INSOURCING VS. OUTSOURCING IN A COMPLEX TIME-SENSITIVE TRANSPORTATION NETWORK

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1.Introduction

Project Background
People Inc. is one of Western New York's leading non-profit human services agencies. While the majority of the firm's transportation services are outsourced to two major carriers, People Inc. also utilizes self-owned vehicles to support their operations(Fig. 1). The management team at People Inc. is concerned about significant cost increases in regards to their current transportation system, and are looking to optimize the methods employed within the agency.

Goal
Explore People Inc.'s current subcontracting and self-transport system to find the optimal mix of insourcing and outsourcing of the agency's client transportation services.

2.Methods

Spreadsheet Analysis	GIS technology	Site Visit	Data Visualization

Step 1. Cost Analysis
People Inc. currently utilizes two carriers to transport their clients between day centers and residence homes. The agency pays between $13-42 per trip – rates vary depending on factors such as one way, wheelchair facilities and etc. Each respective carrier holds roughly half of the agency's business yet it is necessary for the staff to self transport a certain number of individuals. Their current cost structure is as follows:
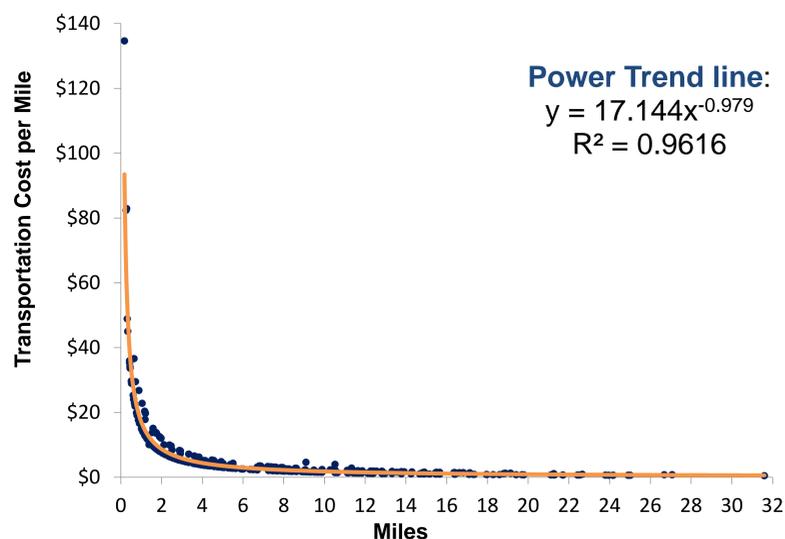

Power Trend line:
$$y = 17.144x^{-0.979}$$
$$R^2 = 0.9616$$

Figure 2.Transportation Rates per Mile based on Trip Distance. The longer the transportation distance, the lower the marginal costs**.** This chart indicates potential cost savings of using carriers' vehicles to provide long distance transportation services.
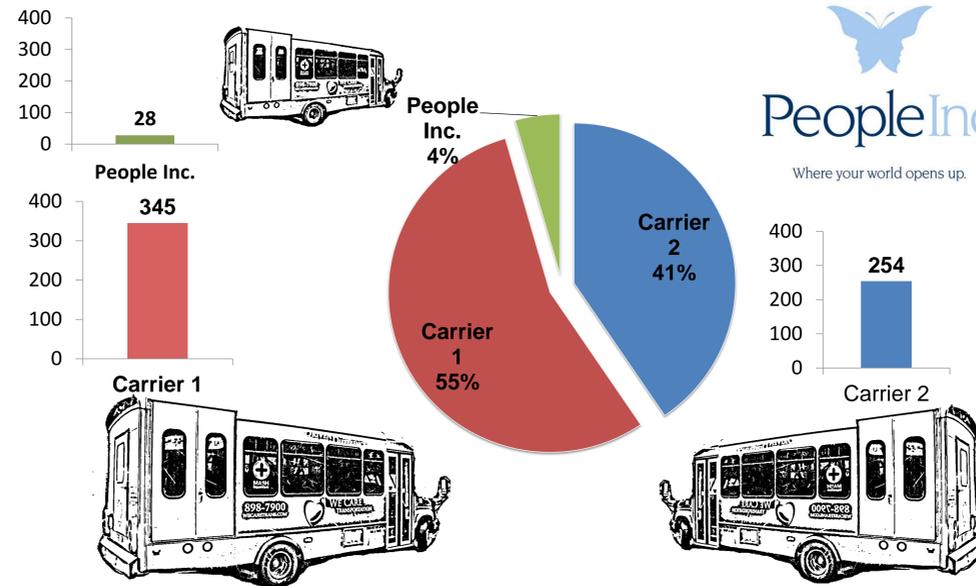

Figure 1. Current Transportation Choices of 627 Clients.

Step 2. Distance Matrix
Under the current system, the carriers serve about 430 locations, 16 of which are day centers. These locations extend over the majority of Erie county, with a few locations in both Niagara and Wyoming counties. Using GIS technology and datasheet modeling, we have acquired the following physical representations of the locations over specified latitudes and longitudes.
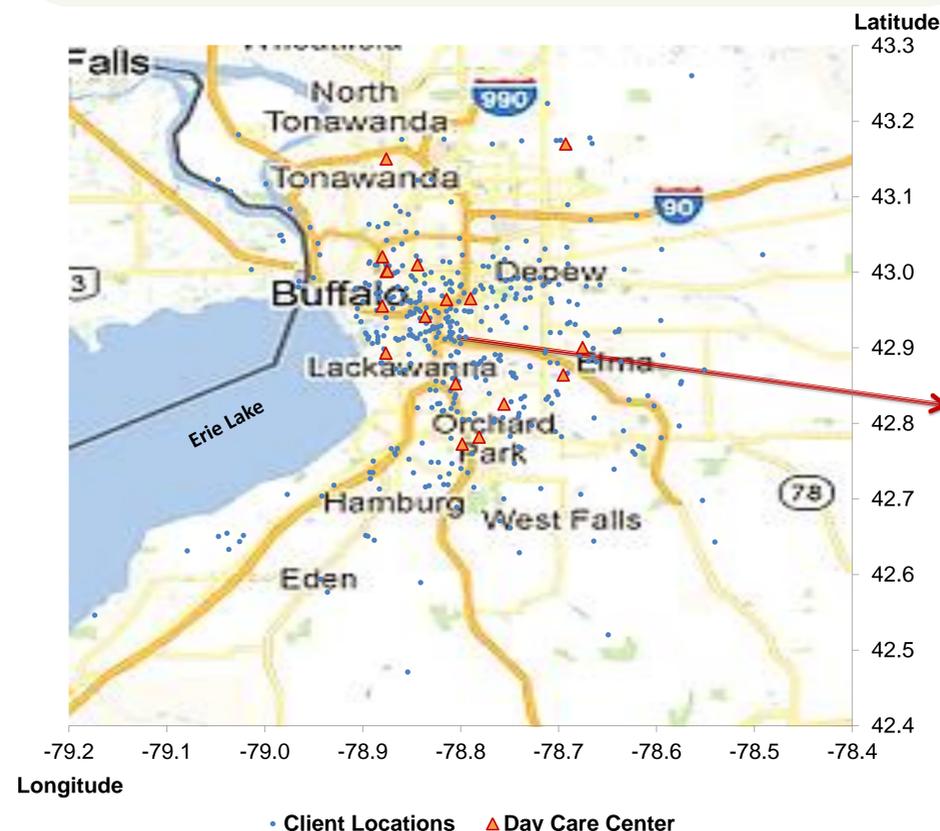

- • Client Locations ▲ Day Care Center

Figure 3. Day Care Center and Clients Location Distribution Map

3.Conclusion

The above analysis reveals the potential for People Inc. to insource more of their transportation services for short distances, as a large number of their clients' locations are clustered closely around their respective day care centers. Meanwhile, People Inc. could expect significant cost savings, as they currently pay a relatively high price to their providers for trips that are under two miles.

For further study, we would like to:
- • Further analyze the current resources (vehicles) People Inc. possesses and whether they can be utilized for extended transportation activities.
- • Work through a cost analysis to determine the additional cost they would bear if they were to insource certain activities.
- • Determine whether insourcing is more cost effective than continuing to outsource their transportation needs.

Step 3. Hierarchy Clustering
Hierarchical clustering is used to merge similar groups of points. In our case, any locations that are within 0.25 miles from each other, are respectively merged into groups suing **visual modeling software NetDraw**. As the distance level increases, more locations will be clustered into the same group. From previous analysis, we focus on the most promising areas for self-transportation(under 0.25 miles).
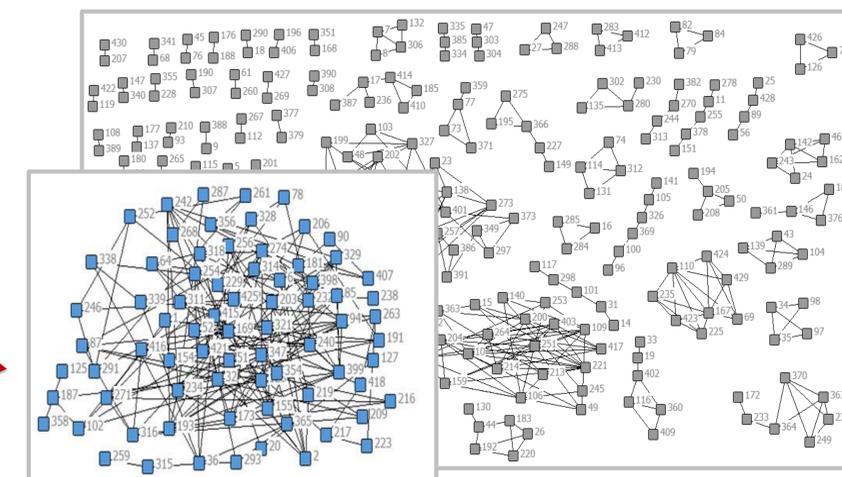

Figure 4. Clustered Location Groups Under 0.25 Mile Level. The largest clustered group can be easily traced back to the most densely area in Fig.3. Groups in very close proximity could be studied for self transportation based on resources available in that area.

4.Acknowledgements