EVALUATION OF THE BUILD-UP AREAS IN THE HISTORIC URBAN PATTERN BY USING GEOGRAPHIC INFORMATION TECHNOLOGIES

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ABSTRACT

New buildings in the historic places always constitute problems from past till now. Modern architecture is important for the continuation of historic and cultural values in historic places that carry out different potentials. Technologic improvements and also changes in the quality of life yield the unavoidable change in physical space, by means of architectural and urban space within all scales. In this study it is intended to investigate the built-up urban areas with in historic settlements, to detect the change of the urban pattern in time, to find out the ratio changes between the historic buildings and non-historic buildings and to determine the kinds of analysis that could be performed to understand and find out the characteristics of the pattern which would give a perspective to planning and design by using Geographic Information Systems (GIS).

1. INTRODUCTION

Historic places, lead the urban built-up space; to gain identity, to be original beyond others and they add value to built-up space. In addition to those features; they have to be preserved because of their cultural, emotional and usage reasons (Zeren; 1981).

Conservation of historic urban space is always a subject of argument from past till now in every culture. New developments in technology and changes in life-style, results in new add ups in historic buildings or construction of new buildings in empty lots of historic fabric (Batty et al., 1998.).

This brought out the unavoidable outcome of changing and estranging from the original form of the historic pattern. More or less the metamorphosis of the original historic urban pattern yields it to be problematic against constituting sustainable politics of conservation (Agarwal; 2000). Determining the main planning decisions like; land-usage, balance of the population density and transportation routing in a sensitive urban space which accommodate historic and cultural value naturally appear as an urban problem (Balkanay Ö; 2003). Developing a functional approach to solve the defined problem can only be possible by analyzing the value and potential of he place accurately. At this point of view; this study proposes a new methodology in order to develop Decision Making Systems (DMS) for creating planning and design strategies and to provide sketches for supporting stages of planning and design (Malczewski, 1998).

Data processing and spatial analysis, together with modern decision analysis techniques were used in this study to investigate the built-up urban areas within historic settlements, to detect the change of the urban pattern and to find out the ratio changes between the historic buildings and non-historic buildings in time.

Both empirical evaluation models and models based on expert knowledge can be applied in this approach. The categories that represent the characteristics of the buildings were described as map layers within GIS so that each map layer represents one criterion. GIS was used as the platform in managing combining and displaying the criterion data and also as a tool for producing new data (William et al., 1995).

Criterion standardization, weighting and combining were accomplished by means of multi-criteria evaluation (MCE) methods; the theoretical background is based on the multi-attribute utility theory (MAUT) (Glenn et al., 1993).

The historic potential of the districts and the change in this potential were obtained in order to estimate the development direction and tendency, to find out the physical value of the urban historic pattern, to expose the change characteristics of the pattern and to determine the planning priority between districts.

Thus the distribution of the similar and dissimilar districts and their relation in space can be an important criterion for planning and design. In this concept, Historic Peninsula and Beyoglu which constitute the historic core of Istanbul are selected as the case study.

2. STUDY AREA and DATA COLLECTION

The method is illustrated by a case study in Istanbul which accommodates hundreds of different civilizations from past till now and connects two continents and countless cultures. In this concept, Historic Peninsula and Beyoglu which constitute the historic core of Istanbul are selected as the case study districts for having unique morphological structure and natural pattern with cultural, social, economic, visual and monumental values; for 3000 years.

The criterion which affects the scope and detail of the study is the data itself. The variety of the analysis changes with respect to the data's content and detail. In this study two types of data are considered; geographic data and non-geographic data. The geographic data contains digital maps of roads, buildings, boundaries of city, district and neighborhoods etc. Non-geographic data is the study of "Building Census" which is completed by "Turkey State Statistics Institute" (SSI) in the

year 2000. In the study of SSI all the buildings in Turkey are classified into 19 categories by means of their characteristics and 7 of them are used in this study, which are; completed year of building, usage of building, structural system of the building, floor area of the building, total floor area of the building, number of stories of the building and physical case of the building.

Figure 1. Districts of Istanbul

Although all the characteristics for whole buildings are determined and classified by SSI; the geographic locations of the buildings are unknown. The only specified geographic location is in the neighborhood scale. Buildings are geographically referenced to their neighborhood. In this concept GIS is used to convert the building data of SSI to be geographic with the scale of neighborhood and enabled appropriate analysis.

3. EVALUATION OF THE BUILDINGS

Distinctively determining the characteristics of an historic urban area and expressing it in a visual manner has a vital importance by means of constituting planning and design stages. In this point of view, the objective is to perform the spatial analysis which will facilitate the stages of planning and design by using GIS functions. The analyses are constrained by the extent of the data and it is intended to evaluate the buildings that live in the historic core of the city.

The study area consists of three districts and totally there are 72564 individual buildings and 16528 of them have a historic value. In this study the main idea is to bring out and evaluate the historic pattern and physical quality of the urban fabric therefore different kinds of analyses have been done. The percentage of historic buildings, ratio between historic buildings floor area and total area, ratio between historic and non-historic building construction areas; change in the build-up space and physical quality of buildings are the main analyses.

3.1. The Percentage of Historic Buildings

The buildings which were build between 1929 and 1939 timely in Second National Architecture Period and buildings completed before 1939 were accepted as historic buildings. "Completed year of buildings" category of SSI was used in order to compute this analysis.

Figure 2. Percentage of Historic Buildings

Stating the percentage of historic buildings in neighborhood scale provides us to clarify the picture of which places have historic potential and historic value and it helps us to determine the priority of places to develop conservation plans. Simply, it is intended to determine the density of historic buildings and their location in neighborhood scale.   Total numbers of buildings are considered in this analysis and the resulting map shows the geographic relations of neighborhoods with similar densities by means of historic buildings.

Historic building density could be observed in southern part of Beyoglu district, coastal parts of Golden Horn and Marmara Sea in Historic Peninsula. In Beyoglu district, axle of Istiklal Street preserves its original and historic value from past till now in comparison to other places.

3.2. Ratio Between Historic Buildings Floor Area and Total Area

In this analysis ratio between total area of historic buildings and area of neighborhood is calculated.   Buildings which have historic value are evaluated in terms of m². It is intended to find out the floor area density of historic buildings in the neighborhood.

Figure 3. Ratio Between Historic Buildings Floor Area and Total Area

Even though; buildings with historic value in a neighborhood may exceed in number; when it is evaluated according to the total area, in large neighborhoods the visual impact of the historic places are rather low. As a result ratio of buildings

having historic value to the total number of buildings should be evaluated together with the total area covered by historic buildings in the neighborhood. Consequently this analysis yields the density of the historic buildings within the neighborhood.

The resulting map indicates total construction area and it is obvious that there is no density of historic buildings in south western and northern parts of Beyoglu district and southern coastal part of Historic Peninsula.

3.3. Ratio Between Historic and Non-Historic Building Floor Areas

Through out this analysis it is intended to calculate the construction area of historic buildings within total construction area. The ratio between total construction area of historic and non-historic buildings are evaluated.

As in the previous analysis; buildings with historic value in a neighborhood may exceed in number; when it is evaluated according to the total construction area, it may indicate the opposite situation. Under those circumstances it can be mentioned that; historic buildings could rather have minimal architecture context and lower mass, volume and size compared with other buildings. Consequently this indicates non-historic buildings have a crushing effect on historic buildings by means of volume and size.
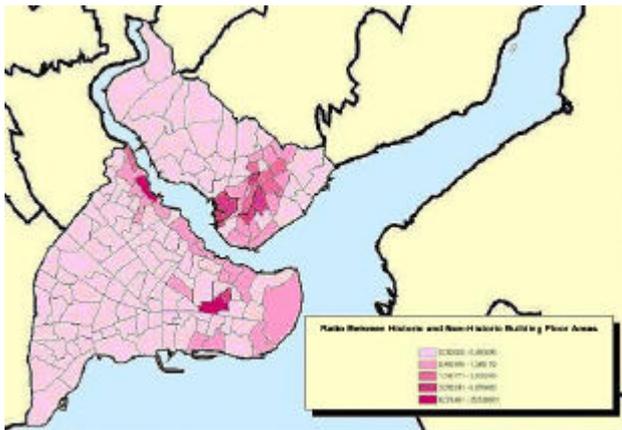
Figure 4. Ratio Between Historic and Non-Historic Building Floor Areas

Change of construction area ratios between historic and non-historic buildings, and the geographic references of that change may have importance while developing conservation plans.

In Beyoglu district it is observed that, neighborhoods located along Istiklal Street have high amounts of construction areas of historic buildings. In historic Peninsula only the coastal areas facing Beyoglu district have considerable results.

3.4. Change in the Build-up Space

The analysis of change in the build-up space introduces; the amount of change in a fixed period of time. Moreover geographical correlations between the areas that are subjected to same amount of change are determined. Also it indicates the areas that have minimum amount of change which preserve their original historic urban pattern.

The change of build-up space by joining, growing and increasing with new buildings; means the loss of the historic value or it means that build-up space with historic value surrounded and sieged by non-historic urban pattern. Understand and investigate the dimensions of that change, gives planners and decision makers a new sight to develop conservation and rehabilitation plans.
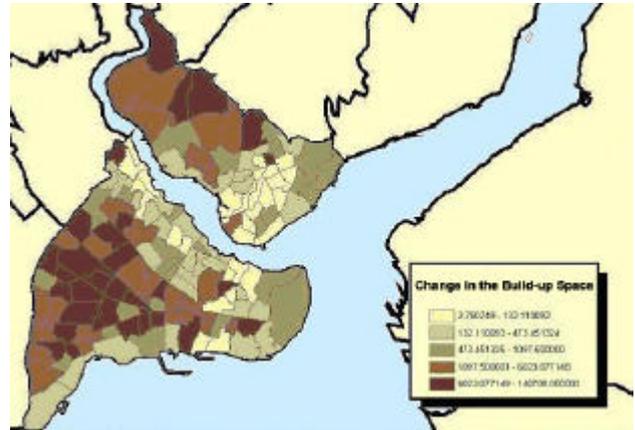
Figure 5. Change in the Build-up Space

In Beyoglu district it could be easily observed that the northern part of the district completely changed and lost their original historic pattern. Furthermore in Historic Peninsula neighborhoods with low values observed in previous analyses have a tremendous increase.

Modeling the change of the build-up space in time; give us the opportunity to gain information about the study area. The passed era's development rate, speed and intensity could give us a way to estimate the future development pattern.

This analysis introduces the amount of change; it is not surprising that the resulting map is just the opposite with the percentage of the historic buildings. This situation yields us to understand that the change degree is minimum in the neighborhoods having dense historic pattern. Thus; especially after the year 1959, neighborhoods without historic pattern had a dense and rapid change with heavy structural attempts.
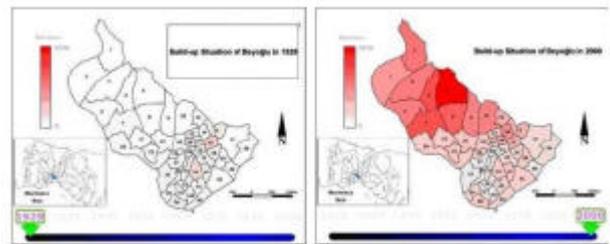

Figure 6. Build-up Situation of Beyoglu in 1929 and 2000.

When the build-up situation in year 1929 is compared with 2000; it can be easily seen that in Beyoglu district the density of the southern neighborhoods did not increase and densely historic buildings take place. And in the year 1929, at the northern parts of Beyoglu, almost no buildings observed but, in the year 2000 those places filled with buildings.
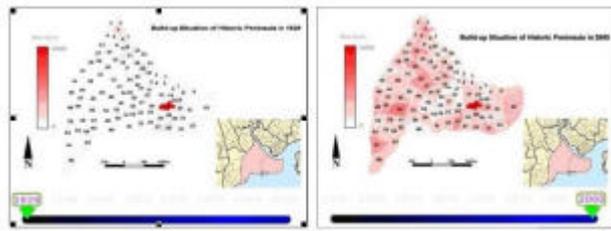
Figure 7. Build-up Situation of Historic Peninsula in 1929 and 2000.

In Historic Peninsula the neighborhoods on the coastal side of the district preserves their historic pattern from 1929 till 2000. After 1939 the density of the build-up space expanded from north to south direction and after the year 1970 a distinctive increase observed in all neighborhoods.

3.5. Physical Quality of Buildings

In this analysis the physical quality of buildings are evaluated by using Multi Criteria Decision (MCD) with respect to the criterion of building construction coefficient value (building land area/building area*number of stories), number of stories and physical condition of buildings. MCD is determined by assigning subjective points to the criterion expressed above. Iterated values in the neighborhood of building construction coefficient and building number of stories are accepted as represented values of the neighborhood. In this concept weighted points are assigned to building construction coefficient value and number of stories criterions with respect to the values differentiate from the represented character in the neighborhood.

The intensity of the physical quality of buildings is evaluated in neighborhood scale and the geographic relations of those similar or dissimilar values are expressed. These evaluations guide the planners and decision makers to set the priority of the neighborhoods to construct conservation and development plans. For every single building, the criterions listed above are evaluated to construct MCD and those obtained values are expressed in the scale of neighborhood.

First of all for the physical case of the building criterion; historic buildings are assigned high to low points by means of their physical case. Although the condition of an historic building is poor it is assigned points because of the potential of carrying historic value and chance of probability to improve with appropriate restoration intervention. For non-historic buildings only the ones having good conditions get points for that criterion.

Second stage is the number of stories criterion. In this stage firstly the most repeated number of stories of historic buildings for neighborhoods are calculated and accepted as representing value of that neighborhood. Then for every single building criterion points are assigned with respect to the represented value of the neighborhood. Both for historic and non-historic buildings having lower or equal to represented value of number of stories get high and others get low points.

Building construction coefficient give us a way to understand the construction pattern of the neighborhood so, third step of the evaluation is to find out the most repeated building construction coefficient for historic buildings and it is accepted as represented building construction coefficient for neighborhood. And higher points are assigned to the buildings having same or less regarding to the represented building construction coefficient value and the others get lower points for both historic and non-historic buildings.
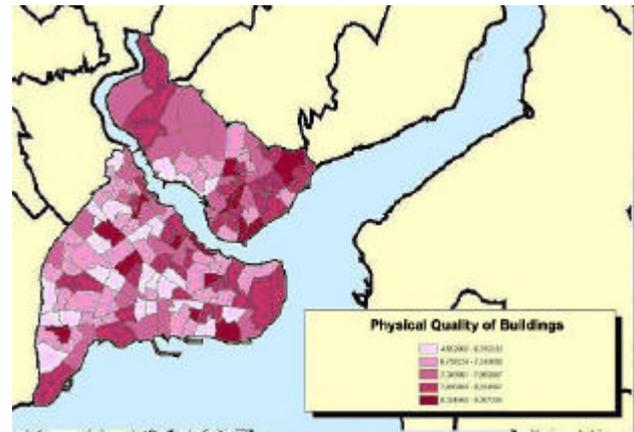

Figure 8. Physical Quality of Buildings

The following stage is to get the average of the assigned points for those four categories for all buildings and total building physical quality points are obtained in a subjective manner by using MCD.

In the resulting map, places nearby Istiklal Street and northern parts of Beyoglu district have higher points by means of physical quality. For Historic Peninsula, a more complex situation is observed, coastal areas of that district, central business districts (CBD) of Fatih and Eminönü have relatively higher points.

3.6. Resulting Analysis

All the results of the analyses explained above are overlaid and a resulting map is obtained. In this analysis again a MCD is applied by using the percentage of historic buildings, ratio between historic buildings floor area and total area, ratio between historic and non-historic building floor areas; ratio between historic and non-historic building construction areas; change in the build-up space and physical quality of buildings analyses. In this concept weight points are assigned to the results of analyses listed above and a resulting map representing the general trend is obtained.

Depending on the results of this analysis it is possible to conclude which neighborhood has historic value; how much affected from the structural change in time interval and beyond those entire criterion in which case the buildings' conditions are.

In a historic urban pattern expressing more than one criterion like percentage of historic buildings, density and expansion of historic buildings construction area, percentage of the change in time and buildings physical case; would assist us to determine planning and design stages and to understand the typical characteristics of the pattern to develop appropriate planning studies. Together with all those, geographic distribution of similar and dissimilar neighborhoods are clarified in terms of planning concepts in the resulting map

In order to perform this analysis using MCD; the analyses listed above are used to assign appropriate points to the results of those analyses. In percentage of historic buildings analysis which shows the density of historic buildings; the higher valued

places get higher points and the others get lower respectively. In ratio between historic buildings floor area and total area analysis; areas having higher ratio gets high, lower ratio gets low points. In ratio between historic and non-historic building construction areas analysis higher ratio gets high and lower ratio gets low points. In change in the build-up space analysis the minimum changed areas get highest and the rest get zero points. In physical quality of buildings analysis higher physical quality gets higher and others get lower points respectively. After all those points are assigned the average of all criterions is calculated and a total weighted point is assigned for every neighborhood and mapped as overlay analysis result.
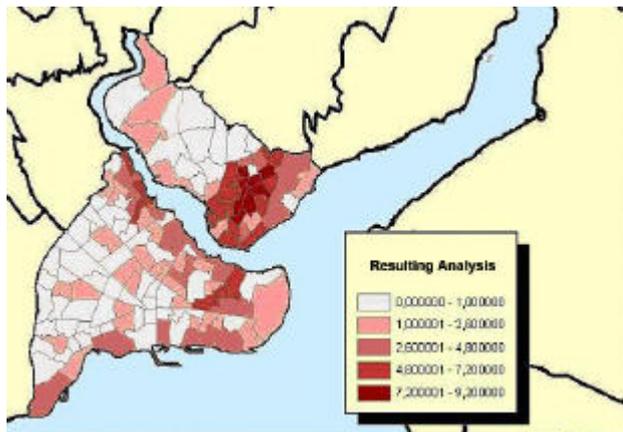
Figure 9. Resulting Analysis

Southern parts of Beyoglu district have higher value just like a part of Istiklal Street and northern parts of that district have relatively lower values. Although, northern parts of that district; have very low amount of historic buildings; by means of the harmony of non-historic buildings to represented building construction coefficient and represented building stories criterion and having higher building physical case conditions, these places gather scores.

In Historic Peninsula northern parts of Fatih District and the boundary places to Eminönü district have higher and the rest of that district have relatively lower scores. Moreover in Eminönü district the central parts have the highest and places diverging from that point get relatively lower scores and also the coastal part of Historic Peninsula have moderate scores.

4. RESULTS

As a result of this study Beyoglu and Historic Peninsula which holds historic potential of the city have been changed in time and partly loose their historic value. Southern part of Beyoglu district and coastal areas of Golden Horn and Marmara Sea in Historic Peninsula accommodate dense historic buildings.

As Istiklal Street constitutes the cultural, social and service center of the city of Istanbul; the nearby neighborhoods have preserved their historic value respectively. In Historic Peninsula even at the first glance it can be mentioned that the past planning decisions carry the neighborhoods to loose their historic value. Neighborhoods far from the central transportation routes luckily preserve their historic potential like the neighborhoods located coastal areas of Golden Horn and Marmara Sea.

Analysis of modeling the change from 1929 to 2000 clearly shows us how governmental decisions could play an active and vital role for conservation of those historic areas. In 1950s and in 1970s the enormous trends of migration of people to Istanbul; lets the city to be the subject to uncontrolled construction demands which the historic core of the city is surrounded and sieged by non-historic urban pattern. This caused the city of Istanbul to loose its historic value.

Setting out from building detail, all the analyses are performed for neighborhood scale. As mentioned above the criterion which affects the scope and detail of the study is the data itself. The variety of the analysis changes with respect to the data's content and detail. By means of the same concept, detailed observations and evaluations could be possible by producing more detailed data with larger scale.

5. CONCLUSION

In this study the main idea is to bring out and evaluate the historic pattern and physical quality of the urban fabric, therefore different kinds of analyses has been done. The percentage of historic buildings, ratio between historic buildings floor area and total area, ratio between historic and non-historic building construction areas; change in the build-up space and physical quality of buildings are the main ones.

In order to reach a result, all the analyses listed above are considered by means of a MCD technique. All the analyses are performed by GIS techniques and it is believed that valuable information for planners and decision makers are gathered. In order to evaluate the historic potential of the districts there are certain items to evaluate. These items are: the change in the potential, to estimate the development direction and tendency, to find out the physical value of the urban historic pattern, to expose the change characteristics of the pattern and to determine the planning priority between districts. Moreover the distribution of the similar and dissimilar districts and their relation in space can be an important criterion for planning and design.

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