OPERATION RESEARCH

Optimizing Logistics Operations for Industrial Expansion

DEEP DIVING INTO LOGISTIC OPTIMIZATION

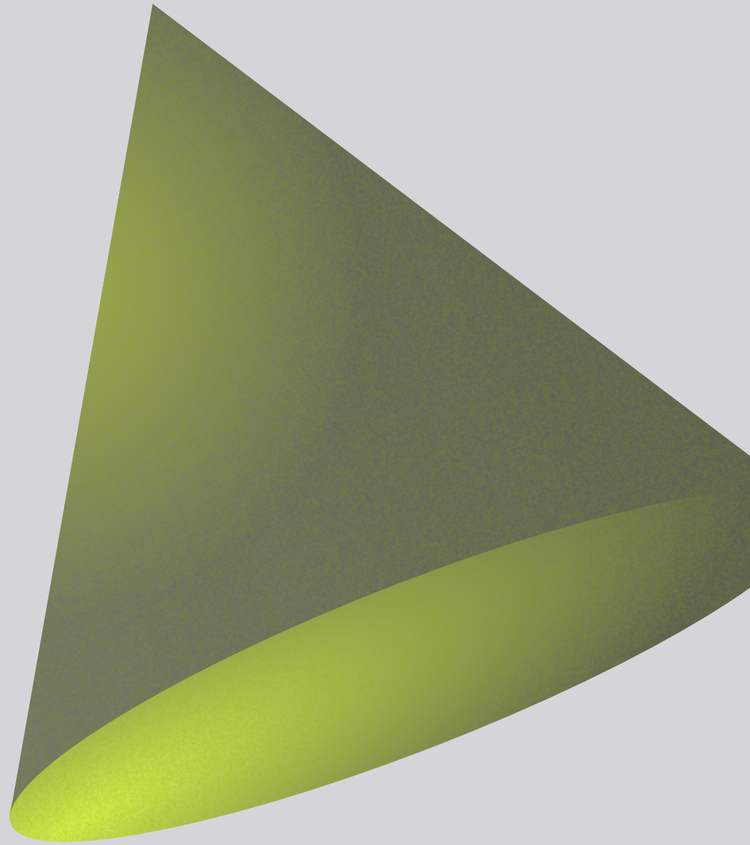
OPERATION RESEARCH

Content

Introduction

Moglix, founded in 2015 by Rahul Garg, revolutionizes B2B commerce through technology-driven procurement solutions.

1. Moglix aims to innovate industrial commerce and empower businesses with efficient procurement solutions.
2. Moglix distinguishes itself through its commitment to leveraging technology and data-driven insights to enhance the procurement experience for its customers through its strong recommendation algorithm.
3. Moglix, a leader in B2B, ventures into D2C, targeting Russia for expansion with plans to establish diverse warehouses nationwide, bolstering its global footprint.



Moglix's Expansion in Russia

- Moglix aims to expand its presence in Russia by strategically establishing Warehouses in select cities to optimize operational efficiency while minimizing costs.
- Moglix's Russian expansion focuses on selecting cities for new Warehouses based on population dynamics while strategically planning warehouse construction to ensure accessibility within a specified range."
- The main branch is in Moscow, necessitating a warehouse establishment for the company's reputation.
- Weekly warehouse replenishment is planned using truck drivers starting their routes from Moscow.

Dataset

CITY DATA

Includes data like City name, latitude, longitude , population size of the city

COSTS RELATED DATA

- Warehouse Rental costs
- Variable transport cost per unit distance.
- Fixed cost of Transportation

DISTANCE DATA

It encovers the distance between the two cities.

USABLE DATA

There are cities where the Warehouses cannot be installed.

Data Collection

OVERVIEW

- Distance between the cities has been calculated using the predefined library geopy in python, which in turn makes the use of latitudes and longitudes which have been carved through the geological data set.
- Usable cities has been interpreted using the population of the cities which was made available through the census data logs.
- Warehouse cost have been certified through the real estate cost.

PROPONENTS

- Warehouse costs mainly include costs like buying, estate, construction and labor attainment cost.
- Transportation cost include truck drivers' salaries, lodging cost, maintenance cost and exorbitant cost.
- Average of the transportation costs have been considered through the individual cities' transportation cost.

Dataset Part

city	lat	lng	country	iso2	admin_name	capital	population	population_proper	cost
Moscow	55.7558	37.6172	Russia	RU	Moskva	primary	17332000	1733200000	6000
Khabarovsk	48.4833	135.0833	Russia	RU	Khabarovskiy Kray	admin	616242	616242	3140
Volgograd	48.7086	44.5147	Russia	RU	Volgogradskaya Oblast’	admin	1004763	1004763	2160
Saratov	51.5333	46.0167	Russia	RU	Saratovskaya Oblast’	admin	845300	845300	2070

Assumption

- Direct Distance
- Single Depot
- Only Top 150 populated city

- Fixed Cost - 75 (For Transportation)
- Variable Cost - 12 (For Transportation
- Truck capacity to refurbish n warehouse

INSTALLATION OPTIMIZATION

OBJECTIVE FUNCTION,

$$\text{INSTALLATION COST} = \sum_{I \in N} C[I] * X[I]$$

SUBJECT TO,

$$\sum_{\text{distance}[i][j] <= \text{range}} X[J] >= 1 \qquad \forall\ I \in N,\ j \in N$$

$$X[I] = 0 \qquad \forall\ I \in N,\ \text{USABLE}[I]=0$$

$$X[0] = 1$$

$$X[J] \in 0,1 \qquad \forall\ J \in N,$$

Clark Wright Savings Algorithm

saving (i,j) = 2 * d_cost(1,i) + 2*d_cost(1,j) - (d_cost(1,i) + d_cost(i,j) + d_cost(j,1))
= d_cost(1,i) + d_cost(1,j) - d_cost(i,j)

routes ⟵ (1,i,1) ∀i in warehouses

S ⟵ saving(i,j) ∀(i,j) in warehouses

Repeat :

currSaving ⟵ Best (S)

S ⟵ S / { currSaving}

if Ind (routes, currSaving) then :

newRoute = mergeRoutesUsing (currSaving)

routes ⟵ routes \ {r1,r2} ∪ {newRoute}

until S ⟵ ∅

Code Demo

Requirements

Solver - Cplex
Iteration_limit - 10000
Code Language - Python
Code Format - Jupyter Notebook
Module - GAMSPY
Package Requirements -

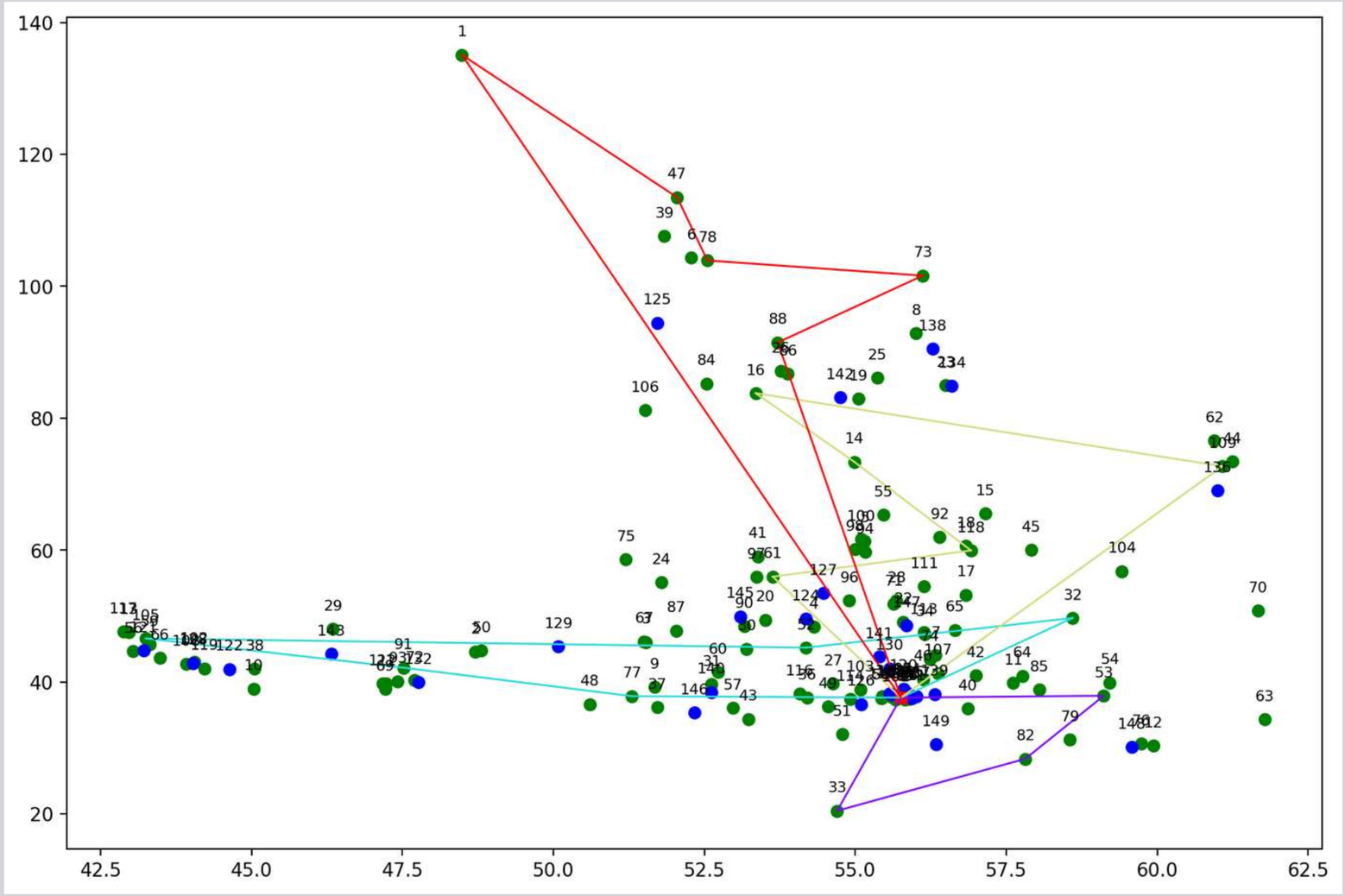
- Gamspy
- Geopy
- Matplotlib
- Pandas

Solution

No. of Warehouse - 19
No. of Path - 4

Intital Warehouse Opening Cost

Building Cost = $ 43.17M
Driving Cost = $ 314.12K
Total Cost = $ 43.48M



Optimize Routes

Future aspects

PROGRESSIVE CALIBRATIONS

Dynamic Route Optimiztaion

- Implement real-time algorithms
- Adapt to changing traffic conditions

Customer Feedback Loop

- Establish feedback mechanism
- Gather customer preferences

Predictive Demand Analysis

- Utilize machine learning models
  - Use historical sales data and external factors to predict future demand for products in each region, aiding in inventory management and supply chain planning.
  - Analyze customer data to identify distinct segments based on purchasing behavior, demographics, and preferences.
- Forecast demand trends

Operational Efficiency Enhancements

Any Question