

Evaluation of New Urbanism Principles: Hybrid AHP-TOPSIS Multi-Criteria Analysis Framework (Case Study: Neighborhoods of Historical Zone of Shiraz)

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ABSTRACT: A large number of studies show that uncontrolled and unplanned spatial and functional developments in old central districts of large and medium-sized Iranian cities in past few decades have resulted in many unpleasant transformations. Thus, the historic urban fabrics have gradually lost their socio-economic livability and quality and this issue has led to urban distress, blight and deterioration. The main objective of this research is to evaluate quality of historical neighborhood of zone eight of Shiraz metropolis municipality [Old CBD] according to set criteria based on New Urbanism Approach and Principles. This is applied research with descriptive – analytical methodology, using a hybrid AHP – TOPSSIS analysis methodology. By ranking these historical districts according to their current quality and capacity, we can determine best cases for development with the low intervention level strategy. The results of multi criteria analysis indicate that among the twelve districts in the historical fabric of Shiraz, Sang-e-Siyah, Mordestan and Meydan-e-Shah are the three best cases for development regarding the potentials and capacity and qualities in historical fabric of Shiraz.

Keywords: Historical Fabric, New Urbanism, Multi Criteria Analysis, AHP-TOPSIS, Shiraz

INTRODUCTION

The historic urban fabric of the city has some features and characteristics which make it distinct from the adjacent fabrics and areas as well as other different parts of the city; it also requires special planning and management, different from other areas in the city. The Historical fabric management requires attention to four elements at the same time, spatial and functional re-organization approach, resources (human, financial, legal and informational), planning framework, and participation of dwellers and stakeholders. The historical fabrics with a high variety of urban elements and spaces within it, such as organic street networks and marketplaces along with the morphological and activities characteristics have significant cultural, social and historical values. Urban development plans and interventions, which have been started a few decades ago, regardless of the above points, have led to the destruction of many traditional values in the fields of urbanism and architecture in the country. Despite the frequent mentioning of historic urban fabric values in resources, the issue of evaluation of its studies show that the construction of the physical fabric of Shiraz has been studied less systematically. This paper seeks

to find answers for the following questions with a systematic attitude:

What are the appropriate Dimensions and indicators for evaluating the qualities of Shiraz historic urban fabric?

What is the appropriate Model and framework for assessing these qualities of Shiraz historic urban fabric? According to the results, we could rank the historic districts and select the three best cases based on urban qualities for the development based on low intervention level.

Statement of the Problem

Currently, the world's population is more than seven billions, and almost half of the population lives in the cities. Along with the rapid growth of urbanization and urbanism in the world, the emergence of increasing abnormalities and the severity of Deteriorated and deprived urban areas is noticeable. These distressed areas have created a public crisis for urban planners and managers in a global level (Davis, 2006, 23). In Iran, the interventions in deteriorated areas and constructions have mainly had economy-based with functionalism approach; and in many cases, due to this attitude, the dominant culture and tradition and special characteristics of these areas have been

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ignored.

Starting the process of transformation in Shiraz as well as many other historical cities of the country, in the first Pahlavi era, created sudden changes in the city's development process. The centrality of socio - economic dimensions of urban life created new parts in the city, and historical urban fabrics faced with a fast process of human transformations and activities and in many cases, this transformation has led to decay and loss of many neighborhoods values.

This simplistic approach, in addition to regarding the traditional urban fabric as worthless, led to the destruction of these areas; Shiraz historic fabrics renamed as old and deteriorated areas, so the original residents who were mostly rich and affluent people of the city moved to the suburban zones.

Despite the historical background, the historic urban fabric of Shiraz has been decayed and transformed into low quality neighborhoods. The only urban management approach in these areas has been a museum-like conservation of some monumental elements and buildings of this area, confined in single buildings; and there has been no attention paid to this area's urban spaces and qualities.

This area has great potential to attract tourists and gains economic prosperity if they became spatially and functional re-organized. Shiraz historic urban fabric is involved in this condition because of a physical, social, economic and cultural decline spiral.

Following this event, the amount of investment in services, commercial and residential land uses has decreased, while the social problems and anomalies have increase. Problems such as poverty and unsustainable housing, lack of diversity in land uses and adequate parking space, traffic congestion, having indefensible spaces and inappropriate quality of building's facade, indicate the necessity of regeneration and mitigate interventions in the historic urban fabric of Shiraz.

Literature Review

With the rise of Reza Khan, intervention in old fabric of Iranian cities began seriously, and Shiraz is also one of the first cities which have been affected by these actions. Most of the projects at that time had harmful effect on the urban fabric and the city's residents; hence, this case requires more attention from planners.

Among the most important activities and research in this field, we have the following:

Narimani: In his book, rehabilitation of the historic urban fabric has offered some regular solutions to organize the city's old fabric and also represents the experiences of some countries in the issue of rehabilitating old urban fabrics (Narimani, 2009, 8).

Alizadeh has concluded that Bushehr has two distinct urban fabrics, and without taking into account the climatic conditions of the city, there has been constructions in the area which makes the city map chaotic; and on the other hand, the imposed war against Iran has caused the destruction of some areas of the

city (Alizadeh, 2010, 123).

Kuchaki in his thesis identifying the physical-spatial structure of Khorramabad deals with decay and restricting factors of the city's old urban fabric; he came to the conclusion that the environmental factors and physical developments of the city has led to deterioration of its old fabric (Kuchaki, 2008, 166).

Vafaei has concluded that although Kashan is a historical city, but changing the overall structure of the city from single-core to multicore, caused the transformation and deterioration of the old urban fabric of the city (Vafaei, 2007, 213).

Yousefi in her thesis deals with the transformations and changes in Reyhan and Khiaban neighborhoods of Qazvin, and comes to the conclusion that environmental factors, the city's physical development and migration of residents have caused the changes in these areas (Yousefi, 2008, 155).

Varesi, et al: In their article, District zone eight of Shiraz Municipality is selected as the study area; it is among the country's distressed urban neighborhoods. The main purpose of this study is to recognize the economic and social characteristics of the inhabitants of Shiraz historic urban fabric, as well as understanding its physical condition. According to the analysis, the results indicate that the lack of facilities, urban utilities and infrastructures and poor accessibility to services have resulted in migration of indigenous dwellers to other areas and therefore led to negative population growth rate in recent years. On the other hand, the Socio - Economic conditions of these residents slow down the process of reform and development, which is the cause of decay and blight of these urban fabrics (Varesi et al., 2012).

Sorouri and Khazaei: This article argues that a new idea is injected in the old urban fabrics. Forecast for enhancing city spaces. as one of the necessities of the urban fabrics and using them to provide a place for social interactions, is one of the important priorities of urban restoration projects due to the impermeability of deteriorated fabrics (Sorouri & Khazaei, 2007).

Intervention in the historic fabric of cities in the modern sense goes back to the late nineteenth century, especially after World War II. A new movement was formed in the late nineteenth century that had stressed on the maintenance and conservation of monuments and minimal intervention in these fabrics was stressed. In the first half of the twentieth century, the dominant thinking in Europe, the attention devoted to the protection of Individual buildings was discussed. Developments from 1960 to 1970 can be considered as the second wave of changes of the conservation movement. 1980s revised the custodians' tendency in giving priority to economic redevelopments, theoretical and practical approaches in the face with the conservation. In the 1990s, moving towards an integrated approach and too much focus on recreation projects conducted in 1980s, raised criticism in scientific meetings local governments which formed based strategies and regeneration policies in Western countries (Sohazade & Izadi, 2004). In recent decades in Iran, deterioration and destruction of old fabrics of the cities has

taken on a new dimension which may seriously threaten the identity of the cities. Interfere in deteriorated and unorganized fabrics of the city began through modernism and changing the spatial – physical structure of the old fabrics in the first Pahlavi era and so far various proposals and projects have been prepared and implemented in order to reform the old fabric of the city (Nazarian, 2009).

Historical fabric can be defined as any form of built environment in which, the organized, sustained and developed reflection of human thought progress in an era of the past, a non-contemporary era can be seen (Fokuhi, 2009). Therefore, the historical neighborhoods of cities is a part of the memory and identity of the city in people's perception in that region and modern cities encountered identity crisis without their old fabric (Mokhtari, 2014,6). Changes of urban life's dimensions affect the structure and the content of urban environments and these development and renewal of social, economic structures and sectorial development approach always led to the deterioration of the traditional structure and emergence of the multilateral deterioration patterns (Martin & Morrison, 2003). Mallach studied the phenomenon of deterioration in American cities, especially in California. The findings indicate that the older areas of the city are the parts in which the rate of abandonment of central urban areas by the original inhabitants, low economic growth, unemployment, abnormalities of the land market, high number of abandoned or dilapidated units, increased crime rate, poor urban services and infrastructure, degradation of physical quality and physical deterioration. The reason is that the lack of attention and consideration of inhabitants in general have led to dramatically reduce to livability in the form of physical, social and economic degradation (Mallach, 2010). Thus, it can be concluded that the historical fabrics, deteriorated areas which have heritage value (Habibi & Maqsudi, 2009).

In this regard, some common patterns emerged for the restoration of the city are as follows: 1) urban refinement; 2) social planning; 3) economic planning; 4) replacement 5) Self-regulation; 6) urban growth driven by investment; 7) gentrification 8) recreation and 9) recreating with preserved historical monuments approach and economic vision (Kalantari & pour Ahmad, 2005).

MATERIALS AND METHODS

Today, the old districts of Asian cities have attracted many experts' attention because of the two main reasons: (a) these countries have a long history of urban civilization. (b) Later than the developed European countries have realized the danger and crisis of destruction of cities' cultural and physical heritage (Ali Afzali, 2006, 48).

Regarding the topic, which is an applied research, the methodology is a combination of the descriptive – analytic research which improve physical, functional quality of Shiraz city through identification of its historical fabric and

provides a framework for organizing. Data collection methods in this research were documentary research, field study, and questionnaires. To analyze the data in this paper, the Hybrid AHP-TOPSIS method was used. This model can have a very flexible structure due to its accuracy in weighing the indicators and simultaneous ranking of high number of alternatives ahead. In this regard, the following steps should be taken:

1. Formation of TOPSIS initial decision table using matrix of measures in 12 areas evaluated;
2. Performing the AHP steps and measuring the indicators' weight;
3. Calculating and determining the final scores TOPSIS of the neighborhoods considering their urban quality composite indicator.

Case Study

Historic zone of Shiraz city with an approximate area of 378 hectares consists of a part of the central district of the city which today's identifies as zone eight municipality of Shiraz. In addition, this area is the initial core of emergence of the city; many central commercial activities, religious centers, services, and administrative activities are placed in it now and has considerable actual and potential capacities to boost tourism, pilgrimage, commercial, cultural and residential activities.



Fig.1. Location of the Historical Fabric of Shiraz City

RESULTS AND DISCUSSION

Evaluation of Historical Districts of the City with New Urbanism Approach

The model presented in this step must possess three important qualities:

A procedure to determine evaluation indicators.

A structure to make a decision matrix based on prioritizing alternatives according to mentioned indicators.

Be able to use both objective and subjective indicators in the model.

In this regard, to determine the first to third priorities, the multi-criteria decision support system based on integration of Analytical Hierarchy Process [AHP] (Saaty 1980) and TOPSIS (Hill Hwang & Yoon, 1981) is structures. Considering that in decision-making structure of the present study, all three

conditions must be established on the AHP-TOPSIS hybrid model.

Making a Decision Matrix

Based on the indicators specified and information acquired from neighborhoods, 42 indicators are accurately assessed and matrix of alternatives' state on each indicator is measured (Fig. 1).

The Final Weight of Indicators and Sub-Indicators Based on the Analytic Hierarchy Process

By creating a paired comparison matrix and by getting experts' opinion in the form of nominal group meetings, information needed for weighting is obtained. Then, the weight of criteria and indicators used will be extracted through the appropriate calculations. The results of paired comparison matrix are shown in Table 1.

The Final Evaluation Using TOPSIS

Given that the decision matrix and the weight of indicators have been obtained in the previous steps, so the final step of the evaluation is taken at this stage using TOPSIS model. At this stage, in order to apply the weight of criteria's importance, the weight obtained from the analytic hierarchy process (AHP) of each indicator is multiplied by its corresponding column in decision matrix. In the end, the final scores of 12 neighborhoods that include «Sang-e-Siyah», «Sar-e-Dozak», «Sarbagh»,

«Lab-e-Ab», «Bala Kaft», «Bazar-e-Morgh», «Darb Masjed», «Eshahgh Bayg», «Kalimiha», «Meydan-e-Shah», «Darb Shazdeh» and «Mordestan» were identified using TOPSIS model.

The First Stage of TOPSIS: Normalizing the Decision Matrix

The columns of decision matrix are normalized and turned into a unit matrix to eliminate the effect of scale on the indicators' values, (Table 2).

The Second Stage TOPSIS: The Weighted Normalized Decision Matrix

At this stage, in order to apply the weight of criteria's importance, the weight obtained from the analytic hierarchy process of each indicator is multiplied by its corresponding column in the decision-making matrix (Table 3).

Once the decision matrix is weighed, the positive and negative ideal vectors can be formed (last two lines in orange and blue in Table 3). The logic of evaluation in TOPSIS method in fact relied on the minimum Euclidean distance from the positive ideal vector (the largest value for indicators with positive direction and the smallest value for the indicators with negative direction in each column of the decision matrix) and the maximum Euclidean distance from the negative ideal vector (the smallest amount of indicators with positive direction and the largest value for the indicators with negative direction in each column of the decision matrix).

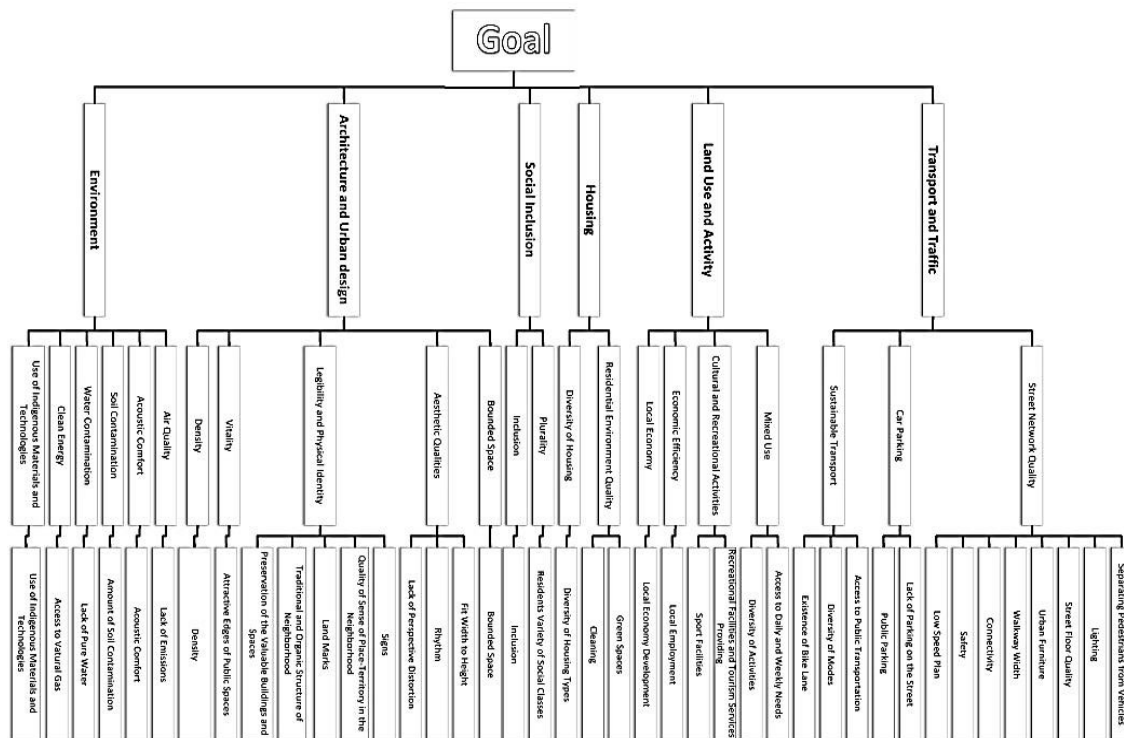


Fig.2: Hierarchy of Decision-Making Indicators and Sub-Indicator.

Table 1: Results of the Analytic Hierarchy Process.

Absolute Weight Indicator	Indicator / Index	Relative Weight of Criteria	Criteria	Relative Weight of Dimension	Dimension
0.008	Separating Pedestrians from Vehicles	11			
0.004	Lighting	12			
0.008	Street Floor Quality	13			
0.004	Urban Furniture	14	0.047	Street Network Quality	C1
0.008	Walkway Width	15			
0.008	Connectivity	16		0.118	
0.008	Safety	17			
0.008	Lack of Parking on the Street	18	0.024	Car Parking	C2
0.016	Public Parking	19			
0.019	Access to Public Transportation	I10			
0.009	Diversity of Modes	I11	0.047	Sustainable Transport	C3
0.019	Existence of bike lane	I12			
0.05	Access to Daily and Weekly Needs	I13	0.067	Mixed Use	C4
0.017	Diversity of Activities	I14			
0.026	Cultural Facilities	I15			
0.013	Recreational Facilities and Tourism Services	I16	0.067	Recreational and Public Facilities	C5
0.026	Sports Facilities	I17			
0.067	Local Employment	I18	0.067	Economic Efficiency	C6
0.034	Local Economy Development	I19	0.034	Local Economy	C7
0.022	Green Spaces	I20			
0.022	Cleaning	I21	0.044	Residential Environment	C8
0.015	Diversity of Housing Types	I22	0.015	Diversity of Housing	C9
0.015	Residents Variety of Social Classes	I23	0.015	Plurality	C10
0.015	Inclusion	I24	0.044	Inclusion	C11
0.021	Bounded Space	I25	0.021	Bounded Space	C12
0.011	Fit width to Height Ration and Proportions	I26			
0.021	Rhythm	I27	0.064	Aesthetic Qualities	C13
0.032	Lack of Perspective Distortion	I28			
0.01	Urban Signs	I29			
0.01	Quality Sense of Territory in the Neighborhood	I30			
0.01	Signs Quality	I31	0.043	Legibility and Physical Identity	C14
0.01	Traditional and Organic Structure of Neighborhood While Flowing	I32			
0.005	Preservation of the Significant Land Marks	I33			
0.064	Attractive Edges in Public Spaces	I34	0.064	Vitality	C15
0.014	High Density, While not Wanting to Tall Building	I35	0.043	Density	C16
0.029	Efficient Use of Urban Land	I36			

Continuine of Table 1: Results of the Analytic Hierarchy Process.

0.066	Lack of Emissions	137	0.066	Air Quality	C17	0.235	Environment	D6
0.022	Acoustic Comfort	138	0.022	Acoustic Comfort	C18			
0.033	Amount of soil Contamination	139	0.033	Soil Contamination	C19			
0.066	Lack of Pure Water	140	0.066	Water Contamination	C20			
0.033	Access to Natural Gas	141	0.033	Clean Energy	C22			
0.016	Use of Indigenous Materials and Technologies	142	0.016	Use of Indigenous Materials and Technologies	C22			

Calculation of the Final Score of Alternatives

The final score of each alternative is calculated according to the equations (1) to (3).

Equation (1): Euclidean distance of alternative i from the positive ideal vector (j: number of row, I_{ij} : value of j^{th} indicator in the i^{th} row and PIS_j is the positive idea value of j^{th} indicator)

$$CP_i = \sqrt{\sum_{j=1}^m (PIS_j - I_{ij})^2}$$

Equation (2): Euclidean distance of alternative i from the negative ideal vector (j is the number of row, I_{ij} is the value of j^{th} indicator in the i^{th} row and NIS_j is the positive ideal value of j^{th} indicator)

$$CN_i = \sqrt{\sum_{j=1}^m (NIS_j - I_{ij})^2}$$

Equation (3): Final score of alternative i

$$Score_i = \frac{CN_i}{CN_i + CP_i}$$

The results of TOPSIS model are completed through these calculations in MATLAB software. Table (4) shows the final scores of the twelve historical sites and their rank based on the assessment.

Table 4: Results of AHP-TOPSIS Hybrid Model.

	CP	CN	CN / CP+CN	Rank
Sang-e-Siyah	0.0189006	0.0226624	0.5452546	1
Sar-e-Dozak	0.0273382	0.0125401	0.3144589	8
Sarbagh	0.0304879	0.0088946	0.2258519	11
Lab-e-Ab	0.0296224	0.0063213	0.1758659	12
Bala Kaft	0.0264121	0.0136821	0.3412486	6
Eshagh Bang	0.0250193	0.0140474	0.3595745	4
Bazar-e-Morgh	0.0290514	0.0149678	0.3400293	7
Darb Masjed	0.0273675	0.0124719	0.3130540	9
Kalimiha	0.0276336	0.0116094	0.2958340	10
Meydan-e-Shah	0.0261562	0.0150346	0.3649994	3
Darb Shazdeh	0.0264401	0.0147417	0.3579664	5
Mordestan	0.0253933	0.0187655	0.4249546	2

Table 2: Normalized Decision-Making Matrix.

Category	Sub-Category	Criterion		Indicator	
		Weight	Score	Weight	Score
Environment	Use of Indigenous Materials and Technologies	Use of Indigenous Materials and Technologies	2	0.051	2
	Clean Energy	Access to Natural Gas	3	0.143	3
	Water Contamination	Lack of Pure Water	3	2	0.086
	Soil Contamination	Amount of Soil Contamination	3	2	0.068
	Acoustic Comfort	Acoustic Comfort	3	2	0.115
	Air Quality	Lack of Emissions	27	3	0.084
Architecture and urban design	Density	Efficient Use of Urban Land	1	10	2
		High Density, While not Wanting to Tall Building	1	1	2
		Attractive Edges in Public Spaces	2	12	3
	Vitality	Preservation of the Significant Land Marks	1	1	1
		Traditional and Organic Structure of Neighborhood While Flowing	2	1	1
		Signs Quality	2	1	1
		Quality Sense of Territory in the Neighborhood	2	2	8
	Legibility and Physical Identity	Urban Signs	3	3	3
		Lack of Perspective Distortion	4	3	3
		Rhythm	2	0.048	3
		Fit Width to Height Ration and Proportions	2	0.083	0.048
		Bounded Space	Bounded Space	2	0.068
Aesthetic Qualities	0.048	2	0.048	2	0.048
	0.129	1	0.104	6	3
	0.038	2	0.076	3	2
Social Inclusion	Inclusion	Inclusion	1	1	1
	Plurality	Residents Variety of Social Classes	3	2	1
	0.075	1	0.165	3	3
Housing	Diversity of Housing	Diversity of Housing Types	2	0.077	2
	Residential Environment	Cleaning	8	0.096	3
		Green Spaces	0	8	0.077
Land Use and Activity	Local Economy	Local Economy Development	0.108	0.084	0.108
	Economic Efficiency	Local Employment	0	0.094	0.162
	Recreational and Public Facilities	Sports Facilities	0	0.347	0
		Recreational Facilities and Tourism Services	0	0.063	0.000
		Cultural Facilities	0.62	12	0.077
	Mixed Use	Diversity of Activities	0.32	27	0.115
Access to Daily and Weekly Needs		0.26	15	0.058	
0.031		0.35	0.006	0.311	0.080
Transport and Traffic	Sustainable Transport	Existence of Bike Lane	0.000	3	0.045
		Diversity of Modes	2	0.000	3
		Access to Public Transportation	0.082	3	0.000
	Car Parking	Public Parking	0.060	0.060	0.125
		Lack of Parking on the Street	0.172	0.054	0.060
	Street Network Quality	Safety	0.194	0.194	0.036
		Connectivity	0.021	0.063	0.172
		Walkway Width	0.023	0.073	0.094
		Urban Furniture	0.038	0.094	0.097
		Street Floor Quality	0.076	0.094	0.079
		Lighting	0.053	0.146	0.037
		Separating Pedestrians from Vehicles	0.069	0.052	0.030

CONCLUSION

One of the main causes of problems in old fabrics globally is the lack of compliance of the traditional neighborhoods with modern needs. The physical parts especially have no access to modern services and facilities.

According to conducted studies and data analysis, the following results are obtained:

It can be observed that by the year of 1943, Shiraz city's total population was covered by the old fabric. However, from this year onwards, the population of the mentioned area has been reduced. From 1976 onwards, the population growth rate of this tissue has become negative. Thus, it can be concluded that elements including the physical development of the city in recent years, the lack of urban facilities and utilities and infrastructure within this zone, immigrant sending of the fabrics and replacing indigenous people with non-indigenous ones with different cultures, etc. are the major factors that have caused the negativity of the growth rate in recent years.

Of all the dimensions of evaluation, environment, urban architecture and design, land use and activity system with a

score of 0.235, of all the criteria, Mixed use, cultural and recreational activities, economic efficiency with a score of 0.067, and the air quality, lack of pure water with a score of 0.066 and vitality with a score of 0.064 and among indicators, job creation with the score of 0.067 and contamination of water and emissions with the score of 0.066 and attractiveness of edges in public spaces with 0.064 have earned the highest points based on analytic hierarchy process.

Finally, through the combination of AHP - TOPSSIS of the 12 neighborhoods in the historical fabric of Shiraz, «Sang-e-Siyah», «Mordestan» and «Meydan-e-Shah», respectively ranked first to third in terms of having potential development in the historical fabric.

Suggestions and Solutions

Table 5 represents some solutions and recommendations to organize Shiraz historical tissue divided by different dimensions:

Table 5: Recommendations and Guidelines.

Suggestion	Dimension
Improved road network	Transport and Traffic
Improve the parking situation	
Development of sustainable transport	
Create account incorporation	User and System Activity
Increase and improve the quality of cultural and recreational activities	
Achieve economic efficiency	
Strengthen the local economy	Housing
Desirable residential environment	
Increasing diversity of housing	
Supporting diversity	Social Inclusion
Increased inclusion	
Exclusive quality improvement	Architecture and Urban Design
Improve the aesthetic quality	
Improve readability to maintain and improve the physical identity	
Increase vitality	
Create an appropriate density and urban waste ground	
(surface scattering)	Environment
Improve air quality	
Increased acoustic comfort	
Lack of doping soil	
Lack of doping water	
Promote environmental health	
Residents access to clean energy	
Use of indigenous materials and technologies	

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