



Full Report

# DEVELOPING ROBUST DISTRIBUTION NETWORKS FOR FUTURE URBAN PLANNING SCENARIOS

## 1 Background

The growth and expansion of cities lead to an increase in consumer product demand and an increase in the distribution network. Supply distribution networks need to be developed to cope with these constant changes, since regularly altering a distribution network is extremely costly. Thus it is important to determine the location of distribution centers (DC) for optimised last mile delivery of consumer goods (from the DC to the retailer) based on possible future city expansion scenarios.

## 2 Project Aim

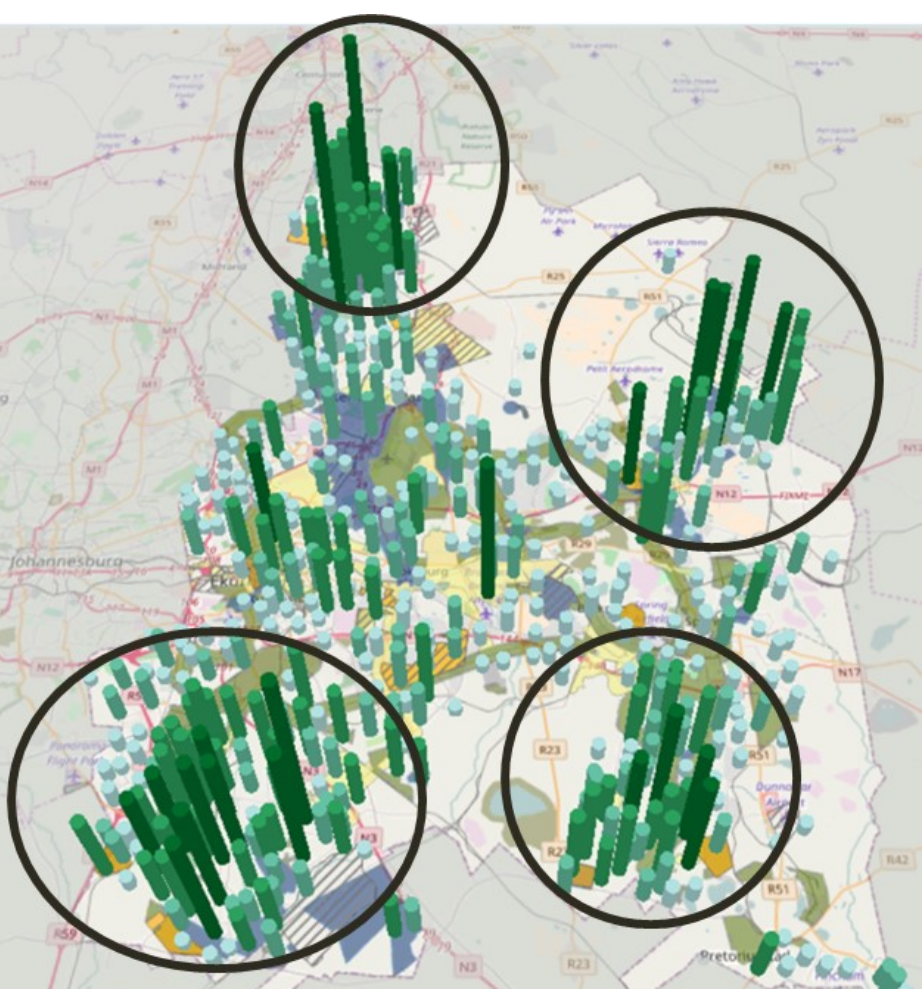
Develop a robust facility location model and last mile distribution network model that will be compatible with any of the multiple possible future scenarios for the Ekurhuleni municipality in 2030.

## 3 Assumptions

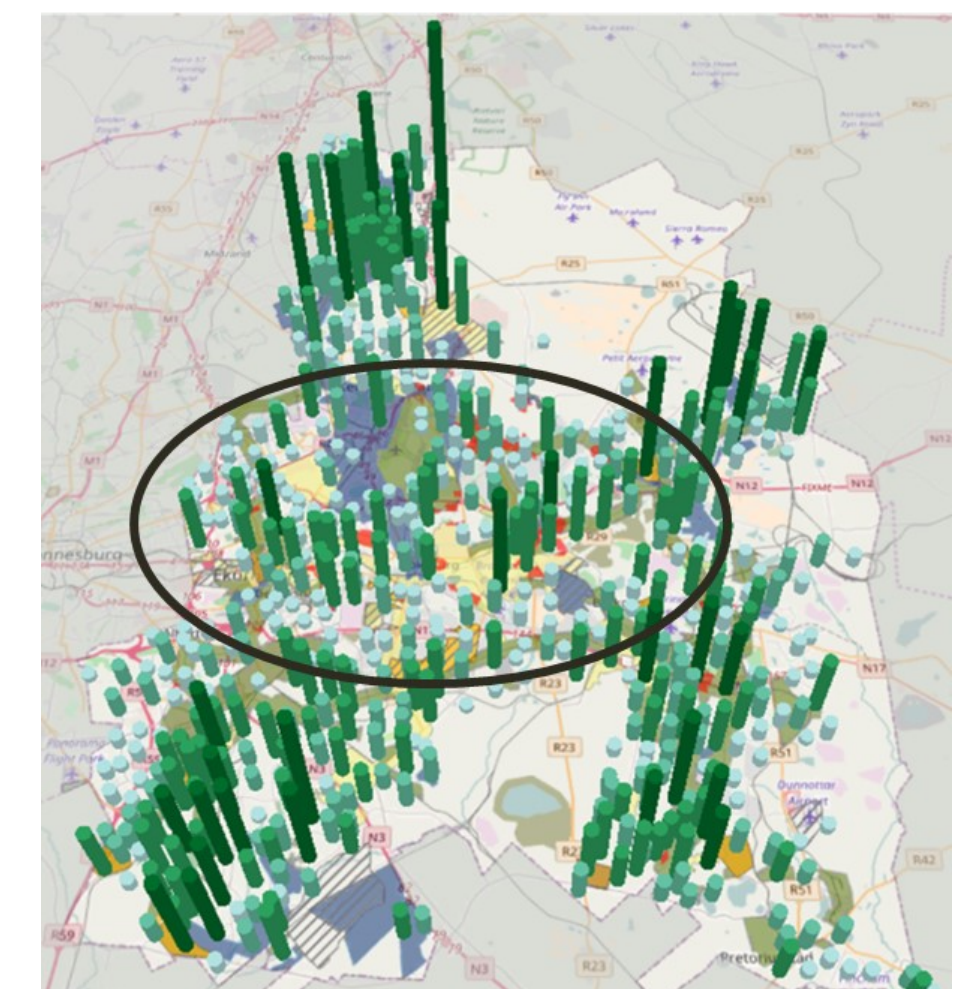
- **1058** zones
- **Customers** per zone same as population per zone
- **Retailers** located at centroid of the zone
- Only **vacant** land considered for DC placement

## 4 Possible future scenarios

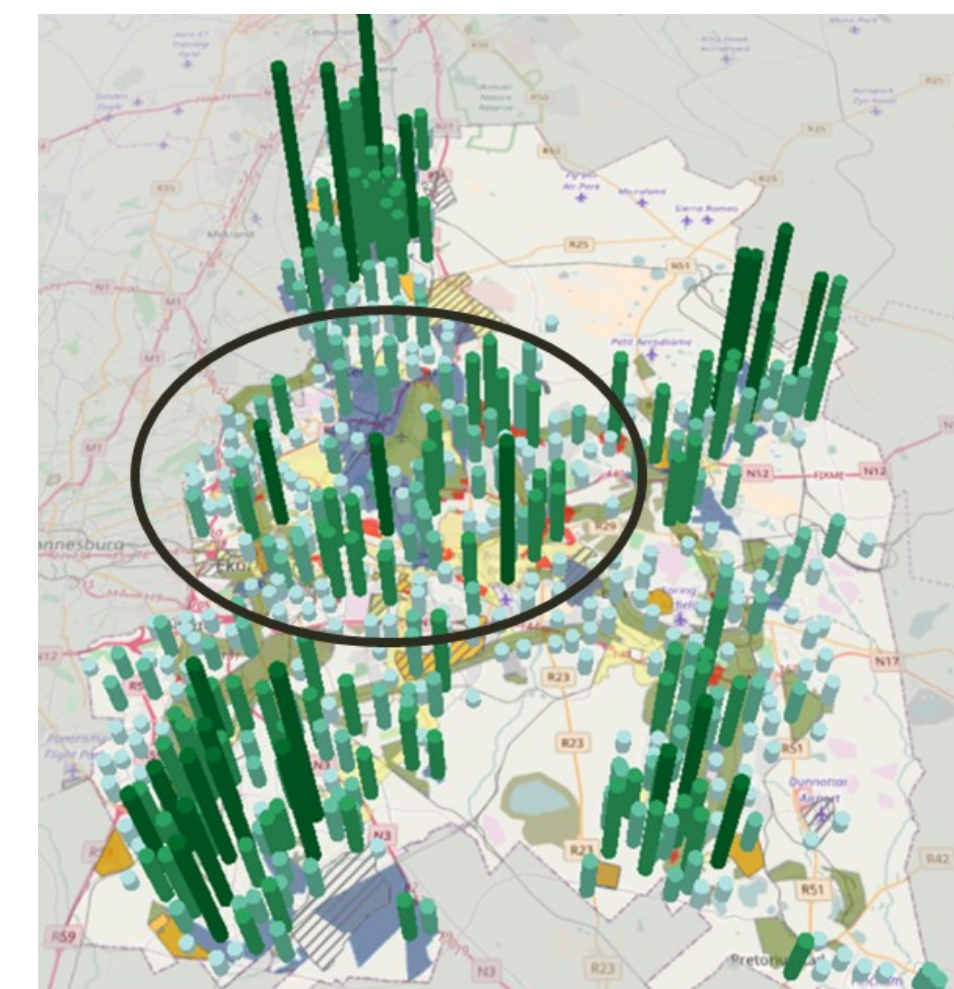
**Trend**  
The population will keep increasing at the current rate and trend. Total number of households by 2030 = **1 756 631**



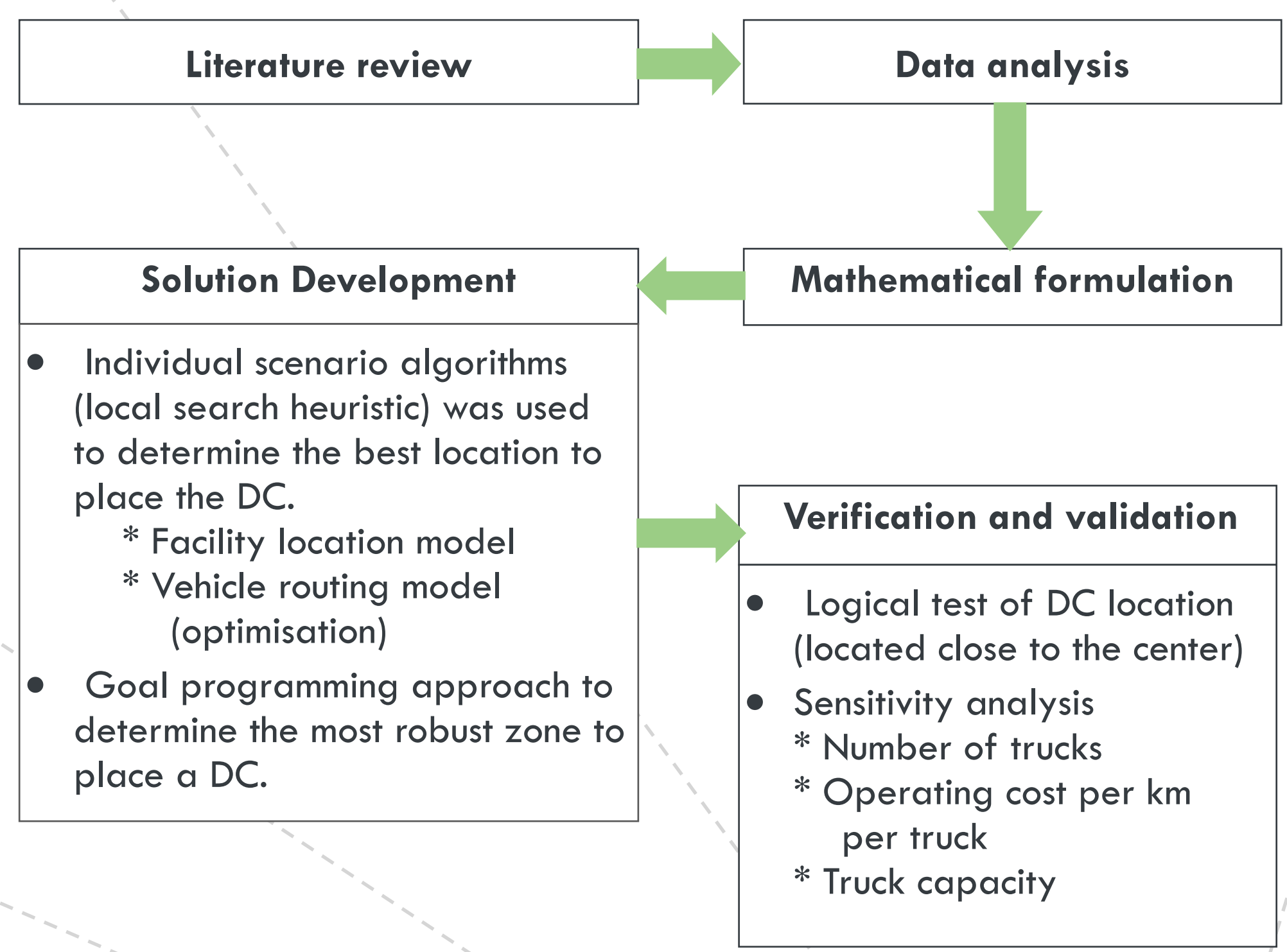
**Aerotropolis**  
Significant increase in industrial activity leading to a large increase in job opportunities. Total number of households by 2030 = **1 786 766**



**Human Settlements project**  
Housing projects in strategically located areas closer to transportation and jobs. Total number of households by 2030 = **1 783 283**

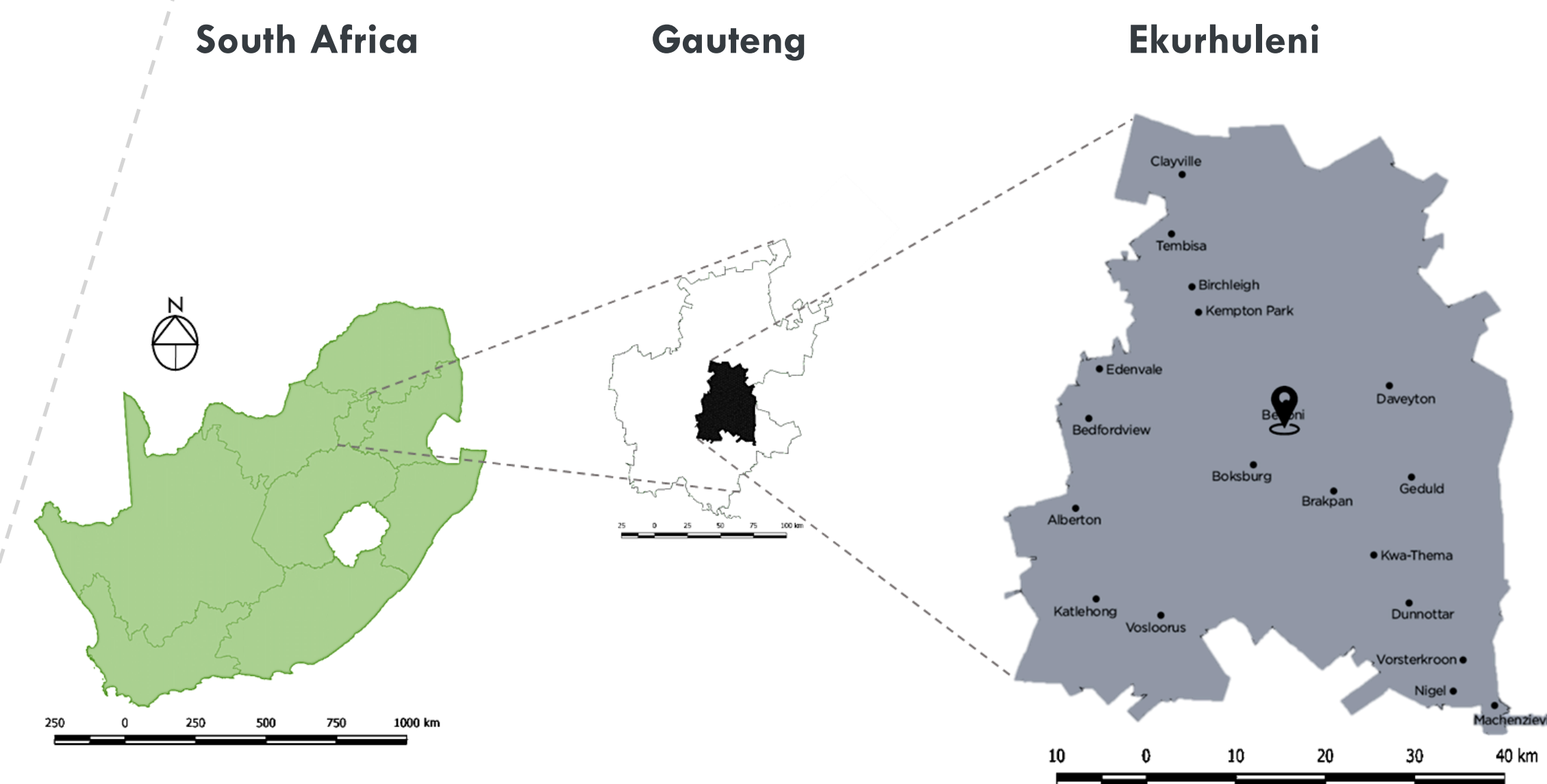


## 5 Approach



## 6 Results

- The robust location of the DC is close to the center of the municipality.
- The most robust zone to locate the DC is **zone 538**.



**\$** The difference between the minimum cost for each scenario and the robust cost for each scenario for each delivery cycle is small which implies the distribution network is indeed robust.

### Comparison of scenario optimal vs. robust solution

	Trend	Aerotropolis	Human settlements project
Optimal zone	444	895	538
Total cost for optimal zone	R29 725 140	R29 725 400	R29 75 244
Robust zone	538	538	538
Total cost for robust zone	R29 725 964	R29 725 611	R29 75 244
<b>Cost difference</b>	<b>R824</b>	<b>R211</b>	<b>R0</b>

**\$** Placing the DC in the robust zone can lead to a saving of up to **R63 279** per delivery cycle irrespective of which scenario realises.

