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Prioritize of Intervention Zones in Central Deteriorated Fabrics of Arak City According to Functional, socio-Economic and Environmental Indicators

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Abstract

Urban deteriorated fabrics form remarkable parts of many cities of Iran. These regions have many structural, social and economic problems and cannot do function as urban regions owing to these problems. In order to solve these problems or at least reduce the negative impacts, before doing any interference action, detection of these urban deteriorated fabrics and prioritizing intervention zones is vital. A review at existing related literature indicates the prevalent efforts are associated with the rules approved by the High Council of Architecture and Urban Planning of Iran. According to their criteria, only physical indicators are used for detecting deteriorated urban fabrics and prioritization. Many urban experts believe that considering only physical indicators is not sufficient and there are more factors that incorporate in this matter. Accordingly, some urban researchers started to use more complete and efficient factors in this topic in recent years, although most of them suffice to give some limited indices or give some suggestions. So in this article we try to have more detailed and precise considerations for recognition of urban deteriorated fabrics and prioritizing of intervention zones in our study area. For this aim, we consider socio-economic and environmental indicators as well as physical factors.

This paper scrutinizes the effect of including socio-economic and environmental indicators as well as physical factors in prioritizing the intervention zones of our study area. It also examined whether the interference of these factors, in addition to conventional measures, priorities will change as distinct or only in their scrutiny and the possibility of utilizing them can be used as alternative indicators? It's essential to be mentioned that in Iran there is no ability to access many necessary information for calculating socio-economic criteria so this limitation affects our analysis for sure, although there are more detailed indicators in evaluating our criteria compare to similar researches.

Our study area was central urban deteriorated fabrics of Arak. This area is about 62 hectare with a population of 18478 people. The condition of this area is critical and about 85 percent of buildings should be demolished or repaired.

For prioritizing vulnerable blocks of our study area according to above triplet indicators (functional, socio-economic and environmental indicators), at first some criteria were selected for every indicator. Then for creating prioritized maps related to every indicator and finally linking them and overlaying the maps, we used two methods of decision making, AHP and Delphi. In this way, we gathered our necessary information from master and detailed plans of Arak (standards of Council of Architecture and Urban Planning, approved in 1383), some related reports which has done in our study area by consulting companies and also some area visiting and filling questionnaires. As can be seen, in the final map, which resulted from overlaying all of criteria of triple indicators, prioritized regions are very similar to those according to functional indicators especially in the first and second priorities. So we can conclude if for any specific reason, information on functional factors is not accessible, socio-economic and environmental indicators for prioritizing of intervention zones can be replaced. Also by adding these information we can have more detailed and accurate view of the region which as well as improving prioritizing method of urban deteriorated fabrics, will help our managers in next steps that they should chose the action strategies for solving the problems in these prioritized regions.

Keywords

Urban Deteriorated Fabrics, Intervention Zones, Priority Indicators, Arak city.

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Introduction

Deteriorated fabric is the whole or part of urban space whose living systems are faced with inefficiency and disorder both in terms of function and construction. In other words, urban deteriorated fabrics are urban zones that are eroded due to urban and spatial decentralization and faced with economic, social, physical and environmental problems (Toopchi Sani, 2010). These fabrics that have shaped and evolved in a long period of time have to cope with current contemporary technological developments. Although these areas contained logical and hierarchical functions in the past time, they are experiencing structural and functional deficiencies right now that cannot meet the needs of residents (Habibi, et al, 2007). Moreover, there is no possibility of self-renewal by residents and owners in the area due to poverty. Therefore, the need to identify and reorganize these old fabrics is highly essential.

This paper aims to prioritize intervention zones in central urban deteriorated fabrics of Arak city. In this regard, socio-economic and environmental effects as well as physical parameters in prioritization is queried. In addition, it is discussed whether the interference of these factors, other than common measures, will change the prioritization distinctly or will they be used only in their scrutiny and the possibility of utilizing them as alternative indicators? However, as a basic premise we must accept that most of the information needed to calculate the indices of socio-economic requirements are either not produced or limitedly produced in Iran. The mentioned studies are carried out under the standards of city territories that may not match the limitations of the current study. Therefore, these limitations can downgrade the depth and width of socio-economic analysis.

The studied deteriorated fabric covers an area of 62 hectares and has a population of about 18478 people. According to the data, this fabric is in critical state with more than 85% damaged buildings and over 80% deadlock alleys, despite being very narrow,

that have caused access problems due to density congestion and expansion of fine grains in the area. Figure 1 displays the situation of deteriorated urban fabric and the studied zone in the urban spatial structure defined in detailed comprehensive plan of Arak city (Zista consulting engineers, 2004)

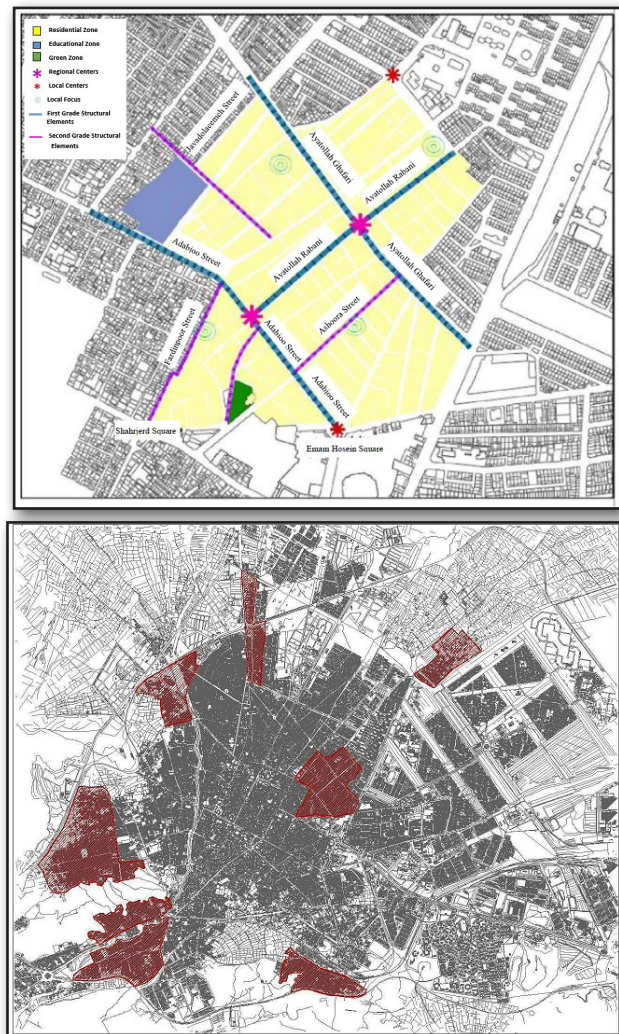


Fig. 1. (A:right) Situation the deteriorated areas of the Arak city including the study area, (B:left) central part.

Source: Consulting engineers of Zista, 2004.

Research Background

Measures adopted by the Supreme Council for Planning and Architecture of Iran in identifying urban deteriorated fabrics considers the physical aspect, and pays no attention to environmental, economic and social issues nor to the urban contexts inefficiency. While, many other measures can be adopted to

complete the physical ones by considering diversity as an urban decay feature and the diversity caused by different functions, social texture and economic status of people.

A literature review suggests that the identification of deteriorated fabric has changed from focusing on physical approaches to social, economic, environmental and cultural considerations. However in most researches such as Hajipour (2007); Pourahmad, et al (2010); Jahanian and Pajooohan (2011); Sedaghat Rostami, et al (2011), this issue is presented quantitatively and not qualitatively.

Meanwhile, few attempts have been conducted recently by researchers of this field using quantitative measures and modeling. Sharifzadegan, et al (2011) have used the SPSS Statistical software, factor analysis, and principal component analysis as well as varimax rotation method in order to define intervention priority in deteriorated blocks of district 15 of Tehran. Not only have they considered physical indicators, but also other variables such as the average household size, average sex ratio as social indicators as well as the average internal rate of return as economic indicators were used. Bemanian and Rezayi Rad (2012) have used factor analysis and Delphi method using GIS to determined physical deteriorated fabric of Khak Sefid neighborhood in Tehran and define intervention priorities. In addition to defining physical indicators such as fine grain, instability and impermeability, they have used other indicators in the model such as the age, quality of construction and building materials. The studies also stated that investigating these factors will lead to a better understanding of deteriorated fabric. Alipoor and colleagues also involved environmental quality standards other than physical measures approved by the Supreme Council of Architecture and Urbanism, (as functional, aesthetic, and ecological sub-criteria) in order to identify priorities for intervention in the deteriorated fabric of the old city of Bandar Lengeh. They used AHP method and GIS software in order to give weight to indicators and sub-criteria and present a priority intervention map.

As noted above, the techniques that are reviewed in researches of priority intervention zones have tried to represent new criteria other than physical characteristics. However, in many of these researches, the criteria are merely qualitative or offers only two or at most three socio-economic and environmental criteria for identifying intervention zone in the studied deteriorated fabrics. In addition, more detailed indicators were used the review of each criterion and in order to put the indicators and create the three mentioned layers two integrated decision-making methods of AHP and Delphi were used.

Basic concepts and models used in this study **-Different types of intervention zones in deteriorated fabric**

Intervention zones are areas in need of specific and coordinated plan. This policy is carried out where the rules of construction conduct and control cannot meet with physical-spatial developments. As a result, land use and physical developments require a planned intervention by prepared and implemented local programs and projects. The types of intervention zones are categorized into two groups:

- Zones in need of planned intervention in urban and beyond-regional scale:

What is meant by urban and beyond-regional scale intervention zones comprises zones where implementation of local plans seems essential. This action can prevent major damages and benefit from exceptional potentials. These zones often provide urban and beyond-regional functions. They are mostly recommended in major plans (comprehensive and detailed plans) due to their entity.

- Zones in need of planned intervention in regional and sub-regional scale:

What is meant by regional and sub-regional scale intervention zones comprises zones where local projects are designed and suggested in order to promote urban fabric quality. Interventions in these zones are at the local, area and regional scale and are

ultimately effective for the residents.

-Deteriorated Fabric Indicators

To determine the deteriorated fabrics in each of the cities of the country, the Supreme Council for Planning and Architecture has approved the three following indicators in May, 1st, 2006 that acknowledged every urban block with these indicators as deteriorated fabric and subject to legal protection enshrined in some laws and regulations in the first stage. The span of these areas are approved by the Supreme Council of Planning and Architecture and in metropolitan areas, and by council of Article 5 as well as planning and development in other cities (Secretariat of the Council of Urban Development and Architecture, 2008).

Indicator 1- fine grain: The blocks with more than 50% of the area less than 200 square meters.

Indicator 2-Instability: The blocks with more than 50% of instable structures and lack of structural systems.

Indicator 3- Permeability: The blocks with more than 50% of pathways with less than 6meter in width.

Analytic hierarchy process (AHP)

The analytic hierarchy process (AHP) is a structured technique for organizing and analyzing complex decisions. The analytical Hierarchy Process has particular application when the issue is capable of being analyzed to a hierarchy of decision making criteria. This method is accomplished in 4 following consecutive steps:

- First step: Defining hierarchies
- Second step: Weighting criteria
- Third step: Weighting alternatives
- Fourth step: Combining results

AHP begins by defining the basic issue and requires a hierarchy for decision-making which includes decision criteria. These criteria are arranged in descending order from the goal to criteria and sub-criteria. Hierarchy should include all necessary aspects for the decision-making process while not being too detailed to lose sensitivity to changes. The decision maker does a pairwise comparison of

decisions and criteria in the form of a matrix. Paired comparisons between criteria and sub-criteria are performed based on a ratio weight and quantitatively (Table 1).

Once performed the paired comparison between the criteria and alternatives, mathematical techniques will be used to determine the weight of each of the comparison matrix in the hierarchy. The final weights obtained are the measurement of the ratio of priority criteria, sub-criteria and alternatives (Ghodsipoor, 2002).

Table 1. The weighted scale for paired calculation of criteria and sub criteria. Source: Ghodsipoor, 2002.

Description	value
Equal priority	1
Low priority	3
High priority	5
Very high priority	7
Completely of priority	9
Choosing between the above intervals	2,4,6,8

-Delphi Method

The Delphi method is a structured process method developed for unanimity among experts in various social, economic and urban aspects. This process is used for forecasting scenarios of a project. In short, the processes of using the Delphi technique are as follows:

- Predictive questionnaire on prepared the forecaster's perceptions of the situation.
- Questionnaires will be sent to a group of experts who will respond to questions.
- Individual questionnaires will be collected and summarized.
- Summary of responses will be returned to respondents to have their reaction.
- This process will be continuing until the achievement

of a general consensus. (Higinz, 2005)

Research Process

-Determining Intervention Zones

As noted in this study, intervention zones in the studied fabric are recognized and prioritized based on physical, social, economic and environmental factors.

Therefore, the corresponding layer of determining and prioritizing of intervention zones for each of the physical, socio-economic and environmental factors were provided by use of indicators and variables. Finally and according to combination methods, zones in need of intervention in deteriorated fabrics were defined by overlaying of the three mentioned layers.

In order to overlay indicators in this method and create the above three layers, two decision making methods of AHP and Delphi were combined. Firstly, a number of criteria were determined to prioritize the neighborhoods for intervention in the studied zone. Thereafter, the relative measures were rated using the Delphi method and finally alternatives were evaluated and intervention priorities were determined by using AHP method (Table2).

- Prioritizing intervention zones based on physical criteria

According to the Supreme Council of Planning and Architecture on the identification of deteriorated fabrics, the three criteria derived out of the studies include instability, permeability and fine grains. Information for the study of major plans (comprehensive plan and detailed plan of Araak city approved in 2004 of) was obtained and updated by field observations.

Thereafter, with the aim of determining the layer for identifying and prioritizing intervention zones in terms of physical indicators, results and parameters of the mentioned indices were combined. In order to incorporate the above criteria, their relative weight was measured (Table 3). Then, the existing information was combined according to the measured weight and the integrated layers of

combined information are created. Fig. 2 displays physical prioritization of intervention zones within the studied deteriorated fabric.

- Prioritizing intervention zones based on socio-economic criteria

Some subjects are of great importance in urban studies including social situation concerning the structure and functioning of social institutions, social relations, attributes, behaviors and beliefs and social attitudes. The combination of economic and social activities in a city or area shows the type and level of participation of the region's role in the national economy, the city's economy, and so in the degree of development.

Table 2. Weight of different criteria. Source: authors.

row	factor	Criteria weight
1	physical	%54
2	Socio-economic	%37
3	environmental	%9

Table 3. Weight of physical indicators. Source: authors.

Row	Factor	Criteria weight
1	Instability	%60
2	Impermeability	%25
3	Fine grain	%15

In studying social conditions, population indicators, migration patterns, literacy rates, education, social stratification, social structure of tribes and ethnic groups, social capital, the location of etc. should be studied. In addition, in studying economic situation, indices such as the working-age population, employment, guardianship, ownership, price of land, goodwill, income, etc. are required.

According to studies on the conceptual evaluation of the detailed comprehensive plan (sustainable environment design consulting engineers, 2007) as well as field studies in the field of socio-economic studies, the layers for recognizing and prioritizing intervention according to socio-economic indicators

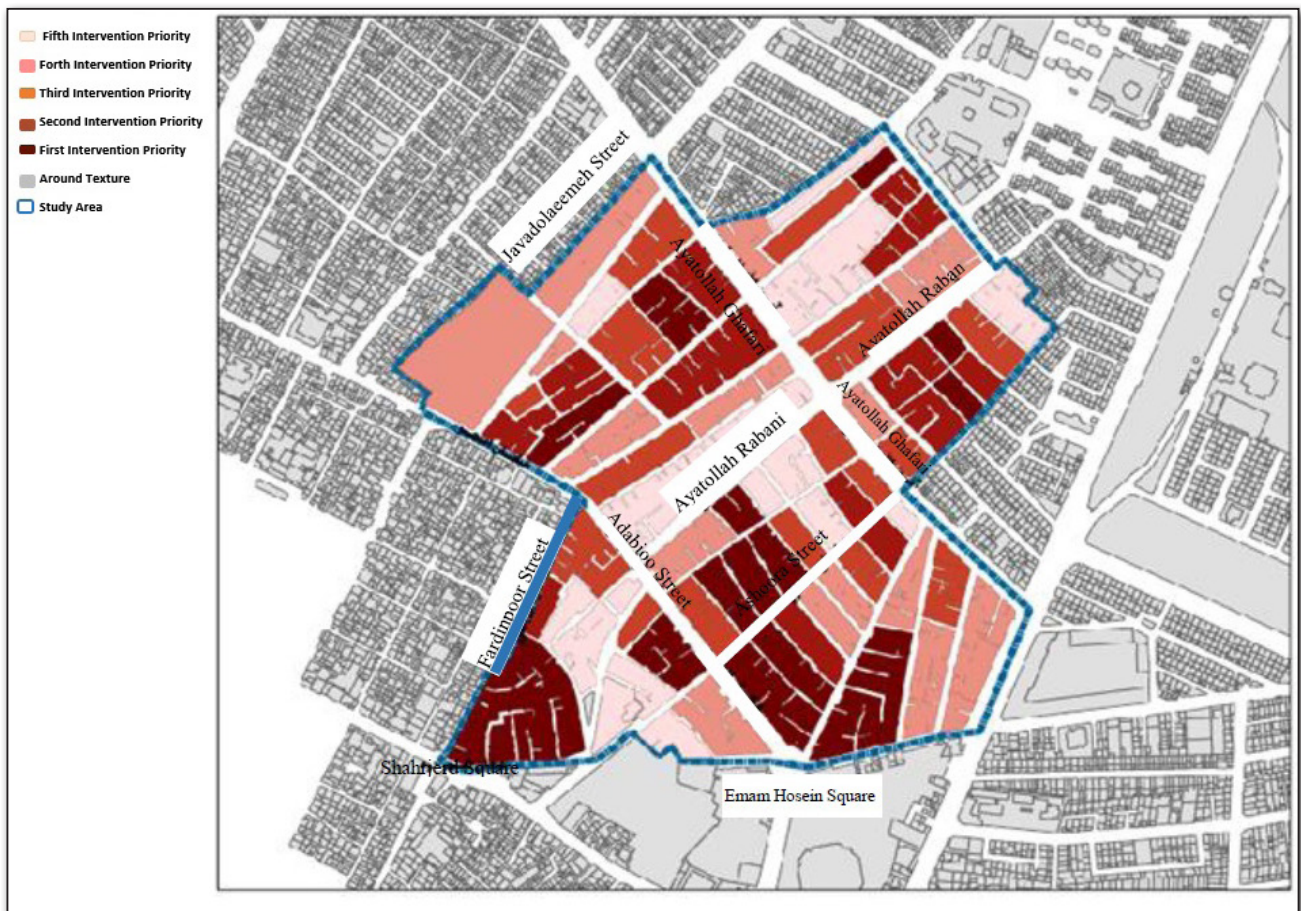


Fig. 2. Physical prioritization of intervention zones. Source: authors.

and variables were extracted and prepared (Fig. 3). Economic and social criteria to determine intervention priorities and their rank and relative weight in determining intervention priorities are presented in table 4. It is noted that, as stated in the introduction, accessing many basic socio-economic indicators

was not achievable in the studied area. However, since this study focuses on utilizing techniques of prioritizing intervention zones, based on the constraints on existing data, the referred criteria are explained in Table 4.

The results of research shown in Figure 3 explains

Table 4. Socio-economic criteria. Source: authors.

row	Criteria	(Percent) Criteria weight	Priority rate
1	population	%13	3
2	Sex ratio	%5	9
3	Family size	%11	5
4	Youth of population	%9	8
5	Population density	%15	2
6	Households in housing units	%10	6
7	Literacy rate	%9.5	7
8	Unemployment rate	%15.5	1
9	Dependency	%12	4

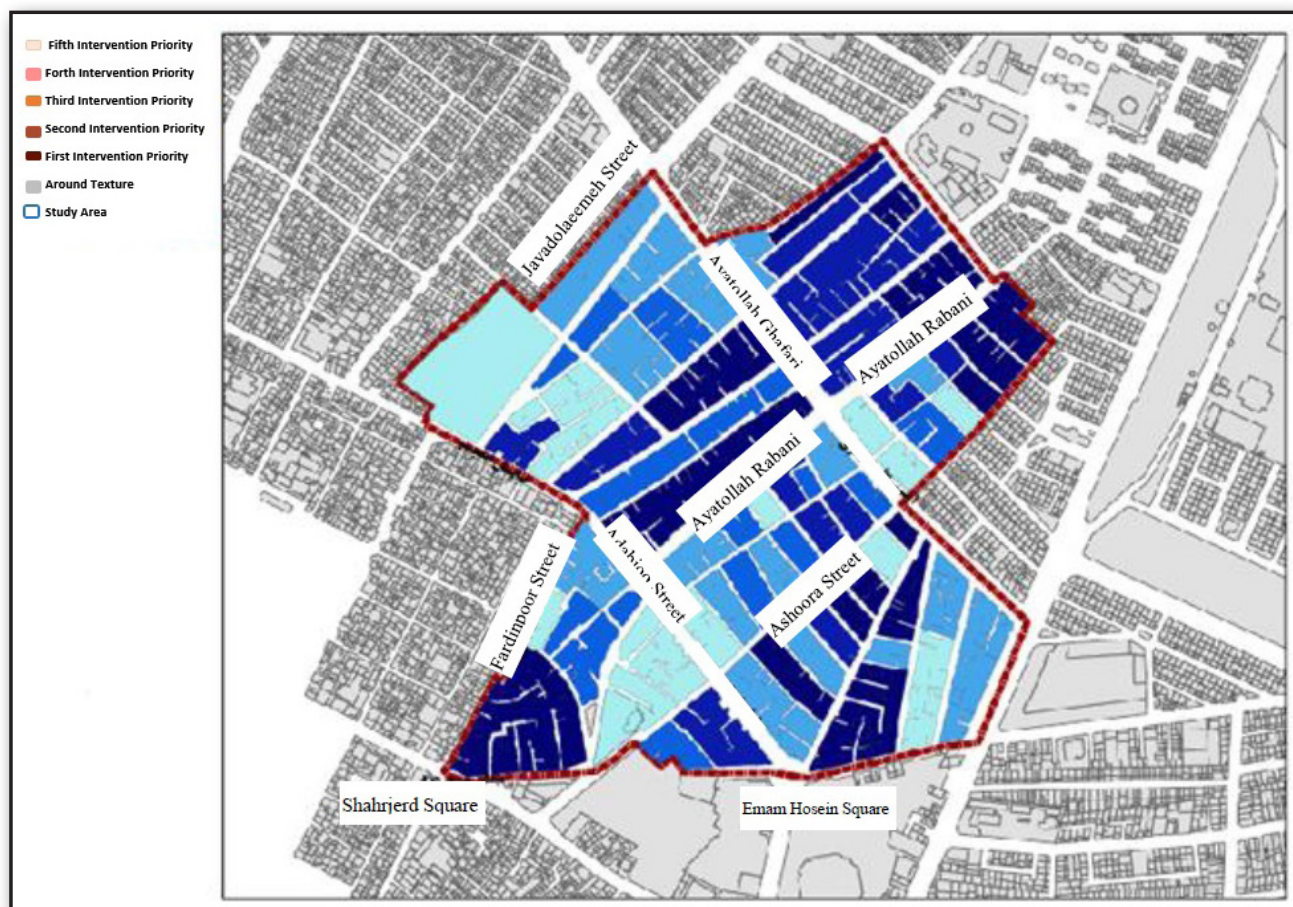


Fig 3. Map of socio-economic priority of intervention zones. Source: authors.

that the west Bank of Shahhid Ayatollah Rabbani Shirazi Street and Western axis of Shahid Ayatollah Ghafari continuously, and north and south and some scattered areas in West and South West have the highest priority areas for intervention in the rankings due to socio-economic indicators.

- Prioritizing intervention zones based on environmental criteria

In order to identify areas of intervention and setting priorities for implementation of environmental projects, various environmental parameters were evaluated in large-scale. Indicators such as (height, slope, Bedrock (Geology), quality of drinking water, drinking water supply, vulnerability to earthquake, flood vulnerability, risk of land subsidence, groundwater level, the dominant wind direction, disposal system of surface water, sewage disposal system, garbage collection system, green space, etc.) are evaluated and scored based on the total score of

each of the areas, with the areas that had the lowest score as the first priority and other areas in the next priorities for intervention due to environmental studies on the project (Table5).

Excellent = 9 scores Good = 7 scores
Fair = 5 scores Poor = 3scores

According to results derived from geographical and environmental evaluation of the studied area (Table 6), and considering the fact that lower scores in of environmental indicators explains worsening of the situation, the west and north are, respectively with a total score of 67 and 73 are in first and second priority. Poor state of sanitation and waste collection and disposal system, improper disposal of surface water and the lack of full implementation of sewage networks, flood and seismic vulnerability of buildings and low quality of drinking water and etc. are the main problems of this area. The south and

Table 5. The guide to evaluate the considerable environmental criteria and indicators. Source: authors.

criteria	indicator	Indicator features
Topography	height	More height due to its positive impact on environmental issues represent a higher score
	slope	Less than 1%, 1% to 3%, 3% to 5%, more than 5%
Geology	bedrock	The more permeable formation, the better, conglomerate, compact alluvium Alternating hard and soft layers, marl, limestone and ... Impermeable formation, Red Formation Balayi - Qom, marl, plaster and...
Water source	Water quality	Drinking water
		consumed water
	Access and water supply	Proximity to the main city pipelines, wells and independent tank in canals and springs and wells out of area
	Water quantity	lack of water for drinking and other uses enough water for drinking and other uses enough water for drinking and shortage for other uses Excess water for drinking and other uses
Environmental hazards	earthquake	Historical earthquakes, the proximity to the fault line, the vulnerability of buildings to earthquakes
	flood	proximity to rivers or watercourses, flooding records, flooding caused by rainfall shower, being located in the flood path
	Fault movements	Landslide, rock fall and...
	The high groundwater level (subsidence)	Less than 3 m, 3 to 6 meters, 6 to 10 meters, above 10 meters, the lower the water level, less the score
climate	Climate type	The higher, the more suitable climate, proximity to green space, proximity to water sources, and...
	Wind direction	Being located in favor of the prevailing wind direction, exposure to the prevailing wind direction, wind velocity
Environmental	Surface water disposal	Trench, ditch, caniveau, canal, free,...
	Sewage system	Domestic or residential wastewater (closed common channel between sewage disposal and surface water disposal) free in the streets and alleys, etc.).
		Sewage (absorption wells, sewage disposal system (ego), drainable well sewage system implementation, etc.)
	Waste disposal system	Automated on time waste collection, timed waste collection, daily delay in waste collecting, waste spread in the environment, lack of waste collection and ...
		Waste landfill (according to environmental regulations + contrary to environmental regulations, etc.)
	Industries	Plurality of industries (area and per capita) + type of intruder industry
	Other polluters	Terminals, remote and proximity to pollution sources outside of the area, pollution of water, soil and air
	Green space	Public green space and equipment area, green space and parks area and the per capita

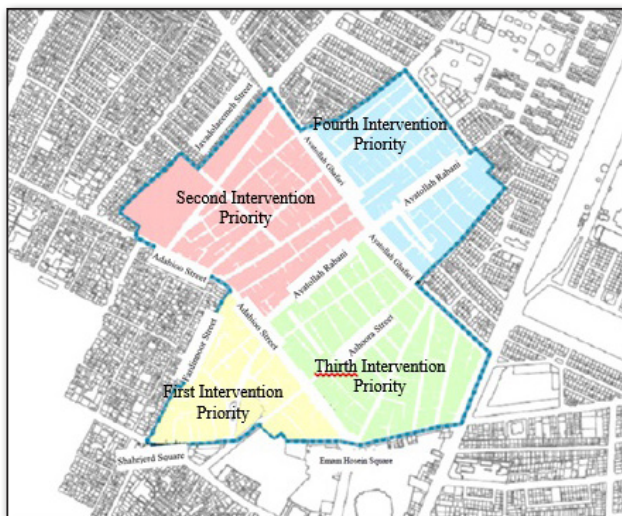


Fig. 4. Map of environmental priority of intervention zones. Source: authors.

east area, respectively, with scores of 87 and 89 in the following priority intervention (Fig. 4).

Combining Results

Having analyzed and defined areas and intervention priorities and by applying physical, socio-economic and environmental indicators, results and findings is organized in the form of layers were eventually combined to achieve the final intervention zones.

In order to combine and overlay the above information, the effect of physical, socio-economic and environmental was applied in the final score. In this regard, the final score for each area of intervention was obtained by the following formula. $(\text{Environmental score} \times 9\%) + (\text{socio-economic scores} \times 37\%) + (\text{physical scores} \times 54\%) = \text{total score}$ Values multiplied by the score of each of the indicators is the corresponding indicator weight. Having achieved the final score, combination of intervention priorities were identified (Fig. 5). As evident, most of the priority intervention are allocated to the south and southeast area. Eventually, the west and north parts are in the next intervention to have priority.

Table 6. Assessment of environmental indicators of deteriorated fabrics of Araak city for to identifying intervention zones. Source: authors.

area	Waste collection and disposal system	Sewage disposal system	Surface water disposal system	The prevailing wind direction 3 and 5	Groundwater levels	Land subsidence	Flood record	Earthquake record	Water supply	Water quality	Bedrock	slope	Height	total
West area	7	3	5	3	3	5	7	3	5	7	7	5	7	67
North area	7	5	5	5	5	5	5	5	5	7	7	5	7	73
South area	7	9	7	7	7	7	5	5	7	5	9	7	5	87
East area	7	9	7	7	7	7	5	7	7	5	9	7	5	89
Total	28	26	24	22	22	24	22	20	24	24	32	24	24	316

Discussion and conclusion

In most intervention zone priority of deteriorated fabric researches zones in the country, the adopted evaluation criteria are confined only to some defined measures or in the case of consideration of other criteria and influencing factors on the problem, only qualitative assessments and proposals are offered. This article tries to identify, assess and intervene socio-economic and environmental criteria, quantitatively and more precisely, other than the approved standards in order to recognize and prioritize intervention zones. Regarding the prioritization maps according to triple criteria (Fig. 2, 3 and 4) a partial agreement can be identified between prioritized zones based on socio-economic and environmental criteria. Therefore, it can be inferred that if part of the information necessary for physical evaluation is missed or unachievable for any reason, socio-economic and environmental information and analysis can be used as a trustable replacement for recognizing and prioritization of deteriorated fabrics. On the other hand combination of zone prioritization based on three studied criteria (Fig. 5) both leads to a better and more accurate identifying of intervention zones and can result in minor changes in prioritization of intervention particularly in the first and third priority. Overall, these proceedings can be prerequisites for determining intervention projects in the deteriorated fabric where consideration of socio-economic and environmental criteria can be effective in the evaluation of effectiveness and feasibility.

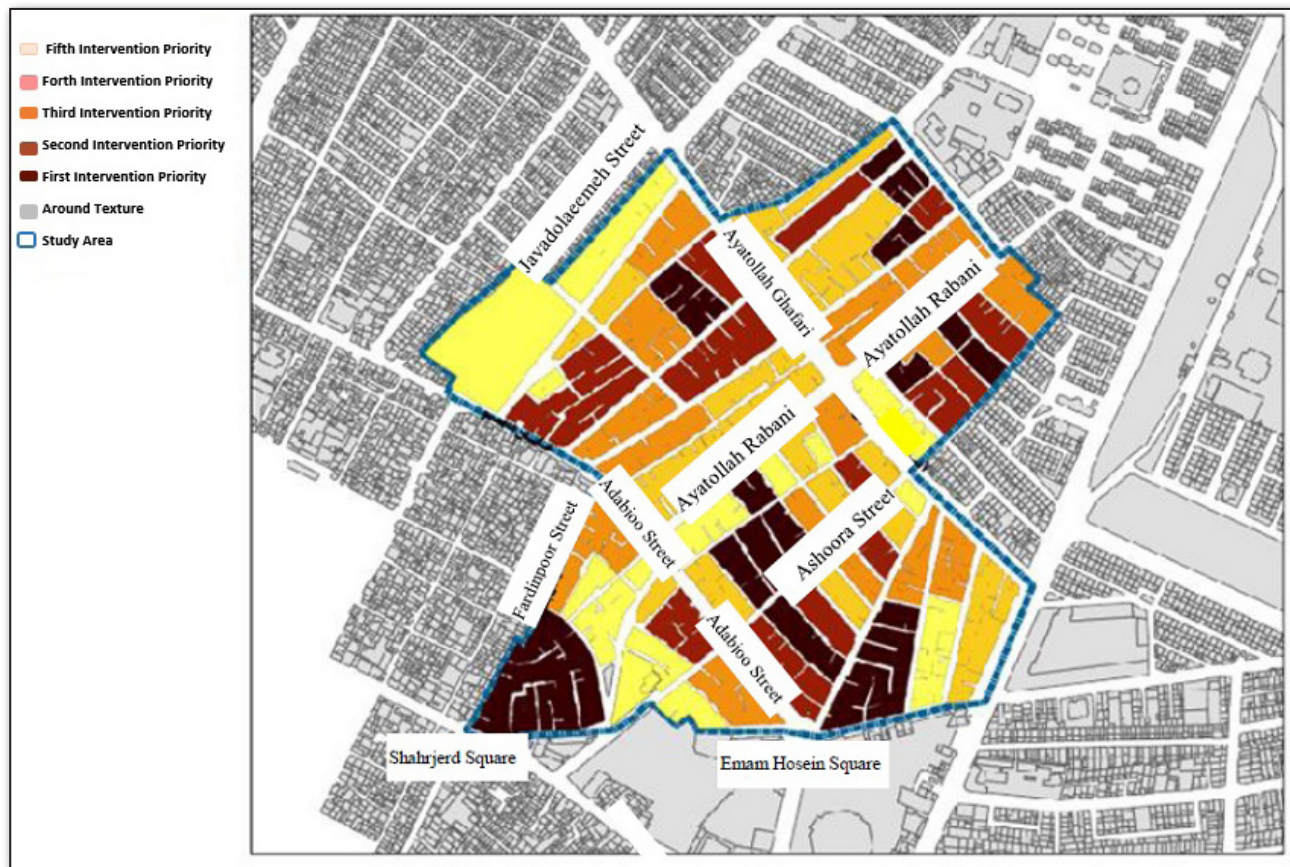


Fig. 5. Map of Integrated priority of intervention areas. Source: authors.

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