7 Umut, E. Why is China's role in Middle East is growing ? [internet resourse]. – URL: http://www.hurriyetdailynews.com/why-is-chinas-role-in-the-middle-east-growing-95402 (date of use: June, 2015).

8 Starr, F., Cornell, S., Norling, N. EU, Central Asia, and the Development of Continental Transport and Trade. Central Asia-Caucasus Institute Silk Road Studies Program.-2015.

9 Craig, O. Russia's role and interests in Central Asia [internet resourse]. – URL: file:///C:/Users/ainur.nurasheva/Downloads/russias-role-and-interests-in-central-asia%20(1).pdf

10 Sen, G. India-Russia relations back in spotlight [internet resourse]. – URL: https://www.thedollarbusiness.com/news/india-russia-relations-back-in-spotlight/11825.

11 International Trade Statistics World Trade Organization [internet resourse]. – URL: https://www.wto.org/english/res_e/statis_e/its_e.htm (year of use: 2015).

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O. Zholamanuly[1]

[1]Suleyman Demirel University, Almaty, Kazakhstan

LOGISTIC OPTIMIZATIONS. SELF-ADAPTIVE ALGORITHM AND SOFTWARE FOR ROUTING OPTIMIZATIONS

Abstract. The purpose of this research is optimization of transport logistics using algorithms to optimize finding the optimal path and implementing the basic necessary for the logistics company, taking into account the characteristics of the goods. The goal of the work is to create the optimal algorithm for logistic transportation with customized superstructures for goods delivery.

Keywords: logistics, optimizations, algorithm, costoptimizations.

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Аңдатпа. Бұл зерттеудің мақсаты тауардың сипаттамаларына қарай оларды тиімді жеткізу алгоритмдерін құру арқылы траснсорт компанияларының логистикалық есептерінің оңтайлы шешу жолдарын қарастыру. Тауар жеткізудің арнайы жекеленген әдістерін таңдау арқылы оңтайлы логистикалық жеткізу алгоритмі қарастырылады.

Кілт сөздер: логистика, оңтайландыру, алгоритм, шығынды оңтайландыру.

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Аннотация. Целью этого исследования является оптимизация транспортной логистики с использованием алгоритмов для оптимизации поиска оптимального пути и реализации основного, необходимого для

логистической компании, с учетом характеристик товара. Рассматривается создание оптимального алгоритма логистической транспортировки с индивидуальными надстройками для доставки товаров.

Ключевые слова: логистика, оптимизация, алгоритм, оптимизация расходов.

Introduction

Because of globalization and longer and more complex supply chain, logistics plays a more critical role in developing a successful supply chain. Total logistics cost has become one of the most important economic indicators of supply chain efficiency. The costs included in logistics activities are: transportation, warehousing, order processing/customer service, administration, and inventory holding costs.

In Kazakhtan industrial and commercial companies, logistics costs have been rather stable during the last five years, accounting for 12-14% of companies' total costs. Transportation costs are the biggest single logistics cost element with 4,4% of total cost on average. Along with warehousing costs, they account for 60-70% of logistics cost and almost 8% of total cost.

On the other hand, in the major business areas of the case company, the logistics costs can be as high as 15 % of total costs. In these companies the transportation and warehousing costs account for more than 10% of the total costs. When logistics costs share is that big part of total costs, it is necessary to evaluate logistic processes and their cost efficiency. Optimizing the processes and costs related to warehousing and transporting goods is the key to better logistics cost efficiency. Especially the activities related to outbound logistics, which account for a major part of warehouse and transportation costs, have to be examined. This research takes a closer look in one individual case in the case company's supply chain and examines ways of optimizing total logistics cost through solving this problem and optimizing the costs related to it.

Logistics is the general control of how goods are acquired, stored and transported to their last destination. Logistics management involves finding prospective distributors and suppliers, and determining their effectiveness and accessibility. Ultimately, management establishes a relationship with the appropriate companies or handles its own logistics if it is more cost-effective to do so.

Examining your transportation costs can pay big dividends. Transportation is one of the highest cost components of cost-of-goods-sold and your supply chain. Operating issues like volatile freight rates (all modes), fuel costs, capacity, inefficient route planning, port and highway congestion, empty miles and productivity impediments are some of the key challenges companies are facing more than ever. We have found that transportation can be optimized in many ways in order to reduce cost while potentially improving customer satisfaction.

Here are some of the actions and analysis we can help you undertake to drive improvements:

- Perform transportation modeling and simulations for your network – this will consider alternate transportation modes, costs, and customer delivery windows.
- Our modeling will also identify the right number of transportation assets and where to domicile these assets. We can simulate routing strategies (carriers, dedicated contract carriage and company fleets) and define costs and service levels.
- It is best to utilize this tool as a living transportation model to determine the cost and service effect of supply chain changes as they occur.
- Utilize a Transportation Management System (TMS) to manage, control and measure all of the transportation methods and modes you use in your supply chain.

If you operate a private fleet or have a dedicated contract carriage arrangment consider:

- Truck and tractor-trailer utilization study – if you operate a fleet, whether it is leased or owned right sizing the fleet periodically affects your bottom line.
- Routing optimization – reduce miles, improve driver productivity and fuel consumed.
- A fresh look at the type of equipment you are operating to see if different equipment configurations can increase your payloads.
- Improve truck or trailer loading of your equipment or that of your carriers that load up at your distribution centers to better utilize trailer cube and increase payload.

Background

System study aims at establishing requests for the system to be development and installed. It involves studying and analyzing the ways of an organization currently processing the data to produce new and needed information. We analyze the problem thoroughly forms the vital part of the system study. In system analysis, prevailing situation of problem is carefully examined by breaking them into sub problems by using dynamic programming. Problematic areas are identified and by doing research information is collected. Data gathering is essential to any needed analysis of requests. It is necessary that this analysis familiarizes the designer and programmer with objectives, activities and the function of the organization in which the system is to be implemented.

Study of existing system

Route optimization algorithms are the mathematical calculations and formulas to solve the routing formulas which includes traffics and having many different routes and points.

Types of routing:Vehicle Routing ProblemԦ Travelling Salesman Problem Ant Colony Problem

Existing algorithms:

- High Dencity Routing - points to waste of collection, local post deliveries, snow cleaning, newsletter delivering and meter reading actions. High Density Routing is used when you have big number of locations to visit on the same scheduled time.
- Point-to-Point Routing – refers to the sales, deliveries and collections with points to visit less than 200 for each day. With this algorithm, boundary is not so important as the schedule and sequence.
- Paired Routing – points to para transit, car with armor routing and etc. This algorithm is similar to point-to-point routing algorithm, but the sequence requires to every stop to be «paired» with trip.

Ant algorithm with ruin and recreate procedure the algorithms Ant and Ruin & Recreate is main idea of the research. Firstly Ant algorithms creates the not the best routing, then I will need to apply ruin and recreate procedure on my routing to improve delivering process.

The main idea of ruin and recreate is ruinning route created by ant and improving it. In first graph of Figure 1.1 we can see how Ant algorithms generated route. As we can see that it is not the optimal road to deliver. Ruin & Recreate destroys some edges between points and searchs for optimal verticel for this route. In the end of ruinning and recreating we will get optimal routing plan than visits all vertices with less resources.

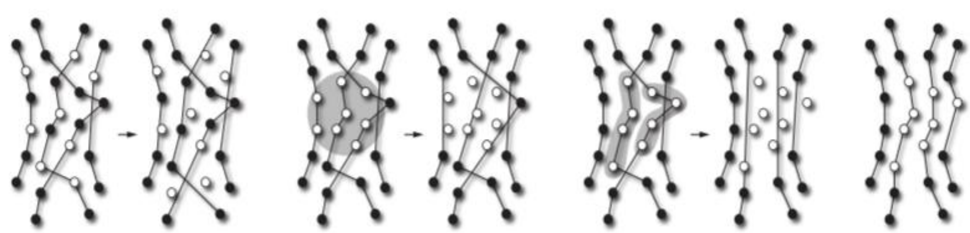


Fig.1.1. Simple Ruin & Recreate

One of the useful method of using ruin and recreate is radiusing the ruin area. When ruinning algorithms looks for a vertices to destroy, it takes only edges which is in selected radius, it is useful when company has geozones in routing.

Constrait programming

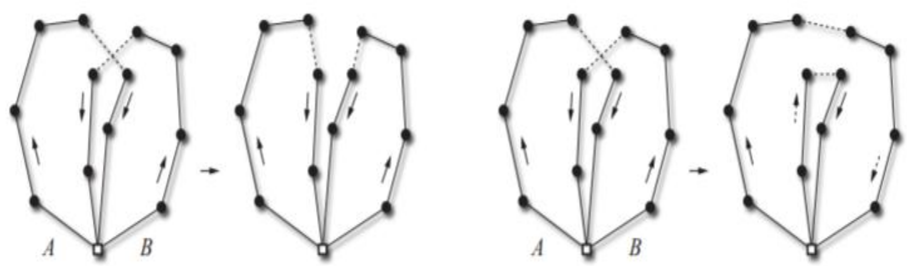
Constrait programming is a way of modeling and solving combinatorial optimization problems, it includes artificial intelligence, logical programming, and operations research techniques. The benefits of Constrait programming:

Systematic search

Reasoning on individual at each search state. Reduce search space filtering at variable domains.

Domains contain holes very suitable for highly combinatorial problems At the Figure 2.1 we can see how ruin and recreate works. The idea of using constrait programming is applying own constraint as logistic company, which includes:

- Goods weight
- Goods volume
- Time to unload
- Maximum weight for courier's transport
- Maximum volume of goods
- Courier's working hours
- Maximum orders which courier can take for each route
- Incompatible orders
- Geozones by routes where courier works



- Geozones by prices
- Time window

```
procedure REMOVECUSTOMERS(s)
    l_max, k_max, k ← calculate(Eq. 3, 4, 5)
    C ← ∅
    T ← ∅
    c_seed ← randomCustomer(s)
    for c ∈ adj(c_seed) and |T| < k do
        if tour(c) ∉ T then
            l_t ← calculate(Eq. 7)
            C ← C ∪ removeSelected(c, l)
            T ← T ∪ tour(c)
        end if
    end for
    return C
end procedure
```

Fig.2.1. Ruin & Recreate Algorithm

Using air and real router

In the real world, vehicles in a Vehicle Routing Problem (VRP) have to follow the roads: they can't travel in a straight line from customer to customer. Most VRP research papers and demo's happily ignore this implementation detail. Although using road distances (instead of air distances) doesn't impact the NP-hard nature of a VRP much, it does result in a few extra challenges.

First off all, we will need real datasets of points. Unfortunately, open VRP datasets with road distances are less than needed in the VRP community. The VRP WebSite has few ones, such as a dataset of Bavaria with 29 locations, but nothing serious. So I had to generate some data by myself with requirements:

- I need to use Google Maps for real distance roads in KM between every pair of point in the dataset. For example, use highways when reasonable over small roads.
- To compare every dataset, I will generate air and road distance.
- To compare scalability, I need to generate a similar dataset in many orders of magnitude.

Add reasonable vehicle capacities and customer demands, for the vehicle capacity constraint in VRP.

When I finished generating datasets in Belgium I had the 2750 locations. figure 3.1

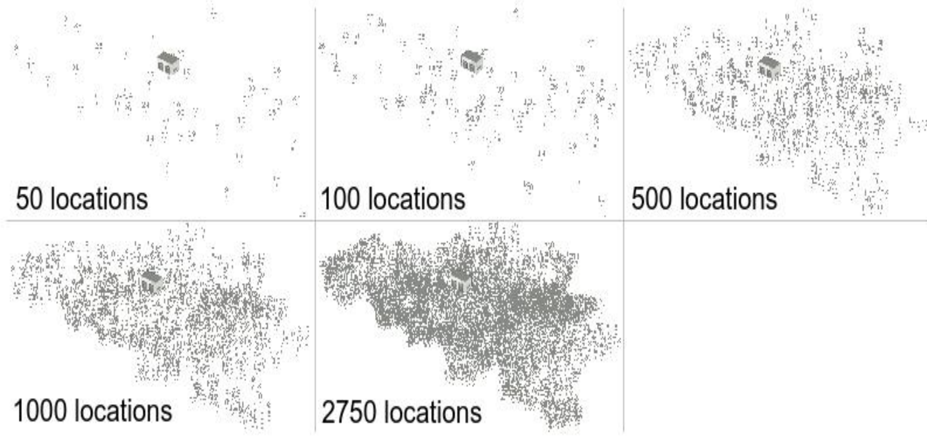


Fig.3.1. Address points

For clear vision, I will focus on belguims choosen dataset of points, which has 50 locations, 10 vehicles with capacity 125 each. Using air distance (which calculates the euclidean distance based on latitude and longitude) results in figure: 3.2

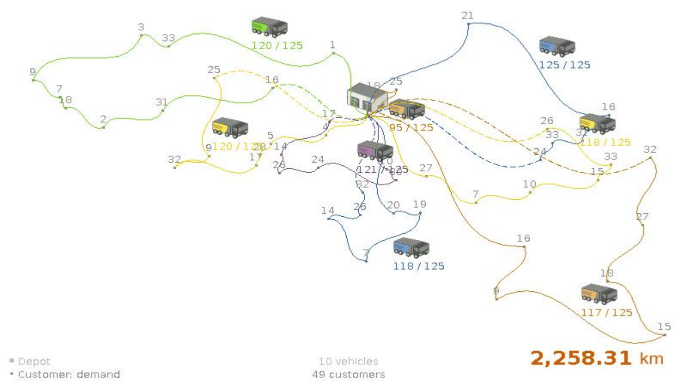


Fig.3.2. Air distance

The total distance is 20.99 KM, it doesn’t say any interesting information because, our vehicles fly between points. Next thing what I do is, apply real distance solution on my air roads which is shown in figure 4.3:

The road distance is 2 366.76 KM. Now I will compare the road distance which I genereated using Graphhopper and OpenStreetMap.

In the figure 4.4 we can see that road distance is 108.45 KM less than air distance, so it’s almost 5% better.

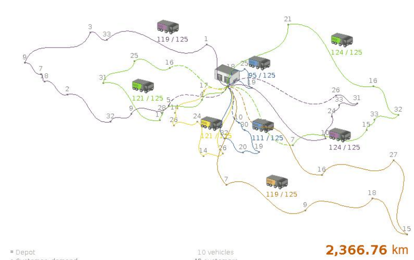


Figure 3.3 Air road distance

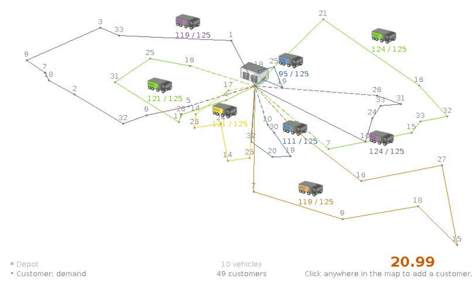


Fig.3.4. Real distance

Conclusion

In addition, due to the current market condition increasing the significance of 4 major logistics performances which are the delivery time, delivery cost, delivery quality, and delivery utilization; the supply chain and logistics functions need to achieve all performances with the minimum total cost. The alternative selection process which combines the total logistics costs, performance measurement, and systems optimization concept altogether is constructed to ensure the optimal decision making in the logistics operations. The conversion of some performance measurements such as the delivery time and delay time into penalties is generated. Model 3 is designed accordingly to select the delivery mode which gives the minimum overall logistics cost. Model 4 extends the use of Model 3 by adding auxiliary binary variables to select the appropriate freight forwarder to handle the operations in the route. The new approach will be expected to give the ensured optimal solution and increase the transparency of the decision making if it is used as the standard procedure.

Generally, the optimization tools in this paper are developed with the intention to optimize the overall logistics cost including the intangible costs. Furthermore, desired objectives have been considered and converted into costs for comparison and all related information from every function in the supply chain has been shared to create the process alignment and gain better communications which are the important characteristics of the responsive supply chain.

References:

1 Goetschalckx, M., Ashayeri, J. Classification and design of order picking. Logistics World. – 1989. – Vol. 2, № 2. – pp. 99-106.

2 Eason, G., Noble, B., Sneddon, I.N. On certain functions of Lipschitz – Hankel type involving products of Bessel functions. – London, 1955. – vol. A247. – pp. 529-551.

3 Clerk Maxwell, J. A Treatise on Android. – Oxford: Clarendon, 1992. – vol. 2. – pp.68-73.

4 Jacobs, I.S., Bean, C.P. Fine particles. – New York: Academic, 1963. – vol. III. – G.T. Rado and H. Suhl, Eds.

5 Zeng, A.Z., Rossetti, C. Developing a framework for evaluating the logistics costs in global sourcing processes: An implementation and insights // International Journal of Physical Distribution & Logistics Management. – 2003. – Vol. 33, issue 9. – Pp. 785-803

6 Özkaya, E., Joseph, V.R., Keskinocak, P., Weight, R. Estimating and benchmarking Less-than-Truckload market rates // Transportation Research, Part E: Logistics and Transportation. – 2010. – Review. Vol. 46, issue 5. – Pp. 667-682.