EVALUATION OF THE RELATIONSHIP BETWEEN THE CHANGES OF ADMINISTRATIVE BOUNDARIES AND BOSPHORUS STRAIT CROSSING USING GIS

Ibrahim Tasdemir [1]
Fatmagul Batuk [2]

[1]Istanbul Metropolitan Municipality, Directorate of Cartography, Istanbul, Turkey.
[2]Yildiz Technical University, Department of Geodesy and Photogrammetry Engineering, Istanbul, Turkey.

ABSTRACT

Rapid urbanization in the world is caused by the population growth in metropolis especially in countries with large population. These cities are regarded as metropolis according to the population criteria. But urban structures and the national and international functions of the city have many differences among all metropolitan areas. In accordance with the specific urban structure and the characteristics within the Turkish urban residential structure that have the features of developing and developed countries, Istanbul can be defined as a megacity.

Istanbul is located on a bridge that many cultures interact each other. Asia and Europe are connected with Bosphorus Strait crossings transportation in marine media and two bridges that are constructed in 1973 and 1988 which are among world's 20 largest bridges. Water resources, forests and green areas are located at the North part of Istanbul. Water resources face a danger of the migration caused by suspension bridges and rapid construction. Administrative decisions and socio-economic factors had a significant effect in this situation. As a result of that Istanbul hasn't developed in a planned way. In this paper; effects of the strait crossings with the change of administrative boundaries of the urban sprawl is examined in the GIS environment. Temporal analysis has indicated a relationship between the change of administrative boundaries and suspension bridges.

Keywords: Istanbul, Bosphorus Straits, GIS, administrative boundaries, migration, Temporal analyse, change detection

1. INTRODUCTION

Con formato: Justificado, No ajustar espacio entre texto latino y asiático

Con formato: Justificado

Transportation is the most important factor which people are directly or indirectly, positively or negatively affected by in every part of life (Gilat, 2002). In any case be dealt with the issue of transportation, planning, investment and development dynamics are to be considered together. But, the relationship between land use and transportation has a higher rate in all of them and it plays the most important role in determining them (Giuliano, 1989).

Social conditions, levels of life and living conditions in planning, health, economy, agriculture, transportation, etc. policy preparation, to investigate socio-economic structure are important. Socio-economic data is mostly associated with location. Socio-economic data to maintain databases, take advantage of geographic information systems analysis and questioned ability, policies, plans and projects to produce would be productive for the country (Batuk, 1996).

The world is experiencing rapid urbanization. This rapid urbanization, usually takes place in the form of population concentration in big cities. In the period from 1950 until today, the population living in cities has increased up to 3 times in the world. This increase in developed countries has doubled. In developing countries it increased up to 4 times. Population, that were living in big cities between the years of 1960-80, was increased to a billion people and half of this increase has been in the developing countries's cities. Therefore, in the world's fastest growing population of 15 cities not found none of the developed countries's cities. Sao Paulo, Lagos, Karachi, Seoul, Bogata, Bombay, Calcutta and Beijing are among these 15 cities (Kalkan vd., 2004).

In accordance with the specific urban structure and the characteristics within the Turkish urban residential structure that have the features of developing and developed countries, Istanbul can be defined as a megacity. The Metropolitan area is experiencing many changes. Since 1923 Istanbul was formed in accordance with the national policies applied on the country's urban structure. Until 1940, depending on the employment created innovative investment; the city had to balance development and spatial change. After 1940 the Istanbul, began to live spatial and socio-economic changes in less developed countries's metropolitan structure. Turkey started a fast changing structure of the settlement and development action plan in line with emerging regional planning studies. However, many of the regional plans to end the scientific determination and hard work could not be applied. Istanbul Metropolitan Area in terms of the routing process has not been successful.

Bosphorus Bridge came into service in 1973. The purpose of this project was to link Asia to Europe and separate transit traffic to city traffic. Then, it has become the city's "physical development of the backbone" and it converted into arteries of the city. Changing behavior model of the city, creates its own demand and this bridge has been inadequate in a short time. In 1988, Fatih Sultan Mehmet Bridge and the second-

generation motorway came into service. Growth towards the north of the city was triggered by both of the bridges. Forest and water catchment areas are located in the north of the city that has faced a great danger. In this paper, effects of the strait crossings with the change of administrative boundaries of the urban sprawl is examined in the GIS environment. Temporal analysis has indicated a relationship between the change of administrative boundaries and suspension bridges.

2. METHODOLOGY

In this paper, we try to find the impact of Bosphorus transition on the spatial growth of Istanbul with using the socio-economic data and temporal analysis using ArcGIS. We use the base data like administrative boundary changes, land use and population for the analyses. Data and the GIS implementation process have been shown at Table 2.1.

3. RESULTS

3.1 Demography

Unlike developed countries, our country has a migration phenomenon which prefers urban poverty to rural poverty. In this context, Istanbul is the city taking the most migration in Turkey (İMM, 2008).

In the first period after the declaration of republic which covers the years 1923-1950; Istanbul came through a process of disengagement by the effect of moving the capital from Istanbul to Ankara. At the beginning of the twentieth century, the city has a population exceeding 1 million, in 1927 population has fallen to 690.000, in 1935 population was 740.000 and population in 1975 was 900,000.

Population increases fluctuating between 15-30% in the first year of the Republic, in 1950 it increased over 50% with migration and showed fluctuations between 50-60% until 2000. After 2000 there was a small decrease. Today, population increase is around 25% (Table 3.1).

Year	Turkey Population	Exchange Rate (%)	Istanbul Population	Exchange Rate (%)	Ist/Turkey Rate (%)
1950	20.947.188	-	1.166.477	-	6
1960	27.754.820	32	1.882.092	61	7
1970	35.605.176	28	3.019.032	60	8
1980	44.736.957	26	4.741.890	57	11
1990	56.473.035	26	7.309.190	54	13
2000	67.803.927	20	10.018.735	37	15
2007	73.000.000	8	12.558.403	25	17

Tablo 3.1 Changing rates of population in Turkey and Istanbul

Eliminado: ¶
Con formato: Justificado, No ajustar espacio entre texto latino y asiático
Con formato: Justificado
Con formato: Fuente: (Predeterminado) Times New Roman
Con formato: Justificado, No ajustar espacio entre texto latino y asiático
Con formato: Fuente: 12 pt
Con formato: Justificado
Con formato: Fuente: 12 pt
Con formato: Justificado
Con formato: Fuente: 12 pt
Con formato: Justificado
Con formato: Fuente: 12 pt
Con formato: Justificado
Con formato: Fuente: 12 pt
Con formato: Justificado
Con formato: Fuente: 12 pt
Con formato: Justificado
Con formato: Fuente: 12 pt
Con formato: Justificado
Con formato: Fuente: 12 pt
Con formato: Justificado
Con formato: Justificado

3.2 Land Use

In this study, the results indicate that Istanbul's development takes place in four phases and these are concentrated around transport axis; (Figure 3.1).

- Urbanization along East-West coast line and around the railway (until 1965)
- Urbanization between railway to E-5 highway (1965-1975)
- Urbanization in north of E-5 highway (1975-1987)
- Urbanization around the TEM highway (1987-2007).

Year	East (m^2)	Raise (%)	West (m^2)	Raise (%)	Sum (m^2)	Raise (%)
1955	26.754.187	-	44.566.216	-	71.320.403	-
1965	38.743.303	45	75.186.490	69	113.929.792	60
1975	63.299.025	63	108.268.391	44	171.567.415	51
1987	137.493.329	117	247.173.399	128	384.666.727	124
1997	317.894.930	131	419.176.607	70	737.071.537	92
2007	434.340.008	37	615.946.224	47	1.050.286.232	42

Table 3.2 East- West settlement areas distribution (Taşdemir, 2009)

Table 3.2 shows very important point between East and West settlement areas growth rate. Evaluation of each side separately shows the great drop rate of one side settlement area while the other side increased. The total area ratio of settlement areas was 1% in 1955 and this rate has risen to19% in 2007 (Table 3.3).

Year	Settlement Area (m^2)	Settlement /Total Area (%)
1955	71320403,26	1
1965	113929792,26	2
1975	171567415,42	3
1987	384666727,21	7
1997	737071536,85	14
2007	1050286231,52	19

Tablo 3.3 Settlement size and rate by years (Taşdemir, 2009)

The total area of the Istanbul province is 540,000 hectares. 53% of this area is basin of water and 48% is forest, so Table 3.3 indicate that the setlement area has reached to dangerous dimensions.

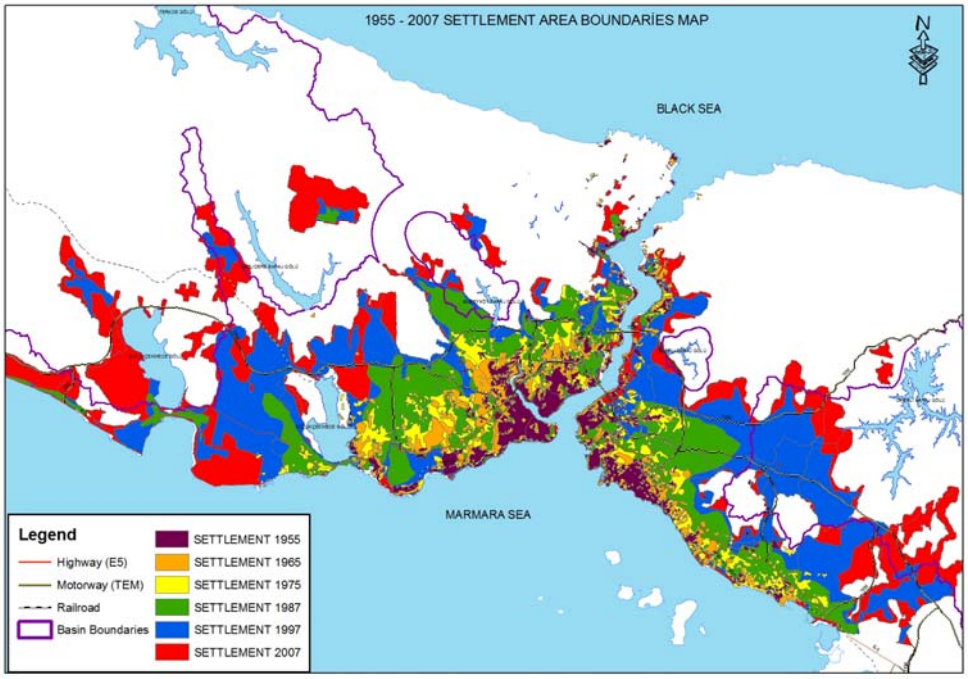

Figure 3.1 1955-2007 Settlement area boundaries map

Con formato: Justificado

3.3 Administrative Changes

Changes of the administrative boundaries of Istanbul are closely related to the political structure of the country. Boundaries of the city are narrowed after the modern steps taken after the foundation of the republic. After that the area is divided into subunits for better governance.

Con formato: Fuente: (Predeterminado) Times New Roman

This modification changes with legislative and administrative decisions. These are; metropolitan, town and town segmentation, organizing new municipalities, change of boundaries about contiguous land etc. Before the construction of the bridges, between 1950s and 1970s, Istanbul crowded its central towns and spreads out from its boundaries with the migrations. Requirement of new roads and new settlements has increased. Thus new projects about linking two sides of Istanbul have accelerated. Three new municipalities are added to city. Istanbul's administrative structure has changed 11 times from 1984 to present-day. Eight new municipalities were added to city between 1990 and 2000 (Figure 3.2). The last two changes of boundaries is very important with regard to growth of the city. One of these changes is "The New Metropolitan Municipality Law" at 2004 and the other is "The New Law about organizing new towns" at 2008.

On the other hand the bridges have an important effect on the growth of the concentrated formation of the city. Consequently, when we look at all of these periodic changes, we consider that it has a very important relation between Bosphorus Strait Crossing and administrative changes:

- In 1973 first bridge
  - after 15 years (1988) second bridge
  - after 20 years (1992-1993) administrative changes
- In 1988 second bridge
  - after 16 years (2004) the Marmaray Tube Transit
  - after 20 years (2008) administrative changes.

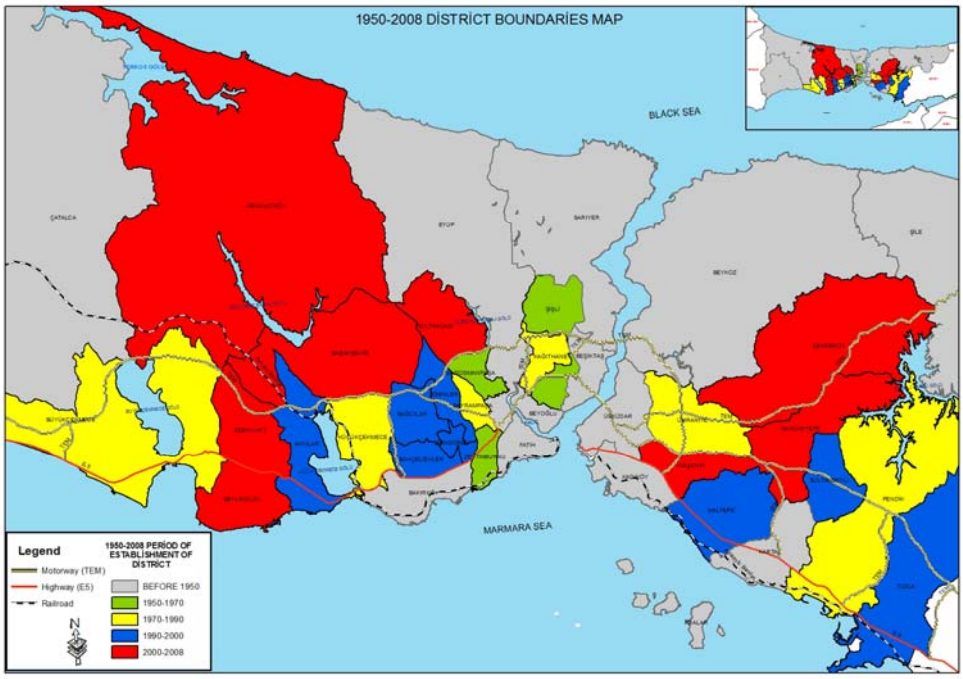

Figure 3.2 1950-2008 District boundaries map

Con formato: Justificado

4. CONCLUSIONS AND OUTLOOK

Istanbul is a megacity with 540,000 hectares area and 12.5 million populations. The most important factors in today's aspect of Istanbul such as land use, administrative boundaries, and demographic data were examined. Unlike developed countries Istanbul's development has been in an unplanned way and that unplanned development of Istanbul was accelerated by the 1st Bosphorus Bridge in 1973 with and the 2nd Bosphorus Bridge in 1988. Bridges trigger process of growth that the city's structure to reach saturation point and led administrative structure to a continuous change.

As a result, due to cultural and economic exposure point, Istanbul is on a suitable area to development. Hopefully to make Istanbul a livable city migration and unplanned development should be avoided and as a rearrangement, protection of forests and catchment areas should be ensured. Otherwise, as seen in the results of these studies; Istanbul will be an undesirable place to live with a constantly changing administrative structures, water catchment and forest areas, with an increasing rate of population and construction.

REFERENCES

Başar, U.G., (2008), **Temporal Analysis of Heat Islands in Istanbul With Remote Sensing Data**, MSc Thesis, Istanbul Technical University Informatics Institute, Istanbul .

Batuk, F.G., (1996) "**A GIS Application for Socio-Economic Structure Research**", Geographic Information Systems Symposium, 26-27-28 September, 1996, Istanbul

Gilat M., Sussman J. M., (2002), **Coordinating Transportation and Land Use Planning in the Developing World: The Case of Mexico City**, Massachusetts, USA.

Giuliano G., (1989), **New Direction for Understanding Transportation and Land Use**, University of California at Irvine, USA.

IMM(Istanbul Metropolitan Municipality), (2008), **1/100.000 Scale Plan Report of the Istanbul Provincial Environment Layout (Draft),** Istanbul Metropolitan Municipality, City Planning Department, Istanbul .

Kalkan, S., Çetiz, S., Akay, Z., (2004), **"**Istanbul Metropolitan Area and the Structural Change in this area" **World Urban Day** 28. Colloquium, 8-9-10 November 2004, Middle East Technical University, Ankara.

Con formato: Justificado

Con formato: Justificado

Taşdemir, İ., (2009) , **Evaluation of Bosphorus strait crossings on socio-economic changes of İstanbul in GIS Environment.**, MSc Thesis, Yildiz Technical University, Institute of Science and Technology, Istanbul .

Tezer, A., (1997) , **Land Use-Transport Interaction Modeling at Planning of the Urban Transportation: A Benchmark on Istanbul**, PhD thesis, Istanbul Technical University, Institute of Science and Technology, Istanbul .

Con formato: Justificado

Dataset	Data	Original Format	Source	Content-Description	Geotadabase Conversion Process	Geotadabase Class and
Land Use	Settlement area in 1955	AutoCAD	Tezer (1997) PhD thesis	This data was prepared using the present time map and aerial photographs	Cad data conver to ArGIS-mdb and graphic corrections were made. This single piece of data separated by county	Settlement 1955 Polygon
	Settlement area in 1965	AutoCAD	Tezer (1997) PhD thesis	This data was prepared using the present time map and aerial photographs.	Cad data conver to ArGIS-mdb and graphic corrections were made. This single piece of data separated by county	Settlement 1965 Polygon
	Settlement area in 1975	AutoCAD	Tezer (1997) PhD thesis	This data was prepared using the present time map and aerial photographs.	Cad data conver to ArGIS-mdb and graphic corrections were made. This single piece of data separated by county	Settlement 1975 Polygon
	1987 Land Use	Erdas- img	Başar and Kaya (2008)	Classified Landsat satellite images which contain Settlement, agriculture forest and sea	Raster data convert to vector-polygon data and Settlement area separated by county	Settlement 1987 Polygon
	1997 Land Use	Erdas- img	Başar and Kaya (2008)	Classified Landsat satellite images which contain Settlement, agriculture forest and sea	Raster data convert to vector-polygon data and Settlement area separated by county	Settlement 1997 Polygon
	2007 Land Use	Erdas- img	Başar and Kaya (2008)	Classified Landsat satellite images which contain Settlement, agriculture forest and sea	Raster data convert to vector-polygon data and Settlement area separated by county	Settlement 2007 Polygon
	the number of	MS Office Excel	Tezer (1997) PhD thesis	the number of buildings which based on district	İt used as a geodatabase table.	Building 1975-1984 Table
	the number of	ArcGIS - shp	Istanbul metropolitan	All buildings of Istanbul .	Building data separated by county and the necessary data is entered.	Building 1987-1999-2007

Tablo 2.1 GIS implementation

Con formato: Fuente: 12 pt
Con formato: Justificado
Con formato: Fuente: 12 pt
Con formato: Justificado
Con formato: Justificado