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Role of income and skill development in plastic waste-to-wealth entrepreneurship: Empowering women in Sub-Saharan Africa

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ABSTRACT

Addressing plastic waste pollution has become a global environmental concern. Although plastic pollution harms terrestrial and aquatic ecosystems, it also presents opportunities for wealth creation. This study investigates the role of plastic waste-to-wealth entrepreneurship in enhancing women's empowerment through income generation and skill development in Lagos State, Nigeria. Using a quantitative research design with a Structural Equation Modelling (SEM) approach, data were collected from 302 women plastic waste pickers across three major dump sites in Lagos State, the largest consumer market in Africa. The study achieved a response rate of 98%. Findings reveal a significant positive relationship between plastic waste-to-wealth initiatives and women's income, as well as a strong link between skill development and empowerment among women entrepreneurs. The study recommends increased financial support, access to resources, and strategic partnerships with plastic waste cooperatives to help women expand their businesses and income. It further emphasises the importance of training and skill acquisition programs in strengthening empowerment and promoting sustainable entrepreneurship.

Contribution/ Originality: This study offers contextual novelty by providing a localized understanding of how plastic waste-to-wealth enterprises influence women in a developing country, enriching the limited gendered research on waste entrepreneurship.

1. INTRODUCTION

The 2030 Agenda for Sustainable Development, adopted by global leaders in 2015, presents a comprehensive framework for advancing sustainability through its 17 Sustainable Development Goals (SDGs) (Olubiyi, Jubril, Sojinu, & Ngari, 2022). At the core of these goals are the principles of inclusivity, with a particular emphasis on eradicating poverty, achieving gender equality, and empowering women. These objectives are embedded within each SDG, ensuring that social, economic, and environmental progress benefits all people, particularly marginalized groups. However, poverty is a widespread issue in Africa and, in particular, in Nigeria, with women disproportionately affected due to various socio-economic, cultural, and structural barriers. The National Bureau of Statistics (NBS) reported that Nigeria's poverty rate was around 40% in 2019, with a significant portion of the impoverished population being women and children. Women in Nigeria encounter unique challenges that worsen their poverty,

such as limited access to education, restricted economic opportunities, and entrenched gender norms that hinder their participation in economic activities (Ogundana, 2020).

In urban centres like Lagos State, Nigeria, poverty and environmental degradation are particularly severe. The role of plastic in modern society is undeniable, having significantly impacted daily life and various industrial sectors across Nigeria (Olubiyi et al., 2024). As the country's largest city and economic centre, Lagos produces massive plastic waste daily, contributing to severe environmental pollution and public health risks (Ojie, Asu Ojong, & Omang, 2023). However, this waste also presents a unique economic opportunity through recycling initiatives. By converting plastic waste into valuable products, such efforts address environmental issues and create income-generating opportunities for marginalized groups, especially women (Aliyu & Amadu, 2017). Plastic waste-to-wealth entrepreneurship has thus emerged as a viable strategy for alleviating poverty and empowering women economically in Lagos. These initiatives typically involve collecting, sorting, and recycling plastic waste into products like plastic bags, furniture, and construction materials, providing both environmental and economic benefits. This approach helps reduce environmental pollution and creates sustainable livelihoods for women, allowing them to overcome socio-economic barriers and improve their living conditions. Through these efforts, women can gain financial independence, enhance their skills, and contribute meaningfully to the local economy, fostering a more inclusive and resilient community (Ufua, Itai, Kumar, & Al-Faryan, 2024). The plastic picking sector in Lagos State, Nigeria, is predominantly male, with men constituting about 75% of the workforce (Omosimua, Oluranti, Obindah, & Busayo, 2021). This male dominance often sidelines women-led initiatives, limiting their ability to scale businesses and generate sustainable income (Adesua, 2012). Women entrepreneurs in the plastic waste-to-wealth sector face systemic discrimination and gender-based biases, leading to challenges such as unequal pay, limited opportunities for skills development and training, and social stigmatization. These barriers further perpetuate their economic vulnerability and hinder their ability to break the cycle of poverty (Babaei et al., 2015). Women entrepreneurs in the plastic waste industry often lack the technical, managerial, and entrepreneurial skills to effectively manage waste, develop value-added products, and run successful businesses (Havik, 2015). Additionally, they face difficulties accessing and adopting appropriate technologies for plastic waste recycling, processing, and product development (Anabaraonye, Nwobu, Ewaa, Okonkwo, & Samuel, 2022). These challenges significantly impede their capacity to compete in the market and grow their enterprises, underscoring the need for targeted support and intervention to empower women in this sector (Omeihe, Simba, Rae, Gustafsson, & Khan, 2021).

Previous studies have demonstrated that plastic waste entrepreneurship is a viable and sustainable approach to poverty alleviation in Nigeria, which has a population of approximately 200 million people. Nigeria is the most populous country in Africa, representing nearly 47% of the total population in West Africa (Omosimua et al., 2021). By providing income-generating opportunities and promoting economic empowerment, these initiatives can transform lives, improve household welfare, and contribute to the broader socio-economic development of Lagos State, Nigeria (Jaiyeola & Bayat, 2020). This study aims to address income and skills development for improving women's empowerment and achieving sustainable entrepreneurship development with the following objectives:

i. Explore the effect of income on women engaged in plastic waste-to-wealth entrepreneurship in Lagos State, Nigeria.
ii. Examine the effect of skills development on women in plastic waste-to-wealth entrepreneurship in Lagos State, Nigeria.

The research is conducted in Lagos State, Nigeria, at the major dumpsites of Ojota, Okofili, and Katangowa (Abule-Egba). These sites and Lagos State are justified due to the high population density and economic significance. As Lagos remains the largest consumer market in Africa, it offers a strategic context for understanding how waste-to-wealth initiatives can scale sustainable entrepreneurship and empower marginalized women in the informal economy. The study's results provided a comprehensive understanding of the effectiveness of plastic waste-to-value entrepreneurship in empowering women and alleviating poverty.

2. LITERATURE REVIEW

Waste is often considered to have minimal economic value and secondary intrinsic worth. Managing waste through prevention, reduction, minimization, and treatment is crucial for environmental sustainability. Municipal authorities play a key role in waste collection, storage, and transportation. Recycling plastic waste faces challenges due to the complexity of plastic types and the high cost of separation (Hammer, Kraak, & Parsons, 2012; Ziani et al., 2023). The informal plastic waste management sector, driven by market demand, employs many urban workers, with women forming a part (Thushari & Senevirathna, 2020; Zen & Siwar, 2015).

In informal plastic waste management, a hierarchical structure resembling a pyramid exists. At the top are a few plastic recyclers, while numerous aggregators are located below them, whom scrap dealers supply. These dealers, in turn, gather plastic waste from a vast network of on-the-ground waste pickers or collectors, forming the base of the pyramid. There can be thousands of waste pickers in cities with only a few recyclers. In Ghana, India, and the Philippines, women are overrepresented as waste collectors, while men dominate higher positions in the hierarchy (Jaiyeola & Bayat, 2020). In Ghana, most waste pickers and sorters are women, yet only a small percentage of CEOs and business owners are female. Similarly, in Pune, India, a significant portion of waste collectors are impoverished women from lower castes, while only a minimal percentage of business owners among recyclers are women (Henry, Foss, & Ahl, 2016; Khan & Arefin, 2013).

Women's entrepreneurial activities are globally recognized for generating significant socio-economic benefits (Nair, 2020). Recent research has highlighted women's significant role as primary earners in households across the developing world (Ogundana, Simba, Dana, & Liguori, 2021). In sub-Saharan Africa, women's entrepreneurship has been shown to reduce issues such as prostitution and child trafficking (Sule, Ibrahim, & Abdullahi, 2024). Furthermore, their involvement in business ventures has led to improvements in child education rates in countries like Nigeria, Ghana, and Niger, as well as enhanced family nutrition in Botswana and overall poverty reduction across Africa (Ojo & Shittu, 2023). Multiple studies and policy reports emphasize the impact of women entrepreneurs on economic and social development. For example, in India, businesses owned by women are among the most significant sources of employment (Kungwansupaphan & Leihaothabam, 2016). While in Kosovo, women entrepreneurs have become crucial income providers for their families (Ramadani, Dana, Sadiku-Dushi, Ratten, & Welsh, 2017). Similarly, women-led enterprises in Latin America are crucial for the financial stability of their families. These findings underscore the importance of supporting female entrepreneurship in fostering global socio-economic development.

Nigerian women face various challenges at the micro level as they work to grow their businesses (Ojo & Shittu, 2023). Studies consistently reveal that women in Nigeria experience greater difficulties accessing external financing than men (Mazonde & Carmichael, 2016). Research has shown that many women entrepreneurs are often denied credit due to discriminatory practices or negative perceptions from financial institutions (Igwe, Amaugo, Ogundana, Egere, & Anigbo, 2018). Moreover, a lack of personal assets further limits women's ability to secure external funding, as family properties are often registered in their husbands' names, restricting their access to essential financial resources (Liñán, Jaén, & Martín, 2022; Yalegama, Chileshe, & Ma, 2016). These barriers underscore the urgent need for targeted policies and initiatives to improve financial access for women entrepreneurs in Nigeria.

In traditional Nigerian culture, women are often viewed primarily as homemakers and guardians of family honour, with societal norms and conservative practices reinforcing these roles. Tribal customs tend to uphold patriarchal structures, leading to the subjugation of women, where men hold greater control over various aspects of women's lives. Gender roles thus become a foundational principle that organises society. As a result, women's social environment has a significant influence on their entrepreneurial efforts, often creating substantial challenges for female entrepreneurs. According to Fielden and Davidson (2006) family responsibilities can impede the success of women in business, a concern that is especially relevant in a patriarchal society like Nigeria. Despite these challenges, women entrepreneurs contribute substantially across various sectors in Nigeria. However, studies by Loison (2015)

and Mahadeo, Dusoye, and Aujayeb-Rogbeer (2015) reveal an apparent gender disparity in entrepreneurship, indicating the urgent need for focused efforts to support women in business.

In Nigeria, businesses owned by women significantly lag behind those owned by men (Ekpe, Eja, & John, 2014). This gender gap is primarily caused by institutional barriers that restrict women's full participation in economic empowerment programs (Ekpe et al., 2014). Traditionally, women are seen as the primary caretakers of the family and household (Motilewa, Onakoya, & Oke, 2015). Societal norms around gender roles often discourage women from engaging in high-risk or challenging entrepreneurial activities, hindering their ability to develop, manage, and grow businesses. Aladejebi (2020) argues that social discrimination is not the most significant obstacle for women entrepreneurs in South-West Nigeria. Instead, she identifies inadequate training, limited access to start-up capital, and lack of familial support, especially from spouses, as significant factors restricting the growth of women-owned businesses (Elkins, 2014; Ufua et al., 2022).

Poverty alleviation encompasses a range of economic and humanitarian measures aimed at permanently lifting individuals and communities out of poverty. While poverty is more prevalent in developing countries, efforts to reduce poverty occur in both developing and developed nations (World Bank, 2021). Historically, poverty was seen as inevitable in many parts of the world due to limited production in non-industrialized economies and rapidly growing populations, which made wealth scarce. In contemporary times, poverty alleviation efforts extend beyond merely creating economic opportunities; they also focus on improving the living conditions of those in poverty. International aid, particularly in sectors such as healthcare and agriculture, has played a pivotal role in enhancing the quality of life. Examples include the Green Revolution and the successful eradication of smallpox. Nevertheless, challenges remain, such as the issue of tied aid. This often compels recipient nations to purchase goods exclusively from donor countries, frequently at higher costs, which can undermine the intended benefits of aid (Hardesty & Vince, 2017; Owolabi, Adedeji, Aderounmu, Oku, & Ogunbiyi, 2023; Shaikh, 2019).

Women's entrepreneurship and income generation are vital in promoting gender equality, empowering women economically, and alleviating poverty. Providing women with access to quality employment opportunities enhances their individual economic well-being and has far-reaching positive effects on their families, communities, and society as a whole. This economic empowerment fosters a more equitable environment and drives sustainable development (UN Women, 2021; World Bank, 2021). Gainful employment empowers women by granting them economic independence, decision-making authority, and a sense of autonomy, contributing to their overall welfare and self-assurance. Moreover, women's employment directly reduces poverty by augmenting household income and facilitating access to essential resources and services (Banerjee & Jackson, 2017; Hessels & Naudé, 2019). Skill training and development are essential components of women's empowerment, offering significant benefits to individuals, communities, and society. Empowering women through education and skill-building equips them to contribute effectively to economic growth, enhances their well-being, and fosters more resilient, prosperous societies. These investments in human capital are crucial for creating long-term positive change across various sectors (UN Women, 2021; World Economic Forum, 2022). Access to quality education, acquisition of relevant skills, and engagement in continuous learning significantly enhance women's capabilities, broaden opportunities, and contribute to multifaceted development. The discussion outlines the advantages of education and skill development in empowering women (Barot, 2015; Chang & Wyszomirski, 2015). From the literature review, the study hypothesizes thus.

H_{01}: Income does not significantly affect women in the plastic waste-to-wealth entrepreneurship in Lagos State, Nigeria.

H_{02}: Is there no significant effect of developing women's skills on plastic waste-to-wealth entrepreneurship in Lagos State, Nigeria?

3. METHODOLOGY

The study focused on women working as plastic waste pickers at Lagos State, Nigeria, dumpsites. A questionnaire was utilized as the primary data collection tool. The questionnaire was designed to capture information on their

experiences, challenges, and opportunities in plastic waste-value entrepreneurship. The study population consists of 1,500 women plastic waste pickers in the three dumpsite locations. The sample size of 308 is obtained from the Krejcie and Morgan (1970) for a population size. This number is considered a fair representation of the entire population (Saunders, Lewis, & Thornhill, 2007). Each participant was selected based on their relevance to the research objective. The purposive sampling technique was employed, allowing for the intentional inclusion of individuals who possess valuable insights. The purposive approach also included respondents from diverse demographic and geographic backgrounds within the dumpsites. A total of 302 responses were received, representing a 98% retrieval rate from the selected women plastic waste picker entrepreneurs in Lagos State, Nigeria. Data were collected through the physical distribution of structured questionnaires. The study employed the Structural Equation Modelling (SEM) approach for analysis, which is well-suited for exploring complex relationships among latent variables (Etikan, Musa, & Alkassim, 2016). The validity and reliability of the process were established through the Kaiser-Meyer-Olkin sampling adequacy (KMO) statistics and Bartlett's Test for structure detection, confirming the data's suitability for factor analysis. Based on the Chi-square normality distribution and the BTS high significance level, the factor indicators with their respective loaded items were considered valid and credible for this research (Rana & Singahi, 2016).

3.1. Data Analysis

This section presents the construct and indicators' reliability and validity of the study instrument. It also involves the empirical validation of the study model using a structural equation modeling (SEM) procedure. Table 1 presents the factor loadings, variance inflation factor (VIF), composite reliability (CR), average variance extracted (AVE), and Cronbach's alpha for the internal consistency of the study construct indicators.

Table 1. Factor loadings for income, skill development, and empowerment on plastic waste-to-wealth.

	Factor loading	VIF	Composite reliability	AVE	Cronbach alpha	No. of indicators
Indicators	> 0.7	< 5	≥0.8	≥0.5	≥0.7	
Skill Development Empowerment			0.896	0.683	0.845	4
SDE1	0.830	2.279				
SDE2	0.798	2.077				
SDE3	0.871	2.925				
SDE4	0.805	2.455				
Income Impact			0.908	0.715	0.863	4
II1	0.920	3.557				
II2	0.893	3.113				
II3	0.859	2.291				
II4	0.692	1.422				
Plastic Waste to Wealth			0.864	0.682	0.763	3
PWW1	0.875	2.012				
PWW2	0.717	1.276				
PWW3	0.875	2.018				

In Table 1, all Skill Development and Empowerment components and Plastic Waste-to-Wealth components have composite internal consistency values greater than 0.60 and Cronbach's alpha reliability values greater than 0.70. The loading coefficients for the specific construct measures ranged from 0.692 to 0.893.

The tool is deemed reliable and legitimate since the primary condition for fitness was met satisfactorily. However, factor loadings of 0.7 and above indicate that the variable has a moderate impact on the factor.

All items had a factor loading of at least 0.7, and the conclusions of the inner structural model are shown in Figures 1 and 2 accordingly.

3.2. Measurement Model

In the model, the covariance analysis of the independent variables comprising income and skill development among women plastic pickers was tested, and the results are presented in Table 1. The oval shape denotes exogenous latent variables for income (INC) and skill development (SKLD), measured with their respective indicators in rectangular shapes and error terms in smaller oval shapes. The double arrow curved line establishes the covariances between the latent exogenous model constructs. INC1…INC4 and SKLD1…SKLD4 capture the income and skill development indicators.

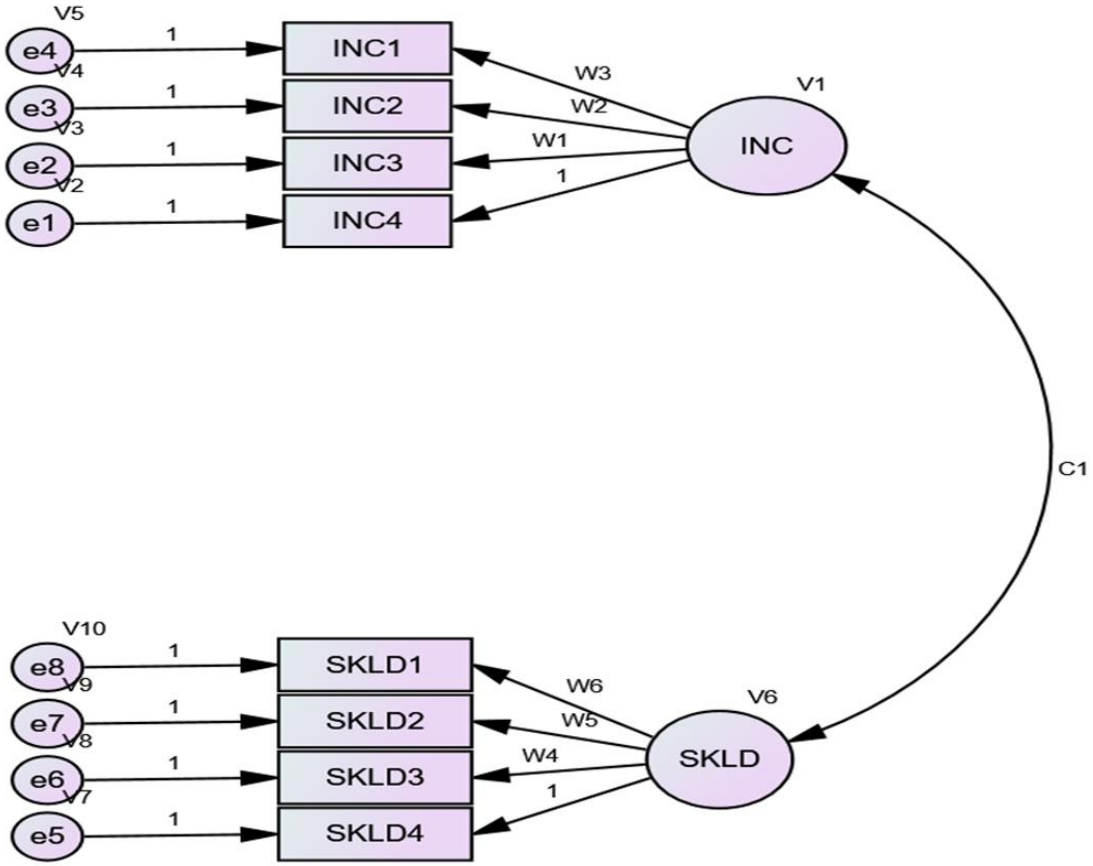

Figure 1. Measurement model I for plastic waste to wealth entrepreneurship.

Table 2. Covariance Analysis.

Variables			Estimate	S.E.	C.R.	P
INC	<-->	SKLD	0.341	.044	7.718	***

Note: *** indicates statistical significance at the 1% level ($p < 0.01$)

The output (Table 2) from the covariance analysis indicates a significant relationship between income (INC) and skill and empowerment (SKLD) among women entrepreneurs. The result shows that there is little or no strong correlation between women's income and skill empowerment that could influence their effect on plastic waste to wealth. Hence, the model is seen to be free from multicollinearity bias and credible for further analysis. The covariance estimate between income (INC) and skill and empowerment (SKLD) is **0.341**. This positive value suggests that as income increases, the levels of skill and empowerment also tend to increase. The P-value at the 1 percent level suggests strong statistical significance, providing high confidence that the observed relationship is not a result of random chance. The positive association between income and skill/empowerment confirms a direct relationship, which implies that higher income levels may provide women entrepreneurs with greater access to education, training,

and resources that facilitate skill development and empowerment. This can manifest in improved job training, professional development opportunities, and enhanced self-efficacy.

3.3. Structural Model Result

Using analysis of moment statistics, the path coefficients and the standardized β coefficient were obtained, and the relevance of the proposition was evaluated as shown in Figure 2. The larger and significant the coefficient value, the more significant the influence on the exogenous construct. The structural model is the underlying framework in structural equation modeling. It entails calculating the factor structure using the weights and significant values of path coefficients (Chin, 2010). Findings in Figure 1 and Table 2 depict that 61.8 and 58.6 percent of the variance of plastic waste to wealth are explained by skill development and income.

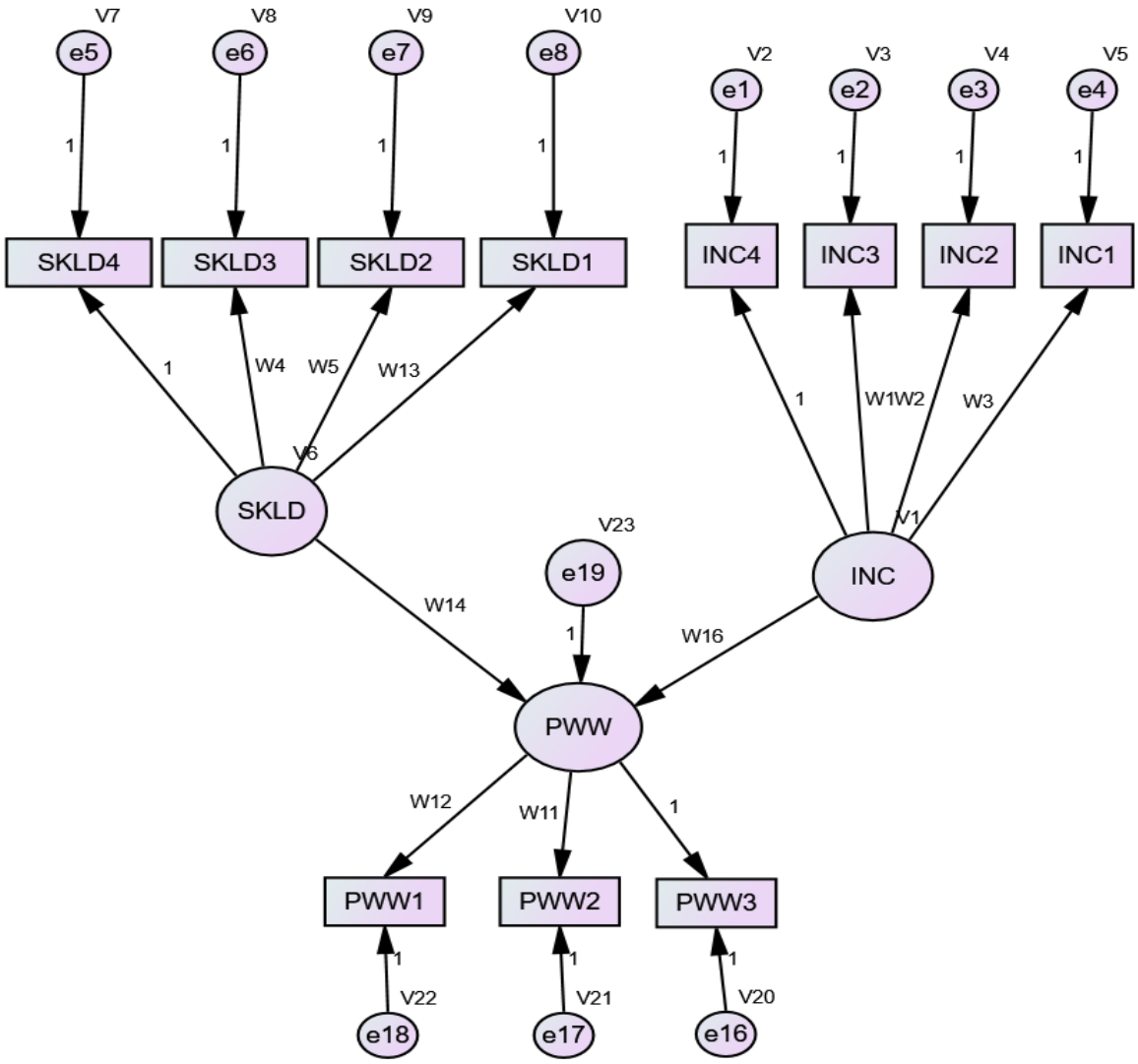

Figure 2. Predictive relevance (Path coefficient) of income impact on plastic waste to wealth.

Evidence from Table 3 shows that women's empowerment and income level have a moderately significant relationship with plastic waste to wealth. Figure 1 also reveals the link involving variables of predictive potential. The estimated parameters for skill development and income effect for women entrepreneurs in plastic waste-to-wealth are as presented in Table 3.

Table 3. Regression weights.

Variables			Path co-efficient	Std. Error	C.R	P-values
PWW	<---	SKLD	-0.618	0.298	-2.077	0.038
PWW	<---	INC	0.586	0.241	2.426	0.015

Diagnostic tests	Recommended Threshold	Statistic	Remark
Root mean-square residual (RMR)	0.05 below	0.047	Satisfied
Goodness of fit index (GFI)	0.70-0.90 above but<1.00	0.935	Satisfied
Adjusted GFI (AGFI)	0.60 above	0.829	Satisfied
Baseline comparisons			
Normed fit index (NFI)	0.70-0.90 above but<1.00	0.945	Satisfied
Relative fit index (RFI)	0.70-0.90 above but<1.00	0.880	Satisfied
Increased fit index (IFI)	0.70-0.90 above but<1.00	0.967	Satisfied
Tucker-Lewis index (TLI)	0.70-0.90 above but<1.00	0.904	Satisfied
Comparative fit index (CFI)	0.70-0.90 above but <1.00	0.956	Satisfied

The path coefficient indicates Skill Development and Empowerment indirectly and significantly influence Plastic Waste-to-Wealth at a <0.05 significance level. It is observed that there is an indirect, negative, and noteworthy influence of Skill Development and Empowerment on Plastic Waste–Wealth (PWW). Ultimately, the apparent significance of the link between Skill Development and Empowerment and Plastic Waste-to-Wealth is affirmed by the beta values of the constructs, which also indicate a solid degree of relationship.

Table 2 suggests that income directly and significantly influences Plastic waste to wealth at the <0.05 level. It is observed that there is a consistent, positive, and noteworthy influence of income on plastic waste and wealth. Generally, the connection between income, plastic waste, and wealth is confirmed to be directly significant based on the beta value of the constructs, which also demonstrates a high degree of interconnection. Subsequently, the p-value is lower than 0.05. As a result, the null hypothesis cannot be accepted.

Based on the result, the diagnostic test (Table 3) evaluates the fit of the statistical model estimating the waste-to-wealth relationship with skill development and income generation. RMR is below the recommended threshold, indicating a good fit between the model and the observed data. A lower value suggests a better model fit, as it reflects the average discrepancy between observed and predicted values. The GFI is significantly above 0.90, indicating an excellent fit. This index measures the proportion of variance in the observed data accounted for by the model, reinforcing the model's strength. The AGFI, which adjusts the GFI for the number of estimated parameters, is also above the acceptable level, suggesting a good balance between model complexity and fit. Each of the baseline indices compares the fit of the default model against a baseline model (usually a null model). All these values indicate a strong model fit, as they are above the recommended thresholds, especially the NFI, IFI, and CFI, which are above 0.90.

4. RESULTS AND DISCUSSION

This study's data were analyzed at the organizational and model levels and merged utilizing the moments of statistics—structural equation modeling technique. However, the influence of Social Empowerment Support on Poverty Alleviation was visualized using multiple regression techniques and normalized estimations (Figure 2). In agreement with Nordhoff, Malmsten, Arem, Liu, and Happee (2021) the 0.05 significance level is the criterion for making a discovery statistically meaningful. The structural equation modeling method combines organizational and model-level analyses of the study's data (Dawn, 2010).

Our hypothesis states that income and skill development factors do not significantly affect plastic waste-to-wealth entrepreneurship in Lagos State, Nigeria. The study findings indicate a significant direct correlation between income (poverty alleviation) and plastic waste-to-wealth among women in the selected plastic waste organization. All path coefficients were statistically significant (below 0.05), supporting the practical relevance of the relationship. The null

hypothesis was rejected, suggesting that income impact predicts plastic waste-to-wealth among women in the plastic waste organization.

Similarly, the study findings reveal a significant direct relationship between 'Skill Development and Empowerment' and income among women in the selected plastic waste organization. The analysis showed that all path coefficients were statistically significant, underscoring the practical importance of this relationship. Consequently, the null hypothesis regarding the effect on income was rejected, further validating the significance of the observed connections. The results demonstrated that, when variables are held constant, a unit positive shift in income will lead to a corresponding increase in plastic waste to wealth entrepreneurship among women. At the same time, skill development and empowerment had a retarding effect. This therefore stresses the need for skill development and empowerment among the women entrepreneurs in this occupational field.

The null hypothesis for the income effect was rejected, suggesting that income predicts plastic waste among women in the plastic waste organization. However, the study's findings show that the substantial rise in income directly contributes to women's economic empowerment by providing them with greater financial independence and stability. Financial independence empowers women to make autonomous decisions regarding personal and household expenses, improving self-esteem and social standing. Given that the significance level of the model is lower than 0.05, the null hypothesis was rejected.

5. CONCLUSION

This study has offered valuable insights into the connection between income generation for poverty alleviation and plastic waste-to-wealth entrepreneurship. Encouraging income generation is vital for reducing women's poverty. The study indicates that providing women access to financial resources, lending options, and financial management training is crucial. These measures help women invest in their businesses and increase their revenue-earning capacity. This aligns with earlier studies highlighting the role of economic empowerment in breaking the cycle of poverty. We recommend that organizations strengthen income for women in the plastic waste sector through increased access to financial resources and partnerships with plastic waste cooperatives. At the same time, a concerted effort should be put in place for women's entrepreneurship development through skill acquisition and training. These women-owned businesses must incorporate ESG (Environmental, Social, and Governance) concepts into their waste management strategies. This improves environmental advantages and fosters social goodwill and effective governance, ultimately enhancing profitability.

5.1. Limitations and Further Research

The study focuses solely on Lagos State, Nigeria, which may limit the generalizability of the findings to other regions with different socio-economic dynamics and waste management practices. Future studies could include comparisons between different states or regions in Nigeria or other countries to explore how local policies and socio-economic factors influence the success of plastic waste-to-wealth, focusing on women's economic empowerment in waste entrepreneurship.

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Institutional Review Board Statement: The Ethical Committee of the West Midlands University, Nigeria has granted approval for this study on 26 September 2024 (Ref. No. WMU/WMUREC/IHM/240/1).
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Data Availability Statement: Upon a reasonable request, the supporting data of this study can be provided by the corresponding author.
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