

# Closed-loop plastic recycling: Design and evaluation of reverse logistics for plastic bottles

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# Plastic waste harms environmental and human health



Urgent action is needed to tackle the waste crisis. Photo: Hazel Thompson/Tearfund



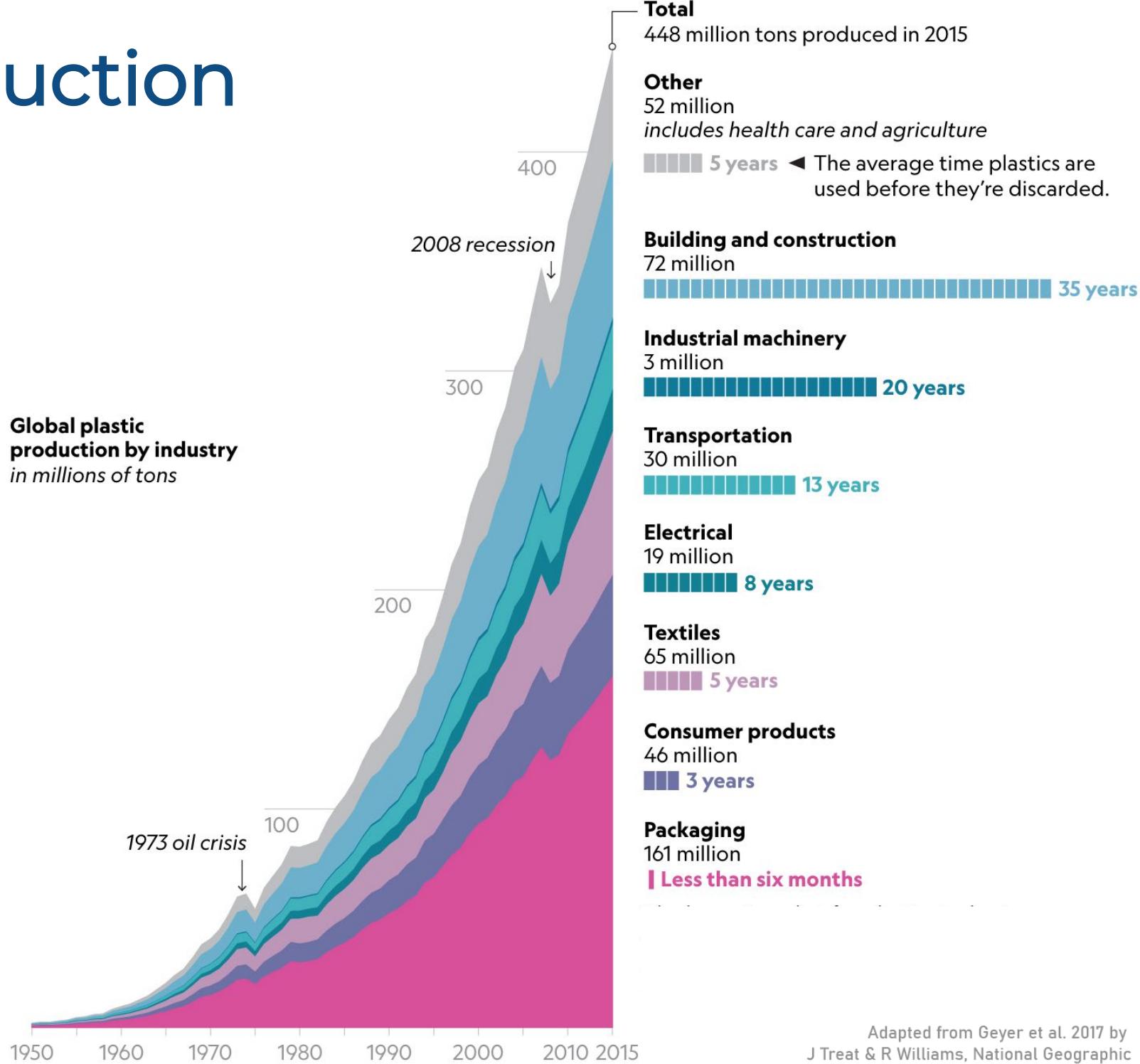
Toxic fumes are released from burning plastic, but many communities have no other options to get rid of their waste. Photo: Hazel Thompson/Tearfund

# 2022 was a year of global commitments

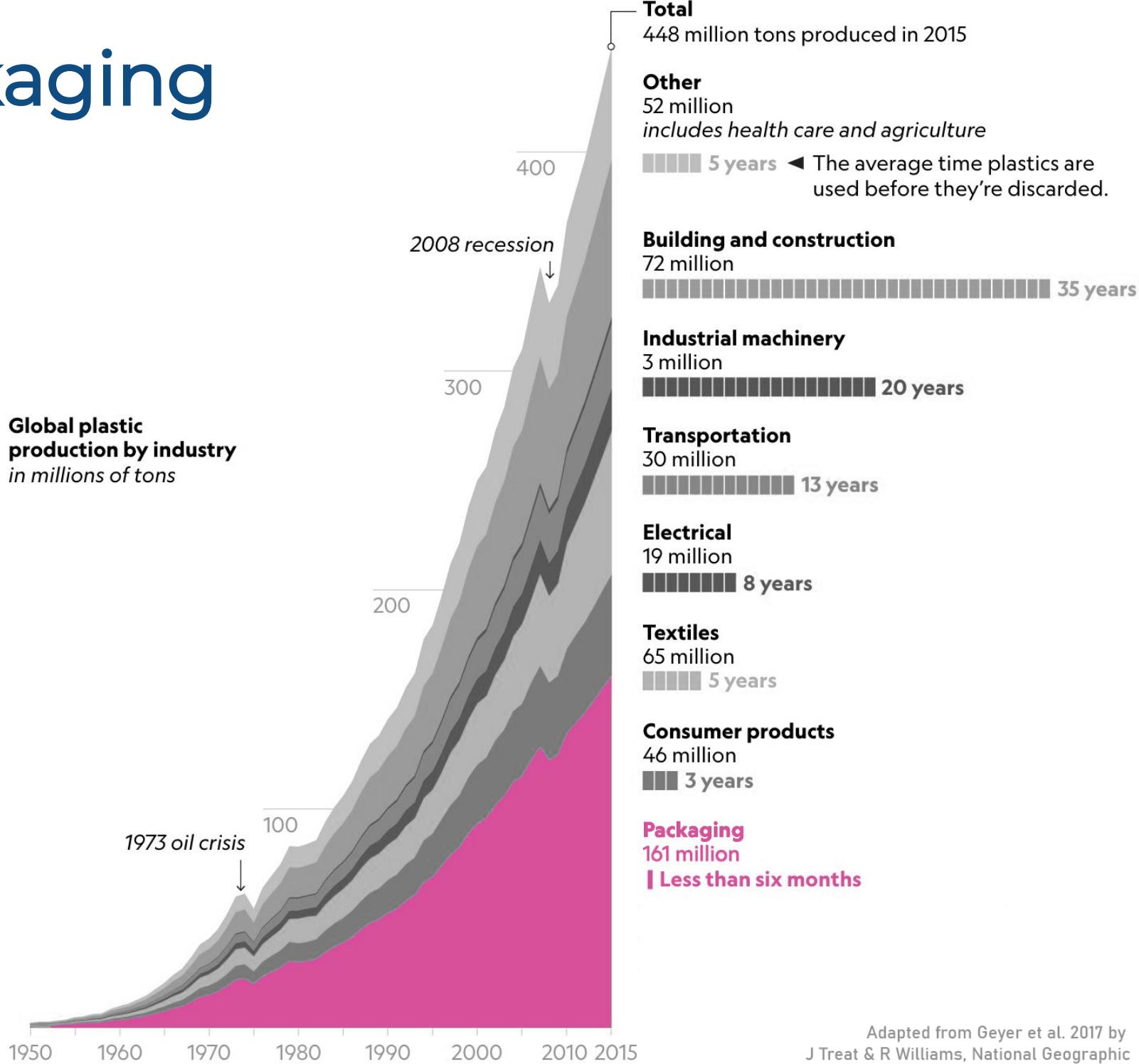


- Global Plastic Treaty, United Nations Environment Assembly
- 50 by 2050 Initiative, United Nations Climate Change conference

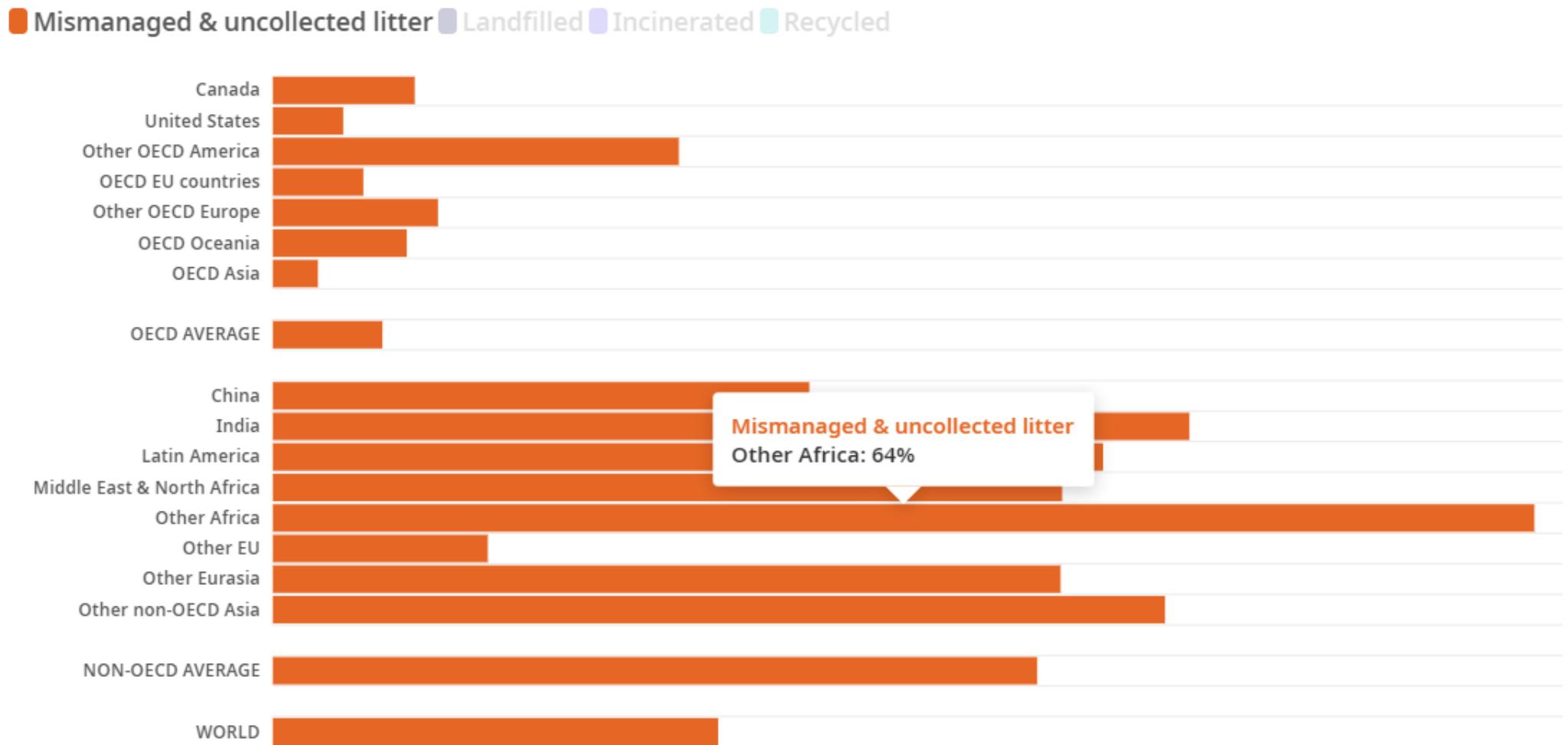
# Production



# Packaging



# Challenge of collection



Source: [OECD Global Plastics Outlook Database](#)



# Challenge of food-contact material

- Even if collection occurs, there are barriers to recycled food-contact materials (FCMs)
  - Contamination from chemicals or previous use
  - Degradation during use/ recycling
  - Commingling of non-food-grade plastics

# Challenge of closing the loop

Forward or direct logistics is the flow of materials from the supplier to consumer



Reverse logistics is the flow of products from the consumer back to the producer



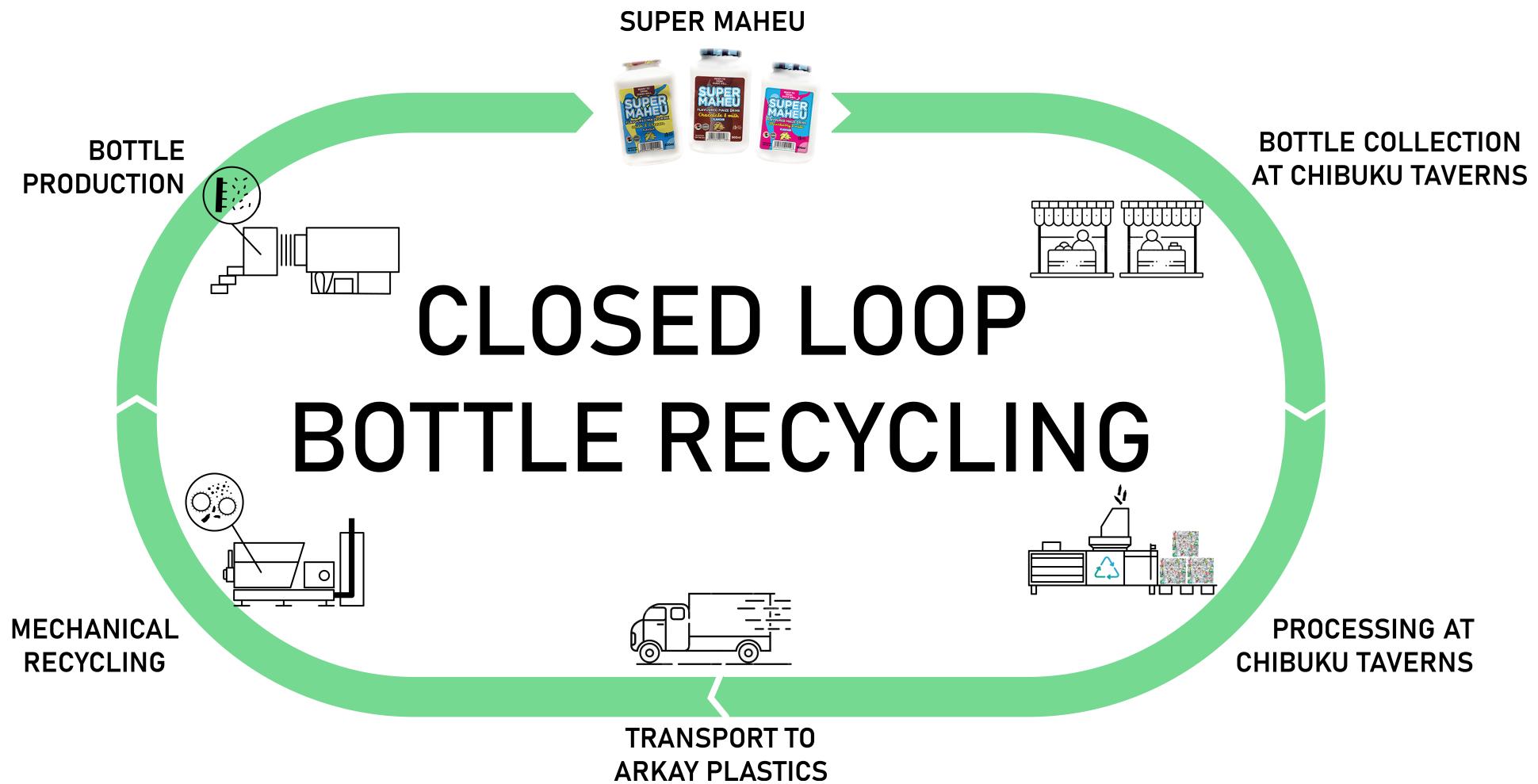
# Goal

Develop and evaluate the use of reverse logistics in closed-loop plastic recycling in a resource-limited context

# Study site

- Malawi
  - Only 12% of waste managed by the municipality (UNDP 2021)
  - Over half the population living in poverty (World Bank 2022)
  - Recycling as both a waste management and economic opportunity
- Blantyre
  - Partnership with Chibuku (beverage company), Arkay (plastic manufacturer), and WASTE Advisers (local NGO)

# Overview - Work Packages



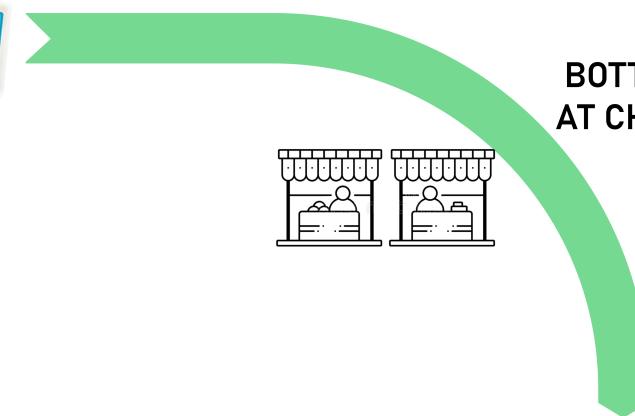
# Overview - Work Package 1

SUPER MAHEU

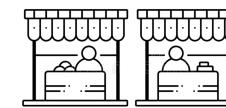


# Overview - Work Package 1

SUPER MAHEU



BOTTLE COLLECTION  
AT CHIBUKU TAVERNS

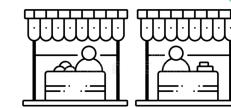


# Overview - Work Package 1

SUPER MAHEU



BOTTLE COLLECTION  
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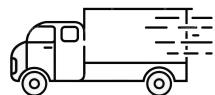
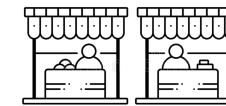
PROCESSING AT  
CHIBUKU TAVERNS

# Overview - Work Package 1

SUPER MAHEU



BOTTLE COLLECTION  
AT CHIBUKU TAVERNS

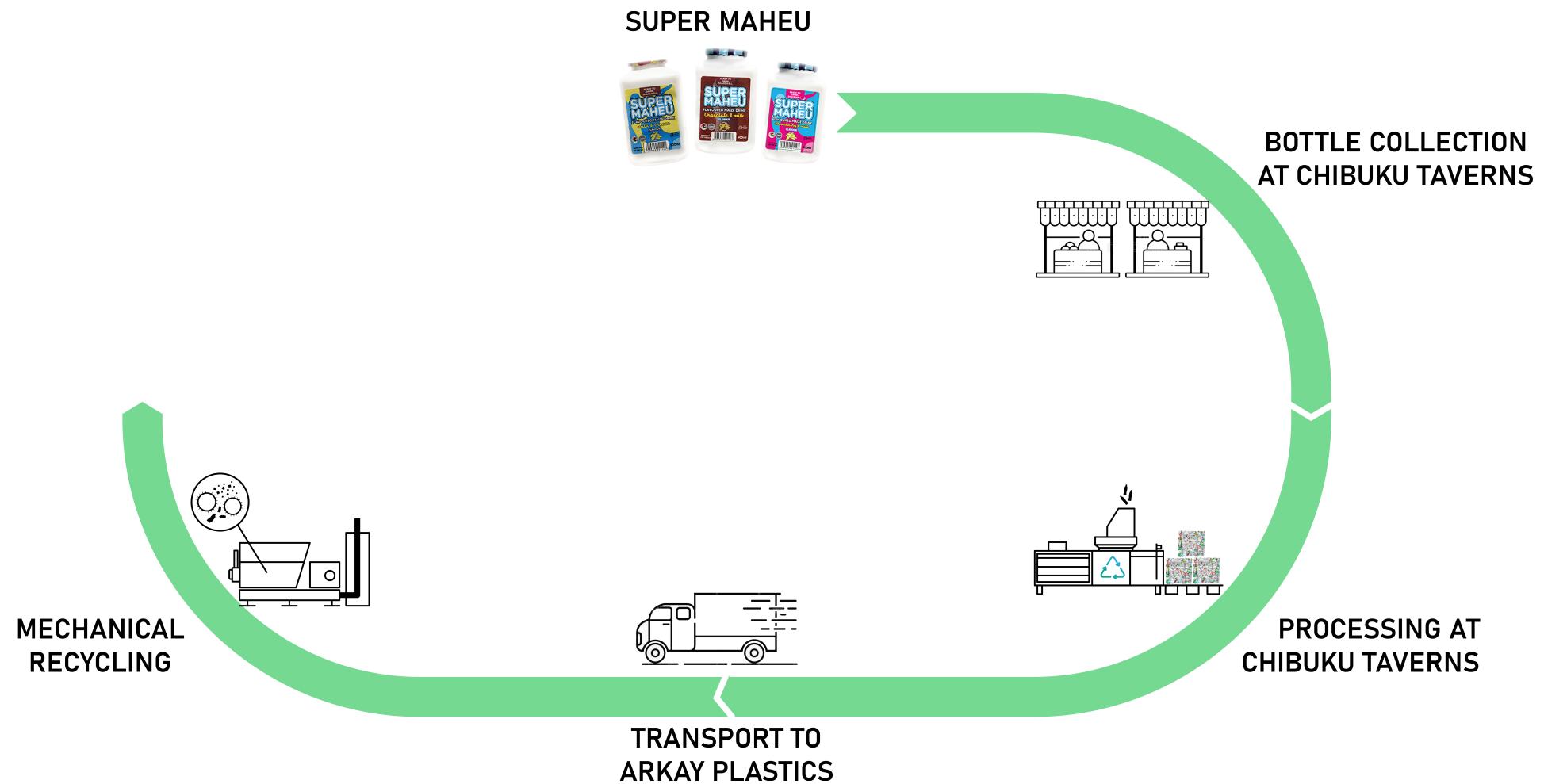


TRANSPORT TO  
ARKAY PLASTICS

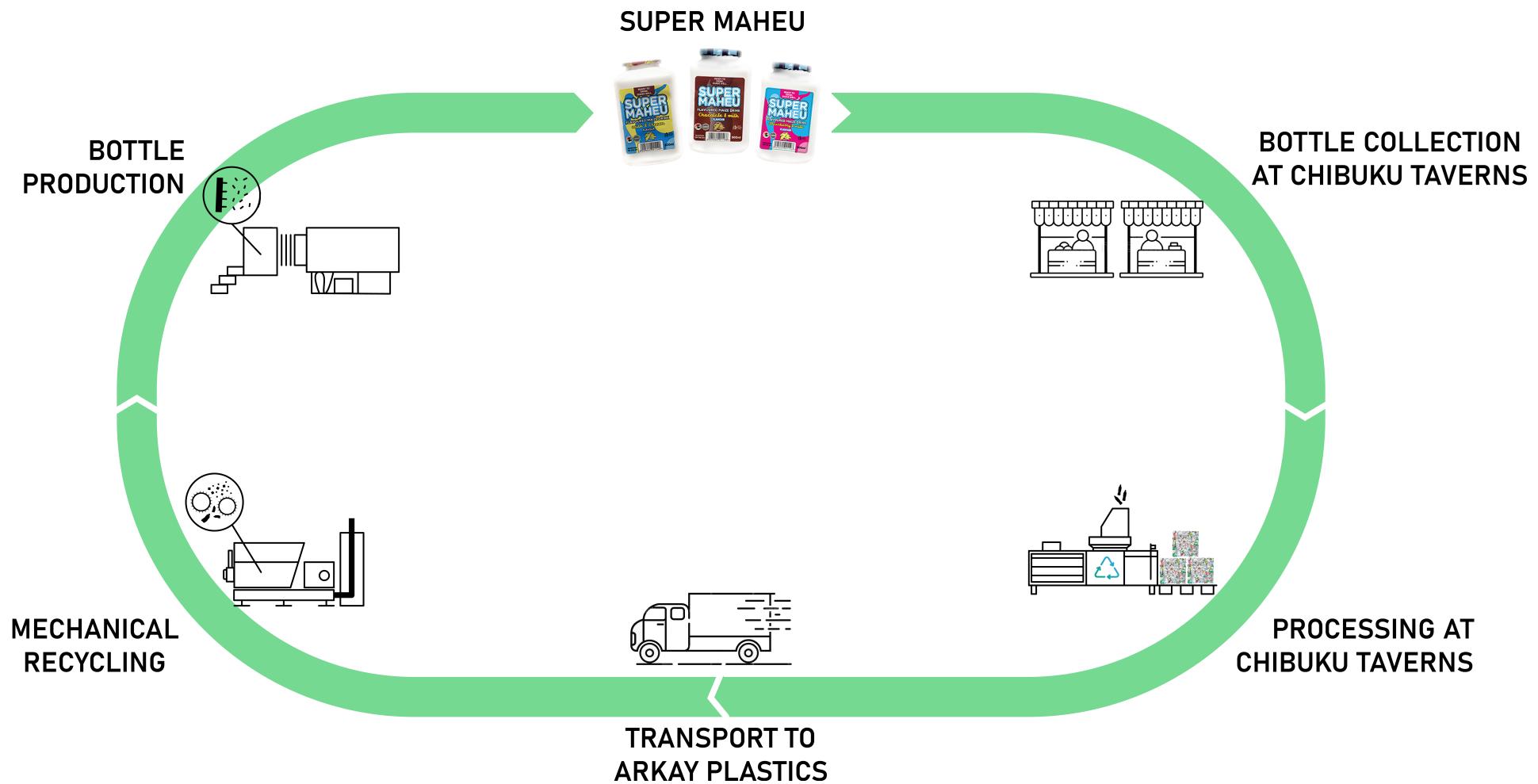


PROCESSING AT  
CHIBUKU TAVERNS

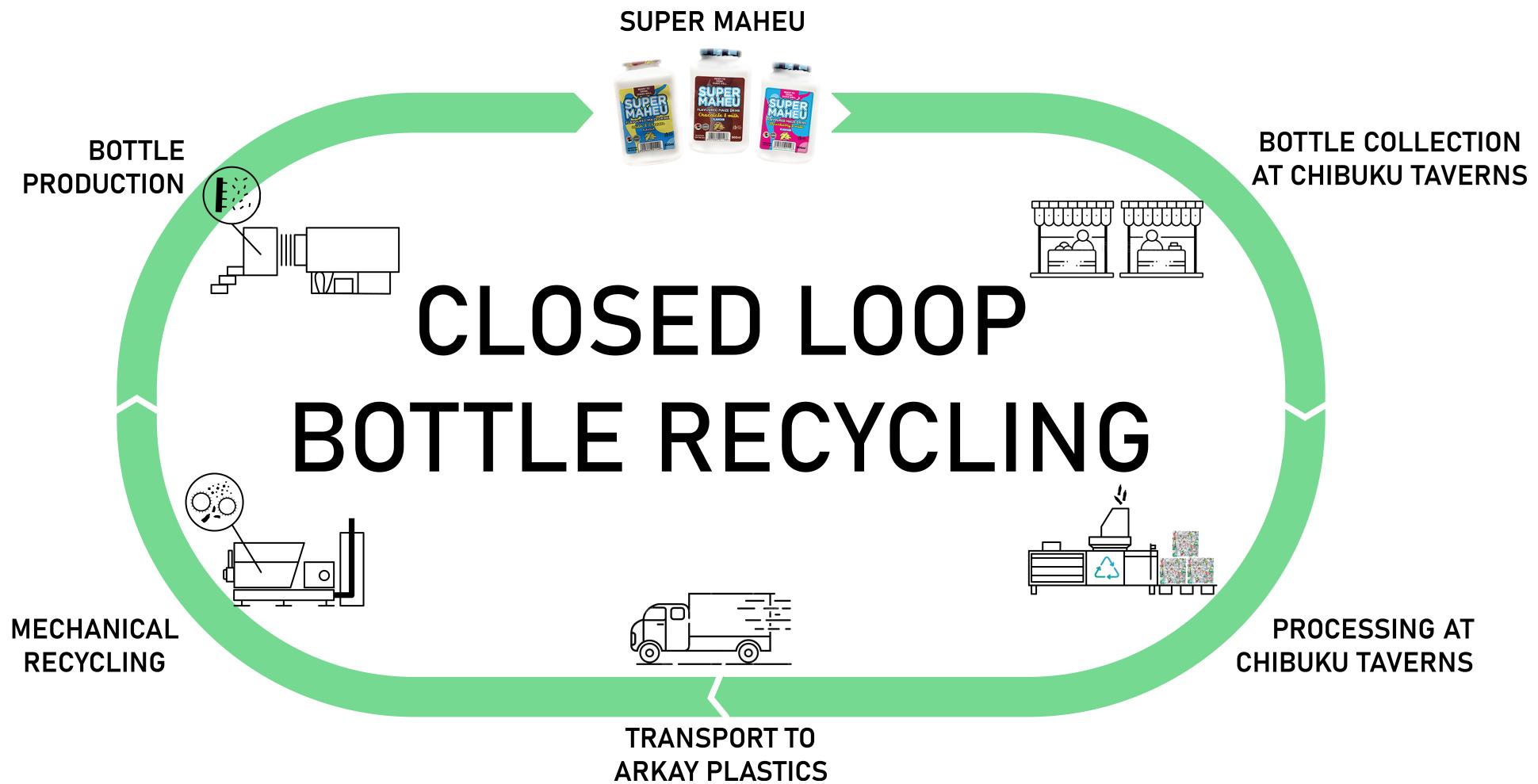
# Overview - Work Package 2



# Overview - Work Package 2



# Overview - Work Package 3



# Work package 1

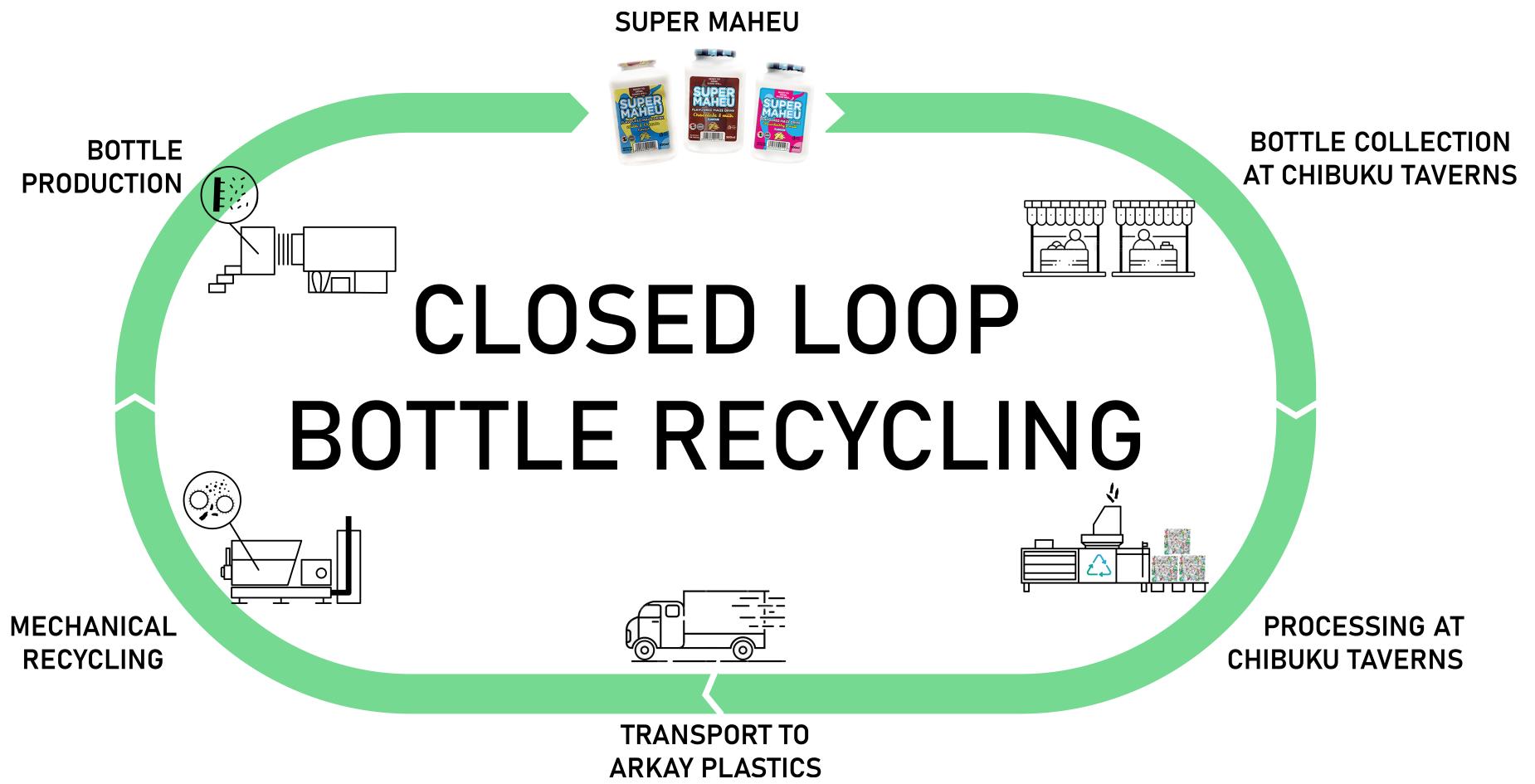
- Research question: What is the willingness to accept (WTA) payment to participate in drop-off recycling at Chibuku taverns?
- Methodology:
  - Physical evaluation
  - Focus group discussions
  - Contingent valuation survey

# Work package 2

- Research question: What is the amount of recycled content that can be safely recycled into new bottles?
- Methodology:
  - Structured questionnaire and Catalogue of Malawi Standards
  - Laboratory tests

# Work package 3

- Research question: What is the financial sustainability of a closed-loop recycling pilot for HDPE bottles?
- Methodology: Financial model assessing total costs along the value chain



# Timeline

# Future directions

- Inclusion of other FCM plastics for recycling (e.g. PET)
- Expansion to other geographies
- Incorporate more recycling partners

# Thanks!

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