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Review Paper

Development of Three-Objective Model for the location- allocation in supply chain distribution network of Nina oil

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Abstract

Locating deals with the location of facilities (manufacturing and services) to meet the organization's objectives at the lowest cost and highest quality possible. Select a suitable location for the establishment of the facility, is searching to find a place that can be coordinated with special needs facilities. Establish distribution centers in appropriate locations could play a key role in reducing costs and increasing satisfaction levels. Distribution centers are considered as the interfaces which deliver goods from producers to consumers. In this study we try to determine the location of the warehouse and distribution depot for oil products distribution company of Nina oil to meet two objectives the minimum distance from the factory warehouse location (Sirjan) and the maximum covering retailers in the western provinces and the three-step data refinement process. Conducted a sensitivity analysis using two Met heuristic genetic algorithm and simulated annealing, different answers depending on the importance (weight) of the objective functions, Covering radius and the number of warehouses, are achieved and finally good results in terms of the importance of the objective functions for the management of Nina is offered. The results show that in the first approach (Considering the coverage radius of 100km), Tabriz (a warehouse), Tabriz and Ahvaz (two warehouse) and Ahvaz, Tabriz and Malayer (three warehouses) and In the second approach (Considering the coverage radius of 120km),Malayer (a warehouse), West Islamabad and Malayer (two warehouse), Malayer, West Islamabad and Urmia (three warehouses) were selected.

Keywords: Location-allocation, distribution, supply chain, Nina Oil Distribution Company

Introduction

There are many decision making problems which the information is spatial (geographical). These kinds of decisions are called location decisions. Location decisions are now a major part of operations research and management science (named location science). Facility location, location science and location models are terms that can be used instead (Zanjirani,R ,2010).location-allocation problem is one of the effective models of decision-making In connection with the establishment of the facility Based on that, the optimum number and optimum location of new facilities With regard to the decision criteria are determined. Select a suitable location for the establishment of the facility, is searching to find a place that can be coordinated with special needs facilities. The first step in such a process, is determine the criteria for locating and collecting data and information. Since location needs to a lot of real information, Large amounts of data must be collected, composition and analysis to represent various locations. Many models have been made to help decision making in this area.

The model and its solution in this study is the development of a model based on real world data and is thus a supplier (oil production), several distributors (warehouses) and several retailers (customers) have. Distributors in several places (warehouses) are known, and we're trying to find a new place to build a warehouse again. This model has been considered by Nina oil Distribution Company and will be resolved, so that the distance between the warehouse and the factory becomes minimum and have the maximum number of retailers (or potential oil customers) will cover. That stock .Mathematical programming model is used to solve the model and the resulting model with two widely used met heuristic methods will resolve this issue. We will then compare answers and best answer for the objective will be achieved.

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Research literature

The location - allocation are models for the efficient and effective decisions on the design of the facility and are subject upon which established the optimum number and optimum location of new facilities in relationship with each other and with the existing facilities process (time) and is determined with the decision criterion to the facilitation we want, so at least (minimum) cost (distance / time) or maximum (max) interest income is gained in the business.

Determine the proper location for distribution center location problem, which is known as distribution centers, a special place is devoted to the concept of supply chain and different scenarios, such as the location and distribution centers with limited capacity, assuming a single source for locating distribution centers, locate distribution centers in the continuous space that is called a multi-facility Weber problem and ... Has been well explored in the literature by researchers.

Set covering problem (SCP) is also one of the models of location – allocation which aims to establish the optimal number and location of facilities are required, so that each client (area) is covered by at least one facilitator. In the problem of locating and assigning a number of points of demand, there are a number of candidate points and facilities to be placed on the establishment candidate, and we want this candidate points to be assigned to demand points. It will be a lot of goals including minimizing the number of facilities that can provide all of the requested service, maximum demand that can be met by the facility, minimizing the maximum distance between the demand points and facility relocation or minimize, minimize the cost and etc.

The first and most important role of distribution centers in the supply chain, is to prevent shortages. Second, the cost of shipment requirements are reduced because the goods are kept closer to the retailers. Inventory management as well as training in this system is simpler and less expensive, because once the inventory is kept in a number of regional distribution centers rather than in each of the retailers to maintain, fewer people are involved in the maintenance. So overall distribution centers in a supply chain play a role in lowering costs and reducing time to deliver their products and hence their location is very important.

The location and allocation problem after that first stated by Cooper in (1963), Hakimi (1964) expanded this subject and proposed weighted networks. The location and allocation of network and many other models by Brady (1999) was introduced. Localization and segmentation models can be defined from different points of view. The parameters of the models can be divided into certain and uncertain. (Shavandi H.,Mahlooji H,2006)

Talk locate the facility in terms of stochastic demand and congestion, there are two streams of study. The first group of models are covering-type models and the second set are median-type models (Berman O., and Drezner Z, 2007).

Another way to classify the facility location problems is based on the number of facilities available. Based on this classification, localization issues are divided into two categories: single facility or multiple facilities (Daskin, M.S, 1995).

You can also locate these issues in the private and public sector location problems, exogenous issues (which is determined by the number of service providers, (Like the P-median) (Weber,A.1909) and indigenous issues (where the number of variables should to be specified as service providers (such as the Set-Covering)) (Zanjirani Farahani.R,2012)., Good things and bad things, issues of dynamic and static location - allocation, Location- allocation issues with service providers be classified into uniform and non-uniform.

The covering problems and both the location and routing problems due to computational complexity are among the NP-hard problems family and the exact solution of the public ways as zero-one programming, dynamic programming, branch and bound and ... is time consuming and unusual for them.

Set covering problem is solved by many researchers like Hyragv, Carla Hoffman, Manfred Padberg, Al Sultan, Lan Lorena, El Daria and G.Mitra, J.Etcheberry and Francis.J.Vasko, Floyd E.Wolf and ... with innovative ways .This all takes less time and effort to achieve and is faster.

Problem statement

The desired optimization problem is to determine one, two or three cities as a distribution center (warehouse) in the west of country. In this study, we investigated the option of Nina Oil Company, a subsidiary company of Frico Holding. Iranian Oil Products Company (Frico) in 1993 was established in Sirjan Special Economic Zone located in the province with a production capacity of 200 tons oil per day in place integrated Frico factories. Nina oil is an edible and a single product oil manufacturing company. Nina is a broadcasting company in charge of the mission to spread the company's products. The company currently has five warehouses in the cities of Mashhad, Babol, Esfahan, Shiraz and Kerman(nearby cities of each of these warehouses are also covered by them) and plans in the provinces of East Azerbaijan, West Azerbaijan, Kurdistan, Hamedan, Ilam, Khuzestan, Bushehr, Lorestan, Ardebil, Kermanshah and Chahar mahal va bakhtiari for storage and distribution depot adjacent to cities and counties to build, as far as the factory's warehouse will be minimized(And therefore also its logistics costs are minimal) and the warehouse can also maximize the potential customer will be covered.

We study the sensitivity analysis, the number of cities, covering radius and the coefficients of the objective function changes and the results are compared. The optimization is performed in two steps under the first approach, the second approach will be described. In the first approach, the number of the region's provinces are 11 and the optimization variables (cities) are 16, which are binary which one is to choose as the distribution center and Zero value is not to select. Eleven of these provinces are a total of 136 cities request that the company's sales manager, provincial capitals and cities of strategic importance in terms of lack of access to main roads and impassable as potential sites for the construction of the warehouse are considered (Due to the mountainous region or two in the vicinity of the sea like Bandar_e_mahshahr). Thus, the number of storage locations required for the construction of the above information during the refinement step decreases to 16 cities. This is due in large cities and provincial capitals, especially, there are more marketing and sales potential, and that the cities in terms of logistics facilities and access to the main roads are in better condition. The experience of the company's marketing and sales, consumption pattern populous cities are usually crowded, affect neighboring cities. So if the city finds a popular consumption commodity, and therefore also affect the neighboring towns began to be popular and the number of sales in these cities will rise. During a period of refinement and during an interview with the manager (second approach), the number of cities and strategically important towns reduced to 9 (of 7 Kurdistan, Ilam, Lorestan, Hamedan, East Azarbaijan, West Azarbaijan and Kermanshah) And then in another step to the 5 provinces (with the exception of the provinces of Lorestan and Ilam) and 6 cities reduced. Other variables and factors involved in the problem, as is already the case. The module has been run and the results obtained.

The area covered by each warehouse is for each of the two terms 100 and 120 km. The coefficients of the objective functions from zero to one in each 0.05 will increase. Since products always carry in a fixed capacity of 10 and 14 are performed by vehicles, the logistical costs of transporting oil to storage area or consumers, is fixed and has a direct relationship with distance from the plant site. That is less than the distance to the plant, logistics costs will be lower.

In start, according to the Census data, the Ministry of Industry, Mine and Trade and Customs of Iran in November 2010, the country's per capita consumption of oil was achieved. According to the types of edible oil in the country is about 18 kg per capita per year, which half of it is about 9 kg of liquid oils.

According to the 2009 census, the population of each of the 136 cities was achieved, respectively. Multiplying the population in each city per capita consumption of oil, one year oil consumption in the city was achieved, respectively. In fact, the rate of oil consumption is the potential sale of oil in each of the cities. So the more populated areas the more you sell oil Nina there.

Unfortunately, no single statistic based on the sale of oil products (divided based on brands) was found in the provinces or cities and so in this study the amount of oil in each city consider the potential sale of its oil and then Nina. This means that in the greater cities that the population of the city and oil consumption is more, Nina oil is expected to sale more.
Then, the distances between the towns and Sirjan city obtains. In this model, the center of the cities are as a retailer and as a representative consider demand the cities, we assume that there is a retailer in each city and has its capacity as the total demand. Sales Director is desired coverage radius 100 km.

The mathematical model

Max $\sum_{i=1}^{m} w_i x_i$
Min $\sum_{j=1}^{n} y_j d_j$
s.t.

$$\sum_{j=1}^{n} y_j = P$$

$$\sum_{j=1}^{n} a_{ij} y_j \geq x_i$$

$x_i = \{0,1\}$, i=1,…,m
$y_j = \{0,1\}$,j=1,…,n

$$a_{ij} = \begin{cases} 1 & (D_{ij} \leq D) \text{ distribution center j to node i covers demand} \\ 0 & \text{Otherwise} \end{cases}$$

$$x_i = \begin{cases} 1 & \text{Demand node i is covered by one of the distribution centers.} \\ 0 & \text{Otherwise} \end{cases}$$

$$y_j = \begin{cases} 1 & \text{Potential distribution center j, is real center.} \\ 0 & \text{Otherwise} \end{cases}$$

Parameters

P: Maximum allowable distribution centers
D: Standard for maximum distance covered by a node demand (retail) distribution center
dj: j th distribution center distance of the main supplier
wi: the demand of nodes (i th retailer) or the amount of demand of each of the cities
m: Number of demand nodes (Retail)
n: number of distribution centers or the number of potential sites for the establishment of distribution centers ($n \leq m$)

Variables: xi and yj

The first constraint represents the number of distribution centers required that in this case study P = 1 is the company's request. The second constraint reflects that the demand to be allocated on actual distribution centers. xi and yj are the binary values of zero or one.
The coefficients of the objective function of maximizing coverage is 0.6 and the objective function to minimize the distance from the factory is 0.4. These coefficients and their significance in terms of preference for the Nina Company and according to the company's manager has been appointed.

How to solve

In this study a mathematical model via two of the most widely used metaheuristic algorithms for solving location – allocation, the SA and GA is used to solve. Studies in several review articles [8] on the application of metaheuristic algorithms, it was found that most of the metaheuristic algorithms to solve location - allocation are used, respectively, are GA and SA.

Simulated annealing algorithm (SA)

Simulated annealing algorithm (SA), is a simple and effective algorithm in solving optimization and of optimizing metaheuristics. The algorithm was invented in 1973 by Scott Kirkpatrick and colleagues. This algorithm is based on the annealing of metals. In the annealing process, the temperature of the metal rises to a high temperature and then a gradual cooling process is done on them to a low temperature. This process increases the temperature of the metal and the atoms movement speed increase sharply and then gradually reducing the temperature of metal causes formation of certain patterns in the adoption of its atoms. The changing pattern of the annealed metal atoms causes the valuable properties that can be pointed to its strength. Based on the thermodynamic process flowchart of the algorithm is as follows:

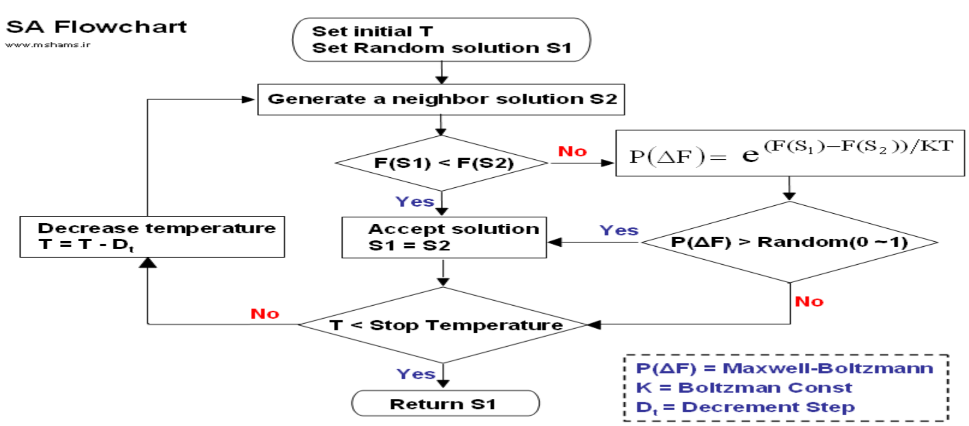

Figure 1: Flowchart of the simulated annealing algorithm

SA algorithm starts with an initial acceptable answer and randomly within a specific mechanism, select a neighboring settlement of the answer and the preliminary results are compared with the initial solution to answer. If the cost function is improved (at minimization is decreased), the solution is kept neighborhood and the solution is to this. Otherwise, neighbors, despite the increase (no improvement) in the cost function are to be accepted with a possibility. This possibility function, in an acceptable level (temperature control parameter) accepts the wrong answer resulting in an increase of the objective function. The possibility function according to the statistical issues is called Type II error (β) and include:$Exp(-\Delta z/t)$.

Genetic Algorithm

Genetic algorithm is one of the most innovative algorithms that is used for optimizing different functions. In this algorithm, the historical data according to the hereditary characteristics of the algorithm are extracted and used in the search process. The main idea of this method is natural genetic science and the process of the algorithm is briefly as follows:

Generate the initial population randomly, the initial guess in the neighborhood of the initial population, measure the response of the condition to adapt it to the problem, select the best answer and transfer it to the next generation, combine the answer with the other answers by randomly ratio by both the mutation and cross over operators and their transmission to the next generation, and this trend continues until the stop condition is met, i.e.: no change in the objective function value or the maximum generation (Asad, Mohammad taghi,1998).

We first solve the model, and the two objective functions becomes a unit function as follows:

This function is intended that each of the two functions are normalized according to the following formula. The reason for this is that the impact of the two objective functions is the same as the general objective function. If the scope changes are large differences in the objective functions, the objective function value of the order is larger, has a greater impact on the value of the objective function and resulting in a two-objective optimization problem into a single objective optimization problem with a focus on the objective function is a higher order. With normalization, the order changes of the objective functions is the same. Also because the two functions are different, one maximum and the other one minimum, by multiplying the maximum function in a minus, we calculate the overall objective function value.

Also the cost function may vary between zero and one.

The first approach

MATLAB software is used for the algorithms for the implementation of the code, in this approach; the number of optimization variables will be equal to 16. The maximum number of iterations the algorithm (algorithm stop condition), the SA algorithm with 500 iterations and 100 iterations of the GA algorithm are considered. This is the maximum number for the occurrence of convergence. In fact, the number of iterations by trial and error and observing the convergence of the algorithm is derived. So the answer is that the algorithm does not change after repeat numbers, this number is chosen as the desired number of repetitions.

The main variable in the SA algorithm, is the number of changes that occur in each step of the algorithm on the alternatives (options). The main variables in the Genetic algorithm is the population of the algorithm in each step. The algorithm for the two values for the variables 25 and 50, have been implemented. Change the value of this variable has a direct impact on the speed of convergence of the algorithm. The greater number of changes in each step, the algorithm has a higher convergence speed and the algorithm in fewer iterations reach to the optimum solution. The initial response has been randomly selected too.

Simulation results

Here the answer to the question of optimization algorithms have been presented at two radius of 100 and 120 km. Answers are provided for different valuesbetween zero and one. Considering the fact that both the algorithms used, are general optimizing algorithms, the answer is the same for both algorithms. This is verified with simulations. Simulation results are summarized and listed in Table 1 overall.

Used to compare the two algorithms, time and number of steps required for convergence of the algorithm is presented in Table 2. Algorithm converges to the mean response during the iteration of the algorithm, the objective function for the response, not less. The two algorithms are compared to the final answer to a specific question on the convergence of the algorithm can also be confirmed. The results presented in Table 2, in the case of two and three distribution centers, genetic algorithms less time and fewer steps are required for convergence. The convergence time of the two algorithms is nearly identical to a distribution center. In this algorithm the average results in each case is 10. Due to the random selection of the initial response to the onset of both algorithms is performed, the convergence time of the algorithm is characterized by the same performances, will be different.

The second approach

In this approach, all the parameters are as in the first approach. Only the number of variables (cities) in the first are nine, then six cities. The maximum number of iterations of the SA algorithm (stopping criteria) 200 iterations are considered. The maximum number of iterations of the GA algorithm with 50 iterations are considered too.

Simulation results

Here the answer to the question of optimization algorithms have been presented at two radius of 100 and 120 km. Answers are provided for different values between zero and one. Simulation results are presented in Tables 3 and 4.

Time and number of steps required for convergence of both algorithms used in this process are presented in Table 5. The results presented in this table also suggest that the two and three distribution centers, in the Genetic algorithm less time and fewer steps are required for convergence. The convergence time of the two algorithms is nearly identical to ONE distribution center.

Table 1: summarizes the results and compare them to the 16-variable optimization problem

Number of distribution centers	Coverage radius(km)	ranges	City	Sirjan distance (km)d_i	Coverage of potential oil consumption (kg)K_i	$+0.6(_{max}\, k_i/k_i)$ $d_{i\,min}/d_i)0.4)$
1	100	0.2-0.55	Ahwaz	1136	2.076×10^7	0.577
		0.6-1.0	Tabriz	1646	2.422×10^7	0.4824
	120	0.15-1.0	Ahwaz	1136	2.583×10^7	0.6202
2	100	0.25-0.35	Malayer Ahwaz	2233	3.606×10^7	0.5108
		0.4-1.0	Ahwaz Tabriz	2782	4.497×10^7	0.5466
	120	0.2-0.4	Malayer Ahwaz	2233	4.486×10^7	0.5864
		0.45-1	Ahwaz Tabriz	2782	5.135×10^7	0.6006
3	100	0.3-0.4	Malayer Ahwaz Tabriz	3879	6.016×10^7	0.6296
		0.45-1	Hamedan Ahwaz Tabriz	3960	6.113×10^7	0.6356
	120	0.3-1.0	Malayer Ahwaz Tabriz	3879	7.038×10^7	0.7172

Table 2: compares the time required for convergence of the optimization problem using two algorithms, SA and GA = 0.75 and the coverage radius of 100 km

Number of distribution centers	Time required for the algorithm SA		Time required for the algorithm GA	
	25 =N_move	50 =N_move	25 =N_Pop	50 =N_Pop
1	0.048 s	0.065 s	0.048 s	0.066
	3 steps	2 steps	3steps	1 step
2	0.536 s	0.659 s	0.185 s	0.209
	31 steps	19 steps	17 steps	8 steps
3	6.214 s	15.877s	0.510s	0.793s
	307 steps	315 steps	44 steps	27 steps

Table 3: summarizes the results of the optimization problem and compare them the 9-variable optimization problem

Number of distribution centers	Coverage (km)radius	ranges	City	Sirjan distance (km)d_i	Coverage of potential oil consumption (kg)K_i	$+0.6(_{max}\, k_i/k_i)$ $d_{i\,min}/d_i)0.4)$
1	100	0.0-0.45	Malayer	1096	1.518×10^7	0.58
		0.5-1.0	Hamedan	1178	1.615×10^7	0.5634
	120	0.0-1.0	Malayer	1096	1.902×10^7	0.6256
2	100	0.0-1.0	Borujerd Malayer	2218	2.167×10^7	0.4544
		0.15-0.3	Borujerd Hamedan	2299	2.731×10^7	0.5138
		0.35-075	Malayer Kermanshah	2460	3.085×10^7	0.5434
		0.8-1	Hamedan Kermanshah	2541	3.11×10^7	0.5408

	120	0.0-0.15	Borujerd Malayer	2218	2.57×10^7	0.5024
		0.2-0.3	Borujerd Hamedan	2299	3.022×10^7	0.5486
		0.35-0.6	Malayer Kermanshah	2460	3.376×10^7	0.5782
		0.65-1	Malayer Eslam abad gharb	2723	3.54×10^7	0.5802
3	100	0.0-0.15	Borujerd Hamedan Malayer	3396	2.731×10^7	0.4522
		0.2-0.75	Borujerd Hamedan Kermanshah	3662	4.226×10^7	0.6018
		0.8-1	Hamedan Urmia Kermanshah	4342	4.434×10^7	0.6264
	120	0.0-0.15	Borujerd Hamedan Malayer	3396	3.022×10^7	0.487
		0.2-0.6	Borujerd Hamedan Kermanshah	3662	4.492×10^7	0.6524
		0.65-1	Malayer Urmia Eslam abad gharb	4524	5.058×10^7	0.6968

Table 4: summarizes the results of the optimization problem and compare them, regardless of Ilam and Lorestan (and cities)

Number of distribution centers	Coverage radius)km(	ranges	City	Sirjan distance (km)d_i	Coverage of potential oil consumption (kg)K_i	)$k_i/k_{i\,max}$+0.6( )$d_{i\,min}/d_i$)0.4
1	100	0.0-1.0	Malayer	1096	1.518×10^7	0.5578
	120	0.0-1.0	Malayer	1096	1.902×10^7	0.598
2	100	0.0-0.3	Kermanshah Malayer	2442	2.28×10^7	0.4162
		0.35-1	Hamedan Kermanshah	2541	3.11×10^7	0.496
	120	0.0-0.3	Sanandaj Malayer	2520	3.54×10^7	0.544
		0.35-1	Malayer Eslam abad gharb	2723	3.44×10^7	0.5182
3	100	0.0-0.75	Urmia Hamedan Kermanshah	4342	5.76×10^7	0.7
		0.8-1	Urmia Malayer Kermanshah	4261	4.434×10^7	0.5828
	120	0.0-0.6	Urmia Hamedan Malayer	4076	5.058×10^7	0.6514
		0.65-1	Malayer Urmia Eslam abad gharb	4522	4.016×10^7	0.528

Table 5: compares the time required for convergence of the optimization problem using two algorithms, SA and GA = 0.75 and a coverage radius of 100 km

Number of distribution centers	Time required for the algorithm SA		Time required for the algorithm GA	
	25 =N_move	50 =N_move	25 =N_Pop	50 =N_Pop
1	0.027 s	0.036S	0.025S	0.037S
	3 steps	2steps	3 steps	1 step
2	0.301 s	0.37 s	0.104 s	0.117s
	17 steps	9 steps	8 steps	4 steps
3	3.495 s	8.93 s	0.286 s	0.446
	117 steps	122 steps	23steps	13 teps

Pareto

As was observed, in different and sometimes conflicting objective functions to optimize simultaneously, we can normalize different objective functions or do such other changes, and will find a fitness value and achieve to the purpose of the objective functions in a single objective function. In this case the problem can be solved by the Pareto front achieved [10]. This chart can be achieved for at least two functions. In this chart non-dominated solutions in the search space and for different objective functions are obtained. Each point on the graph represents the global optimum or near optimum and the chart indicates that all points on the graph are the same value and desirability of optimality.

In the diagram below, the values of the objective function with different values of α and optimal solution in each case is shown. Pareto fronts for 100 and 120 km radius covering problem is presented in Figure 2 and Figure 3. In each diagram, the Pareto front for one, two and three distribution centers are presented. Using these figures for different values of α, the location of responses in the problem can be seen. By increasing in α, the effect of population coverage in the consumer optimization problem increases, in turn, reduces the impact of distance between the distribution centers to the city of Sirjan.

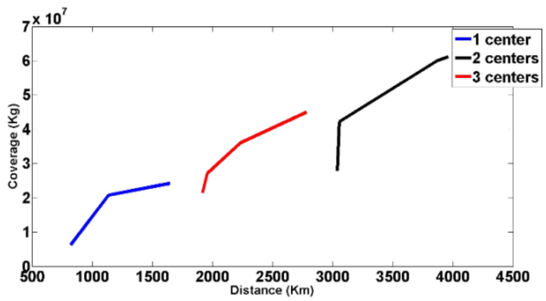

Figure 2 Pareto fronts for different number of distribution centers - covering a radius of 100 km

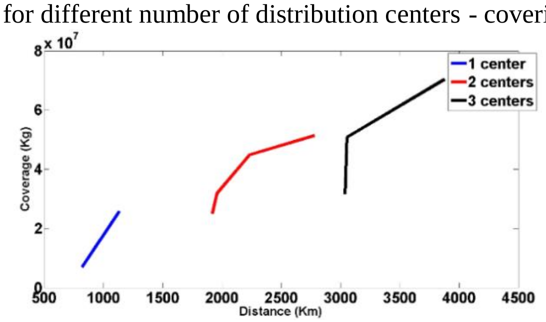

Figure 3 Pareto fronts for different number of distribution centers - covering a radius of 120 km

Results of the first approach

As the tables of both the SA and GA algorithms in the first approach implies, the problem with both 100 and 120 km coverage radius for different and the number one, two and three warehouses have been resolved. Nina Broadcasting Corporation to construct a warehouse of a city, with a coverage radius of 100 km, and the objective function coefficients 0.6 to the maximum coverage and 0.4 for the minimum distance to the factory warehouse location, Tabriz city by a distance of 1646 km to Sirjan and with the potential to cover a 2.422 × 107 kg oil comes from. Also with the characteristics mentioned above and two warehouses, with a total distance of 2782 km to Sirjan, Ahvaz, Tabriz and all 4.497 × 107 kg of oil sales potential is achieved. And with the same specifications and three warehouses, cities, Hamedan, Ahvaz, Tabriz, with a total distance of 3960 km to Sirjan and a potential sale of 6.113 × 107 kg oil are achieved.

If also consider a radius cover of 120 kilometers and consider the objective function coefficients 0.6 to the maximum coverage and

0.4 for the minimum distance to the factory warehouse location, to build one warehouse, a distance of 1136 km to the city of Sirjan, Ahwaz with the potential sale of 2.583 × 107 kg oil comes from. For the construction of two warehouses, Ahvaz, Tabriz, with a total distance of 2782 km to Sirjan and the potential sale of oil to the extent of 5.135 × 107 kg come from and for constructing three warehouses, cities malayer, Ahvaz, Tabriz with a total distance of 3879 km to Sirjan and sales potential oil to the extent 7.038×107 kg comes from.

If we compare the resulting solutions in offering the rankings, SAW can be used to rank the desirability of the options in Table 1 to discuss the option with the highest utility is selected and easily achieve superior options. To do this, a factor of 0.6 of the coverage ratio and 0.4 in the ratio of the distances to Sirjan, we multiply the numbers together and assess. (Last column of Table 1). Using these ratings, the following conclusions are proposed:

A: For a warehouse: Ahwaz, covering a radius of 120 kilometers, and

B: For two warehouses: Ahwaz, Tabriz, 120 km coverage radius for each, and

C: For the three warehouses: cities of Malayer, Ahwaz, Tabriz, each covering a radius of 120 kilometers, and a

Results of the second approach

As the tables of both the SA and GA algorithms in the second approach suggests, the problem with both 100 and 120 km coverage radius for different α and the number one, two and three warehouses have been resolved. In this approach the city that we are looking to build a warehouse for Nina company,with the coverage radius of 100 km, and the objective function coefficients 0.6 to the maximum coverage and 0.4 for the minimum distance to the factory warehouse location, is Hamadan with 1178 kilometers away from Sirjan and the potential sale of 1.615 × 107 kg oil ,too. Also with the characteristics mentioned above and two warehouses, malayer and Kermanshah (Hamedan and Kermanshah) with a total of 2,460 (2541) Kilometers to Sirjan and all 3.085 × 107 (3.11 × 107) kg oil sales potential are obtained and As well as the specifications and three warehouses, Boroojerd, Hamedan and Kermanshah (Hamedan and Kermanshah and Urmia) with a total distance of 3662 (4342) km to Sirjan and the potential sale of 4.226 × 107 (4.434 × 107) Kg oil are obtained. If also consider a radius of 120 kilometers, and the objective function coefficients 0.6 to the maximum coverage and 0.4 for the minimum distance to the factory warehouse location, to build a warehouse, City Malayer,with a distance of 1096 km to Sirjan and the potential sale of 1.902 × 107 kg oil is obtained, and with the similar specifications for the construction of two warehouses, Malayer and Eslamabad gharb, with a total distance of 2723 Km to Sirjan and the potential sale of 3.54 × 107 kg oil is obtained and to build three warehouses, cities of Malayer, Urmia and Eslam abad gharb, with a total distance of 4524 km to Sirjan and potential sale of oil of 5.058 × 107 kg is obtained. Also, if we compare the solutions obtained by using ranking, we are still using the SAW, ranking the desirability of the options in Table 3 to discuss the option with the highest utility is selected and easily find the preferred option. Using these ratings, the following conclusions are proposed:

A: For one warehouse: Malayer city, covering a radius of 120 km, and

B: For two warehouses: malayer and Eslam abad gharb, 120 km coverage radius for each, and

C: For the three warehouses: malayer, Eslam abad gharb and Urmia, with each covering a radius of 120 kilometers, and

If we look at to the answer with the Nina's management desired specifications(coverage for a radius of 100 kilometers, and the coefficients 0.6 and 0.4 for the two objective functions), we see that for the construction of three warehouses, cities of (Borujerd, Hamedan and Kermanshah) and also (Hamedan, Kermanshah and Urmia) as the desired results are achieved. But, since the cities of Hamedan and Borujerd, are located near the 160 kilometers away from each other and we do not want just focus on one region of the country, and our goal is to build three warehouses that a number of additional cities we can cover, so the choice between the two options, Hamedan, Kermanshah and Urmia are a better choice.

Also, after removal of the provinces of Lorestan and Ilam, the solutions that are based on the ranking of the SAW method are:

A: For a warehouse: malayer city, covering a radius of 120 km, and

B: For two warehouses: malayer and Sanandaj, with 120 km radius of coverage for each, and

C: For the three warehouses: Cities of Urmia, Hamedan and Kermanshah, each covering a radius of 100 kilometers, and

Finally, the selection of a city depends on the decisions of Nina corporate management and of course, the answer is a more appropriate choice if we combine the mathematical model and our experiences and then decide upon it. Decisions like this, so it is important that can lead to the growth and prosperity of a company or lead to bankruptcy of a company. So the answer cannot be resolved solely on the experimental results or a mathematical model and a combined optimization problem can reach to a best answer Generally, the selection of a suitable site for the construction of the warehouse, can reduce the warehouse and distribution costs, increase profit margins and reduce costs for consumers.

It should also be noted that the solutions of both algorithms are in different situations in terms of the radius of coverage, value of, and the number of warehouses, we obtain the same. The only difference between the two algorithms is the computation time associated with the number of warehouses, computation time and number of steps required to achieve convergence of the SA algorithm(rather than the GA algorithm) increases as the number of warehouses increase.

The use of Met heuristic algorithms for solving this model is that when the number of warehouses needed to construct are more than one number, the proportion of the issue becomes larger and the need to implement Metaheuristic algorithms in solving, appears. But to find a place to build just one warehouse, due to the small size, it can be solved by methods other than Metaheuristic algorithms.

Also the reason for using two different metaheuristic algorithms for solving the model is that we never can argue that the algorithms such as SA or GA in comparison with other algorithms will get better optimal solution or are used on all problems. Thus, by using two or more Metaheuristic algorithms to solve problems, compare the solutions of the algorithms and their optimality in terms of overall problem solving time can be compared with each other. Also in this case, the only difference between the two algorithms is the computation time when the number of warehouses is more than one number.

Recommendations and future research

a) Given that at present, no data are based on the sale of oil separation (Brand), the separation of the country's cities, and the separation of requirements retailers in Iran, if we have access to detailed statistics in this field, we can find more accurately model and its answer.

b) Distribution is one of the basic marketing tactics that is employed to persuade customers along with other factors such as product, price and promotion. Effective distribution can be a competitive advantage of an enterprise than its competitors. Decisions about the distribution and sales channels, include the most important decisions that managers are facing. Decisions about the distribution and sale of goods have a direct impact on other marketing decisions. Distribution and sales network is the pulse of a company, but with all these situations, companies often do not pay enough attention to their goods distribution channels, and this sometimes leads to disastrous consequences for them. In contrast, many companies are using innovative distribution systems to achieve competitive advantages. In the past, large inventory and raw materials in the warehouses was common place for organizations. But today, the private sector and industry, despite the different policies and different views, will keep their inventory in the warehouses at the minimum level. Keeping too much inventory disinvestment will be considered, because it does not generate income for the company. Inventory management due to its direct effect on sales and marketing management, is an important issue in physical distribution management. The system approach to the management of physical distribution, the total cost is important. Because the component costs is less important than the total cost. Costs are a reflect of the distribution strategy and with minimum costs, maximum services would not be possible. Capillary distribution is a manner that can do the distribution of goods and services and pay a steady stream to start. Capillary distribution is a system that all businesses should be taken into serious consideration. The advantages of this type of distribution is:

c) Gathering more information and updates from market, market coverage, extensive communication with customers, reduce the risk of losing customers, increase the bargaining power of the company, reducing the possibility of formation of new competitors, the steady stream of cash, expand market share in the most sales agents, increase profits in the long run due to lower costs of wholesalers and wholesale distribution systems, increasing agility and enabling faster implementation of the ideas in the market and many other benefits.

d) Thus, future research is suggested; using capillary distribution system, compare the cost of transportation and distribution of goods in this method with the existing methods (distributed through warehouses or retailers) and the amount of shipping goods to warehouses and to the consumers directly.

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