Bagh- e Nazar, 16 (70):19-34 /Apr. 2019
DOI: 10.22034/bagh.2019.84924

Persian translation of this paper entitled:
شناسایی مراکز شهری با استفاده از فعالیت‌ها و عملکردهای شهری
(نمونهٔ پژوهشی مراکز شهری کلان‌شهر تبریز)
is also published in this issue of journal.

The Impact of Urban Centers on the Urban Structure Transformation in Tabriz Metropolis*

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Received 2018/02/21 revised 2018/06/24 accepted 2018/07/30 available online 2019/03/21

Abstract

Problem statement: Urban population rapid growth and driving forces have led to the rapid urban transformation, which transforms the form and structure of cities, in the continuous process. Always the urban transformation has adverse effects, especially when it is happening without any plans, which this makes the urban structure of metropolis unbalanced.

One of the major transformations that have taken place in the structure of Tabriz metropolis is the increase of new urban centers with new functional roles and increasing density in certain parts of this metropolis. The result of this transformation is the unbalanced spatial development in the urban structure of Tabriz. This paper is an attempt to answer this question : How does the spatial distribution of urban centers in Tabriz Metropolis affect the spatial balance or spatial imbalance of the urban structure of this metropolis? Before answering the previous question, it is asked how urban centers are identified and analyzed?

Research Objectives: The main purpose of this research is to investigate the impact of new urban centers on the spatial transformation of Tabriz metropolis urban structure during the recent decades, another purpose of this paper is to provide a scientific method for identifying urban centers.

Research method: This research is a theoritical- practical and applied research. Data were gathered through surveying and docments for the descriptive-analytical method and GIS is used to describe and analyze data and maps.

Conclusion: The results of the research show that the transformation and new urban centers, as well as urban transformation and its structural reaction, have been shaped by the dialectical relationship between urban structure and driving forces (structure and agency).It also became clear that the spaces of action and power (urban structure and urban spaces) have beencreated by factors of action and power (capital and rent), in which the share of the state sector and financial institutions and shopping centers in the transformation of the urban structure have been significant. The urban structure of Tabriz metropolis has seen many transformations in its structure over the past decades, the transformation in its structure has often occurred in the eastern and northeastern parts of the metropolis, including the formation of three new urban centers (1-Abrasan 2-Valiasr 3-Baghmīşhe-Shahid-e-Fahmideh) in these areas. The geographical and spatial distribution of urban centers has unbalanced the structure of the Tabriz metropolis, which should be considered in future urban development plans.

Keywords: *Spatial balance, Spatial transformation, Urban centers, Polycentric, structure,Tabriz metropolis.*

*. This paper is part of Hassan Vahdani charzekhon's Ph.D. thesis entitled "The Impact of Urban Centers on the Urban Structure Transformation in Tabriz Metropolis" conducted under the supervision of Dr. Behnaz Aminzadeh and advisement of Dr.Hamid Reza Parsi at Tehran University.

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Introduction and problem statement

Many factors have contributed to the transformation of human settlements, such as population growth, mass production of goods, the formation of social and civil institutions, technological expertise, the industrial plant system, the effects of the use of public transportation vehicles (Morris, 1979), development plans, natural and historical crisis, state systems, globalization and political economy, which have led to the expansion of urban areas with polycentric form in many cities (Rode, Floater, Thomopoulos, Docherty, Schwinger, Mahendra, and Fang, 2014) and Some scholars also argue that over the past century and a half, new transportation technologies and new technologies have expanded many cities from their historical cores (Buliung, 2011) and new urban areas have been created.

The thinkers of urban structure believe that urban populations and other driving forces have led to a rapid urban transformation, which in turn transforms the city into a continuous process. In general, the process of urban development includes three periods: the first period: urban expansions which occurred outside of the metropolitan area; the second period: the expansions that took place within the urban area; the third phase: the expansion of the city in continuity with the main city and the subsequent expansion of the old cities and new cities (Merlin, 2000: 235)

In the urban structure transformation, several structural elements are involved, one of which is the transforming urban centers by transforming this element, urban structure is transformed, the structure of the primary cities is very simple, and even before the twentieth century, traditional cities generally had traditional, organic and monocentric forms; transformations and developments in the urban structure and spatial organization have taken place in the twentieth century, but qualitative changes have occurred in the urban structure of metropolis in recent decades (Anas, Arnott & Small, 1998: 38; Clark, 2008: 150).

The polycentric urban structure of metropolises has been shaped by a decentralized urban process, which has transformed their structure in two old and the new part and can be identified as emerging new urban structure (Hall & Pain, 2006). The polycentric structure can be kind of from the "flow of space" (Castells, 1996), in which the physical regions are separated and merged with a dense stream of individuals, information and products. According to Hall and Pain (2006), the emergence of urban polycentric urban structure forms, depends on economic and social changes, and is largely dependent on personal transportation system. Urban development and transformation have always been a problem, especially when rapid urban development is associated with population growth and GDP (Roubini, 2011: 14); Tabriz, as a metropolis, is no exception to this matter, and it is transforming day to day towards polycentric and decentralization of space.

The emergence of polycentric urban structure forms depends on economic and social changes and is largely dependent on personal transportation system. The results of the rapid development of Tabriz Metropolis, which has transformed the urban structure, include expansion of unplanned urban centers, arising towers and skyscrapers, supermarkets and megastructures, the sharp polarization of neighborhoods, large size and large-scale land uses in special parts of this metropolis. Considering that the metropolis structure is undergoing a transformation due to the reasons mentioned above, and this transformation has caused some problems, understanding the urban structure and its elements requires inclusive and exclusive studies. These studies can be effective in the model building of urban future development and transformation patterns and this research is a step in this direction.

Research Questions

1. How does the spatial distribution of urban centers in Tabriz Metropolis affect the spatial balance or spatial imbalance of the urban structure of this metropolis?
2. How are urban centers identified and analyzed?

The answer to the research questions provides a systematic framework for identifying urban centers in Iranian metropolises and assessing their urban structure.

Literature review

Pertinent studies on the urban structure and urban centers show the course of this movement over recent decades. Urban planners such as Alan Berthaud, Albert Speer and Reibsamen, Rossi, Charles C. Bohl, Christopher Alexander have looked for a way to develop and adaptive planning with human spirit in order to improve the quality of life and design a dynamic environment with social interactions (Luchinger, 1981), some recent related research are below:

In their research entitled " Polycentric urban structure and housing price in transitional China: Evidence from Hangzhou", (Wen&Tao,2015) have concluded that simultaneous with rapid urbanization, urban structure has undergone a major transformation in China, and urban structure in its cities such as Shanghai, Beijing, and Guangzhou have changed from monocentric to polycentric form. Erick Guerra (2014), in his research on "The built environment and car use in Mexico City," suggests that land-use planning has an effective role in reducing car travels in Mexico City. In another study by Manuel Suárez (2012) entitled "Is Mexico City polycentric? " It looks at whether Mexico City is a polycentric metropolis; the results show that Mexico City is a hybrid city, but it still has a monocentric urban structure.

In a study entitled "Functional polycentricity: examining metropolitan spatial structure through the connectivity of urban sub-centers", Vasanen (2012) states that transformation from monocentric cities to polycentric cities are expanding. In this paper, a new method for measuring the polycentric application has been presented, which several functional polycentric has been formed by connecting the sub-centers to the urban system.

Another study entitled, "City Shape and the Fractality of Street Patterns" by Mohajeri (Mohajeri et al., 2012) have addressed the impact of the environment on the formation of the city's form and communication networks. Batty, et al. (2011) have calculated the trip attraction rate of each urban cell by using the density and entropy method and have identified urban centers in Singapore, with an emphasis on both important factors of diversity and density of functions. Lee Bie (2007) in his article entitled "Edge" or "edgeless" cities? showed the spatial structure of the United States metropolitan areas from 1980 to 2000. The results of this research have shown the structure of metropolis of Portland, Philadelphia, Los Angeles, San Francisco, New York and Boston, with their differences and similarities.

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Horner (2004), in a study entitled "Exploring metropolitan accessibility and urban structure," show that residential accessibility patterns are similar across urban, taking a monocentric form where the central urban area is most attractive. However, employment accessibility varies more from urban to urban; moreover, the areas of highest employment accessibility tend to be decentralized within their respective regions (Horner, 2004). Bertaud, in his two studies, entitled "Metropolis: A Measure of the Spatial Organization of 7 Large Cities (2001)" and "The spatial structure of cities : international example of the interaction of, government, topography, and markets (2003)" has conducted researches on the spatial structure of the urbans and Metropolises.

Dowall & Treffeisen (1991) in a study entitled "Spatial transformation in cities of the developing world" describes how the city of Bugatta has transformed from monocentric to polycentric urban structure. Hillier and Hanson (1984) have conducted a joint study about the analysis of space properties in the urban structure using the space syntax method. Harris and Ullman mentioned that small towns have only one center and today's large cities often

have several centers based on the Multiple nuclei model (Harris & Ullman, 1945) and the formation of these centers within cities can be made possible by transportation routes. According to this pattern, centers located at the intersection of the main city routes have access to the majority of the city's population. Industrial areas, recreational facilities, schools, universities, and cemeteries attract the population, that has created a new urban center.

The evolution of investigation in urban structure transformation shows that it has been transformed from monocentric form to polycentric form and often the formation of new urban centers has taken place on the basis of the role of social, economic and communication functions; but in previous studies, this issue has not been addressed . Therefore, this study is an attempt to identify urban centers using a suitable method has been transformed from a centralized single central shape.

Theoretical Framework

Centrality is an important concept in urban studies, which involves behavioral tendency to concentrate and attendance in the central regions (Latham, McCormack, McNamara & McNeill, 2008). This concept has been dealt with by two approaches: the subjective approach and the objective approach (Yaotian & Ying, 2018: 136). The subjective approach is mainly based on the psychological knowledge of the inhabitants about the urban center, in which the center is the most pivotal and fundamental part of an urban, or it is a definite activity hub such as a day care center, a shopping center or a medical center (Merriam-webster, 2018). But in an objective approach, data (e.g. population density, building density etc)extracted from the city is used. In recent decades, metropolises have experienced a variety of development and have become increasingly and continuously transformed from a centralized form into a polycentric form, and urban centers as one of the main elements in the structure of the urban, in many ways, are different from other areas in the urban, This decentralized phenomenon is gradually emerging around the world.

Greene (1977) states three possible scenarios lead to the structure of a polycentric urban (Salahi Moghadam, Soltani & Parolin, 2017). The first scenario shows that industries and manufacturers outside of the (CBD) are creating a center and are interested -in having access to import and export nodes . In the second scenario, the formation of sub-centers in the suburbs begins by middle-income and high-income households, and then regional market enterprises, in particular shopping and employment centers, are formed around it. The third scenario involves the expansion of an urban area that overcomes smaller cities around it and they fall inside the metropolitan area or urban area, which are referred to below as examples.

Polycentric urban are visible in vast areas in Asia, in which there is a rapid economic growth and development, such as China, whose metropolitan areas are emerging through the country (Wu, 1998- Xueqiang & Si-ming, 1990- Yue, Liu & Fan, 2010). In Europe, the polycentric transformation is notable in many regions, Hall and Pain confirmed this claim by examining and comparing the eight regions of the southeast of England, Rheinstedt (Holland), central Belgium, Rhine and Ruhr, the main Rhine, the European Metropolitan Region (EMR) The northern Switzerland, the Paris region and the big Dublin area (Hall & Pain, 2006).

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The polycentricity can be the result of planning or self-organizing, some poly center cities like Singapore, (Field, 1999) or Shanghai are planned before (Ziegler, 2005), and some of them, like the great Jakarta region, is gradually formed by changing the program at various historical stages (Hudalah and Firman, 2012), and other, like Guangzhou and Shenzhen, have been developed as a result of

specific urban policies (Fulong, 1998) and another group, such as London and many other European cities, have been shaped by planning from the top to bottom as well as self-organized (Hall & Pain, 2006). Identification of urban centers is one of the issues that always has been the subject of many urban planners; Speck (2012) believes that in the identification method based on objective measurement, an urban center is a place in which people have social, economic, political and cultural life, so it can be defined from three perspectives: population, activity and physical characteristics (Speck, 2012 and Yaotian & Ying, 2018). The characteristics of the 65 urban centers in the United States are described by the above indicators (Malizia & Song, 2015). Some thinkers consider shopping centers as a center in the city (Gregory, Johnston, Pratt & Whatmore, 2011) and others believe that the Central Business District (CBD) is an urban center, which offers goods and services to the surrounding area as an example of centrality (Latham, et al., 2008) and some authors believe that the city has a central business center (CBD), regional center, city center and neighborhood center, which, according to Filion and Bunting, ranked retail outlets in the city (Filion & Bunting, 1991), also, the urban centers and its range are of great importance in terms of scale, morphology, activity, and vitality. Yang uses the Murphy Index to Identify the urban centers (CBDs) and sets the areas with the highest public service index as the urban center area in China (Yang & Shi, 2014).

The activities that turn the city into a center are as follows: 1. Bank 2. Branche of important chain stores 3. High school 4. Hospitals 5. Cinemas 6. Weekly newspapers. Centers have different meanings in terms of their population and function due to the range of activities that offer .Therefore, higher-level centers provide more specialized functions and for this reason, they can be identified with a larger functional area and the sphere of influence that attracts their population and the importance of cities and centers in the system of “central place theory” is generally based on the density and diversity of activities and population; therefore, due to the theoretical basis and research background, the structure of polycentric urban and urban centers can be examined based on two complementary indicators: morphological index and functional index (EPSON, 2004, Green, 2007, Goei De, et al, 2010; Davoudi, 2003; Meijers & Burger, 2010), and each of which has variables.

Table 1 shows the indicators and variables for measuring the transformation and identification of urban centers. In this paper, the according to Fig. 2 and Table 1, the indicators and variables required to identify and analyze the transformation of urban centers in Metropolis of Tabriz are shown.

According detailed above, the transformation in the structure of the urban takes place in two ways: one is the transformation through top-down coding programs, and the other is the natural transformation that is driven by forces. Transformation in the first case can be controlled and supervised while in the second case it can not. Most of the transformations in the structure of the urban and the resulting issues are due to the second state, Figure 1 shows the cycle of the creation or transformation of urban centers in metropolitan areas, also according to the basic principles of the central place theory (CPT) and definitions of urban centers, two important issues are identified in the identification of urban centers: one is the density of goods and services where residents are attracted there, and the other is the variety of activities and functions that as a result, the functional diversity of urban land use is obtained; in other words, in the urban, the center is a space and place, which has at least two features of density and diversity.

Research Methodology

This research is is a theoritical- practical and applied research. Data were gathered through surveying and docments for the descriptive-analytical method and GIS is used to describe and analyze data and maps. In this paper, the research area is Tabriz metropolis centers with urban and intra-urban functional scales, which attempts to investigate the features of the

Table 1. Indicators and variables for assessing the transformation and identification of urban centers. Source: authors.

Indicator	**functional**					**morphological**			
Variable	Functional scale	Population	Functional diversity	Functional role	Communication	Connectivity	Position	Size	Building density

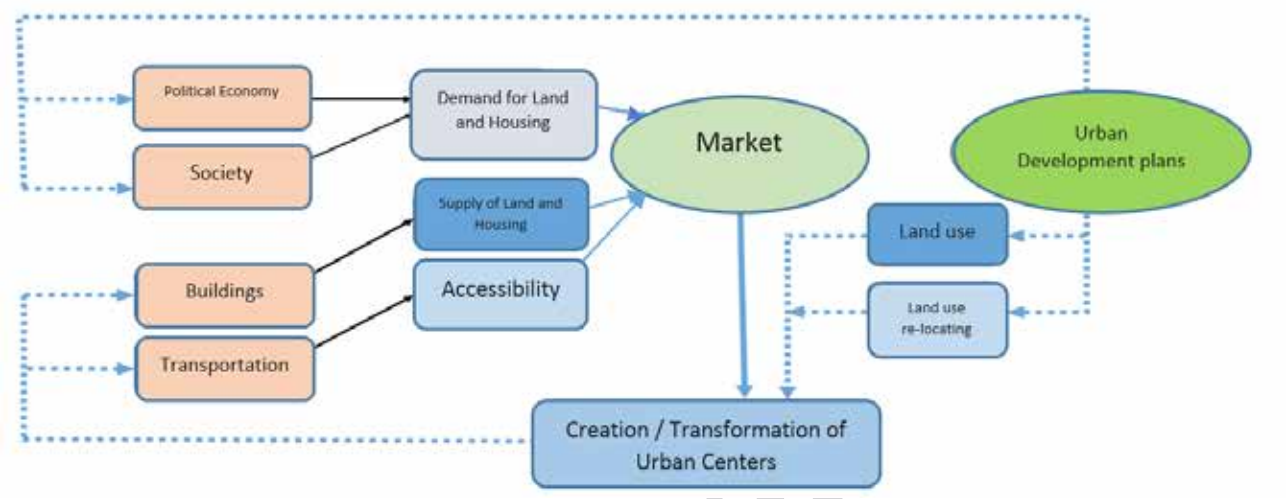

Fig. 1. The cycle of creation or transformation of urban centers in metropolises. Source: authors.

urban centers exclusively and their transformation and impacts on the structure of this metropolis inclusively. This is an interpretative research and it dose not intend to test a hypothesis, and its main objective is to answer the research questions and optimization the method of identifying urban centers. Despite the importance of urban centers in the structure of urban, they have not been systematically studied. One of the major problems of urban centers is the data gathering and the accuracy of them. However, despite the lack of extensive studies, in the past decades, researchers in Iran and other countries have carried out different studies on the methodology of identifying urban centers. In most studies, especially in China, metropolis centers have been investigated by using Big Data (Long and Shen, 2015), and in some cases, they have done by Open Data, which is not possible in Iranian metropolises for various reasons.

Therefore, it is necessary to use an appropriate method to identify urban centers according to their conditions. The model of Batty et al. (2011) has been used in this research, which emphasizes two important factors of diversity and density. Each of them has advantages and disadvantages, which seems to be a better result of their integration, in addition, in the mentioned studies, diversity is considered for different land-uses. But the density was considered merely for the trip attraction and it merely worked trips in the study of Batty, et al. (2011). This problem is considered as a scientific gap in the field of urban structure and urban centers studies, to overcome this scientific gap the model of Batty et al. has been optimized and the ability of any land use and activity has been used to measure the travel attraction during peak hours which has several advantages:

1. All trips are considered and merely work trips are not considered;
2. The fairly detailed information is derived from the amount of travel attraction for each land use and activity,

in which case no advanced equipment is required;
3. This method can assess the impact of activities on transforming a location into an urban center.

This article attempts to identify and measure the extent of transformation and the formation of urban centers and the general transformation of the city in terms of centrality, as well as the geographical distribution of urban centers in Tabriz metropolis, in order to determine the extent of anomalies in the development and expansion of urban centers to be recognized. Fig. 2 shows the identification process of urban centers. Based on the subject and purpose of the paper, the measurement method of urban centers includes:

- **Calculate the density**

Density is a term that shows the relationship between a certain area and the number of people who are in or out of the area. (Forsyth et al., 2003: 679; Forsyth et al., 2007: 997).Density can be defined as a measurement system that can mathematically and simply calculate the number of people at a given level of land as a population density or the amount of infrastructure located at a certain level of land as a building density. (Seifolddini, 1999: 125 and Azizi, 2004: 21). Density has dimensions related to each other and measures the magnitude and intensity of focused human activities in a spatial unit (Cervero & Kockelman ,1997 - Hess , Vernez Moudon & Logsdon 2001).

Density is measured by the number of trips attracted at a specified level unit at a certain time, and the level and point that has the greatest potential for trip attraction are defined as a center, which is calculated by a trip attraction equation. However, using the number of trips that have been attracted to the city centers, it is possible to determine the place of the attraction of the highest number of trips, or the density and accumulation of trips, which is obtained by using the density equation.

- **Diversity calculation**

Measuring diversity is used to find out how different types of activities mix together (Ibid). An entropy method is used to identify urban centers within certain limits and analyzes and quantifies the transformations over a period of time.

Ranking the Centers

For ranking the centers, absolute values are converted and normalized, the easiest way to do this is to compare the rank of each center with the maximum score earned, which is the highest rank or most entropy at close proximity to 1. Using the rating method, the characteristics of all urban centers were compared and evaluated.

- **Integration of Density and Diversity**

Density and diversity are two complementary indicators that refer to the spatial distribution of activities, where any place has the greatest centrality indicator; therefore, it is indicative of its centrality and vice versa. To integrate two components of density and diversity, they must be converted into a function. Table 2 shows the density and diversity, ranking and Integration of the density and diversity of activities in urban centers.

Introducing the Case Study

The metropolis of Tabriz is the center of East Azarbaijan province, and it is located in the geographical coordinates of 46 degrees and 18 minutes east and 38 degrees 4 minutes north latitude from the Greenwich meridian. This metropolis is surrounded by the Aoun bin Ali mountains from the north and east and by the Sahand mountains from the south and it is limited from the west with a gentle slope to the Urmia Lake and has an area of about 33037.8 hectares.

Tabriz has experienced different demographic changes that can be considered as one of the driving forces behind the development and transformation of the structure of metropolis. Table 3 shows the demographic changes from 1956 to 2016.

In the master plan of Tabriz in 1970, it with an approximate area of 2310 hectares, was integrated into planning. In 1980 according to the detailed plan of Tabriz, this urban with an approximate area of 3866 hectares was divided into 12 urban districts

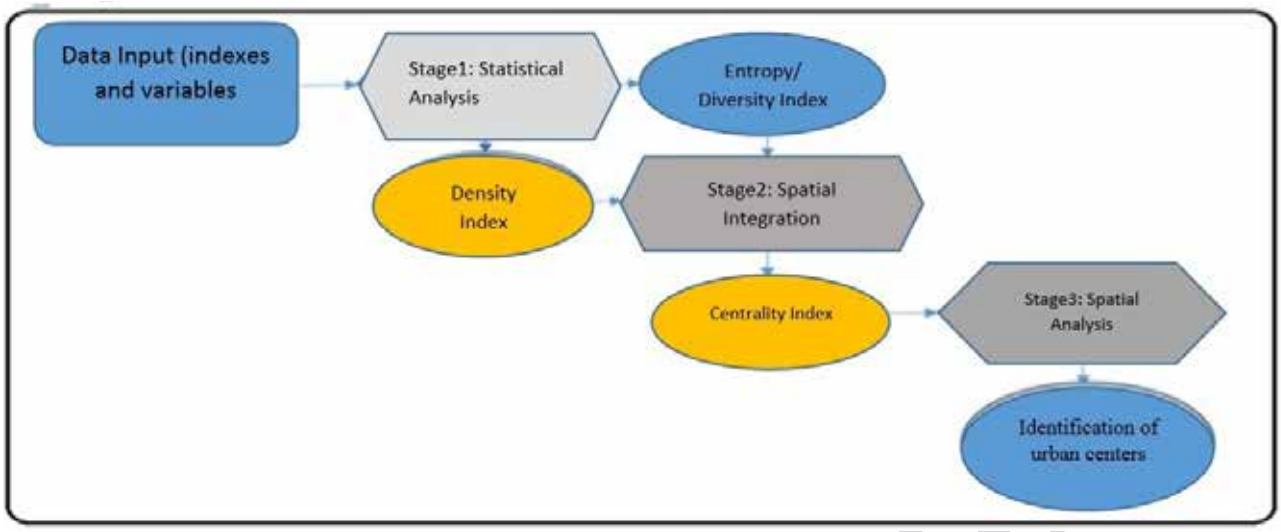

Fig. 2. The identification process of urban centers. Source: authors.

Table 2. Calculation the density and diversity, ranking and integration of density and diversity of activities in urban centers. Source: Markaz- e amar-e Iran, 1996; 2006; 2011; 2016.

$D(x-1,y+1)$ $D(x,y+1)$ $D(x+1,y+1)$ $D(x-1,y)$ $D(x,y)$ $D(x+1,y)$ $D(x-1,y-1)$ $D(x,y-1)$ $D(x+1,y-1)$	$E(x-1,y+1)$ $E(x,y+1)$ $E(x+1,y+1)$ $E(x-1,y)$ $E(x,y)$ $E(x+1,y)$ $E(x-1,y-1)$ $E(x,y-1)$ $E(x+1,y-1)$	Calculation the drnsity and diversity
$R_D(x-1,y+1)$ $R_D(x,y+1)$ $R_D(x+1,y+1)$ $R_D(x-1,y)$ $R_D(x,y)$ $R_D(x+1,y)$ $R_D(x-1,y-1)$ $R_D(x,y-1)$ $R_D(x+1,y-1)$	$R_E(x-1,y+1)$ $R_E(x,y+1)$ $R_E(x+1,y+1)$ $R_E(x-1,y)$ $R_E(x,y)$ $R_E(x+1,y)$ $R_E(x-1,y-1)$ $R_E(x,y-1)$ $R_E(x+1,y-1)$	Ranking
$R_D(x-1,y+1)$ $R_D(x,y+1)$ $R_D(x+1,y+1)$ $R_D(x-1,y)$ $R_D(x,y)$ $R_D(x+1,y)$ $R_D(x-1,y-1)$ $R_D(x,y-1)$ $R_D(x+1,y-1)$ $C(x,y) = R_D(x,y) * R_E(x,y)$ $R_E(x-1,y+1)$ $R_E(x,y+1)$ $R_E(x+1,y+1)$ $R_E(x-1,y)$ $R_E(x,y)$ $R_E(x+1,y)$ $R_E(x-1,y-1)$ $R_E(x,y-1)$ $R_E(x+1,y-1)$ $C(x,y)$		Integration of density and diversity

(Marjan Consulting Engineers, 1359: 185).During the preparation of the development plan, between the years of 1371-1374, the city was divided into four urban regions based on two horizontal axes (Imam

Table 3. Population Changes in Metropolis of Tabriz from 1956 to 2016. Source: Statistics Center, Population and Housing Census, 1956-1966-1976-1986-1996-2006-2011 and 2016.

Population / Regions	1956	1966	1976	1986	1996	2006	2011	2016
Region1						314071	212206	218647
Region2						280261	169047	196507
Region3						327799	243400	229474
Region4						301561	316126	315138
Region5						65092	92274	126124
Region6						24627	94897	98910
Region7						48454	143460	155872
Region8						17070	28700	29384
Region9						-	324	634
Region10						-	187958	194564
Tabriz metropolis	289996	403413	597976	971482	1191043	1378935	1494998	1558693

Khomeini street) and vertical axis Sharyati street) (Arseh Engineers Consulting, 1995: Vol. 18.1).

In the Development Plan of Tabriz in 1995, this urban had 14,000 hectares and it was divided into 9 urban regions, each region was divided into 3 - 5 zones and each zone was divided into neighborhoods with 10,000 persons (Ibid., 50-51). In 2016, the area of the metropolis of Tabriz increased to 33037.8 hectares.Currently, this metropolis was divided into 10 urban regions. In recent years, Tabriz has a big transformation in the rate of construction, which is one of the factors that have transformed the structure of urban in the last decade. Table 4 shows the quantity and the area of the issued construction permits from 2010 to 2015 in Tabriz Metropolis (Table 4).

Research findings

- **Identification of urban centers**

One of the main objectives of this paper is to identify urban centers based on a scientific method that responds to the need of the urban planning profession for preparing urban development plans and fill this scientific gap; with regard to the identification process of urban centers as shown in Fig. 1, the urban centers of Tabriz metropolis were identified based on two main characteristics of the functional density and functional diversity and usage of these two important features simultaneously. In this paper, urban centers refer to the areas where the functional scale of the centers is urban and inter- urban scale and have two important features of density and diversity of activities simultaneously, accordingly, in order to identify the urban centers of the Tabriz metropolis, first, the areas of activity, function and major land use in the urban and intera urban scale were identified through the land use system (LBCS). Then, the quations of trip attraction, density and diversity, their integration and location and weight of each of them were specified by using the Fishnet method in the GIS (ArcGIS), (maps 1 and 2).Finally, by using the method of Kriging and Hotspot, urban centers boundaries in four main centers of the Tabriz metropolis were identified as follows: 1- The traditional Bazaar district 2- Abrasan and Tabriz University 3- Valiasr 4-Baghmishe and Shahid Fahmideh. Map 3 shows the location of the main urban centers in Tabriz metropolis.

- **Spatial distribution of urban centers and spatial transformations of urban structure of Tabriz metropolis**

According to the results, urban centers identified in

Table 4. The number and area of construction permits from 2010- 2015 in Tabriz metropolis. Source: Statistics of the Metropolitan Municipality of Tabriz from 2010-2011-2012-2013-2014 and 2015.

Issued primets / Regions	2010		2011		2012		2013		2014		2015	
	Number	Area (m²)	Number	Area (m²)	Number	Area (m²)	Number	Area (m²)	Number	Area (m²)	Number	Area (m²)
Region1	۲۲۱	۲۱۴۴۵۰	۴۴۸	۴۱۰۷۶۲	۵۱۶	۴۹۹۲۲۶	۴۹۶	۵۱۶۸۲۲	۲۹۲	۴۲۶۱۸۲	۲۵۰	۲۹۴۲۲۷
Region2	۵۲۵	۵۲۶۹۷۵	۶۴۹	۶۸۶۸۰۳	۸۵۶	۸۲۱۵۸۴	۷۴۹	۸۶۱۲۴۲	۵۵۲	۷۶۲۱۴۹	۴۲۷	۸۱۱۶۸۴
Region3	۴۸۶	۲۱۵۹۰۸	۶۲۹	۴۰۲۸۶۲	۷۲۴	۶۹۴۱۲۶	۷۲۲	۵۱۲۶۸۲	۵۰۰	۲۶۹۰۸۱	۲۵۸	۲۴۵۱۷۶
Region4	۱۰۴۹	۵۲۵۴۸۰	۱۰۶۷	۶۲۷۸۶۲	۱۱۰۷	۶۲۴۲۲۶	۹۴۷	۵۶۰۶۸۵	۲۵۰	۲۸۵۶۰۸	۵۵۲	۷۱۸۲۰۸
Region5	۵۲۸	۵۶۲۲۱۰	۶۰۹	۶۲۱۷۴۲	۷۲۶	۱۰۱۷۷۰۶	۷۲۵	۸۷۰۰۹۱	۵۵۰	۹۶۵۸۴۱	۲۲۲	۲۶۷۲۵۲
Region6	۲۵۲	۲۲۹۴۱۲	۲۶۸	۲۵۷۱۹۹	۲۱۷	۱۵۵۸۶۰	۲۷۶	۲۵۸۷۷۲	۲۹۹	۲۹۴۰۹۲	۲۵۶	۱۶۵۱۸۵
Region7	۲۷۲	۲۷۹۲۱۷	۲۶۶	۲۲۹۲۸۵	۲۹۲	۱۷۱۵۸۶	۲۷۰	۲۲۵۲۴۴	۲۰۶	۱۹۹۹۵۶	۲۱۶	۱۶۹۲۲۷
Region8	۱۱۰	۱۰۶۴۸۰	۱۲۲	۱۲۵۸۲۲	۱۲۲	۱۲۶۹۲۷	۱۲۴	۱۵۰۶۲۷	۱۲۶	۱۱۶۵۵۲	۷۵	۶۴۵۲۵
Region9	۸	۸۹۲۹	۲۲	۲۰۶۵۷	۱۹	۲۰۶۹۲	۲۸	۶۶۹۷۸	۲۲	۱۲۲۰۲۲	۱۸	۹۲۴۱۱
Region10	۲۵۱	۱۸۲۵۷۲	۲۲۹	۱۶۹۵۱۹	۲۲۴	۱۹۹۶۸۹	۲۵۷	۲۲۵۷۵۹	۲۷۴	۱۸۶۱۲۵	۲۵۱	۱۶۰۱۴۵
Tabriz metropolis	۴۰۲۲	۳۰۶۲۷۴۵	۴۵۱۹	۳۶۷۲۶۲۶	۴۹۲۶	۴۱۵۱۷۵۲	۴۶۹۴	۴۲۵۹۸۲۲	۲۲۸۲	۲۷۴۸۶۱۹	۲۸۲۵	۲۱۶۸۰۴۱

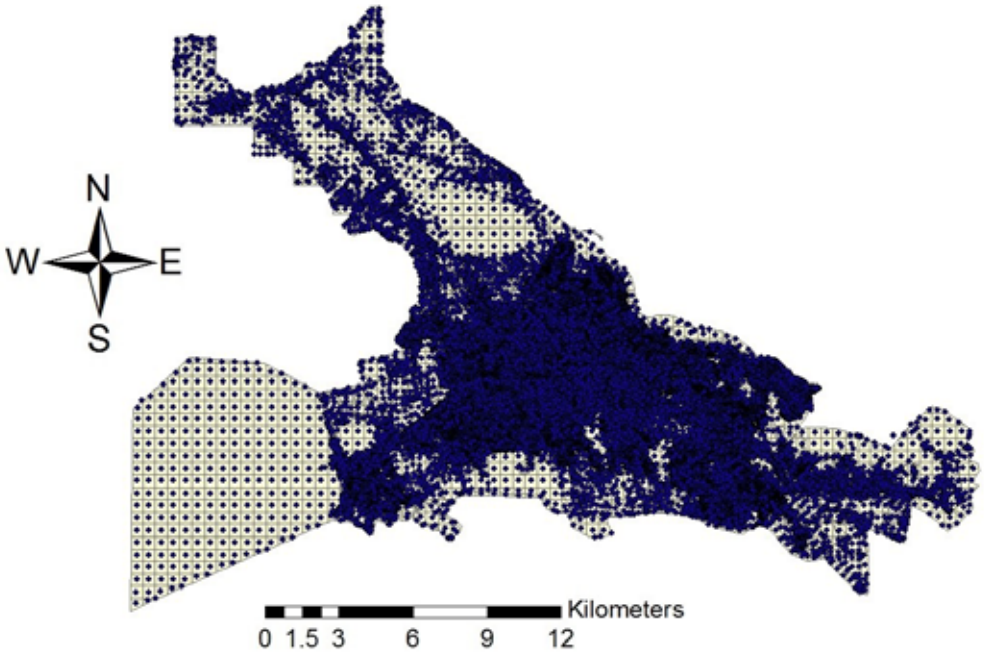

Fig. 3. The distribution of activities and functions in Tabriz metropolis. Source: authors.

Tabriz metropolis are multifunctional based on the division of social labor -and not monofunctional- then they are shaped by the influence of economic and geographic factors, and the urban structure is continuously developing to the eastern and northeastern regions and these centers have mutual interactions. This study show that the urban structure of Tabriz has expanded to the eastern and northeast suburbs. Its reasons refer to large lands where located in mentioned areas with out any administrative and legal barriers compared to the central fabric of this metropolis, which is attractive to investors for

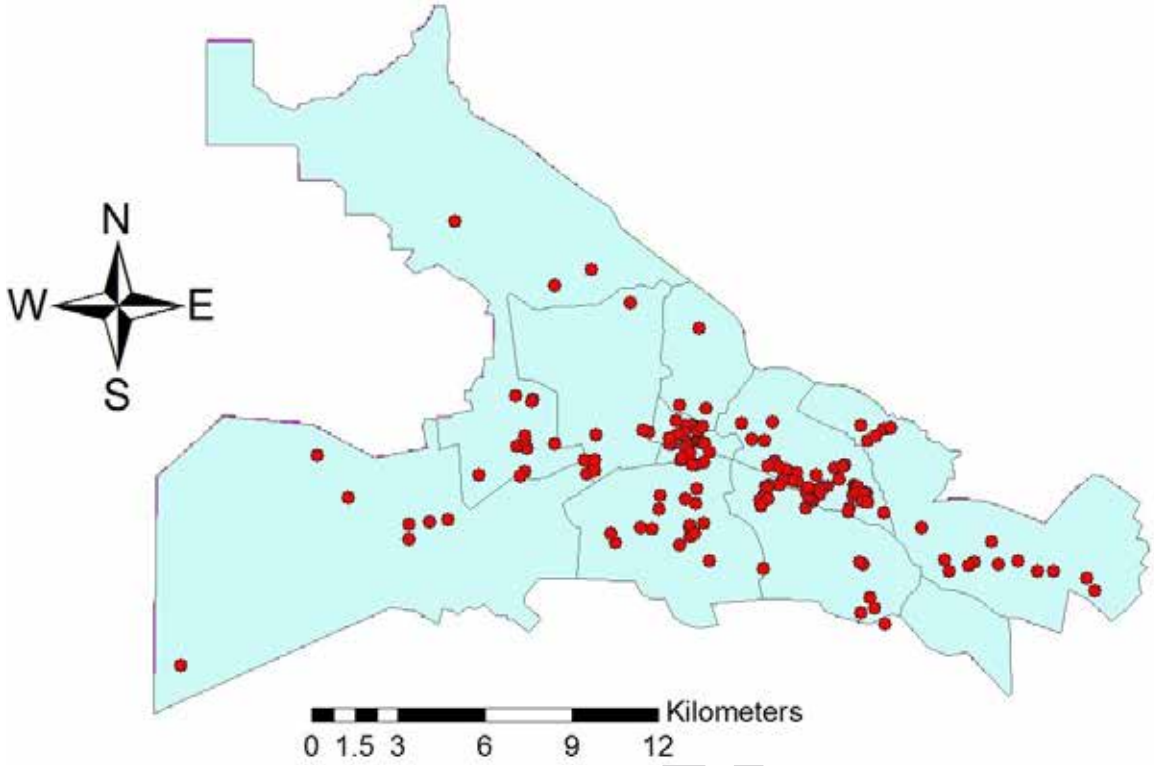

Fig. 4. The integration of functional density and functional diversity in Tabriz metropolis. Source: authors.

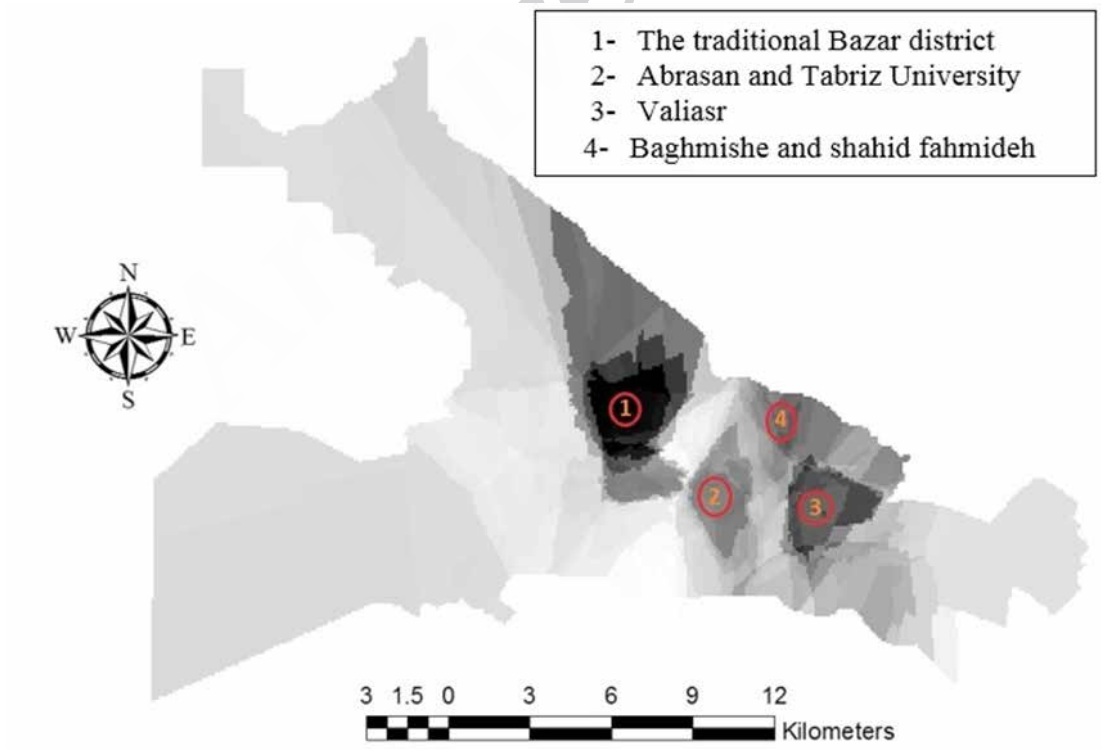

Fig. 5. The location of the main urban centers in Tabriz metropolis. Source: authors.

construction.

The results of such actions have led to eliminating the central neighborhoods and the creation of new centers and neighborhoods around this metropolis in the eastern and northeastern parts. In the long term, such actions would have adverse effects on the central parts of the metropolis. The results of the analysis of urban centers in this metropolis show that the distribution of these centers in the metropolitan area is not normal, which has led to numerous physical, infrastructural, social and economic problems. Diagram 2 shows the distribution of urban centers at the metropolis of Tabriz.

According to the above diagram, as well as Fig. 7, which is used to check the normal distribution of data, , a normal line is depicted as a norm of normal distribution, as far as the points representing the data (metropolis centers) are closer to this line and the proximity of the distribution of the centers shows the normal distribution,and vice versa, when the points of the urban centers of the metropolis are far from the normal standard line, they will have no normal distribution. Diagram 3 (Polt Q-Q) shows the normal distribution of urban centers in Tabriz metropolis.

Discussion

The present study examines a way of identifying metropolis centers of Tabriz and their impact on the urban structure to take a step towards the model building in the urban structure in the metropolises and it seeks to discover the "spatial distribution of urban centers" and its impact on the structure of urban.

The findings of this paper show that the formation of new urban centers in Tabriz metropolis during 1970-2018 was based on the expansion of the metropolis to the east and northeast suburbs according to the second scenario of Green (1977), where the middle and high-income households, firms, shopping malls, and employment have been formed around it. The spatial distribution of new urban centers in just one direction of the structure reflects the imbalance and inadequacy of space in the urban, which has caused many problems., Available studies on urban centers, have focused on identifying urban centers on different scales and specifying the main element of the urban structure, and they have concluded that the urban structure of future metropolises will be polycentric and all of them are moving towards decentralization and polycentric form, and the results of this study confirm the claims of mentioned studies.

Previous studies in urban centers identification have often sought to describe urban centers based on the subjective approach and used less than objective methods, and methodologically they have failed to predict the formation of urban centers and also they have failed to determine their impact on the structure of the urban, some objective studies (such as Batty) only work with accurate data (Big and Open data), otherwise they will not be able to describe and analyze the existing urban centers in Iran, the present research, while filling the scientific gap, has the potential to analyze the proposed centers in urban development plans and how can these centers influence them. As mentioned above, the model of Batty et al. is considered as the basic model and method in this paper, that needs to optimize. This study has attempted to overcome the shortcomings of this model and to optimize it based on the characteristics of Iranian metropolises. In this research, two factors of functional density and functional diversity have been used in identifying urban centers.

The density in this paper is the number of referrals and users of a specific range that is derived from other densities and related to each of them. Getting travel density requires accurate data and information about the amount of travel attraction and travel types, this has been addressed in developed countries with regard to the their infrastructures, but in our metropolises, because of the lack of facilities for data gathering, it is not possible, The proposed method in this paper has eliminated it. Considering that each index of density and diversity is associated with specific physical and functional characteristics, the center's mean is a place that has both functional

Fig. 6. Distribution of urban centers at the metropolitan area of Tabriz. Source: authors.

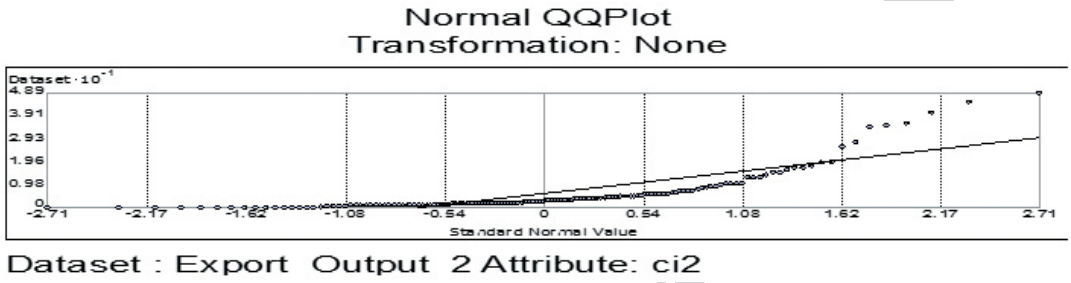

Fig. 7. Polt Q-Q Diagram.The Normal Distribution of Urban Centers in Tabriz Metropolis. Source: authors.

density and diversity of land uses .

With this approach, each of them alone is unobtainable, and neither of them can individualize the conditions of centrality, especially in modern cities, where monofunctional areas are located alongside multifunctional areas (Batty, Besussi, Maat & Harts, 2004: 324-337), in this paper, the integration of two indexes of density and diversity were considered as a centrality indicator. Finally, this research has been conducted by attention to previous related studies about urban centers identification and has tried to complete them by applying the relevant theoretical framework and identification methods in accordance with the features of Iranian metropolises, and in particular metropolis of Tabriz. It is also an attempt to establish a systematic and scientific framework for identifying urban centers in Iranian metropolises and assessing their urban structure.

Conclusion

The purpose of this study was to identify urban centers of Tabriz metropolis and evaluate their impact on the urban structure. The research findings show that the urban structure of Tabriz metropolis has seen a lot of physical transformations over the past decades, by the increasing constructions, due to the driving forces and factors which have transformed the structure of urban. Urban structure transformation and expansion in recent years in the eastern and northeastern parts of Tabriz, which has had impacts on the structure of this metropolis, including the formation of three new urban centers (1-Abrasan 2- Vali-e-Asr-3-Baghmīşe-Shahid- Fahmeideh (Fig. 5). The formation of new urban centers only in the eastern part of Tabriz has caused a spatial imbalance in its urban structure. The tendency to expand the urban structure to the suburbs (the eastern and northeastern parts) due to its convenient obtain has led to the destruction of gardens and agricultural lands around the city, and the “marginalization of the central areas”.

The tendency to expand the metropolis to the suburbs (the eastern and northeastern parts) due to its convenient occupancy has led to the destruction of gardens and agricultural lands around the city,

and the "marginalization of the central areas". The examination of building permits issued between the 2001 to 2015 shows that the number of permits in the eastern and northeastern parts of the metropolis is far more than other areas, while the 1,2 and 5 regions of the municipality of Tabriz, which is located in the east and northeast have the greatest number of building permits and the largest construction area, conversely in the central region of metropolis, there is no incentive to attract the population and the amount of construction. This reflects the inactivity of construction in these areas. The number of four-story buildings and more in the eastern and northeastern parts of Tabriz is far more than other areas, also the transformations in urban structure of this metropolis have increased the quality of urban life in the eastern and northeastern parts of it, which to the same deal, it has led to declining the quality of urban life in the central districts, due to the deterioration of neighborhoods and the depreciation of urban infrastructure, and ultimately has caused an imbalance in the urban structure of this metropolis (Fig. 2 and 3).

The growth and expansion of the metropolis of Tabriz are not proportional to the population growth rate in different census periods, as the extent of physical development in different periods is far greater than the population growth of this metropolis. The population of Tabriz metropolis is 289996 people in 1965 and 1558693 people in 2016, that is equal to 5.5 times but the extent of the urban area has risen 15 times, indicating a spatial imbalance in this metropolis structure. Several causes and factors have contributed to the physical growth and expansion of the metropolis, including the increase of constructions in the eastern and northeastern parts of the city , and consequently , it should be noted that the increase in the amount of investment in it and the reproduction of land and housing speculation that has occurred in these areas these sections.

The unbalanced distribution of urban centers in the metropolis of Tabriz has affected the urban structure and has caused numerous problems such as overcrowding in some areas, the polarization of activities and functions, spatial gap and the polarization of urban neighborhoods, disproportionate distribution urban infrastructure, and increasing the cost of land and housing. In the end, using the proposed method of this paper, to identify urban centers in metropolises and using it in metropolis development plans, one can evaluate the effects of existing centers and loading of activities and their position in proposed centers before they are implemented in different scenarios, and examine the transformations of urban centers and their impact on the structure of metropolises by using a scientifically measurable method. The proposed method is aimed at eliminating the existing gap in the identification of urban centers, in metropolises without accurate data; it is capable of measuring and evaluating centers. By applying this method, it will possible to achieve the spatial balance in urban structure of metropolises in order to achieve spatial justice.

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HOW TO CITE THIS ARTICLE

Vahdani charzekhon, H., Aminzadeh, B. & Reza Parsi,H. (2019). The Impact of Urban Centers on the Urban Structure Transformation in Tabriz Metropolis. Bagh- e Nazar, 16 (70):19-34.

DOI: 10.22034/bagh.2019.84924
URL: http://www.bagh-sj.com/article_69479_en.html