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Circular Supplier Sourcing and Performance of Manufacturing Companies in Kenya

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Abstract

Purpose: This study evaluated the influence of circular supply supplier sourcing on the performance of manufacturing companies in Kenya. The research was guided by the specific objectives: to determine the effect of circular supplier sourcing on performance of manufacturing companies in Kenya and to assess the moderating effect of circular supply chain reconfiguration on the relationship between circular supplier sourcing and performance of manufacturing companies in Kenya. The theoretical framework was underpinned by Systems theory and Strategic choice theory.

Methodology: Employing a cross-sectional survey design, the study targeted 795 manufacturing companies in Kenya, excluding the service sector, as per the 2023 KAM directory. A sample of 266 companies was drawn using Slovin's formula and stratified sampling technique. Data was collected using questionnaires. Quantitative data was analyzed using both descriptive and inferential statistics and with the help of SPSS version 27. Regression analysis was used to show the relationship between the dependent variable and the independent variable and the study employed multiple linear regression analysis to test the hypotheses.

Findings: Key findings revealed that circular supplier sourcing had significant positive effects on company performance and supply chain reconfiguration demonstrated a significant moderating effect on the relationship between circular supplier sourcing and company performance. These findings contribute to understanding circular economy principles in the Kenyan manufacturing context and provide valuable insights for practitioners and policymakers in implementing circular supply chain management practices.

Unique Contribution to Theory, Policy and practice: Thus, the study recommends that manufacturing firms should put into consideration circular supplier sourcing practices to improve performance in market share, sales volume and return on investment levels. Future research directions include a longitudinal study to examine the long-term effects of circular supplier sourcing practices on manufacturing performance and a comparative study of circular supplier sourcing practices across different industries in Kenya to identify sector-specific challenges and opportunities.

Keywords: *Circular Supply Chain, Manufacturing, Kenya*

1.1. Background of Study

Sourcing decisions typically concern internal buying processes that relate primarily to relations with direct suppliers (Miemczyk et al., 2012). These relations also termed as buying, purchasing or procurement have in the recent years shifted focus from purchasing as a transactional action to a more strategic one, especially regarding sustainable and circular sourcing that considers social and environmental factors (Giunipero et al., 2019). Sustainable sourcing in the circular economy context, i.e. circular sourcing, is more narrowly defined; while striving for environmentally friendly material, it aims to create new loops of material use across supply chains to minimize waste, for instance by recycling or by purchasing recycled materials (Qazi and Appolloni, 2022). Transition to a circular economy by firms in an industry is majorly influenced by individual firm's circular sourcing strategies as circularity is linked both within individual firms and across industries (Gothár & Schanz, 2024).

Emphasis is put on the manufacturing industry as the sector is regarded as the backbone of the world's social and economic development (Byrne et al., 2020). The manufacturing industry focuses on one business, creating products from raw materials, semi-finished products, and finished products (KNID, 2017). Manufacturing companies usually operate in highly competitive environments as they are at times subjected to global competition in terms of new products, production technologies, new materials, and legislative or organizational or business model developments (Mamasioulas et al., 2020). The most successful companies in the sector are expected to expand their market share and pioneer in innovation as the global consumption for manufacturing goods annually rises (Cobano-Conde, 2018).

According to (WEForum, 2019) China is the world's largest manufacturing economy driven with its ability to deliver low-cost labor and materials, favorable policies and infrastructure, a large consumer base, established supplier network, manufacturing capabilities from low-cost goods to more advanced products. The U.S manufacturing sector also represents over 18.2% of the world's total goods every year with it being one of the greatest contributors to the U.S' employment GDP and overall economic development (Cobano-Conde, 2018). Given the large contributions to the economy for these superpower countries, it is interesting to note the level of combined contributions of manufacturing companies in the entire global economy which has significant effect in the world. Their processes and performance ought to be at the optimum (Simiyu & Maina, 2018).

When applied as an industrialization strategy, the circular supply chain management has the potential to decouple resource use from economic development to help address key African challenges like climate change, food security, water scarcity and natural resource management, which all affect management in our industries. Circularity can also promote greater resilience to exogenous shocks through the creation of regional value chains for self-sufficiency hence it is particularly relevant to tackle pandemic-induced economic fragility (WEForum, 2021).

According to (Laurin & Fantazy, 2017) in the process of balancing cost reduction with social responsibilities, there are many events involving environmental degradation, global warming

and corporate pressures that lead to adoption of circular initiatives. These activities are currently stressing organizations to incorporate and implement circular practices into their manufacturing operations and seek effective strategies to measure the performance of their sustainability efforts while still meeting their performance goals (Laurin & Fantazy, 2017). This paper aims to define a set of aspects that are currently being used by manufacturers in circular supplier sourcing practices and how they assist in meeting their performance goals.

1.2. Statement of the Problem

According to the (Circle Economy, 2021) about 100 billion tons of raw materials enter the production channel per year but only 8.6% of all these are recycled implying that demand for raw materials will outstrip its supply thus affecting manufacturing performance. Furthermore, the increasing commodity prices and resource scarcity poses a great threat to global supply chains, whose impact is felt significantly on the GDP of developing economies (UNEP, 2019). In the local context and specifically in Kenya, policies have been created by the Vision 2030 Manufacturing Sector agenda to ensure that the manufacturing and industry space is developing to generate employment and positively contribute to GDP using assets present in Kenya (Were, 2016). Despite all this the performance of manufacturing companies in the Kenyan context has not been growing as expected (Were, 2016).

Manufacturing plays a pivotal role in Kenya's economic development due to its significant contribution to industrial output, employment and export growth. Manufacturing GDP contribution can give indications whether a country is making strides in industrialization. Notwithstanding, the sector's performance over the last 10 years has faced significant challenges, which has seen its contribution to GDP drop significantly from 11.08% recorded in 2011 to 7.8% in 2022. Kenya hopes to reverse this trend through the Manufacturing 20BY30 Vision that seeks to increase the sector's contribution to GDP to 20% by 2030. However, it is good to note that in the recent years the world real GDP growth has slowed down to 2.4% in 2024 from 2.6% in 2023, 3.0% in 2022 and a high of 6.2% in 2021 while the Kenyan real GDP has experienced volatility with a high of 7.8% in 2021, dropping to 4.8% in 2022, staggering to 5.1% in 2023 and 5.3% in 2024 as per (KAM, 2024) and (KNBS, 2024). All this is affected by various circumstances such as Kenyan institutions struggling with SCM issues where malpractices cases have been reported because of existing supply chain operations not being based on sustainable goals according to World Bank (2017). It is also notable that in the Kenyan context more focus has been on green sustainable practices and their effects on manufacturing performance and the few studies on circular economy approach are based only on waste management for instance (Abong et al., 2021) studies on green consumerism in Kenya and (Musau, 2021) who studied the effects of green manufacturing in Kenya. The impact of circular supplier sourcing practices on performance of manufacturing companies are yet to be fully explored in the Kenyan perspective hence this study.

The lack of well-established circular supplier sourcing practices and the inefficiencies in supply chain coordination adversely affects the overall performance of manufacturing

companies hence hindering the companies' ability to meet sustainability goals, optimize costs and remain competitive in a global market that increasingly demands sustainable practices. There is hence a need to understand how circular supplier sourcing practice can be integrated into the supply chain and its impact on the overall performance of manufacturing companies in Kenya (Giudice et al., 2021). Apart from the sparse information, it is not adequate to only consider the technical and engineering performance of manufacturing systems as per the current available information. This study hence entails measuring the ability of manufacturing companies in Kenya to satisfy their present performance needs through circular supplier sourcing practices of restoration and regeneration by onboarding reliable suppliers with circular and sustainable contracts with an emphasis on adoption of current circular innovations in their company operations and additionally, identifying the variables that have the highest influence or role (Geissdoerfer et al., 2017).

1.3. Specific Objectives

i. To determine the effect of circular supplier sourcing on performance of manufacturing companies in Kenya.
ii. To assess the moderating effect of circular supply chain reconfiguration on the relationship between circular supplier sourcing and performance of manufacturing companies in Kenya.

1.4. Study Hypothesis

H01: Circular supplier sourcing has no significant effect on the performance of manufacturing companies in Kenya.

H02: Circular supply chain reconfiguration has no significant moderating effect on the relationship between circular supplier sourcing and performance of manufacturing companies in Kenya.

2.1. Theoretical Review

2.1.1. The Systems Theory

A systems theory is a theoretical perspective that analyses a phenomenon seen as a whole. It is an interdisciplinary study of systems as they relate to one another within a larger, more complex system. Basically, the whole is greater than the sum of its parts (Hedayat & Lapraz, 2019). The focus is on the systems, subsystems, interrelatedness, interconnectivity and on the relationships between parts in order to understand an entity's organization, functioning and outcomes and eventually developing an appropriate design for the same.

Systems can be found in nature, in science, in society, in an economic context, and within information systems. System theory can also be related to the effects of external systems on the decisions and behaviour of an organization; where external systems include regulations, the law, professional standards, interest organizations and social belief. The ultimate success of a supply chain depends upon various factors among which are customer's expectations,

globalization, information technology, government regulations, competition, and the environment (Singh et al., 2015).

Circular supplier sourcing is well elaborated through systems theory as a worldview of holism. It involves shared attributes with suppliers concerning circular practices of everything and methodology of holistic thinking with the aim of developing a circular supply chain system having common goals and values. Creative co-operation of the different suppliers in a supply chain from mutually different professions with similar goals and values enables creating means of sustainable products and features sustaining their systems and operations. It involves a transition from reductionism to perspectivism allowing for many perspectives in the supply chain to co-exist. This is enabled through education of the different operations processes of the partners in the supply chain and the development of interdisciplinary principles which when applied through circular supplier sourcing, will contribute to efficient overall organisational performance (Ngoto, 2016).

2.1.2. Strategic Choice Theory

Strategic choice is a systemic theory of strategy. According to (Zhu, 2012) the theory is built on an interaction mode where organisations adapt to their environment in a conducive manner that will enable achievement of their goals. It was developed by John Child (1972) and continues to provide a significant influence on the study of organisations and management (Harney, 2016). The variance of environmental conditions, whether the environment was dynamic or static, and organisational contingencies were seen to automatically produce a specific type of organisational response. This contingency approach served the objective of offering insights into what management should do (Harney, 2016). Strategic choice brings about managerial agency and decision making more directly into the equation. For (Child, 1972), strategic choice was defined as the process whereby power holders in an organisation decide upon courses of strategic action. Managerial discretion is important in making strategic choices and it ought to be informed by underlying values and beliefs (Harney, 2016).

Strategic choice being a systematic theory of strategy in this study is built on a notion of interaction between partners in a supply chain which enhances organisations adapt to their environment in a self- regulating manner to achieve their goals and the dynamics over time become stable hence bring about circular economy aspects in the social, economic and environmental aspects of the supply chain partners. The strategic choice decisions determine the future strategy of the firm, hence the strengths, weaknesses, threats and opportunities that can be exploited. This in turn determines the performance of the entity. It is therefore a paramount theory in consideration of circular reconfiguration practices which will affect the performance of any organisation while taking into consideration return on investment This is because the Strategic Choice Theory details the importance of taking the right action in a contradicting situation so as to achieve efficiency as a result of the choices picked.

2.2. Conceptual Framework

A conceptual framework is a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation. Mugenda and Mugenda (2016) define a conceptual framework as hypothesized model identifying the model under study and the relationship between study variables variables. Figure 1 presents the hypothesized relationship between the independent variables, the moderating variable and the dependent variable for testing in this study:

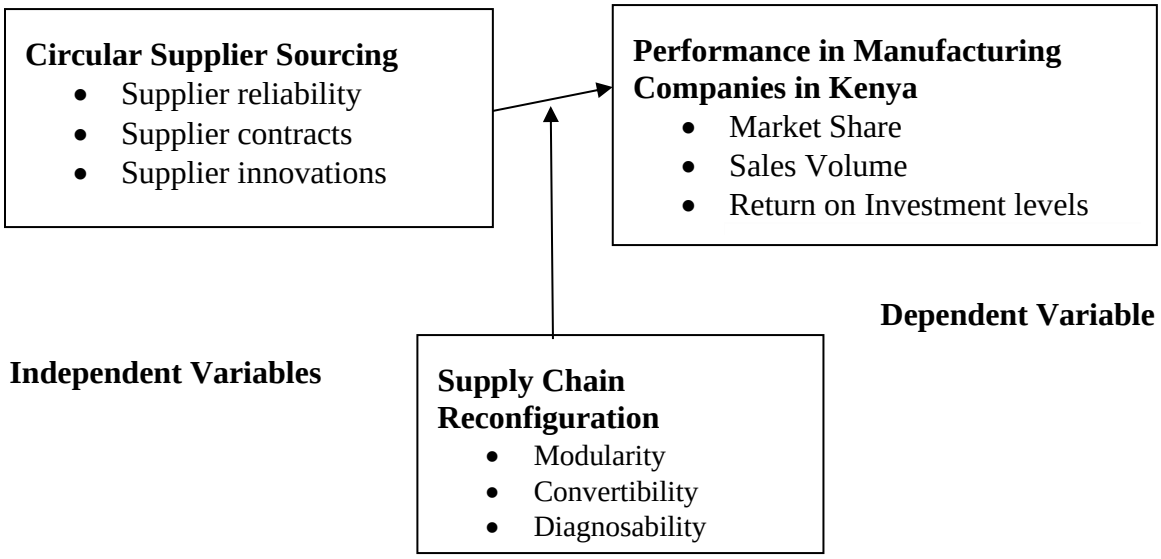

Figure 1: Conceptual Framework

2.2.1. Circular Supplier Sourcing

Circular supplier sourcing or circular procurement is when people or organizations buy products and services that involves sourcing sustainable circular products, materials and services thus strengthening the foundations upon which circular supply chains are built and minimizing environmental impacts over their life cycle of manufacturing, transportation, use and recycling or disposal. It refers to the procurement of products and services that have a reduced effect on human health and the environment when compared with competing products or services that serve the same purpose (Cruz, 2019). Research in this area has consistently shown that professional purchasers who adopt criteria which is environmentally preferable can reduce or even eliminate waste and environmental impacts as well as reduce costs.

According to University of Louisville, (2018), environmental performance is improved while addressing ethics, social regeneration, and economic concerns. Circular supplier sourcing can enable an organization to offset financial and environmental risk rather than inheriting it from their suppliers. It encourages an organisation to involve the suppliers at the design stage or develop a network to prequalify suppliers that have responsible environmental management. It can also bring important benefits for its practitioners: risk management, eco-efficiency,

stronger supplier relationships and improvements in environmental performance, according to University of Louisville (2018).

Additionally, rapid developments in technology, globalisation and competition have heightened the interest and opportunities for inter-organisational relationships as firms seek productive efficiencies in sourcing, production, distribution, retail and other supply chain functions. These, together with changing consumer demand, give rise to uncertainties in firms when maintaining inter-organisational relationships between all the stakeholders in the organisational environment (Soosay & Hyland, 2015).

To grasp the sustainability impacts of your supply chain it is important for a business to have a detailed analysis of the product journey starting with inviting Tier 1 suppliers to join the process and who in turn will pass the invite to Tier 2s and so on right down through the tiers. Thereafter it is important to evaluate their supplier contracts and environmental requirements in the supply chain and whether they meet the sustainability thresholds. The circular innovation methods used by the suppliers are also analysed and linked to each other in the chain. The key to success is to ensure that each person can link what they sell to whom and the details of what they buy link to the next party in the supply chain (Agyabeng-Mensah et al., 2020).

2.2.2. Supply Chain Reconfiguration

Reconfigurability is used to measure quantitatively the capability of supply chain to easily change their structure and functions. Given the COVID 19 pandemic, fluctuating demand, market uncertainty and the emergence of new technologies, a more flexible and agile supply chain in response to the market trends is needed. Ensuring supply chain flexibility, agility, resilience, and viability requires the development of a reconfigurable supply chain that can cope with various market changes in the supply chain levels with the minimum resources time and cost (Zidi et al., 2022).

To stay responsive to evolving customer demands and to meet the need for greater product customizations, there is need for organizations to quickly reconfigure their manufacturing systems and supply chain. Supply chain reconfiguration is hence applied as a moderating variable as reconfiguration can alter the association between the independent and dependent variables by either strengthening or diminishing the association according to operational circumstances of the organization (Tian & Guo, 2019).

Modularity based manufacturing practices are the application of unit standardisation or substitution principles to create modular components and processes that can be configured into a wide range of end products to meet specific customer needs (Tu et al., 2004). These practices enable firms to achieve modularity in product design, production process design and organizational design which can be achieved when their components can be disaggregated and recombined into new configurations with little loss of functionality. Dividing a complex system into smaller modules and examining each piece separately can ease management in a business and increase benefits such as economies of scale, increased feasibility of

product/components change, increased product variety and reduced lead time, ease of product upgrade, maintenance, repair and disposal among others thus implementing a reconfigurable manufacturing system (Omai et al., 2018).

To support these processes, convertibility is incorporated which involves having flexible and changeable dynamics in the manufacturing process which can easily be applied at the equipment, production system and assembly levels to dynamically and efficiently change the capabilities of the system, resources, and new configurations to adopt to the rapidly changing manufacturing environment hence increase and maintain efficient performance in the companies (Zidi et al., 2022). To detect and correct failures quickly, the reconfigurable supply chain system must have a high degree of diagnosability which can be measured through parameters like detectability, predictability, and distinguishability. Detectability determines the time before detecting the failure, predictability which measures the time before the failure re-occurrence and distinguishability which measures the time necessary to identify the replaceable unit of a system that causes a failure. Bottom line, supply chain reconfiguration aspect of diagnosability is measured by considering two quantitative factors: supply chain visibility and detection time (Zidi et al., 2022).

2.2.3. The Concept of Performance

Performance is defined as the operational excellence to deliver leading customer experience (Trong, 2016). According to (Byrne et al., 2020) performance is to be interpreted in relation to technical efficiencies and capabilities, agility, resilience and robustness of manufacturing companies. For a long time in history, the goals of organizations' existence was making of profits or return on investments but during the more recent years marketplace characteristics have changed as customers are demanding goods and services at a more quicker delivery, higher quality, better price and greater service excellence (Nia et al., 2016) which also leads to increased awareness of the ecological dimension and the social dimensions such as people's fear of losing their jobs due to emerging technologies (Birkel & Müllerb, 2021).

Also, apart from economic performance, other stakeholders such as policy makers and non-governmental organizations (NGO)s are also showing interest in the social and environmental performance of companies (Schoggl et al., 2016). To thus achieve synergies in performance, the three interdependent dimensions of triple bottom line (TBL) concept are considered. They include economic, environmental and social aspects of performance (Birkel & Müllerb, 2021).

Sustainable performance of an organization refers to its ability to meet the needs and expectations of customers and other stakeholders on long-term, balanced by an effective management organization by organizing staff awareness by learning and applying appropriate improvements and innovation which in turn leads to an increase in market share and return on investments of the companies as a consequence of the social and economic aspects and effects of an organization (Stanciu, Constandache, & Condrea, 2014).

RESEARCH METHODOLOGY

3.1. Research Design

The study applied a cross-sectional research design in analysis. The design was applied as it enabled the researcher to generalize the findings to a larger population and focus on the relationship between independent variables and the dependent variables. The research design helped to describe the existing scenario in the circular supplier sourcing practices and performance of manufacturing companies and expounded on the relationship between the variables Shikokoti, Okoth & Abungana, (2024).

3.2. Target Population and sample size of the Study

In this study, the target population was manufacturing companies in Kenya. This was to reach the entire Kenyan manufacturing segment to provide up to date information on circular supply chain operations as a country because different regions and sectors contain different information which will be important to capture thus making the results more conclusive in comparison to focus on one region and sector. The 2023 KAM directory has a listing of members by sectors, which contains a register of 14 sectors of those in manufacturing firms spread all over Kenya. The directory categorizes members per sector, which is defined by the services they produce, the type of raw materials they import or the products they manufacture. The population of all the registered members for the 14 sectors, as per the directory, was 1,048. The two service sectors of fresh produce and service and consultancy were eliminated to remain with the 12 manufacturing sectors because their focus is on the provision of services and not the actual manufacture of goods and products.

The 12 manufacturing sectors have a total population of 795 companies, which comprise the unit of analysis while the unit of observation was the organizational management officers conversant with the supply chain process and their assistants. Additionally, the sample size derived from the target population using the Slovin formula for this study was 266 respondents and is shown in Table 1 below:

Table 1: Classification of the Sample Size

Types of Sectors	Manufacturing Companies in the sector	Sample size
Building, Mining & Construction	49	16
Chemical & Allied	81	29
Energy, Electrical & Electronics	50	17
Food & Beverages	193	64
Leather & Footwear	17	6
Metal & Allied	87	29
Automotive	56	18
Paper & Board	58	19
Pharmaceutical & Medical Equipment	29	10
Plastics & Rubber	83	27
Textiles & Apparel	62	21
Timber, Wood & Furniture	30	10
Total	**795**	**266**

Note. This table was created by the author of this article.

The stratified sampling method was used to put the population into distinct, independent strata that enable the researcher to draw inferences about specific subgroups that may be lost in a more generalized random sample, thus leading to more efficient statistical estimates (Creswell & Guetterman, 2018).

3.3. Data Collection Instrument

Data collection is how information is obtained from the selected subject of an investigation (Mugenda & Mugenda, 2016). The researcher collected primary data during the research. Primary data was collected using a questionnaire covering circular supplier sourcing practices and the performance of manufacturing companies in Kenya. The questionnaire contained closed-ended questions that limited the respondents to variables in which the researcher was interested.

3.4. Data Analysis

The objectives of the study were analyzed using descriptive statistics techniques and multiple regression models were fitted to the data to determine how the predictor/independent variables affect the response/dependent variable. The equation for circular supplier sourcing and the performance of manufacturing companies in Kenya is expressed in the following equation:

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \varepsilon}$$

This study used multiple regressions analysis (hierarchical moderated method) to establish the moderating effect of Supply Chain Reconfiguration (Z) on the relationship between circular supplier sourcing and performance of manufacturing companies in Kenya. The regression model for the moderating effect was as follows.

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 (X_1 Z) + e}$$

Where:

Y = Performance of manufacturing companies

β_0= Intercept coefficient or value of dependent variable when the independent variable is zero

β_1= Coefficient for circular supplier sourcing

X_1 = Circular supplier sourcing

β_2= Coefficients for interaction terms between supply chain reconfiguration and circular supplier sourcing

Z = Circular supply chain reconfiguration

e = Error term

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

4.1. Results and discussion

Out of the 266 questionnaires administered among the respondents, 221 questionnaires were returned filled, representing a response rate of 83.1%.

4.2. Descriptive Statistics Analysis

In this section, the study presents the finding on the specific objectives of the study. On the likert scale questions, the scale was 5 with 1 Strongly Disagree, 2 Disagree, 3 Moderate, 4 Agree and 5 Strongly agree. Means and standard deviations were used to interpret the results with a mean of 0-1.4 implied that the respondents strongly disagreed, a mean of 1.4-2.4 implied they disagreed, 2.5-3.4 suggest that they were neutral, a mean of 3.5-4.4 suggest they agreed, and a mean of 4.5-5 implies the respondents strongly agreed (Trochim, 2016).

4.2.1. Circular Supplier Sourcing

The 12-item scale assessed circular souring practices across several areas, including organisational policies and standards, supplier selection, adherence to existing regulations, and circular metrics. The overall mean response score was 4.27, with a standard deviation of 0.591. This score falls within the interval range, indicating that respondents agreed that circular supplier sourcing has an impact on the performance of manufacturing companies in Kenya. The results were as shown in Table 2 below:

Table 2: Circular Supplier Sourcing

Circular Supplier Sourcing	1	2	3	4	5	N	Mean	Std D
Our organisation has a circular sourcing policy in place	0	6	0	154	60	220	4.22	0.579
Our suppliers are selected based on compliance to circular standards and practices	0	10	8	129	74	221	4.21	0.715
Our suppliers are reliable in terms of quality	0	3	1	135	82	221	4.34	0.562
Our organisation shares feedback with our suppliers on areas of improvement	0	0	5	120	96	221	4.41	0.537
There is an evaluation and selection process for suppliers	0	0	2	129	89	220	4.40	0.508
Our suppliers have circular values and metrics	1	12	12	163	32	220	3.97	0.678
Our suppliers have environmental certifications	0	0	7	130	84	221	4.35	0.540
Our suppliers adhere tour contracts	0	1	3	121	96	221	4.41	0.546
Our suppliers have total product knowledge, functional systems, research and development of circular practices	6	2	17	158	37	220	3.99	0.728
Our Suppliers have internal competence in product and process development	1	0	3	150	67	221	4.28	0.532
Our suppliers adopt technology that reduces energy consumption	1	1	6	120	92	220	4.37	0.609
Our suppliers use environmentally friendly processes	0	1	9	138	73	221	4.28	0.558
Circular Supplier Sourcing							**4.27**	**0.591**

Key: 1 = strongly disagree, 2 = disagree, 3 = Neither agree nor disagree, 4 = agree, 5 = strongly agree

Note. This table was created by the author of this article.

4.2.2. Supply Chain Reconfiguration

The second specific objective of the study was to assess the moderating effect of circular supply chain reconfiguration on the relationship between circular supplier sourcing and performance of manufacturing companies in Kenya. The supply chain reconfiguration construct measured SC flexibility or the degree to which manufacturing companies can easily modify their SC structure to meet changing needs (Zidi et al., 2022). A 12-item scale was used for this construct. Areas of focus included modular design, circular inputs and sub-products, circular and efficient conversion, and emergency response. The responses to the SCR items are in Table 4.3.

Table 3: Supply Chain Reconfiguration Variables

Supply Chain Reconfiguration	1	2	3	4	5	N	Mn	S D
Our organisation uses the modular design of creating an item out of smaller, interchangeable parts or modules.	1	34	8	150	28	221	3.77	0.877
Our sub products and input in production leads to specialization	0	31	9	149	32	221	3.82	0.848
Circular sub-products and input in production enhances operations	1	29	13	151	26	220	3.78	0.837
Circular sub-products and input are easy to source	0	69	20	111	21	221	3.38	1.027
Our organisation manages conversion of circular material i.e., biodegradable material without use of toxic chemicals, to finished products	1	44	9	130	37	221	3.71	0.984
Our organisation has invested in machinery and systems that are used in conversion of input to finish products	1	23	11	137	49	221	3.95	0.854
Our organisation employs professionals who are knowledgeable of the company's production process	1	26	5	124	65	221	4.02	0.912
The conversion of raw material to finished goods in our organisation is effective	1	25	7	141	47	221	3.94	0.859
Our organisation has a laid down structure for adoption in operation	0	26	6	130	59	221	4.00	0.876
Our organisation can quickly diagnose issues within its supply chain	1	25	7	128	60	221	4.00	0.894
There are monitoring teams tasked with ensuring smooth operation of the company	0	26	6	128	61	221	4.01	0.882
Our organisation is quick in responding to emergency situations	1	24	6	133	57	221	4.00	0.874
Supply Chain Reconfiguration							**3.87**	**0.894**

Key: 1= strongly disagree, 2= disagree, 3 = neither agree nor disagree, 4= agree, 5= strongly agree

Note. This table was created by the author of this article.

4.2.3. Manufacturing Performance

The study assessed participants' views of the performances of their organizations using a 12-item instrument. The questionnaire covered various performance aspects, including customer relations, product/service delivery/quality, technology integration, and financial performance. The questionnaire prompted participants to indicate their agreement with each item. Their responses are shown in Table 4. All the 12 items were assessed using positively worded statements. Mean scores were then computed for the items following the procedure outlined previously. The overall mean in the 12 items was 3.82 (SD = 0.911), an equivalent of 76.3%. In other words, on average, participants assigned a rating of 76.3% (high) to their organizations' manufacturing performance.

Table 4: Manufacturing Performance Variable

Manufacturing Performance	1	2	3	4	5	N	Mn	Std D
Our business has improved because of the trust with customers and suppliers	0	26	7	130	58	221	4.00	0.876
Our organization delivers services to its customers at a reduced cost	1	35	8	141	36	221	3.80	0.914
The integration of technology, people, business, and processes has enhanced our organization's competitive edge in the current digital age	1	21	7	147	45	221	3.97	0.811
Our organisation can provide better products to our customers	1	25	6	146	43	221	3.93	0.844
Our organisation has an Enterprise Resource management system that tracks sales volumes and stock turnover levels which enable the company to reorder with greater accuracy.	1	25	6	149	40	221	3.91	0.835
Our sales and inventory turnover levels are reported and forecasted effectively.	1	2	10	142	40	219	3.89	0.857
Our management of inventory turnover levels helps in managing production schedules	1	24	6	126	64	221	4.03	0.891
Proper management of inventory turnover levels promotes relationships	1	24	7	151	38	221	3.91	0.821
Our company has significant financial reserve to cover all potential needs	3	32	18	140	28	221	3.71	0.912
Our company's profits have increased for the last 3 years.	3	37	17	137	27	221	3.67	0.941
Our overhead costs have reduced for the last 3 years	4	73	14	107	23	221	3.33	1.097
Our company's procurement costs have reduced for the last 3 years	0	39	20	143	19	221	3.64	0.871
Manufacturing Performance							**3.82**	**0.885**

Key: 1= strongly disagree, 2= disagree, 3 = neither agree nor disagree, 4= agree, 5= strongly agree

Note. This table was created by the author of this article.

4.3. Hypothesis testing

4.3.1. Test for Hypothesis One

The first objective of the study was to determine the effect of circular supplier sourcing on performance of manufacturing companies in Kenya. The corresponding hypothesis was:

Ho_1: Circular supplier sourcing has no significant effect on the performance of manufacturing companies in Kenya.

A univariate analysis was therefore conducted to test the null hypothesis. From the model summary findings in Table 5, the r-squared for the relationship between circular supplier sourcing and performance of manufacturing companies in Kenya was 0.437; this is an indication that at 95% confidence interval, 43.7% variation in performance of manufacturing companies in Kenya can be attributed to changes in circular supplier sourcing. However, the remaining 56.3% variation in supply chain performance suggests that there are other factors other than circular supplier sourcing that explain performance of manufacturing companies in Kenya.

Table 5: Model Summary for Circular Supplier Sourcing

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.661[a]	.437	.434	.65924

a. Predictors: (Constant), Circular supplier sourcing

b. Dependent Variable: Performance of manufacturing companies

The ANOVA results for this hypothesis displayed in table 7 showed that the model was statistically significant ($F = 169.855$, $p < 0.001$). This indicates that circular supplier sourcing significantly influences the performance of manufacturing companies in Kenya. The significant F-statistic confirms that the predictor variable, circular supplier sourcing, contributes meaningfully to the model, explaining a portion of the variance in performance. Since the F value is large at 169.855, it indicates that the model explains a significant portion of the variation in the performance of manufacturing companies in Kenya. These findings suggested that as manufacturing companies in Kenya increased their focus on circular supplier sourcing, their overall performance tended to improve. Additionally, the null hypothesis was rejected and the alternative hypothesis was upheld as the p value was below the significant value of 0.05 at 0.000, meaning that means that there is enough evidence to conclude that Circular supplier sourcing does have a significant impact on performance.

Table 6: ANOVA for Circular Supplier Sourcing

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	73.818	1	73.818	169.855	.000[b]
	Residual	95.177	219	.435		
	Total	168.995	220			

a. Dependent Variable: Performance of manufacturing companies

b. Predictors: (Constant), Circular supplier sourcing

From the results in table 7, the following regression model was fitted.

Y(Performance of manufacturing companies)=1.506+0.66X1(Circular supplier sourcing)+*e*

The coefficient results showed that the constant had a coefficient of 1.506 suggesting that if circular supplier sourcing was held constant at zero, performance of manufacturing companies in Kenya would be at 1.505 units. In addition, results showed that circular supplier sourcing coefficient was 0.66 indicating that a unit increase in circular supplier sourcing would result in a 0.660 increase in supply chain performance. It was also noted that the P-value for circular supplier sourcing coefficient was 0.000 which is less than the set 0.05 significance level indicating that circular supplier sourcing was significant. Based on these results, the study rejected the null hypothesis and accepted the alternative that Circular supplier sourcing has a significant effect on the performance of manufacturing companies in Kenya

Table 7: Beta Coefficients for Circular Supplier Sourcing

		Unstandardized Coefficients		Standardized Coefficients		
Model		**B**	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	1.506	.196		7.680	.000
	Circular supplier sourcing	.660	.051	.661	13.033	.000

a. Dependent Variable: Performance of manufacturing companies

4.3.2.2. Test for Hypothesis Two

The second objective of the study was to assess the moderating effect of circular supply chain reconfiguration on the relationship between circular supplier sourcing and performance of manufacturing companies in Kenya. Moderation happens when the relationship between the

dependent variable and the independent variables is dependent on a third variable (moderating variable). The effect that this variable has is termed as interaction as it affects the direction or strength of the relationship between the dependent and independent variable. To achieve this research objective, the study computed moderating effect regression analysis. Supply chain reconfiguration was introduced as the moderating variable.

Ho_5: Circular supply chain reconfiguration has no significant moderating effect on the relationship between circular supplier sourcing and performance of manufacturing companies in Kenya.

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 (X_1 Z) + e}$$

Where:

Y = Performance of manufacturing companies

β_0= Intercept coefficient or value of dependent variable when the independent variable is zero

β_1= Coefficient for circular supplier sourcing

X_1 = Circular supplier sourcing

β_2= Coefficients for interaction terms between supply chain reconfiguration and circular supplier sourcing

Z = Circular supply chain reconfiguration

e = Error term

Table 8 Model summary between circular supply sourcing and Manufacturing performance with the moderating variable of supply chain reconfiguration

					Change Statistics				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**R Square Change**	**F Change**	**df1**	**df2**	**Sig. F Change**
1	.661[a]	.437	.434	.65924	.437	169.855	1	219	.000
2	.684[b]	.468	.463	.64242	.031	12.618	1	218	.000

a. Predictors: (Constant), Circular supplier sourcing

b. Predictors: (Constant), Circular supplier sourcing, Supply chain reconfiguration

Table 8 shows the model summary which has a positive relationship; R= 0.437, between the circular supply sourcing and Manufacturing performance. The combined linear effects of the variables explained 43.7 percent variance in the management. This implied that management

was lowly predictable by the determinant. Additionally, there is the model summary 2 which has a positive relationship; R= 0.031, between the circular supply sourcing and Manufacturing performance with the moderating variable of supply reconfiguration. The combined linear effects of the variables explained 3.1 percent variance in the manufacturing performance. This implied that manufacturing performance was lowly predictable by the determinant with effect from supply chain reconfiguration.

Table 9 Anova table between circular supply sourcing and Manufacturing performance with the moderating variable of supply chain reconfiguration

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	73.818	1	73.818	169.855	.000[b]
	Residual	95.177	219	.435		
	Total	168.995	220			
2	Regression	79.026	2	39.513	95.742	.000[c]
	Residual	89.969	218	.413		
	Total	168.995	220			

a. Dependent Variable: Manufacturing Performance

b. Predictors: (Constant), Circular Supply Sourcing

c. Predictors: (Constant), Circular Supply Sourcing, Supply Chain Reconfiguration

Table 9 shows the test of significance of the model using ANOVA between Circular supplier sourcing and Manufacturing performance. There are a total of 220(N-1) degrees of freedom. With 1 predictor variable, the regression effect has 1 degrees of freedom. The regression effect was statistically significant; F (1,219) =169.855, p=.000). The test of significance of the model using ANOVA between Circular Supply Sourcing and Manufacturing performance with the moderating variable of Supply Chain Reconfiguration. There are a total of 220(N-1) degrees of freedom. With 2 predictor variables, the regression effect has 2 degrees of freedom. The regression effect was statistically significant; F (2,218) =95.742, p=.000).

Table 10: Regression Analysis between circular supplier sourcing and Manufacturing performance with the moderating variable of supply chain reconfiguration

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	1.506	.196		7.680	.000
	Circular Supplier Sourcing	.660	.051	.661	13.033	.000
2	(Constant)	1.751	.203		8.620	.000
	Circular Supplier Sourcing,	.716	.052	.717	13.822	.000
	Supply Chain reconfiguration	.142	.040	.184	3.552	.000

a. Dependent Variable: Manufacturing Performance

Table 11 shows that out of the 1 predictor that displayed significant relationships, Circular supplier sourcing (β=.660, p<.05) had a higher influence on the criterion variable. This implies that a change in one unit (going up) of a predictor, Manufacturing performance, is predicted to go up by the standardized β-value shown in Table 10. For instance, if Circular Supplier Sourcing, which had a higher influence, goes up by 1-unit Manufacturing performance goes up by .660. Further, by substituting the beta values as well as the constant term from the coefficient's findings for the first step regression modelling, the following regression model will be fitted:

$Y = 1.506 + 0.660\ \mathbf{X_1}$

Where $\mathbf{X_1}$ is Circular Supplier Sourcing

The second model in Table 10 shows that out of the 1 predictor that displayed significant relationships, Circular Supply Sourcing (β=.716, p<.05) had a higher influence on the criterion variable with Supply Chain reconfiguration (β=.142, p<.05) having a positive influence on the criterion variable as a moderating variable. This implies that a change in one unit (going up) of a moderating variable, the predictor goes up, Manufacturing performance is predicted to go up by the standardized β-value shown in Table 4.8. For instance, if supply chain configuration

influences positively the Circular Supply Sourcing goes up by one unit influencing Manufacturing performance by going up by .716.

By substituting the beta values as well as the constant term from model 2 emanating from the second step in regression modeling the following regression model was fitted:

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 (X_1 Z) + e}$$

$$\mathbf{Y = 1.751 + 0.716\ X_1 + 1.42(X_1 Z)}$$

Where:

Y = Performance of manufacturing companies

β_0= Intercept coefficient or value of dependent variable when the independent variable is zero

β_1= Coefficient for circular supplier sourcing

X_1 = Circular supplier sourcing

β_2= Coefficients for interaction terms between supply chain reconfiguration and circular supplier sourcing

Z = Circular supply chain reconfiguration

e = Error term

FINDINGS AND RECOMMENDATIONS

5.1. Findings

The study sought to establish the effect of circular supplier sourcing on the performance of manufacturing companies in Kenya. The study found a strong positive relationship between circular supplier sourcing and performance of manufacturing companies in Kenya. Further, the relationship between circular supplier sourcing and the performance of manufacturing companies was found to be significant. This suggests that their overall performance improved as companies increased their focus on circular supplier sourcing. The study revealed that moderate companies have a sourcing policy in place and that their supplier selection is based on compliance with their standards and policies. The suppliers selected are reliable in terms of conforming to the quality of materials and products required and any feedback on areas of improvement is usually shared with the suppliers and when necessary, they educate them on the requirements needed. Additionally, moderate suppliers have circular model values and metrics together with environmental certifications, but most of the suppliers adhere to the contracts with the companies involved.

5.2. Conclusion

The study concludes that circular supplier sourcing has a positive and significant effect on performance of manufacturing companies in Kenya. Based on the findings it was revealed that supplier reliability, supplier contracts and supplier innovation influences performance of

manufacturing companies in Kenya. This implies that a unit improvement in circular supplier sourcing would lead to improvement in performance of manufacturing companies in Kenya.

5.3. Recommendations

Manufacturing companies in Kenya should emphasize implementing circular supplier sourcing practices as a critical strategy to enhance performance. By integrating these practices, firms can reduce waste, improve resource efficiency, and meet growing consumer and regulatory demands for sustainability. Additionally, these practices can enhance supplier relationships and create competitive advantages by aligning with global trends in circular and sustainable manufacturing. Further, when reconfiguring supply chains to support circular supplier sourcing, companies should carefully evaluate the scope and potential effects of these changes. In this case, companies must assess the financial and operational impact of these changes while ensuring they do not compromise supply chain effectiveness and trust between the companies involved. Besides, conducting pilot programs, collaborating with stakeholders, and leveraging digital tools for data-driven decision-making will help the companies achieve the desired balance.

To build upon the findings of this study, the following further research areas are suggested: The study was limited to the variables: circular supplier sourcing practices with supply chain reconfiguration as a moderating variable. The study recommends that similar studies be conducted with the inclusion of other circular supply chain management practices variable and with a different moderating variable. Future research should also focus on a longitudinal study to assess the long-term effects of circular supplier sourcing practices on the performance of manufacturing companies in Kenya.

Additionally, to enhance the quality and impact of the paper, it is suggested that future research incorporate a mixed-methods approach, combining quantitative data with qualitative insights from industry practitioners. This could provide a richer understanding of the barriers to implementing circular supplier sourcing practices and the contextual factors influencing performance. It is also good to note that the study focused on the entire manufacturing industry. Although the industry was selected as it is one of the largest sectors in the country, a comparative study of circular supply chain management practices across various industries in Kenya could help identify sector-specific challenges and best practices in circular economy implementation. Furthermore, other comparative studies touching the different sectors of the manufacturing industry in Kenya can be conducted to add on more knowledge of the industry.

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