

Factors Influencing the Penetration of Circularity within the Tourism Economy of Western Kisumu - Kenya: A Partial Least Squares Structural Equation Modelling.

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Abstract

In Africa, tourism destinations face sustainability challenges as tourist arrivals adversely affect their ecological integrity. Although circularity offers numerous opportunities, including enhanced resource efficiency and reduced waste, its adoption is still limited. This study examines factors influencing the adoption of circular practices in the tourism economy of Western Kenya, using a survey of 232 hospitality facilities and PLS SEM analysis. The results reveal, *inter alia*, a negative relationship between high tourist activity and circularity penetration, awareness of environmental policies boosts circularity, and a positive effect of employee training on industrial integration of circularity. These findings emphasise the need for targeted interventions such as policy awareness, staff training, and infrastructure investment to promote circularity in the Kisumu tourism sector. The research provides empirical evidence from rural local enterprises in Kisumu, extending the understanding of circular principles applications in the rural tourism economy.

Keywords: Circular economy, Circularity penetration, Sustainable tourism, PLS SEM analysis, Kisumu County.

1. Introduction

The viability of tourist destinations worldwide is threatened by industrialisation, as such destinations continue to grapple with sustainability challenges, including pollution, habitat destruction caused by tourism infrastructure, and climate change, among others. Additionally, it has been observed that circularity penetration in developing countries is dismal, thereby denying such destinations the positive opportunities associated with efficiency in resource utilisation and conservation. The reversal of the negative trends calls for the adoption of circular economy principles and practices in the affected destination, especially in the western region of Kisumu, which has experienced increased tourist arrivals as a result of infrastructural development brought about by the devolution of governance and resources.

Although, there is a lot of literature on the negative environmental impacts of tourism as a result of tourism industry operating mostly in linear economy (Foschi, Barbir, Mersico & Stasiskieni, 2025; Kiausiene, Hladkova

and Makunaite 2024; Mensah,2020) and how adaptation of circular economy principles and practices can contribute to the mitigation of the negative tourism footprints on the environment (World Economic Forum,2020; Kuffer, Grezes & Grezes, 2023), most of the literature is Eurocentric and reveal little about the current trends in East Africa regarding the application of circularity and the extent of their penetration in the tourism economy. This gap motivated the current study, whose aim is to establish the factors which determine the penetration of circularity principles and practices in the tourism economy in Africa, with a focus on the Western region of Kisumu County in Kenya.

The objective of the study were: first, to find out the effect of the intensity of tourists activities on the penetration of circular practices; second, to find out whether circularity practices mediate the intensity of tourist activities on sustainable outcomes and whether circularity is associated with sustainable development outcomes; third, to find out whether the scope of tourism operation influence penetration of circularity practices; and establish whether the effect of awareness of environmental policy on penetration of circularity principles is mediated by ecological attitude. Lastly, the study sought to find out the role of employee training on the integration of circularity practices within the tourism and hospitality sector. The units of analysis were various types of tourist facilities, including hotels, guest houses and restaurants. The sampling units or respondents encompassed different categories of employees and owners. The rest of the paper is structured into a review of extant literature on circularity, methodology, results and discussion before ending with a conclusion.

2. Literature Review

2.1 Overview

The thematic areas covered under this section include the concept of circularity, the significance of circularity in tourist destinations, and the relationship between circularity and sustainable tourism development. It also includes the status of circularity in tourism, the barriers and enablers of circularity. The section ends with a proposed theoretical model of circularity adoption in tourism.

2.1.1 Concept of Circularity

The successful application of the circular economy practices in tourist destinations is conditioned on its clear conception. Circularity is defined as:

“An economy that focuses on value preservation, encompassing all activities that reduce the material input of production, and extends the service–life of goods, components and material” Stahel and Clift, 2015:10.

Circularity is, therefore, typified by preservation of value, reduction of production material input and the extension of products' service life. The definition is also amplified in the theoretical framework of Montellano and Meer (2022) according to which circular materials, components, and products embody value, which can be extracted and retained within the system at various value retention stages such as redesign, reuse, resell and recycle. The outcome of the successful implementation of circularity, according to Montellano and Meer, is business models which guarantee social equity, coupled with improved environmental performance, and favourable effects on social development among communities in destinations. However, circularity is not a fixed concept but varies in the extent of its application. For example, Kirchherr, Reike and Hekkert (2017) conceived circularity as a continuum ranging from a linear economy to a circular economy. The continuum is divided into three broad successive steps realised through different sets of strategies. The first steps, which characterise a linear economy, involve the useful application of materials through recycling and recovery. This is followed by an intermediate

step between linear and circular economy called product and parts lifespan extension. Strategies for realising the intermediate step are reuse, repair, refurbishment, remanufacture and repurpose. The last step typifies the circular economy, which encompasses smart product and manufacturing through refuse, rethink and reduce (Kirchherr et al, 2017). Lastly, the concept of circularity is further enriched by augmenting it with a new sufficiency paradigm advanced by Bocken and Short (2020), which addresses excessive consumption that creates waste accumulation, asymmetrical resource distribution and resource scarcity. The relevance of circular practices in the tourism and hospitality industry cannot be overemphasized.

2.1.2 The Significance of Circularity in the Sustainable Tourism Destinations

Circularity is significant in tourist destinations, especially in areas proximal to sensitive ecosystems found within and around the protected areas in Western Kisumu. The tourism industry, through its predominantly linear model, utilises a significant amount of finite resources in the process of hosting tourists (Kiausiene et al., 2024), and this has serious short-term and long-term implications for the conservation and sustainability of the affected tourist destinations. For instance, it has been established by some studies that a huge influx of tourists increases waste accumulation, which undermines destinations' eco-efficiency (Przydatek & Ciaglo, 2020; Senante et al., 2023; Kaliotasi, Abeliotis, & Tsartas, 2023), and that the seasonal nature of tourism constrains the destination's capacity to manage waste (Foschi, et al., 2025). Furthermore, lodges, especially those found within protected areas, generate a significant amount of waste (Mensah, 2020), which may be harmful to destinations with sensitive ecosystems. This observation naturally leads to the following hypothesis:

H₁: Intensity of tourists' activities within tourist destination areas is negatively associated with circularity.

On the positive note, however, the circular economy has potential to promote economic growth with reasonable constraints on waste accumulation, pollution and other adverse environmental impacts (Khan, Marrucci, Daddi and Bellini, 2021), and sustainable development ensures equity within the current generation without limiting the same benefits to future generations (Montellano and Meer, 2022). Through the reduction of greenhouse effect, promotion of resource conservation, and diversification of economic activities (World Economic Forum, 2020; Kuffer, Grezes & Grezes, 2023), the circular economy guarantees sustainable industrial development while, at the same time, mitigates the challenges of climate change. Similarly, the integration of circular practices in tourism operations is central in reducing the adverse environmental impacts of tourism and enhancing efficiency in resource utilisation (Kuffer et al., 2023; Kiausiene, Hladkova, & Makunaite, 2024). The need to appropriate the positive outcome of circularity partly explains the initiative by the Portuguese hotel industry towards promoting circularity through employees' education on sustainability, based on strategies such as reduce, reuse and recycle on materials, waste, energy and water (Santos et al., 2024). Despite the foregoing efforts in promoting circularity, the implementation of circularity has not been successfully realised in the entire tourism economy or supply chain, but is limited to value chains such as local handicrafts, food and beverage, accommodation, tour guiding, and transport (Foschi et al., 2025). The key insight from the finding is that circularity practices are not pervasive within and across the tourism and hospitality operations, but there is some link between circularity on one hand, and sustainable development and environmental education on the other. The analysis leads to the following three hypotheses:

H₂: The relationship between the intensity of tourists' activities with sustainable development outcomes is mediated by circularity penetration.

H₃: Circularity is associated with the sustainable development outcomes.

H₄: The service scope of a tourism enterprise has a negative association with the extent of circularity.

Though the studies indirectly underscore the potential role of circularity in mitigating negative tourism environmental footprints, most studies, especially Przydatek and Ciaglo (2020), Kaliotasi et al. (2023), Foschi et al. (2025), and Kiausiene et al. (2024), were qualitative in nature, undermining the generalizability of their findings to places such as Africa. Although the studies by Senante (2023) and Mensah (2025) are relatively rigorous, they are only generalizable to municipal waste service providers in Chile and managers of small hotels in Accra, Ghana, respectively. Additionally, the study by Mensah (2025) was based on covariance-based structural equation modelling appropriate for confirming the extant theoretical perspective, contrary to the analytic goal of the current study, which is biased towards an inductive approach. In retrospect, however, the perspectives of Khan et al. (2021), Kuffer et al. (2023), and Kiausiene et al. (2024) were all focused on the tourism industry, thus relevant in the current study, unlike all the other scholars whose perspectives were drawn from European experience and may not be exactly replicable in the context of Western Kisumu. Furthermore, most studies were qualitative except for Khan et al. (2021), which employed random sampling of tourism SMEs based in Cyprus, France and Italy.

2.1.3 Barriers and enablers of Circularity in Tourism Economy

Having had a rough picture of the status of circularity in tourism, there is a need to identify possible factors constraining the widespread application of circularity in the tourism economy. There are myriad factors which can be advanced to explain the limited application of circularity practices within the tourism economy in particular. The overwhelming rate of tourist arrivals to destinations, socioeconomic status of the local population, limited compliance with waste management policy, poor legislation enforcement and limited environmental awareness have been cited to aggravate the challenge of waste accumulation (Przydatek & Ciaglo, 2020; Kaliotasi et al., 2023; Senante et al., 2023; Foschi et al., 2025). Also, Ahmadov, Durst and Gerstlberger (2025) and Masdek (2023) found that the firm sizes have a moderating effect on the relationship between stakeholder pressure and circular economy practices, and that the household knowledge about sustainable food waste management is associated with a positive attitude towards waste disposal. Furthermore, environmental attitudes of managers, which are understood as beliefs, affect and behavioural intentions related to environmental issues and activities, influence adoption of environmentally sustainable practices (Mensah & Ampofo, 2020). Moreover, the lack of financial resources, information about potential partners and skilled personnel impeded the transition towards a circular tourism economy (Khan et al., 2021). Last but not least, circularity behaviours among tourists and visitors tended to vary with the distance away from their countries of origin (Fredrick, 2023), with the implication that attracting tourists from distant tourist markets is likely to increase challenges of waste management. From a critical perspective, the conclusion derived from the studies of Khan et al. (2021) and Fredrick (2023), based on tourism SMEs in Cyprus, France and Italy, and German consumers, respectively, employed descriptive statistics and thus cannot be generalised beyond the study samples. However, the conclusions from Ahmadov et al. (2025), Masdek (2023) and Mensah and Ampofo (2020) were based on large sample sizes including hotel managers, households and owners of SMEs. In addition, they were subjected to more rigorous analyses using inferential statistics, and thus could be generalized to all owners and managers of SMEs in the three countries in Eastern Europe, all households living in Klan Valley in Malaysia and small hotels in metropolitan area of Accra, Ghana. It is, therefore, apparent that while barriers to transition to circular economy in developed countries are behavioural, attitudinal, institutional and economic, it is still not clear whether the same applies in developing countries such as the western region of Kisumu with a unique cultural and socioeconomic context. Based on the foregoing findings and conclusions, the following hypothesis is deduced:

H₅: The level of environmental policy awareness by tourism enterprise managers is positively related to the extent of circularity in tourism, and it is mediated by environmental attitude.

Although the implementation of the circular economy is undermined by many constraints, there are isolated cases where its application has yielded positive outcomes attributable to some facilitating factors. For instance, a case study of four established paper and beverage industries in Europe found that the transition to circular economy is enhanced by circular trends, government pressure, market sustainability trends and changes in consumer preferences in favour of green products (Franzo, Urbinati, Chiaroni and Chiesa, 2021). In addition, training, government policy such as tax and financial incentives directed to the small and micro tourism enterprises, support from supply chain agents, and national awareness promote circular practices (Costa, Rodriguez, Silva and Pacheco, 2022). In Tanzania, the likelihood of circular transition is enhanced by some level of education, household income, peer group influence and incentives (Chukwuone, Amaechina, and Ifelunini, 2022). The literature underscores the role of government policy, dynamism in consumer taste and preferences and institutional factors in driving circularity in tourism economy. However, it may not be accurate to assume that the identified factors are equally relevant and that they can easily be controlled to driving circularity in the western region of Kisumu with unique social and economic priorities and challenges. Therefore, the following hypothesis follows from the literature:

H₆: The level of employees' training is positively associated with the integration of circularity practices within the tourism sector.

2.1.4 Summary

The circular economy is a term used to refer to an economic system in which economic growth is pursued with minimal waste, pollution and other adverse environmental impacts. In other words, it is the economy intentionally designed to be regenerative and restorative through the preservation of value, reduction in the material input of production and the extension of service life of product, material or components. Sustainable development, which is driven by circularity, is a form of development that is consistent with both intragenerational and intergenerational equity. In the circular economy, materials, components and products are assumed to embody some value whose extraction is implemented at different stages, namely redesign, reuse, recycle, refurbish, among others, to confer resource efficiency, minimal environmental impacts, a diversified economy and social equity. The widespread application of circularity in the tourism economy is still dismal despite its potential benefits. This is partly attributed to myriad barriers which are institutional, economic and political. The key enablers of circularity include government influence in the form of financial and tax incentives, education and national awareness.

3. Methodology

3.1 Overview

The section covers research design, population, sample and participants. Additionally, it includes the data collection instruments, variable definitions and materials. Lastly, it covers the definition of the proposed structural model, procedure for data analysis, ethical considerations and data set screening.

3.1.1 Research Design

The study adopted an explanatory and predictive modelling approach in which the relationship of the various exogenous constructs and the target endogenous constructs was determined through path analysis. The survey was used to collect primary data from different tourism facilities, which were geographically dispersed within the regions of western Kisumu. The facilities were identified from a sampling frame in the form of a database maintained by the tourism regulatory authority. The data was collected over a period of two weeks, from the

beginning of August through mid-August 2025, through the use of an online questionnaire administered through the Kobo platform.

3.1.2 Target Population, Sampling and Unit of Analysis

Table 1 Type Tourist Facilities

	Frequency	Percent	Valid Percent	Cumulative Percent
Guest House	57	24.6	24.6	24.6
Home Stays	47	20.3	20.3	44.8
Hotels	32	13.8	13.8	58.6
Lodges	46	19.8	19.8	78.4
Restaurants	50	21.6	21.6	100.0
Total	232	100.0	100.0	

The unit of analysis was tourism enterprises, which, according to table 1, were categorised into restaurants, hotels, homestays, lodges and guest houses located in the Western regions of Kisumu County.

Table 2 Roles of Respondents across various Tourist Facilities

	Frequency	Percent	Valid Percent	Cumulative Percent
Employee	81	34.9	34.9	34.9
Manager	42	18.1	18.1	53.0
Owner and Manager	26	11.2	11.2	64.2
Supervisor	64	27.6	27.6	91.8
Tour Guide	19	8.2	8.2	100.0
Total	232	100.0	100.0	

From the unit of analysis, the respondents were employees, managers, supervisors, tour guide or owners manager from each hotel, guest house, and restaurant as indicated in table 2. The units of analysis were selected through simple random sampling, and whoever was available to represent the establishment was engaged through the online platform. The minimum required sample size of 69 was determined using Hair (2022), based on a path coefficient of 0.216, 80% power, and a 5% significance level. To account for missing data and low response rates, the study initially targeted 300 respondents from tourist facilities. However, the final analysis was based on 232 valid responses.

3.1.3 Data Collection Instruments, variables and materials

Table 3 Table 4.1.3: Constructs, Indicators and Measurements

ACT: Intensity of Tourist Activity Construct		Measurement
Lactive_1	"On average, how many clients does your business serve per week?"	Integer
Lactive_2	"How many supplies does your business receive every month?"*	Integer

Lactive_3	<i>“How do you rate the scale of your daily business activity?”</i>	5-point Likert Scale.
Lactive_4	<i>“How many suppliers do you handle every week?”*</i>	Integer
SCOPE: Service Scope Construct		Measurement
Sc	<i>“Indicate the number of unique areas or sections where waste is generated in your establishment”</i>	Integer
SIZE: Size of Tourism Facility		Metric
FacSz	<i>“What is the total number of employees in your facility?”</i>	Integer
SKILL: Waste Management Skill Construct		Measurement
w_1	<i>“I have acquired skills in how to manage waste”</i>	5-point Likert Scale.
w_2	<i>“Biodegradable materials are easier to handle than non-biodegradable ones.”</i>	5-point Likert Scale
w_3	<i>“I know how to recycle wastewater for other uses”</i>	5-point Likert Scale.
w_4	<i>“I always advise visitors on how to handle waste in their spaces”</i>	5-point Likert Scale.
w_5	<i>“We have systems for sorting waste into hazardous, biodegradable and non-biodegradable”</i>	5-point Likert Scale.
w_6	<i>“We burn non-hazardous waste for heating water”**</i>	5-point Likert Scale.
CEP: Circularity Penetration Construct		Measurement
ce_1	<i>“We have eliminated the use of plastic cups, plates and bottles in our food and beverage service”*</i>	5-point Likert Scale
ce_2	<i>“We encourage employees to use the public transport system provided by management while commuting to and from work”</i>	5-point Likert Scale
ce_3	<i>“We have installed water-saving showers, taps and cisterns in all our rooms”</i>	5-point Likert Scale
ce_4	<i>“We use solar energy in our lighting systems”</i>	5-point Likert Scale
ce_5	<i>“We mostly use LED lights in our facility”</i>	5-point Likert Scale
TFAC: Type of Tourist Facility		Measurement
tf_1	Guest House	Nominal (Ref. Cat)
tf_2	Home Stay	Nominal
tf_3	Hotel*	Nominal
tf_4	Lodge*	Nominal
tf_5	Restaurant	Nominal
ATTITUDE: Environmental Attitude Construct		Measurement
ttd_1	<i>“We should allow communities to stay and cultivate in Mau Forest”*</i>	5-point Likert Scale
ttd_2	<i>“Climate change and its effects are consequences of human interference with nature”</i>	5-point Likert Scale
ttd_3	<i>“People tend to misuse natural resources”*</i>	5-point Likert Scale
ttd_4	<i>“Roads within national parks and reserves should be tarmacked to ease navigation and enhance the tourist experience”</i>	5-point Likert Scale
POLICY: Environmental Policy Awareness Construct		Measurement
p_1	<i>“We are well informed about the regulation of the National Environment Authority (NEMA)”*</i>	5-point Likert Scale

P_2	<i>"We have a standard operating procedure useful in reducing the impact of our operations on the environment"</i>	5-point Likert Scale
p_3	<i>"We have an environmental protection program, which is implemented periodically to enhance the quality of our environment"</i>	5-point Likert Scale
p_4	<i>"We have recently held a workshop to sensitise employees on NEMA regulations"</i>	5-point Likert Scale
SO: Sustainability Outcome Construct		
SOCB: Societal Benefits Construct		Measurement
sb_1	<i>"We contract members of our community in waste separation, recycling and recovery."*</i>	5-point Likert Scale
sb_2	<i>"We have received complaints of pollution from community members"</i>	5-point Likert Scale
sb_3	<i>"We have established goodwill in our community because we adhered to environmental ethics"</i>	5-point Likert Scale
ECOB: Economic Benefit Construct		Measurement
eb_1	<i>"We have continued to receive many clients from within and abroad"*</i>	5-point Likert Scale
eb_2	<i>"We have enhanced the profitability of our business since we started adopting good environmental practices"</i>	5-point Likert Scale
eb_3	<i>"Our business has created extra jobs for the local community in areas of waste management"</i>	5-point Likert Scale
ENVB: Environmental Benefits		Measurement
envb_1	<i>"Visitors and tourists like the natural environment in which we operate"*</i>	5-point Likert Scale
Envb	<i>"We have received positive commendation from stakeholders following our environmental practices"</i>	5-point Likert Scale
envb_3	<i>"Cases of animal death due to poisoning within our environment have been reported"*</i>	5-point Likert Scale

Data were collected online over one month using Kobo software to maximise the response rate and minimise response time, as the targeted respondents were capable of using electronic devices (Masdek, 2023). The questionnaire was structured to cover eleven main constructs, each measured with a varying number of indicators: five items under intensity of tourist activities, a single item under service scope, and the size of tourism facility, and six items under waste management skills. It also had five items under circularity penetration, five items under types of tourism facility, four items under environmental attitude and four items under environmental policy awareness. Furthermore, the sustainable outcome had three different dimensions, two of which were measured by three items and the other was measured by a single item.

The details of each construct and its respective indicators are shown in table3, and the hypothesised relationship among the constructs is reflected in the proposed structural model in Figure 3.5 below

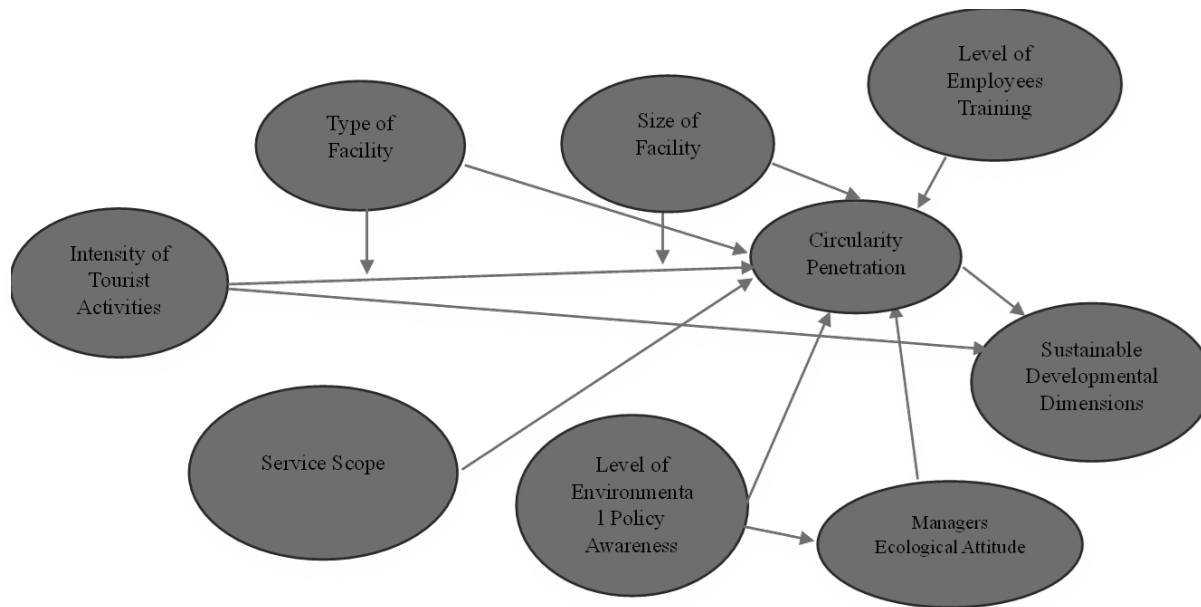


Figure1 The Proposed Structural Model of Circularity Penetration in Tourism Economy

The structural model in Figure 1 above is grounded on the idea that the penetration of circularity within the tourism economy in general or within tourism and hospitality enterprises in particular is negatively associated with the intensity of tourists' activities, which is moderated by the size and type of tourists' facilities. Circularity is also associated with not only the level of employees' training on circularity strategies and sustainable development outcomes, but also with the scope of operations. Lastly, the level of awareness of environmental policy, which is itself mediated by managers' ecological attitudes, is associated with the penetration of circularity.

3.1.3.1 Measurements

The theoretical path model of circularity penetration, according to Table 3, comprises seven constructs: intensity of tourist activities, business operation scope, level of employees' training, circularity penetration, types of tourist facilities, management environmental attitude, sustainable development outcome, and awareness of environmental policy, all of which were adopted from the extant literature. In particular, the intensity of tourist activity is operationalised by four items, each of which is based on a 5-point Likert scale. The constructs and associated items were inferred from Przydatek and Ciaglo,(2020), Senante et al.(2023) and Kaliotasi et al., (2023). Scope of business operations construct is a single-item construct inferred from Kuffer et al., (2023), and Kiausiene, et al.(2024). The level of employee training construct was coined from Zulfa and Nugraheri(2020) and circularity penetration constructs was adopted from Costa el al.(2022), and Kirchherr,et al.(2017). The constructs were both operationalised by five indicators measured on a 5-point Likert Scale adopted with some modification from Kirchherr. Environmental attitude and environmental policy awareness constructs were inferred from Chukwuone et al.(2022) and were both approximated by three indicators originated by the author. Each indicator was measured on a 5-point Likert Scale which was also developed by the author. Lastly, the sustainable development outcome has three abstract dimensions, which include environmental, social and economic benefits were adopted from World Economic Forum,(2020) and Kuffer,et al.(2023).

3.1.4 Data Analysis Procedure

Partial Least Squares Structural Equation Modelling was used to estimate the parameters in both the various measurement models and the structural model. This was facilitated through the use of the SEMINR package, which is embedded in the R programming language. Since PLS SEM is a non-parametric tool, the statistical significance of the indicator and path coefficients was determined using bootstrapping based on 1,000 iterations and 95% bootstrap confidence intervals.

3.1.5 Ethical Consideration

The study respondents were informed about the purpose of the study and were advised to provide their responses unanimously. Furthermore, the study minimised any inconvenience or harm to the respondents by providing an online platform for completing the questionnaire at their convenience after work. Finally, to ensure informed consent by the respondents, the purpose of the study was clearly stated on the first page of the online questionnaire administered through Kobo and respondents' agreement to participate was sought before they could access questionnaire items online.

3.1.6 Data Screening

The data was screened for missing values, outliers and distributional assumptions. Though there were no missing values, some variables, which were measured on a ratio scale, had a positively skewed distribution. The skewed distribution was corrected through logarithmic transformation. The affected variable included three indicators of the intensity of tourist activity construct, and an indicator of the size of the tourism facility. The distribution of all other variables was such that the skewness and kurtosis were less than 2, and thus were considered satisfactory. The few outlier values which were created by erroneous data entry by the respondents were deleted from the affected record and replaced through mean substitution. The screen data set was then prepared for data analysis by recoding the study variables and indicators.

4. Result and Discussion

4.1 Profile of Respondents

Table 1 shows the distribution of the respondents by types of tourist facilities. Respondents mostly came from guest houses, restaurants, home stays and lodges. Others came from hotels. According to the Table 2, most of the respondents were employees, followed by supervisors, managers, owner managers and resident tour guides.

4.2 Path Model Diagnostics

4.2.1 Outer Model

The diagnostics focus on the validity of loadings both at the indicator and construct levels, internal consistency reliability and discriminant validity. Though nine out of twenty-seven indicators across different constructs had loadings above 0.708 thus meeting the required threshold, the ones with loadings between 0.40 and 0.70 were maintained in the path model to conserve the content validity of the affected constructs. Regarding construct validity, the constructs such as ACTIVE, ATTD, ECOB, SIZE, SCOPE, and ENVB had average variance extracted (AVE) values and composite reliability coefficients above 0.5 and 0.60, respectively. However, the TFAC construct that represented the type of facility as a categorical variable had an AVE and a reliability coefficient value of 0.311 and 0.292, respectively. This construct was, however, maintained in the path model to facilitate the interpretation of differences in the penetration of circular practices across different types of facilities.

On the discriminant validity, the Heterotrait–Monotrait (HTMT) ratio was used to determine the extent to which each construct captured phenomena. Discriminant validity was established among constructs other than between SKILL, CEP, SOCB, ECOB and ENVB, between POLICY, CEP, SOCB, ECOB and ENVB, and between ATTD, SOCB, ECOB and ENVB. Furthermore, there was no significant discriminant validity between CEP, SOCB, ECOB and ENVB, between SOCB, ECOB and ENVB, and lastly, between ECOB and ENVB.

4.2.2 Inner Model

The absence of collinearity among the exogenous constructs is indicated by Variance Inflationary Factor values ranging from 1.107 to 1.93 across all the constructs. The statistical significance of the path coefficients was determined based on the percentile method, whereby 1000 bootstrap samples and 95% bootstrap confidence intervals were used. All the path coefficients were significant except the path coefficient linking ACTIVE and SOCB constructs, ACTIVE and ECOB constructs, SCOPE and CEP constructs, SIZE and CEP constructs, and TFAC and CEP constructs. However, the nonsignificant coefficients were retained because of their theoretical relevance. Lastly, based on the coefficient of determination of 0.47, the exogenous constructs in the path model accounted for 47% of the total variation in the ultimate CEP endogenous construct. Since the study was exploratory, the explained variance was deemed satisfactory.

4.3 The Path Model: Hypotheses

The study hypotheses reflected in the proposed structural model in Figure 1 were as follows:

H₁: Intensity of tourists' activities within tourist destination areas is negatively associated with circularity.

H₂: The relationship between the intensity of tourists' activities with sustainable development outcomes is mediated by circularity penetration.

H₃: Circularity is associated with the sustainable development outcomes.

H₄: The scope of tourism and hospitality operations is negatively associated with the extent of circularity.

H₅: The level of environmental policy awareness by tourism enterprise managers is positively related to the extent of circularity in tourism, and it is mediated by environmental attitude.

H₆: The level of employees' training is positively associated with the extent of circularity.

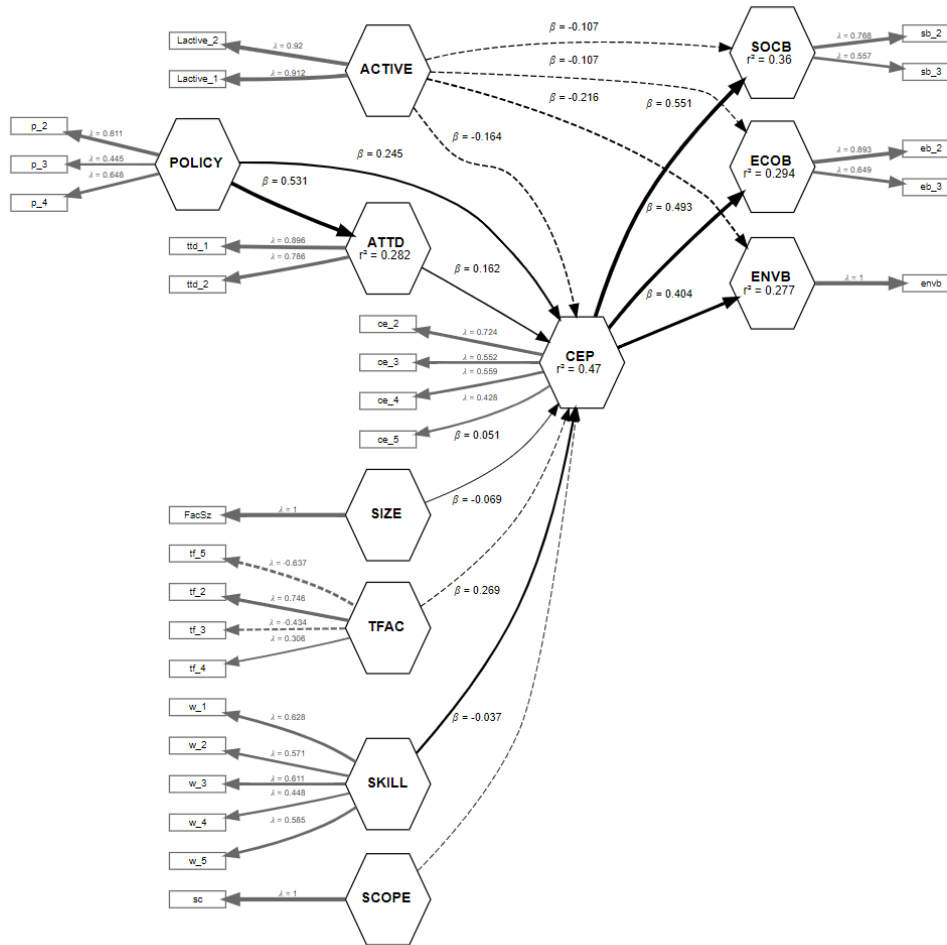


Figure 2 TheEstimated Circular Penetration Path Model

Table 4 Path Coefficients and their significance

Hypotheses	Original Est.	Bootstrap Mean	Bootstrap SD	T Stat.	2.5% CI	97.5% CI
ACTIVE -> CEP	-0.16403313	-0.164669567	0.06188487	-2.6506174	-0.28607175	-0.04047758
ACTIVE -> SOCB	-0.10694118	-0.106893131	0.06648579	-1.6084817	-0.23663563	0.02439646
ACTIVE -> ECOB	-0.10660635	-0.104875334	0.06495827	-1.6411512	-0.23546900	0.02124124
ACTIVE -> ENVB	-0.21597533	-0.218058622	0.05718514	-3.7767736	-0.32574009	-0.10741886
SIZE -> CEP	0.05111982	0.046915495	0.04623446	1.1056649	-0.04088601	0.14052308
TFAC -> CEP	-0.06914512	-0.006814627	0.09988968	-0.6922149	-0.17345054	0.16035698
SKILL -> CEP	0.26931069	0.275305429	0.06499237	4.1437281	0.14211620	0.40091901

Hypotheses	Original Est.	Bootstrap Mean	Bootstrap SD	T Stat.	2.5% CI	97.5% CI
SCOPE -> CEP	-0.03698402	-0.033859386	0.05557810	-0.6654423	-0.14424235	0.07863529
POLICY -> ATTD	0.53094835	0.535301276	0.04835770	10.9796024	0.43612648	0.62696129
POLICY -> CEP	0.24453012	0.243684147	0.07389032	3.3093660	0.09393926	0.38302309
ATTD -> CEP	0.16207222	0.159219370	0.06328278	2.5610792	0.03613587	0.27825257
CEP -> SOCB	0.55102210	0.554563164	0.05906668	9.3288153	0.44066589	0.66138774
CEP -> ECOB	0.49290509	0.498220058	0.06028030	8.1768846	0.37695466	0.61151943
CEP -> ENVB	0.40398112	0.405049251	0.06230142	6.4843000	0.27670627	0.52183809

Table 5 Toatal Effects

ACTIVE	SIZE	TFAC	SKILL	SCOPE	POLICY	ATTD	CEP	SOCB	ECOB	ENVB
ACTIVE	0	0	0	0	0	0.0000000	-0.16403313	-0.19732706	-0.18745911	-0.28224162
SIZE	0	0	0	0	0	0.0000000	0.05111982	0.02816815	0.02519722	0.02065144
TFAC	0	0	0	0	0	0.0000000	-0.06914512	-0.03810049	-0.03408198	-0.02793332
SKILL	0	0	0	0	0	0.0000000	0.26931069	0.14839614	0.13274461	0.10879643
SCOPE	0	0	0	0	0	0.0000000	-0.03698402	-0.02037901	-0.01822961	-0.01494084
POLICY	0	0	0	0	0	0.5309483	0.33058209	0.18215804	0.16294560	0.13354892
ATTD	0	0	0	0	0	0.0000000	0.16207222	0.08930538	0.07988622	0.06547412
CEP	0	0	0	0	0	0.0000000	0.00000000	0.55102210	0.49290509	0.40398112
SOCB	0	0	0	0	0	0.0000000	0.00000000	0.00000000	0.00000000	0.00000000
ECOB	0	0	0	0	0	0.0000000	0.00000000	0.00000000	0.00000000	0.00000000
ENVB	0	0	0	0	0	0.0000000	0.00000000	0.00000000	0.00000000	0.00000000

Table 6 Total Indirect Effects

ACTIVE	SIZE	TFAC	SKILL	SCOPE	POLICY	ATTD	CEP	SOCB	ECOB	ENVB
ACTIVE	0	0	0	0	0	0	0.00000000	-0.09038588	-0.08085276	-0.06626628
SIZE	0	0	0	0	0	0	0.00000000	0.02816815	0.02519722	0.02065144
TFAC	0	0	0	0	0	0	0.00000000	-0.03810049	-0.03408198	-0.02793332
SKILL	0	0	0	0	0	0	0.00000000	0.14839614	0.13274461	0.10879643
SCOPE	0	0	0	0	0	0	0.00000000	-0.02037901	-0.01822961	-0.01494084

ACTIVE	SIZE	TFAC	SKILL	SCOPE	POLICY	ATTD	CEP	SOCB	ECOB	ENVB
POLICY	0	0	0	0	0	0	0.08605198	0.18215804	0.16294560	0.13354892
ATTD	0	0	0	0	0	0	0.00000000	0.08930538	0.07988622	0.06547412
CEP	0	0	0	0	0	0	0.00000000	0.00000000	0.00000000	0.00000000
SOCB	0	0	0	0	0	0	0.00000000	0.00000000	0.00000000	0.00000000
ECOB	0	0	0	0	0	0	0.00000000	0.00000000	0.00000000	0.00000000
ENVB	0	0	0	0	0	0	0.00000000	0.00000000	0.00000000	0.00000000

4. 3.1 The Relationship between the Intensity of Tourist Activity and the Penetration of Circular Practices.

From the results in Table 4 and Figure 2 above, there is a significant relationship between the intensity of tourist activity (ACTIVE) and the penetration of circularity practices (CEP), which is independent of the type of tourist facility within the tourism economy. A positive change in the level of tourist activity is associated with a decrease in the penetration of circularity practices, 95% CI (- 0.286, -0.004). This finding leads to the failure to reject the first hypothesis that the intensity of tourists' activities within tourist destination areas is negatively associated with circularity, and that this association is moderated by the size and type of tourists' facilities. The increased level of tourists' arrivals and activities undermines the capacity of a destination to cope with increased levels of waste accumulation as a result of tourist activities. This is supported by Przydatek and Ciaglo, (2020), Senante et al.,(2023), and Kaliotasi, et al., (2023), who found that a huge influx of tourists into a destination affects its eco-efficiency and that the seasonal nature of tourism constrains destination capacity to manage waste (Foschi,2025).

4.3.2 The Mediation effects of Penetration of Circularity Practices on the key Sustainable Outcomes

The relationship between the penetration of circularity practices (CEP) and the key sustainable outcomes, namely social benefits (SOCB), economic benefits (ECOB) and environmental benefits (ENVB), is decomposed into direct and indirect effects as indicated in Table 4 and Table 6, respectively. From Figure 1 above, the direct effects, represented by path coefficients, between intensity of tourists' activities (ACTIVE) and each of the sustainable outcomes: social benefits, economic benefits and environmental benefits are respectively $\beta = -0.107$, -0.107 and -0.216 while the corresponding indirect effects, according to Table 6, are $\beta = -0.090$, -0.081 and -0.066 . The findings on the direct effects indicate that high levels of tourist' activity is inconsistent with sustainability benefits. However, among the three indirect effects, only the indirect effect between intensity of tourist activities (ACTIVE) and environmental benefits (ENVB) is significant, 95% CI (-0.118, -0.015). This indicates that tourists' activities on environmental benefits are negatively mediated by circularity practices, partly confirming the hypothesis that the relationship between the intensity of tourists' activities with sustainable development outcomes is mediated by circularity penetration, but in a negative way. The negative mediation by circularity practices may be attributed to inappropriate or inadequate application of circularity practices, or failure on the part of tour operators to appropriately influence tourists behaviours in their interaction with the natural environment and waste management. Although increased level of tourists' activities reduces the destination capacity to handle waste, it can still lead to increased environmental benefits if circularity practices are ubiquitous and appropriately applied by both tourists and tour operators throughout the destination as was previously envisaged by Kuffer et al.,(2023), and Kiausiene et al.,(2024).

4.3.3 The association between Circularity Penetration and Sustainable Outcomes

Table 4.3.1 indicates the association between circularity penetration and the three dimensions of sustainable outcomes, namely, social benefits (SOCB), economic benefits (ECOB) and environmental benefits (ENVB). According to the results in the table, penetration of circularity practices enhances social benefits, 95% CI (0.441, 0.661), economic benefits, 95%CI (0.377, 0.612) and environmental benefits, 95% CI (0.277, 0.522). This finding not only confirms the hypothesis that circularity is associated with sustainable outcomes, but it is also in agreement with the earlier findings of Khan et al, (2021) that the circular economy brings about economic prosperity coupled with less impacts on the environment through efficient resource utilisation, and increased social benefits.

4.3.4 The effect of the Scope of Tourism Operation on Circularity Penetration

According to the results in Table 4, there is no significant effect of the scope of tourism operation (SCOPE) on penetration of circularity (CEP) within the tourism economy, 95%CI (-0.144, 0.079), leading to the rejection of the hypothesis that the scope of tourism and hospitality operations is negatively associated with the extent of circularity, contrary to the earlier finding that circularity in tourism is limited only along value chains such as local handicraft, food and beverage, accommodation, tour guiding, and transport (Foschi et al., 2025). The key insight from this finding is that the scope of tourism operation does not in any way influence the penetration of circularity practices. Circularity practices can be equally applied regardless the extent of the tourism supply or value chain.

4.3.5 The Mediating effect of Environmental attitude on the association between Environmental Policy awareness and Penetration of Circularity Practices.

Table 4 indicates that a significant direct positive effect of the awareness of environmental policy (POLICY) on penetration of circularity, 95% CI (0.094, 0.383). Moreover, Table 6 indicates that the indirect effect of awareness of the policy on penetration of circularity is positive and significant, 95% CI (0.0195, 0.1560). Also, the excess of the total effect of environmental policy awareness on the penetration of circularity, as indicated in table 5, over its direct effect on the circularity penetration as indicated in table 4, infers the positive mediation of environmental attitude (ATTD) on the relationship between environmental policy awareness and circularity penetration. The result confirms the previous study findings of Ahmadov et al. (2025), Masdek (2023), and Mensah and Ampofo, (2020) that sustainable waste management is associated with a positive attitude towards waste disposal and influences environmentally sustainable practices. It further contributes new insight by revealing the mediating role of attitude in the effective implementation of environmental policy.

4.3.6 The association between the Level of Waste Management Training and Circularity Penetration.

Lastly, according to the findings in Table 5, there is a significant positive effect of employee training on waste management (SKILL) on the penetration of circularity (CEP), 95% CI (0.142, 0.401). The finding, therefore, leads to the failure to reject the hypothesis that the level of employees' training is positively associated with the extent of circularity, thereby confirming the observations of Costa et al, (2020) and Chukwuone et al (2022) that training and some level of education enhance transition to circularity.

5.1 Theoretical Contribution

The study contributes to the new understanding of the negative relationship between tourism growth and the capacity to handle the environmental challenges brought about by such growth, especially in suburban areas typified by Kisumu County. It also highlights the role of widespread adoption of circularity as a means of sustaining the ability of the popular yet sensitive destinations in developing countries to cope with a high level of

tourism activity. It however, challenges the thinking that circularity penetration in tourism economy is limited to certain aspects of the tourism value and supply chain, or scope of operations (Foschi et al., 2025).

Many developing countries depend on their natural assets to earn foreign exchange and have ratified environmental policies to ensure their conservation. The study contributes towards strengthening such policies by revealing the positive mediation role of ecological attitude as a prerequisite to efficacious environmental policy in the conservation of natural resources. Also, the study found that favourable attitudinal change among tourism business operators is a core mechanism through which environmental policy can be translated into desirable behavioural change, leading to a sustainable interaction between the tourism industry and the ecological resources.

Lastly, the current study has highlighted the link between training on waste management and the adoption of circularity practices, and the invariance of the penetration of circularity principles and practices on the scope of tourism operations. This means that training in waste management is likely to increase environmental sensitivity and a higher appreciation of the need for behaviour change and adoption of circularity practices regardless of operational scope of the tourism industry at macro level, or tourism business at the micro level. This is very critical in developing countries, where there is widespread ignorance about the value of environmental protection.

5.2 Practical Implications

Firstly, the negative relationship between the level of tourist activities and circularity penetration calls for heightened promotion of environmental ethics among tour guides, operators, visitors and tourists during high tourism seasons. Tour operators and tour guides who take visitors to sensitive ecosystems should put a lot of emphasis on leading by example in exhibiting behaviours which are not harmful to the ecosystem. For example, using a larger tour van as opposed to having many small tour vans during game drives, encouraging visitors to buy drinks in larger containers instead of many small plastic containers, ensuring that the tour vans are adequately equipped with waste disposal equipment, where visitors and tourists can discard waste materials to be reused for other purposes upon conclusion of a tour and discouraging visitors from feeding wild animals or wasting water. Also, management of protected areas needs to invest in the monitoring systems to ensure that lodge operators and investors in tented camp operations have a recycling system in place, which reduces the discharge of harmful effluents into the nearby water systems. They also need to provide supportive information and physical infrastructure to guarantee responsible visitor behaviours as they interact and experience wildlife at all stages in a tour.

It has been found that the adoption of circularity practices and principles is enhanced by training on waste management, and that an ecological attitude is a prerequisite to the effective implementation of environmental policy. The findings have implications for tourism facility operators within Kisumu county, whose employees have limited knowledge about treating and managing waste emanating from their establishments, and for community members living adjacent to protected areas who have yet to appreciate the importance of embracing circularity practices. Holding regular staff training within tourism establishments and neighbouring communities, especially during low tourism seasons, presents an opportunity for tourism facility managers and community members to benefit from resource efficiency and extra income. The facility manager who demonstrates their corporate social responsibility by empowering adjacent community members with the skills in resource reuse, repurposing and recycling required for enhanced penetration of circularity enhances the capacity of the community to act as a sink for used equipment, used textiles, and old furniture and other non biodegradable materials that can be innovatively repurposed for alternative uses and sold by community members to other users especially to local children orphanages common in Kisumu county. This would create a new market for such transformed and valorised equipment and materials, giving community members avenues for new or extra income during low seasons instead of having them accumulate in landfills as waste materials.

5.3 Limitations and Future Research Recommendations

The weaknesses of the study include reliance on a limited number of indicators to capture specific constructs, such as the scope of tourism operations (SCOPE), size of tourism firms (SIZE), the level of tourism activities (ACTIVE), and the three dimensions of sustainable tourism benefits (ECOB, ENVB, and SOCB). Additionally, the findings are generalisable to the tourism economy of the western region of Kisumu County because of the inclusion criteria, which primarily biased the tourism enterprises within the region. Furthermore, some information might have been lost by using a 5-point Likert scale instead of a 7-point or 9-point scale among various items measured on an ordinal scale. Lastly, reliance on quantitative data prevented the capture of subjective insights that could have enriched the overall findings. In light of the foregoing short comings, future research should adopt a more inclusive sampling frame for random sample selection to enable a more global generalisation across the national tourism economy, and consider enriching single item constructs such as scope of tourism operation and firm size with more indicators to capture their enough conceptual dimensions.

6. Conclusion

The overall aim of the study was to determine factors which affect the penetration of circular practices within the tourism economy of the western region of Kisumu in Kenya. From the results, it has been established that the penetration of circularity is influenced by a myriad of factors, namely that the intensity of tourists' activities in a destination decreases the penetration of circular practices if the affected destination has insufficient capacity to cope with accumulated waste. Furthermore, high levels of tourists' activities are not only incompatible with sustainability outcomes but also have negative effects on environmental benefits that are mediated by low or non-penetration of circularity practices. Also, destinations which adopt circularity practices can significantly accrue sustainability benefits. However, the operational scope of tourism enterprises does not affect the penetration of circularity practices. Last but not least, the awareness of environmental policy and regulation influences circularity penetration through a favourable environmental attitude nurtured through training and some level of education.

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