



Reuse, Remanufacturing and Environmental Performance: Analysis of Timber Processing Firms in Nakuru County

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Abstract: This study intended to establish the effect of reuse and remanufacturing on environmental performance of timber processing firms in Nakuru County. This was a case study survey and Comply Company, a company located in the outskirts of Nakuru town was used as a case. Comply Company deals majorly in the processing of timber products like furniture and other wood structures. This study considered all procurement activities of timber processing firms. The study targeted as respondents, employees from production, procurement, finance and accounting marketing departments of Comply Company. The findings of the study revealed that reuse and remanufacturing individually have positive relationship with environmental performance of timber processing firms in Nakuru County. The following recommendations were made from the study; Organizations especially manufacturing and processing should develop environmental management policies that should be well communicated and shared across the organization. These policies should be written down and followed in environmental management. Secondly, management of sustainable procurement strategies and environment should be given a strategic look. The management should align sustainable procurement strategies and environmental management's policies with the overall direction of the organization. Lastly, further studies should be done to identify the management role in adoption of sustainable procurement practices.

Keywords: Reuse, Remanufacture, Environmental Performance

1. Introduction

In the recent past and even currently, there continues to be growing interest in sustainability across all business functions and all business operations. Such interests build pressure in the operating environment of organizations. To survive such pressure, businesses resort to sustainable business practices. The common sustainable practices adopted by organizations include; reuse, remanufacturing, recycling, waste management and adoption of other green procurement strategies. This study focused on two sustainable procurement practices; reuse and remanufacturing and their relationship with environmental performance.

1.1. Objectives of the Study

- To assess the effect of Reuse on Environmental Performance of timber processing firms in Nakuru County
- To determine the effect of Remanufacture on

Environment Performance of timber processing firms in Nakuru County

1.2. Significance of the Study

This study aimed to build literature that would stimulate further research on Sustainable Procurement Practices and Environmental Performance. The findings of the study will contribute to adoption of sustainable procurement in timber products manufacturing industry as well as in other manufacturing industries. The recommendations of this study would be useful to procurement organizations and procurement managers in understanding the adoption of sustainable procurement practices and the effects such practices have on environmental performance of organizations adopting them.

1.3. Conceptual Framework

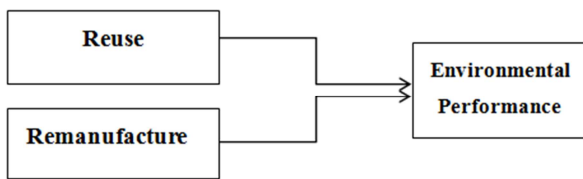


Figure 1.1. Conceptual Framework.

2. Literature Review

2.1. Economic Organization Theory

Economic organization theory looks at an organization as an entity within and through which individuals interact to achieve individual and collective goals. The main aim of existence of organizations according to this theory is to achieve economic gains. The economic performance of an organization is measured in terms of productivity, profitability and sustainability of its operations (Muma et al., 2014).

The theory of economic organization is grounded on building blocks. The first building block is coordination and motivation. Effective coordination is critical in an organization in deciding on what tasks to be performed, when they are to be performed, by whom they should be performed and in what priority. On the other hand, motivation is important in inspiring the employees to individually and collectively work towards achievement of set goals. The second building block is transactions and contracts. Through transactions, individuals and organizations plan and implement organizational operations. Contracts however provides a means through which agreements between the partners is coordinated. The contracts need not to be written, however, they should be clear be made on continuous basis as the business environment keeps changing. The third building block is bounded rationality. According to Simon (1951), cited by Fudenberg (1990), individuals are limited in their scope to act rationally. This is because of the limitations relating to accessible information and the conception ability of the individuals. The forth building block of the economic theory is the principal-agent framework. In many business activities, the principal agent relationship is adopted. There is need for free flow of information and motivation to ensure the agent knows the principal's requirements and is committed towards achieving them. The last building block is governance structure outlining the rules and regulations and procedures relating to transactions. There must be integration between procurement and other factional areas of the organization. The organization must also have structures that facilitate coordination and cooperation between functional areas (Fundenberg et al., 1990).

Sustainable procurement is one of the strategies that most organizations are currently adopting to achieve economic objectives. This theory brings an understanding on how the organization can align its structure and resources to implement sustainable procurement initiatives. It sets out the need to have coordination between functional areas of the organization,

communication and building of organizational structures that facilitates partnership, key ingredients in implementing sustainable procurement.

2.2. Reuse

Reuse is one of the most common strategies of outbound logistics. It involves re-injecting the unused products back into the supply chain. Commonly returned products are products that are in good condition that have not been used, the products that have been partially used and are returned for upgrade and products that have completely been used but can be reused in other areas. Hazen et al. (2011) points out that product or material can only be reused if its position in the supply chain is capable of moving in the reverse position. It should not be at the beginning of the supply chain. Reuse maximises value to the organization by making use of materials that would otherwise be regarded as wastes. Reuse also reduces materials extraction, transportation thereby reducing operational costs (Gray and charter, 2014)

2.3. Remanufacture

Hazen et al. (2011) defines remanufacturing as the process of repairing, refurbishing or overhauling an item so as to extend its life span or recover the lost value in the item. When a product becomes unusable, the only strategy to restore the usability of the product is through remanufacturing. Remanufacturing is commonly adopted as a sustainable strategy to achieve competitive advantage. If managed strategically, remanufacturing can enhance productivity and improve operational performance of the organization. Remanufacturing includes recycling-integrated manufacturing that aims at reclaiming value from materials that have reached the end of their life span (Sarkis, 2010).

Gray and charter (2014) point out that remanufacturing is mainly driven by the market demand, government regulations and international standards that calls on manufacturers to guarantee customer product quality. It is considered a proactive production method that an organization can use to recover product value and enhance environmental responsiveness. Study conducted by Sustainable Resource Group (2012) reveals that remanufacturing comes with huge financial and environmental opportunity. It can enhance organization's financial and environmental performance. Successful implementation of remanufacturing process require certain conditions; the products should be of high value, the production technology should not change quickly, fashion trends about the product should remain unchanged for a considerable long time, the product should be durable and easy to disassemble and lastly, the product should be leased as a service and not a hard ware.

2.4. Environmental Performance

Environmental performance describes a performance of the organization in relation to ecological effects of goods procured by an organization by taking to less environmentally damaging activities (Preuss, 2009). Environmental

Performance is concerned with Fitness for Purpose, Biodegradability, Design and Disassembly of the products purchased and supplied by the organization. It is the extent to which purchased or supplied products give value for money for the organization and its customers. Indicators of Environmental Performance include: Minimum Use of Virgin and Non-renewable Materials by the organization, Resource, Energy and Water efficiency, Fault and Waste Prevention and Maximum Durability. In addition, environmental performance can be indicated by the level of Reusability and Recyclability of products and Associated Materials, Minimum Packaging, Maximum use of Post-Consumer Materials and Minimum Pollution of products purchased and supplied by the organization (Meehan & Bryde, 2011).

Study by (Henry & Journeault, 2007) on Environmental performance indicators: An empirical study of Canadian manufacturing firms, examined the importance of measurement and use of environmental performance indicators within manufacturing firms. The objective of this exploratory study was to identify the associations among firm

characteristics and the importance of measurement of EPIs and their use. The results of this study suggest three main conclusions. First, the importance of measurement of EPIs is associated with; firms having a more active environmental strategy, ISO 14001 compliant firms, larger firms, and public firms. Second, the global use of EPIs is also associated with a more active environmental strategy, ISO 14001 compliance, larger firms and public firms. Third, the specific uses of EPIs are associated with different firm characteristics and objectives: monitoring compliance, associated with ISO-compliant firms, motivation of continuous improvement associated with an active environmental strategy and larger firms, decision making associated with an active environmental strategy, and external reporting associated with public firms. This study has analyzed in great depth the EPIs and how they affect overall Environmental Management practices but it has not analyzed the relationship between sustainable procurement and environmental performance of a firm.

Table 2.1. *Elements for Improving Environmental Performance (EP) and Compliance.*

Element	Components
Environmental Policy	Compliance with environmental requirements, Commitment to continuous improvement in EP, Commitment to pollution prevention, Commitment to reduce environmental risks and Commitment to share Environmental Management information
Environmental Requirements and Voluntary Undertakings	Statutes, Regulations, Permits, Enforceable agreements, Environmental principles and Industry Norms
Objectives and Targets	Compliance with Environmental Requirements, Continuous Improvement in EP, Pollution Prevention, and Information Sharing with external stakeholders
Structure, Responsibility and Resources	Sufficient Personnel, Adequate Resources, Procedures of Achieving Objectives, Compliance Roles and Responsibilities
Operational Control	Planning and Management of Organization's Operations, Facility Maintenance
Corrective and Preventive Action and Emergency Procedures.	Documented Procedures for Preventing, Detecting, Investigating and Initiating Corrective action and reporting Progress
Training, Awareness and Competence	Training on Roles and Responsibility and Importance of Environmental Management
Organizational Decision-making and Planning.	Decisions on Capital Improvements, Product and Process Design, Training Programs, and Maintenance Activities
Document Control	Appropriate Documentation of Environmental Objectives and Targets
Continuous Evaluation and Improvement	Periodic Documented and Auditing of Organization's Environmental Performance

3. Research Methodology

The researchers used correlational research design. This design is deemed appropriate as it allows the researcher to draw conclusion on the link between reuse and remanufacture and environmental performance of firms. The study employed a case study census cross-section (conducted at one point in time) survey strategy. Comply Company was chosen because of its accessibility and the fact that the company is practicing sustainable procurement practices. The target population for this study comprised all employees attached to the mentioned departments of Comply Company. The departments were chosen based on their involvement in the procurement process. Since the targeted respondents are only 100, all the respondents were involved in the study. Primary data was collected using structured questionnaires. The filled questionnaires were then collected after one week; this gave respondents enough time to answer the questions promptly. Each item in the questionnaire was developed to address a

specific objective or research question. A pilot test was carried at Cabro Timber Processing company procurement department only to determine the feasibility of the data collection instrument. The collected data was keyed into SPSS version 2. Single tailed Spearson's Correlation test was conducted to establish the relationship between reuse, remanufacture and environmental performance.

4. Findings, Conclusions and Recommendation

4.1. Findings on Reuse, Remanufacturing and Environmental Performance

From table 4.1, the means >3.5 imply that most of the respondents agreed that timber processing firms produce materials that can be reused, reuse products and materials where possible and encourage stakeholders to reuse materials.

Table 4.1. Findings on Reuse.

Statements	N	Min	Max	Mean	Std. Deviation
Company produces products that can be reused	61	2	5	4.63	.720
Company re-uses inputs and materials where possible	61	1	5	4.08	.977
Company package materials in re-used packaging materials	61	2	5	4.35	.796
Company has in place systems to recover partly used and faulty products	61	1	5	3.92	.093
Company encourages distributors and customers to return faulty and used products	61	2	5	4.33	.816
Company reuses its packaging materials where possible	61	1	5	4.02	.049

Table 4.2. Findings on Remanufacture.

Statements	N	Min	Max	Mean	Std. Deviation
Your Company repairs products returned by customers	61	4	5	4.86	.348
Your company remanufacture faulty products identified before going to the market	61	3	5	4.57	.539
Your company refurbishes faulty products identified before going to market	61	3	5	4.65	.559
Your company refurbishes faulty products returned by customers	61	3	5	4.51	.579
Your company overhauls products where it is not possible to repair or refurbish before products are taken to market.	61	3	5	4.61	.603
Customers are encouraged to bring faulty products back for repair	61	2	5	4.49	.644
Company overhauls returned products that are beyond repair or refurbish	61	3	5	4.65	.559
Company has in place system to recover faulty products for repair	61	3	5	4.51	.579

Table 4.2 reveal that most of the respondents agreed with the statements as evidenced by mean > 3.5. This implies that timber processing firms repair, remanufacture, refurbishes or overhauls products and materials where possible. The companies also encourage the use of remanufactured products by stakeholders and take the lead in remanufacture use of remanufactured products.

Table 4.3. Findings on Environmental Performance.

Statements	N	Min	Max	Mean	Std. Deviation
Firm emits minimal gases into the environment	61	3	5	4.65	.522
Firm deposits minimal solid wastes on land	61	1	5	4.49	.834
Firm releases minimal liquid wastes into water bodies or land	61	3	5	4.53	.703
Wastes by the firm poses minimal environmental risks and hazards	61	1	5	4.37	.799
Wastes of the firm are Biodegradable	61	3	5	4.55	.702
The firm uses minimal non-renewable inputs and materials	61	1	5	3.94	1.207
The firm uses inputs and materials efficiently	61	1	5	3.50	1.206
The firm uses minimal fuel energy	61	4	5	4.80	.401
The firm saves on electric power usage	61	3	5	4.49	.612
Products of the firm are Biodegradable	61	1	5	4.24	1.031
Products of the firm are Durable	61	3	5	4.53	.703
Products of the organization are Recyclable	61	1	5	4.37	.799
Packaging material used by the firm has minimal environmental effects	61	3	5	4.90	.100
Products produced by the firm have minimal defects and faults	61	3	5	4.65	.522
Firm has environmental protection policies	61	1	5	4.49	.834
Management of the firm listens to local community complains on environmental issues	61	2	5	4.43	.781
Management of the firm implements environmental protection polices as required	61	2	5	4.55	.673
Management has a budget for environmental management efforts	61	2	5	4.33	.841
Management compensates people affected by its no eco-friendly policies	61	3	5	4.53	.703
Company adheres to international environmental standards	61	1	5	4.37	.799

From table 4.3, it is evident that the timber processing firms enjoy improved environmental performance. This is evidenced by the high means of on the responses. The organizations operate in line with local, governmental and international environmental standards and have in place policies for implementation of such standards. Subsequently, the firms face limited challenges and complaints related to

environmental degradation.

4.2. Correlation Analysis

Correlation analysis was conducted to establish the relationship between reuse, remanufacture, recycle and waste management and environmental performance. The findings were as shown in table 4.4

Table 4.4. *Correlation Matrix.*

		Reuse	Remanufacture	Recycle	Waste Management	Environmental Performance
Reuse	Pearson Correlation	1	.011	.171	-.212	.359**
	Sig. (2-tailed)		.936	.189	.102	.004
	N	61	61	61	61	61
Remanufacture	Pearson Correlation	.011	1	.003	-.042	.004
	Sig. (2-tailed)	.936		.984	.747	.973
	N	61	61	61	61	61

Table 4.4 gives the result of correlation analysis on reuse, remanufacture and environmental performance. The Pearson Correlation value of 0.359 indicates that reuse has a positive correlation with environmental performance. The significance value of $0.004 < 0.005$ indicates that the correlation is statistically significant. It was therefore concluded that there is positive relationship between recycling and environmental performance. Pearson Correlation value of 0.004 indicates a weak positive correlation between remanufacture and environmental

performance. The significance value of $0.973 > 0.005$ indicates that the correlation is not statistically significant. Conclusion was made that there is weak positive relationship between remanufacture and environmental performance of timber processing firms.

4.3. Summary of Findings

The findings of this study are summarized in table 4.5.

Table 4.5. *Summary of Findings.*

No.	Objective	Key Findings
1.	To establish the extent to which timber processing firms in Nakuru County adopts reuse	Timber processing firms reuse materials, products and wastes where possible.
	To determine the level of environmental performance achieved by timber processing firms in Nakuru County	Timber processing firms achieve good environmental performance
	To assess how the level of reuse affects environmental performance	Reuse has positive effect on environmental performance
2.	To determine the extent to which timber processing firms in Nakuru County adopts remanufacturing	Timber processing firms repair, remanufacture and refurbish products where possible
	To determine the level of environmental performance achieved by timber processing firms in Nakuru County	Timber processing firms achieve good environmental performance
	To determine the effect of remanufacture on environmental performance of timber processing firms in Nakuru County	Remanufacture positively affects environmental performance of timber processing firms in Nakuru County

4.4. Conclusions

The first conclusion was made that Comply timber processing firm are adopting sustainable procurement strategies; they reuse materials, products and wastes where possible, they repair, refurbish and overhaul faulty and used products as appropriate, they recycle wastes, materials and used materials and products as well as purchase recycle products, they recover and manage wastes properly this is evidenced by the mean score of above 4.0 in most of the statements. Commission for Environmental Cooperation (2000) identified ten indicators of environmental performance which has ten elements. Among them are; environmental policy aimed at enhancing organization's commitment to environmental management, commitment to continuous improvement, elaboration and communication of all environmental requirements and practices to the stakeholders, environmental performance, structure, responsibility and resources required for environmental management, operational control, corrective and preventive action for environmental management, training and competence in environmental management etc.

The second conclusion was made that timber processing

firms in Nakuru County are experiencing good environmental performance; they have environmental management policies, employees are trained on environmental management, they experience reduced costs, wastages and complaints on environmental degradation etc. as evidenced by majority of respondents agreeing or strongly agreeing with the statements. These findings are in agreement with findings of Muma et al. (2014) and Green et al (2013) that linked environmental performance with reduced costs in environmental management, reduced waste emission into the environment, reduced complaints on environmental management and existence of environmental policies that are well communicated and followed.

From the conclusions of the study, the study recommends the following; Organizations especially manufacturing and processing should develop environmental management policies that should be well communicated and shared across the organization. These policies should be written down and followed in environmental management. Secondly, Management of sustainable procurement strategies and environment should be given a strategic look. The management should align sustainable procurement strategies and environmental management's policies with the overall

direction of the organization. Further studies should be done to identify the management role in adoption of sustainable procurement practices.

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