

# **GEOMARKETING AND GEOGRAPHIC INFORMATION SYSTEMS FOR URBAN DECISIONS: INDICATION OF THE BEST LOCATION FOR A CONVENTION CENTER IN BELO HORIZONTE – MG.**

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## **ABSTRACT**

The main objective of this article is to illustrate how geomarketing and geographic information system (GIS) can assist the process of decisions making in urban planning, specifically in the identification and characterization of the best places for the construction of a convention center in Belo Horizonte, state of Minas Gerais, Brazil. A convention center is a typically large building, essential for a metropolis, designed to hold business and tourism conventions and events.

Establishing the best locations for a convention center involves research of which variables should compose the analysis and how to cross them. For this purpose, the work was based on the method of multicriteria analysis, which evaluates various criteria and processes contributing for the result, trying to cover all the factors that influence the choice of the local of the convention center.

This is a macro view of analysis, which examines the city as a whole. The work of selection for the best location can be divided into four steps: 1) identification of places with highest number of weighted desirable characteristics, 2) selection of vacant lots with an area over 10.000m<sup>2</sup>, 3) exclusion of lots from areas with characteristics identified as unfavorable, and 4) application of calculus of Accessibility.

At first, it was identified locations which had the highest amount of desirable characteristics crossing maps from the software SAGA with the calculus of weighted average, using variables defined by Exploratory Spatial Data Analysis (ESDA), and weights and notes defined by the Delphi method. After identifying those areas, it was searched for areas which had vacant lots measuring over 10.000m<sup>2</sup>.

Thus, as a result of this article, it was found in Belo Horizonte 11 ideal places to build a convention center, instead of only one location. A convention center can be built in any of these locations, according to the selected criteria, although some places are more accessible or more suitable for the activity. Therefore, this article presents not only a single place, but a list of suggestions. The choice of one location between the options presented, however, requires a micro analysis of each of them, since this article diagnosis was macro, which contemplated the entire city of Belo Horizonte.

## **Introduction**

This study aims to identify the best locations for the implementation of a convention center in Belo Horizonte, Minas Gerais, by understanding the factors that influence its location. The identification of these areas involves the understanding of variables that influence the location of a very large tourist venue, and the complexity of their interrelationship.

The understanding of the factors that influences the location of large venues make possible to generate predictive scenarios, and, consequently, indicate the potential areas to build a convention center in Belo Horizonte. Considering that are many variables that affect the location of tourist facilities and the correlation between them we tried to use the multi-criteria analysis, a method capable of simplifying the reality, enabling the advancement of knowledge of their object of study.

The understanding of the spatial distribution of urban elements requires a broad overview, able to identify and correlate the various social, economical, cultural and environmental processes the enable the distribution of activities in an urban space (Ramos, 2002). Therefore, the use of spatial modeling is required to prepare a complete analysis, considering all the variables and the complex relationship between them.

## **Definition of the Best locations**

Models of spatial optimization are aimed to create tools which represent accurately real processes and problems, helping the search for better solutions. According to Moreno (2004), these models have a purpose of helping the processes of planning and spatial management, allowing the administrator:

- Generate and analyze a list of alternatives, and identify the best one based on a specific goal;
- Support the choices made by the planner, providing evidences and arguments;
- Compare optimal solutions to those politically acceptable, analyzing their differences and resemblances;
- Evaluate if the strategies and location schemes adopted or to be adopted respect the spatial study conducted.
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## **Previous studies of location**

The location of human activities relates closely to one of the most relevant discussions in Geography: the spatial organization of the land. Therefore, both Regional Geography and Quantitative Geography dedicate to study and develop concepts, methods and instruments to describe and explain the location of human activity over the land. The

most important insights about the theory of spatial location were proposed by economists and regional scientists who through decades proposed theories and models about the question. On the other hand, quantitative geographers, such as Haggett, Bunge and Morill started, on the beginning of the 1960's, to apply and develop theories and models of location, based on the pioneer studies from Cristalle in 1930's.

Studies conducted by Losch in the 1950's supported that the degree of proximity between offer and demand seems to be one of the keys to the most and least use of tools by a population. This hypothesis was already confirmed by a number of studies. Around 1960's, as the urbanization spread around the world and more specialized and complementary spaces were developed, the conclusion that geography should be more connected to the problems of circulation, relative positioning and distances was reached. Thus, after the World War II, part of Anglo-Saxon human geography, induced by a new reliability on the power of science conceived by models of physics, adopted the hypothetical deductive method and a mathematical language highly formalized.

Later, at the end of 1960's and through 1970's, behavior based geographers conducted a scientific reorganization of the concepts of location theory, bringing it closer to reality and to the needs of individuals.

The so called new geography changes its focus from the study of the extraordinary and unique to the search of regularity and models of general characterization, with the ability to explain and predict events. According to these geographers, the locations converge in a set of knots, masses, functions, distances and interrelationships, where can be searched for general laws which can explain their categorization and hierarchy, and allow, in the future, plan their development.

In the last two decades, the development of Geographic Information Systems (GIS) allow the location studies to improve their functionality, due to the capacity of these systems of storage, manage, process and create georeferenced information.

## **Methods**

The methodological design to identify the best places the build a convention center cam be summarized in five steps (figure 1):

- 1) Elaboration of a cartographic basis;
- 2) Elaboration of a favorable characteristics base map, through identification and crossing of favorable characteristics and locations most suitable for a convention center;
- 3) Identification of vacant lots in favorable areas;
- 4) Exclusion of lots in unfavorable areas for the construction;
- 5) Classification of lots according to the factor of accessibility.

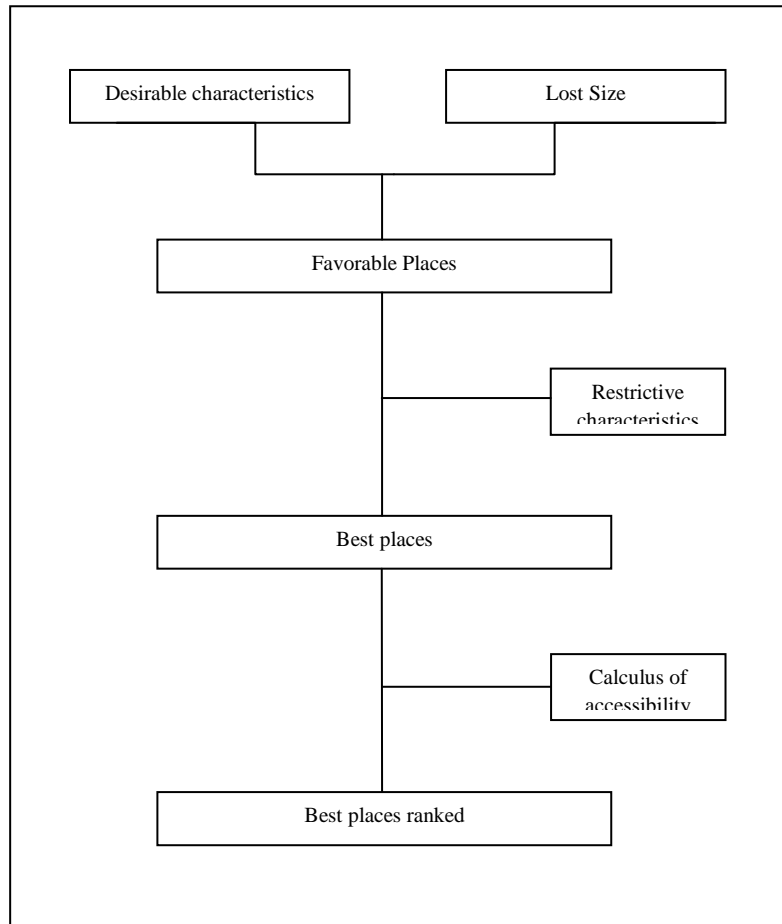


Figure 1: Methodology Employed

## Procedures

### 1. Elaboration of Cartographic Data

The design of the base data map involved the collection, organization and standardization of data from various institutes mapping the city, always trying to reproduce the appropriate scale for the type of analysis used. The collection of data contains information about urban infrastructure, tourism, trade, services and characterization of the local population. The cartographic basis were acquired in scale 1:2000, organized and processed in Arcgis and SAGA software. It was used the coordinate system Universal Transverse Mercator (UTM), datum SAD 69 – South American Datum 1969, Zone 23 South.

### 2. Elaboration of a favorable characteristics base map

The first step to identify the best places is the elaboration of a base map aggregating the favorable characteristics. This map was elaborated through crossing the variables and map algebra processed using Signature tool of SAGA software (Geo-Environment Analysis System), developed by Universidade Federal do Rio de Janeiro - Doctor Jorge Xavier da Silva's team. The variables used in the map were defined through Exploratory Spatial Data Analysis (ESDA) and validated by a group of experts. The ESDA can correlate the spatial behavior of a chosen variable to different characteristics of the land. Exploratory analysis and opinion of experts defined a list of 10 favorable variables and only one unfavorable variable for the construction of a convention center. The favorable variables are proximity to hotels, proximity to restaurants, proximity to pubs, proximity to museums and other cultural and tourist attractions, proximity to travel agents and operators, proximity to banks, proximity to hospitals and health centers, Human Development Index (HDI), proximity to shops and services (figure 2). The only unfavorable variable is the proximity to slums (figure 4), that will be applied to the unfavorable characteristics map (step 4).

The definition of weights for each category is obtained from the Delphi method, which consists on consulting the experts on the particular object of study. To accomplish this stage, it was collected, through a questionnaire, the opinions of 15 experts from the tourism sector, including managers and employees of spaces for events and hotels, public and private organs and agencies of tourism promotion and events.

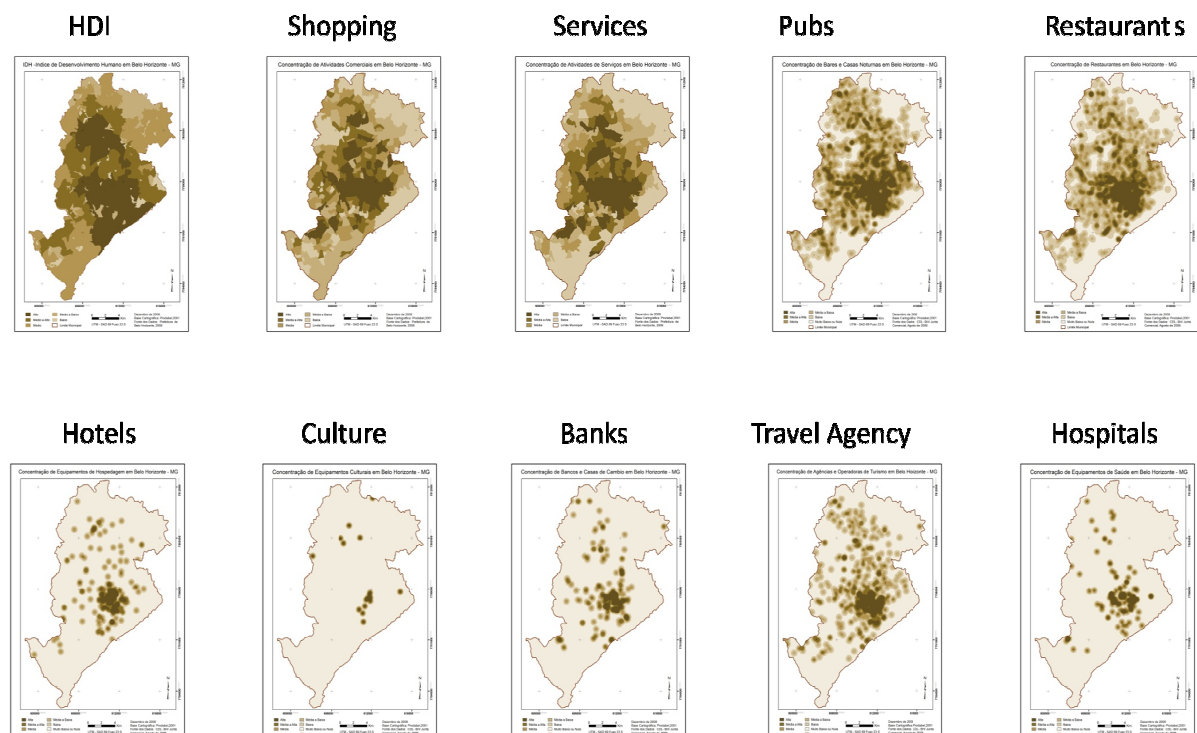


Figure 2: Favorable Variable

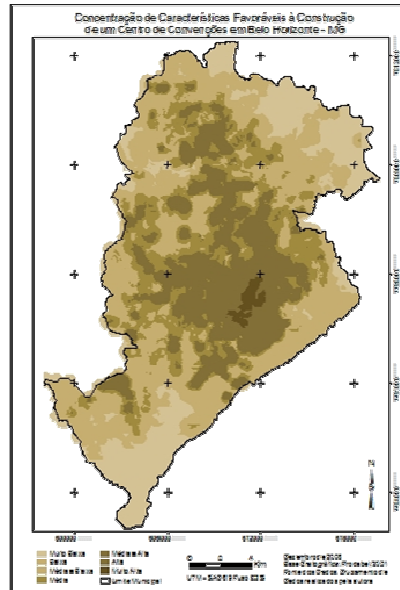


Figure 3: areas with higher weighted confluence of favorable characteristics

Thus, the 10 favorable variables for the construction of a convention center were crossed through map algebra generated by SAGA software, in which each variable influenced the analysis according to its respective weight defined by an expert on Delphi method. The result of map algebra identifies areas with higher weighted confluence of favorable characteristics, which can be seen in figure 3:

Moura (2005) explains that the results of this crossing are not a binary response of what areas are defined as suitable and not suitable for the construction of a convention center. The results only classify places as more suitable and less suitable for the activity.

It is important to observe that most favorable variables converge in south-central area, economic and social center of cities, while unfavorable characteristics, slums, are spread all over the city, instead of one specific location.

### 3. Definition of Vacant Lots in Best Areas

By crossing the variables, Belo Horizonte was divided into areas of higher and lower concentration of desirable characteristics. However, to indicate the best places to build a convention center, it is necessary more detailing of the place. For this purpose, the map of favorable characteristics was crossed with a layer of vacant lots with an area over 10,000 m<sup>2</sup>. It was selected vacant lots with an area over 10.000 m<sup>2</sup>, which were in areas of very high, high or medium to high concentration of desirable characteristics. By crossing these two layers, it was reached the result of 20 locations in the map (figure 4).

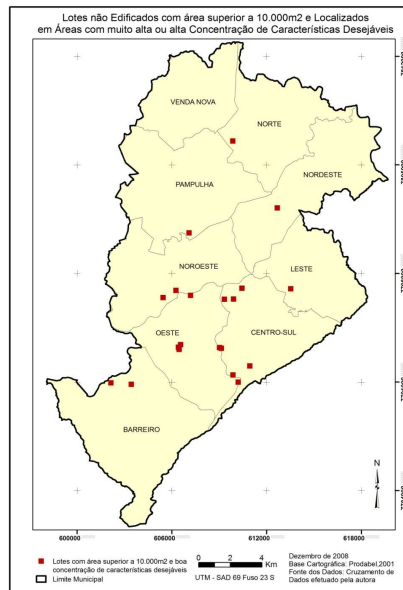


Figure 4: Vacant Lots in areas with high concentration of desired characteristics

#### 4. Exclusion of the Lots Next Unfavorable Characteristics

The last step to define the list of the best locations is the exclusion of candidates presenting unfavorable characteristics; in this case, proximity to slums. A consultation with experts confirmed that the proximity of slums provides the image of violence and instability. Therefore, it was excluded from the list all vacant lots in a radius of 500 meters of slums (figure 5).

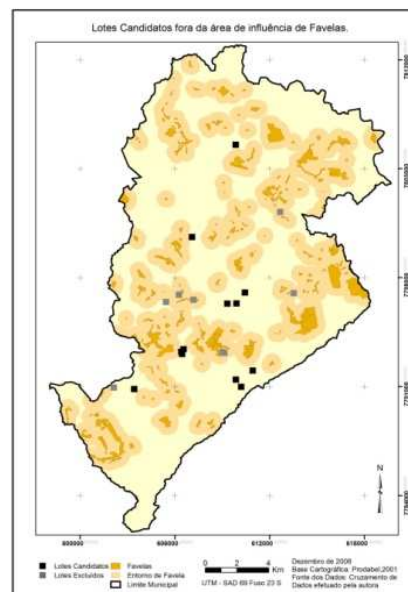


Figure 5: Exclusion of vacant lots near to slums

## 5. Classification of Great Places Second Accessibility

After the choice of lots with areas over 10.000 m<sup>2</sup> located in places with favorable conditions and away from slums, it was applied the last filter, the factor of accessibility. The factor of accessibility does not limit the options studied, but it classifies in the order of the most to the least accessible.

To include accessibility as a factor in the research, it was developed an equation based on models to maximize efficiency, described in Moreno and Sendra (2004). The accessibility equation applied can be observed below:

$$\pi_i = Q_j / (a + t_{ij}^B)$$

Where:

$\pi_i$  → potential calculated on the point of demand i

$Q_j$  → attractiveness of the installation to point out in the local j

a → constant (habitually 1 to prevent the division for 0)

$t_{ij}$  → distance between the point of demand i (hotels, airports) and the place of installation j (possible locations).

The result of this calculation classifies the 11 possible locations according to accessibility, as it can be observer in figure 6.

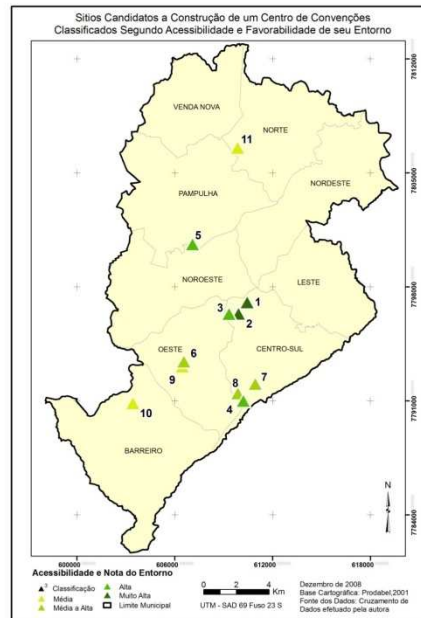


Figure 6: Lots classified by accessibility



## Conclusions

The result of this article provides a list of 11 best places to build a convention center in Belo Horizonte. Any of these places is suitable for the construct of a convention center, according to the selected criteria. Some locations are more accessible and more suitable for the activity. Thus, this article does not select one single place, but a list of suggestions, all feasible. The choice of a location between the options presented, however, requires a micro analysis of each site, since our diagnosis was macro, which contemplated the entire city of Belo Horizonte.

It should be brought to attention that the results are entirely related to the procedures applied. It is important to highlight that the results are a crop of reality and they are closely associated with the authors and their collaborators' point of view, which are inserted in a cultural context. A model is a piece of reality, according to the definition of criteria. Thus, these results are valid within the cultural context, and economic history in which they were conceived. They are not an absolute truth. Since any model is a simplification, it must be remembered that this is a simplified view of reality, based mainly on secondary data, provided by public or private institutions operating in the city. Thus, the results are also closely linked to these variables, the quality of their sources and the method by which they were analyzed.

However, it is a satisfactory result for a macro analysis, since the whole city area was considered as a possibility, and this article presents 11 possible places for the construction, even though each model have its own peculiarity. It can be said that the result were satisfactory, not only to guide the choice of places for a convention center in Belo Horizonte, but also to serve as a methodological basis for further studies of tourism and geomarketing location. These types of studies are still very incipient in Brazil, and those models must be reapplied for other cases in the same category.

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