

Determination of the Most Suitable Location for Retail Shopping Store by Using Geographic Information Systems Technology: A Case Study of Konya/TURKEY

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Key words: GIS, Spatial Data, Spatial Analysis, Retail Market

SUMMARY

Geographical Information systems (GIS) are an important tool to present spatial and non-spatial data together with the ability of creating decision support systems. GIS, which is an important decision support system, used not in the fields of engineering, but also in businesses and finance. Questioning of geographical data, and comparing of it in different dimensions, conflicting, bringing up its similarities and differences, and then obtaining of net outcomes had become simplest by using of these systems. Although GIS applications are intensely conducted in private in the world, they are mostly used by public sector and municipalities in Turkey. Nowadays among GIS applications, the selection of the most suitable location for a particular place are becoming popular.

This study presents a research in that an optimum location is searched as a new branch of a retail company. This study is an application based on most suitable location problem which has strategic matter for retail shopping sector which has been developing rapidly in Turkey. The application is performed for most suitable department location of SütGross Food, Animal Industry and Trade Limited Company in Konya Province. Spatial and non-spatial data as an input with non-positional population, construction number and residential areas are transferred to GIS system. A Database is occurred for these data. Retail shop areas of SütGross Food, Animal Industry and Trade Limited Company in Konya Province are determined by important criterion such as distance, population density and closeness to road. As a result of the analysis, the most suitable locations for the SütGross Company are determined separately for the Selçuklu, Meram and Karatay districts in Konya. It has been observed that the northern part of Aydinlikevler neighborhood, the center of Bedir neighborhood, the eastern part of Kılıcarslan neighborhood in Konya's Selçuklu district and the northern part of Havzan neighborhood of Meram district and the whole part of Karacigan, Sems Tebrizi, Kalenderhane neighborhoods, the western part of Aziziye, Nakipoglu neighborhoods of Karatay district.

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1. INTRODUCTION

Together with the opening of the Turkish economy to the foreign countries in the 1980s, the Turkish retail sector has undergone major changes in terms of scale, organization and geography with the effect of significant developments in the economic and social structure. Increasing income level, high urbanization rate, the increase in the number of working women and the impacts of the western lifestyle that come with the global expansion have led to changes in consumer lifestyle and shopping habits (Ong, 2005).

Since 1990s, shopping center and hypermarket investments in major cities have become popular. With these investments, the Turkish retail sector has begun to change rapidly (Şahin, 2010).

The organizations that deliver all the goods and services needed by the ultimate consumer carrying out all marketing activities are called “retail organizations”. Retail organizations are profit organizations (Gülçubuk, 2010).

Geographic Information Systems (GIS); is an information system that performs the functions of collecting, storing, processing and presenting graphical and non-graphical data obtained by location-based observations in integrity (Yomralıoğlu, 2000). The most suitable location selection projects developed with conventional methods (mathematical/statistics) require huge investments and cause high costs. As to location analyses with GIS, they cause less cost and result faster. Depending on the developing technology, the evaluation of data by the computer software of GIS enables to obtain clear results in a short period of time while speeding up the studies. Improvements in GIS technology, along with significant savings in time and labor, minimize the error rates and enable synthesis with clearer results, by evaluating the geographic data in the digital environment.

Today, some of the examples of application areas of retail organizations with GIS are as follows;

- Location Analysis
- Marketing and Scheduling Planning
- Urban Structure Planning
- Cost Analysis
- Cadastral Analysis Collection and Attachment
- Resource Allocation Facility Analysis

Location selection is the process of finding the desired location(s) by matching the existing criteria and the identified specific factors. The Multiple Criteria Decision Analysis (MCDA) problem is a solution that is applied in situations where more than one criterion must be evaluated together. The basic method of solving the problem is to divide the problem into small, simple and understandable parts so that a meaningful result can be obtained from these parts (Malczewski, 1999).

MCDA includes the definition of the problem, the criteria concerning the problem and the stages of determining the suitability of these criteria (Malczewski, 1999). MCDA, according to the decision-maker, is a process that requires making a selection among many criteria that have changing significance. The result is obtained with weights given to the criteria, and the exact truth about the significance ratings of the criteria must be obtained, as they may have different weights for the decision maker (Öztürk and Batuk, 2007).

Apart from locating and allocating retail markets, a GIS approach is sufficient for analyzes such as other businesses, marketing strategies and market entry, business forecasting, consumer behavior, profile tracking and forecasting. This approach to business practice is still under investigation. However, the usefulness of the construction projects in the construction sector is obvious, as they involve a large number of location analyzes for both technical and non-technical problematic areas. The most time-consuming and boring task in a GIS in location selection (non-technical area) is probably the creation of detailed digital maps that have the characteristics of every point, line, and range (such as street, road and demographic data). Despite the use of such descriptive maps, decision makers can decide very accurate solutions of the problems (Cheng and et. al., 2007).

The aim of the study, the subject of which is “Comparison of Street and Shopping Center Store in terms of Establishment Location”, is to determine how the preferences of managers in the retail sector are shaped according to "street stores" and "shopping malls".

The quantitative data collected by the snowball sampling method were analyzed using one way variance analysis (ANOVA) and t test. As a result, in the case/type of two stores, when choosing the location, it is understood that the managers are primarily concerned with the criteria of broad parking lot, playgrounds for children, cleaning, security, in-store ventilation. In addition, the establishment of an institutional structure in order to be a reliable enterprise is also seen as having great importance (Köksal and Emirza, 2011).

Reengineering of retail networks is a continual process that has been in the forefront of management attention worldwide. The central question is how to achieve positive business results under high costs, but at the same time maintain the attained service quality. This reengineering process may be implemented successfully only if preceded by detailed preparations concerning, primarily, the analysis of business results, market potentials and retail outlet location. GIS tools offer a strong support to this process. Apart from theoretical considerations, this paper will also present the use of GIS as a tool in determining the optimal

locations of the Serbian post retail. For the problem addressed in this paper, finding optimal retail outlet locations, criteria to be considered include: profitability, quality of service, urban construction criteria. Geographic information systems provide valuable support in this regard. GIS tools will certainly not provide exact results, but will allow us to include a variety of factors into consideration without increasing considerably data processing time. By analyzing and combining the layers formed, we may reach conclusions helpful not only in finding an optimal location but also in retail network management (N. Trubint and et. al.,2006).

In this study, analysis is made for Sütgross Food Animal Husbandry Industry and Trade Limited Company for branch location selection problem which is one of the issues of strategic importance for the retail grocery sector that is one of the rapidly developing sectors in Turkey. In the scope of implementation, non-spatial population, number of buildings and settlements are already transferred to the GIS system as an input layer of Konya data and a database is created. The most suitable market areas have been determined with the help of important criteria such as distance to rival markets, population density and proximity to roads.

2. MATERIAL AND METHOD

Konya, with a surface area of 39,000 km², is the largest and the seventh most crowded city in Turkey. Konya, which is adjacent to Ankara, Aksaray, Niğde, Mersin, Karaman, Antalya, Isparta, Afyon and Eskişehir through the Central Anatolian Plateau, is between 36° 22' and 39° 08' northern parallels and 31° 14' and 34° 05' eastern meridians (Figure 1). In Konya, which consists of thirty one districts, 2.108.808 people live according to 2014 data. Konya, one of the economically developed cities of Turkey, is also important with its natural and historical richness. Çatalhöyük, one of the oldest settlements in the world, was taken to the UNESCO World Heritage List in 2012.



Figure 1. Study Area

Sütgross Food Animal Husbandry Industry and Trade Limited Company is a local company that sells milk and dairy products. Most of its activities are carried out in Konya. It also markets its products to other cities. There is only one retail point of sale in the center of Konya. It is planning to open different sales points. It aims that the sales points planned to be opened is in different places of Karatay, Meram, Selçuklu districts of Konya.

ArcGIS 10 program which allows processing and analyzing geographical data has been used. Data such as numerical maps of Konya, population information, neighborhood borders, building numbers, public transportation stops have been taken from Konya Metropolitan Municipality and internet sources. There are a total of 276 local and national markets in Konya. The locations of these markets are determined from the Google Earth program and the internet sites of the related markets and processed into digital maps. The numbers of these markets in the central districts of Konya are shown in Table 1.

Table 1. Classification of retail markets and distribution by districts

Districts of Konya Province	RETAIL MARKETS								
	National Markets				Local Markets				
	Bim	A101	Nargross	Emekli	Ova	Makro	Sincap	Adese	Çelikkayalar
Meram	52	7	1	3	2	7	18	45	8
Selçuklu	22	4	1	4	2	4	7	24	4

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Karatay	23	3	-	2	2	2	6	10	3
TOTAL	97	14	2	9	6	13	31	89	15

Numerical data has been associated with non-graphical data converted to the coordinate system of UTM 6°, WGS84, 36N. In this study, the following criteria were used in order to select the most suitable place by using MCDA. They are defined as;

- The proximity to rival markets,
- Proximity to the markets that it wants to be close
- Proximity to social facilities
- Proximity to religious facilities
- Proximity to hospitals, health centers
- Proximity to educational institutions
- Proximity to trade areas
- Proximity to tourism areas
- Proximity to parking areas
- Proximity to public transport stops
- Proximity to public transport routes
- Proximity to the industry areas

3. RESULTS and DISCUSSION

Choice of retail market places is a very important subject for high profit margin, so that the investments that are made do not go to waste, and to be able to provide quality service to the customer. For these, many criteria need to be evaluated together. For example; while determining the most suitable place, not being too far away from the rival markets, being close to public transportation stops and easy to reach are the criteria that should be paid attention. 12 criteria were used in this study. Layers were created for each criterion. A map has been created for each layer and the result map has been merged with the combination of these maps. In Table 2, the buffer ranges and weight scores used for each layer are given.

Table 2. Attribute ranking for the maps

<i>Layer</i>	<i>Point</i>	<i>Layer</i>	<i>Point</i>	<i>Layer</i>	<i>Point</i>	<i>Layer</i>	<i>Point</i>	<i>Layer</i>	<i>Point</i>	<i>Layer</i>	<i>Point</i>
Educational Institutions		Trade Areas		Tourism Areas		Parking Areas		Public Transport Stops		Industry Areas	
0-0.2 km	1	0-1 km	1	0-1 km	1	0-1 km	1	0-0.05 km	1	0-3 km	1
0.2-0.4 km	2	1-2 km	2	1-2 km	2	1-2 km	2	0.05-0.1 km	2	3-6 km	2
0.4-0.6 km	3	2-3 km	3	2-3 km	3	2-3 km	3	0.1-0.15 km	3	6-9 km	3
0.6-0.8 km	4	3-4 km	4	3-4 km	4	3-4 km	4	0.15-0.20 km	4	9-12 km	4
0.8-1 km	5	4-5 km	5	4-5 km	5	4-5 km	5	0.20-0.25 km	5	12-15 km	5
1-1.2 km	6	5-6 km	6	5-6 km	6	5-6 km	6	0.25-0.30 km	6	15-18 km	6

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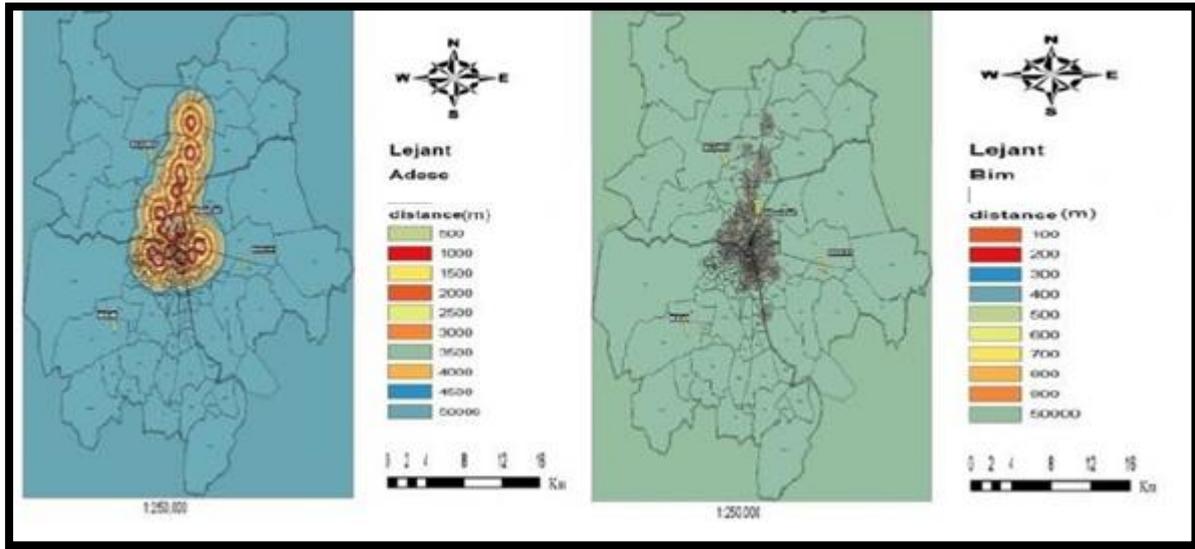
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1.2-1.4 km	7	6-7 km	7	6-7 km	7	6-7 km	7	0.30-0.35 km	7	18-21 km	7
1.4-1.6 km	8	7-8 km	8	7-8 km	8	7-8 km	8	0.35-0.40 km	8	21-24 km	8
1.6-1.8 km	9	8-9 km	9	8-9 km	9	8-9 km	9	0.40-0.45 km	9	24-27 km	9
1.8- 50 km	10	9-50 km	10	9-50 km	10	9-50 km	10	0.45-50 km	10	27- 50 km	10
<i>Layer</i>	<i>Point</i>	<i>Layer</i>	<i>Point</i>	<i>Layer</i>	<i>Point</i>	<i>Layer</i>	<i>Point</i>	<i>Layer</i>	<i>Point</i>	<i>Layer</i>	<i>Point</i>
National Markets		Local Markets		Public Transport Routes		Social Facilities		Religious Facilities		Hospital	
0-0.5 km	1	0-0.1 km	1	0-0.05 km	1	0-0.2 km	1	0-0.2 km	1	0-0.2 km	1
0.5-1 km	2	0.1-0.2 km	2	0.05-0.1 km	2	0.2-0.4 km	2	0.2-0.4 km	2	0.2-0.4 km	2
1-1.5 km	3	0.2-0.3 km	3	0.1-0.15 km	3	0.4-0.6 km	3	0.4-0.6 km	3	0.4-0.6 km	3
1.5-2 km	4	0.3-0.4 km	4	0.15-0.20 km	4	0.6-0.8 km	4	0.6-0.8 km	4	0.6-0.8 km	4
2-2.5 km	5	0.4-0.5 km	5	0.20-0.25 km	5	0.8-1 km	5	0.8-1 km	5	0.8-1 km	5
2.5-3 km	6	0.5-0.6 km	6	0.25-0.30 km	6	1-1.2 km	6	1-1.2 km	6	1-1.2 km	6
3-3.5 km	7	0.6-0.7 km	7	0.30-0.35 km	7	1.2-1.4 km	7	1.2-1.4 km	7	1.2-1.4 km	7
3.5-4 km	8	0.7-0.8 km	8	0.35-0.40 km	8	1.4-1.6 km	8	1.4-1.6 km	8	1.4-1.6 km	8
4-4.5 km	9	0.8-0.9 km	9	0.40-0.45 km	9	1.6-1.8 km	9	1.6-1.8 km	9	1.6-1.8 km	9
4.5-50 km	10	0.9-50 km	10	0.45-50 km	10	1.8- 50 km	10	1.8- 50 km	10	1.8- 50 km	10

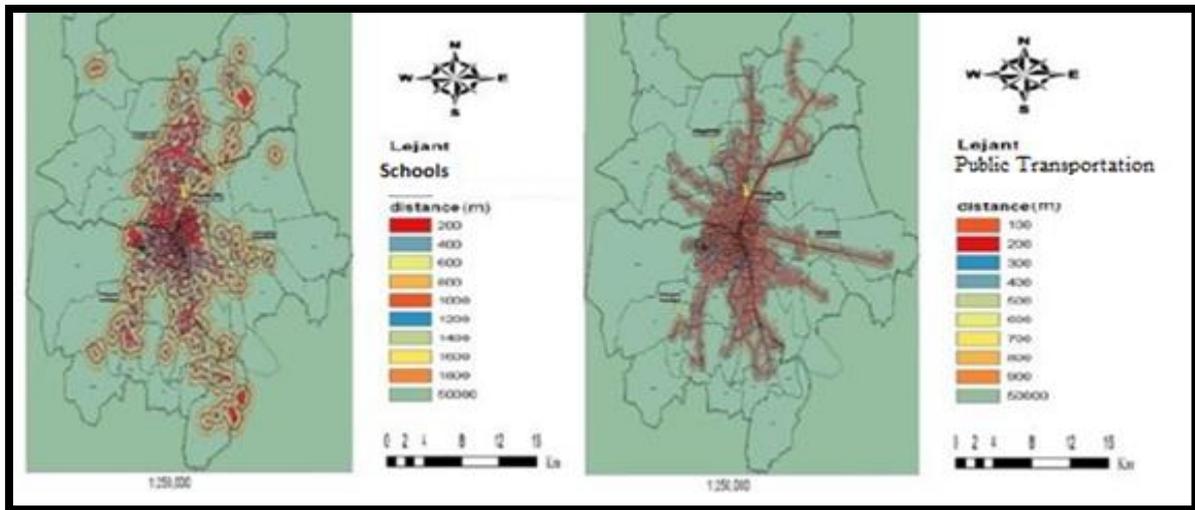
Weight ratings are given based on internet sources, expert opinions and opinions of business owners. For example; it is necessary to have a minimum distance of 500 m to not be far away from rival markets. The reason of this is to create an environment that will increase competition for the retail market. The reason for choosing a distance of 100 m to the markets (A101, BİM) that it wants to be close to is because of wanting to convert a situation which is caused by customer attraction of the indicated markets to advantage. A place close to public transport lines and stops should be chosen because people much more prefer the nearest stores on their return routes to home. It is also asked to be 200 m to social facilities, religious facilities, health facilities and educational institutions. The reason for this is that the walking distance is defined as 200 m. In addition, it should be 1000 m to commercial areas because if the area of trade in the surrounding area of 1000 m is found, marketing is important in terms of providing convenience. Additionally, the retail market needs to be close to the tourist areas because of the desire to provide instant service to consumers. It is required to be close to parking lots because of their desires to park safely and make comfortable shopping. The most suitable distance to industrial establishments is asked to be 3000 m because it is very important for the retail market to be able to transmit the products produced in the factory from the short way, to store the products and to offer the consumers safely.

Figure 2 shows the maps produced for national and local markets, education and public transport routes in the study area.



(a)

(b)



(c)

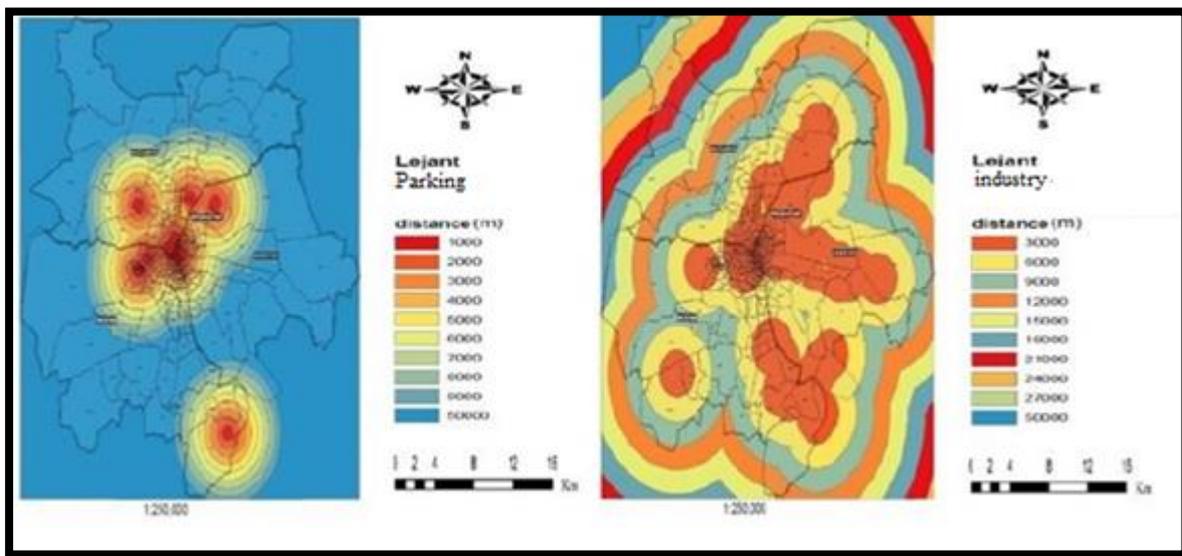
(d)

Figure 2. (a) Map of Adese Market Place (b) Map of Bim Market Place (c) Map of Educational Facility Location (d) Map of Public Transportation Route Location

According to Figure 2.a, the market named Adese (local) is intensified around Alaaddin Hill and its surroundings. In addition, it is seen that it has many branches in Bosnia Herzegovina, Yazır, Binkonutlar and Kosovo neighborhoods in Selçuklu district, Aşkan and Toprak Sarıncı neighborhoods in Meram district and Fetih neighborhood in Karatay district (a). The market named Bim(national) is intensified in and around Alaaddin Hill. Furthermore, it is seen that it has many branches in the districts of Selçuklu, Bosnia Herzegovina, Beyhekim, Kosova,

Yazır, Sancak, Sille Parsana, Şeyh Şamil, Binkonutlar and Buhara neighborhoods; in the district of Meram West Hadimi, Alpaslan and Kalfalar neighborhoods and in the districts of Karatay, Çatal Tömek, Gazi Osman Paşa, Fetih and Karaaslan Dede neighborhoods (Figure 2.b). It is seen that Educational Education Facility area is intensified in Alaaddin Hill and its surroundings. Also it is seen that it is intensified in the Selçuklu district Bosnia Herzegovina, Kosovo, Yazır, Sancak, Sille Parsana, Şeyh Şamil, Binkonutlar, Sille neighborhoods, in the districts of Meram Batı, Hadimi, Dere Aşıklar, Karadiğın Toptaş, Yeni Bahçe, Alpaslan, Gödene, Alakova, Telafer and Kalfalar neighborhoods; in Karatay district Saraçoğlu, Başak, Tatlıcak, Fetih and Karaaslan Dede neighborhoods (Figure 2.c). In addition, most of the Selçuklu, Karatay and Meram districts have public transportation lines (Figure 2.d).

Figure 3 shows the maps generated for parking, industry, social facilities and tourism areas in the study area.



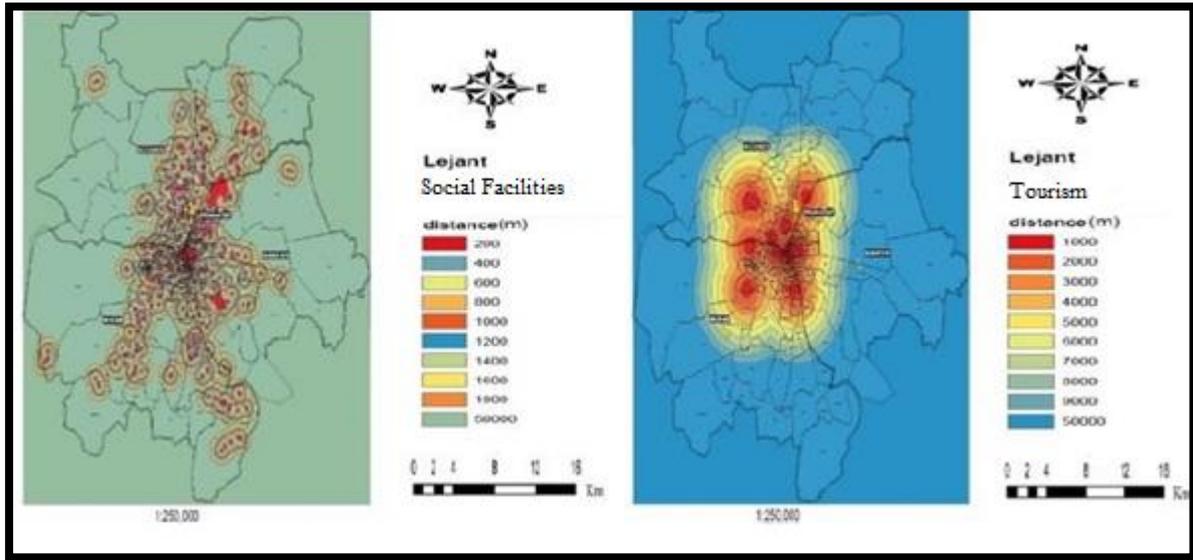
(a)

(b)

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(c)

(d)

Figure 3. (a) Map of Parking Locations (b) Map of Industrial Locations (c) Map of Social Facilities Locations (d) Map of Tourism Locations

The parking areas are intensified in Selçuklu district Horozluhan and Sille neighborhoods, in Meram district Selam and Çarıklar Fatih neighborhoods, in Karatay district Fevzi Çakmak neighborhood (Figure 3.a). Industrial areas are located in the neighborhoods of Fatih, Musalla Bağları, Horozluhan, Büyük Kayacık, Tömek and Aşağı Pınarbaşı in the district of Selçuklu, in the district of Meram: Kaşınhanı Station and Kaşınhanı Yeni neighborhoods and in the district of Karatay: Satır, Başak, Tatlıcak, Sakyatan, Hacı Yusuf Mescit, Fevzi Çakmak, Hacı Dede Mescit, Fetih, Akabe and Ulubatlı Hasan neighborhoods (Figure 3.b). Social facilities are intensified around Alaaddin Hill. Also, in the districts of Selçuklu, Bosnia Herzegovina, Beyhekim, Kosova, Yazır, Sancak, Sille Parsana Şeyh Şamil, Binkonutlar, Sille Ardıçlı and Buhara neighborhoods; in the district of Meram, Batı Hadimi, Dere Aşıklar, Karadığın Toptaş, Yeni Bahçe and Kalfalar neighborhoods; in Karatay district Saraçoğlu, Başak, Çatal Tömek, Gazi Osman Paşa, Fetih and Karaaslan Dede neighborhoods (Figure 3.c). The tourism areas are located in Horozluhan, Sille and Hocacihan neighborhoods in Selçuklu district, Durunday neighborhood in Meram district (Figure 3.d).

Taking all these factors into account and using the ArcGIS 10 software, the most suitable locations were determined by performing MCDA and a conformity map was produced (Figure 4).

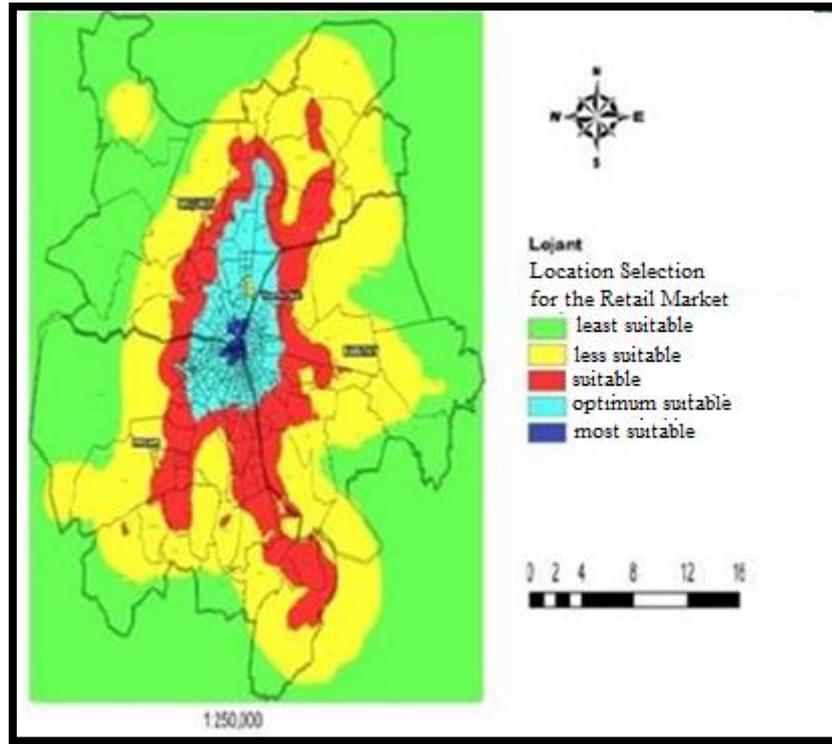


Figure 4. Suitability Map for the Retail Market

The most suitable places for the retail market has been found intensified in Alaaddin Hill and its surroundings and also in the district of Selçuklu: Aydınlikevler neighborhood (Kadayıfçı street, Naima street, Zara street), Bedir (Hat street), Selçuk neighborhood (Harzami street, Güvenilen street, Selamet street) and Fatih neighborhood (Karababa street, Mahmuriye street, Dağsaray street) in Meram district: Meliksah neighborhood (Hacova street, Meliksah street) and Orgeneral Tural neighborhood (Kocadağ street, Bozkaya street) and Keykubat neighborhood of Karatay district (Kapalı street, Karakayalı street, Lali street) and in Kerimdede neighborhood (Kerimler street). The enlarged view of the Alaaddin hill and its surroundings, which is the center of Konya province, is shown in Figure 5.

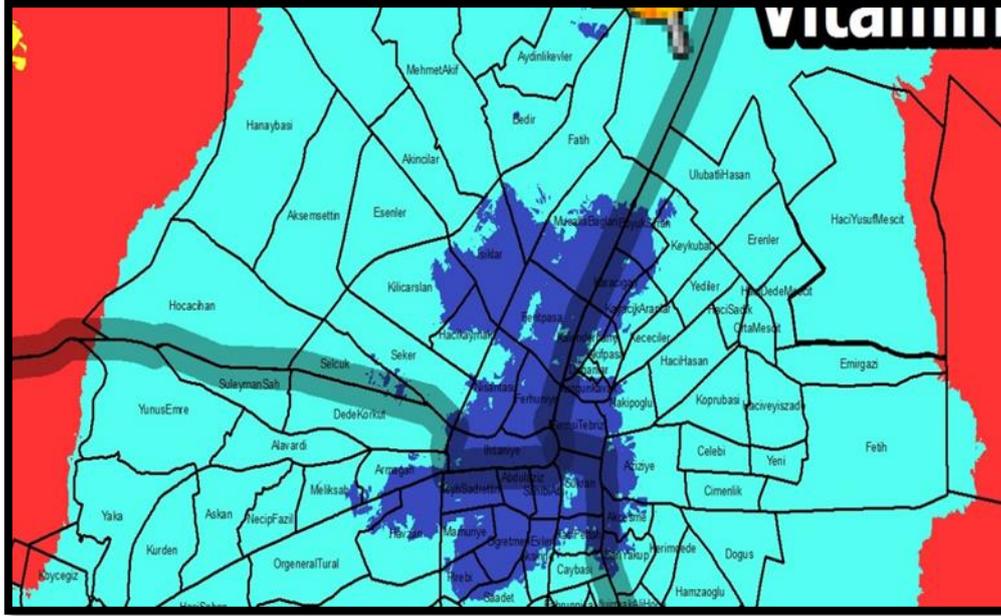


Figure 5. Image of Alaaddin Hill Suitability Map for Retail Markets

It is seen that Alaaddin hill and its surroundings are the most suitable areas as a result of the analysis made for determining the most suitable place of the retail market which is requested to be opened for Sütgross Food Animal Husbandry Industry and Trade Limited Company.

The population of the north-eastern part of Aydınlikevler neighborhood of Konya, the central part of Bedir neighborhood, all parts except the western part of Işıklar neighborhood, all of Feritpaşa neighborhood, the eastern part of Kılıçarslan neighborhood, the southern part of Fatih neighborhood and the northern part of Havzan neighborhood of Meram district are over ten thousand people. As a result of this, it has been determined that the selection of the location of the retail market to be opened is directly proportional to the neighborhood population. On the other hand, the population of all the sections except the northwestern part of the Musalla Bağları neighborhood, the whole part of Ferhuniye and İhsaniye neighborhoods, the northern part of Hacıkaymak neighborhood, the whole part of Nişantaşı neighborhood except the northwestern part, the eastern part of Selçuk neighborhood of Selçuklu district, all parts of Şeyh Sadrettin, Abdülaziz, Pirebi, Sahipata and Öğretmenevleri neighborhoods, the southern part of Hacı Fettah neighborhood, the northern part of Aksinne neighborhood, the north part of Saadet neighborhood, the southeastern part of Armağan and Meliksah neighborhoods, whole part except the southwestern part of Mamuriye neighborhood, the whole part except the western part of the Şükran neighborhood of Meram district; the whole part of Karacihan, Şems Tebrizi, Kalenderhane, Kuzgunkavak neighborhoods, the south of Büyük Sinan neighborhood, the northwestern part of Keykubat neighborhood, the western part of Kayacık Araplar, Nakipoğlu, Aziziye, Akçesme and

Sarıyakup neighborhoods of Karatay district is under ten thousand people. As a result of the analysis carried out, it was determined that although the neighborhood population is low, there are also suitable places in these areas.

4. CONCLUSION

GIS is one of the most suitable tools of identifying the most suitable retail market places. The use of GIS for determining the locations of retail market makes it easy to make accurate and quick decisions.

It is very important to choose the spatial location of stores or sales places for retail markets. Firms in Turkey generally take into account the availability of existing rival firms where they have opened or think to open in the choice of retail market place. They want to use their customer profile as near to rival markets. However, by using GIS technology, it is possible to determine more convenient places where customer majority, marketing simplicity and the least risk.

As a result of the analysis carried out according to 12 criteria, the most suitable retail market places were determined. The current branch of "Sütgross Food Animal Husbandry Industry and Trade Limited Company" is located in the third grade suitable location, so the existing branch did not open in a convenient place. This situation may cause problems in the trade of the company. Changing the location of this branch and opening new branches in more convenient places is very important for the activities of the company.

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BIOGRAPHICAL NOTES

Fadim Koç was born in Konya/Turkey. She received her BS degree in Geomatics Engineering from Selcuk University. She started MS degree in Geomatics Engineering from Selcuk University in 2016.

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