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Spatial segregation of traditional buildings over a conservation site in Kastamonu

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Abstract

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In recent years, cities have been in a rapid change in which differences arise, both among themselves and different quarters within each of them. These discrepancies, which are reflected in living spaces, create an explicit segregation, and an overwhelming challenges to the planning framework. This study aims to investigate the concept of spatial segregation in urban historic sites by evaluating the structural changes through spatial analyses on a case city in Kastamonu, Turkey. This segregation will thus be investigated as to whether the conservation site boundary reflects the existing heritage characteristics by seeking the spatial features of the historic building stock which presents raditional construction types. This specific data obtained from the Kastamonu Municipality was used to establish whether there is spatial segregation between neighbourhoods located within the borders of historical city centre of Kastamonu and the peripheral neighbourhood. The study organises the building types into two categorical data according to their construction systems, namely traditional and non-traditional construction materials, and analyses the differences and similarities between the neighbourhood within and outside the conservation site and its buffer zone. This analysis is implemented by the use of Location Quotient, Getis-Ord Gi* and Anselin Local Moran's I methods. Analysis reveals that the existing conservation site boundaries do not reflect the spatial character, seamlessly. Areas that are accumulated with buildings, which have traditional construction materials more, are observed within buffer zones and its close periphery. In conclusion, the boundary of both urban conservation sites and the buffer zone can be spatially evaluated after this study and could later be validated with a comprehensive heritage value in a detailed survey data for further study.

Key words: spatial segregation, spatial analyses, spatial autocorrelation, urban historic site, Kastamonu.

1. Introduction

The socio-economic structure of cities stands out as the most important component of an urban environment. Together with globalisation, cities have undergone a rapid change and profound transformation, causing emergence of differences both among themselves and in terms of their interaction with other cities. The recent technological advances and certain changes in demographic structure have led to rapid population increase in cities. From a global perspective, developing transportation and communication technologies have expanded the scale of capital cities resulting in a change in production and consumption mechanisms. All these differences and the development of the international service sector have created a competitive environment among cities, bringing about physical, social, economic, environmental, cultural and political transformations (Marcuse, van Kempen, 2000).

This process has witnessed the increase of income disparity in social structure, which causes divergence and the gradual segregation of the communities. Segregation becomes visible in both social and spatial dimension in that high-income groups prefer to settle in more secure and prosperous parts of the city while the low-income group has to live in underdeveloped areas against their will. Such socio-spatial segregation in cities brings about cultural differences as well. Thus, different groups, clustered in separate areas of the city, start affecting one another, creating the process, known as neighbourhood effect, by which individuals of the same neighbourhood may be affected by different rehabilitation and renewal programmes both positively or negatively in socio-cultural aspects.

The same process is taking place in Turkey. There have arisen manifest differences in expectations, lifestyles and use of services between groups in all cities of Turkey, depending on many independent variables and particularly triggered by rapid urbanisation and the relevant rural-urban migration. Therefore, it is quite possible to come across various and different social and economic characteristics among the people living in cities (Keleş 1978:42).

These segregations and differences cause problems in cities such as insecurity, unhealthy living spaces, social exclusion, uncleanliness, lack of integration and impossibility of coexistence to arise. Therefore, it is of critical importance to identify socio-economic segregation in cities in order to create liveable spaces in equity, develop an understanding of urbanisation presenting the same conditions for all and enable the introduction of policies for this purpose (Mutlu, Varol, 2017). This segregation pattern, differing more dramatically in urban historic sites, is considered an important element in the determination of conservation and renewal boundary that is the subject matter of this study.

Turkey has many historic city centres, and these cities face many problems from the distribution of spatial thresholds and features to registration of conservation areas. Furthermore, there is no cited study within Turkey where a city or area has undergone an analytical process for the determination of conservation and renewal boundaries. Actually, these boundaries create controversial circumstances in many registered conservation sites according to various studies conducted in this field. However, it is vitally important, for the conservation and planning agenda of Turkey, to take into account the specified features and thresholds while deciding the location of renewal projects or transformation projects. This critical issue is an important fact for international scholars as well regarding selection of boundaries in area-based renewal and regeneration programs (Koramaz 2018).

This study aims to examine the concept of spatial segregation in urban historic sites by evaluating the structural variations through spatial analyses in the case of the city of Kastamonu in Turkey. This variations in urban historic site is examined through historic building stock with which presents raditional construction types. Afterwards, the physical properties of the neighborhoods within the boundaries of the existing conservation site are determined through the interaction of neighborhoods with each other by spatial analysis method. All these investigations reveal whether the site boundary reflects the existing historical pattern.

In this study, it is targeted to validate answers to essential questions regarding the aforementioned motivation. Does the current site boundary of the approved conservation site reflect the historic urban quality of the case area?

In an attempt to answer this question, the notion of social-spatial segregation was addressed using a theoretical framework. Spatial segregation and evidences related to spatial autocorrelation were also analysed. Data obtained from the Turkish Statistical Institute (TUIK) and the Kastamonu Municipality were used to establish whether there is spatial segregation between the neighbourhood located within the borders of historical city centre of Kastamonu and the peripheral neighbourhood, and whether these neighbourhoods spatially affect one another. This study organises the building types into two categories of data according to their construction systems, namely traditional and non-traditional construction materials, and analyses the differences and similarities between the neighbourhood within and outside the conservation site. This analysis is conducted by the use of Location Quotient (LQ), Getis-Ord Gi* and Anselin Local Moran's I methods, which are spatially analysed by the use of Geographic Information Systems.

Comparison of the analysis reveals that the existing site boundaries does not reflect the historical urban character of the area. Areas with density of traditional buildings are not located within the site boundaries in some places. It can be concluded that the urban site boundaries and buffer zone of conservation site should be analysed in more detail with scientific data.

2. Socio-Spatial Segregation

Segregation is referred to as a social and spatial phenomena in literature which has emerged out of the interaction of interdependent factors. Even though it takes place in different dimensions because of various layers, segregation is usually addressed from the socio-cultural or physical/spatial perspective. Social segregation is discussed with the differences among the groups and the unequal relations arising from, whereas spatial segregation is considered as spatial reflection of cultural or social differentiation among these groups led by ethnically or socially different groups (Andersen 2003).

This study focuses on spatial segregation, as it will examine spatial variations of the segregation with physical dimension of urban environment, which reflects the social dimension. Spatial segregation emerges from the desire of individuals to choose a better qualite of life affected from the external forces. To give an example, people with the same ethnicity or fellow citizens prefer to live together as they share the same cultural structure (Harvey 2002: 163-164). Sometimes, groups become obliged to live in a certain area without any preference, namely the location of some groups in underdeveloped parts of the city for economic reasons or clustering of such groups because of certain state policies.

From the perspective of Turkey, when the basic structure of the society underwent a profound transformation with industrialisation, particularly with the rapid detachment from the land and recession of peasantry, communities who flooded into cities with rural-urban migration movements had adaptation problems. This condition is considerably different from the income-related problems, as there is a problem of urbanisation, characterised by the inability to keep up with the urban life (Es 2010). This causes community groups to cluster in the neighbourhood and segregate in the city because of aformentioned reasons, next to ethnicity, lifestyle, status and social image, etc. Residents of the neighbourhood affect each other and get deprived, bringing the negative impacts of segregation to a dead end. Nevertheless, segregations had not directly reflected to space in especially medium-scale Anatolian cities by 1980s (Uyanıker Kırbaş 2017). That is to say, differences of religion, ethnicity, status, language, etc. did not pose an obstacle for peaceful cohabitation of people in the neighbourhood with such mixed structure.To focus on medium-scale cities with historic qualities in Anatolia, which is the subject matter of this study, there are many cities which spatially bear the traces of an Ottoman city. Therefore, from the point of Ottoman urbanisation, and following the proclamation of the Republic, neighbourhood were still considered as physical spaces without any indication of status and class differences (Küçükaşçı, Yel, 2003: 323-326). During the Ottoman period, there were mansions in amongst the houses of the low-income groups, and senior officials or rich tradesmen – people with high status – had social interactions with the low-income groups of the neighbourhood, which indicates that they were living heterogeneously together in safety. This could be interpreted as a social mixture without any polarisation or exclusions despite the structural differences, and the spatial setup reflects this structure (Kuban 1994: 244). It is seen that these differences maintained their permeability throughout the Ottoman urban experience and also in the early yearrs of the Republic, and even if diminished, they still tend to maintain a certain level of permeability (Erkilet 2017).

This kind of social mixture, in neighbourhood structure can be regained with social inclusion principle under the name of European restructuring policy (Musterd, Andersson, 2005). It is aimed to achieve a social structure where the poor are clustered in neighbourhoods, different income groups, excluded inhabitants and people with different social status live together in mixed neighbourhoods (Musterd, Andersson, 2005). After the socio-spatial segregation is established, it is important to consider what kind of spatial organisation should be conducted in cities and what social and economic policy should be implemented in order for the groups to live together in spite of all these inequalities. Thus, it would be possible to obtain a structure with socio-spatial integration in the city even though it actually creates a homogenous structure per se.

In Turkey, these inequalities and different lifestyles that became even more obvious after the 1980s engendered differentiation and variation dynamics affecting the urbanisation of Turkey to a great extent. Consequently, social segregation also became visible in space with the effect of neoliberal policies, and the emerging tendencies of segregation gradually surrounded cities (Uyanıker Kırbaş 2017). Such problems as disorder, insecure places and income inequality made people with different social status feel threatened. Therefore, new spaces became to emerge with the poor living in the neighbourhood of the city centres, the middle class constructing building complexes on large areas of land through cooperative initiatives in the peripheries in search of new living areas for themselves, and upper classes who settle in cleaner and more peaceful areas far from the commotion of the city by creating a protected area for themselves with private security systems and high-walls. These new spaces are located in the peripheries of the city or in a secured zone, where social and class segregation support spatial segregation in lieu of social conciliation (Işık, Pınarcıoğlu, 2009: 128; Alver, 2010: 100).

From another perspective, the state policies on conservation and renewal programmes which especially offered in the urban historic sites, has been known as a challenge on the determination of the spatial boundary, which is needed to be validated. It is evident that the areas, covered with highly physically decayed and deteriorated are overlapped with the ones, having traditional building construction types. Next to building construction types, physical deterioration characteristics, neighbourhood characteristics, residential unit characteristics, and size of residential unit and parcel, is relevant to the determination of the boundary of renewal programme, which holds both spatial and socio-economic features of segregation (Koramaz 2018). Thus, it would be possible to obtain more realistic and practicable results with a spatial validation of historic building stock with which presents raditional construction types, assumed to reflect the socio-economic structure and socio-cultural structure among neighbourhoods.

In conclusion, in the case of Turkey, these groups who fell apart as a result of unhealthy urbanisation processes arising from rapid urbanisation and increased rural-urban migration movements, and income disparity brought about by globalisation have also resulted in the emergence of differing preferences and expectations. These preferences and expectations are reflected in urban spaces with the differentiation of the quality of the built environment and housing needs that can be afforded according to the socio-economic situation. Therefore, housing, workplace, shopping, recreation and living areas of low and upper class have caused the development of a closed and fragmented city, characterised by different spatial searches of two opposite groups.

3. Measuring segregation and methodology

3.1. Examples of methods used in the literature to measuring segregation

Having been studied by many scientists, the segregation was analysed with various methods of measurement. The recent technological developments have brought about comprehensive transformation of the methods used for measuring segregation. Strengths and weaknesses of the differences in segregation measures have long been discussed in the literature.

To elaborate on the different measures of segregation, it has been observed that while dealing with the analysis of social segregation, the studies were separated from one another through different statistical methods and different techniques of spatial analysis with a special focus on clustered analysis. Furthermore, the reviewed literature indicates that socio-spatial segregation has been discussed from the point of housing, use and demographic structure, etc. (Duncan, Duncan, 1955; Massey, Denton, 1988; Morril, 1991; Güvenç, Işık, 1996; Wong, Chong, 1998; Gorard, Taylor, 2002; Güvenç, Işık, 2002; Brown, Chung, 2006; Firidin Özgür, 2006; Yüceşahin, Tuysuz, 2011; Kısar Koramaz, 2014; Paez et al, 2015; Ataç 2015; Östh et al, 2015).

According to A. Paez et al. (2015), the segregation has two phases, which are the study of process and the study of measurement. The study of process aims to put forth the origin of the segregation and understand the means of avoiding and reducing segregation. The study of measurement, on the other hand, is vitally important for presenting the evidence of segregation and defining the hypothesis that will reveal the process of segregation (Paez et al., 2015).

D. S. Massey and N. A. Denton (1988) explained the factors causing urban segregation as settlement of two or more groups separately in different parts of the city. These authors identified the underlying reasons of segregation as follows (Massey, Denton, 1988).

Evenness refers to the degree of differentiation between two social groups; the method used: *Index of Dissimilarity (D)*;

Exposure refers to the level of potential relation in case of probable interaction between minority or majority groups of a city; the method used: *Index of Isolation (xPx). Atkinson Index(A), Entropy Index (H)*;

Concentration refers to the spatial distribution of the minority groups within near or connected areas in a city for interaction; the method used: *Delta index (DEL), ACO and RCO (Relative Concentration Index)*;

Centralisation refers to the settlement of a group in areas close to the city centre; the method used: *Absolute Centralisation Index (ACE)*;

Clustering refers to the residential clustering of a minority group in a certain part of the city; the method used: *Spatial Proximity Index.*

As to the other studies on segregation, it is accepted to be two-dimensions, i.e. evenness-concentration and clustering/exposure according to L. A. Brown and S. Y. Chung (2006) and exposure-evenness/clustering according to S. F. Reardon and R. O'Sullivan (2004). Clustering defines the spatial proximity between the individuals of the same groups. Exposure, on the other hand, defines the spatial proximity between the individuals of the different groups (Paez et al., 2015). Segregation is determined by conducting statistical measures for all characteristics above.

Making use of the studies of all these researchers, it is possible to establish the factors that cause segregation in cities (Tab. 1).

Table 1. Variables causing segregation

Main variables	Housing (Kısar Koramaz 2014), education (Fryer, Echenique, 2007) health, culture, trade (Ljunggren, Andersen, 2015) transport, ethnicity (Sabater, Finney, 2015), status (Güvenç, Işık, 1996; Işık, Pınarcıoğlu, 2009; Ataç 2015).
In addition to main variables	Value of the land, rents, prestige, aesthetic concerns (noise, smoke and uncleanliness), lifestyle, preferences, workplace environment and quality, habits, traditions, tastes and biases (Shevky, Bell, 1955; Weber 2000; Fryer, Harvey, 2002; Echenique 2007; Akyol Altun, 2010; Giddens 2012).

Each of the factors above makes up the variables that can be used to measure the extent of urban segregation in cities. In addition to the quantitative analysis of segregation in common literature, spatial and socio-economic features related to the determination of conservation and renewal programmes are rarely analysed with spatial autocorrelation on whether there is a spatial variance, clustering or concentration in terms of building construction types and distribution of historic buildings.

This study uses the following to measure spatial segregation in terms of construction systems in the historic cities:

- Location Quotient to measure Concentration,

- Getis-Ord Gi* and Anselin Local Moran's I analysis to indicate Cluster.

These methods enable the measurement of the extent of socio-spatial segregation in a city. Different variables may be used to find out in which areas of the city the relevant variables are concentrated or in which areas there are differences, contradictions and clusters. This study used spatial autocorrelation methods to identify concentration and cluster – two dimensions of the spatial segregation – and the results were evaluated by comparison. Similarly, studies evaluating the analysis by two of these methods were captured with the abilities of spatial clustering. These studies mainly include what is indicated beneath.

In 'Location Quotients Versus Spatial Autocorrelation in Identifying Potential Cluster Regions', titled article, M. C. Carroll et al. (2008) compared Location Quotient and Getis-Ord Gi* statistical methods to identify potential cluster regions in the transportation equipment industry of four states in the Midwestern USA (Carrol et al., 2008). While Location Quotient is used to measure relative employment intensity, Gi* measures spatial autocorrelation by examining the relationship between neighbours. Remarks indicated in this study that Gi* depicted the characteristics of the surrounding areas and spatial lag with relatively better results than Location Quotient (LQ) (Carrol et al., 2008).

In 'Spatio-Temporal Clustering of Road Accidents: GIS Based Analysis and Assessment', V. Prasannakumar et al. (2011) used Getis-Ord Gi* and Moran I indexes to assess spatial clustering of road accidents and hot spots (Prasannakumar et al., 2011). The study was carried out in order to identify and evaluate the hot spots of traffic congestion and accidents that occur frequently in South India due to the lack of road transport network. In this study, Moran's I method of spatial autocorrelation and Getis-Ord Gi* statistics with Kernel density functions were used to determine the effects of spatial and temporal factors. As the outcome of this paper, hot spots and spatial clusters of accidents emerged the nature of spatial phenomenon and these clusters revealed a random distribution in certain zones (Prasannakumar et al., 2011).

In 'Spatial Segregation, Segregation Indices and the Geographical Perspective, Population, Space and Place Population', L. A. Brown and S. Y. Chung (2006) used Location Quotient and local Moran I index to measure concentration and cluster of the ethnic groups in the city (Brown, Chung, 2006). Methods such as non-spatial dissimilarity index (D) which is widely used in the measurement of residential clustering/segregation in literature, may neglect the opportunities of spatial autocorrelation methods such as Local Moran's I or Location Quotient (LQ) which used to measure concentration/evenness. Dissimilarity index (D) defines the segregation on a global measure; therefore, the existence of racial/ethnic residential clustering is a local measure, affected by spatial variances with distinctive outlier values. Findings obtained from the two methods (Brown, Chung, 2006) indicated that Local Moran's I offer more prominent results than global analysis.

Gi* statistics and Moran I measure distinctively the spatial autocorrelation. However, both statistics are evaluated based on spatial theory, which allows easy comparison and assessment of a range of standard normal variables obtained from each statistical method (Getis, Ord, 1992).

3.2. Use and interpretation of location quotient method

Location quotient analysis has been widely used in the field of regional economy since the 1940s (Moineddin at al., 2003:249). It is used in economy to determine whether there is sectoral concentration in a region, and to identify the specialised economic sectors in the relevant region (Isserman 1977). However, there are studies which indicate that it is also used to measure urban segregation (Brown, Chung, 2006; Ataç, 2015). It allows for the making of comparisons as it shows the locations where variables are concentrated in each neighbourhood for measurement of urban segregation.

D. S. Massey and N. A. Denton (1988) used many different methods to determine concentration for measuring urban segregation (Ord, Getis, 1995). Location quotient method was used in this study to find out the areas where different groups were concentrated in the city. Location Quotient basically and simply, quantifies a particular demographic group within a city compared to the whole amount, and aims to determine whether there is an over-represented demographic group in any neighbourhood of the city (Ataç 2015). It is calculated with the formula (1) below (Cromley, Hanink, 2012).

$$LQ_i = (e_i/E_i)/(e/E) \quad (1)$$

e_i – Population of the group e resident in the neighbourhood i,

E_i – Total population in the neighbourhood i,

e – Total population of the group e,

E – Population of the city as a whole.

This is then is interpreted as follows; if the percentage of a group in a local areal unit matches its percentage for the urban area overall **LQi = 1**, if the percentage in a local areal unit is less than that for the urban area overall **LQi <1**, if the percentage in a local areal unit is greater than that for the urban area overall **LQi> 1** (Brown, Chung, 2006).

3.3. Use and interpretation of spatial autocorrelation statistics method: Getis-Ord Gi*

Developed by Arthur Getis and J. Keith Ord (Getis, Ord, 1992; Ord, Getis, 1995). Getis-Ord Gi* Statistics or Getis-Ord spatial analysis, in other words, is the most common technique for measuring spatial autocorrelation.

Getis-Ord Gi* variable values are used to determine whether similar points have clustering tendencies, and ascertain the location of these spatial clusters. It is different from the other methods in that it puts forth results concerning the location of the clusters (Getis, Ord, 1992). This is a spatial autocorrelation method that compares local average of the neighbouring values with the general average. Gi* statistics processes all data in a certain d distance. Within this procedure, both Z score and P probability values are obtained as output data. This calculation is made for each point in the sample dependent on the neighbourhood relation (Erdoğan et al., 2015a).

Getis-Ord Gi* local statistic is calculated for all points in the sample to identify hot spots and cold spots in the area of study (Getis, Ord, 1992).

Accordingly, Getis-Ord local statistic, Gi* for each spot;

$$G_i^* = \frac{\sum_{j=1}^{n} w_{ij}\, x_j - \bar{x}\sum_{j=1}^{n} w_{ij}}{s\sqrt{\frac{\left[\left(n\sum_{j=1}^{n} w_{ij}^2\right) - \left(\sum_{j=1}^{n} w_{ij}\right)^2\right]}{n-1}}} \quad (2)$$

n – number of points in the sample,

x_j – variable value of the point j,

w_{ij} – spatial weight value indicating relation of proximity between point i and point j,

$\bar{x}$: average value of the variable

$$S = \sqrt{\frac{\left[\sum_{j=1}^{n} x_j^2\right]}{n} - (\bar{x})^2} \quad (3)$$

Spatial weight matrix (w_{ij}) consists of the values **0 and 1.**

In the method, the symmetry is equal to 1 for all connections of a given region i within d, and 0 for all other connections containing the region i, which are the elements of the binary spatial weight matrix (Ertur, Le Gallo, 2003).

The calculated Getis-Ord Gi* local statistic has the normal distribution, and the calculated value is the values of z-statistic (Getis 2010). Positive high values refer to the units of high absolute value for a high-value spatial cluster existing together, whereas negative Gi* values refer to the units with low variable values existing together (Erdoğan et al., 2015b; ESRI 2019b). Hypothesis test is necessary to understand whether each unit is statistically different than the entire area. Neighbouring units are still important itself for the Getis-Ord Gi* spatial statistic method while validating variations within the neighbours.

3.4. Use and interpretation of spatial autocorrelation statistics method: Anselin Local Moran's I

The Moran's I index is of general scale and measures the level of spatial dependence of the distribution of the study area. However, it does not show where the distribution is clustered. For this reason, Anselin Local Moran's I index was developed in order to make spatial analysis of the distribution in regional scale. Statistically hot, cold and spatial contradictions of a predominantly set of features can be determined using the Anselin Regional Moran's I spatial statistics (İlçi 2013). Anselin Local Moran's Spatial Statistics is another common spatial autocorrelation technique.

Anselin Local Moran's I Spatial Statistic is different from the Getis-Ord local Gi* statistic in that Anselin Local Moran's I Spatial Statistic was developed to determine spatial outliers whether neighbouring units are significantly different from each other instead of entire area.

In calculating the Anselin Local Moran's I Spatial Statistics, the spatial weight matrix value (w_{ij}) to each point itself is equal to 0 (Anselin, 1995). High positive I_i values indicate that the point i is a spatial cluster of points with similar variable values, while high negative I_i values show that the point i is a spatial outlier and there is contradiction. In both cases, the p value must be small enough for the cluster or outlier to be considered statistically significant (Anselin 1995; ESRI 2019a).

It is calculated with the formula below.

$$I_i = z_i \sum_{j}^{n} w_{ij} z_j \tag{4}$$

n – number of points in the sample,

$\mathbf{w_{ij}}$ – weight value indicating relation of proximity between point i and point j,

$\mathbf{z_i}$ and $\mathbf{z_j}$ – deviations from average for variable value of the points i and j.

- Clustering of high values High-High **(HH)**,
- Clustering of low values Low-Low **(LL)**,
- High values surrounded by low values High- Low **(HL)** contradiction,
- Low values surrounded by high values Low-High **(LH)** contradiction (Anselin 1995).

4. Results for a case study on Kastamonu

4.1. Geographical location of Kastamonu

This section provides information about geographical location and demographic structure of Kastamonu Centre, the physical structure of the neighbourhood, and the conservation area. Maps were obtained by using Location Quotient, Getis-Ord Gi* and Anselin Local Moran's I methods making use of Geographic Information Systems (ArcGIS 10.5, Spatial Analyst Tool). The generated maps were interpreted and evaluated.

Kastamonu province is located in the Western Black Sea Region, in the north of Turkey (Fig. 1). It is a very important city in terms of historical background, geographical features and cultural characteristics, and has a historical environment spread over a wide area.

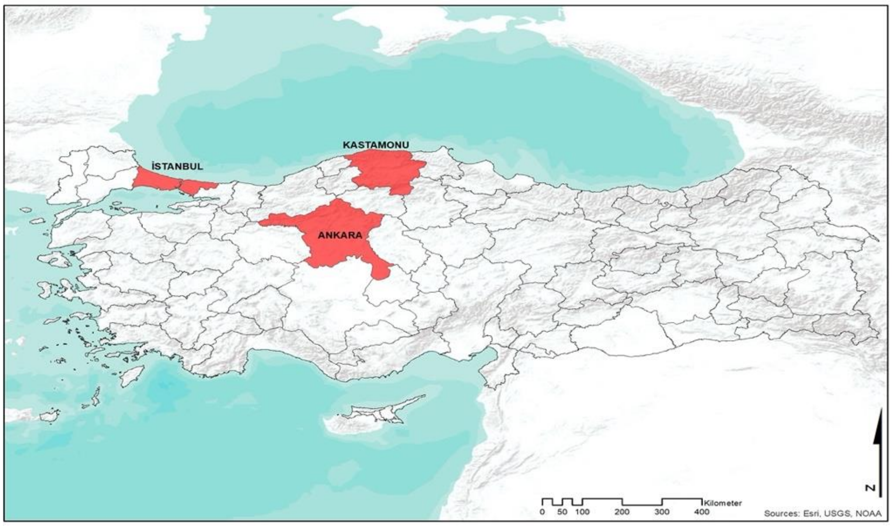

Figure 1. Location of Kastamonu

Source: the author

4.2. Spatial distribution of the traditional buildings through conservation site in Kastamonu

The central settlement of the province contains 396 registered buildings, 434 traditional buildings within the site boundary within its conservation site, 92 registered buildings, and 326 traditional buildings in the buffer zone (Fig. 2; Kastamonu Municipality 2011). Kastamonu city centre and conservation site has been referred with a very diverse population with different socio-economic background, among administrative borders of the neighbourhood (Kastamonu Municipality 2011). These features indicate the importance of urban segregation fact, to be investigated with spatial analysis methods.

The Kastamonu Conservation and Development Plan was first introduced in 1979, and then revised in 1990 with the approval of conservation site decision by conservation board in Kastamonu. The conservation and development plan was then revised again in 2015. The site boundary has been changed, and the registered status of certain historical buildings has been cancelled, and some buildings have not been registered in the conservation plan under revision (Kastamonu Municipality 2011).

To provide information about the demographic structure of Kastamonu, the population is 148 931 according Address-based Population Registry System of 2018. Kastamonu Central District has 20 separate neighbourhood. According to 2018 population data, 118 282 people live in 20 neighbourhoods (TUIK 2019). Kastamonu is one of the provinces with the highest number of cultural assets, which has played a role in the selection of the study area. Including 1134 registered buildings in total – 488 in city centre and 646 in other districts, Kastamonu hosts 1428 registered buildings (Kastamonu Municipality 2011; database gathered from Modül Planlama).

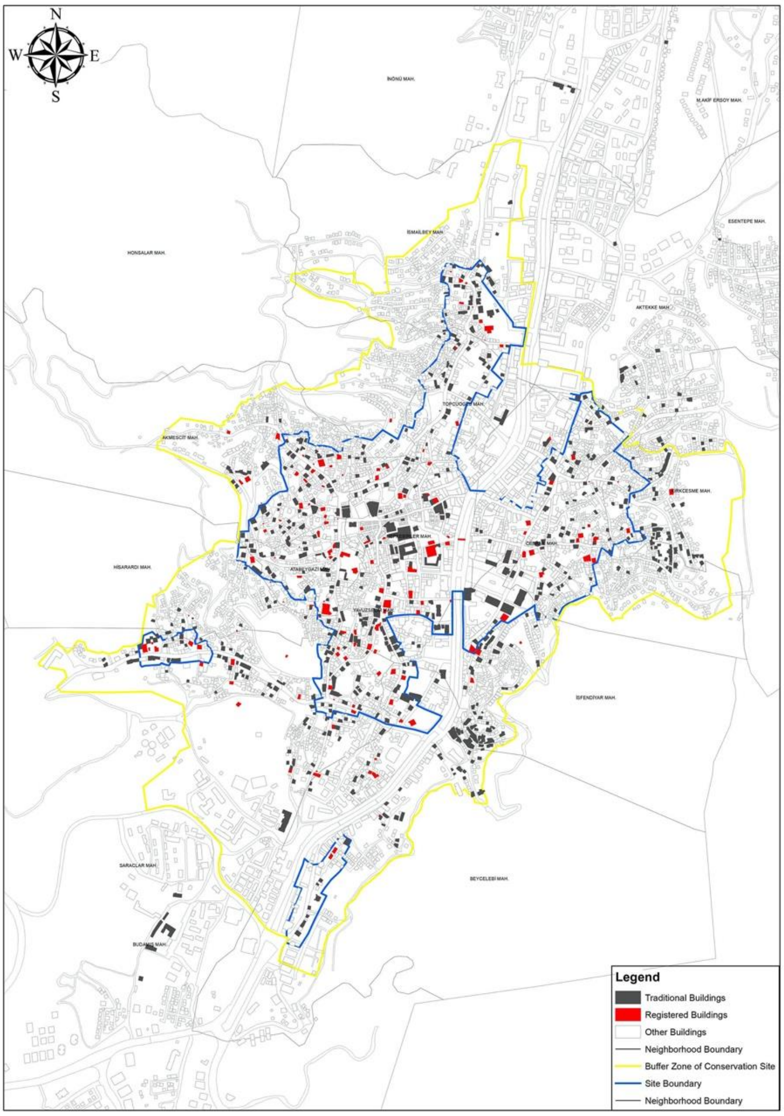

Figure 2. Neighbourhood within the conservation area of Kastamonu as well as registered civil and monumental buildings

Source: Kastamonu Municipality (2011)

Conservation area in the city centre of Kastamonu covers 165 ha, and 14 neighbourhood are in mutual interaction in this fully built-up border (Fig. 2). Population density is very high in some of the neighbourhood as they have very small borders.

4.3. General information on demographic structure and neighbourhoods of Kastamonu

Out of 20 neighbourhoods of Kastamonu, Hepkebirler, located in the centre on an area of 17 ha, hosts the highest number of cultural assets with 116 registered buildings. Beycelebi and Saraclar, the greatest neighbourhood in size, have around 25 registered buildings (Kastamonu Municipality 2011; database gathered from Modül Planlama; TUIK 2019).

Kuzeykent and İnonu, located in the north of the city, are the most populated neighbourhood and planned as development area. while it is decreasing in the other neighbourhood. It is observed that the neighbourhood with decreasing population are located in the historical centre of the city where traditional buildings are very common (see Figures 3 and 4).

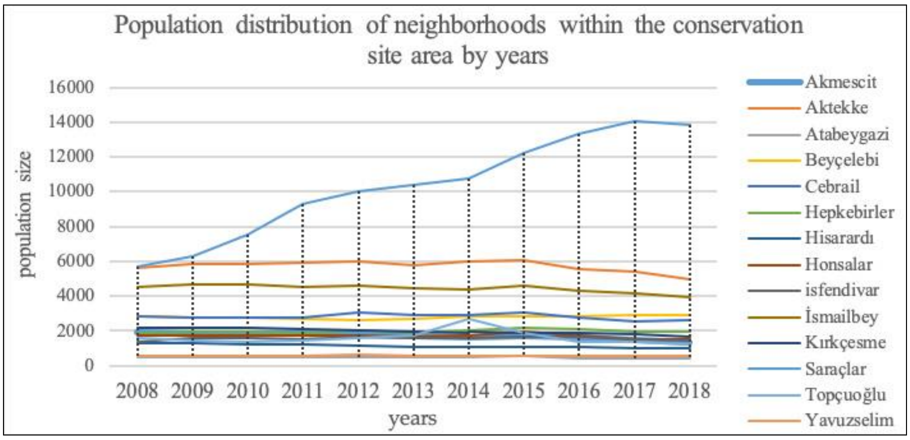

Figure 3. Population distribution of neighbourhood within Kastamonu site boundary by years

Source: TUIK (2019)

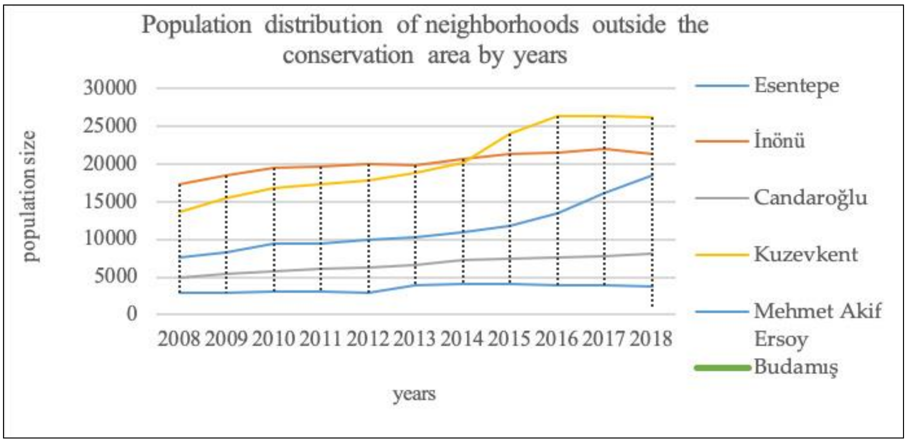

Figure 4. Population distribution of neighbourhood outside Kastamonu site boundary by years

Source: TUIK (2019)

Different methods such as Location Quotient, Getis-Ord Gi* and Anselin Local Moran's I were used in order to measure spatial segregation in neighbourhood of Kastamonu through variable of buildings with traditional construction material find out whether the neighbourhood affect one another in different or similar elements, and measure concentration – one of the dimensions of spatial segregation, and the analysis were conducted based on the information provided by Kastamonu Municipality. Construction types include mud brick, stone masonry, reinforced concrete, steel construction etc. To conduct this investigation, these data were divided into two categories as non-traditional buildings (reinforced concrete, steel construction, and concrete brick) and traditional buildings (mud brick, stone masonry). Thus, it was examined whether there was consistency between spatial distribution of traditional buildings within and outside the site boundaries. Firstly, Location Quotient (LQ) Getis-Ord Gi* and Anselin Local Moran's I analysis defined above were calculated for 20 neighbourhood of Kastamonu and then methods were tested by comparing the results of the analysis.

4.4. Use in measuring spatial segregation of traditional building with location quotient

Location Quotient (LQ) analysis, which shows the concentration of traditional buildings in the city, was conducted in this study by applying Location Quotient

(LQ) in each square by creating a 150 x 150 m grid for Kastamonu city in order to see the segregation and similarity in the city in more detail. Accordingly (see Fig. 4).

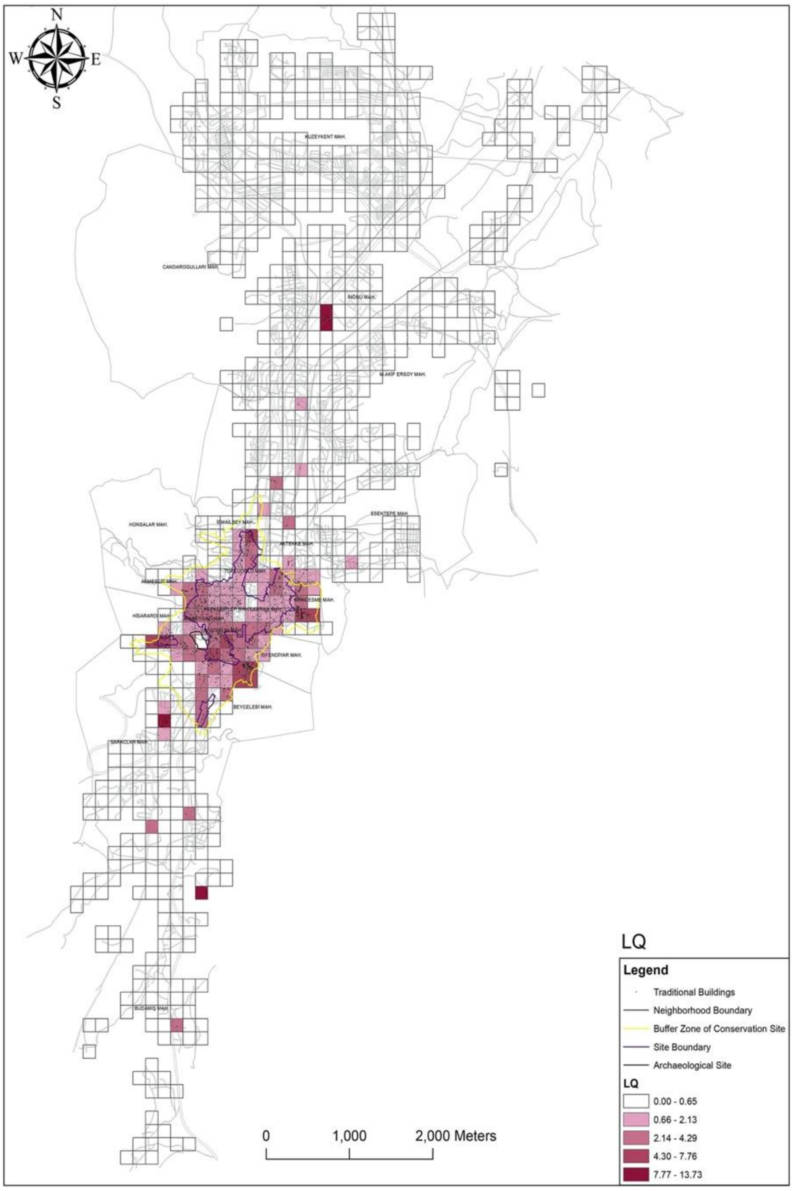

Figure 5. Application of location quotient (LQ) values between neighbourhood to the city through grid system

Source: the author

The map shows where traditional buildings are concentrated. According to this, the darker red areas with the highest Location Quotient (LQ) values indicate the location with the highest number of traditional buildings. Concerning white areas in the range of 0.00–0,65, it can be said that the traditional building density is low. When the current site boundary was compared with the traditional building density in the map, it was found that the areas outside the site boundary also hosted a high density of traditional buildings. For this reason, the areas covered by the site boundary and buffer zone of conservation site need to be reviewed (see Fig. 5).

4.5. Use in measuring spatial segregation of traditional building with Getis-Ord Gi* statistic

This method includes conducting hotspot (Getis-Ord Gi*) analysis with 300 m and 750 m bandwidth by creating 150 x 150 m grid and making use of the traditional building data in each square. Data of traditional buildings located in the neighbourhood of the study area were analysed to indicate where the high values and low values were clustered while investigating spatial autocorrelation.

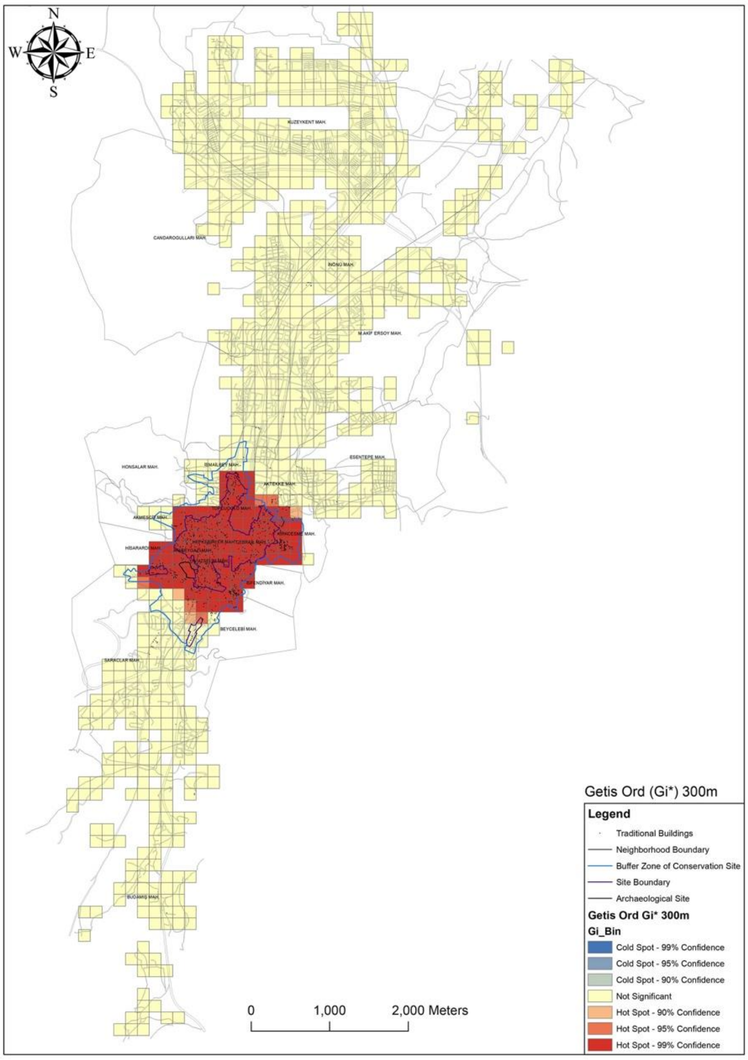

Figure 6a. Getis-Ord Gi* analysis with 300 m bandwidth

Source: the author

Analysis of the traditional buildings for each square is available in Figure 6a for the 300 m bandwidth. Getis-Ord Gi* local statistic was calculated for all points in the sample to expose hot spots and cold spots in the study area. Hot spots refer to the areas with clustering of high variable values while cold spots refer to the areas with clustering of low variable values (Çubukçu 2015, ESRI 2019b).

Cold spots were not found in the analysis conducted with 300 m bandwidth. It is, however, observed that hot spots are created, by 99% confidence interval, at the central neighbourhood of the conservation area with dense traditional buildings, and thus areas where traditional buildings are the most densely clustered can be seen (see Fig. 6a).

In Gi* statistic, Z score is calculated for any object in the data set. A high Z score and small p value indicate significant spatial clustering of high values. Hot spots in red colour show the areas where traditional buildings are concentrated. In addition, low negative Z score and small p value also indicate spatial clustering but of low values. Thus cold spots become visible in which case clusters of non-traditional buildings should be observed as cold spots. The higher (or lower) the Z score, the denser the clustering. A Z score close to zero means that there is no significant spatial clustering (ESRI 2019b). Since the bandwidth is 300 m on this map, buildings in neighbourhood outside the conservation area are not included in the analysis.

In case of 750 m bandwidth, the interaction of each square at a distance of 750 m is as shown in Figure 6b. Hot spots indicate the areas where traditional buildings are densely clustered. What is important here is the fact that traditional buildings are still quite dense in areas within the buffer zone of conservation site.

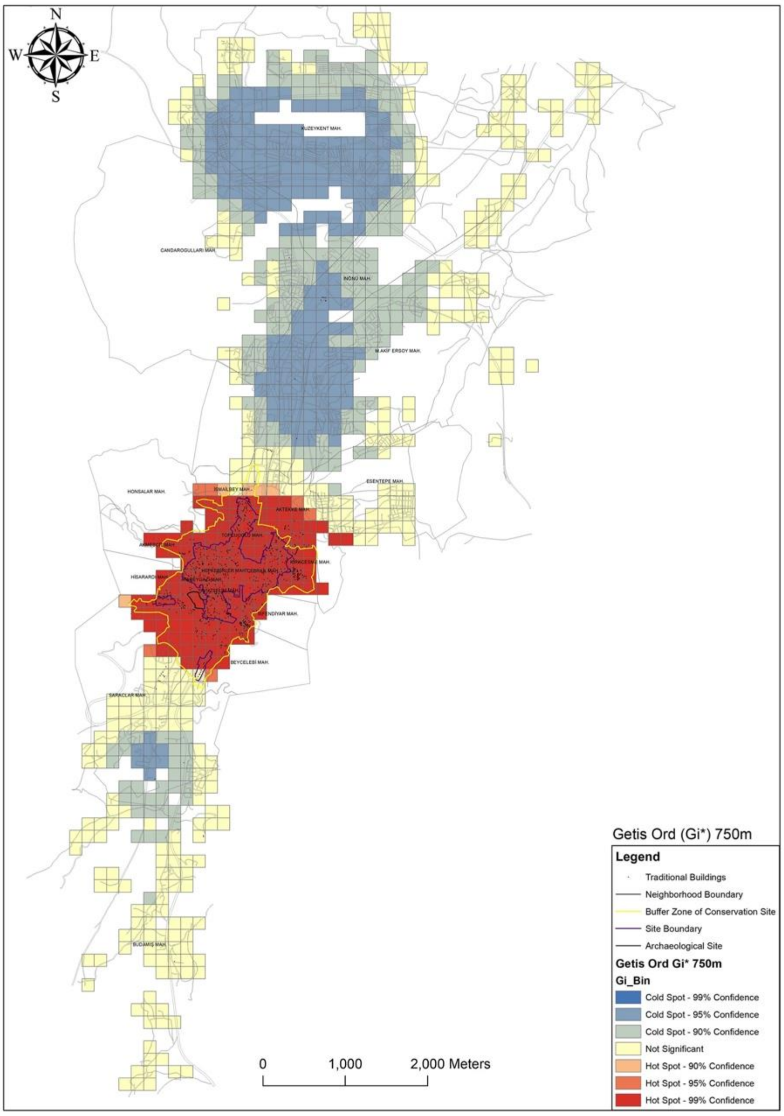

Figure 6b. Getis-Ord Gi* analysis with 750 m bandwidth

Source: the author

It is seen that the urban conservation site boundary does not limit the areas where traditional buildings are dense and the traditional buildings indicated by dots, but also concentrated outside the site boundaries (Kirkcesme, İsfendiyar, Hisarardi, Beycelebi and Saraclar neighbourhoods). Such concentrations are then found out at the buffer zone of conservation site. This analysis can be interpreted to conclude that the urban site boundaries are inconsistent with the areas where traditional buildings and registered buildings are densely located. Then it can be interpreted that it would be better to extend the urban conservation site. Because for both bandwidths 300 m and 750 m, it is also possible to depict hot spots where traditional buildings have positive spatial autocorrelation.

According to the analysis, the dark blue refers to the areas where non-traditional buildings are heavily clustered. M. Akif Ersoy, Inonu, Candarogulları, Saraclar and Kuzeykent neighbourhoods have a highly clustered zones with modern buildings. Since the modern buildings are not dense enough in the neighbourhood located in the conservation area, it is seen that there is no place to be shown as a cold spot.

4.6. Use in measuring spatial segregation of traditional building with Anselin Local Moran's I statistic

Bandwidth of 300 m and 750 m was used for Anselin Local Moran's I analysis which was conducted with traditional building data through the Geographic Information System. Accordingly, spatial cluster of low values (LL) and high values (HH) indicate the significant clusters, on the other hand, outlier in which a high value is surrounded with low values (HL), and outlier in which a low value is surrounded with high values (LH) introduce the fact that contradictions were observed.

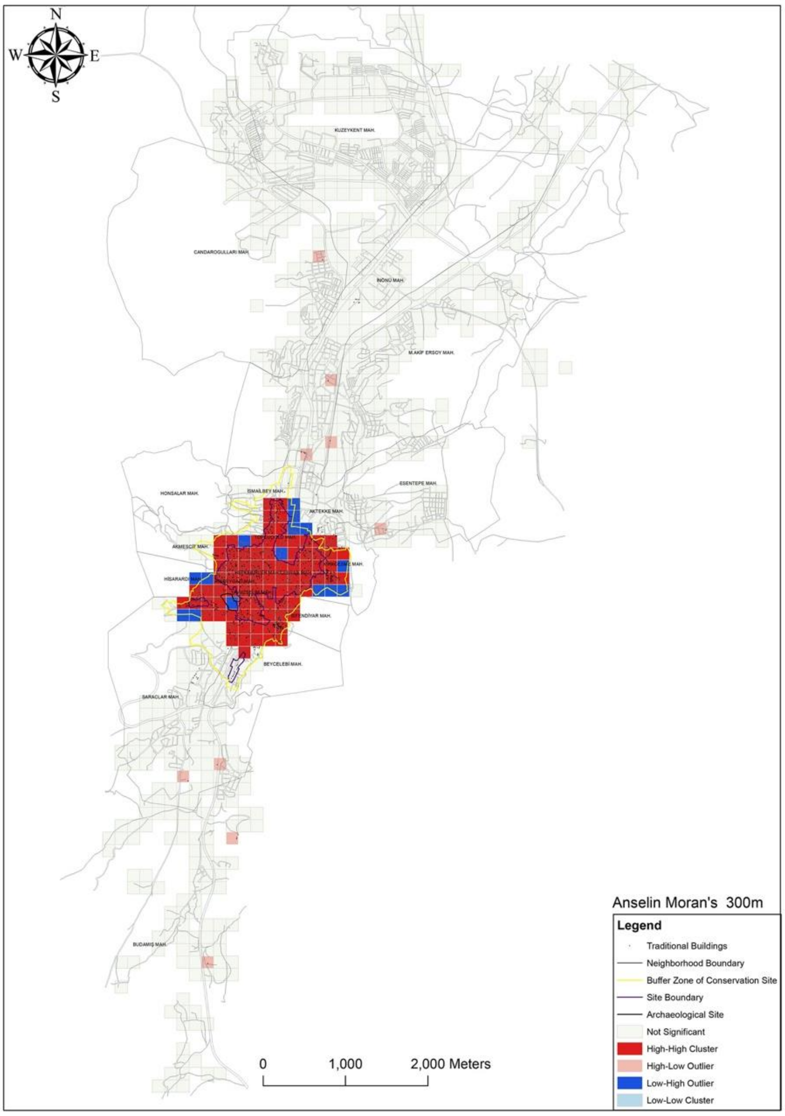

Figure 7a. Anselin local Moran's I analysis with 300 m bandwidth

Source: the author

The red colour in Figure 7a shows the areas where traditional buildings are densely clustered (High-High). As there is not any space, within the conservation area, in which high traditional buildings are surrounded with non-traditional buildings, there is not any outlier cell in which a high value is primarily surrounded with low values. The High-Low segregation (pink colour) is visible in Inonu, Saraclar, Esentepe, Ismailbey and Candarogulları neighbourhoods as few of traditional buildings are surrounded with non-traditional buildings therein, which reveals that traditional buildings are segregated among buildings with modern construction material (see Fig. 7a).

Another important finding is that there are Low-High segregation points in the areas located within the buffer zone of conservation site. The dark blue colour shows the areas which are densely surrounded by traditional buildings in the immediate vicinity but where non-traditional buildings are clustered in a manner to show contradiction. In other words, density of traditional buildings indicates the segregation of non-traditional structures in high numbers. According to this analysis, it can be said that site boundary and buffer zone of the conservation site are nearly consistent in terms of the density of traditional and registered buildings, but there are partial regions where non-traditional buildings are concentrated in the conservation area and buffer zone of conservation site.

Using the bandwidth of 750 m results in some differentiations in the map.

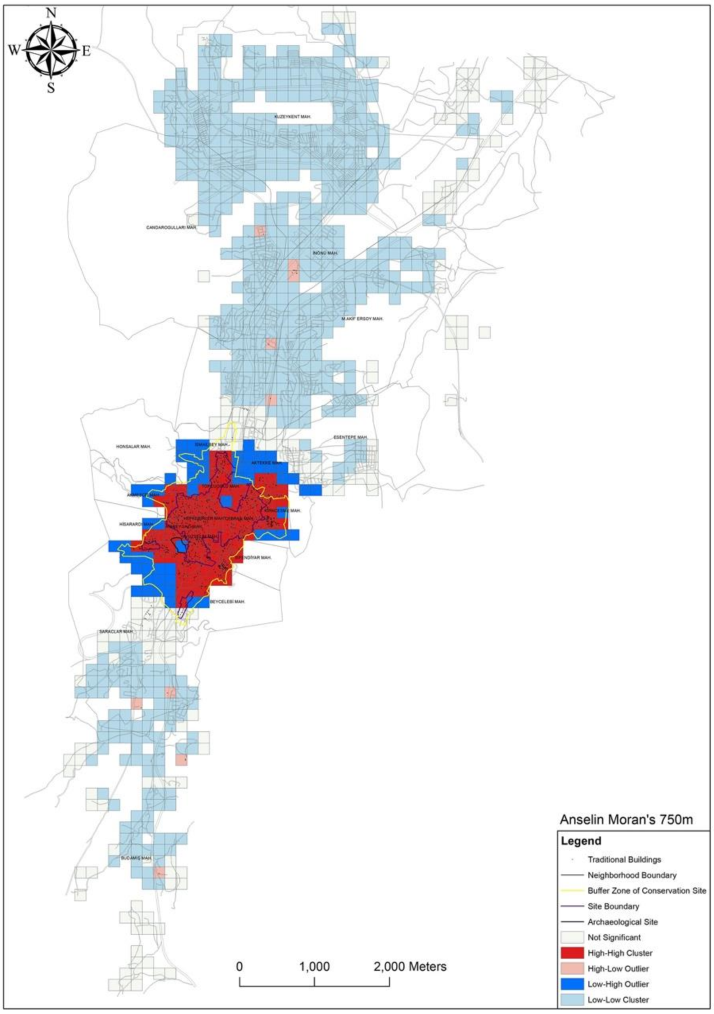

Figure 7b. Anselin Local Moran's I analysis with 750 m bandwidth

Source: the author

The light blue colour shows the areas where non-traditional buildings are densely clustered (Low-Low cluster). It is observed that traditional buildings are surrounded with even denser non-traditional buildings in Inonu, Saraclar and Candarogulları neighbourhoods, which causes segregation of the traditional buildings from the others. These include vineyards and examples of rural architecture that must be conserved. Moreover, traditional buildings (High-High) are densely clustered within the conservation area (red colour). Such spaces are available both within and outside the boundary of the conservation area. There are also rather dense traditional buildings clustered within the buffer zone of conservation site. This implies that there are inconsistencies between the site boundary and density of traditional buildings. In fact, it can be said, according to the analysis, that the boundary of the conservation area should be crossed in the red areas viewed as High-High. In addition, the Low-High dark blue areas show the segregation of the non-traditional buildings from the traditional building density, and therefore buffer zone of the conservation site should lay in these areas (see Fig. 7b).

4.7. Assessment of findings

The Location Quotient method essentially compares the relative share of a variable in a neighbourhood with its share in the city as a whole (Ataç 2015) and it is used to determine the areas where data are concentrated in a neighbourhood.

Getis-Ord Gi* is an effective method for finding hot and cold spots, that is to say, it is possible to indicate where the variable is concentrated or not concentrated. However, Anselin Local Moran's I method additionally calculates the negative autocorrelation and puts forth the statistically significant contradictions with spatial outliers, for instance in the analysis of V. İlçi (2013). Anselin Local Moran's I calculates the average with all neighbour values and deduces all neighbour values from this average. Therefore, it can be said that this method works based on the similarity with the neighbours. In other words, while calculating using Anselin Local Moran's I index, a spatial autocorrelation method, the points where the outlier variable in two categorical data is concentrated are indicated besides the variable used. Thus, negative autocorrelation is achieved, and it becomes possible to indicate the different and similar points.

When the two different analysis conducted are compared with one another;

Location Quotient (LQ) analysis shows the concentration of traditional buildings per square (Fig. 5). According to this analysis, traditional buildings are also concentrated outside the conservation area. In fact, as it can represent the segregations significantly, Anselin Local Moran's I enables us to understand whether there is consistency between the site boundaries and the density of traditional buildings Comparison with Location Quotient (LQ) analysis allows to find out whether the boundary is consistent or where it would be more suitable to cross the boundary. Moran's I analysis can be used as a kind of validation test for Location Quotient (LQ) analysis (Fig. 7a, b). Comparison of these two analysis makes it clear that the current site boundaries does not reflect exactly the urban conservation site boundary. Some of the areas (which neighborhoods in Kastamonu) with high concentration of traditional buildings are not located within the site boundaries. Getis-Ord Gi* analysis shows the concentration of positive and plus values (Fig. 6a, b). This analysis also enables us to see whether there is sharp segregation between the values.

5. Conclusions

In Kastamonu city centre, distribution of traditional structures refers to the same structural transformation experienced by many cities in Turkey. The renewal and transformation practices that particularly aim to respond to the rural-to-urban migration, development movements and the increasing infrastructure needs have become the basic processes determining the macroform of cities in Turkey. The rapid urbanisation that erupted in Turkey mainly after 1950s brought about the problem of unplanned urbanisation, which adversely affected the historical urban pattern through squatting (Keleş 1978; Tekeli, 1982). Prioritisation of the urbanisation and development during that period delayed enactment of regulations concerning conservation of historical cities, which eventually delayed practical plans and projects for urban conservation (Yucel, Zeren Gulersoy, 2006).

This process ended in decrease of the green areas as public spaces were appropriated in the cities with unplanned urbanisation, and dull reinforced concrete structures started to be constructed instead of the qualified structures reflecting architectural characteristics of a certain period (Avcı 2002). It is evident that some measures need to be taken to conserve the historical pattern during the planning stage. Therefore, the relevant areas of conservation were identified and these areas were declared as conservation sites after which planning was stopped resulting in the terms of the new conservation and development plan superseding the former plan decisions. However, it is not possible to control the misapplications during the transitory period until the new plans are prepared or the cases where gaps in the laws are exploited (Gulersoy-Zeren et. al., 2008). This brings about dilapidation in the traditional pattern and historical city centre, arising from neglect and absence of protection, the overall result of which is leaving the traditional pattern and transforming into an area of deposition (Tuncer 2014; Gunay et. al., 2015). Policies of protection applied in Turkey cannot suffice to prevent such situations because of the inadequacy of planning activities, conflict of power and cumbersome nature of planning hierarchies.

In Turkey, conservation areas are protected pursuant to the terms of the Conservation Law no 5226 (Law No. 5226, 2004). As it was planned, after a certain time, to perform restoration on the conserved historical city pattern; repair and reconstruction programmes were designed for the areas which had deteriorated and on the verge of losing their characteristics and that were proclaimed to be conservation sites by the Regional Board for Conservation of Cultural and Natural Assets. Thus, Law No. 5366 on Renovating, Conserving and Actively Using Dilapidated Historical and Cultural Immovable Assets was enacted for reconstruction and restoration of the buildings with a view to revitalising the historical pattern in line with the development of the region (Law No. 5366, 2005; Koramaz 2018). Law No. 6306 on Transforming of the Areas Those are Under Disaster Risk are applied for the dilapidated regions outside the conservation site. These two laws have completely different areas of application. The renewal law no 5366 relates to the renewal of the dilapidated historical pattern in the conservation areas whereas the transformation law no 6306 is about demolishment and reconstruction of the pattern dilapidated or non-resistant to natural disasters (Law No. 6306, 2012). Besides the renewal and transformation works, it is also essential to ensure the sustainability of the historical pattern, and conservation of the concrete and non-concrete legacy in an integrated manner. As is indicated in this study, it is highly important to identify the site boundaries for development of the relevant conservation strategies and planning decisions.

Conservation sites are identified within the framework of the Regulation on Identification and Registration of Immovable Cultural Assets to be Protected and Conservation Sites.

The Regulation stipulates in the chapter 'Evaluation criteria for identification and registration', Article 3 paragraph c that in order for an area to be identified as conservation site, 'it has to be characteristic in terms of structure, materials, construction technique and form, and make a contribution to the urban and environmental identity and pattern' (The Regulation on Identification and Registration of Immovable Cultural Assets to be Protected and Conservation Sites, 2012).

Focusing on the particular case of the study area, Kastamonu, it is critically important to protect the conservation site in Kastamonu where the historical city center is spread across a very large area. As a matter of fact, Kastamonu was included among the cities for which the very first conservation plans were prepared, and conservation activities have been conducted there since 1979 (Kastamonu Municipality 2011). Conservation and restoration of the historical city centre was an important concern especially between 1997 and 2003 and thereafter (Yeter 2002).

All these processes enabled examination and identification of the conservation site through 'material, construction technique and form characteristics' in order to find out whether the current conservation site boundaries reflect the historical pattern. In this regard, it is aimed to establish existence of segregation or similarity between the traditional pattern and the areas of reinforced concrete structures, and understand, by comparing the established pattern with the current site boundaries, whether the latter represents the traditional pattern.

This study conducts a method test, making use of different methods for 'spatial analysis of the spatial distribution of the buildings with traditional construction system' in Kastamonu. To do so, segregation indexes were applied over the building construction systems. As a result, the neighbourhood where traditional buildings are concentrated and which neighbourhood look similar in terms of density of traditional buildings were indicated. Furthermore, spatial autocorrelation, in other words, interaction with neighbours was set making use of the Getis-Ord Gi* and Anselin Local

Moran's I methods. Getis-Ord Gi* analysis showed the areas where the buildings were clustered according to construction systems, and Anselin Local Moran's I method revealed the segregated and similar areas. In terms of construction systems, the neighbourhood with concentration of mud brick and stone masonry buildings were identified. Compared with the conservation site boundaries, it is observed that the boundaries do not cover exactly the similar dense areas of traditional buildings. However, it is seen that these structures fall within the boundaries of the buffer zone of conservation area. As a result of these analyses, it is necessary to re-evaluate the boundaries of the buffer zone of conservation area and perhaps to extend the site boundary.

There are plans to conduct a survey to obtain more clear results about the differentiated structure. Dimensions of segregation can be investigated over different variables in the future studies. Thus, it will be possible to analyse whether there is consistency between administrative borders of the neighbourhood and socio-economic structure of the city, and whether neighbourhoods located within the conservation site boundaries are segregated from one another in terms of social and cultural aspects, living conditions, education, accessibility and economics. Similarly, the structural pattern of the neighbourhood within the urban conservation area will be determined, and whether the current condition of the site boundaries is consistent with the structural condition of the historical city centre will be established.

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