

GIS BASED INERACTIVE BUSINESS GEOLOCALIZATION

Marita Cekule

Researcher, Institute of Geodesy and Geoinformation, University of Latvia,
maritacekule@inbox.lv

Mara Zira

Head of Analytical Planning Division, Riga City Council, mara.zira@riga.lv

Kaspars Cabs

Bod Ltd, IS Project Manager, kaspars@bod.lv

Irina Baltmane

Asistant, Institute of Geodesy and Geoinformation, University of Latvia, irinag@lu.lv

Abstract

Geolocalization of an enterprise or in other words the choice of location is different for every type of business, besides it is also experiencing changes due to the time dimension, which means increase in the level of use of information and communication technologies. Thus also number of the potential territories for the location of the enterprises is increasing, as in their identification the new location criteria and impacts have to be taken into consideration. This process is fostering competition between the regions not only on the local, but also on the global scale. Under the circumstances of global localization the decision on location of the enterprise as any other effective decision has to be based on the results of a complex global and local system analysis.

Aim of the research is to elaborate methodology for definition of the mutual correlations of business geolocalization factors for Riga – capital of Latvia, and its vicinity. In the research area the potential business opportunities are being assessed based on the development planning documents, evaluation of the existing situation, analysis of the retrospective data, elaboration of prognosis and scenarios. There are data bases created with a wide range of attributes, which are located on the map thus defining the scope of the spatial analysis, e.g. evaluation of new locations or measuring the impact of a new store or competitor. The enterprise database used is related to the concrete spheres of activity, also analysis on its interrelation with the connected spheres is made, as well as its link to the specific infrastructure, demographic, environmental and other data layers. Analysis is based on the interrelations used in the global experience and their adoption to the situation in the given territory. It results in the possibility to assess the impact of changes in different GIS layers on the businesses in the research territory and vice versa - impact of business development on the other GIS layers.

To foster this process the advantages of the IT can be used, i.e. data processing, visualization, spatial analyzing and speed of information flow, quality, etc. – thus information from different disciplines can be combined to contribute to the business development. Web based business geolocalization system for Riga allows performing the business location analyses in the real time.

Keywords: business geolocalization, main factors of business location, GIS, spatial analyze, WEB based system architecture.

Introduction

In this paper we examine the role of Geographic information systems (GIS) and web-based data geolocalization for business activities, as well as methodology for definition of the mutual correlations of business geolocalization factors for city.

The analysis of spatial data is an important backbone for many applications and decision processes in research and business.

Determining the physical location, known as geolocalization (Wong et al., 2003), for many enterprises one of the most important business elements, which is essential for the profit (Cekule et. al., 2007), locations conditions can play a significant role in performance of industrial firms (Gray & Parker, 1998; Porter, 1998; Malecki, 1997).

Geolocalization of an enterprise or in other words the choice of location is different for every type of business, besides it is also experiencing changes due to the time dimension, which means increase in the level of use of information and communication technologies. Thus also number of the potential territories for the location of the enterprises is increasing, as in their identification the new location criteria and impacts have to be taken into consideration.

21st century is marked by rapid development of Information Technologies (IT), which is also promoting constant changes in the society, economy, environment, as well as having its impact on the business. Thus business has to undergo continued adaptation to the new circumstances, which are growing more and more dynamic in the time dimension. One of the most important business success factors is information, which gives the opportunity to respond to the changes and to take effective decisions, besides this information has to be precise and accessible, for time is money (Cekule et.al., 2007).

The Internet becomes increasingly important as a source of data. There are manifold services and communities with commercially or collaboratively maintained, reviewed and classified data of high quality.

The required underlying GIS technologies are continuously evolving and improve their functionality, accuracy, variety, capacity and speed; in the developed countries GIS technologies are widely used in different fields for analyses and interpretation on the infrastructure development, land survey and population management, for planning, monitoring and modeling of the new development tendencies (Jain, 2000).

But the quality of the results does not just depend on the sophistication of the GIS, only if we can integrate the data we need to represent a problem, and only if we can compose and correlate the data as required, we can generate plausible results. Same authors also have a meaning that GIS have been in use for quite awhile now (Coppock & Rhind, 1991), but their functionality has changed only little over the years (Guesgen et. al., 2003). In the spite of being called geographic, GIS have so far been mostly geometric in nature, ignoring the temporal, thematic, and qualitative dimensions of geographic features (Molenaar, 1996; Usery, 1996).

Essential factors for business geolocalization

Business geolocalization is one of the most difficult and complex decisions to be taken when starting a business or changing its location. Its complexity is based on the following conditions: there cannot be the situation of having only one possible location for the business and the economic space is not homogeneous from the business's point of view (Diedrich, 2000), besides, the choice of location can be the reason for both, successful and unsuccessful entrepreneurship (Kotler, 2003). As the aim of any business is profit, but its location is generating costs, it is necessary to find the optimal solution when the profit is maximal compared to the costs. H.Diedrich stresses that when choosing the location, business has to take into consideration its mutual relations with the market, i.e. being both, the demander of the means of production and labor as well as the supplier of services or goods in the market.

Place is also one of the elements in the widely spread “Marketing Mix”, which is the aggregation of actions performed by entrepreneurs to achieve the marketing goals in the target market. Marketing mix consists of 4, 5 or 7 variables. Four most known are Product, Price, Place and Promotion, the so-called “4 Ps”, which can be adapted to the changing market demands and to the dynamic marketing environment. In this context “Place” means that the product/service is available on the right spot, at the right time and in the necessary quantity. Besides, it includes not only the location of the enterprise, but also the delivery of the product/ service from the producer/ service provider to the user, i.e. logistics, distribution channels, warehouses, communication (internet, mobile), etc. (McCarthy & Jerome, 1987). Nowadays due to the rapid development of e-services many transactions can be managed in the web, and it changes priorities when choosing the business location. Also characteristic of each enterprise defines the importance of business geographical location on profit. However, in general the attractiveness of a location from the point of view of a business is characterized by the accessibility of the land/ premises and their price, taxes and other regulations, accessibility of the labor in terms of quantity and quality, availability of suppliers and clients, market demand, status of the location, quality of living environment and easy access to the quality services.

Sometimes companies representing one industry are located in one place because of raw materials or labour force (Blythe, 2004). Therefore also industry analysis is important element, which should be one part of business geolocalization.

Each business has its own conditions for the choice of location; however, there are main criteria, which define this decision. The research carried out by the European Cities Monitor (2005, 2008) is based on the interviews with 500 senior executives of the enterprises who evaluate the leading business cities in Europe; and based on these the experts point out the following factors which are prevailing when taking the decision on the business location (Fig.1).

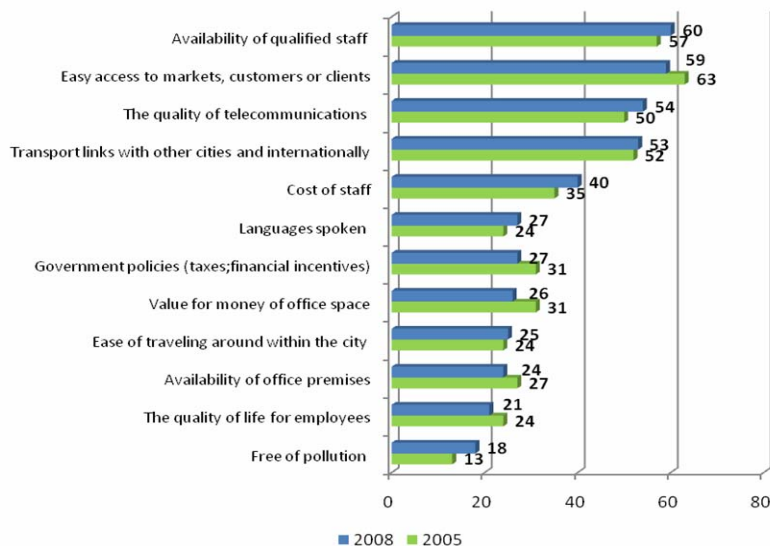


Figure1. Essential factors for business location, %. Data Source: European Cities Monitor, 2008, CUCHMAN&WAKEFIELD

According to Fig.1 it is important take into account that developing model technologies and habits of clients are changing in the process of time. As well as significance of separate criteria of business area location are changing too.

Significance of various factors depends on represented branch of enterprise. For example, importance of availability of qualified staff is the main factor, but the most important it is for industrial sector where it is evaluated to 60% (see table 1).

	Industrial %	Consumer Retail & Distribution %	Professional Services %
Availability of qualified staff	64	57	60
Easy access to markets, customers or clients	62	55	57
The quality of telecommunications	50	57	56
Transport links with other cities and internationally	55	53	51
Cost of staff	39	40	43
The environment that governments create for business through tax policies or financial incentives	27	30	23
Value for money of office space	19	31	29
Languages spoken	32	22	22
Availability of office premises	20	25	28
Ease of travelling around within the city	21	29	28
The quality of life for employees	17	27	21
Free of pollution	19	18	15

Table 1. Essential factors by type of business. Source: European Cities monitor, 2008, CUCHMAN&WAKEFIELD

Retailers and services are more dependent on company's location, because they are more dependent on customers and their habits. As customers generally choose the nearest services (banks, gas stations, shops etc.), it is important for entrepreneurs representing sectors such as department-stores, fast-food restaurants, gas stations etc. to work out detailed market research to find best location (Kotler, 2003). Therefore described model will be supporting tool for

complex territorial analyses for entrepreneurs for qualitative and fast analyze and analyze will serve as basis for decision making.

The main target groups of model are SMEs (small and medium sized enterprises) because they are more flexible and more often take decision to change location than large companies. Authors have made analysis and determined main factors for business location in Riga. The most essential factors and their importance according to business type are shown in Fig.2

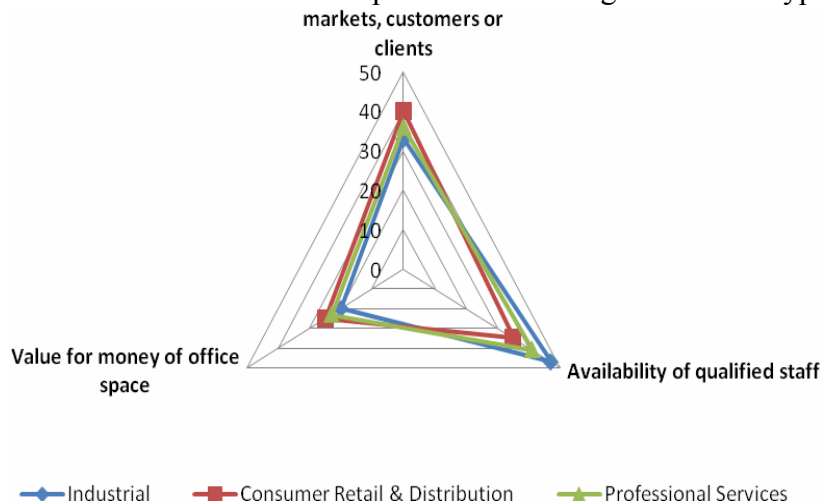


Figure 2. Essential factors for business location by type of business in Riga

As model is adapted for Riga it doesn't include such factors as taxes, pollution, quality of telecommunications, cost of staff etc. because all these factors are considered to be constant in chosen etalon territory.

Web – based data geolocalization system for business activities

In the 21st century one of the eight main tendencies characterizing our life is that 'every second counts'. It means that the rapid development requires productive use of the time; it cannot be wasted (Jordan, 2006). Thus there is the necessity to find solutions, which allow saving time, and by this maximizing the profit. It is the reason for rapid growth in the use and importance of IT, as it is increasing the speed and accessibility of the information flow, which, in its turn, is one of the basic preconditions for the profitability. This function is fulfilled best by the Internet, which allows quick sending and receipt of information.

Data geolocalization and digital cartography in the Internet environment is the most suitable and unique communication channel, which supports textual information. For creation of such databases the geomatic platform and infrastructure of spatial data is needed.

Map is the best tool for representing the spatial process. In the perception and representation of the space we use the visual, verbal, mathematic, digital methods, as well as the individual approach of each particular person. In ideal case it should be possible to join all these elements into one analytic system (Cekule et. al., 2007).

The Open Source GIS Software is growing in popularity within geo-information community. Such software plays an important role in breaking down barriers where the cost limits the use of public spatial data and access to GIS tools (Song et. al., 2004), the compiled set of the open source software will allow fast and economics deployment of GIS and database applications (Belickas et. al., 2005).

Using the GIS technologies the spatial analyzing and modeling process of real processes and phenomenon is made faster, cheaper, better accessible and understandable for decision

makers (Fotheringham & Rogerson, 1994; Timmermans, 1997). As well known, that using GIS in different spheres, the new analyzing and modeling methods of spatial analyze are implemented and the created abstract models describe real objects, its relations and correlations, roles of the real world (Goodchild, 2000; Johannesson et al., 1999; Filho et al., 2002).

Spatial objects include their spatial description, characteristics of their features and the description of the possible functions. Their features are generalization, inclusion, diversity and inheritance (Cekule et. al., 2007).

The spatial analysis methods propose a possibility to analyze human impact on the environment in the spatial context, as well as to create a spatial division, social, economical, demographical and other phenomena models (McGregor, 2000).

An essential operation in GIS and spatial analyze is map overlay, where new maps are computed from existing ones by applying either: buffer operation which increase the size of an object by extending its boundary, or set operations, such as complement, union, and intersection. These operations are exact quantitative operations. Humans, however, often prefer a quantitative operation (Guesgen & Histed, 1996; Guesgen et. al., 2003).

Web based business geolocalization system for Riga operates with data available on territorial dimension in the city. Each user has a possibility to choose between the different criteria and to classify them according to their significance for the particular sector, characteristics of the business, form of entrepreneurship, etc. (the total weight being 100%) and to define the criteria to describe the potential locations for the business (Fig.3).

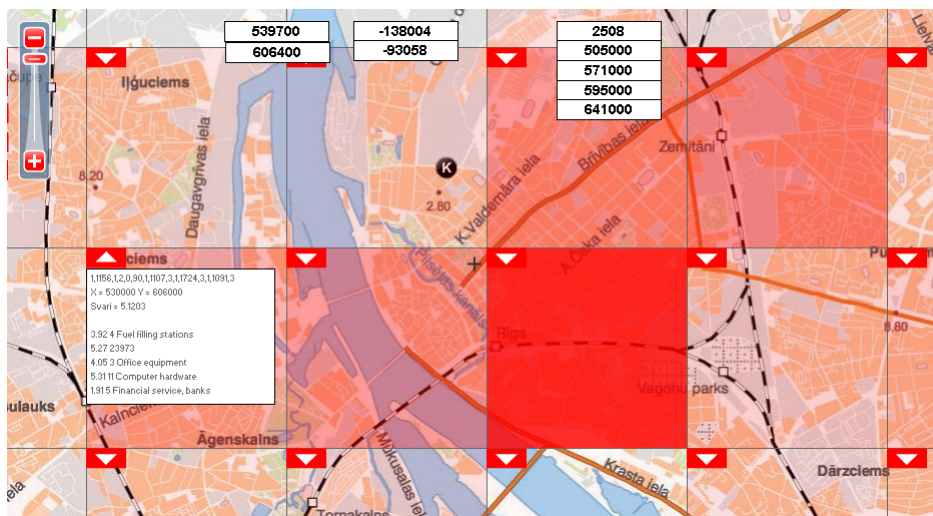


Figure 3. Web based data information systems application

The system offers also an opportunity to create the personal profiles, where the previously generated reports could be saved (in the form of maps, tables, charts, text), besides, there is an additional option - automatic update using the newest data (and saving the previous one).

To ensure the high-speed performance of the system and in order not to load it with 'unnecessary' calculations (like statistic information independent of additional data layers and result), it is made available in the raster. In the system these are the basic maps showing the buildings, infrastructure, communications, topography, etc.

Information to be analyzed is created in form of the additional thematic layers with the attributes, i.e. databases. Data processing for the business geolocalization is made using the mathematic programming methodes, system architecture is illustrated in Fig. 4.

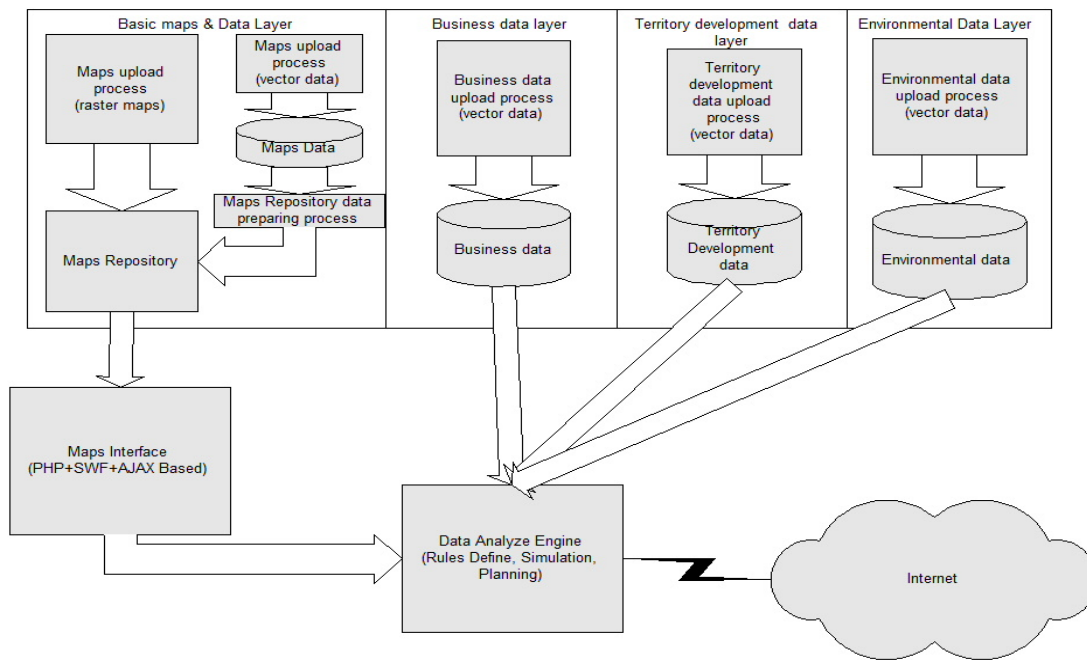


Figure 4. Business geolocalization system architecture

As the system operation is web-based and is operating in the real time, the operation principles for this system have to be based on the user-friendly and easy-to-understand interface, where the number of parameters to be chosen by the user is reduced, however, still allowing to perform the indistinctive analyses, e.g. the correlation between the criminal situation and enterprises of a certain branch.

The databases adjusted to business needs are created based on GIS. The digital maps are linked with different information, e.g. demographic, environment, socio-economic data, etc. For example, point layer - city address database, where based on the database relation principle each address has enterprise database information attached, which, in its turn, is using as a parameter the number of enterprises displayed. In the same way the layer showing public transport stops is using the stops as the attributes, which are enciphered, i.e. divided into several layers based on the number of public transport lines using the particular stop. In addition data on the biggest shopping malls, parking, etc. is used. Line layer - the street and road layer is used, where the parameter used is the category of the street/road. Polygon layers are mainly displayed as the rectangle objects, i.e. all the thematic layers for spatial statistics analyses, e.g. demographic data (age, density of population, employment level, etc.), criminal situation, environment indicators, noise zoning, as well as the urban spatial development plans. Graphic description is made of the rectangles with the parameters attributed to them. When analyzing the particular business sphere, the co-relation between the enterprise data, employment infrastructure layers, public transport, streets/ roads, spatial planning has to be taken into consideration.

This system gives a possibility for fast and convenient display of the territorial analyses.

For example, Figure 5. shows three potential arrangements of office place in one of the districts in the city 1 km from the main office, in buildings available for rent.

Map overlay, selection, intersection, buffering and other functions, as well as demographic data, street and building layers and databases of enterprises are using for spatial analyses.

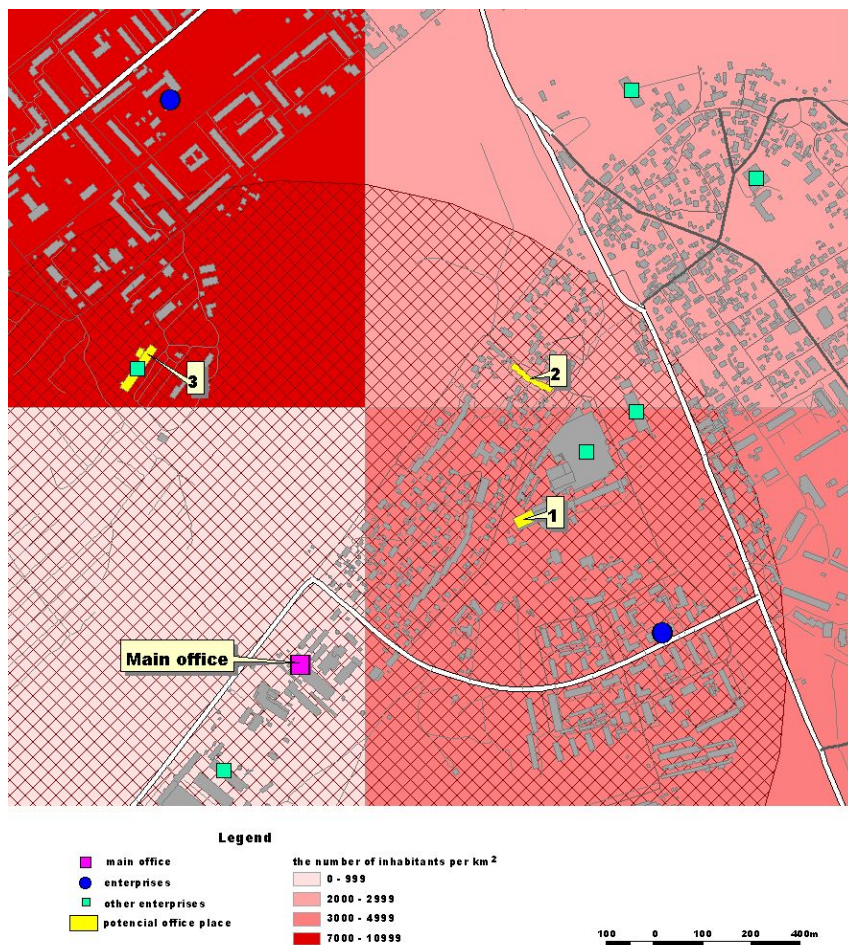


Figure 5. Territorial analyze for potential locations of new business office

However, in order to take the final decision on the business location, also additional criteria have to be taken into account, like subjective desires of the businessman (if user likes the particular area, etc.). This is why it is useful to evaluate on the spot the alternatives suggested by the model before taking the decision.

Conclusion

Within last year the economy of Latvia like global economy has a recession and it has negatively influenced almost all business activities. It has created surplus of office and trade premises in market and it was a cause of essential decrease of rent prices. Entrepreneurs, who proceed to work, now have great opportunity to find new premises in the more attractive areas for considerably lower prices.

Despite existing recession, it is worth to plan and analyze market and looking for economic growth, as well as find ideal place for new enterprise.

The essential factors for business location by type of business in Riga are:

- access to markets, customers or clients,
- availability of qualified staff,
- value for money of office space

By using the Web based business geolocalization system for Riga allows performing the business location analyses in the real time.

The system was created for different kind of users, as well as businessmen/ investors, researchers, state and municipal institutions, individuals etc. The main target groups are SMEs (small and medium sized enterprises) because they are more flexible and more often take decision to change location than large companies.

Is important take into account that developing system technologies and habits of clients are changing in the process of time. As well as significance of separate criteria of business area location are changing too.

The main problems are availability, regularity of updating, quality of databases and integration in the system from different users.

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