The role of urban planning in reducing the harmful consequences of natural disasters (Case Study: Abbar)

Naghi Safari
Graduate student, Geography, Urban Planning, Islamic Azad University, Rasht Branch, Iran
Nagi.safari@yahoo.com

Akbar Motamedi Mehr
Assistant Professor, Faculty Member, Islamic Azad University, Rasht Branch, Iran
motamedimehr@iaurasht.ac.ir

Roghaye Heidari
PhD Candidate, Geography and Urban Planning, Payame Noor University, Tehran branch, Iran
hroghaye@ymail.com

Abstract

Many security problems have been emerged in cities due to development of urbanization, development of cities, and lack of planning for preventing uncontrolled growth of cities. In this regard, urban planning may identify the risky elements and strengthen the security of cities to reduce and prevent harmful consequences of natural disasters. Therefore, this study aimed to investigate the role of urban planning in reducing the harmful consequences of natural disasters (Case Study: Abbar). This was descriptive survey study. The population consisted of experts who were working in municipality, City Council, and other relevant departments (N=83). A researcher made questionnaire was used for collecting the data. The validity of this questionnaire was confirmed by professors; using Alpha Cronbach, its reliability was determined to be 0.70. Using SPSS software, the collected data were analyzed at both descriptive and inferential levels. The findings showed that the consequences of natural disasters would be reduced by observing structural laws, technical principles of designing roads and other structures, and proportionality between structures and population density. Also, the findings showed that there was difference between the views of experts in terms of demographic characteristics-based urban planning in Abbar.

Keywords: Urban Planning, Natural Disasters, Experts, Abbar.
Introduction:
Nature is the context for city localization, urban collections, and other human activities; it always imposes some conditions on cities. One of the concepts in nature is (natural disasters) which includes floods, earthquakes, tornadoes, hurricanes, volcanoes, and etc. Human life has constantly been threatened with these events. Throughout the history, people have experienced them and tried to reduce their effects and prevent loss of lives and properties (Zangiabadi & Ismailian, 2013: 114). Due to its prominent geological feature, Iran is located on great fold belt of geological third age; this has made it mountainous. Iran is located on seismic Alpine - Himalayan belt and has been affected by its geologic features. Iran is one of Earth's tectonic active zones; many natural events have been happened there. In terms of climate, the diversity and heterogeneity of climatic factors in Iran have had many environmental effects in geographical environment. In Iran, different environmental conditions have been created due to river characteristics and slope movements. These conditions have led to occurrence of known disasters (Mohammadkhani & Salmanian, 2011: 3). Today, disasters are a larger worry for human society than the past (Heidari et al., 2015: 33). Some of the risks are predictable, while some others may be unpredictable (Eskunk et al., 2005). Although natural disasters are inevitable and it is impossible to prevent their occurrence, the timely alerts and warnings to public, proper planning, and timely reaction to these accidents may largely reduce their damages and losses (Heidari, 2015: 33). The effects of natural disasters may be reduced through activities before the disaster for mitigating the risks. These activities are among the most important factors of disaster risk reduction and formation of a coordinated strategy or plan. The mobilizing of resources increases awareness level in community and help resource evaluation and public awareness (Kangabam et al., 2012). The focus and attention to vulnerability against natural disasters is one of the important and significant aspects in development planning. The cities demand more attention due to high volume of investments and many socio-economic facilities and tools. In the case of these events, there will be a lot of life and financial losses and damages (Latifi, 2010: 113).

The establishment of many human settlements on lands which are vulnerable to natural disasters, particularly in Iran, has made inevitable the attention to policies, plans, and programs for damage reduction and crisis management. The occurrence of natural disasters such as earthquakes is sudden; it may be reflected in a region and even affects national issues. Sometimes, the dimensions of disaster are so vast which require attention and support at international level. In this situation, the damage reduction and crisis management are integral components of urban planning and design. However, it should be noted that crisis management is not only a management category; it is strongly dependent on physical characteristics of settlements. The planning for crisis management should not be considered only an operational-organizational measure. It should consider the physical and functional design and organization of settlements (Hamidi, 1995: 1653). Therefore, understanding vulnerability reasons and the areas which are impacted by earthquake depends on accurate understanding of vulnerability reasons of each of the constituent elements of city texture. The most influential elements of city texture include land use, urban texture, open spaces distribution pattern, proximity and location of urban facilities and infrastructures, and communication networks (Azizi and Homafar, 2013: 6). The natural hazards prevention plans are provided in developed and leading countries in urban planning to eliminate or reduce the long-term effects and consequences of known natural hazards on lives and assets of
human societies. These plans aim to improve current situations and protect future developments. In these plans, the methods and measures to mitigate the effects of risks include structural measures (such as buildings and infrastructure protection against damaging effects caused by water and wind) and non-structural measures (such as law provision or promotion and adoption of policies on land use). The development of a plan for prevention of risks is based on following three major processes:

1. Analysis of vulnerability against hazards;
2. Development of disaster prevention strategies;
3. Integration of desired plan with comprehensive plans and other prepared plans (Bemanian et al., 2014, 6).

However, the safety of cities against natural hazards is one of main objectives of urban planning. Therefore, it is essential to conduct research on vulnerability of urban settlements and recognize their vulnerability level against natural hazards (Mohammadi Ahmadiani, 2011: 123).

The urban environment quality depends on its facilities, convenience, and safety. The urban planning aims to prevent disasters by identifying risky elements and strengthening environment safety; this depends on improving city and urban development (Abdullahi, 2003: 76). Explaining the principles and concepts and using geographic data, the urban development Knowledge may greatly reduce the effects of such disasters. Also, urban managers may use this data to implement management principles to reduce the vulnerability of cities against these events (Mohammadi Ahmadiani, 2011: 125).

The risk assessment information publication is the first step towards implementation of disaster prevention plan through urban planning; therefore, these plans will be understandable accurately and completely for people (Abdullahi, 2003: 76). Along with natural hazards and in the context of active management, the urban planning will be able to greatly reduce deaths and damages caused by natural hazards (Hosseinzadeh, 2005: 62). In general, the principles of urban planning for disaster prevention are: (rebuilding a vulnerable environment and development of safe and secure environment) (Abdullahi, 2003: 76). So, the policies are required which may reduce natural disasters risks (Hamidi, 1995: 1662).

In a study titled (The reduction of natural disasters (earthquake) risks in cities through land use planning (case study: Area 5 District 3, Tehran)), Bemanian and others (2014) showed that the use of risk assessment methods, particularly quantitative and comparative methods, is efficient in provision of practical and logical framework to measure risks, conduction of land use planning decisions accurately and with higher quality, and showing priorities and deficiencies which increase the vulnerability of cities against natural events, especially earthquakes. In a study titled (The role of urban land use planning in reducing vulnerability of cities against natural disasters (flood) risks), Rostami and Rafieian (2015) concluded that land use planning has an important role in disaster risk reduction and it is one of the key elements in reducing disaster risks. Also, the lack of attention to land-use planning for disaster reduction in scientific and international literature was introduced as the main reason for ineffectiveness of planning, especially in flood crisis management. Cross (2001) believes that the vulnerability of metropolises against risks is considered during the International Decade for Natural Disaster Reduction. In many aspects, however, the inhabitants of small towns and rural communities are more vulnerable to disasters. In fact, small towns are more vulnerable against natural disasters than metropolises due to their economic and political deprivations and lack of sufficient potential to withstand catastrophic
losses which may seriously affect global economy. Despite their small population, they may suffer the most damage. Kuhlicke argued that it is very important to create a capacity to cope with natural hazards in communities which face with economic, social, and environmental challenges. The creation of social capacity for natural hazards has become an important issue for developed countries and European countries which are faced with many challenges. They use a coherent perspective on several issues of social sciences to provide information in the field of crisis management and risk effects reduction. Parlak et al (2012) reported that the planning for sheltering or evacuation is considered in America to respond to crisis situations. This planning includes numerous issues such as infrastructure engineering, emergency management, health care, mass communication, food and water supply and distribution, and so on. The awareness of population behavior under different conditions such as work, home, and travel should impact on many dimensions such as protection, prevention, response, and recovery. Therefore, the attention to risks of crises is very important. The mitigation of disasters effects should be considered as a national and local priority. Meanwhile, it is important to pay attention to urban planning and consider risk considerations.

Abbar is a city in and capital of Tarom County, Zanjan Province. It is a foothill town and is located on alluvial fans which are created by flood sediments. In earthquake hazard zoning, it is classified as relatively high hazard zone. Therefore, it is necessary to have a comprehensive planning for crisis management in Abbar; and the role of urban planning to reduce losses and damage is more important than ever. However, this study aims to answer this question: what is the role of urban planning in reducing the harmful consequences of natural disasters?

Methodology:
This was descriptive survey study. The population consisted of experts who were working in municipality, City Council, and other relevant departments (N=83). A researcher made questionnaire was used for collecting the data. The validity of this questionnaire was confirmed by professors; using Alpha Cronbach, its reliability was determined to be 0.70. Using SPSS software, the collected data were analyzed at both descriptive and inferential levels.

The location of study:
Abbar is a city in and capital of Tarom County. It is located in 48 km northeast of Zanjan (Figure 1). This city's geographical position is 48° 58' east longitude and 36° 55' north latitude. Its height is 620 meters above sea level (Table 1).

<table>
<thead>
<tr>
<th>Name of city</th>
<th>Name of county</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Height above sea level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbar</td>
<td>Tarom</td>
<td>55</td>
<td>36</td>
<td>620</td>
</tr>
</tbody>
</table>

Table 1: geographical characteristics of Abbar

Source: (Papali Yazdi, 2010: 33)
As straight-line, the distance of this city from province capital is about 48 km; based on existing communication road, the distance is about 90 km. It is a foothill city. The Abbar River is one of the main causes of this city formation. This river flows at eastern end of city.

Map 1: Geographical location of studied area in Zanjan and Iran

**Findings:**

First hypothesis test:

Hypothesis: The structural conditions, in terms of laws, play an important role in reduction of harmful consequences of natural disasters in Abbar urban planning.

The Pearson correlation coefficient was used to investigate the role of structural conditions, in terms of laws, in reduction of harmful consequences of natural disasters in urban planning.

Table 2: Pearson's correlation coefficient test data to test first hypothesis

<table>
<thead>
<tr>
<th>Pearson correlation coefficient</th>
<th>Reduction of harmful consequences of natural disasters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural conditions in terms of laws</td>
<td>Correlation coefficient</td>
</tr>
<tr>
<td></td>
<td>Sig. level</td>
</tr>
<tr>
<td></td>
<td>Number</td>
</tr>
</tbody>
</table>

The Pearson correlation coefficient is 0.913 and is significant at level below 0.01. Therefore, there is relationship between structural conditions in terms of laws and reduced natural disasters effects; so, the first hypothesis is confirmed. Considering the positive sign of Pearson correlation...
coefficient, also, it can be concluded that there is direct and increasing relationship between structural conditions in terms of laws and reduction of natural disasters consequences.

Second hypothesis test:
Hypothesis: The technical principles of designing pathways and other structures play an important role in reduction of harmful consequences of natural disasters in Abbar urban planning.
The Pearson correlation coefficient was used to investigate the role of technical principles of designing pathways and other structures in reduction of harmful consequences of natural disasters in urban planning.

Table 3: Pearson's correlation coefficient test data to test second hypothesis

<table>
<thead>
<tr>
<th>Pearson correlation coefficient</th>
<th>Reduction of harmful consequences of natural disasters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical principles of designing pathways and other structures</td>
<td>Correlation coefficient</td>
</tr>
<tr>
<td></td>
<td>Sig. level</td>
</tr>
<tr>
<td></td>
<td>Number</td>
</tr>
</tbody>
</table>

The Pearson correlation coefficient is 0.907 and is significant at level below 0.01. Therefore, there is relationship between technical principles of designing pathways and other structures and reduced natural disasters effects; so, the first hypothesis is confirmed. Considering the positive sign of Pearson correlation coefficient, also, it can be concluded that there is direct and increasing relationship between technical principles of designing pathways and other structures and reduction of natural disasters consequences.

Third hypothesis test:
Hypothesis: The proportionality between structures and population density plays an important role in reduction of harmful consequences of natural disasters in Abbar urban planning.
The Pearson correlation coefficient was used to investigate the role of technical proportionality between structures and population density in reduction of harmful consequences of natural disasters in urban planning.

Table 4: Pearson's correlation coefficient test data to test third hypothesis

<table>
<thead>
<tr>
<th>Pearson correlation coefficient</th>
<th>Reduction of harmful consequences of natural disasters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportionality between structures and population density</td>
<td>Correlation coefficient</td>
</tr>
<tr>
<td></td>
<td>Sig. level</td>
</tr>
<tr>
<td></td>
<td>Number</td>
</tr>
</tbody>
</table>
The Pearson correlation coefficient is 0.771 and is significant at level below 0.01. Therefore, there is relationship between proportionality of structures and population density and reduced natural disasters effects; so, the first hypothesis is confirmed. Considering the positive sign of Pearson correlation coefficient, also, it can be concluded that there is direct and increasing relationship between proportionality of structures and population density and reduction of natural disasters consequences.

Fourth hypothesis test:
Hypothesis: The experts with different demographic characteristics have different views on urban planning in Abbar.

A) Gender: The independent t-test was used to determine the difference between opinions of urban planning experts in terms of gender.

Table 5: The independent t-test data to determine the differences in opinions based on gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>Gender</th>
<th>Number</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Standard deviation error</th>
<th>Degree of freedom</th>
<th>t-value absolute value</th>
<th>Mean difference absolute value</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban planning</td>
<td>Experts</td>
<td>Male</td>
<td>69</td>
<td>97.37</td>
<td>13.48</td>
<td>1.6234</td>
<td>81</td>
<td>.701</td>
<td>3.3768</td>
<td>.485</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>14</td>
<td>94.00</td>
<td>27.01</td>
<td>7.2210</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The independent t-test is not significant with mean difference absolute value of 3.37 and t-value absolute value of 0.70 at level below 0.05. Therefore, there is no significant difference between male and female experts' views on urban planning in Abbar. Both groups believe in observing design principles and construction principles in urban planning; there is no significant difference between their opinions.

B) Employment sector: The independent t-test was used to determine the difference between opinions of urban planning experts in terms of employment sector.

Table 6: The independent t-test data to determine the differences in opinions based on employment sector

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>Employment sector</th>
<th>Number</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Standard deviation error</th>
<th>Degree of freedom</th>
<th>t-value absolute value</th>
<th>Mean difference absolute value</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban planning</td>
<td>Experts</td>
<td>Private</td>
<td>2</td>
<td>79.00</td>
<td>.0000</td>
<td>.00000</td>
<td>81</td>
<td>1.571</td>
<td>18.246</td>
<td>.120</td>
</tr>
</tbody>
</table>
The independent t-test is not significant with mean difference absolute value of 18.24 and t-value absolute value of 1.57 at level below 0.05. Therefore, there is no significant difference between views of experts who are working in public and private sectors on urban planning in Abbar. Both groups believe in observing design principles and construction principles in urban planning; there is no significant difference between their opinions.

C) Education degree: The one-way ANOVA test was used to determine the difference between opinions of urban planning experts in terms of education degree.

Table 7: The one-way ANOVA test data to determine the differences in opinions based on education degree

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>Differences</th>
<th>Degree of freedom</th>
<th>Mean square</th>
<th>F value</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban planning</td>
<td>Experts</td>
<td>Between groups</td>
<td>3</td>
<td>1084.723</td>
<td>4.574</td>
<td>.005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Within groups</td>
<td>79</td>
<td>237.149</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Since the test of urban planning variable is significant at level below 0.01, it can be concluded that there is difference between experts with different education levels in terms of their opinions about urban planning. Also, Tukey HSD test data showed that people with higher education degrees have more positive attitude towards urban planning in Abbar.

**Discussion and conclusion:**
According to findings, it can be concluded that there is direct and increasing relationship between structural conditions in terms of laws and reduction of natural disasters consequences. This means that by increasing observance of structural conditions in terms of laws, the consequences of natural disasters are reduced. Also, there is direct and increasing relationship between technical principles of designing pathways and other structures and reduction of natural disasters consequences. In other words, if the technical principles of designing pathways and other structures are observed in terms of rules and regulations, the harmful consequences of natural disasters will be reduced. Based on the findings, there is direct and increasing relationship between proportionality of structures and population density and reduction of natural disasters consequences. In other words, if proportionality of structures and population density is observed, the harmful consequences of natural disasters will be reduced.

The findings of this study are consistent with findings of Amini Veraki et al. (2015). Based on Q-factor analysis, the findings show three perspectives on urban vulnerability in Iran. The first perspective is crisis management and passive defense experts' attitude which emphasizes on risky use of urban lands and urban infrastructures; the second perspective is geography-environmental hazards experts’ attitude which focuses on natural factors; the third perspective is urban development- geography and urban planning experts’ attitude which emphasizes on structural components, texture, and density of city. Parlak et al (2012) reported that the planning
for sheltering or evacuation is considered in America to respond to crisis situations. This planning includes numerous issues such as infrastructure engineering, emergency management, health care, mass communication, food and water supply and distribution, and so on. The awareness of population behavior under different conditions such as work, home, and travel should impact on many dimensions such as protection, prevention, response, and recovery. Also, the findings showed that there is no significant difference between male and female experts' views on urban planning in Abbar. Both groups believe in observing design principles and construction principles in urban planning; there is no significant difference between their opinions. There is no significant difference between views of experts who are working in public and private sectors on urban planning in Abbar. Both groups believe in observing design principles and construction principles in urban planning; there is no significant difference between their opinions. Also, there is difference between experts with different education levels in terms of their opinions about urban planning. In general, the people with higher education degrees have more positive attitude towards urban planning in Abbar. However, this study showed that urban planning plays an important role in reducing the harmful consequences of natural disasters. Therefore, it is suggested that the geographic location of building will be considered in structures’ construction instructions and their establishment in high-risk areas will be avoided. The regulations should be implemented for constructions retrofitting and prevention of non-standard constructions which do not withstand events. It is recommended that regulations to be provided for observing technical principles of designing pathways and other structures to retrofit and reduce the harmful consequences of natural disasters. Also, the proportionality of structures and population density will be increased by supervision of experts to reduce the impact of natural disasters.
References

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