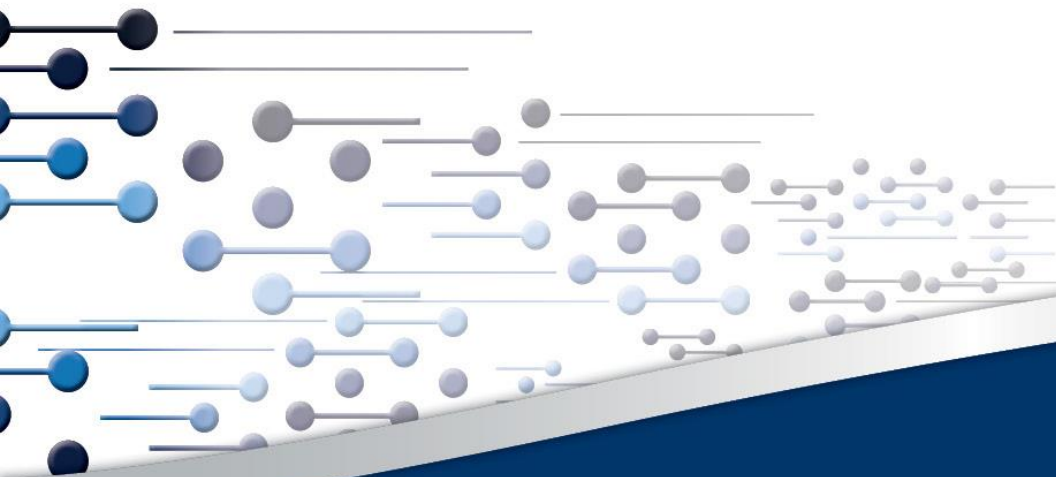


**Progress Report  
Natsurv 1  
K5\_2285/3  
The Malt Brewing Industry**



Presented by: Fhumulani Ramukhwatho  
31 July 2014

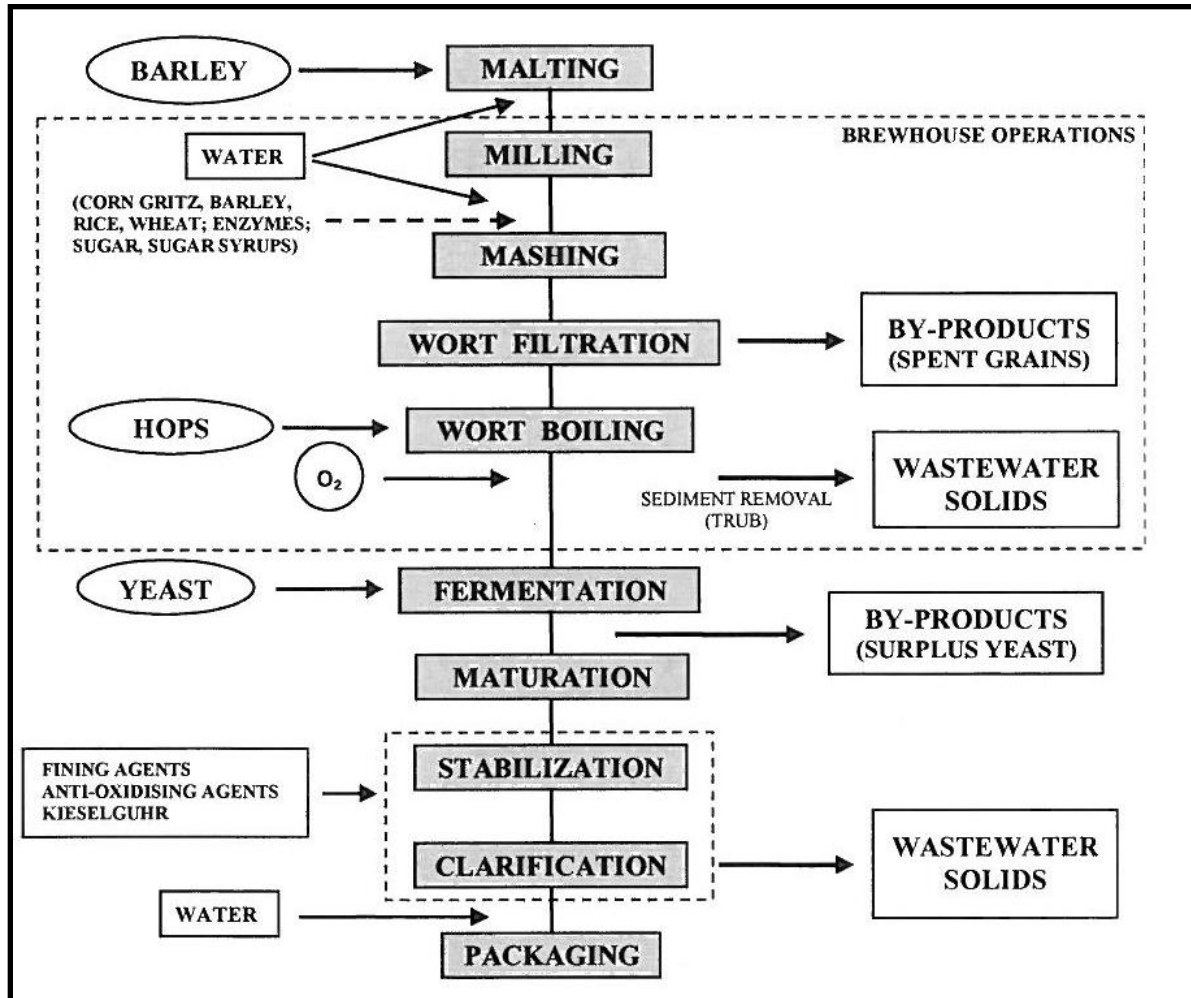
# Industry Overview

- SABMiller holds 95% share of the market
- Brand house and Microbreweries
- Overview of SABMiller:
  - 5113 direct employees and a total of 355 000 supply chain
  - Annual brewing capacity of 3.1 billion litres per year
  - Contributed R66.2 billion to the GDP in 2009
  - Annual Revenue: R42 billion (2009)

# Methodology and Approach

- Through literature survey to gain an understanding of the malt brewing industry with respect to:
  - Production processes
  - Process inputs (raw materials)
  - Waste streams (solid, liquid, etc.)
  - Technologies evolution
  - Legislative framework
- Identify malt breweries operating within South Africa, and classify them according to production capacity
- Soliciting of breweries participation through telephonic and email contacts
- Use of a targeted questionnaire

# Overview of brewing process cycle



The generic brewing processes for beer production (Varman and Sutherland, 1994; Unicer, SA, 2005)

# Breweries Classification

## Per Barrel produced:

Large:  $> 6\,000\,000$

Medium:  $\geq 15\,000 \leq 6\,000\,000$

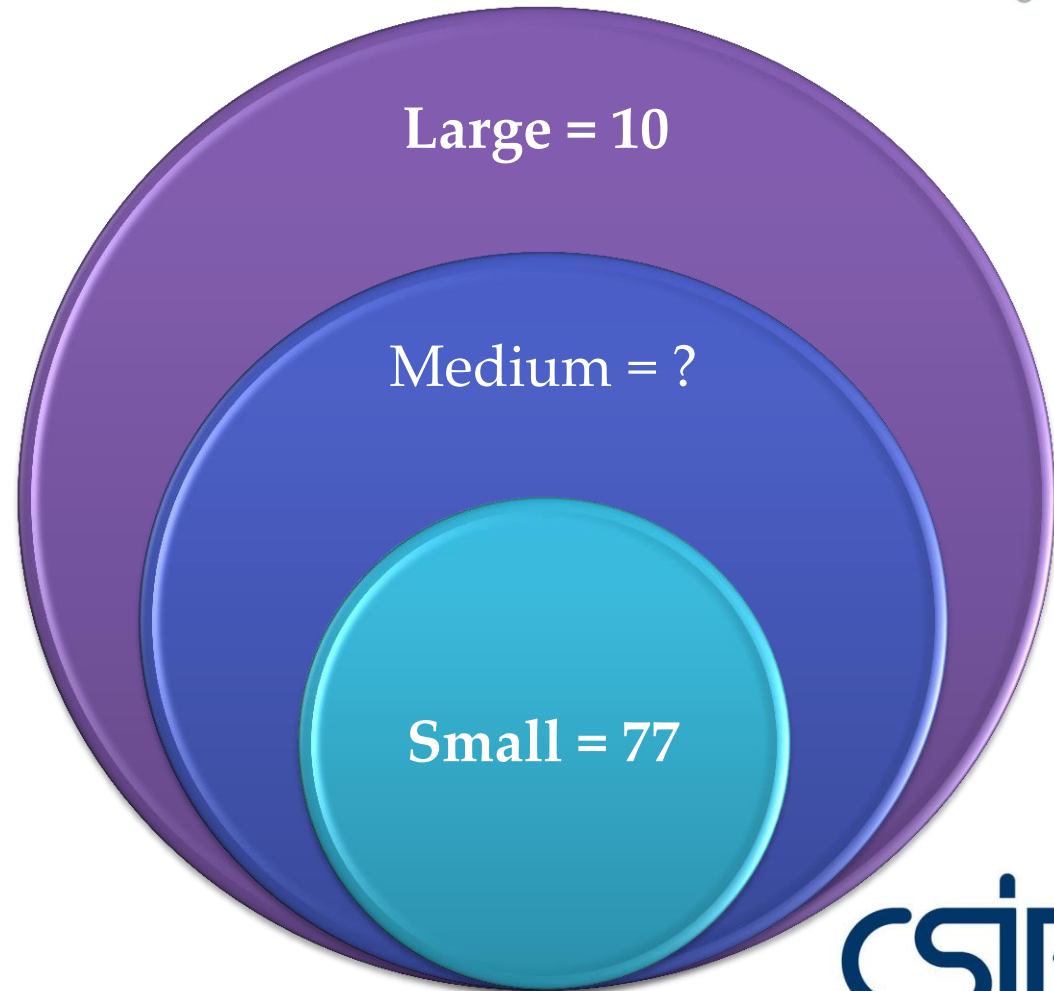
Small:  $< 15\,000$

## Per Hectolitre produced:

Large:  $> 70\,20000$

Medium:  $\geq 17\,550 \leq 70\,20000$

Small:  $< 17\,550$

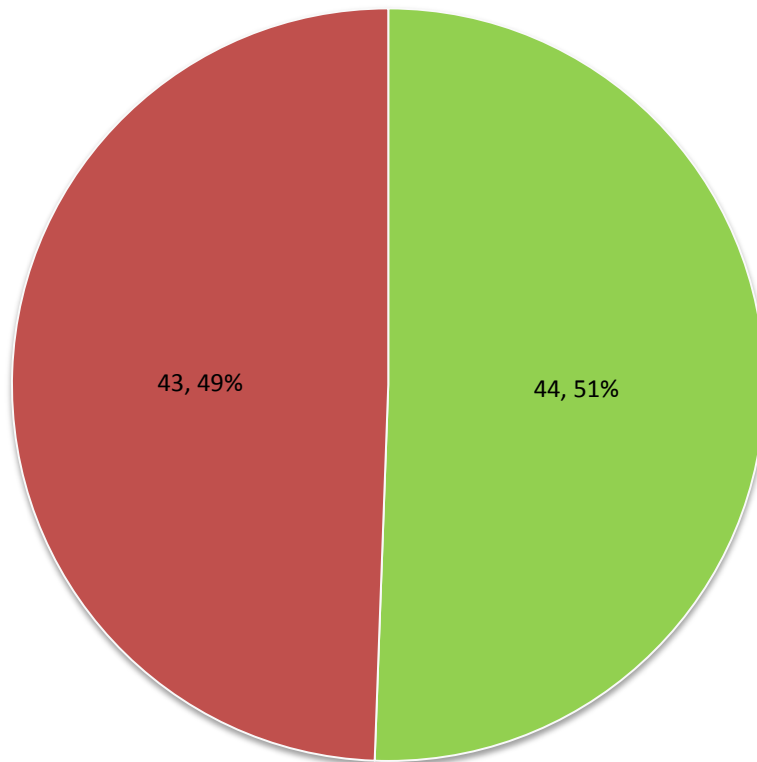


# Questionnaire Approach

- Questionnaire formulated based on literature and discussions with industry experts
- Questionnaire covered the following aspects:
  - manufacturing processes (7)
  - water consumption (10)
  - energy consumption (9)
  - waste and wastewater treatment (3)
  - best practices (3)
- Questionnaire was intended to be sent to 44 breweries, 37 accepted to participate in the study and response was expected in 4 weeks time. Only 8 ( $\approx 22\%$ ) have responded

# Total number of breweries contacted

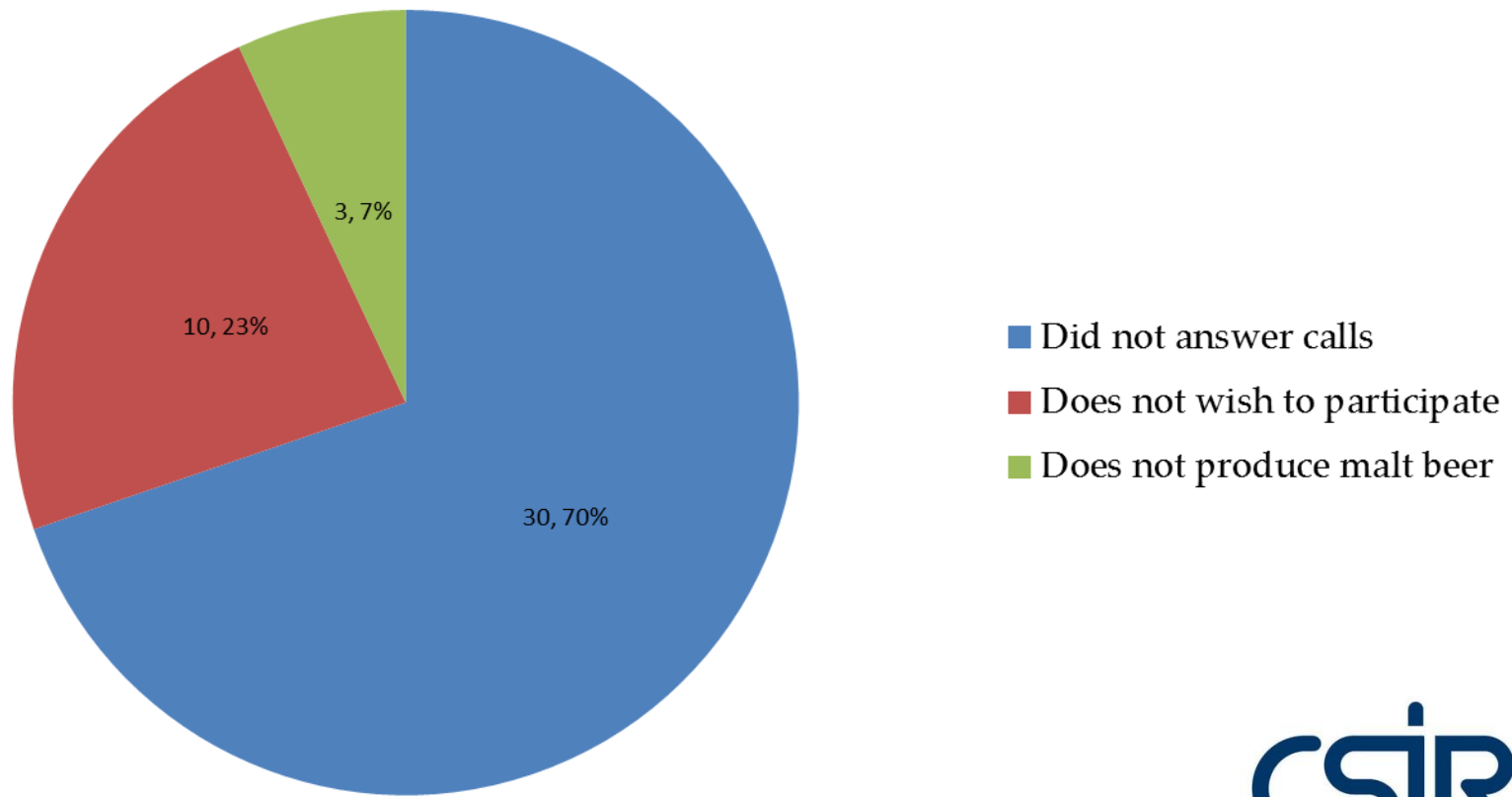
## Breweries contacted (87)



- Amount of breweries viable for the study
- Breweries that could not be reached

# Reasons for not participating in study

## Breweries not participating in study (43)

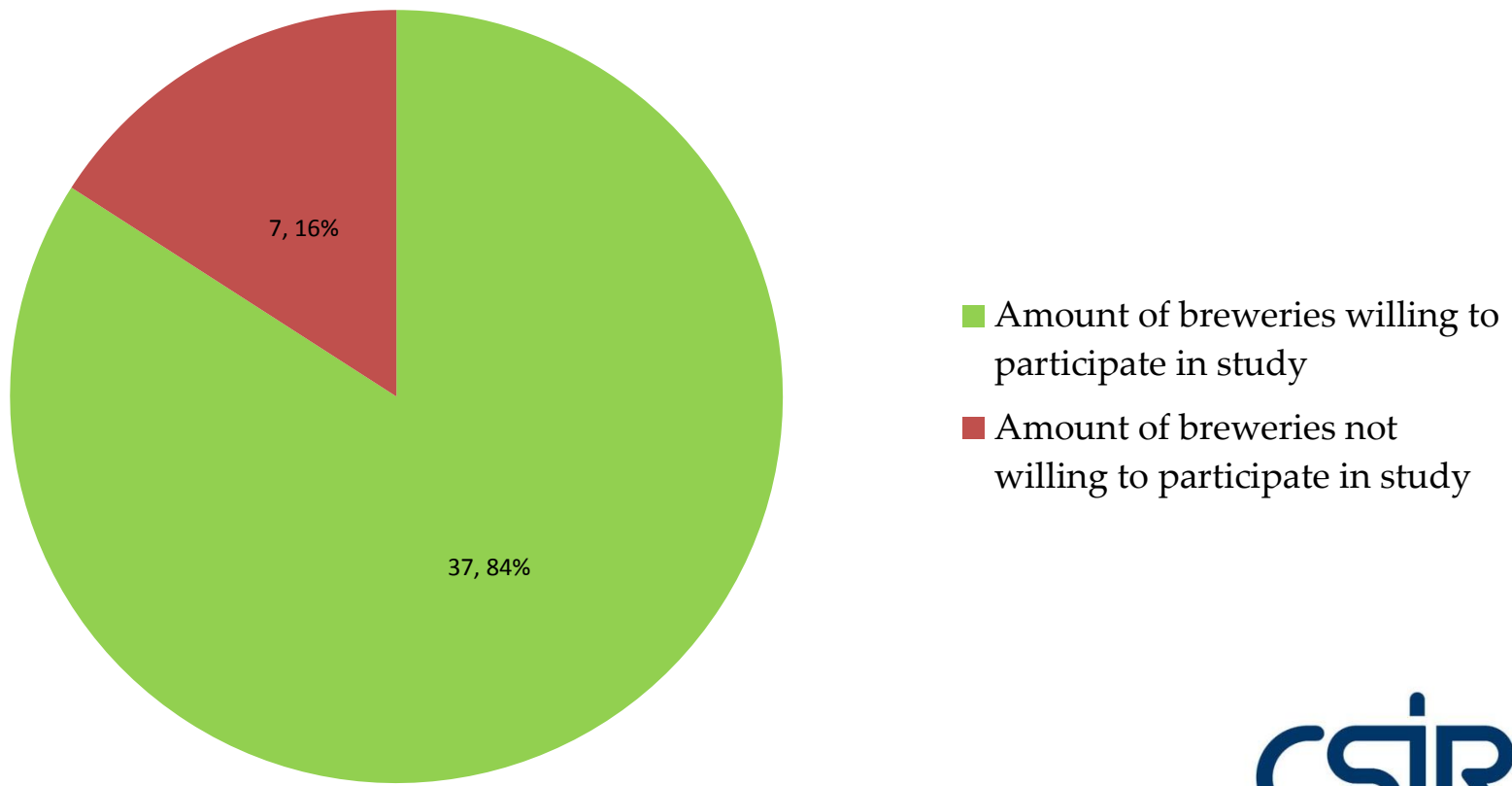


- Did not answer calls
- Does not wish to participate
- Does not produce malt beer

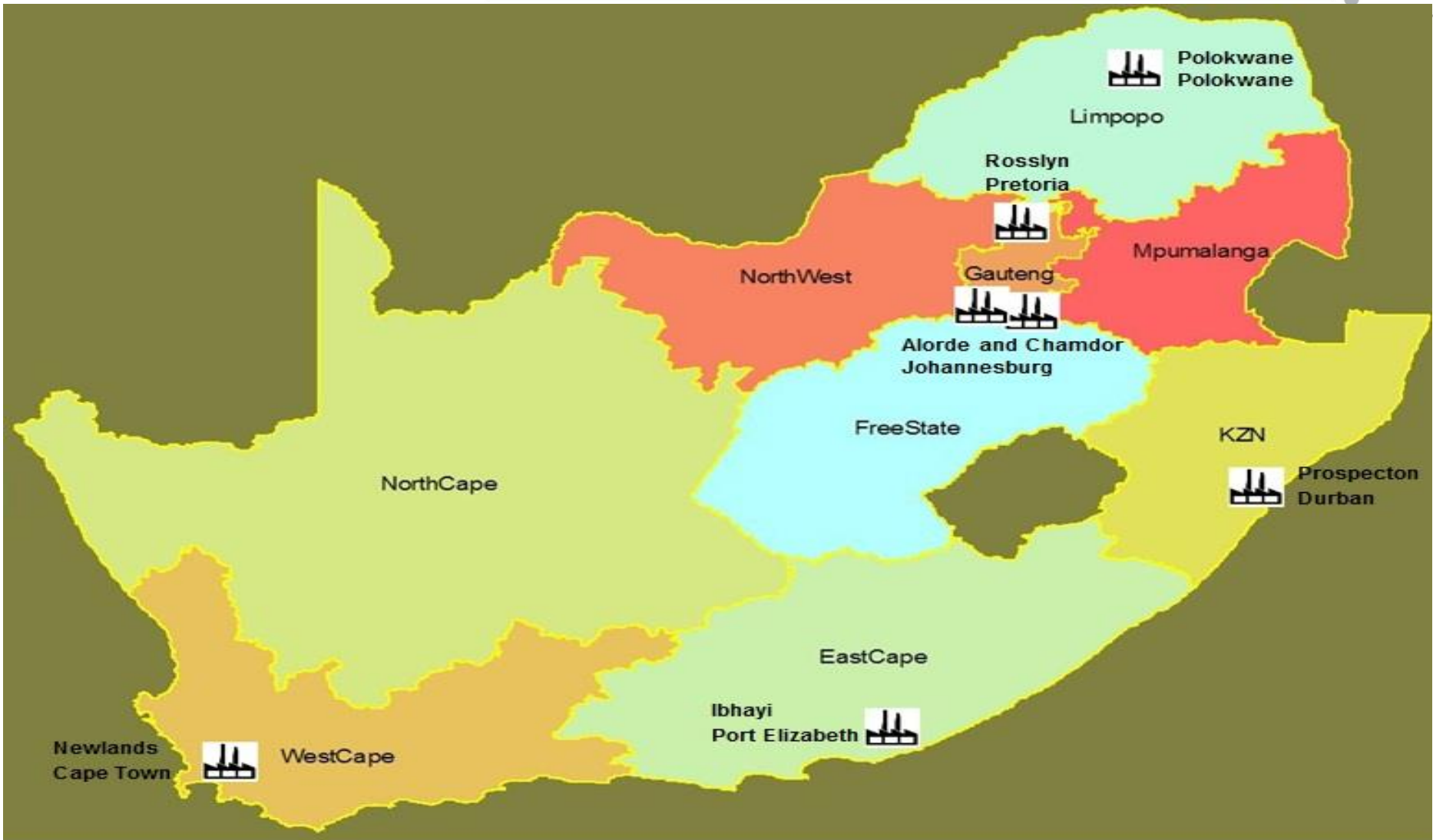


# Willingness to participate in study

## Breakdown of response from viable breweries



# Loci of Malt Breweries in SA



# Key Brewing Processes



**Brewing**



**Fermentation**



**Storage**



**Bottling**



**Barrelling**

# Preliminary Results from Questionnaire/ literature

- Results based on 8 responses (breweries)
- Data to date was synthesized in the context of resources consumption and waste generation
- Identification of key resources consumption and waste generation
- Identification of current best practices

# Results : Manufacturing Processes

- Manufacturing quantities of beer
  - $< 100$  hl (2)
  - $\geq 100 \leq 1000$  hl (2)
  - $\geq 1000 \leq 5000$  hl (2)
  - $\geq 5000$  (1)
- Dry milling conditions
- Breweries operations are seasonal
- Most breweries use manual washing
- Adopt changes in breweries



# Results Cont.: Water Consumption

- Water quality don't differ
- Water meters installed and maintained weekly
- Water saving methods
- CIP with caustic and acid flush
- Fermenters and storage tanks; uni tanks
- Cascaded water recycling system
- Hot water bath, direct electric element and steam methods are used for heating the kettle during wort boiling brewing phase
- Hot water bath is heated with gas burner electrically



# Results Cont...: Energy Consumption

- Energy policy & Audited monthly
- Fitted heat recovery system in different processes
- Insulated Pipes, storage tanks & process units used for heating/refrigeration
- Suggested solar panels in the future
- Processes currently utilised in breweries:
  - Recover heat from wort cooling
  - Vary washing cycle based on size of keg/bottle
  - Plant operated to place maximum cooling at night
  - Use of temperature control loops
  - Insulation of valves, fittings and flanges
  - Use of fixed spray injectors



# Results Cont...:Waste and Wastewater Treatment

- WWTP and plans to construct WWTP
- Techniques used for the treatment/capturing of the gases
- Emissions treatment





# Results Cont.: Best Practices

- key stages in relation pollution in production stages:
  - Waste disposal
  - Wort boiling in the kettle
  - Wastewater treatment and end use thereof
  - Cleaning
- Legislation governing the management of waste, water and energy
- Cleaner production practices:
  - Re-use of packaging materials
  - Sell spent grains to pig farmers
  - Wastewater to irrigation
  - Oriented to re use of waste and emissions
  - Capture of water and heat during wort chilling

# Resources Consumption Matrix

## Intensive Resource Consumption / Wastewater Generation

Process	Energy	Water	Wastewater
Milling		x	x
Separation (Filtration)		x	x
Wort Boiling	x		
Cooling	x		
Stabilization and Clarification			x
Pasteurization	x	x	
Packaging and Cleaning	x	x	x

# Generic best practices

- **Cascaded Water Management:** Water is recycled from one process to the next. This practice is utilised in the cooling, pasteurization, cleaning and bottle washing processes.
- **Energy Pinch:** A technology that facilitates the recycle of heat (energy) between processes. Heat exchangers allow numerous process streams to come in contact with one another which facilitate the heating of cold streams and the cooling of hot streams. The practice is utilised in wort boiling, cooling, pasteurization and bottle cleaning processes.

# Specific best practices by process

- **Mashing:** Bladed Mash Filters act as spargers that squeeze any excess wort out of the grains.
- **Wort Boiling:** Use of sealed kettles with internal heating systems or thermo syphon wort boilers greatly reduce heat loss by vaporization of liquids into the atmosphere.
- **Maturation:** Bioreactors that contain immobilised yeast are capable of accelerating the maturation stage.

# Specific best practices by process continued

- **Cooling:** Pre-cooling liquids to reduce the energy stress of the cooling procedure.
- **Pasteurization:** Making use of flash pasteurization as opposed to tunnel pasteurization due to the reduced water requirement of flash pasteurization.
- **Packaging:** Single strip nonreturnable bottles greatly reduce water and energy consumption due to the bottle washing step being omitted.
- **Cleaning:** Automated bottle washing fixed spray injectors reduce water usage and wastewater generation.



**Thank you**



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