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Office Location, a Strategy for Legal Logistics

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Abstract. Center of gravity is a geographical location method widely used in industrial management. Apply for legal logistics were a challenge to find possible locations to settle future law firms in other locations. Brazil is a continental country with different population densities that make the use of technologies and methodologies necessary to become more assertive geographical location. Using the problem-solving method and the creation of an electronic simulator was possible to find the optimum location to minimize both costs and results.

Keywords: Office Location • Localization strategy • Logistics legal • Gravity center • Location businesses.

1 Introduction

The present work aims to expose the case study results conducted at law firm Araújo HIDD& Melo, which was calculated the location of the best city for the settlement of a new subsidiary, aiming to reduce corresponding costs, increase operating area as well as the company's profits. To achieve these results, the Logistics Center of Gravity model was applied.

The center of gravity is a quantitative data model used to determine the location of a facility based on weighted weights determined, the results of this method are the Cartesian coordinates X and Y so that the weight "cost" is minimized.

For the study used data from the acts performed in Brazilian cities of Piauí and Maranhão(Brazilian states), by law firms Araújo HIDD& Melo from Teresina, São Luís, as well as their corresponding (lawyers / Supervisor of support) in the period from January to June 2015.

The acts referred in this paper should be understood as the Hearings and Diligences made in the above period, of the active customers in September 2015.

The software used for the study was the Microsoft Office Excel 2013 version that is very usefull for those who domine the formulas that can automate various stages of the calculation of the Centre of Gravity process. The company provided the entire cost of

adfa, p. 1, 2011.
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database and receipt by city in spreadsheets. Also in format spreadsheets, they were willing to location of cities in the state of Piauí and Maranhão. These data(s) are available at database of the IBGE initials for Brazilian Institute of Geographic and Statistics (Instituto Brasileiro de Geografia e Estatística).

2 Lower's Office In Brazil

Brazil has a projection for 2018 that will have 1 million lawyers. Increasingly increases competitiveness among professionals of law. In 2014, Brazil had more than 835,000 lawyers. [1] Brazil has 357 lawyers for every 100,000 inhabitant, those numbers put the country in the second place in world ranking after the USA - United States of America.[2]

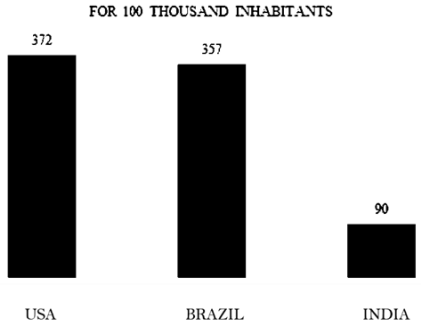

Fig. 1. World ranking Lawyers Amount

Appear in the middle of this competitive Lawyer's market a new term called Legal Logistics or lawyerly logistics. They are basically two activities: Diligence and audience. Diligences are copies, distribution, protocols, removal of documents and charters, emission of certificates and guides, loads, diligences in Procon (an institute that works in Brazil for Consumer Protection and Defense Foundation - Fundação de Proteção e Defesa do Consumidor), real estate records and government agencies, as well as every effort involving electronic processes, including transfer of subpoenas. Audiences are designations of lawyers and agents for all judicial and administrative spheres. [3]

The legal logistics basically works by hiring a company that operates throughout the country and hire a law firms to take care of all legal demands, usually dealing with final costumer. This office performs contracting with the company and outsourcing services in the Brazilian states, each one in each state of the federation that stay one outsourced. In each state there is a third one who needs a fourth to share the service. Usually in this agreement there is a severe penalty clause if the service is not due in a timely manner which causes the office the need for improved efficiency and effectiveness in the general services.

2.1 The Law Office

The Office Araújo HIDD & Melo located in Teresina – PI owns a subsidiary at the city São Luís capital of Maranhão State located at 450 kms (279,617 miles) from Teresina. Basically it is an outsourced service for the major offices working sorely with the legal logistics making over 1000 acts of investigations and hearings, working in both states Piauí and Maranhão.

In order to find, the best geographic location for a new office, the research used a mathematical model to help the shareholders to make the decisions.

3 Methodology

The company location can directly affect logistics costs. The company's location is a fundamental issue, thinking in retail can be decisive for the success or failure of it. It impacts directly in operations costs, prices and service capacity. According to Krajewski [] one of the companies localization best method for logistics tools is the Center of gravity to find the optimum point based on the criteria of each location. In this research for legal logistics it has one more aggravating point because of the large numbers of activities (hearing and occurrences) and a fine of not running at the time set by law.

According to Martins one of the goals of the study for logistics is the movement of materials. The location of the company or its deposits will directly interfere in this matter. The service also works similar to other branches. The author reports that there are quantitative factors and goals and also no quantitative and subjective factors. In the current study the two cases was used: the first was the aim of the location through the center of gravity method with electronic simulator (http://zip.net/bgsBLm) and the second with the approach using subjective criteria as access road in good condition, suitable internet to work, city Forum and facility rental. This simulator can be used by anyone with other data from another company.

Initially used the problem solving method to identify and analyze the root causes and elect a key element to be treated [5] as related in Falconi's book. Once identified the main problem made a detailed study to find the best location solution for the law office under study.

Archimedes (287 BC-212 BC) was the one who systematized the center of gravity in his study identifies the center of gravity of geometric figures in Archimedes book [6], center of gravity and leverage is a classic mechanics and subsequently used this principle to other areas of science.

Define the location of installations is a study that has been conducted since the nineteenth century, created several methods and theories in various areas of logistics. This work in particular was based on the method proposed by Weber.

Alfred Weber [7] initiated the study Factories location in 1909 aiming to minimize the distance among the facility and the points of supply and demand. Initially in his calculations were considered only two-dimensional space variables assuming the absence of constraints and path as a straight-line shortest distance between two points. As

deepened in his studies, it became clear that both the production and the location was affected by raw materials and other factors, were then inserted some variables that ponder the calculation, contributing to increase or decrease the weight given point.

With this method, it is possible to find a center point P that minimizes the sum of pondered distances.

For this study, the Weber's method was adapted considering each point as the set of coordinating for a city that will be called city "i" (Dxi, Dyi), inclused a weighted by the sum of Amount Received by acts performed in this city "I" (Ri) and also the Value payed per Correspondents also in the city "i". Upon sum calculation described above and dividing by the sum of the weights, the coordinates (Px, Py) of the Center of Gravity is found (Eq 1 and Eq 2).

$$Px = \frac{\sum(Dxi \times Ri \times Ci)}{\sum(Ri \times Ci)} \tag{1}$$

$$P\boldsymbol{y} = \frac{\sum(D\boldsymbol{y}i \times Ri \times Ci)}{\sum(Ri \times Ci)} \tag{2}$$

In this paper, was used the electronic simulator engine with Microsoft Office Excel 2013 version. In the simulator enters with the data of cities and their corresponding latitude and longitude, then adds the weights of the criteria chosen, in our case the criterions were: the amount received and the amount paid. The simulator returns the geographic coordinates of the center of gravity; this result puts up on Google Maps and identifies the nearest place found in such cities. In Brazil, you can find the geographical coordinate of the cities in the IBGE. The simulator is available for download by the author.

In the simulator, you should only fill the cells in yellow as shown in Figure 1, the simulator, according to the criterion or weights established in the cells F7, G7 and H7 address in each city, returns the center of gravity in D3 address. From now on, it is necessary to copy in the Google Maps and the system returns the location of the point indicated.

	A	B	C	D	E	F	G	H
1		Coordinates Found						
2		LATITUDE	LONGITUDE	Copy these data on Google Maps				
3		-5º47'22"	-42º22'42"	-5º47'22" ,-42º22'42"				
4								
5						Weighting		
6	CITY	CITY LATITUDE	CITY LONGITUDE	X	Y	Weighting - I	Weighting - II	Weighting - III
7	Teresina	05º 05' 21" S	42º 48' 07" W	5,09	42,80	38.000,00	14.000,00	1
8	Picos	07º 04' 37" S	41º 28' 01" W	7,08	41,47	43.000,00	12.000,00	1
9	Parnaíba	02º 54' 17" S	41º 46' 36" W	2,90	41,78	26.000,00	14.000,00	1
10	Floriano	06º 46' 01" S	43º 01' 21" W	6,77	43,02	44.000,00	4.000,00	1
11	Corrente	10º 26' 36" S	45º 09' 44" W	10,44	45,16	18.000,00	7.000,00	1

COPY THESE DATA

Fig. 2. Electronic simulator

The center of gravity method is a mathematical model of location, after finding that point took into consideration other variables finding the nearest city from the point found that has the best structure to host a law firm of this magnitude such as: easy access, internet available, affordable rent, competent professional, Proximity regional Forum.

4 Results and Discussion

Once defined the working method, collected the data and treated on an electronic simulator as the EXCEL spreadsheet was reached the following results. The study was based on the latitude and longitude of Piauí and Maranhão cities where the offices acts, making various analyzes according to the classification.

The calculation was classified as follows:

- North Piauí : Between Teresina and Piaui's Coast (Luís Correia City 02º52'45"S 41º40'01"W) – Figure 3 – Yellow Part;
- South Piauí : Between Teresina and Extreme South of Piauí (Corrente City 10º26'36"S 45º09'44"W) Figure 3 – Blue Part;
- Piauí without the city of Teresina and nearby cities (radius ilustred at Figure 3) it is called High Teresina or metropolitan region of Teresina;
- Maranhão without the city São Luís and nearby cities (radiuesilustred at Figure 3) it is called High São Luiz or metropolitan region of São Luiz;
- Entire Maranhão;
- Entire Piauí and Maranhão (General result);

The following Figure 3 illustrate the division of the studied areas.

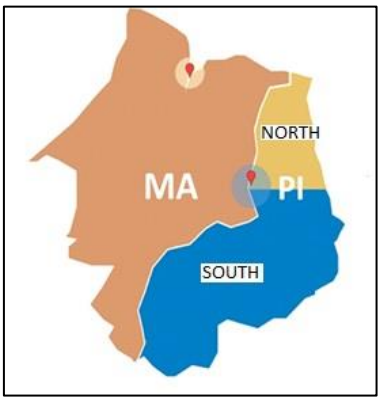

Fig. 3. Map according to the classification

The results of the study, showed a sort of cities concentrate on the central location at the above regions, considering the criterion of the amount of costs and receipts. The analyze of quantitative data resulted in the Cities demonstrated in Column 3 (City Correspondent) of Table1. According to the processes results, were analyzed qualitative data that approached the result for larger cities.

Table 1. Results found in the Simulation Center of Gravity.

	Latitude	Longitude	Correspondent City	Near City
PI - North	04º 01’ 30’’ S	42º 04’ 30’’ W	Batalha	Batalha
PI - South	07º 21’ 18’’ S	40º 54’ 16’’ W	Padre Marcos	Picos
PI – Teresina	04º 49’ 40’’ S	42º 10’ 07’’ W	Campo Maior	Teresina
Ma - São Luis	04º 40’ 00’’ S	44º 51’ 00’’ W	Poção de Pedras	Bacabal
MA	04º 06’ 53’’ S	45º 08’ 23’’ W	Olho D’agua das Cunhãs	Bacabal
General	04º 07’ 48’’ S	44º 07’ 27’’ W	Coroatá	Bacabal

The cities found in the present study are show in Figure 5, and emphasized the best locations by region. Wine color is located in the best cities according to qualitative data.

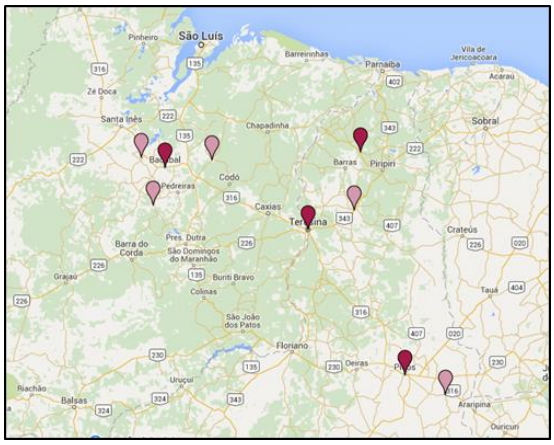

Fig. 4. Map with the results obtained in the study

It is often a discrepancy between the results presented by the Center of Gravity method and common sense on choosing a location. The Center of Gravity is based purely on logic, the input data to determine what would be the most advantageous choice, through it are not considered external factors such as difficulty of travel, cost of new facilities, etc. These criterions are called qualitative data.

This part of the work will expose some qualitative data on the city with the best location according to the quantitative data, and the city proposed by the shareholders of the law firm, they believe to be an open door to regions of Maranhão that difficulties in commuting and absence of correspondents is still a poorly explored area. They are, Bacabal - MA and Itapecuru Mirim - MA, respectively. In Table 2 follow the comparative data listing the main points of both cities.

Table 2. Comparative data between two cities.

Data	Itapecuru Mirim	Bacabal
Human Development Index	0.599	0.651
Population	62.110	100.014
Area of territorial unit	1.471,438km² 568,12538796mi²	1.682,963 km² 649,79564705 mi²
Gross Domestic Product (GDP)	R$ 4.357,26	R$ 5.221,41
Received Value	R$ 8.775,00	R$ 17.865,00
Pay Value	R$ 3.506,66	R$ 6.235,00
Profit	R$ 5.268,34	R$ 11.630,00

5 Conclusion

The main objective was to expose the results obtained from the Logistics Center of Gravity Calculation. According to the results, the city of Bacabal- MA presents the best location. With the installation of a new subsidiary in this city, according to the data, the amount received should be maximized and the cost corresponding minimized.

According to qualitative data, characteristics of location, this presents an excellent structure to attend the acts carried out in the town and nearby.

As a suggestion for future studies can use the same simulator to find the best residence location of the possible agents or forth party services of Araújo HIDD & Melo office.

The simple and objective way that had created the simulator can be used for other companies in various lines of business to find the best geographical location for minimize the commuting costs and consequently maximize results.

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