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Spatial Analysis of Physical Poverty of Urban Housing (Case Study: District 17 of Tehran)

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Abstract: Poverty as one of the unfavourable social and economic phenomena is one of the most important issues that has affected all countries. Housing is one of the important indicators for identifying poverty and deprivation. Providing adequate shelter and providing urban amenities and services is now one of the main problems of the growing urban population in Tehran. Various studies such as the comprehensive urban planning reports reflect the fact that the metropolis of Tehran faces many problems in the housing sector. The issue of the physical security of housing in the city of Tehran is one of the most fundamental problems that has severely threatened its sustainability. This research studies the physical housing poverty in Tehran District 17. The research method is descriptive-analytical and the type of research is essentially applied. In the descriptive section, the information required for the research has been collected through library studies, by the use of documentation, field studies and the use of a detailed plan; and in the analytical section, the physical analysis of housing poverty has been conducted by the use of the Fuzzy AHP model and spatial analysis (GIS). The findings of the research show that the District 17 of Tehran in its residential section faces problems such as low quality of buildings, the use of non-durable materials, etc. In terms of physical housing indices, Tehran District 17 has 13.9 hectares of very poor area (2.69%), 122.8 hectares of poor area (23.88%), 337.2 hectares of medium area (65.31%), 26 hectares of prosperous area (5.3%), and only 16.4 hectares of very prosperous area (3.17%).

Key words: Urban poverty, housing, housing poverty, physical dimensions, social justice, District 17.

Introduction

2007 was the first year in human history with more than half of the world's population in the cities; and in the same year, we witnessed the increasing population settled in the suburbs of the cities to reach beyond one billion i.e. "one out of every three people in the cities" (Ahari, 1991). Hence, we conclude that urbanization of poverty is one of the greatest challenges of global development which if continues in the current unfavourable situation, in the next three decades, it will include two billion people living in suburban areas (Brady Annamadnejad Raheem, 2009). With the increase of the urban population, another problem that arises is how to settle the population. It is true that housing is in a state of affairs where in the current situation, a large number of our households are living under the abusive housing conditions (Ahira et al., 2008). One of the indicators for measuring poverty is housing. Good and adequate housing in many cases is the most important factor affecting the individual's life satisfaction in a neighbourhood and its environment (Westaway, 2006). The lack of safe and secure housing is one of the characteristics of urban poverty. Housing is a physical location that is formed in the space and, as a shelter, it is considered to be a basic household requirement.

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In developing countries, only a handful of people in the community are able to access their affordable housing as a result of the rest of the social strata; especially the wider low-income groups always have a decent living space. Low-income groups have always faced difficulties in providing housing (Khodadadkashi et al., 2005). Hence, the average household size and the density of people in the residential units, etc. are high in places where these groups reside. Therefore, this group has no choice but to fall into the poverty cycle. Such a cycle can be seen clearly in Tehran. Housing is the most important productive asset that gives credit to life (Masika et al., 1977). In fact, housing is the smallest form of physical visualization of human-environment interaction and represents the spatial form of the function of human habitation for fulfillment of his essential roles (Rahnema, 2003). Hence in order to understand the way of life and determine the degree of welfare, citizens are aware of the importance of housing indices. Therefore, in this research, with emphasis on the physical characteristics of housing, the depiction of poverty in urban blocks of the District 17 of Tehran has been considered as a symbol of the physical reflection of social inequality.

Research Questions

- What indicators are effective in assessing the physical housing poverty in urban areas?
- How is spatial distribution of housing poverty in Tehran's District 17?

Theoretical Foundations

Poverty Approaches

A. *Income Poverty Approach:* The scientific calculation of the poverty line has begun in the world since about 100 years ago. Income poverty approaches are basically one-off and are evaluated only in terms of income or consumption. The advantage of information on income is that because of provincial and national samples, it shows the poverty situation in the provinces and in the country (Rezaei Mohammad Khavarian et al., 2013).

B. *Capacity Poverty Approach:* In its 2000-2001 report, the World Bank expanded its concept of poverty which, in addition to material deprivation, expanded immensity issues such as deprivation of education, health vulnerability, and ill-treatment (World Bank, 2003). Not having education and health is one of the deprivations that deprives people of having a desirable life. The poor are more vulnerable to diseases, economic crises, and natural disasters than other people. This deprivation and vulnerability limit human capabilities and deprive them of their freedom to live according to the values they believe in (Fay, 2005).

This approach evaluates poverty in terms of both human and social indicators in addition to access to adequate nutrition and adequate housing. Attention is also paid to health services, education and participation in decision making.

Housing Poverty

Suitable housing is one of the important dimensions of welfare which must meet both quantitative and qualitative indicators. In many cases it is the most important factor affecting the level of citizens' satisfaction with residence in a neighborhood as well as with its housing and environmental conditions. Therefore housing is important for recognizing the way of life and determining the welfare of citizens (Raghfar et al., 2011).

Like poverty in its general sense, housing poverty has been defined in different ways according to location and time and there has always been a controversy among researchers, but most researchers agree on the need to define housing poverty. In the conceptual literature, with a high degree of agreement, poverty has been defined as living in disadvantaged housing conditions. Poverty refers to the lives of people who live in inappropriate housing due to lack of access to the minimum housing. Suitable housing is the housing that provides at least two of the basic principles of affordable housing including accommodation privacy and property security. There are no international standards for measuring deprivation of housing and operational definitions vary throughout the world and many of them are not clear in terms of conceptual frameworks (Baker, 2009).

The term "housing poverty" refers to poverty being not only a lack of income and insufficiency but also a lack of physical necessities for life and other assets. Often poverty represents a human requirement or need that has not been fulfilled. Therefore, the measure is criticized merely on the need for the economy because of its inability to depict the well-being of the community's realities. Measurements that combine a wider range of indicators including non-economic and physical dimensions are conceptually more advanced and useful (Whitener, 2002). Such an argument can also include housing poverty (Imad, 1999).

Housing Poverty Line

To measure poverty we need a criterion which is called the poverty line. The poverty line means the amount

of resources the household needs to reach a certain level of welfare. This level of well-being is known as the poverty threshold (poverty line) (Needleman, 1965). Those who are less well-off are considered poor. According to Ravallion (1998), the poverty line is the costs that a person has to pay in a certain time and place to reach a minimum welfare level. People who do not have this level of well-being are considered poor and those who have access to this minimum welfare level are not considered poor (Khodadadkashi,1998).

In the analysis of housing poverty, one of the main questions is: how can families of poor households be identified from other households in the community? In this context several criteria and methods have been proposed which can be categorized in two qualitative and quantitative categories of housing (Roosti, 2012). More quantitative indicators are defined in the area of housing costs, the area of housing units, and the location of the units (marginal and unofficial) and so on. These indicators are readily measurable and can be considered as a good analytical basis for housing poverty. On the other hand, more quality indicators rely on basic housing facilities such as healthy drinking water, kitchens, bathrooms, and other residential facilities. Specifically the concept of the quality of a residential unit is personal and relative so much so that the number of people in a community could have different ratings of the quality of residential units (Pourmohammadi, 2014). Although the quality of the residential location is hidden, it can be measured based on indicators. The lack of consensus in defining the right poverty line and then assessing it has made housing a multi-dimensional commodity and how to integrate these dimensions into a single index has always been controversial. In order to determine which households suffer from housing poverty, first, there should be a defined threshold of facilities or household benefits. This threshold is the same as the poverty line of housing (Martinez and Perales, 2015).

Physical Indicators of Housing

The physical dimensions of housing can be viewed from two perspectives: firstly, the housing structure as a residential unit Doma; secondly, the physical relationship of housing with its residential environment which is somehow a social indicator and suggests the role and place of housing in urban development.

Housing pattern (single-unit, apartment, complex and high-rise building): The pattern of housing as one of the factors and indicators restricting expansion towards outside of the city is one of the factors that change the construction pattern (Sarafi, 2008).

Development pattern: Although population density seems to be a social indicator, the physical effects of this index are important. The type of population settlement can have different effects on the city, effects such as expansion of its area, increase of the buildings' height, and city development from within.

Construction density: This indicator is a measure of how the total surface area of a unit is divided by the total area of that piece of land. Through this indicator, the intensity of land use is determined (Abdi Dolyskani, 2015).

Occupancy level: This index reflects the issue of mass and space which is a major issue in urban planning and design. The level of occupation is calculated by dividing the ground level of an underground floor on a plot of land.

Residential density: This index has many branches such as residential general density, residential gross density and residential net density.

Area and Per Capita of Area: Several factors have contributed to changing these indicators including access to land, land prices, population, and cultural issues. The analysis of these indicators explains the relationship between housing and urban development and shows how the city's physical form is combined and shaped.

Type of building materials and methods of production.

Abnormal and unauthorized dwellings: The index shows other aspects of housing such as housing shortages, lack of affordable housing, and housing problems (Azizi Mohammad Mehdi, 2005).

Research Method

The research method in this study is descriptive-analytical and the type of research applied and its approach are quantitative and qualitative. The required data for research has been collected through library studies and by the use of documents as well as field studies from the scope of the study and the use of detailed plans of the region. Poverty analysis has been conducted by the use of the criteria and physical indicators of housing in the District 17 of Tehran using

the AHP model and its subcomponents including EC1 EXT_AHP in the GIS software environment in four stages in a hierarchical manner.

1. Determining the criteria and sub-criteria for housing poverty
2. Determining the preference factor (importance) of the criteria for housing poverty
3. Determining the coefficient of importance of sub-criteria and analyzing the poverty of housing
4. Final analysis of physical housing poverty

Analysis Tool

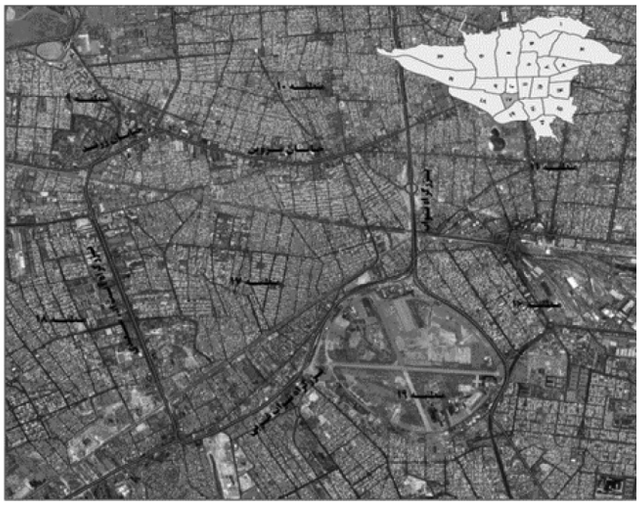
In this study, SPSS and Excel software was analyzed using spatial analysis by the use of IDRISI and GIS.

The Study Area

Tehran is the largest city in Iran. This city is also the capital of Tehran province and the centre of its neighbourhood. Its population (census 2016) is 8429807 which is the 19th most populated city in the world. The total area of this city is 730 km². In the past 100 years Tehran has attracted a large number of immigrants from all over Iran. Population density in Tehran is estimated to be between 10700 people and above 11000 people per square kilometre which, according to the statistics, makes it the 16th most populated city in the world. The District 17 from the southern parts of Tehran is about 8298 hectares and is occupied by 1.1 of the total land in the legal area of Tehran adjacent to 9, 10, 11, 16, 18 and 19.

Variables and Indicators

In order to measure housing poverty, like most other concepts, it is necessary to determine the indicators wherein each one of them assesses one aspect of the subject and basically in this evaluation, those indicators should be prioritized which are consistent with the social reality and can be easily quantified and measured in this regard. According to the researches done in measuring the poverty of different countries and their various scales and conditions, in Iran the final indices are extracted and summarized in the form of a table broken down by index items and their logic.



Map 1: Location of the District 17 of Tehran.

Data Analysis

In the present study, based on the analytical hierarchical and systematic analytic steps in the model (AHP) which was presented in the previous sections, after selecting the criteria and indicators required to analyze the physical housing poverty which has been done by the use of scientific resources, surveys, and consultation, it is time to implement the selected criteria in the model system. The assessment of the sustainability of the physical dimensions of housing has been carried out in four stages in a hierarchical manner.

Determining the Criteria and Sub-criteria for Housing Mortality

In the hierarchical analyzing process, the criteria and sub-criteria for the physical dimensions of housing poverty have been determined for Tehran District 17. Each of the sub-criteria is divided according to the same factor (sub-criterion) in the region. For example, in the case of instability of the structure, there are only three types of metal skeleton, reinforced concrete, and structures made of stone, wood, and clay in the region. The benchmarks for the following criteria are listed in Table 2.

Determining the Preference Factor (Importance) of Criteria in the Physical Housing Poverty

At this stage, the weighing of the main criteria is carried out in a binary comparison method. The superiority of each criterion relative to other criteria is determined by their role in the physical stability of the house. The scoring range of the criteria is the same as the weights of the 9-quantitative hours that are the basis of the judgment. The weighing was done by experts and specialists. Then, according to EC software, the final score of each of the criteria was determined.

The software compares the weights together and finally a total weight is obtained for each of the criteria. As seen in Figure 1, the weight of the factor of the room density in the residential unit is 2988.0, the weight of the building age is equal to 1781.0, the unstable weight of the residential units is 1.1512, and the density of the

Table 1: The criteria and indicators of the physical housing of the selected housing

Indicator logic	*Gauge*	*Indicator*
The high level of this indicator shows that it is impossible to carry out relief and rescue operations in the event of an emergency and also reduce the supervision of the law enforcement forces.	Access to public passages less than six metres	Impermeability
Indicates the risk of falling and vulnerability to natural disasters.	The type of materials used in the construction of residential buildings (metal, concrete, stone, wood, etc.)	Instability
The high level of this index reflects the compression of the urban texture and the decline of life quality and the provision of urban services and infrastructures.	The ratio of the area of residential units below 100 square metres to the total area of residential units (percentages)	Residential Area (Occupancy level)
The high level of this indicator shows that the field of physical exhaustion is higher in blocks.	Ratio of residential units with a life span of over 30 years in total units of residential block (%)	
If residents do not enjoy the least welfare they will not be able to provide basic living expenses for tissue construction, and urban texture will be burned out.	The ratio of the number of residential units lacking the proper sewage system, bathroom and kitchen to the residential units of the block (percent)	Structure age
The high index indicates that the quality of life in the blocks is low. The low index indicates that the quality of life in the blocks is low.	The ratio of the number of households per block to the number of residential units	Facilities and equipment of the residential unit

Table 2: Criteria and sub-criteria for physical housing poverty in Tehran District 17

Sub-criteria	*Major criteria*
0-6 6-12 12-22 22-33 32	Intrusiveness of the transit network
Less than 50 square metres 50-100 100-200 200-300 300	Residential Area (Average residential area of living/space residential housing unit)
Steel structure Concrete skeleton Other materials (wood, bricks, clay)	Instability of the building/type of materials used in the construction of residential buildings (metal, concrete, stone, wood, etc.)
1 room in residential unit 2 rooms in residential units 3 rooms in residential units More than 4 rooms in residential units	Room density in the residential unit (more than three people in the living room)
No kitchen and bathroom system Water and sewage system 85 to 90 75 to 84 years	Facilities and equipment of the residential unit (the ratio of the number of residential units lacking the proper sewage system, the bathroom and the kitchen to the residential units of the block to the percentage)
65 to 74 years 64 to 45	Structure age

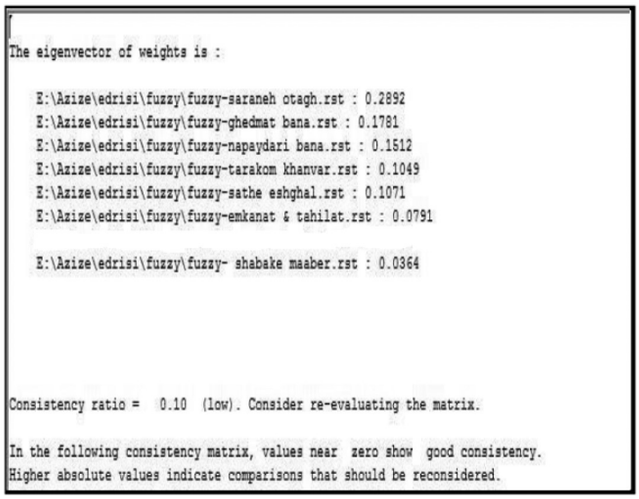


Figure 1: Final score of the peculiarities of housing poverty. (*Source:* Author, 2017)

households in the residential unit is equal to 1049.0. The infrastructural weight of the residential unit is 0.1071, the weight of facilities and equipment is 0.0791, the population density is 0.0540, and the end of the communication lines is 0.364. The compatibility rate is 0.1 which is acceptable. After gaining weights, various factors bring these weights into the software and present the final map to us.

Determining the Coefficient of Importance of Sub-criteria and the Final Analysis of Housing Poverty

In this section, according to the data of the Statistical Yearbook of 2011 from the Statistics Center of Iran, the raster layers, the number of rooms in the residential unit, the age of residential units, instability of buildings, household density in the residential unit, the area of residential units, and the network of streets have been provided. According to the existing standards, for each criterion, according to their importance in the physical housing poverty, a score of 0 to 1 was given. Furthermore, according to these weights, the raster map of each of the main criteria for the physical housing poverty was prepared by the use of the Geographic Information System. And the data on the basis of housing metrics has been extracted from the Population and Housing Census of 2011. The peculiar dimensions of housing poverty in District 17 of Tehran have been studied at block levels except the streets network.

Due to the high volume of work, this part avoids bringing charts and maps of each of the criteria only to explain the statistical distribution of some of them.

The rate of housing poverty in terms of the density of the room in the residential unit

In order to produce the existing map of the room density in the residential unit in the district, considering the data of the Statistics Center of Iran, the number of households in the residential units of the district were divided according to the number of rooms i.e. one room in the residential unit, two rooms in the residential unit, three rooms in the residential unit and four rooms or more in the residential unit. One raster was made with each one of them. Then, we combined these three layers, and gave them weights according to their importance. Weighing 0.2 to residential units with one room in the residential unit, weighing 0.4 to residential units with two rooms in a residential unit, weighing 0.6 to residential units with three rooms in residential units, and we gave the weight of 0.8 to residential units with more than four rooms per unit. It was because of the fact that they had the most impact on physical housing poverty. Ultimately, Table 2 and raster map was achieved.

The Rate of Housing Poverty in Terms of the Building Age

The building age is one of the criteria to be considered. This criterion was divided into five general categories from the viewpoint of the age of the buildings: 85-90 year-old buildings, 75-84 year-old buildings, 65-74 year-old buildings, 64-45 year-old buildings, and buildings with ages below 45 years. Then, one raster was made for each one of them. Then, we combined these five layers and gave them weights according to the importance of each of the groups. Here we can see the 85 to 90 yea-old buildings weighing 0.2, the 75 to 84 year-old buildings

Table 3: Statistical distribution of poor housing in terms of the density of rooms in residential units

The density of the room in the residential unit	*Poverty level*	*Weight score*	*Number of residential units*	*Percentage*
One room	Too much	2.0	2174	4.9
Two rooms	Much	4.0	27182	51.19
Three rooms	Low	6.0	19059	35.89
More than four rooms	Very little	8.0	4682	8.81

weighing 0.3, the 65 to 74 year-old buildings weighing 0.5 and the 64 to 45 year-old buildings weighing 0.6, and the buildings lower than 45 years old, since they had the greatest impact on physical housing poverty, were weighed 0.8. The results of this are shown in Table 4 and the raster map of the buildings age.

Poverty Rate in Terms of Building Area

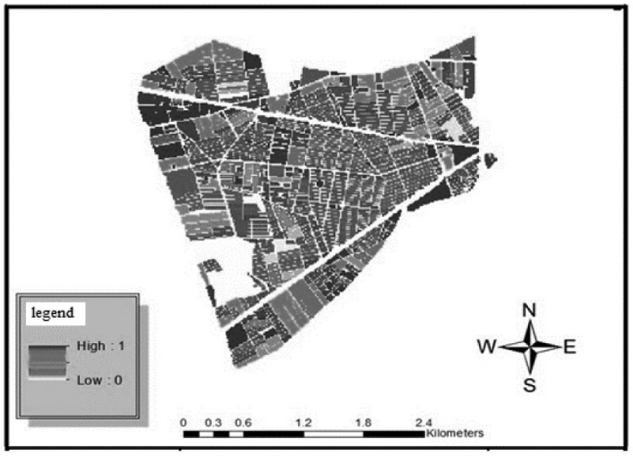
In order to produce a map of the area of the existing buildings in the region, according to the data of the Iranian Statistics Center, the existing buildings in the region are divided into five general classes from the viewpoint of the area: buildings with an area of less than 50 square metres, buildings with 50 to 100 square metres, 100 to 200 square metres, 200 to 300 square metres, and buildings with more than 300 square metres. We made each one of them a raster; then we combined these three layers and weighted them according to the importance of each of these five groups. Buildings with area of less than 50 square metres were given the weight of 0.8, buildings with area between 50 and 100 metres were given the weight of 0.6, buildings with area of 100 to 200 square metres were given the weight of 0.5, buildings with area of 200 to 300 square metres were given 0.3, and buildings with area of above 300 square metres were given the weight of 0.2 because they had the least impact on poverty. Finally, the general raster table (Table 5) and map were achieved as shown.

The Final Analysis of the Physical Housing Poverty

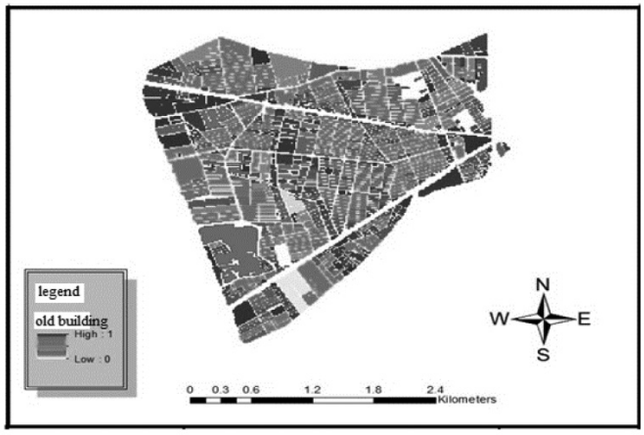
Until this stage, the required maps of each criterion were weighed and analyzed according to the principles and standards. Based on the systemic and combined viewpoint, determining the physical housing poverty data of Tehran District 17 was not a rational indicator, but different indices should be studied and analyzed together. Also the criteria used to determine the physical housing poverty are not equally important and might be superior to other criteria by one degree. The result of studying the status of civil housing poverty indicators in Tehran District 17 was designing of the final map of physical housing poverty of the district. It has been achieved by combining the different physical layers with the certain weight of that layer. In order to show

Table 4: Statistical distribution of housing poverty in terms of building age

Age of the building	*Poverty level*	*Weight score*	*Number of residential units*	*Percentage*
85 to 90	Very prosperous	2.0	19363	26.47
75 to 84	Rich	3.0	11182	15.28
65 to 74	Medium	5.0	6124	8.37
64 to 45	Poor	6.0	27638	37.7
Before 45	Very poor	8.0	8828	12.07



Map 2: Distribution of housing poverty in terms of the room density in the residential unit. (Reference: Author, 2017)



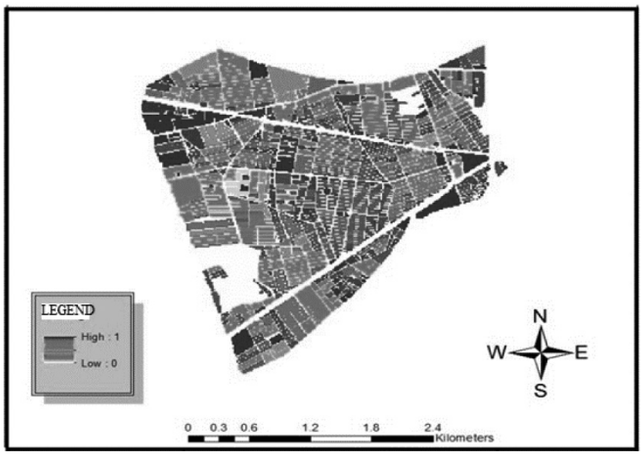
Map 3: Distribution of housing poverty in terms of the building age. (*Source:* Author, 2017)

Table 5. Statistical distribution of housing poverty in terms of building area

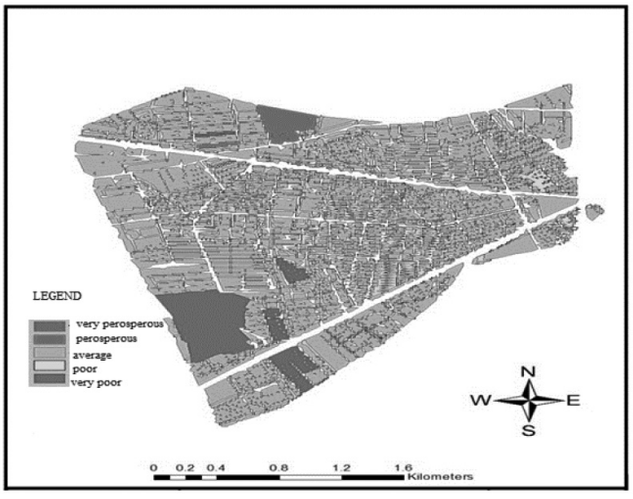
Area area	*Poverty level*	*Weight score*	*Number of residential units*	*Percentage*
Less than 50	Very poor	8.0	20281	28.54
50 to 100	Poor	6.0	39007	54.93
100-200	medium	5.0	10922	15.37
200-300	rich	3.0	527	7.0
> 300	Very prosperous	2.0	311	4.0

Table 6: Statistical distribution of physical poverty of housing in District 17 of Tehran

Poverty level	*Area per hectare*	*Percentage*	*Points*
Very poor	13.9	2.69	1
Poor	122.8	23.78	2
Medium	337.2	65.31	3
Rich	26	5.3	4
Very prosperous	16.4	3.17	5



Map 4: Distribution of housing poverty in terms of the amount of area in the residential unit. (*Source:* Author, 2017)



Map 5: Ultimate map for housing poverty in District 17 of Tehran. (*Source:* Author, 2017)

the rate of physical housing poverty precisely and in details on the map, it has been categorized in five certain categories. The first category is a zone marked 1 where the poverty rate is very high and according to our survey, 2.69% of the district is placed in this category. The second category includes the regions marked 2 and covers 23.78% of the district area. The third category is marked 3 and includes 65.31% of the district area. The fourth category, marked 4, covers 5.3% of the district area; and finally the fifth category, marked 5, includes the lowest rate of poverty i.e. only 3.17% of the district area. The statistical distribution (Table 6) and the final map of the physical housing poverty are presented.

Summary and Conclusion

The growth and expansion of cities without planning is one of the problems of the cities nowadays, especially large cities and populations. It has led to different phenomena such as marginalization, deficiency, and ill-settlement. In fact, the problem of housing in the large cities is one of the most fundamental problems that greatly threatens their sustainability. The city of Karaj is one of the metropolitan areas of the country that has been expanded without planning; it faces many problems especially in the physical housing sector.

According to the conducted studies and evaluations on the poverty status of residential buildings in the District 17 of Tehran, this district has an inappropriate and poorly settled situation particularly in residential areas on the eastern, western and southern steep areas. These poor housing conditions are not appropriate for human beings living in the 21st century. Although

District 17 is located in a special geographical location of the city of Karaj, but large parts of this district have been marginalized. These residential areas could be mentioned as the tissues suffering from urban appendix in the texture of the city of Tehran. According to the research findings, in the residential section, Tehran District 17 faces problems such as being adjacent to various types of incompatible activities with residential use, placement of residential areas in steep slopes, low quality of buildings, and the use of non-durable materials. In fact, the results indicate undesirable situation of housing indices according to the principles of sustainable urban development in the district and show that only 8.47% of the total area of District 17 is prosperous in terms of physical indicators as a living area.

In order to institutionalize preventive planning against the unsustainable development of cities, assessment of the structural sustainability of housing requires a comprehensive overview. Considering the existence of marginal and old tissues in the Iranian cities and considering the poor quality of housing in these sectors, the need for comprehensive and in-depth planning of different housing measures is essential to prevent unsustainable development and to move towards sustainable development of cities.

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