

Awareness and Utilization of Cassava Processing Waste among Small-Scale Processors in Akoko-Edo, Edo State, Nigeria

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Abstract

Cassava (*Manihot esculenta* Crantz) processing generates substantial quantities of peels, pulp, and liquid effluents as major by-products. Badly handled, these residues pollute; put to use, they can earn money. This study assessed how aware small-scale processors in Akoko-Edo Local Government Area, Edo State, Nigeria, are of cassava waste utilization and how far they actually use the waste. Using a multistage sampling procedure, 120 processors were drawn from three communities with active cassava processing and interviewed with a structured questionnaire. Descriptive statistics summarized the data, and binary logistic regression tested how selected socio-economic variables affect utilization. Women made up 68.3% of respondents, and most were in the economically active age bracket. Awareness was highest for livestock feed (72%) and compost (65%) and lowest for bioenergy (28%) and industrial processing (22%). In practice, 26.7% of processors fed peels to livestock and 21.7% composted, while 41.7% discarded their waste with no productive use. Education, household size, and processing experience each raised the likelihood of utilization significantly ($p < 0.05$). The distance between knowing and doing suggests that skills and labour, not only information, hold processors back. Extension agencies should therefore offer practical training in cassava waste valorization and promote simple, affordable technologies that turn residues into marketable products.

Keywords: Cassava Processing Waste, Awareness, Waste Utilization, Cassava Processors, Edo State.

I. INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is one of the most important staple crops in tropical food systems, particularly because of its contribution to food security, rural livelihoods, and household income. Millions of people, mostly in developing countries, rely on it for calories. Its appeal is practical: it survives dry spells, grows on poor soils, and still yields something with little fertilizer or other inputs. It feeds families, creates jobs, and spreads income across rural households, and output has climbed as markets for food, animal feed, and industrial starch have widened. According to the Food and Agriculture Organization (FAO, 2023), global cassava production exceeded 300 million tonnes in 2022, with Africa accounting for the largest share of global production. More cassava grown means more cassava processed, and more residue left over. Peeling, grating, fermenting, pressing, and sieving produce peels, fibrous pulp, sieveate, and liquid effluent. This material is high in organic matter and cyanogenic compounds, so careless disposal carries real risks. Pandey *et al.* (2000) link it to contaminated soil, polluted water, and foul smells in villages where processing is concentrated. Handling this waste has become an environmental question for many cassava-growing regions.

The same residues are not simply a nuisance. Within a circular bioeconomy, farm and processing by-products are treated as raw materials. Detoxified peels and fibre can go into livestock rations, and cassava wastewater can feed biogas digesters or be made into organic fertilizer (Aro *et al.*, 2017; Olukanni & Olatunji, 2018; Pandey *et al.*, 2000). For rural households, such uses could bring extra income and cut pollution at the same time.

Africa produces over 60 percent of the world's cassava. In Nigeria, the Democratic Republic of the Congo, Ghana, and Tanzania, cassava serves not only as an important staple crop but also as a significant source of employment and livelihoods for rural populations (Food and Agriculture Organization of the United Nations [FAO], 2023). Nigeria has long been the largest single producer. Smallholders grow the crop in every agro-ecological zone and process it into garri, fufu, starch, and high-quality cassava flour, work that sustains millions of households and is largely done by women.

The waste that results is, in practice, left where it falls. Peels, fibrous residue, sievate, and effluent pile up at many village processing centres because no organized system exists to collect or treat them, and effluent can find its way into streams and ponds. Pandey *et al.* (2000) note the high biochemical oxygen demand and cyanogenic content of such effluent, which can foul soil and water when untreated. Bad odours, degraded surroundings, and health worries follow.

Turning waste into something of value is the idea behind "waste-to-wealth", which has drawn growing interest from researchers and policymakers. Peels can become livestock feed, briquettes, ethanol, or manure. A processor who does this may spend less on inputs, earn more, and leave a cleaner site. Whether processors actually do so depends largely on what they know about these options and whether they act on it.

Knowing comes before doing. Rogers (2003) identifies knowledge as the first stage of the innovation-decision process, occurring when an individual becomes aware of an innovation and gains an understanding of how it works and its potential benefits. Thus, before an individual can develop interest in or decide to adopt an innovation, some level of knowledge about its existence, characteristics and potential advantages is required. In this study, awareness refers to the extent to which cassava processors understand the environmental and economic benefits associated with the recovery and utilisation of cassava residues.

Many small-scale cassava processors continue to dispose of processing residues rather than recover and utilise them as productive resources. One contributing factor may be limited awareness of the potential economic value and alternative uses of materials such as peels and sievate. Education may influence processors' ability to access and interpret information, understand new technologies, and make informed decisions about resource utilisation. Evidence from agricultural adoption studies also suggests that educational attainment can enhance farmers' capacity to adopt improved technologies and practices (Mwangi & Kariuki, 2015).

Skill is a second barrier. Composting, feed preparation, and bioenergy all call for know-how that many rural processors have never been taught, and training and extension services rarely reach them. Experience could narrow this gap: processors who have worked longer know how much waste they produce and what it is like, and so may spot uses for it more readily (Mwangi & Kariuki, 2015).

Labour is a third. Making compost or sun-drying peels for feed takes time on top of the processing itself, so a processor short of hands may skip these tasks even when convinced of their worth. Researchers commonly treat household size as a stand-in for available labour, because bigger households have more people to help (Mwangi & Kariuki, 2015).

Age and gender probably matter too. Older processors bring long experience but may stick to customary disposal, while younger ones may be quicker to try methods promoted through extension or training. Women, who dominate cassava processing, often have less access to training, credit, and extension, so gender can also reflect differences in information, bargaining power, and control over resources within the household.

Knowing how these five characteristics relate to awareness and use of cassava waste can guide extension programmes and policies aimed at cleaner processing sites and better rural incomes. This study therefore looked at awareness and utilization of cassava processing waste among small-scale processors in Edo State, Nigeria. Its objectives were to (i) describe the processors' socio-economic characteristics; (ii) assess their awareness of waste utilization practices; (iii) establish how far they actually utilize the waste; and (iv) identify the socio-economic factors that influence utilization. The null hypothesis was that socio-economic characteristics have no significant relationship with utilization of cassava processing waste.

II. MATERIALS AND METHODS

Study area

The study took place in Akoko-Edo Local Government Area, in the north of Edo State, Nigeria. Cassava is one of the main crops of the area, which falls in the rainforest-savannah transition zone; farmers also grow yam, maize, and rice. Small-scale processors in rural communities turn fresh roots into garri, fufu, and cassava flour, and the peels, fibrous residue, sievate, and effluent from this work are usually discarded around the processing sites.

Research design

A cross-sectional survey was used, collecting data once from a sample of processors. This suits the aim of measuring awareness and utilization at a point in time, and survey designs are standard in extension and rural development research on perceptions, awareness, and adoption (Mwangi & Kariuki, 2015). It allowed information to be gathered on waste generation, awareness of utilization practices, and the factors linked to utilization.

Population and sampling procedure

The target population was every small-scale cassava processor in the local government area using traditional or semi-mechanized methods. No complete count existed, so lists of registered processors from local cooperative societies and Agricultural Development Programme extension offices served as the sampling frame.

Sampling had three stages. Akoko-Edo was chosen purposively because cassava growing and processing are concentrated there. Three rural communities with active processing were then chosen purposively, guided by extension agents and community leaders. Finally, cooperative leaders and extension officers helped list the processors in each community, and respondents were drawn from these lists by simple random sampling, giving every processor the same chance of selection.

Sample size followed Yamane's formula, a common choice in social science research for finite populations:

$$n = N / [1 + N(e)^2]$$

where n is the sample size, N the number of cassava processors in the selected communities, and e the margin of error (5 percent). The calculation gave 120 respondents.

Data collection

A structured questionnaire was administered to the selected processors. It asked about socio-economic characteristics, awareness of waste utilization, the kinds of waste produced, and how the waste was used or disposed of, using both closed and open-ended items. It was pre-tested on a small group of processors outside the study communities to check that the questions were clear and the instrument was reliable and valid.

Measurement of variables

The dependent variable, utilization of cassava processing waste, was binary: 1 if the processor put waste to any productive use (livestock feed, compost, or other value addition) and 0 otherwise. The independent variables were age in years, gender (male or female), educational level (highest formal education attained), household size (people living in the household, a proxy for available labour), and processing experience (years spent processing cassava).

Data analysis

Frequencies, percentages, means, and standard deviations summarized respondents' characteristics and awareness. Binary logistic regression estimated how the independent variables affected the likelihood of utilizing waste; the model suits a binary dependent variable and is common in technology-adoption research (Mwangi & Kariuki, 2015).

III. RESULTS AND DISCUSSION

Socio-economic characteristics of respondents

Women made up 68.3% of respondents (Table 1), which fits the pattern in rural Nigeria where women carry out most post-harvest processing. Nearly four in five processors (78.3%) were 50 or younger, and the largest group (33.3%) was aged 41–50, so processing seems to remain a livelihood for people still strong enough for heavy work. Schooling was uneven: 36.7% had secondary education and 31.7% primary, 16.7% had none, and 15.0% had gone to tertiary level. Education matters for adoption because it makes information easier to obtain, understand, and apply (Mwangi & Kariuki, 2015).

Most households (48.3%) had six to ten members. Since household size stands in for labour, larger households are better placed for work such as composting or preparing peels for feed. Three-quarters of respondents (75.0%) had been processing for more than five years, and that experience could sharpen their sense of how much and what kind of waste they produce and prompt them to look for uses.

Table 1. Socio-economic characteristics of respondents (n = 120)

Variable	Category	Frequency	Percentage (%)
Gender	Male	38	31.7
	Female	82	68.3
Age (years)	20–30	18	15.0
	31–40	36	30.0
	41–50	40	33.3
	Above 50	26	21.7

Education	No formal education	20	16.7
	Primary	38	31.7
	Secondary	44	36.7
	Tertiary	18	15.0
Household size	1–5	42	35.0
	6–10	58	48.3
	Above 10	20	16.7
Processing experience	1–5 years	30	25.0
	6–10 years	48	40.0
	Above 10 years	42	35.0

Source: Field survey, 2024.

Awareness of cassava processing waste utilization

Awareness is the first step toward better waste management. Table 2 shows that most processors knew peels can feed livestock once properly treated (72%) and that waste can make compost or organic fertilizer (65%). Far fewer knew of other uses: 34% for mushroom substrate, 28% for bioenergy or biogas, and 22% for industrial processing. Averaged over the five practices, 44.2% of respondents were aware of any given one. Thin awareness of the more technical options may slow adoption, in line with Rogers' (2003) view that awareness must come first.

Table 2. Awareness of cassava processing waste utilization practices

Waste utilization practice	Aware (%)	Not aware (%)
Livestock feed from cassava peels	72	28
Compost or organic fertilizer	65	35
Mushroom cultivation substrate	34	66
Bioenergy/biogas production	28	72
Industrial processing	22	78

Source: Field survey, 2024.

Utilization of cassava processing waste

Knowing did not mean doing. Table 3 shows that 26.7% of processors fed peels to livestock, 21.7% composted, 10.0% found other uses, and 41.7% simply disposed of the waste, mostly by dumping it near the processing site. For the two best-known practices the shortfall is large: 72% knew about livestock feeding but 26.7% practised it, and 65% knew about composting against 21.7% practising. Labour demands, technical difficulty, and limited training opportunities are plausible reasons.

Table 3. Utilization of cassava processing waste

Utilization method	Frequency	Percentage (%)
Livestock feeding	32	26.7
Compost production	26	21.7
Other uses	12	10.0
Not utilized (disposed)	50	41.7

Source: Field survey, 2024. Percentages are of 120 respondents and may not sum to exactly 100 because of rounding.

Factors influencing utilization of cassava processing waste

Binary logistic regression (Table 4) showed that education, household size, and processing experience each raised the likelihood of utilizing waste significantly, while age and gender had no significant effect. Better-educated processors are probably more able to follow utilization technologies, and larger households can supply the labour these practices need. Experienced processors may also have built up knowledge that helps them see how residues can become useful products. Previous studies likewise point to socio-economic factors as drivers of agricultural technology adoption (Mwangi & Kariuki, 2015).

Table 4. Logistic regression results for factors influencing utilization of cassava processing waste

Variable	Coefficient	Standard error	Exp(B)	Significance
Age	0.12	0.08	1.13	0.110
Gender	−0.09	0.07	0.91	0.210
Education	0.31	0.10	1.36	0.004*
Household size	0.27	0.09	1.31	0.008*
Processing experience	0.29	0.11	1.34	0.012*

Source: Field survey, 2024. Dependent variable: utilization of cassava processing waste (1 = utilized, 0 = not utilized). * Significant at the 5% level.

IV. CONCLUSION

Cassava processing is a mainstay of rural livelihoods in Nigeria, with small-scale processors turning fresh roots into garri, fufu, and cassava flour. It supports food supply, jobs, and incomes, but leaves behind peels, sieveate, and effluent that, if badly disposed of, degrade soil, contaminate water, and smell. Used well, the same residues can add value as livestock feed, as compost, and through other forms of resource recovery.

Many processors in this study knew of some uses, mainly livestock feeding and composting, yet practice lagged well behind awareness, and 41.7% still discarded their waste with no productive use. Awareness of bioenergy and industrial uses was low. Education, household size, and processing experience each significantly increased the likelihood of utilization: education eases access to and understanding of new ideas, larger households supply labour, and experience builds knowledge of the waste stream. These results agree with earlier work on socio-economic influences on adoption (Mwangi & Kariuki, 2015).

Raising awareness and building processors' practical skills should therefore be priorities if cassava waste is to become a source of income instead of a pollutant. Doing so would help the environment, diversify rural incomes, and make better use of resources.

V. POLICY RECOMMENDATIONS

The findings point to the following recommendations for raising awareness and use of cassava processing waste among small-scale processors.

First, extension agencies should step up awareness campaigns and training on the economic and environmental benefits of using cassava waste, and include hands-on demonstrations of turning peels and other residues into livestock feed, compost, and other products.

Second, government and development agencies should fund technical training in cassava waste processing, concentrating on simple, low-cost methods that rural processors can realistically adopt.

Third, community-based processing centres, where processors pool residues to make animal feed and organic fertilizer, should be encouraged; working together can ease labour shortages and make valorization more economical.

Fourth, microcredit and grants should be made available so that processors can buy small-scale waste processing equipment, adopt better technologies, and earn extra income from residues.

Finally, gender-sensitive policies should back the women who dominate cassava processing, since better access to training, credit, and extension would greatly improve their ability to utilize waste and contribute to sustainable agriculture.

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