

Generation of Improved Milk-runs for the Mexican Maquiladora Industry

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Funded by TRW and NSF Grant REU for DMI-0100370

Logistics of the Maquiladora Industry

- Business Model:
 - Raw material originates in the US
 - Assembly is performed in Mexico
 - Final product is sold all over the world
- Increased Transportation Costs:
 - Retrieval of raw materials
 - Transfer parts between plants
 - Deliver finished products

TRW-Chihuahua

- Problems:
 - No focus on transportation costs
 - No checks on Third Party Logistics company
 - Poor truck utilization

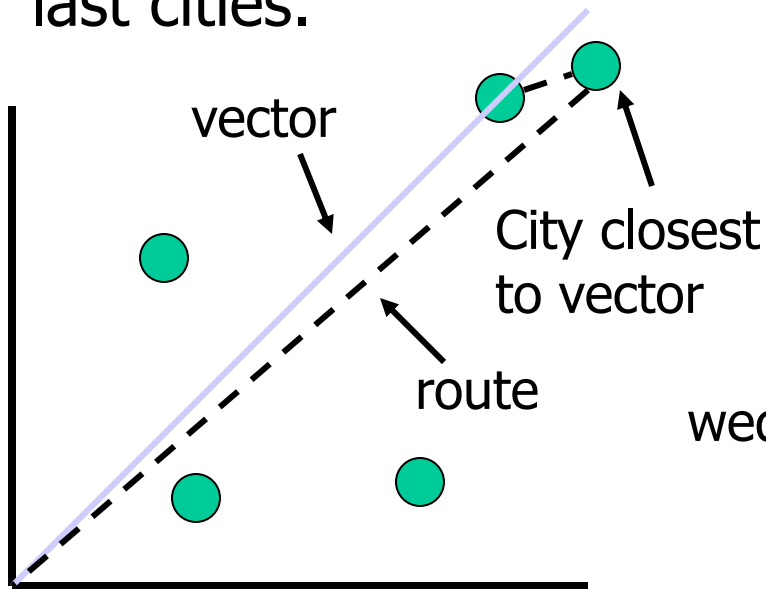
- Solutions:
 - Assessment of Third Party Logistics company
 - Cost comparison with other providers
 - Route analysis
 - Bring routing in-house (develop application)

Technical Implications

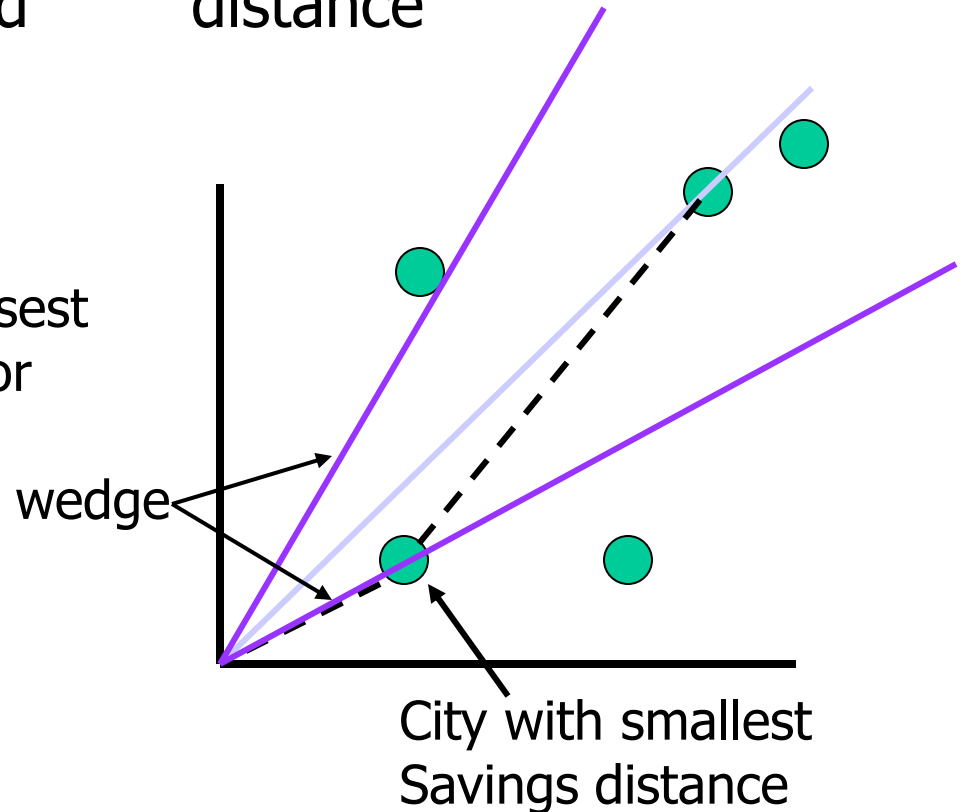
- A special case of the Traveling Salesman Problem
 - Constraints (truck capacity, supplier time windows)
 - Multiple trucks (“salesmen”)
 - One-way trips (not round trips)
- Binary integer programming is possible but *np* hard.
- A combination of alterations of the following algorithms were used:
 - Savings Method
 - Sweep Heuristic
 - Closest Insertion Algorithm
 - 2op Exchange (city swap)
 - Simulated Annealing
 - Balancing Heuristic (EAL)

Sweep Heuristic Alterations

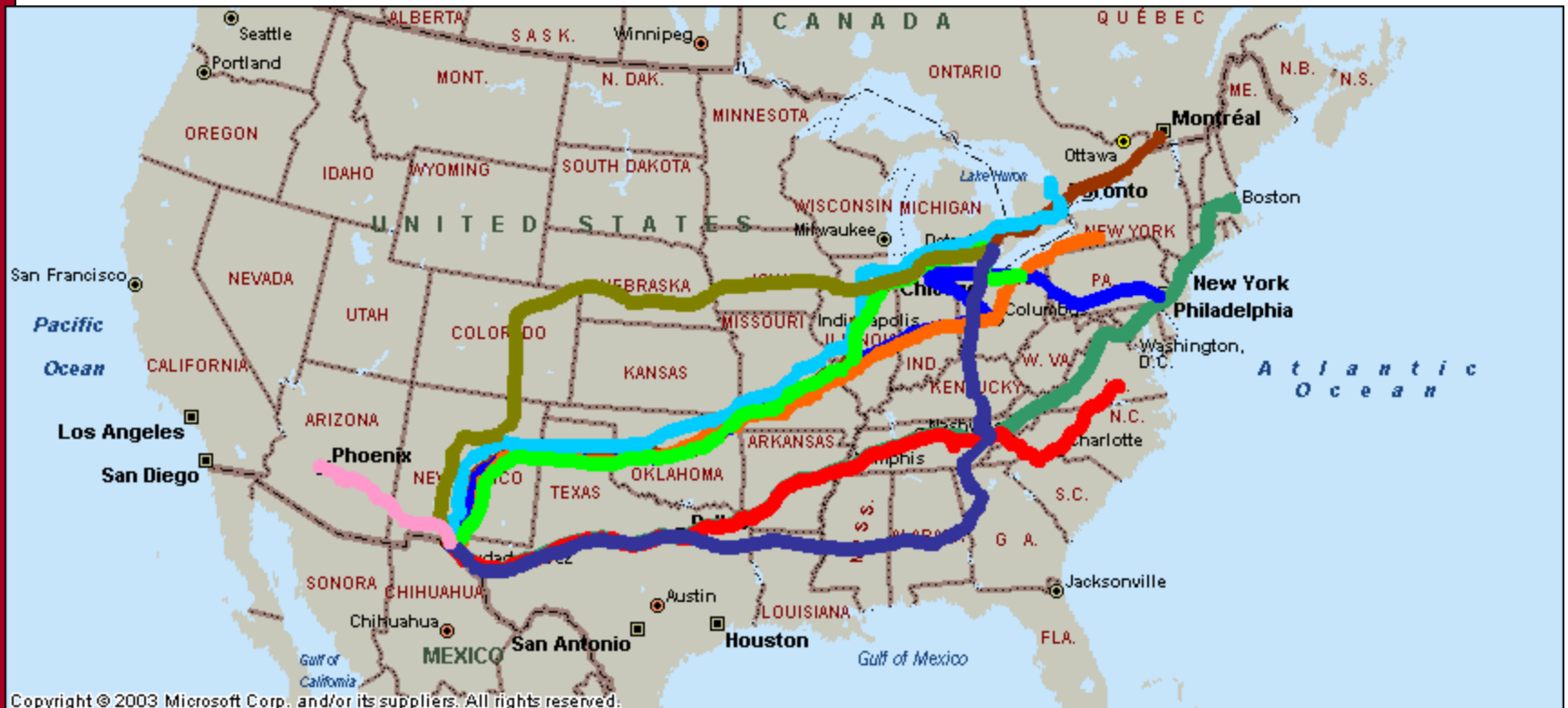
chooses the closest unrouted city to the vector connecting the first and last cities.



chooses the city in a wedge with the smallest "Savings" distance



Sample Routes



Since the project began...

- Over 30% savings in transportation costs
- More awareness of logistics issues throughout the plant
- Recognized importance of monitoring outsourcing companies