

# INFLUENCE OF GREEN PRODUCT DESIGN ON PERFORMANCE OF MANUFACTURING ENTERPRISES IN KENYA'S EXPORT PROCESSING ZONES

Benjamin Mutuku Muthoka<sup>1</sup>, Dr. Morrisson Mutuku<sup>2</sup>

<sup>1,2</sup>Department of Management Science, School of Business, Economics and Tourism, Kenyatta University, Kenya

DOI: <https://doi.org/10.5281/zenodo.8031791>

Published Date: 13-June-2023

---

**Abstract:** Manufacturing enterprise sectors are known as the backbone of development in general and economic development in particular because they not only help modernize agriculture but also lessen the heavy reliance of people on it by giving them jobs in secondary and tertiary sectors. However, Kenya's manufacturing companies have performance issues that, among other things, have prevented them from achieving their objectives, delayed the implementation of scheduled programs, and canceled planned activities. As a result, the goal of this study was to find out how green product design affects manufacturing firms' performance in Kenya's export processing zones. The descriptive research design was used in this study. All procurement managers from the selected ten manufacturing EPZ companies in Nairobi City County, Kenya, made up this study population, which served as the accessible and target sample. As a result, the sample for the study consisted of 112 procurement managers from all EPZ manufacturing companies. The respondents to this study were divided into groups based on their firm's specialization. The respondents from each stratum were selected using a simple method of random sampling. The sample size was 88 respondents. Primary data was gathered through the use of a semi-structured questionnaire. 11 respondents took part in the pilot study. The content validity test was used to guarantee the questionnaires' validity. Reliability of the questionnaires was tried utilizing the Cronbach's alpha test. Descriptive statistics like mean and standard deviation was used to analyze quantitative data. Inferential statistics such as regression analysis was used to test the relationship between variables and their influence on one another. The study found that green product design had a positive significance influence on the performance of manufacturing enterprises in Kenya's export processing zones. The study concluded that green product design aims at reducing waste and maximizing resource efficiency. The study recommended that when creating new products, both companies and product designers can advocate and design for the use of green materials.

**Keywords:** Green Product Design, Organizational Performance.

---

## 1. INTRODUCTION

Striking a balance between economic and environmental performance is more important for organizations that are under pressure from the community, regulations, and competition. Projects should implement procedures to lessen the ecological effects of their goods and services given the increased pressures for natural maintainability (Lee, Kim, and Choi, 2020). The purpose of their endeavors needs to be reexamined, agreeing with Younis, Sundarakani, and Vel (2021), who lay out their ecological picture. Successfully tackling environmental issues may open up new avenues for competition and ways to improve core business initiatives. Thus, eco-efficiency, environmental management systems, and cleaner production are examples of strategies that have been incorporated into green management practices.

The term "green supply chain practices" (GSCP) refers to a broad range of actions taken by an organization to lessen their impact on the environment, according to Diab, Al-Bourini, and Abu-Rumman (2015). Supply chains aim to maintain both

internal health and environmental sustainability by having the capability to self-correct based on data from the external environment. According to Sahoo and Vijayvargy (2021), green supply chain management (GSCM) is essential for making sure that each of these factors is taken into account. Environmental effects happen all along a product's lifespan. As a result, GSCM has emerged as a significant new prime example for businesses looking to accomplish benefit and share of the pie goals by reducing their natural dangers and effects while increasing their environmental productivity.

Export processing zones, or EPZs, are designated areas where domestic and international businesses can produce or assemble goods without being subject to standard customs regulations and quotas. According to Bendell, Miller, Weber, & Zhan (2015), there were more than 4,000 zones in more than 130 nations as of 2015. EPZs now play a significant role in economic growth, particularly in developing nations. Their performance is crucial to the creation of employment opportunities and drives economic expansion (Majumder, Rahman, & Martial, 2022). According to Rondinelli (1987), EPZs have therefore emerged as a popular policy tool to encourage international trade and attract foreign investment. According to Dörry and Hesse (2022), the government provides special tax and regulatory incentives in these designated areas where goods are produced for export. The point is to establish an empowering climate for organizations to work productively, create business potential open doors, and improve the nation's intensity.

EPZs' global performance has been mixed (Waters, 2013). While some nations have struggled to reap the benefits of EPZs, others have succeeded in attracting foreign investment and expanding their exports. The country's economic policies, infrastructure, workforce skills, and the availability of raw materials all play a role in whether EPZs succeed or fail. For instance, according to Chen, Poncet, & Xiong (2017), China is widely considered to be the global leader in EPZ performance. China started experimenting with EPZs in the 1980s as a way to encourage foreign investment and economic growth. There are currently hundreds of EPZs in China, which contribute significantly to the country's exports. Companies operating in these zones have benefited greatly from the tax breaks, low-interest loans, and simplified customs procedures offered by the Chinese government. As a result of exports coming from EPZs, China's economy has grown rapidly over the past few decades.

Chen, Poncet, and Xiong (2017) claim that the performance of China's EPZs has inspired other Asian nations to implement strategies of a similar nature. Singapore, Malaysia, Thailand, and Vietnam have laid out EPZs, with fluctuating levels of achievement. In Malaysia, for instance, the public authority made the Free Modern Zones (FIZs) during the 1970s, which animated the development of the nation's assembling base (Jauch, 2002). However, growth and development have been hindered by other nations' inability to attract foreign investment into EPZs, such as Indonesia. EPZs have had a significant economic impact on continents like America, but their performance has varied based on a number of factors. For instance, the success of the EPZs has been significantly influenced by their location. They have performed better than those in less accessible areas that are physically accessible and have good transportation links. In addition, EPZs have produced a diverse range of goods, with some zones focusing on high-tech industries and others on more conventional ones.

According to Ogunlela (2018), a major factor in the adoption of green initiatives in Nigeria's manufacturing sector is employee training. Nigeria's working climate, presumably, has significant imperatives, both from a strategy and legislative issues perspective. Ososanmi, Ojo, Ogundimu and Oke (2022) see that the degree of familiarity with store network the executives is low in Nigerian development industry and mindfulness crusade was proposed to sharpen all partners in the development business. In order to boost the profit margin of contractors, construction industry supply chain management needs to be improved.

According to Mafini and Loury-Okoumba (2018), the South African government actively promotes an effective and efficient construction industry that uses resources effectively, reduces waste, and transforms its workforce's working environment for improved employment and productivity. This government is doing this as both a regulator and a client. This is in line with the trend that is occurring all over the world. According to Bag, Gupta, Kumar, and Sivarajah (2021), despite the fact that the majority of industries have experienced significant transformations over the course of the past three decades, the construction industry in South Africa stands out as an obvious and glaring exception to these trends. Because of its significance to both the micro and macroeconomics, In South Africa's construction industry, green supply chain management (GSCM) has become one of the most important emerging business best practices.

Green production network the board alludes to the joining of eco-accommodating practices into the assembling, dispersion, and operations processes Green, Zelbst, Meacha and Bhadauria, 2012). This idea is picking up speed as organizations endeavor to diminish their environmental impression and measure up to shoppers' assumptions for socially capable strategic policies. According to Zhu, Sarkis, & Lai (2008), practices in green supply chain management center on minimizing waste, conserving natural resources, minimizing emissions, and developing a sustainable business model. Green product design,

green distribution, green packaging materials, green storage, and green disposal are all examples of these practices. Zhu and He (2017) say that green product design is a holistic way to make products that are sustainable, socially responsible, and economically viable. Green product design is good for the environment, manufacturers, and consumers alike. Companies can save money on production costs and make their brand more appealing to customers who value sustainability by reducing waste and using eco-friendly materials (Chen, 2001).

## STATEMENT OF THE PROBLEM

Even though eco-friendly product and service design is high on everyone's environmental, economic, social, and political agenda, it may be out of reach to network. Rao (2020) asserts that there may be connections between green supply chain management, which is an effort to improve the environment, economic performance, and competitiveness. According to Cherrafi, Garza-Reyes, Kumar, Mishra, Ghobadian, and Elfezazi (2018), the need to achieve greater economic prosperity while minimizing the impact on the environment has resulted in the development of a brand-new manufacturing paradigm known as green supply chain management. This paradigm entails designing, manufacturing, delivering, and disposing of goods that have a minimal negative impact on society and the environment and are economically viable.

According to a 2019 report by the National Environmental Authority (NEMA), the majority of EPZ manufacturing companies were leading the way in unsustainable manufacturing practices. Consequently, the majority of EPZA industries' effluent flows into the larger Athi River, which is a significant source of downstream livelihoods. Synresins, Sameer Agriculture and Livestock Limited (Daima), Kamongo Waste Recycling, Modern Lithography, Associated Battery Manufacturers (ABM), Apex Coating East Africa, and Thorlite Kenya were all forced to close as a result of EPZA's failure to implement recommendations to improve their solid waste and waste water management (NEMA, 2019).

According to Word Bank (2019), the entire manufacturing sector has contributed less than 10% to the GDP over the past five years and has been on the decline as a result of the closing of these businesses. For instance, GDP fell from 8.4% in 2017 to 7.7% in 2018 and 7.54 percent in 2019 respectively. Concerns have been expressed by Kenya Association of Manufacturers (KAM) (2018) regarding the declining fortunes of the manufacturing sector as a result of the sector's declining contribution to GDP. Regardless of this reality, sparse writing exists on the impact of green production network the executives rehearses on feasible execution of assembling firms in trade handling zones in Kenya.

## 2. LITERATURE REVIEW

### Theoretical Literature Review

Edith Penrose created the Resources Based-View Theory in 1960. The process of acquiring goods and services from outside sources to meet an organization's requirements and goals is known as procurement management. According to Yunus and Michalisin (2016), the resource-based view theory of procurement management is a strategic approach that focuses on the role that procurement plays in establishing and maintaining competitive advantage.

According to the resource-based view theory (RBV), an organization's competitive advantage is primarily determined by its resources and capabilities (Barney, 2002). This indicates that an organization's procurement function and resources can contribute to its competitive advantage by enabling cost savings and efficiency gains, facilitating the development of long-term relationships with key suppliers, and providing access to unique and valuable resources (Hunt & Davis, 2012).

Prior to implementing the RBV theory to supply chain management, businesses must identify their most important supply chain resources and capabilities. This might include having a procurement team that is knowledgeable and well-trained, having access to supplier networks and market intelligence, and having well-established procedures for contract management and negotiation (Huo, Han, & Prajogo, 2016; 2019 (Yang, Jia, and Xu). In addition, businesses must integrate their supply chain strategy with their overall business strategy, taking into account costs, quality, creativity, and long-term viability. Additionally, procurement teams must establish and maintain solid relationships with key suppliers in order to capitalize on their expertise and capabilities for their own advantage over competitors.

In addition, in order to maintain a competitive edge, businesses must cultivate a culture of continuous improvement within their procurement function by continuously evaluating and enhancing their supply chain practices. In conclusion, the resource-based view theory of procurement management emphasizes the significance of viewing the procurement function as a strategic asset that can help an organization gain an edge over its competitors. Organizations can use their supply chain to create value and achieve superior market performance by identifying key supply chain resources and capabilities, aligning supply chain strategy with overall business strategy, establishing strong supplier relationships, and fostering a culture of continuous improvement.

### Empirical Literature Review

In a 2018 study, Ahmad, Iteng, Saad, and Abd looked at how sustainable product development and organizational performance are related. This study employs the causal relationship method by randomly selecting 273 Malaysian automotive suppliers. The findings of the PLS SEM analysis show that the criteria for sustainable product development—economic, social, and environmental factors—have a significant positive impact on the automotive industry's organizational performance. The study, on the other hand, used random sampling, which may have resulted in sample bias.

The impact of green product innovation on business performance and competitive capability was investigated in a study by Ar (2020): the moderating effect of managerial concern for the environment. Structural Equation Modeling was used to analyze the information that was gathered from 140 Turkish manufacturers working in a variety of industries through a survey that used a questionnaire. Green product innovation significantly improves firm performance and competitive capability, according to statistical findings. On the other hand, the relationship between green product innovation and firm performance is only moderated by managerial environmental concerns. However, secondary data were used in the study.

Luan, Hau and Thu (2022) study looked at the impact of green item advancement execution to improve venture adequacy and development. More than a thousand people filled out a survey questionnaire to gather data for this study. Green creativity, green dynamic capabilities, the development of exceptional green product development performance is influenced by green transformational leadership, reactive green innovation, and proactive green innovation, according to this study. But innovation was a factor in performance evaluation.

### 3. RESEARCH METHODOLOGY

The descriptive research design was used in this study. All procurement managers from the selected ten manufacturing EPZ companies in Nairobi City County, Kenya, made up this study population, which served as the accessible and target sample. As a result, the sample for the study consisted of 112 procurement managers from all EPZ manufacturing companies. The respondents to this study were divided into groups based on their firm's specialization. The respondents from each stratum were selected using a simple method of random sampling. The sample size was 88 respondents. Primary data was gathered through the use of a semi-structured questionnaire. 11 respondents took part in the pilot study. The content validity test was used to guarantee the questionnaires' validity. Reliability of the questionnaires was tried utilizing the Cronbach's alpha test. Descriptive statistics like mean and standard deviation was used to analyze quantitative data. Inferential statistics such as regression analysis was used to test the relationship between variables and their influence on one another.

### 4. FINDINGS

The descriptive statistics results of green product design are presented in Table 1.

**Table 1: Descriptive Statistics of Green Product Design**

Statement	SA	A	N	D	SD	M	Std.Dev
	%	%	%	%	%		
Green product design reduces material costs, increasing market share	41.2	34.1	12.9	8.2	3.5	4.01	0.99
Material selection allows companies to access more global markets while also lowering compliance costs	35.3	49.4	4.7	4.7	5.9	4.04	0.96
Applying green product design allows businesses to focus on resource efficiencies, which reduces costs	38.8	55.3	3.5	2.4	0.0	4.31	0.69
Applying green product design frequently reduces production time, driving product and process innovation	36.5	49.4	11.8	2.4	0.0	4.20	0.80
A product's bottom line contributions to the company are positively impacted when it is designed for recovery, reuse, or recycling.	45.9	44.7	0.0	5.9	3.5	4.24	0.76
The designers of eco-friendly products who place an emphasis on recycling speed up	39.5	46.6	6.8	4.7	2.6	4.16	0.84

The results as presented in Table 4.4 show that the mean score of 4.31 indicates that the respondents agreed on the statement that applying green product design allows businesses to focus on resource efficiencies, which reduces costs with a standard deviation of 0.69. This statement was strongly agreed by 38.8% of the respondent, 55.3%, 3.5% neutral and 2.4% disagreed. According to Sahoo and Vijayvargy (2021), green supply chain management (GSCM) is essential for making sure that each of these factors is taken into account. Environmental effects happen all along a product's lifespan. As a result, GSCM has emerged as a significant new prime example for businesses looking to accomplish benefit and share of the pie goals by reducing their natural dangers and effects while increasing their environmental productivity.

The mean score of 4.24 indicates that the respondents agreed on the statement that a product's bottom line contributions to the company are positively impacted when it is designed for recovery, reuse, or recycling with standard deviation of 0.76. This was strongly agreed by 45.9% of the respondents, 44.7% agreed, 5.9% disagreed and 3.5% strongly disagreed. According to Zhu, Sarkis, & Lai (2008), practices in green supply chain management center on minimizing waste, conserving natural resources, minimizing emissions, and developing a sustainable business model.

The mean score of 4.20 indicates that the respondents agreed on the statement that applying green product design frequently reduces production time, driving product and process innovation with standard deviation of 0.80. This was strongly agreed by 36.5% of the respondents, 49.4% agreed, 11.8% neutral and 2.4% disagreed. This finding is supported by the study on search engine marketing impact on the internet marketing strategy that was studied by Hidayanto, Adha, Jiwanggi and Melia (2018) and found that the social media plug-in gives an extra advantage in terms of traffic generation; nevertheless, the traffic generated is less important than that generated by search engines.

### Results of Regression Analysis

**Table 2: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.886 <sup>a</sup>	.785	.780	.20319

The adjusted R<sup>2</sup> which is the coefficient of multiple determinations, is the percent of the variance in the dependent explained uniquely or jointly by the independent variables 0.780(78.0%) of the changes in the performance of manufacturing firms in export processing zones in Kenya variables could be attributed to the green product design. This means that other variables not studied contribute 0.22(22.0%) of the performance of manufacturing firms in export processing zones in Kenya.

**Table 3: Coefficients**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.731	.130		5.623	.000
	Green product design	.746	.249	.639	2.996	.000

The results in Table 3 show that when green product design is held constant performance of manufacturing firms in export processing zones in Kenya would be at 0.731. The results also show that, when green product design is increased by one unit the sustainable performance of manufacturing firms in export processing zones in Kenya would be increased by 74.6%.

The results in Table 3 indicated that the multiple linear regression model was given by;

$$Y = 0.731 + 0.746 (\text{green product design})$$

In addition, the results in Table 3, shows that green product design had a positive and significant relationship as indicated by t-values. The relationships ( $p < 0.05$ ) are all significant with green product design ( $t=2.996$ ,  $p < 0.05$ ).

## 5. CONCLUSIONS

The study concluded that green product design aims at reducing waste and maximizing resource efficiency. Developing green products opens the doors to an all-new market of green consumers who buy only green products and even pay more for the same. Since eco-friendly products are made from materials that are free from harmful chemicals and components, they not only improve physical but also mental health. Green products reduce the threat of overuse of resources and fossil fuels and encourages the generation of energy using natural resources.

## 6. RECOMMENDATIONS

The study recommended that when creating new products, both companies and product designers can advocate and design for the use of green materials. They can design products that minimize waste and energy consumption. The firms should their design process by taking a step back to reflect on the lifecycle of their product. Find the lifecycle phases with the biggest negative impacts and focus on improving those in your design process. The firms should find design solutions that will decrease the highest instances of energy expenditure and waste during their product's lifetime.

### REFERENCES

- [1] Ahmad, M. A., Iteng, R., Saad, R., & Abd Rahim, M. K. I. (2018). The criteria of sustainable product development and organizational performance. *International Journal of Supply Chain Management (IJSCM)*, 7(5), 497-501
- [2] Ar, I. M. (2020). The impact of green product innovation on firm performance and competitive capability: the moderating role of managerial environmental concern. *Procedia-Social and Behavioral Sciences*, 62, 854-864
- [3] Bag, S., Gupta, S., Kumar, S., & Sivarajah, U. (2021). Role of technological dimensions of green supply chain management practices on firm performance. *Journal of Enterprise Information Management*, 34(1), 1-27
- [4] Bendell, J., Miller, A., Weber, J., & Zhan, J. (2015). Enhancing the contribution of Export Processing Zones to Sustainable Development Goals: an analysis of 100 EPZs and a framework for sustainable economic zones
- [5] Chen, Z., Poncet, S., & Xiong, R. (2017). Inter-industry relatedness and industrial-policy efficiency: Evidence from China's export processing zones. *Journal of Comparative Economics*, 45(4), 809-826
- [6] Cherrafi, A., Garza-Reyes, J. A., Kumar, V., Mishra, N., Ghobadian, A., & Elfezazi, S. (2018). Lean, green practices and process innovation: A model for green supply chain performance. *International Journal of Production Economics*, 206, 79-92
- [7] Diab, S. M., Al-Bourini, F. A., & Abu-Rumman, A. H. (2015). The impact of green supply chain management practices on organizational performance: a study of Jordanian food industries. *J. Mgmt. & Sustainability*, 5(1), 149 – 156
- [8] Dörry, S., & Hesse, M. (2022). Zones and zoning: Linking the geographies of freeports with ArtTech and financial market making. *Geoforum*, 134, 165-172
- [9] Green, K. W., Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green supply chain management practices: impact on performance. *Supply chain management: an international journal*, 17(3), 290-305
- [10] Jauch, H. (2002). Export processing zones and the quest for sustainable development: a Southern African perspective. *Environment and urbanization*, 14(1), 101-113
- [11] Lee, S. M., Kim, S. T., & Choi, D. (2020). Green supply chain management and organizational performance. *Industrial Management & Data Systems*, 112(8), 1148-1180
- [12] Luan, N. T., Hau, D. N. D., & Thu, N. T. A. (2022). The Influence of Green Product Development Performance to Enhance Enterprise Effectiveness and Innovation. *Economies*, 10(5), 113 – 119
- [13] Majumder, S. C., Rahman, M. H., & Martial, A. A. A. (2022). The effects of foreign direct investment on export processing zones in Bangladesh using Generalized Method of Moments Approach. *Social Sciences & Humanities Open*, 6(1), 100277
- [14] Ogunlela, G. O. (2018). Green supply chain management as a competitive tool in the fast-moving consumer goods manufacturing industry. *Journal of Business and Retail Management Research*, 12(4), 4 – 9
- [15] Rondinelli, D. A. (1987). Export processing zones and economic development in Asia: A review and reassessment of a means of promoting growth and jobs. *American Journal of Economics and Sociology*, 46(1), 89-106
- [16] Sahoo, S., & Vijayvargy, L. (2021). Green supply chain management practices and its impact on organizational performance: evidence from Indian manufacturers. *Journal of Manufacturing Technology Management*, 32(4), 862-886.
- [17] Younis, H., Sundarakani, B., & Vel, P. (2021). The impact of implementing green supply chain management practices on corporate performance. *Competitiveness Review*, 2(1), 6 – 11
- [18] Zhu, W., & He, Y. (2017). Green product design in supply chains under competition. *European Journal of Operational Research*, 258(1), 165-180