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The effects of spatial relations in property-led regeneration

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Abstract

In Turkey, since the entry of the Law on Redevelopment of Areas under Disaster Risk (Law No. 6306) into force in 2012, there has been a significant increase in the number of both property-led and area-based renewals. Property-led regeneration works as an invisible tool of a greater urban regeneration process that creates a broader impact on the city. Although the practice is comprised of singular constructions, as it reflects the renewal of individual buildings, it transforms the general appearance of the urban fabric. This transformation is not as sharp as it is in area-based urban regeneration practices, but still the individually renewed buildings dramatically affect the quality of urban space.

The sole control of local authorities over this renewal process is the construction and utilisation permits they give. In spite of this uncontrolled and unplanned trend, these renewals seem to concentrate in certain areas occasionally, suggesting that there are some determinants. Particularly, the differentiation in areas which have similar building densities and construction permits is remarkable.

This paper presents a part of a more comprehensive research that investigates the triggering factors and consequences of property-led regeneration. The entire central area of Bakirköy, Istanbul that has varying building densities and different settlement layouts has been selected for case study. Within the scope of this paper, the locations of individual renewals are analysed in terms of their spatial relations. This way, it is aimed to understand the role of spatial relations in property-led regenerations.

By defining the factors that affect the locations of these individual constructions, it would be possible to predict the locations that have this tendency. We believe that such an approach would be of significant aid for the local authorities to take necessary precautions to direct this process which considerably affects the quality of urban space.

Keywords

Space syntax, Istanbul, urban planning, urban analysis, urban regeneration.
1. Introduction

Debates on housing issue polarize between two main topics; first debate focuses on the economic value produced by housing sector and the second one approaches to the issue socially with an emphasis on the right to healthy life. Renewal of existing housing stock is discussed in terms of social, economic and physical aspects of the renewal process as well as stakeholders involved in the process and practises are evaluated accordingly.

In international literature, housing renewal processes have two implementation models; “property-led” and “area-based”. Regeneration concept has been developed to define the housing policies, legal tools and programs that aim to re-organize the areas especially in the city centre, that have lost their functionality, that are transforming into areas of physical degradation and that need structural strengthening. The term “property-led regeneration” has been brought to the planning agenda as a consequence of the fast urbanization after 1950s especially in the US (Wolf-Powers, 2005). The first implementation tools of this practise have been land-use regulations and economic development tools that provide low-interest building loans (Healey, 1990; Weber, 2002).

The fundamental task of the public administration in property-led regenerations, which are led by private sector, is described as provision of a platform, coordination in capital stocks and investments, efficient organisation of local institutions (Carley, 1991; Mackintosh, 1992). The task of coordination is suggested to bring together central government, related public institutions and local administration (Imrie and Thomas, 1993). Although the positive aspects of property-led regenerations in terms of economic development are recognized, the need for improving the role of the inhabitants of deprivation areas in local economy is also argued. However, the economic focus of the issue is often criticized for it leads to an uncontrolled development (Turok, 1992). In 1980s, social development issues gained priority and neighbourhood-oriented regeneration operations were developed in Europe as response to this criticism (Jacquier, 2005). In this approach, named area-based regeneration, redevelopment of a neighbourhood that has integrity in its structure is targeted. The crucial aim in this approach is to develop an integrated program with physical, economic and social aspects in these physically degraded and economically disadvantaged neighbourhoods. Expressing that the property-led regeneration is exceedingly economy-based, area-based regeneration concept initiated numerous programs and policies until 2000s in many of the European countries particularly in France, Netherlands and UK. Notwithstanding the intention to bring physical, social and economic gain at the same time, today, area-based regeneration programs have also generally failed to do so (Aalbers and van Beckhoven, 2010).

Neo-liberal processes provoked the opinion that construction sector and real estate investments greatly contribute to the competitive power of the cities (Haran et.al, 2011). In Turkey also, real estate projects and construction sector are seen as primary condition to development of cities and metropolitan areas in line with this global assumption (Güzey, 2009). Uncontrolled growth of settlements fostered by regeneration processes indicates a problematic practise of basic planning principles in Turkey (Görgülü, 2005). Not only metropolitan cities like Istanbul, which are affected heavily from neo-liberal and global processes, but also smaller cities have started to experience the sprawled and dense urbanization as a result of property-led regeneration practises lacking any renewal program and depending solely on economic profit (Ünlü, 2009).

A great amount of research is carried out on the role of spatial relations on the patterns of urban growth. Space syntax analyses settlement layouts and provides mathematical interpretations on their spatial relations (Hillier and Hanson, 1984). Hillier (2002) states that the range of integration values in a layout is the indicator of “configurational inequalities” of the urban grid, which also cause “attractional inequalities”, which in return affect the densities and land use patterns (Hillier, 2002).

Many of the space syntax research regarding urban regeneration focus on regeneration of informal settlements and deprivation areas. Urban form influences the social life as a result of spatial configuration. A notable finding of urban form studies in developing countries is that characteristics of urban form play a significant role in the functioning of both social systems and urban economy.
A study on the informal settlements of Santiago in Chile shows that the level of spatial relations of these areas with the rest of the city affects how they develop. The informal settlements that integrate more with the city have a greater success in local economic progress (Hillier et al., 2000; Hillier and Vaughan, 2007). Some parts of the cities constantly appear as areas of social exclusion. Poverty and deprivation arise in areas that are geographically disadvantaged, which can be explained with spatial relations (Vaughan et al., 2005). Karimi (2012) interprets the constant decline of informal settlements as a “vicious circle”. The ultimate solution to fix these areas should be a regeneration program that understands both the characteristics and the causes of informal settlements (Karimi et al., 2012).

In this paper, we address a self-regeneration process that is triggered with a new legal framework. Since spatial relations are proved to have significant power on urban development, we believe they would help to understand the underlying reasons of locations of the individual constructions.

Urban regeneration is one of the most controversial issues in Turkey’s urbanization process and practices. The legal basis of both the property and area led regeneration implementations, is the Law on Redevelopment of Areas under Disaster Risk, which entered into force in 2012 and known as Law no: 6306. The Law departs from the earthquake risk and it aims the renewal of buildings which are in danger of an earthquake risk. The Law defines the implementation processes and tools for both property and area based regeneration implementations. Law no 6306 introduces the term “risky building” and defines it as the buildings which are in an area that face the danger of earthquake risk or buildings which are determined as facing the danger of collapsing down or get seriously damaged in an earthquake, through scientific and technical inquiry. The Law facilitates the process of demolishing of a risky building and constructing a new one.

Since the entry of the Law no 6306, there have been a significant increase in numbers of both property and area led regeneration projects. So far, due to their widespread effects in socio-cultural and physical fabric of the city, cases of area led regeneration projects have significantly been an issue of debate and have been considered in academic research. Nevertheless, despite the dramatic increase in numbers of property led regeneration implications, still not much academic research has considered property led renewals in terms of their triggering factors and consequences. In Istanbul, property led regeneration is usually seen in residential areas which developed according to planning processes. While the existing buildings are renewed through property led regeneration, a significant transformation is also observed in residential areas in terms of physical environmental characteristics as well as the social and economic characteristics as an overall effect of these individual implications.

2. Methodology and Study Area

In order to evaluate the site-selection of new building constructions, central Bakirkoy area is selected for the case study (Figure 1). Bakirkoy, which is one of the oldest neighbourhoods of Istanbul, had varying levels of importance throughout history within urban context. Many resources indicate the origin of the name Bakirkoy as “Makri Köy” (Distant Town). The distant location of Bakirkoy to town centre has been the main reason behind its varying importance. The suburban line that was built in 1871 was the main connection of Istanbul with Europe and it also increased the accessibility of Bakirkoy from the city centre. After 1950s, there was an expansible population movement from the rural areas towards city centres, which triggered uncontrolled growth of the city and unplanned settlement formations. In addition to formation of new neighbourhoods, a simultaneous regeneration process transformed the existing low density housing areas to 5-6 storey apartments. The mass-housing projects initiated by a banking corporation in 1980s pioneered the planned growth (urbanization) in Bakirkoy. By means of the housing policies that were put into action in that period, development pressure in the city centre was dropped and dispersed towards peripheral areas, gradually. Bakirkoy has been considered as completely urbanized since 1990s (Bakirkoy Municipality, 2002).

Functional transformation of the area highlighted Istanbul Street in east-west direction and Incirli and Istanloy streets in north-south direction, which are dominated with commercial and service
functions. Structural reflections of this process were the conversion of 1-2 storey buildings to 5-6 storey buildings and fill of the empty spaces. Considering the settlement history and structural features of Bakirkoy, it is natural to see diversified neighbourhood characteristics within its jurisdiction.

In order to evaluate the regeneration practices in the study area, construction permits recorded since 2012 -after the announcement of the law no. 6306- were obtained from Bakirkoy Municipality, in July, 2014. The records were digitized and linked with spatial data. Study area is limited to the central Bakirkoy because the entire neighbourhood was established in the same period through similar processes. The study area is approximately 323ha and according to Turkish Statistical Institute 111.117 people inhabit in the area.

For spatial analysis, a larger extent was used in order to prevent edge effect. The extent for spatial analysis included northern side of the E-5 highway as well as adjacent neighbourhoods in east and west areas. Spatial relations of central Bakirkoy areas were analysed using angular segment analysis of depthmapX (Varoudis, 2012). Angular integration and angular choice were calculated in both global and local levels at different radii those are 50m, 250m, 400m, 800m and 1200m. Road-centre map prepared by the Greater Municipality of Istanbul was the base for segment analysis. Side roads of the northern highway are represented with extra lines in this road-centre map, therefore the map was modified before analysing to eliminate these extra lines.

Construction permits were also entered to the segment database as a dummy variable. Next step was to statistically compare the distribution of new building constructions with spatial measures.

![Figure 1: Central Bakirkoy area](image.png)
3. Analyses

Spatial Analyses

Global integration analyses demonstrate a circular accessibility schema enclosing most of the study area. Northern highway (E-5) is defined with the highest values and one of the main connecting roads (Hippodrome Road) in north-south direction sustains its high integration values till it connects with Istanbul Street which runs in east-west direction (Figure 2).

Incirli Street, which is the busiest street of central Bakirkoy, also runs in north-south direction and constitutes a part of the integration core. Although it doesn’t have proper connections in the south, its strong link to E-5 and to northern neighbourhoods makes it appear as part of the circular schema. Average values observed on the coastal Kennedy Street are due to its limited and indirect connections with the rest of the road network.

Inner parts of central Bakirkoy display a fragmented street pattern with sharp angles and lack of continuousness. Streets that continue with little changes in direction either lose their direction or are completely blocked (like dead-ends) before they connect to other strong lines. This disintegrated structure of the street network becomes evident in the angular integration values, thus the inner parts of the area show low values.

Local integration analyses emphasize the strong local structure of the northern part that has a regular grid pattern. Istanbul Street in the south, which has high global integration values, shows partially high values in the local analyses. Vicinity of this street is shown as another local centre, due to its dominance. Hippodrome Road appears rather segregated, most probably with the effect of low street density in its close environment. However, neighbourhoods on the eastern side of this road has the highest local values independent from any connection to Hippodrome Road. Structure of these neighbourhoods is comprised of smaller urban blocks thus creating a denser road network. The linearity of the streets on this area results in a more regular pattern compared to inner parts of central Bakirkoy. These characteristics of eastern neighbourhoods cause the high local values in this area. Analyses of different radii result in very similar schemas (Figure 2).

Figure 2: Angular segment analysis, A- global integration, B- local integration
The composition presented by the global choice values emphasizes the same roads as in the global integration analyses. The circular accessibility schema mentioned in global integration analysis is also visible in global choice analysis; Hippodrome Road, Incirli and Istanbul streets have high values in choice analysis as well. Coastal Road, is defined with average choice values (Figure 3).

In the local choice analysis, the fragmented structure of the road network is evident. Some of the secondary streets shine out, which are not essential parts of the traffic system of central Bakirkoy but no continuous line can be followed. However, in the eastern neighbourhoods, a well-connected and continuous local structure is observed (Figure 3).

Distribution of new building constructions

According to the data obtained from Bakirkoy Municipality, 106 new permits have been given in the period between January-2012 (entry of the new law) and June-2014. The new construction permits are either for constructing on an empty plot, or for demolishing an existing building and constructing a new one. Number of construction permits are 24 in the entire 2012, it increases to 37 in 2013 and it reaches 45 in the first half of 2014.

The distribution of building permits do not show any identifiable pattern, although there are a few areas that a number of building permits appear close to each other (Figure 4). These areas must be studied further to understand the reasons behind these clusters of permits. Except these areas, the general distribution of permits is dispersed. However, even in this scattered pattern, there are no new construction permits on the main arteries. Main arteries always have higher property values compared to secondary roads. Therefore, buildings on main arteries are usually renewed independent of regeneration trends, in order to preserve their values.
Accordingly, most of the buildings on the main arteries of central Bakirkoy are supposed to have been renewed before the new legislation.

The gathered data includes information of new permitted building size and total floor area. Total floor area for new buildings in central Bakirkoy is 891.948 sq. m and the total area of their parcels is 270.084 sq. m, which makes the gross floor area ratio 3.17. Within the study area, there are also new large-scale housing developments. When parcels over 5000 sq. m. that received new construction permits are extracted from the calculations, assuming they belong to large-scale housing developments, the median for floor area ratio is 3,05. Statistical evaluations of the standard deviation and difference between mean and median values show that high floor area ratios are more common in the dataset.

Using base maps of Bakirkoy, floor area ratios prior to the construction permits are calculated for each parcel that has a new permit. Accordingly, median value for floor area ratios before the constructions is 1,29 while the median for floor area ratio defined with the municipality permits is 3,05 (Table 1). These figures clearly show the increasing building density resulting from these renewals, which leads to an overall change in the urban fabric.
Effects of Spatial Relations in the Distribution of New Building Constructions Permits

In order to measure the effects of spatial relations in property-led regeneration, the segments in case area are grouped into two clusters; segments which face at least one parcel having new building construction permit (segment group 1); and segments which face the parcels not having any construction permit (segment group 2). There are 2523 segments in Bakirkoy case area which are used in spatial analysis.

The comparison between the segment groups facing a parcel with new construction permit or not, have been conducted with a statistical method, linear discriminant analysis. This analysis which is used to attain weightings of syntactic properties to discriminate between segment groups, obtain a function based on measuring the distance between two groups consisting an F-test analysis (Srivastava, 2002).

Linear discriminant analysis has been processed for syntactic properties and calculated the values indicating whether there is a statistical significant difference with considerable explanation power for discriminant function. Since the segment groups have unbalanced distribution both in number and values of observed data, outliers have been omitted from the statistical analysis; all records have been transformed into logarithmic values and finally syntactic properties which have significant difference have been involved in the discriminant function. For this analysis, outliers have been chosen within the syntactic property of segment length for the values above 200 m, which equals to 33 segments. It is explicitly observed that construction permits are mostly located on the segments facing inner housing quarters rather than main transportation arteries facing non-residential land uses. Since there are sharp differences among the integration and choice values, logarithmic transformation was conducted for the entire syntactic properties except connectivity.

As linear discriminant analysis determines the mean values of each syntactic property; significant ones were chosen in this case. Table 2 shows the results of the F-test for the segment groups.

5 out of 8 syntactic measures are significantly higher (95% confidence interval) in the first segment group which are segment length, connectivity, global integration, local integration for 800 m and 1200m. On the contrary, group mean values of local integration for 50 m, node count for 50m and total depth are higher in the second segment group.

Linear discriminant analysis calculates not only difference between group mean values but also attain a discriminant function which is called Fisher’s Linear Discriminant Function. This discriminant function corresponds to a threshold for dividing the answers into two segment groups at what extent these syntactic properties identify the identical differences. Test of this function has been held by a chi square test for Wilk’s lambda, too. The classification which is constructed by discriminant function is mainly measured on the discriminant scores, and the scores calculated with a linear equation. Classification for effects of spatial relations in the distribution of new building construction permits in this case have been calculated with the following equation;

Table 1: Floor area ratios before and after the construction permits

<table>
<thead>
<tr>
<th></th>
<th>Floor area ratios defined with the permits</th>
<th>Floor area ratios before the permits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=97*)</td>
<td>(n=97*)</td>
</tr>
<tr>
<td>Median</td>
<td>3,05</td>
<td>1,29</td>
</tr>
<tr>
<td>Mean</td>
<td>3,20</td>
<td>1,35</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>1,11</td>
<td>0,87</td>
</tr>
</tbody>
</table>

* Parcels over 5000 sq. m were not included in the calculation of mean and median values.
\[ D = 6.445 + 1.479 \ln(\text{node 50m}) - 0.787 \ln(\text{global integration}) - 0.593 \ln(\text{local integration 800m}) + 0.348 \ln(\text{local integration 50m}) + 0.330 \ln(\text{local integration 1200m}) - 0.202 \text{(connectivity)} - 0.062 \ln(\text{segment length}) \]

Where \( D \) = Discriminant Function, \( (...) = \text{values for each syntactic property} \)

The coefficients of each syntactic property reflect the pre-eminence in the discriminant function as “\( \ln(\text{node 50m}) \)” has the highest coefficient value as +1.479 and –0.787 for “\( \ln(\text{global integration}) \)”. In other words, a 1% increase in “\( \ln(\text{node 50m}) \)” increase the discriminant score (the possibility of facing a parcel with construction permit) by 1.479%, then a 1% increase in “\( \ln(\text{global integration}) \)” reduce the discriminant score (the possibility of facing a parcel with construction permit) by 0.787%. Each one unit increase in “connectivity” (because of not being transformed into logarithmic values), increases the discriminant score by 20.2%. The least powerful syntactic measure for this case is “\( \ln(\text{segment length}) \)” as it has the lowest coefficient value as –0.062. It means a 1% increase in length reduces the discriminant score by 0.004%.

### Table 2: Group mean values and F-test results

<table>
<thead>
<tr>
<th>SYNTACTIC MEASURES</th>
<th>Segment Group 1</th>
<th>Segment Group 2</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 77</td>
<td>N = 2418</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev.</td>
<td>Mean</td>
<td>Std. Dev.</td>
</tr>
<tr>
<td>Ln segment length</td>
<td>4,249</td>
<td>0,538</td>
<td>3,558</td>
<td>1,426</td>
</tr>
<tr>
<td>Connectivity</td>
<td>4,351</td>
<td>1,233</td>
<td>3,771</td>
<td>1,348</td>
</tr>
<tr>
<td>Ln global integration</td>
<td>6,846</td>
<td>0,103</td>
<td>6,796</td>
<td>0,184</td>
</tr>
<tr>
<td>Ln local integration (50m)</td>
<td>0,834</td>
<td>1,209</td>
<td>1,825</td>
<td>1,504</td>
</tr>
<tr>
<td>Ln local integration (800m)</td>
<td>4,711</td>
<td>0,279</td>
<td>4,576</td>
<td>0,480</td>
</tr>
<tr>
<td>Ln local integration (1200m)</td>
<td>5,263</td>
<td>0,247</td>
<td>5,125</td>
<td>0,455</td>
</tr>
<tr>
<td>Ln node count (50m)</td>
<td>-0,009</td>
<td>0,203</td>
<td>0,201</td>
<td>0,353</td>
</tr>
<tr>
<td>Ln total depth</td>
<td>10,687</td>
<td>0,103</td>
<td>10,736</td>
<td>0,184</td>
</tr>
</tbody>
</table>

Note: Higher mean values in the segment groups are indicated in bold figures.

Test of this function has been proved with chi square test for Wilk’s lambda (Chi-square = 58.139 and Significance = 0.000). This function indicates similar trends with dominant syntactic measures as the F-test results represent. Linear discriminant analysis gives possibility to estimate whether the group cases classifies correctly in a classification shown in Table 3.
Classification table indicates the number and percent of segments that belongs to groups which are distinguished in this paper by the presence of parcels with new construction permit. For instance, discriminant scores from 61 out of 77 segments could be classified into the first group. It means that 16 segments in the first group had been closer to the scores of the second segment group. But on the contrary, from 1553 out of 2418 segments in the second group could be grouped into the same group, 865 segments are more likely to act like the segments facing the parcels with new construction permit. As 65.0% of original grouped cases correctly classified, it can be concluded that there are significant differences in the segment groups and spatial characteristics of the street segments in both global and local context to change the potential of new building construction permit, in other words, property-led regeneration.

4. Conclusion

The rapid urbanization process has been transforming the cities into masses of buildings, which causes inadequacy of open spaces and recreational areas. In densely developed cities, older neighbourhoods are thought to have reached a level of saturation and cities tend to grow outwards. Regeneration of these older neighbourhoods is an opportunity to reassess the existing structure and to develop an integral approach. However, property-led regeneration is an uncontrolled process displaying a disconnected pattern with increased building densities, which is clearly a result of self-interest of the individuals. In order to guide the municipalities in this process, we aimed to develop an analytical approach to understand the spatial factors that affect the locations of singular constructions.

As a result, it is observed that syntactic measures significantly differentiate in the case of having a construction permit. Segment length, connectivity, global integration, local integration (800m) function negatively, whereas node count (50m), local integration (50m) and (1200m) function negatively in the possibility of new building construction permit. The strongest measure in the equation is node count (50m), followed by global integration.

Choice values do not appear in the equation in neither global nor local contexts. Choice is a measure of betweenness, calculated by taking all the segments in a system as both origins and destinations and tracing all possible routes (Turner, 2007). In this sense, choice values provide us the meaning of a segment as part of a route. In Bakirkoy, the street network lacks a continuous pattern because of sharp angles or sudden closures, which may affect the results. Therefore, the effects of spatial measures on the new construction permits should be studied further with different case areas.

In Bakirkoy case, the results indicate an evident relation between the spatial measures and possibility of construction permits. In order to increase the percentage of explanation, additional surveys are being conducted by the research team. We believe these results will shed light on future research on property-led regeneration process.
References


