VARIATIONS IN THE SPATIAL DISTRIBUTION OF POPULATION IN ISTANBUL ON THE BASIS OF DISTRICTS (THE 1990-2010 PERIOD)

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Abstract:
The population of Istanbul is constantly changing by its dynamic nature. The population has shown a continuous increase as a result of immigrations after 1950 in particular. Population growth does not only affect population density in existing residential areas, but also leads to population of new areas. In this case, the city of Istanbul develops in the horizontal direction, especially in the east-west direction. Central locations have become business districts more. Thus, population has started to accumulate in the periphery, and new centers of attraction have appeared in such areas. This situation has caused the center of gravity of population to change in Istanbul over time.
This study analyzes the change in density of population of Istanbul in the last two decades (1990-2010) on the basis of districts. The change in the center of gravity of the population was calculated through various statistical analysis methods, and the same was mapped by means of GIS method.
Key Words: Istanbul, Population, Population Change, Spatial Statistical Analysis, Center of Gravity of Population

Methods of the study:
Statistical data related to population of Istanbul on the basis of districts were obtained from the Turkish Statistical Institute (TürkStat). Obtained data were arranged and harmonized due to changes occurring in the administrative structure. Then, density maps were formed. Total administrative area of Istanbul was considered a homogenous plane, and the center of gravity where this plane could stand in balance was determined. Later, each population was regarded as a particular gravity, and the change in the center of gravity was interpreted by calculating the state of balance, which varies in accordance with the amount of the said gravities in the administrative units they are in, by years. The following formula was used for calculating the center of weight.

$$\bar{x} = \sum_{i=1}^{n} P_i x_i / \sum_{i=1}^{n} P_i \qquad \bar{y} = \sum_{i=1}^{n} P_i y_i / \sum_{i=1}^{n} P_i$$

$\bar{X}$ and $\bar{y}$ *the average coordinates of the gravity center*

$P_i =$ *the population of the i point*

x_i ve $y_i =$ *coordinate value of point i*

Quelle: Plane and Rogerson, 1994; 31, from Yakar, 2011; 390

Finally, the centers of gravity determined were mapped by means of Arc-Gis.

Spatial Variation of the Population in Istanbul
Istanbul had a crowded population not only because of the importance of the location it was situated in but also due to the fact that it was the capital of the Ottoman Empire before the World War I. The population of the city estimated to be over one million diminished because of negative conditions brought about by the war and adoption of Ankara as capital of the newly founded Republic of Turkey. As a matter of fact, the population of Istanbul was found to be 699,607 in the first population census conducted in 1927. For a long time, Istanbul displayed a population growth lower than the general population increase in Turkey. However, population started to rapidly increase in the period as of 1950 in which it started to let in immigrants from other cities. Population growths over the country averages led to a spatial diffusion in Istanbul and caused the city to become a metropolis within a short time (Fig.1, Fig.2). Today, Istanbul is the most important 2nd center of Europe after Moscow in terms of population. In the world, it is the 22nd biggest area where the population accumulates.
Where does the population accumulate in Istanbul? Which geographical factors have an impact on this accumulation?

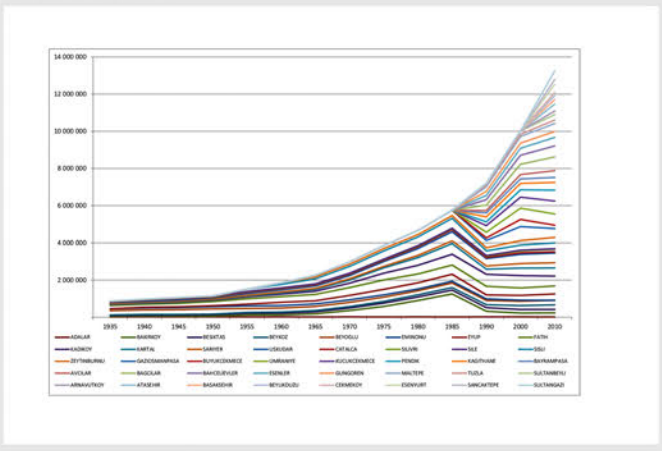


Fig. 1:Population trends in Istanbul

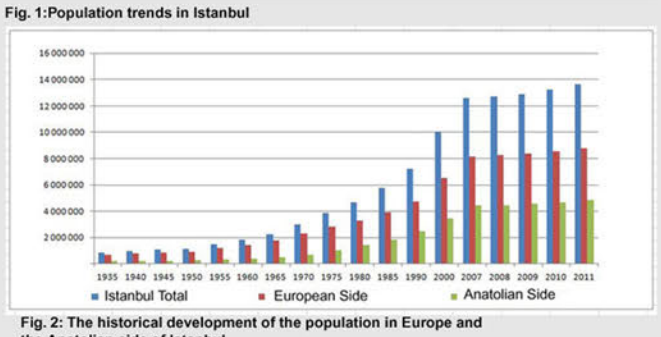
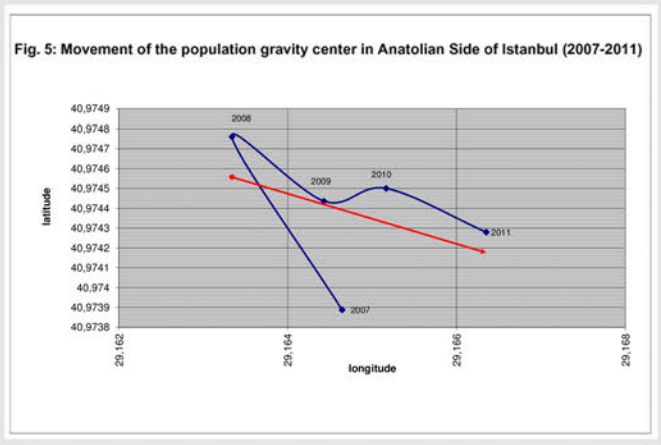
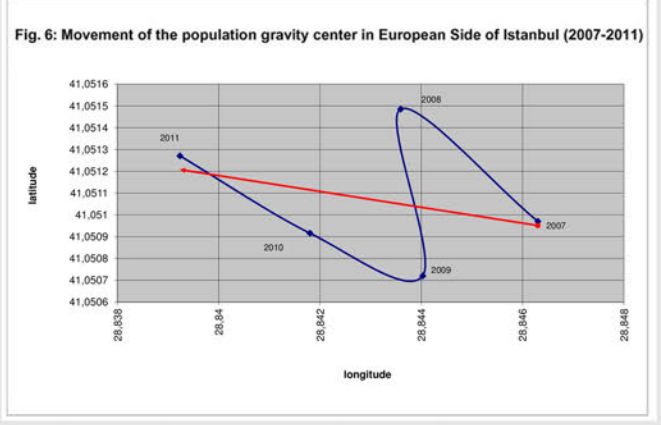


Fig. 2: The historical development of the population in Europe and the Anatolian side of Istanbul

In Istanbul, public transportation was performed by sea or railway until 1927. The roads were made suitable for motor land vehicles and broad streets were formed in the historic city between 1927 and 19In Istanbul, public transportation was performed by sea or railway until 1927. The roads were made suitable for motor land vehicles and broad streets were formed in the historic city between 1927 and 1945. Public transportation developed and decentralization trend increased in the period from 1945 to 1970. Decentralization, which started in that period, gradually grew stronger. Private vehicle ownership increased between 1975 and 1985. Thus, the area of settlement broadened. This is also the period where traffic and environmental pollution problems were experienced in the central areas. The rail system, which had been removed in 1966, started to be re-established as of 1985, and the importance of public transportation for Istanbul increased more (Murat and (ahin, 2010; 207-210). The population, which largely concentrated on the historical peninsula and Beyoolu in the European side and Üsküdar and Kaddköy in the Anatolian side until the 1950s, extended in the east-west direction in parallel to E-5 highway as a result of increase in the transportation alternatives and the pressure created by the integral migrations. This extension reached Tekirdaa border in the west and Kocaeli border in the east in an area of approximately 150 kilometers. The extension in the east-west direction started to shift to the north direction as a result of launch of the second ring road (TEM) in the north of the city in 1988 (Fig.2 and Fig.3). Water basins and forested lands on the north of the city started to be under threat. Today, there are many settlements established through demolition of the forests under threat. Acarkent in the Anatolian side and Göktürk in the European side are among such settlements. In general, high-income groups live in these settlements. Acarkent is the largest project of Turkey on a single parcel built upon an area of 2.291.220 m² in Saip Molla private forest land located in the Beykoz forested land . It consists of a total of 1452 villas, 80 flats with a Bosphorus view, 64 apart-flats, 72 studio flats and commercial units as well as social playfields. Göktürk is a settlement in Belgrad forests where developing high-income groups live . It is observed that while high-income groups settle in the forest areas, though through illegal ways, low- and medium-income groups push the limits of forestry through industrial zones and collective housings built upon agricultural areas. Collective housing regions, which are formed close by the Organized Industrial Zones in both the European side and Anatolian side and where people are planned to live in mass, attract population from both inside and outside Istanbul. Ayddnll and Orhanll industrial zones in Tuzla district, Kurtköy Industrial zone in Pendik district, and Dudullu Industrial Zone in Ümraniye district in the Anatolian side encourage population accumulation in their immediate vicinity. Recently, accumulation in these areas has caused center of gravity of population to move towards southeast in the Anatolian side of Istanbul (Fig 5). A similar tendency is observed in the direction of northwest in the European side due to kitelli Organized Industrial Zone in Baaakkehir, Haddmköy Organized Industrial Zone in Arnavutköy, and Beylikdüzü Organized Industrial Zone (Fig. 6). Baaakkehir is the biggest collective housing region of Istanbul. High amount of population in the European side causes center of gravity of population across Istanbul to be northwest (Fig. 7). While Average Center of Gravity in Marmara Region shifts to northeast due to rapid population growth in Istanbul-Kocaeli-Sakarya Metropolitan Area (SANDAL, et al. 2003m pp.23), center of gravity shifts to northwest in Istanbul. The center of gravity in the Anatolian side corresponds to 29 degrees 16 minutes east longitude and 40 degrees 97 minutes north latitude north latitude, it corresponds to 28 degrees 84 minutes east longitude and 41 degrees and 05 minutes north latitude in the European side (Fig. 5 and Fig 6). Movement of the population in this direction will increasingly continue as a result of new highway to be constructed in the north of the city. If population growth in Istanbul is not prevented, forested lands of Istanbul both in the European and Anatolian side will be negatively affected. 45. Public transportation developed and decentralization trend increased in the period from 1945 to 1970. Decentralization, which started in that period, gradually grew stronger. Private vehicle ownership increased between 1975 and 1985. Thus, the area of settlement broadened. This is also the period where traffic and environmental pollution problems were experienced in the central areas.





How can the pressure on forested lands be diminished? Based on the maps, there is a relationship between dense population districts and military areas (Fig. 8). That is to say, the pressure on forestry areas and water basins can be diminished if the military areas are renounced for settlement. However, such steps can bring about only short-term solutions. The main solution is to encourage formation and development of alternative centers in Turkey to diminish the pressure on metropolitan Istanbul. Considering that population of Istanbul has doubled in the last 20 years, it will be impossible to breathe in Istanbul despite all suitable geographical conditions (climate, location) if no measure is taken.

Conclusion:
Population movements from center to periphery in Istanbul have started to threaten water basins and forestry areas of the city. Recently, the highest population growth has been observed in the area located between Büyükçekmece Lake and Küçükçekmece Lake. Millions of people have started to reside in this region within a short time. Population growth, which is generally between the two highways, will shift to north more due to the third highway to surround the city from the north, which has started to be constructed. If forestry areas can be protected through measures to be taken, the city will rapidly extend towards agricultural areas of Çatalca. Thus, rural area in Istanbul will completely disappear. The extension in the Anatolian side that is in the direction of east due to Ömerli Dam Lake Basin in the north will go beyond the borders of Istanbul.

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