Open Access
J. Glob. Innov. Agric. Sci., 2025, 13(x): xxx
ISSN (Online): 2788-4546; ISSN (Print):2788-4538
DOI: https://doi.org/10.22194/JGIAS/25.1715
http://www.jgiass.com

Influence of Selected Institutional Factors on Adoption Intensity of Circular Economy Practices Among Sugarcane and Rice Processors in Western Kenya

Ezekiel Areri Kamau[1]*, Moses Mutharime Mwito[1], Paul Mugambi Joshua[1], Hezron Rasugu Mogaka[2], Florence Kaumi Kirimi[2], Charles Nyambane Onyari[3], Lydia Muriithi[3], Otara Nyaboe Elvin[2], Shadrack Kiprotich[2], Moses Muchangi Njiru[2], Scholastica Kavata Mutungi[2] and Annastacia Kyalo[2]

[1]Department of Economics, University of Embu, Embu, Kenya; [2]Department of Agricultural Economics and Extension, University of Embu, Embu, Kenya; [3]Department of Water and Agricultural Resource Management, University of Embu, Embu, Kenya
*Corresponding author's email: ezekielkamau45@gmail.com

The transition to circular economy (CE) is very critical for sustainable development in industrial sector however, its adoption remains limited particularly in developing countries. This study examines the selected institutional factors influencing adoption intensity of circular economy (CE) practices among sugarcane and rice processors in Kisumu, Siaya, and Busia counties in Western Kenya. Given the rising waste crisis in Kenya coupled with- Western Kenya's growing need for sustainable industrial practices, this study assesses the key institutional drivers of adoption intensity of circular economy practices, among them, technical training, regulatory support, extension services, policy awareness, NGO support, and access to grants. A census survey of 19 processors of sugarcane and rice was conducted using structured questionnaire and semi-structured interview. Utilizing a mixed-methods approach, this study combines qualitative insights with quantitative analysis through an ordered logistic regression model. Descriptive statistics indicate a low level of access to technical training (M = 2.368, SD = 0.955), insufficient regulatory support (M = 1.842, SD = 1.425), and a lack of awareness regarding CE-related policies (M = 1.632, SD = 1.674). The regression analysis shows that technical training (β = 2.852, p = 0.032), regulatory support (β = 1.115, p = 0.09), and availability of grants (β = 1.532, p = 0.072) significantly affect the intensity of adoption. Conversely, support from NGOs and awareness of policies have less pronounced correlations with adoption. These results highlight the necessity of structured institutional support, financial incentives, and regulatory frameworks in promoting CE adoption. Additionally, the study recommends for minimization of waste and increased resource efficiency in Western Kenya's sugarcane and rice processing sector.

Keywords: Adoption intensity, circular economy, rice processors, sugarcane processors, institutional factors, waste management.

INTRODUCTION

Global industrialization has contributed significantly to accumulation of waste over time, thereby necessitating promotion of circular economy (CE) (Halog and Anieke, 2021). CE is guided by the principles of reusing, reducing, and recycling materials all aimed at sustainable development and waste reduction (Kirchherr *et al*., 2023). The increasing global interest in CE provides an opportunity to improve society's resource usage efficiency and sustainability. According to the United Nations Environmental Program (UNEP, 2024), worldwide trash output is expected to increase from 2.3 billion tons in 2023 to 3.8 billion tons in 2050, unless immediate action is taken to enhance waste management (Hub, 2024). Consequently, most firms are concentrating more on increasing and optimizing resource reuse and reducing capital, therefore prioritizing the CE concept. Despite these efforts, the current global economy is estimated to be less than 10% circular (Salmenperä *et al*., 2021). This

Kamau, E.A., M.M. Mwito, P.M. Joshua, H.R. Mogaka, F.K. Kirimi, C.N. Onyari, L. Muriithi, O.N. Elvin, S. Kiprotich, M.M. Njiru, S.K. Mutungi and A. Kyalo. 2025. Influence of Selected Institutional Factors on Adoption Intensity of Circular Economy Practices Among Sugarcane and Rice Processors in Western Kenya. Journal of Global Innovations in Agricultural Sciences 13(x): xxxxx.
[Received 27 Feb 2025; Accepted 2 Jun 2025; Published (online) xx Xxx 2025]

indicates that there is minimal application of efficient waste management practices globally.

Waste management in Sub-Saharan African (SSA) countries is of great concern due to the continuous practice of the old traditional linear waste economy, which comprises taking, making, and disposing of garbage. The linear waste economy poses dangers to global environmental sustainability and aggravates global warming through the generation of greenhouse gases (GHG) (Debrah *et al*., 2022). According to Debrah *et al.* (2022), there is a high projection of the growth rate of waste production in SSA as illustrated in Figure 1. Figure 1 illustrates the projected growth of waste production in SSA by 2025 as compared to population growth rate. The figure emphasizes the rapid increase in waste generation as compared population growth indicating that there is need for preparedness for waste management practices hence the need for CE practices. Due to the high waste production, around 36 countries in SSA are affected by land degradation (Mangoro and Kubanza, 2023). This has resulted in reduction in crop yields, jeopardizing of safety and security of agricultural produce and even affecting human health in the region.

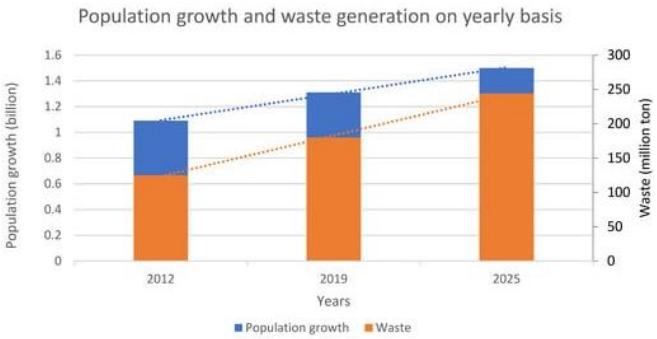

Figure 1. Population Growth and Waste Generation in SSA (Debrah *et al.*, 2022).

Kenya is among few African countries that have started championing for CE practices by formulating rules and guidelines that support its implementation. However, there is limited evidence to show policies that have been implemented to support CE (Muriithi and Ngare, 2023). Existing literature on CE adoption has primarily focused on regulatory constraints and market-related barriers, with limited attention given to institutional factors that shape CE adoption at the firm level. For instance, Singh *et al.* (2020) analyzed CE barriers in the Indian mineral sector and found that government regulations and market dynamics were major obstacles, but the study did not assess the role of institutional incentives such as training, policy awareness, and financial support. Similarly, Gedam *et al.* (2021) examined CE barriers in food supply chains in developing countries and highlighted the absence of technology and high costs as key barriers. However, their study did not account for the influence of government and NGO support on CE adoption, hence need for empirical research to assess the institutional barriers influencing the adoption intensity of circular economy practices. The implication is that there is need for proper clarification of policies to support CE in Kenya where rice ranks as the third most significant cereal crop after maize and wheat, with approximately 28% of its production resulting in rice husk as a by-product and waste (Njagi *et al*., 2022). Additionally, Kenya produces about 1.6 million tons annually of sugarcane bagasse, which holds potential for use in modern commercial activities such as bio-energy and fuel production, composting and soil amendment (particularly bio-char), high quality animal feed, and activated carbon (charcoal) among others. However, this waste is typically discarded, burned, and left in open fields where it poses environmental risks (Daniel *et al*., 2020). Burning and dumping rice husk and sugarcane bagasse in uncontrolled conditions results in air, soil, and water pollution and stands the potential of being a major contributor to GHGs.

Sugar industries in Western Kenya offer opportunities like creation of employment opportunities, but the society fails to fully enjoy because of negative externalities arising from the factory's processes leading to soil and water pollutions (Ojijo, 2023). Transitioning from this current situation to CE economy needs creation of awareness (Gonella *et al*., 2024). Organizations like World Bank have tried to put measures to clean the environment but the measures have failed because sugar mills in Western Kenya continue to pollute the environment (Andolo, 2023). This study aims to address the existing research gap by examining how institutional factors such as policy awareness, technical training, regulatory support, NGO involvement, and financial incentives affect the adoption intensity of CE practices among sugarcane and rice processors in Western Kenya. For this study adoption intensity is measured in terms of the proportion of total waste which is under CE. Higher adoption intensity reflects deeper commitment to CE principle. By addressing these institutional challenges, the study aims to enhance CE adoption, improve industrial sustainability, and support environmental conservation efforts in Kenya.

MATERIALS AND METHODS

***Study area*:** The study was conducted in the Counties of Busia, Siaya, and Kisumu in the Western region of Kenya. Siaya County borders Busia County to the North and Kisumu County to the South East. The main economic activities in the region are fishing and agricultural production, where the main crops grown are rice, sugarcane, and some cash crops that include cotton and tobacco.

***Target population*:** This study's targeted population consisted of all sugarcane and rice processors from the selected Counties both small, medium and large-scale processors.

***Sampling technique and sample size*:** The census method was appropriately employed covering all the 19 sugarcane and rice processors with main target being on one manager in each mill. The choice of census technique was important since it provided sufficient information avoiding any bias that could have been caused by sampling. Similarly, the census method was appropriate because of the smaller sample size comprising of 19 (14 rice millers and 5 sugarcane millers) small, medium and large-scale documented sugarcane and rice processors in the three Counties.

***Model specification*:** To analyze the data on institutional factors influencing adoption intensity of circular economy practices among sugarcane and rice processors in Western Kenya, an ordered logit regression model was employed. This model is suitable for analyzing ordinal dependent variables and has been applied in various studies such as Casinillo *et al*. (2024) to explain the levels of adoption of vegetable technologies among youth members of 4-H clubs in Philippines.

The model assumes unobserved continuous variable Y^* which represents the true adoption intensity of circular economy and the variable is determined by a set of independent variable X and the error term;

$$Y^* = \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \epsilon \quad \text{Eq.1}$$

Where Y^* is unobserved propensity to adopt circular economy, $X_1, X_2 \ldots X_n$ are institutional factors affecting adoption intensity, $\beta_1, \beta_2 \ldots \beta_n$ are coefficients of independent variable and ϵ is the error term assumed to take a standard logistic distribution with a zero mean.

Given that the Y^* is unobserved, we assume that it is mapped into ordinal dependent variable r (observed adoption intensity) using threshold values (α_j):

$$r = \begin{cases} 1, & if\ Y^* \le \alpha_1 \\ 2, & if\ \alpha_1 < Y^* \le \alpha_2 \\ 3, & if\ \alpha_2 < Y^* \le \alpha_3 \\ & \cdot \\ & \cdot \\ & \cdot \\ J, & if\ Y^* > \alpha_{J-1} \end{cases} \quad \text{Eq.2}$$

Where r represents ordinal categories of adoption intensity, $\alpha_1, \alpha_2 \ldots \alpha_{J-1}$ are threshold parameters to be estimated while J is the highest adoption category.

The probability that an observation falls into category j or bellow is given by:

$$P(r \le j) = P(Y^* \le \alpha_j) \quad \text{Eq.3}$$

Substituting the unobserved variable Y^* and then rearrange the Eq.we get:

$$P(r \le j) = P(\beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \epsilon \le \alpha j \quad \text{Eq.4}$$

$$P(r \le j) = P(\epsilon \le \alpha - (\beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n)) \quad \text{Eq.5}$$

Since the ϵ follows the standard logistic distribution, the cumulative distribution function of the logistic distribution is given by:

$$F(\epsilon) = \frac{1}{1+e^{-\epsilon}} \quad \text{Eq.6}$$

Replacing to Eq.6 and taking the logit transformation we get the general regression Eq.for model specification as:

$$P(r \le j) = F(\alpha_j - (\beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n)) \quad \text{Eq.7}$$

$$\log\left(\frac{r \le j}{1 - r \le j}\right) = \alpha_j - \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n \quad \text{Eq.8}$$

$$logit\big(P(\gamma \le j)\big) = \alpha_j - \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n \quad \text{Eq.9}$$

This model allowed for the identification and interpretation of the key institutional factors influencing adoption intensity of circular economy practices based on their ordered levels.

RESULTS AND DISCUSSION

***Descriptive statistics*:** The descriptive statistics providing an overview of key variables influencing adoption intensity, is as presented in Table 1.

Table 1. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Technical training	19	2.368	0.955	1	4
Regulatory support	19	1.842	1.425	0	4
Extension services	19	2.000	1.732	1	4
Policy Awareness	19	1.632	1.674	0	4
NGOs Support	19	0.895	1.243	0	3
Access to grants	19	0.684	1.003	0	3

From Table 1, it can be noted that access to technical training has a mean value of 2.368, with a standard deviation of 0.955. The minimum score of 1 indicates that some processors never accessed technical training, while the maximum score of 4 suggests that others accessed it very frequently. On average, processors reported that they rarely accessed technical training. The relatively low standard deviation indicates that respondents' perceptions were fairly consistent, suggesting general agreement that access to technical training is limited. The limited range from never to very frequently implies that respondents did not report extreme views, highlighting a moderate level of technical training access among the processors. Interviews with processors revealed that while some larger firms have invested in modern technologies such as bio-waste conversion and water recycling systems, many smaller processors lack the financial resources and technical training skills to adopt these innovations. For instance, one of the respondents from a rice processing facility in Kisumu stated that:

"We see advanced machines being used elsewhere, but we cannot afford them. Even when funding is available, the technical know-how to operate and maintain such technology is missing."

This qualitative insight aligns with the moderate mean score observed in the quantitative results and underscores the need for both financial and technical support to enhance technology adoption.

The level of regulatory support from the government has a mean value of 1.842 with a standard deviation of 1.425, and ratings range from not supportive to very supportive. The mean value, being closer to 2 (less supportive), indicates that respondents generally perceive the regulatory environment as less supportive. The high standard deviation points to significant variability in how the regulatory environment is viewed, with some participants perceiving strong regulatory support, while others report minimal or no support. This variation could stem from differing levels of exposure to regulatory frameworks or the perceived effectiveness of these regulations in supporting circular economy practices. Qualitative data reveal that while government policies supporting circular economy (CE) practices exist, enforcement is weak. A processor from Siaya mentioned:

"Policies are there, but implementation is another story. Many processors don't comply because monitoring is irregular, and penalties are rarely enforced."

This suggests that policy awareness and enforcement mechanisms need to be strengthened to ensure that regulatory support translates into tangible impacts on adoption intensity. On average processors moderately accessed extension services on circular economy practices. The results on extension services revealed a standard deviation of 1.732. The relatively high standard deviation suggests that there is greater variability in the responses. This could mean that while some processors access extension services frequently, others may have limited or inconsistent access. This variability points to differences in how extension services are provided or accessed across different processors, with larger processors possibly having more access compared to smaller ones. The minimum score indicated rarely accessed extension services, and the maximum score was frequently accessed the extension services.

The level of awareness on policies supporting CE practices was found to have a mean score of 1.632 corresponding to less aware with a standard deviation of 1.674. The responses on policies awareness on policies supporting CE practices ranged from not aware (0) to very aware (4). The mean score suggests that, on average, participants have a less knowledge regarding policies related to circular economy practices. However, the high standard deviation indicates considerable diversity in the awareness levels, with some participants being very aware of the policies, while others reflecting no awareness at all. Processors in areas with active government or NGO-led training programs displayed higher awareness, while those in remote regions lacked exposure. As one rice processor in Busia stated:

"I have never heard of circular economy policies. We only hear about taxation policies and environmental compliance when we are fined."

This highlights the need for targeted awareness campaigns and capacity-building initiatives to bridge the knowledge gap.

The level of support from NGOs has the lowest mean score of 0.895, with a standard deviation of 1.243, and values ranging from 0 to 3. This low mean suggests that respondents perceive limited support from non-governmental organizations (NGOs). The high standard deviation, greater than the average, indicates that while most participants experience little to no support from NGOs, there are a few who received higher levels of assistance. This finding underscores the lack of significant NGO involvement in promoting circular economy practices among sugarcane and rice processors, which could be a crucial area for intervention. For instance, a rice processor Busia noted:

'We know about some innovations but have never been able to get someone to show us how to use them. We don't have extension officers visiting us regularly to teach us these things.'

This feedback reflects the varying access to extension services, where a lack of consistent engagement from extension officers or local agencies appears to hinder some processors' ability to adopt new practices effectively.

Lastly, the ease of access to grants has a mean of 0.684 and a standard deviation of 1.003, with scores ranging from no access to moderately accessible. This is the lowest mean among all the variables, indicating that most respondents have no access to grants. The standard deviation, although somewhat low, still reflects a certain degree of variation, with some respondents reporting slightly better access to grants while others have little or no access to these services. The overall trend however, reflects a significant challenge in securing financial resources to support CE practices, which can be a major barrier to adopting new technologies in the region.

The low mean scores for the variables in the quantitative analysis suggest that NGOs and financial institutions play a limited role in supporting circular economy adoption. Qualitative findings confirm this challenge. Many processors indicated that existing financial institutions prioritize conventional business models over sustainability-focused investments. A sugarcane processor in Kisumu remarked:

"Donors don't understand circular economy. When you ask for incentives to invest in waste recycling, they say it's risky and unprofitable."

These findings suggest that financial institutions and NGOs need to develop tailored support programs to encourage circular economy adoption.

***Correlation analysis*:** The correlation analysis of variables sheds light on the factors that influence the intensity with which sugarcane and rice processors in Western Kenya use circular economy methods. The findings show varied degrees of correlation between adoption intensity and institutional aspects such as training, regulatory support, extension services, policy awareness, NGO support, and grant accessibility. A substantial positive connection (0.603) exists between adoption intensity and technical training, suggesting

that entities that possess more technical expertise are more likely to embrace circular economy methods. This underlines the importance of capacity-building efforts for providing processors with the skills and information they need for executing sustainable practices. Regulatory support exhibits the strongest relationship (0.766) with adoption intensity, demonstrating that favorable regulations, incentives, and enforcement systems considerably increase the adoption of circular economy initiatives. This underscores the crucial role of government policies in encouraging sustainability in the sector, as businesses that operate within well-structured regulatory frameworks are more likely to embrace circular economy ideas. The correlation analysis among variables is presented in Table 2.

Table 2. Matrix of correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Adoption intensity	1.000						
(2) Technical training	0.603	1.000					
(3) Regulatory support	0.766	0.453	1.000				
(4) Extension services	0.657	0.369	0.630	1.000			
(5) Policy Awareness	0.335	0.090	0.347	0.537	1.000		
(6) NGOs Support	0.135	-0.340	0.241	0.000	0.167	1.000	
(7) Access to grants	0.179	-0.452	0.158	0.320	0.192	0.239	1.000

Extension services also show a significant relationship (0.657) with adoption intensity, indicating that enterprises who benefit from providing guidance programs and knowledge transfer are more likely to implement circular economy initiatives effectively. This suggests that frequent meetings with extension authorities and industry specialists could assist raise awareness and practical application of circular processes.

Policy awareness has a slight correlation (0.335) with adoption intensity. While policy awareness is crucial in impacting organization behavior, the comparatively low correlation implies that awareness may not be sufficient for promoting adoption. Firms might require additional incentives, training, and enforcement methods to turn knowledge into action.

A slight relationship (0.135) exists between NGO support and adoption intensity. It implies that, while NGOs help to promote the principles of the circular economy, their influence may be less direct or significant than regulatory support, training, and extension services. Their perspective may be more complementary than a key driver of adoption.

Likewise, there is a weak positive relationship (0.179) between grant availability and adoption intensity, suggesting that while financial assistance may promote adoption, it is not the most significant factor. This suggests that while money is useful, adoption is more significantly influenced by other institutional elements like regulations, training, and extension services.

In general, regulatory support, technical training, and extension services are among the most effective factors in supporting the implementation of circular economy techniques. Policy awareness, while important, must be supplemented by practical assistance. The less significant relationships between NGO support and grant access exhibit that, while financial and non-governmental measures may help to drive adoption, they may not be the key a variable. These findings emphasize the importance of a strong institutional framework that includes training, regulatory support, and advisory services to promote widespread adoption of circular economy strategies in the sugarcane and rice processing industries.

***Regression analysis*:** An ordered logistic regression model was used, given the ordinal nature of the dependent variable (Adoption Intensity). The categories for adoption intensity were defined as; Very low adoption intensity (0-25%), Moderate adoption intensity (25.1-50%), High adoption intensity (50.1-75%), Very high adoption intensity (75.1-100%). The outcome of the analysis was to determine how each independent variable influenced the likelihood of being in a higher or lower adoption category. Six independent variables were included in the analysis: Frequency of access to technical training on waste utilization, level of regulatory support from the government, frequency of access to extension services on CE practices, level of awareness on policies supporting CE practices, level of support from NGOs, and, the ease of access to grants. The model showed strong explanatory power, with a pseudo R-squared value of 0.548, indicating that institutional factors explain a substantial proportion of the variance in adoption intensity. The chi-square test was significant ($\chi^2 = 27.00$, $p < 0.001$), suggesting the model's overall goodness-of-fit. The key outputs from the model are summarized in the Table 3.

The results in table 3 show how different institutional factors relate to the intensity of adopting circular economy practices, with a focus on their statistical significance and direction of impact. The coefficient for technical training is 2.852, meaning that an increase in access to technical training significantly increases the likelihood of a processor moving into a higher adoption intensity category. The p-value (0.032) indicates that this effect is statistically significant at the 5% level, confirming the crucial role of technical training in driving circular economy adoption. The t-value (2.15) is greater than 1.96, reinforcing the significance of the relationship. The findings from this study are in line with the findings by Mishra *et al.* (2024), which identified technological upgrade as an essential enabler of CE adoption. The relatively large standard error (1.328) suggests some

Table 3. Ordered logistic regression results.

Adoption intensity	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Technical training	2.852	1.328	2.15	0.032	0.249	5.456	**
Regulatory support	1.115	0.657	1.70	0.09	-0.172	2.403	*
Extension services	0.481	0.617	0.78	0.435	-0.728	1.691	
Policy Awareness	-0.111	0.504	-0.22	0.826	-1.100	0.878	
NGOs Support	0.886	0.652	1.36	0.174	-0.392	2.164	
Access to grants	1.532	0.853	1.80	0.072	-0.139	3.203	*
cut1	9.741	3.757	.b	.b	2.377	17.106	
cut2	13.884	4.832	.b	.b	4.415	23.354	
cut3	17.595	5.871	.b	.b	6.088	29.102	
Mean dependent var		2.053	SD dependent var			1.026	
Pseudo r-squared		0.548	Number of obs			19	
Chi-square		27.000	Prob > chi2			0.000	
Akaike crit. (AIC)		40.281	Bayesian crit. (BIC)			48.781	

**** p<.01, ** p<.05, * p<.1*

variability in responses, possibly due to differences in the quality or availability of training programs among processors. The strong, statistically significant effect of technology access on adoption intensity aligns with qualitative findings. Processors emphasized that training sessions enhance awareness, improve technical skills, and build confidence in adopting waste utilization strategies. A processor in Busia noted:

"Before attending training, we used to discard rice husks as waste, but after learning about alternative uses, we started converting them into briquettes for fuel. Now, we see waste as a valuable resource rather than a disposal problem."

This suggests that interventions focusing on frequency access to technical training could significantly enhance adoption rates.

***Level of regulatory support from the government*:** The coefficient for regulatory support is 1.115, indicating that processors who receive greater regulatory support are more likely to adopt circular economy practices at higher intensities. The p-value (0.09) suggests that this relationship is statistically significant at the 10% level, meaning that while regulatory support is important, it is not the most dominant factor influencing adoption intensity. The t-value (1.70) is slightly below 1.96, which suggests a moderate effect. The standard error (0.657) indicates a fair level of precision in the estimate. While the relationship is not as strong as that of technical training, the finding suggests that government policies and regulatory frameworks can play a role in fostering the adoption of circular economy practices, although their effect may not be as pronounced. This is in line with the findings by Ting *et al.* (2023) which found that lack of regulatory framework may decline the adoption of circular business models in developing and less developed countries. Qualitative findings indicate that inconsistent enforcement and bureaucracy hinder the effectiveness of regulatory frameworks. A respondent noted:

"Sometimes policies favor big companies that can comply, while small processors are left struggling."

This highlights the need for policies that cater to both large and small-scale processors. The findings is in line with a study conducted by Pasqualotto et al. (2023) reviewing on categorization of barriers and drivers of circular economy adoption which revealed lack of support from CE in form of rules , laws and norms is a major obstacle of implementation of the CE.

***Ease of access to grants*:** The coefficient for access to grants is 1.532, suggesting that processors who have access to financial grants are more likely to engage in higher-intensity circular economy practices. The p-value (0.072) makes this effect statistically significant at the 10% level, meaning that grants play an important but not dominant role in adoption intensity. The t-value (1.80) is just below 1.96, indicating a moderate level of significance. The standard error (0.853) indicates that there may be some variance in the effects of grants on certain processors, which could be caused by differences in grant quantity, accessibility, or funding conditions. The finding is particularly significant because it is often necessary for processors to secure funding in order to invest in the infrastructure and technological advances needed to adopt circular economy practices. According to Nassanbekova (2024), the circular economy is primarily motivated by financial incentives such as grants and subsidies, but the implementation of circular economy practices may be constrained by a lack of funds and knowledge of how to acquire these incentives.

"Even if we have the will to change, without money, we can't do anything."

This finding recommends that lawmakers and financial institutions ought to create specialized loans and financial

incentives, such as subsidies and grants, to encourage circular economy initiatives.

***Variance inflation factor*:** Table 4 represents the Variance Inflation Factor (VIF). The VIF results, range from 1.48 to 2.86, with an average VIF of 2.18. Since all VIF values are less than the usually accepted threshold of 10, it is concluded that multicollinearity is not an issue in this study, ensuring the reliability of the regression estimations.

Table 4. Variance inflation factor (VIF) results.

Variable	VIF	1/VIF
Technical training	2.86	0.349264
Extension services	2.71	0.368945
Regulatory support	2.47	0.404331
Access to grants	2.02	0.495698
NGOs Support	1.54	0.651177
Policy Awareness	1.48	0.674927
Mean VIF	2.18	

***Conclusion*:** The study examined the influence of institutional factors on the adoption of circular economy (CE) practices among sugarcane and rice processors in Busia, Siaya, and Kisumu counties. Using an ordered logit regression model, the findings indicated that regulatory assistance, technical training, and access to extension services all have a substantial impact on CE adoption. Descriptive and qualitative results revealed that financial restrictions, a lack of policy awareness, and insufficient NGO support hampered implementation of circular economy practices. The findings highlight the importance of structured institutional support in promoting sustainability in the processing sector.

To encourage CE adoption, policies ought to focus on more technical training and extension services. Governments could tighten regulatory frameworks by ensuring compliance and providing incentives to promote CE use. Furthermore, focused awareness programs on CE rules should be implemented to close the knowledge gap among processors. Financial organizations should offer accessible grants and loans for CE investments.

For CE practices to be scaled, cooperation between stakeholders, including NGOs and government organizations, is essential. In order to help both small and large processors, policymakers should incorporate sustainability goals into industrial legislation. Sustainable processing can be further supported by promoting waste utilization technology research and innovation. Western Kenyan sugarcane and rice processors can shift to more ecologically friendly and resource-efficient operations by putting these strategies into practice, which will have long-term positive effects on the economy and the environment.

***Acknowledgement*:** The authors of this paper are so grateful for the financial support received by the French Embassy in Nairobi.

***Authors contributions statement*:** Conceptualization; Ezekiel Areri Kamau, Moses Mutharime Mwito, Paul Mugambi Joshua, and Hezron Rasugu Mogaka, Methodology; Ezekiel Areri Kamau, Software; Shadrack Kiprotich, Validation; Moses Mutharime Mwito, Paul Mugambi Joshua, and Hezron Rasugu Mogaka, Formal analysis; Ezekiel Areri Kamau , Investigations, Hezron Rasugu Mogaka, Data curation; Ezekiel Areri Kamau, Writing- Original draft; Ezekiel Areri Kamau, Writing-review and editing; Ezekiel Areri Kamau, Moses Mutharime Mwito, Paul Mugambi Joshua, Hezron Rasugu Mogaka, Florence Kaumi Kirimi, Charles Nyambane Onyari, Lydia Muriithi, Otara Nyaboe Elvin, Shadrack Kiprotich, Moses Muchangi Njiru, Scholastica Kavata Mutungi, and Annastacia Kyalo, Formal analysis; Ezekiel Areri Kamau, Florence Kaumi Kirimi, Charles Nyambane Onyari, and Lydia Muriithi, Supervision; Moses Mutharime Mwito, Paul Mugambi Joshua, and Hezron Rasugu Mogaka.

***Conflict of interest*:** No potential conflict of interest is reported by the authors.

***Funding*:** This research received funding from the French Embassy in Nairobi through the Bio Kenya Project (Validating, Up-scaling and Commercialization of Biochar and Insect-Composted Organic Fertilizers in Western Kenya).

***Availability of data and materials*:** the data from the study is available upon reasonable request from the authors

***Consent to participate*:** All authors participated in this research study.

***Consent for publication*:** All authors have contributed their inputs and agreed to publish this version of manuscript to the JGIAS

***Informed consent*:** N/A

***SDG's addressed*:** Industry, innovation and infrastructure, responsible consumption and production, climate action.

***Policy referred*:** Thus, the significant policy referred to is Kenya's nascent and underdeveloped Circular Economy policy framework, which exists in form (guidelines/rules) but lacks strong implementation and clarity, limiting its influence on CE adoption among processors in Western Kenya.

.

***Publisher's note*:** All claims stated in this article are exclusively those of the authors and do not necessarily represent those of their affiliated organizations or those of the publisher, the editors, and the reviewers. Any product that may be evaluated/assessed in this article or claimed by its manufacturer is not guaranteed or endorsed by the publisher/editors.

.

REFERENCES

Andolo. 2023. Effect of green supply chain management practices on environmental performance of sugar firms in Western Kenya. International Journal of Management, Accounting & Economics 10:260-283.

Casinillo, L.F., C.A. Clava, M.C. Bales and M.O. Hungo. 2024. Ordered logistic models for the stages of adoption of vegetable technologies 24:157-168

Daniel K.K., Z.O. Siagi and J.O. Ogola. 2020. Effect of Formulation, binder and compaction pressure of rice husk-bagasse briquettes on thermal and physical properties. Journal of Scientific Research and Reports 26:38-53.

Debrah, J.K., G.K. Teye and M.A. Dinis. 2022. Barriers and challenges to waste management hindering the circular economy in Sub-Saharan Africa. Urban Science 6:57.

Gedam, V.V., R.D. Raut, A.B. Lopes de Sousa Jabbour, A.N. Tanksale and B.E. Narkhede. 2021. Circular economy practices in a developing economy: Barriers to be defeated. Journal of Cleaner Production 311:127670.

Gonella, S.L., F.M. M.F. Godinho, G.M.D. Ganga, H. Latan and C.J. Chiappetta Jabbour. 2024. A behavioral perspective on circular economy awareness: The moderating role of social influence and psychological barriers. Journal of Cleaner Production 441:141062.

Halog, A. and S. Anieke. 2021. A Review of circular economy studies in developed countries and its potential adoption in developing countries. CircEconSust 1:209-230.

Hub, ISK. 2024. UNEP report calls for shift to zero waste to prevent runaway negative impacts | News | SDG Knowledge Hub | IISD. [accessed 2024 Jun 6].

Kirchherr, J., N-H.N. Yang, F. Schulze-Spüntrup, M.J. Heerink and K. Hartley. 2023. Conceptualizing the circular economy (revisited): an analysis of 221 definitions. Resources, Conservation and Recycling 194:107001.

Mangoro, N., N.S. Kubanza. 2023. Community perceptions on the impacts of Solid Waste Management on Human Health and the Environment in Sub-Saharan African Cities: A study of Diepsloot, Johannesburg, South Africa. Development Southern Africa 40:1214-1233.

Mishra, S., D. Sahoo and S. Mohapatra. 2024. Circular economy adoption in MSMEs: unveiling enablers and barriers. International Journal of Development Issues. ahead-of-print(ahead-of-print).

Muriithi, J.K. and I.O. Ngare. 2023. Transitioning circular economy from policy to practice in Kenya. Front Sustain 4:1190470.

Njagi, J.A.M., B.O. Okoya and M. Munyua. 2022. Investigation into the effect of rice husk ash in partial replacement of cement in concrete. East African Journal of Engineering 5:181-194.

Ojijo, A. 2023. International journal of research publication and reviews managing environmental pollution of sugar companies in western kenya: a supply chain integration approach. International Journal of Business Research. 4:5654-5662.

Pasqualotto, C., D. Callegaro-De-Menezes and C.L. Schutte. 2023. An Overview and Categorization of the Drivers and Barriers to the Adoption of the Circular Economy: A Systematic Literature Review. Sustainability 15:10532.

Salmenperä, H., K. Pitkänen, P. Kautto and L. Saikku. 2021. Critical factors for enhancing the circular economy in waste management. Journal of Cleaner Production 280:124339.

Singh, R.K., A. Kumar, J.J. Garza-Reyes and M.M. de Sá. 2020. Managing operations for circular economy in the mining sector: An analysis of barriers intensity. Resources Policy 69:101752.

Ting, L.S., S. Zailani, N.M. Sidek and M.R. Shaharudin. 2023 May 23. Motivators and barriers of circular economy business model adoption and its impact on sustainable production in Malaysia. Environment, Development, and Sustainability 26:17551-17578.