CYPRUS 2025 - 12º INTERNATIONAL CONFERENCE ON SUSTAINABLE SOLID WASTE MANAGMENT I 25 - 28 June 2025, Paphos, Cyprus

Circularity of Urban Waste in the Municipality of Maputo, Mozambique

A Holistic Approach Using the WMS - DSC Model

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Circularity is essential — but how do we measure it where official data is scarce, and informal systems drive the sector

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- Only 7.2% of the global economy is circular (2023)
- Global waste generation is to rise from 2.3 billion tones (2023) to 3.8 billion tones (2050) (UNEP GWMO 2024).

How can we measure circularity?

Examples of existing tools and reports:

- UN-Habitat's Waste Wise Cities Tool
- WARM (US EPA, 2002)
- Wasteaware Benchmark (Wilson et al., 2015)
- ORWARE (KTH, Sweden)
- Global Waste Management Outlook (UNEP)
- What a Waste 2.0 (World Bank, 2018)

Problem 1: These tools require a huge amount of data to be implemented !!!!

Official data is scarce, fragmented, or incomplete, which complicates the application of heavy-data models.
Difficulty in measuring circularity due to limited indicators is also highlighted by the European Commission's Circular Economy Monitoring Framework

Problem 2: Holistic approaches to WMS assessment are rare

Often, WMS components regarding the waste sector market, prevention, reuse and governance are missing or underrepresented in the assessment.

Justification of the Methodology Adopted in this Study

A more comprehensive and adaptable model, capable of integrating different physical and governance components of SGRUs, as well as measuring circularity based on indicators adjustable to local specificities.

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IN 2022, CAMPITELLI *ET AL.* (2022) DEVELOPED A CIRCULARITY ASSESSMENT FRAMEWORK BASED ON THE CONCEPT OF DEVELOPMENT STAGES THAT ASSESS BOTH THE PHYSICAL AND GOVERNANCE ASPECTS OF WASTE MANAGEMENT:

There are 5 development stages for Waste management Systems:

- Stage 1 – Absence of essential WMS elements
- **Stage 2 – Functional waste collection and safe disposal**
- Stage 3 – Selective collection and waste sorting
- Stage 4 – Expansion of recycling industry
- Stage 5 – Full circular economy implementation

The approach by Campitelli includes 7 core components and 53 subcomponents

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- 📄 Governance (16 subcomponents)
- ♻️ Waste Market (7 subcomponents)
- 🚚 Collection & Transport (8 subcomponents)
- 🗑️ Waste Disposal (5 subcomponents)
- 🔥 Energy Recovery (3 subcomponents)
- 🔄 Recycling (8 subcomponents)
- 🚫 Prevention & Reuse (6 subcomponents)

An assessment methodology should cover all related and relevant components of a waste Management system.

URBAN WASTE IN MAPUTO - MOZAMBIQUE

- **Rapid urbanization → surpassing capacity to address waste**
- **Maputo: 2.2 million inhabitants (2020), generating ~1,100 tones/day.**
- **Around 50% of waste remains uncollected, especially in informal areas.**
- **80% of collected waste is sent to Hulene landfill, the rest dumped or burned.**
- **Estimated 60% of waste is potentially reusable or recyclable, but market and infrastructure remain limited.**

SPECIFIC OBJECTIVES

1. Assess the circularity level of municipal waste management in Maputo - applying the Development Stage Concept approach

2. Identify inefficiencies / barriers and propose solutions to enhance circularity.

Methodology

Stage 1:
Data Collection & Literature Review

Stage 2:
Application of the Urban Waste Management System Development Stage model (WMS-DSC) by Campitelli et al. (2022)

Stage 3:
Identification of critical barriers to circularity in Maputo, and proposal of improvement measures.

08 ANALYSIS AND PERFORMANCE OF WMS-DSC FOR THE MUNICIPALITY OF MAPUTO

Data Analysis: Data available for consultation at: •Results compiled in an Excel database, classifying the performance and stage of each WMS component

•Data input and assessment performed using the WMS-DSC Excel tool.

•Each criterion was categorized as: Met l Partially me l Not met or Information unavailabl

•Results compiled in an Excel database, classifying the performance and stage of each WMS component

Table 1

WMS-DSC Evaluation	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Governance					
Waste Market					
Collection and Transport					
Waste Disposal					
Energy Recovery					
Recycling					
Prevention & Reuse					

Recommendation For Action to Improve WMS and Circularity in Maputo

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33 measures identified were summarized in four thematic groups

Group A
Increase the collection rate and selective collection of waste

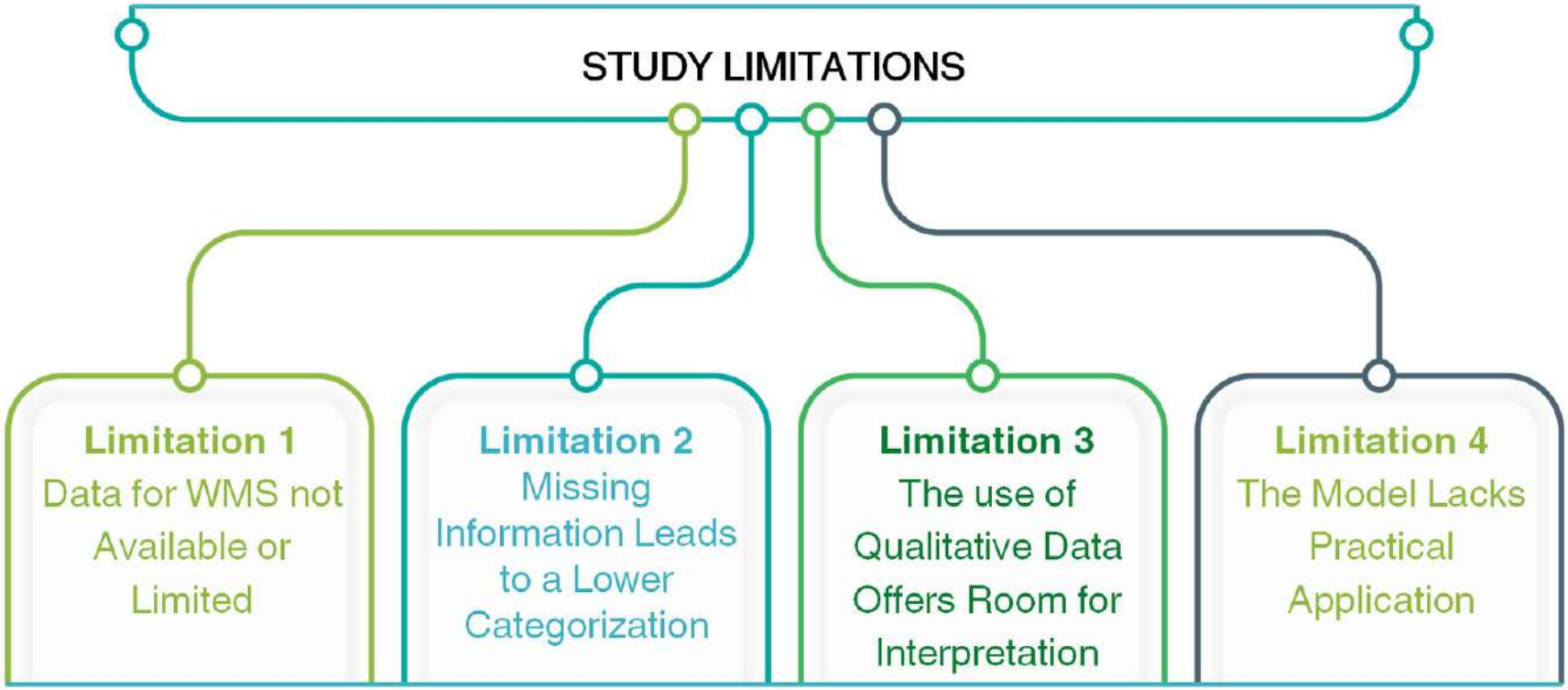
Group B
Improve control, regulation, monitoring and evaluation

Group C
Promote the closing of the cycle in Maputo

Group D
Encourage cooperation between research, companies and society

Data available for consultation at::https://doi.org/10.5281/zenodo.15552044

DISCUSSION OF RESULTS



Final Considerations Obtained By the Application of the WMS-DSC Model In Maputo, Mozambique

Strengths

- Policy Framework
- Community Engagement
- International Support
- Informal Recycling Economy

Weaknesses

- Infrastructure Deficiencies
- Financial Constraints
- Limited Recycling Capacity
- Public Awareness and Education

Key Points

- 🌎 Sustainable Waste Management in the Global South should be a priority.
- ⚖️ Major Inequalities Persist Between WMS in Developed and Developing Countries.
- 🤝 International Cooperation, Technology Transfer, and Local Capacity Building are Essential.
- 🛠️ Integrating Informal Sector Workers is Essential.

Thank you for your attention!
I'm happy to take your questions

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