framework for sustainable supply-chain contract management. *International Journal of Production Economics*, *200*, 240-261.

Eshikumo, S. M., & Odock, S. O. (2017). Green manufacturing and operational performance of a firm: Case of cement manufacturing in Kenya. *International Journal of Business and Social Science*, *8*(4), 106-120

Ghazilla, R. A. R., Sakundarini, N., Abdul-Rashid, S. H., Ayub, N. S., Olugu, E. U., & Musa, S. N. (2015). Drivers and barriers analysis for green manufacturing practices in Malaysian SMEs: a preliminary findings. *Procedia Cirp*, *26*, 658-663.

Goksoy, A., Vayvay, O., & Ergeneli, N. (2013). Gaining competitive advantage through innovation strategies: an application in warehouse management processes. *American Journal of Business and Management*, *2*(4), 304-321.

Hasan, M. (2017). Supply chain management in readymade garments industry, Bangladesh. *Asian Business Review*, *7*(3), 103-110.

Hosseini-Motlagh, S. M., Nematollahi, M., & Nouri, M. (2018). Coordination of green quality and green warranty decisions in a two-echelon competitive supply chain with substitutable products. *Journal of cleaner production*, *196*, 961-984.

Jabbour, C. J. C., de Sousa Jabbour, A. B. L., Govindan, K., De Freitas, T. P., Soubihia, D. F., Kannan, D., & Latan, H. (2016). Barriers to the adoption of green operational practices at Brazilian companies: effects on green and operational performance. *International journal of production research*, *54*(10), 3042-3058.

Khan, S. A. R., & Qianli, D. (2017). Impact of green supply chain management practices on firms' performance: an empirical study from the perspective of Pakistan. *Environmental Science and Pollution Research*, *24*, 16829-16844.

Mani, V., Gunasekaran, A., Papadopoulos, T., Hazen, B., & Dubey, R. (2016). Supply chain social sustainability for developing nations: Evidence from India. *Resources, Conservation and Recycling*, *111*, 42-52.

Rashid, A. Z. A., Alzyoud, A. A. Y., Al Shdaifat, F. H. A., & Omar, K. M. (2019). Does green supply chain management influence to suppliers' performance? Mediating role of social capital. *Int. J Sup. Chain. Mgt Vol*, *8*(3), 143.

Choi, S. B., Min, H., Joo, H. Y., & Choi, H. B. (2017). Assessing the impact of green supply chain practices on firm performance in the Korean manufacturing industry. *International Journal of Logistics Research and Applications*, *20*(2), 129-145.

Vrchota, J., Pech, M., Rolinek, L., & Bednář, J. (2020). Sustainability outcomes of green processes in relation to industry 4.0 in manufacturing: Systematic review. *Sustainability*, *12*(15), 5968.

Orji, I., & Wei, S. (2016). A detailed calculation model for costing of green manufacturing. *Industrial Management & Data Systems*, *116*(1), 65-86.

Zhao, Y., Cao, Y., Li, H., Wang, S., Liu, Y., Li, Y., & Zhang, Y. (2018). Bullwhip effect mitigation of green supply chain optimization in electronics industry. *Journal of Cleaner Production*