

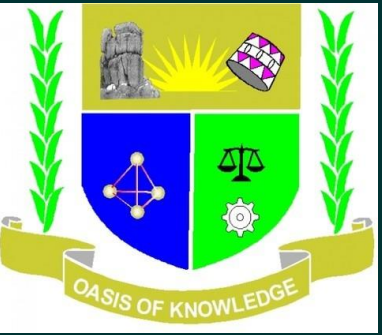
Title:

Circular Business Models for Food Waste and Loss Management in Kisumu City, Kenya

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Abstract

Rapid urbanization in Kisumu City, Kenya, has intensified food waste challenges, with 65% of the 400 tonnes of daily waste being organic. Only 20-30% is formally collected, while the rest accumulates in drains, dumpsites, and open spaces. Using surveys, interviews, and policy reviews, this study examined food waste management and identified circular business models—resource recovery, reuse, and upcycling—as viable solutions. Initiatives like the Kisumu Waste Actors Network (KIWAN) demonstrate the potential of cooperative approaches. Despite challenges such as limited financing and poor infrastructure, these models offer pathways to transform waste into economic value, promoting urban sustainability and resilient livelihoods.

Keywords: Circular economy, food waste, urban waste management sustainability, Kisumu, organic waste valorization

1.1 Introduction (Background information)

Food waste is a major urban environmental challenge, with Kenya generating over 4 million tonnes annually—60% from households. Kisumu City produces 400 tonnes of solid waste daily, 65% of which is organic, yet less than 30% is collected, leading to illegal dumping, flooding, and health risks. This study presents findings from a citywide survey on food waste management in Kisumu and proposes a circular business model integrating resource recovery, reuse, and recycling.

By linking governance, community actors, and private enterprises, the model demonstrates how circular economy approaches can convert waste into valuable products, promoting sustainability and resilient urban livelihoods

1.2 Justification

Conventional linear waste management models (collection-transport-disposal) are unsustainable and costly. Kisumu faces rising waste volumes, limited collection capacity, and ecological risks due to its proximity to Lake Victoria, a critical transboundary freshwater resource. A circular food waste management system offers Environmental, Economic and Social benefits. Without interventions, Kisumu risks worsening waste crises, public health hazards, and missed opportunities for a green economy transition

1.3 Significance of the Study:

- Provides empirical evidence on food waste generation, handling, and valorization in a rapidly urbanizing African city.
- Offers a practical circular business model adaptable to other cities in Kenya and beyond.
- Supports policy formulation for sustainable urban waste governance and climate action.
- Demonstrates inclusive approaches that integrate women, youth, and informal actors in waste value chains.

1.4 Objectives of the study

- Facilitate Kisumu City development through waste management technology transfer;
- Develop food waste business models that transform food waste into a valuable resource
- Enhance revenue generation for the City through Privatization of waste management services (e.g. a private business operating for Kisumu City under a delegated management contract)
- Contribute to effective management of solid waste within the city

1.5 Methodology

- A mixed-methods approach was applied in 2021-2022. Data collection included:
 - Household survey:** 371 households randomly sampled across Kisumu's 102,508 households.
 - Business survey:** 301 enterprises purposively sampled due to informality of registrations.
 - Key informant interviews:** Three interviews with officials from Kisumu City Environment Office, County Government, and National Environmental Management Authority (NEMA).
 - Focus group discussions:** Kisumu Waste Actors Network (KIWAN) and fish traders' groups.
 - Policy review:** Kenya's Environmental Management and Coordination Act (EMCA), Solid Waste Management Bill, and Kisumu County Integrated Development Plan.
 - Observations:** site visits to markets, dumpsites, and fish markets.

1.6 Data Analysis

Quantitative data were analyzed using descriptive statistics (percentages, means), while qualitative data were coded thematically to identify governance, economic, and social dynamics in food waste management.

2.1 Results

2.1.1 Food Waste value chain

- Kisumu generates 400 tonnes of waste daily; 65% organic, 27% recyclable.
- Only 20-30% is formally collected;
- 70-80% remains uncollected, especially in informal settlements.
- Waste collection mainly occurs in CBD and markets, leaving households underserved.

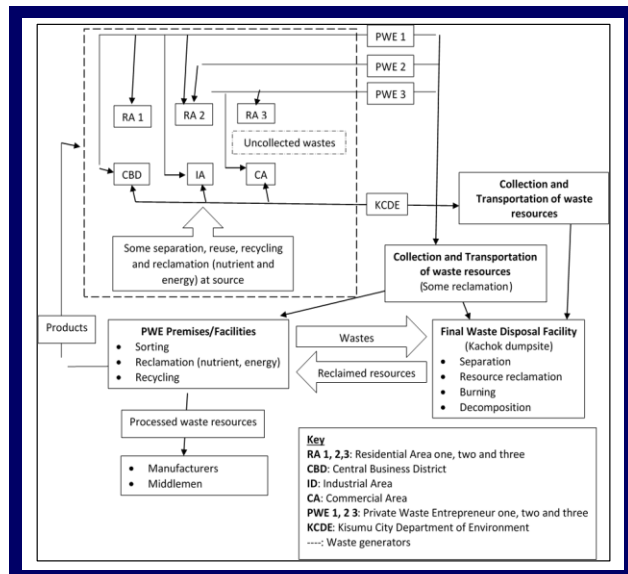


Figure 1.1: Food waste value chain

2.2. Business models for food waste and food loss management

2.2.1 Resource Recovery Business Model:

A resource recovery business model extracts and reprocesses valuable materials from waste streams to create new products and resources. Case one: KA-WAYA ZERO WASTE- Recovering fruit loss and recycle fruit waste to beauty products-Herbal Therapy and SAUNA



Fresh fruit waste for processing into other products



Frozen fruit waste preserved for processing



Food waste processed to face scrub



Food waste processed to face serum

2.2.2 Upcycling and value addition business model

This model converts waste material to a new, high-quality life. Example, fish waste is converted to fish chips, chicken feed and a Mgongo wasi (Skeleton) which is a delicacy for human consumption

Case 2: Fish waste re-use at Obunga Pap Mbuta: Nile Perch by-products transformed into food, animal feed, leather, and jewellery by 300 traders in Obunga



Fish Mbuta (Intestine) ready for processing to chicken feed



Fish Mgongo-wasi (skeleton) being deep fried for human consumption



Food waste being preserved in cold room at Obunga market for processing



Dried fish skin for consumption and production of chicken feed



Unprocessed dry fish skeleton for processing

2.2.3 Re-use for other industries/Composting

Case 3: Black Soldier Fly (BSF) processing at JOOUST: conversion of fruit waste and rotten fruits into organic fertilizers and animal feed.



Fruit waste from suppliers undergoing segregation stage



Larvae fed with fruit waste. It uses rotten fruits or fruit waste



Larvae for making fish pellet



Dry pupae for multiplication



BSF for larvae production



Frass use as organic manure rich in nitrogen

2.2.4 Redistribution of surplus food

Case 4: Food surplus redistribution at Maendeleo Waste Recovery Centre and Food Banking Kenya



Food waste during storage fed to livestock



Food waste at household level



Food loss during harvesting and storage

2.4 Challenges of commercializing food waste business

- Poor infrastructure for segregation at source and collection.
- Weak enforcement or lack of policies on food waste businesses.
- Limited financing and technical training.
- Negative perceptions of waste-based enterprises and products.
- Limited quantitative data on household and business food waste generation which hampers accurate assessment of resource potential, making it difficult to demonstrate the viability of food waste-based business models.

2.5 Conclusions

Kisumu City's food waste problem can be reframed as an economic and social opportunity. A circular business model, integrating collection, segregation, valorization, and market linkages, is feasible and already emerging through grassroots initiatives. Strengthening institutional support, financial access, and infrastructure will accelerate the transition toward sustainable food waste management.

2.6 Recommendations

- Policy strengthening: Develop and enforce county-specific food waste management by-laws aligned with the national circular economy strategy.
- Infrastructure investment: Establish decentralized composting hubs, BSF processing units, and waste segregation facilities.
- Capacity-building: Train waste actors on quality standards, financial management, and business skills.
- Financing mechanisms: Establish SACCOs, micro-credit facilities, and PPPs to support small-scale waste enterprises.
- Awareness campaigns: Promote positive perceptions of waste-to-resource initiatives.
- Food banking systems: Scale up surplus redistribution to address both food insecurity and waste reduction.

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