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Circular Economy Innovations in Small and Medium Enterprises in Ngong Town Kajiado County, Kenya for Environmental Protection and Sustainable Development

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ABSTRACT: *Circular economy emerged as way of managing waste, lessening resource uses, and preventing environmental deterioration. Circular economy is being developed and implemented in governmental, business and academic settings mainly in line with the UN Sustainable Development Goal 12. Waste generated from residents in Ngong town has built up landfills and has clogged sewer lines and pathways. These wastes encompass various forms of electrical, plastics and electronic appliances that have ceased to be of any value to their owners. These types of wastes can have harmful effects on humans and the physical environment. Waste require special handling and disposal techniques due to their hazardous properties as they may be toxic, carcinogenic, flammable including other effects. This study explored the circular economy innovations in SMEs in Ngong town as contribution to addressing this problem. The study specific objectives were, to find out the circular economy innovations, to identify opportunities and to determine the factors that influence circular economy innovations in Ngong town. A sample of forty owners/operators of SMEs in Ngong town was conveniently selected and interviewed using a questionnaire. It was found that a number of innovations were implemented and only 67.5% had knowledge of circular economy. The SMEs had customers who can buy product from their innovations, and there were factors that influenced circular economy innovations such as government policies and regulations, lack of infrastructure, financial resources, and partnerships.For SMEs to move from linear to circular economy in Ngong town, the study recommends training on circular economy innovations and the county government of Kajiado should implement policies and regulations that promote the circular economy innovations for the protection of the market and environmental sustainability.*

KEYWORDS: circular economy, innovations, SME, environment, sustainability

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INTRODUCTION

Circular economy innovation is an economic system that presents a fundamental change between society and environment and seeks to prevent the depletion of resources through the elimination of resources both material and energy cycle for the advancement of sustainable development. The primary benefit of the circular economy is to make the economy capable of self-regeneration through the development of eco-innovations.

The Ellen MacArthur Foundation points out that the move to circular economy involves a systematic change that aims to create long-term resilience and reduce the effects of the linear economy to create long-term resilience, economic, social and environmental opportunities (Suchek, N., Fernandes, C. I., Kraus, S., Filser, M., & Sjögrén, H., 2021).

A great change in the way natural resources are utilized is important to achieving needs of next generations. For example, some product manufacturers request that when buying their products, and once you are done utilizing the products, the containers should be returned to the purchasing store for recycling. This will eliminate too much waste from the environment and it will create sustainability. The act, take, make and throw away has resulted to the reduction of raw materials and the depletion of limited natural resources. The idea of circular economy as an economic framework has gained momentum lately and is viewed as a way to attain viability on local, national and international levels (Behrens, A., Giljum, S., Kovanda, J., & Niza, S., 2007).

The African continent is cognizant of increasing challenges brought by the linear economy. The population is growing, and the natural resource base is being extracted rapidly. There is no doubt that the world has been in need of an economy that is innovative (Sariatli, 2007). The shift to circular economy will reduce the burden on natural resources, create sustainable employment opportunities and promote a healthy and safe environment. In addition, it is essential to prevent the loss of biodiversity and to achieve the environmental neutrality objective (Spain, 2020).

Circular economy in Africa is growing and forward-thinking. Majority of circular approaches currently in use are driven by the issue of managing waste. However, due to Africa's rapid expansion, Africa still has a great opportunity to thrive by creating effective systems. The focus needs to shift from solving 'waste' problems to innovations and investments. However, in Kenya to ensure that policy priorities are budgeted, circular economy requires to be explored (Moya, B., Sakrabani, R., & Parker, A., 2019).

In Africa, and particularly in Kenya, many products currently available do not have value after being consumed. For example, flexible plastic containers with multiple components are not composted, recycled, or utilized and they end up becoming garbage. For products like these, landfills are built in. From small impermanent stuff like sweet wraps right up to permanent

buildings and roads. The economy is filled with products that have been designed without considering what will become of them at the end of their life span (Billiet, S., & Trenor, S. R., 2020). For example, waste generated from residents in Ngong town (domestic waste/ household waste) has built up landfills and has clogged sewer lines and pathways. These wastes encompass various forms of electrical, plastics and electronic appliances that have ceased to be of any value to their owners. The wastes require special handling and disposal techniques due to their hazardous properties as they may be toxic, carcinogenic, flammable including other effects. Therefore, these wastes are not suitable for direct disposal into a landfill.

Image: The author was not known but hereby fully acknowledged by the researchers

In Ngong town, most landfills are made through damping of wastes from the modern market. These wastes include clothing and food stuffs that residents and SMEs are dumping because they do not have nor follow the knowledge on transformation of trash into a new usable item that has equivalent chemical structure. This study seeks to explore the circular economy innovations in SMES in Ngong town.

The broad objective of this study was to explore the circular economy innovations in small and medium sized enterprises in Ngong town. The specific objectives were:

i. To find out the circular economy innovations in small and medium enterprises in Ngong town, Kajiado County.
ii. To identify the opportunities available for SMEs to implement circular economy innovations in Ngong town, Kajiado County.
iii. To determine the factors that influence the circular economy innovations in SMEs in Ngong town, Kajiado County.

The study sought to answer the following research questions:

i. What are the circular economy innovations in small and medium enterprises in Ngong town, Kajiado county?
ii. What opportunities are available for SMEs to implement circular economy innovations in Ngong town, Kajiado County?
iii. What factors influence circular economy innovations in SMEs in Ngong Town, Kajiado county?

The research findings will promote the design of circular economy innovations in SMEs in Ngong town in a way that will help to effectively manage wastes. They will provide valuable insights for guiding and informing residents of Ngong Town Kajiado county on circular economy innovations which have positive effects on the environment and small and medium enterprises. In Ngong town, circular economy in SMEs will create jobs and enable people to generate income for use, saving and investments. Circular economy innovations create jobs and reduce unemployment and the negative socio-economic and health impacts of climate change and pollution.

LITERATURE REVIEW, THEORETICAL AND CONCEPTUAL FRAMEWORKS

Literature Review

Circular economy consumes things in a way that minimizes the use of world's resources, cuts wastes and reduces carbon emissions. It earns the government huge revenues and contributes to the growth of the economy, creates jobs and has high innovativeness. Development of SMEs is less and slowly adopted in developing nations due to large barriers experienced. According to Ellen Macarthur Foundation (2023), the circular economy is based on three principles, all driven by design, namely to eliminate waste and pollution, to circulate products and materials at their highest value, and to regenerate nature. In a circular economy, a specification for any design is that the materials re-enter the economy at the end of their use. By doing this, linear take- make-waste system is changed to circular. Ellen MacArthur Foundation continues to suggest that many products could be circulated by being maintained, shared, re-used, repaired, refurbished, remanufactured and as a last resort recycled. Food and other biological materials that are safe to

return to nature can regenerate the land, fuelling the production of new food and materials. With focus on design, the concept of waste can be eliminated (Morseletto, 2020).

EU is recognized as a leading proponent of international action on environment and it is committed to promoting sustainable development continentally. Sustainable development is one of the overarching objectives of the EU as set out in its treaties. EU is an active participant in the elaboration and implementation of multilateral environmental agreements and other environmental negotiations and processes, notably in the United Nations framework (Howlett, M., & Rayner, J., 2006).

According to Peter Desmond (2017) Africa is leapfrogging from linear to circular economy and there are still lessons to learn from the evolution of industrialized economies to create a sustainable, equitable and prosperous society in Africa. He argued that circular economy could be the link in avoiding the ecosystem degradation, expensive or scarce resources, or unethical and unsafe employment practices. Besides, Desmond Peter noted that Africa leapfrogging traditional landlines onto mobile phone technology helps avoid high infrastructure cost of land-based communications and enables innovative systems like M-PESA mobile banking in Kenya.

On the other hand, Africa is facing challenges for the circular economy through constant population growth and prevailing linear production and consumption patterns. This puts pressure on raw materials since consumption of products using raw materials and resources in Africa is increasing rapidly.

Africa's environmental footprint continues to increase due to economic growth in various regions, population growth and rapid urbanization. Circular principles and approaches provide solutions for these challenges, namely for industries and the economy at large, for people, and for cities and religions (Mishra, S., Jain, S., & Malhotra, G., 2021).

Lack of capital or financial resources is one of the major barriers for SMEs that always hinders entrepreneurs who prefer bootstrapping to run their businesses to avoid loans which have hefty charges. Additionally, businesses in most countries trying to innovate have challenges in accessing bank loans due to borrowing rates required by banks which are very high. In Kenya, accessing bank loans is tedious and consumes a lot of time and energy. There must be a collateral with the bank and a guarantee for refunding the loans with high interest rates and shorter repaying periods which end up frustrating the borrowers. Funding of SMEs and accessing finance plays major roles for SMEs broadening.

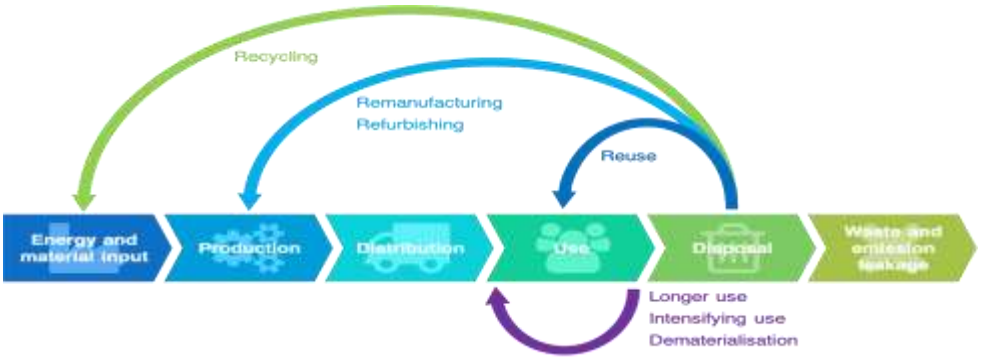
Kenya is blessed with beauty and various natural resources such as iron, gold, water, coal, sand, limestone, salt and many other rare gemstones are mined in Kenya. For example, creating construction material out of reused materials (waste), treating waste water for consumption, repairing/refurbishing electronics -these are opportunities to create new industries (transform a value chain), whereby a by-product of one is a raw material for another, and it creates employment in the process (Taylor, C. D., Schulz, K. J., Doebrich, J. L., Orris, G. J., Denning, P. D., & Kirschbaum, M. J., 2005).

According to the United Nations Environment Programme (UNEP), at the current pace, plastic pollution, which is already around 400 million tonnes per year (of which only 10% is being recycled and 14% incinerated), could double by 2040. The Global Plastic Action estimates that Ghana generates about 0.84 million tonnes of plastic waste per year (of which only 5% is collected for recycling). This figure grows at an annual rate of 5.4% - meaning that by 2040, plastic waste could reach 2.3 million tonnes per year (UNEP, 2023; EU, 2022). There are countries and companies where this plastic challenge has been tackled in innovative ways. Throughout Latin America, the percentage of recycled material in packaging is growing. It is currently 42% in Colombia, 25% in Costa Rica, Ecuador, El Salvador, Honduras, Nicaragua and Panama and 10% in Guatemala. Patent Plant Bottle technology introduced in 2009 has been used in more than 60 billion packages worldwide. Plant Bottle is composed of 30% plant-based materials reducing the need for petroleum and therefore reducing carbon foot print. Diana Breed director of Packaging Research, Coca-Cola Company talks about light weighting design on plastic packaging used today which is lighter than glass which makes it easier and less energy intensive to use. South Africa's approach towards recycling solution was shocked with plastic waste recycling rates in single digits in 2000 to 65% in 2017, and the Government has proposed a package tax for beverage and food containers and a more holistic approaches such as promoting the reuse of plastic in packaging and other end products, providing infrastructure to recycling centres and support collections by establishing a guaranteed floor for the price of recycled plastic (Mogoatlhe, 2019).

2.2 Theoretical Framework

The study is based on the three principles of circular economy namely to eliminate waste and pollution, to circulate products and materials at their highest value, and to regenerate nature (Ellen Macarthur Foundation, 2023).

Figure 1.1: An illustration of the circular concept



Source: Geissdoerfer *et al*. (2020). *Journal of Cleaner Production 277 (2020) 123741*

Re-use: to use something more than once. Example using a carrier bag or an old shirt as a rag.

Recycle: the process of converting waste into reusable materials and objects such as bottles or paper.

Redesign: change the design of something. Example improve a building or a vehicle that is rebuilding into a new design.

Regenerate: restore or renew something that has been damaged. Example rotation of crops

Remanufacture: to make into new product by renovating and reassembling its components.

2.3 Conceptual Framework

Figure below shows the conceptualized relationships between the independent and dependent variables in this study.

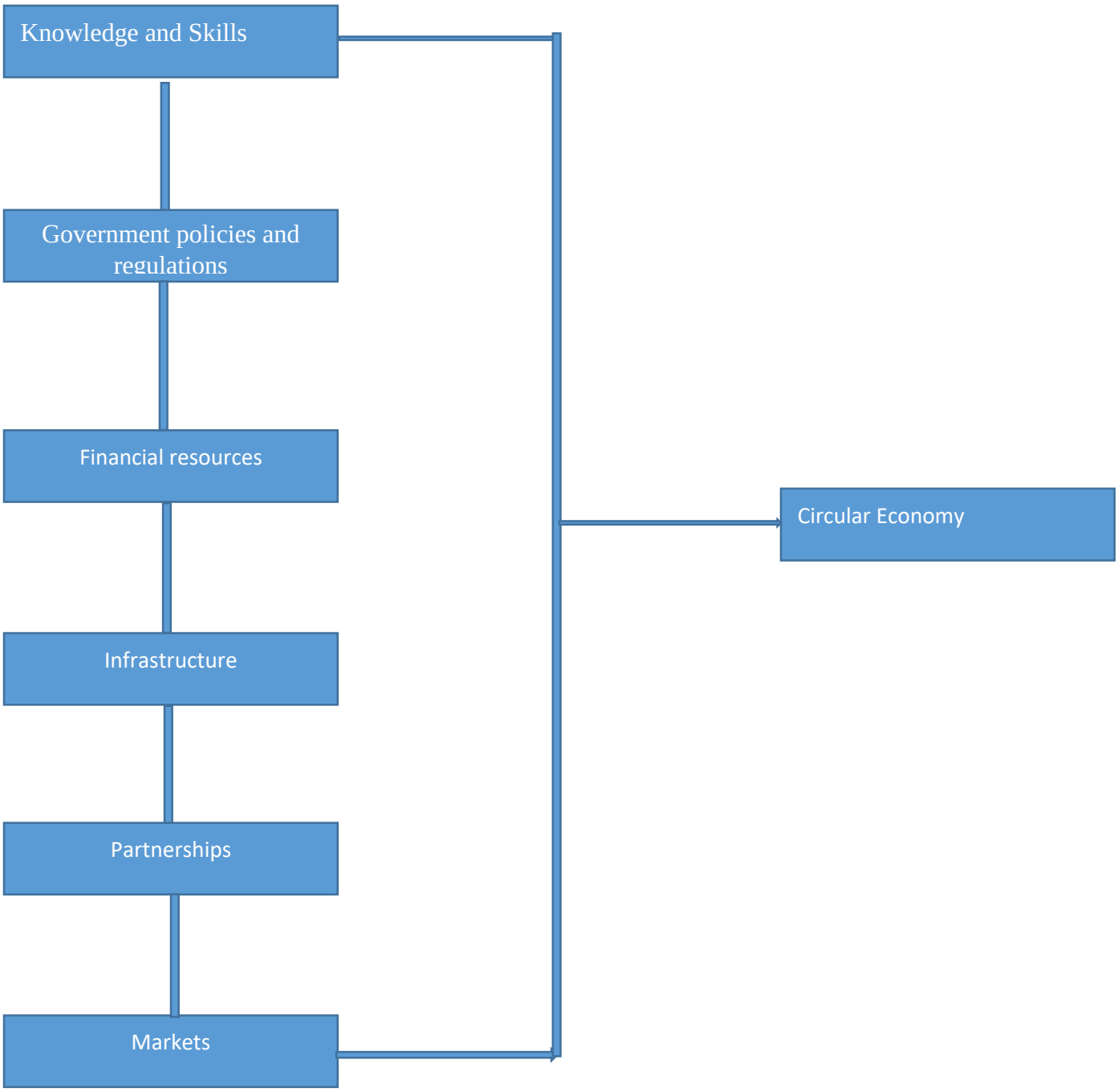


Figure 1.2: Conceptual Framework

RESEARCH METHODOLOGY

Dooley (2007) defines research design as the strategy, framework and scheme utilized to identify solutions to research questions, or the conceptual structure that provides the blueprint for conducting research. This study used a cross-sectional descriptive design. The study focused on circular economy innovations in selected SMEs located in Ngong town, Kajiado county. This study targets the owners or operators of small and medium enterprises in Ngong town, Kajiado County. Forty participants, a large sample statistically since more than 30, were conveniently selected to participate in the study as shown in Table 1 below.

Table 1.1 Sample size

No.	Business Category	Sample
1	Vendors of Fresh fruits and vegetables	10
2	Pharmaceuticals/chemists	5
3	Tailors and Vendors of clothes	10
4	Cobblers	5
5	Artisans	5
6	Vendors of Food and beverage	5
	Total	**40**

Maletz, Roman; Dornack, Christina; Ziyang (2018) state that primary sources are used immediately for research. In order for the final data to present both quantitative and qualitative information, the data collection process involved gathering both numeric (numbers) and text data using a questionnaire. The data was analysed using descriptive statistics such as frequencies, percentages displayed in tables and content analysis for qualitative data. The respondents gave their informed consent to voluntarily participate in the study. The principles of informed consent, anonymity and confidentiality were upheld during the entire research process and the results and recommendations of this study will be disseminated to stakeholders for future policies and practices.

RESULTS

Socio demographic characteristics of participants

The study was about circular economy innovations in SMEs in Ngong town, Kajiado county and thus the respondents' level of education, age, religion and marital status are considered very important demographic facet in findings and are presented in tables below

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Table 4.1 Gender of respondents

Gender	Frequency	Percentage
Male	20	50%
Female	20	50%
Total	**40**	**100%**

The study conveniently equaled male and female respondents.

Table 4.2 Age of respondents

Age	Frequency	Percentage
Below 20	0	0%
20-29	20	51.28%
30-39	9	23.08%
40-49	2	5.13%
Above 50	8	20.51%
Total	**39**	**100%**

Majority 20 (51.28%) were between 20 to 29 years old.

Table 4.3 Education level of respondents

Education level	Frequency	Percentage
Certificate	8	21.05%
Diploma	11	28.95%

Degree Postgraduate	17 2	 44.74%
Total	38	5.26% **100%**

The majority 17(44.74%) of respondents had a degree as the highest level of education.

Table 4.4 Religion of respondents

Religion	**Female**	**Male**	**Total**
Christian	15	17	32 (80%)
Muslim	5	3	8 (20%)
Total	**20**	**20**	**40 (100%)**

The majority 32 (80%) of participants were Christians.

Table 4.5 Marital status of respondents

Marital status	**Female**	**Male**	**Total**
Married	11	9	20
Divorced	0	1	1
Separated	2	1	3
Single	7	9	16
Total	**20**	**20**	**40**

The majority 20 (50%) of respondents were married.

Table 4.6 Business experience in the SMEs

Experience	**Female**	**Male**	**Total**
Less than 1 year	0	1	1
1 year – 5 years	11	7	18
More than 5 years	9	12	21
Total	**20**	**20**	**40**

The majority 21 (52.5%) had more experience of more than five years in the SME.

The circular economy innovations in small and medium enterprises in Ngong town Kajiado County

Table 4.7 Knowledge of circular economy innovations

Circular Economy	Frequency	Percentage
Yes	27	67.5%
No	13	32.5%
Total	**40**	**100%**

The majority 27(67.5%) of respondents had knowledge of circular economy innovations.

Table 4.8 Extent of circular economy implementation in the business

Extent	Female	Male	Total
No innovations	3	2	5
Some extent	15	14	29
Great extent	2	3	5
Total	**20**	**19**	**39**

Majority 29(74.34%) had implemented circular economy innovations to some extent in their SMEs.

Table 4.9 Circular economy Innovations

Innovation	Female	Male	Total
Reuse	16	13	29
Recycle	10	17	27
Redesign	7	3	10
Regenerate	3	4	7
Remanufacture	5	11	16

The most implemented circular economy innovations were re-use with 29(72.5%) and recycle with 27(67.5%) of respondents.

Opportunities available for SMEs to implement circular economy innovations

Table 4.10 Opportunities

Opportunity	Female	Male	Total
I have customers who can buy the products or services from the innovations	13	12	25
I can reuse the waste to produce energy	2	2	4
I can create construction material out of used material	0	1	1
I can refurbish/repair electronics	1	6	7
Other	2	0	2

Most respondents 25(62.5%) reported having customers who can buy the products or services from their innovations.

4. 4 Factors that influence circular economy innovations in Ngong town

Tables 4.11- 4.16 display the number of respondents who strongly disagreed (1), disagreed (2), agreed (3) and strongly agreed (4) with the statements related to factors influencing circular economy innovations in SMEs.

Table 4.11 Knowledge and skills

Statement	1	2	3	4	Total
I have knowledge and Skills on waste management in my business	4	8	17	10	39
Lack of education hinders circular economy innovations on small and medium enterprises in Ngong town	1	5	20	11	37
Lack of training and skills of circular economy innovations has slowed down innovations in circular economy	2	5	18	10	35
I have knowledge and skills on product transformation	5	12	9	9	35

Table 4.12 Government policies and regulations

Statement	1	2	3	4	Total
The county government of Kajiado has encouraged innovations created by Small and medium enterprises	13	8	12	6	39
Policies and regulations implemented by the county government of Kajiado hinders circular economy innovations in Ngong town	5	10	11	10	36

Table 4.13 Financial resources

Statement	1	2	3	4	Total
Lack of funds hinders innovations in Circular economy innovations in Ngong town.	6	4	15	14	39
High interest rates on loans accessed by Small and medium enterprise businesses has hindered innovations in circular economy	5	2	16	15	38

Table 4.14 Infrastructure

Statement	1	2	3	4	Total
Infrastructure is a challenge in circular economy innovations for growth and development of small and medium enterprises in Ngong town	1	3	18	18	40
Infrastructure minimizes the amount of material used across the infrastructure value chain	2	10	19	8	39

Table 4.15 Partnerships

Statement	1	2	3	4	Total
There have been partners working with my business to promote circular economy innovations	16	9	11	4	40

Table 4.16 Markets

Statement	1	2	3	4	Total
The products from SMEs circular innovations are accepted by customers	5	14	13	8	40
The government of Kajiado county has done enough to protect the market for innovations developed in SMEs	10	19	3	5	37

Despite many respondents having knowledge on waste management, knowledge and skills were cited as influencing the circular economy innovations in SMEs. A significant number of respondents found that the regulations and policies hindered innovations in SMEs. The infrastructure was still a challenge to circular economy innovations in SMEs in Ngong town, Kajiado County. Most SMEs still needed more partners to work on circular economy innovations. The Government of Kajiado county still has to do more to protect the market for innovations developed in SMEs.

INTERPRETATION OF THE FINDINGS AND DISCUSSION

In line with the findings of circular economy innovations in Ngong town Kajiado county, from Table 4.9, research findings indicate that circular economy innovations in Ngong town are being implemented by small and medium enterprises. For example, vendors of fresh fruits and vegetables, responded to selling of waste for hay and fodder and those vendors of clothes and tailors giving out outgrown clothes to charity and friends. Small and Medium Enterprises recycle and reuse products so as to promote environmental sustainability and help reduce landfills created through waste. Respondents according to the study agreed to recycling of glass bottles and buying beverages in returnable containers. The results support the shift from the linear to circular economy innovations as Ellen Macarthur advocated for transforming the system were waste is eliminated, resources are circulated, and nature regenerated for environmental protection. In addition, products produced in circular economy were acceptable by customers.

In Ngong town, respondents saw opportunities in reusing of plastic bags and paper bags as this has helped in easing waste management within Ngong town. In Ngong respondents from Small and Medium Enterprises got the opportunities of selling their products as some agreed to having customers for their innovations. The results suggest that respondents who agreed to having customers who can buy products or services from the innovations saw opportunities in creating jobs and income through innovations, and the County Government of Kajiado should protect the market for innovations developed in SMEs.

The factors such as lack of funds and the high interest rates while accessing loans hindered innovations in circular economy as found in previous other studies. Lack of training and skills on circular economy innovations, lack of partners, lack of infrastructure such as equipment to help in innovations, and the policies implemented by the County Government have hindered circular economy innovations like found in previous studies elsewhere.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of the study

The study explored the circular economy innovations in SMEs in Ngong town. While some circular economy innovations are implemented to some extent in SMEs in Ngong town, there is still a need to increase knowledge and skills on circular economy innovations among the SME operators and owners. It was found that a number of innovations were implemented and only 67.5% of participants had knowledge of circular economy.

The study also sought to know the opportunities available for SMEs to implement circular economy innovations. The results showed that that SMEs had customers who can buy products from their innovations. The respondents also indicated some of the factors that hinder them from innovating in their SMEs.

Conclusion

While some circular economy innovations are implemented to some extent in SMEs in Ngong town, there is still a need to increase knowledge and skills on circular economy innovations among the SME operators and owners. There are opportunities available for SMEs to implement more circular economy innovations. There were factors that influenced circular economy innovations such as government policies and regulations, lack of infrastructure, financial resources, and partnerships.

Recommendations

For policy makers

The study recommends that for SMEs to move from linear to circular economy in Ngong town, the County Government of Kajiado should implement policies and regulations that promote the circular economy innovations for the protection of the market and environmental sustainability.
There is a need to improve the infrastructure for circular economy innovations in Ngong town, Kajiado County.

For other audiences

There should be training on circular economy innovations as people lack knowledge and skills on circular economy. There is a need to improve accessibility to financial resources for circular economy innovations and create networks to promote partnerships.

Suggestions for further research

Further research could be done on circular economy in other parts of the county so that people can have knowledge and skills on circular economy and other factors influencing it for environmental protection and sustainable development.

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