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SEPARATION OF URBAN AREAS BASED ON THE TYPE OF CRIME WITH THE HELP OF CLUSTERING TOOLS IN GIS SOFTWARE CASE STUDY: QAZVIN PROVINCE

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ABSTRACT

Crime analysis is an important executive process to identify and understand the crime and involves the collection and analysis of data reported from incidents of crime, victim and criminals' characteristics and information developed in this field used in the actions related to the prevention and detection of the crime. In this paper, the average center for the sum of all crimes was used as a criterion to compare four types of data from various kinds of crime. The average center of burglary from homes in compare to the average center of all crimes and two other crimes has greater tendency toward north. The average center for crimes related to cars in compare to the other crimes has greater tendency toward southern parts of the city and street thefts such as homes took place almost in the northern parts of Qazvin city, but has had slight tendency toward western parts of the city, too. In the following functional form it was decided to use cluster analysis while crowded areas of cities were inserted in GIS software and different types of crimes as well. Then the ellipse of its standard deviation was drawn and by using cluster tool, different fields of crimes were also classified in the map. The table of effects including the most essential information to evaluate the problem and considered as a basis for multi- criteria approaches were presented. The table of effects includes solutions, criteria and effects. Solutions and the name of the criteria and the number of crimes in the 5 police stations in Qazvin (crime frequency relating to security, economy, and society) were studied.

Keywords: *Crime Analysis, Types of Crime, Criteria, Solutions, and Effects*

INTRODUCTION

Urban life does not lead directly to urban deviance but could be a predisposing factor to deviance. However, the best social services of the country are given in cities; many social disadvantages including crime, murder, and social unrest are placed there as well.

There are different conditions in cities such as high density of population, immigrants with different cultures and ethnic groups, many single young men, social class differences, high unemployment, income and economic problems, lack of adequate housing and the like, cause urban crime. Large cities attract lots of immigrants (especially rural migrants) for various reasons. Immigration is not an only and complete reason for deviations and delinquency, but if it happens with other good conditions provided less in the first environment, the way for immigrants' delinquency will be likely paved. Migration will break the social bonds. Lack of social bonds; result in ignoring the social requirements, so the immigrants can do some actions considered anti-social behavior for them. The difficulty of lives of migrant population, often young, naive, jobless and hopeless about the future can display themselves through violent actions (Bastiyeh, 1998). Competition in the city allows people to act in any way to achieve their intended goals and as they do not find legitimate income sufficient to support their lives, they tend to deviation. Economic and social insecurity, including lack of proper nutrition, housing and health facilities lead to the lack of human relationships, aggression, inattention toward classical theory in the community (Mafi, 1999).

Alienation, loneliness, and norm-breaking and stress of urban society imposes on its citizens increase depression, suicide, addiction, aggression, social deviations, types of crime, higher divorce rates and so on in the urban societies (Shokuhi, 1995). Urban lifestyle provides situations in which homes remain empty

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and without residents which makes the rates of thefts in the cities increased. Burgess believes that urban mobility with an increase created in the number and intensity of stimuli make people inevitably concerned with chaos and moral degradation (Walmsly, 1988; Dickens, 1998). Crowded slum neighborhood created through small homes far from the eyes of the city officials are the centers of the crisis and the society problems. Material and cultural poverty, crowding and unemployment, drug trafficking and addiction are among the factors that provide the context for youth delinquency and to reduce social security. Studies done in the field of the impact of housing, neighborhood and city on youth incompatibility has been demonstrated that youth incompatibility and delinquency generally depend on the neighborhood usually with small homes and inappropriate conditions (Kamyar, 2000). Housing problems in cities can lead to abnormalities. Lack of access to adequate housing is connected directly to increasing delinquency, divorce and social disruption and considered as deterrent factor to social, cultural and psychological growth and promotion (Dalalpour Mohamdi, 2000).

Effective Factors in Reducing or Increasing Security

It should be noted that there are different factors affecting the social security which can not be possible just by police. In fact, economic, social, cultural, political factors impact on providing security.

Economic, Social, and Cultural Factors

Security in cities depends on socio-economic conditions. In the cities, ethnic, cultural, and economic diversity are high and all the security problems can not be attributed to the city and its physical body. This means that if the social, economic, cultural conditions of civil society are good, the security factor will increase. For example, the studies that have been done on crime prone areas in cities have indicated a direct relationship between social and economic conditions and crime -prone neighborhoods. In fact, in dense or slum neighborhoods, the crime occurred more than other neighborhoods and most prisoners belong to the same neighborhoods. Even the type of crime in the neighborhoods is different from predominantly affluent neighborhoods and usually dirty crimes occur more in these neighborhoods. Identity conflicts are effective factors in reducing security and committing in crimes. Poverty is not considered the only factor in committing the crimes, but discrimination between individuals is a key factor in reducing security. Identity conflicts and feelings of discrimination are factors against the current disciplines. When a person feels lack of identity and sees his identity in conflict with another identity one of his possible reactions can be aggression toward the current situation. As mentioned before, crowded places in the cities can be changed into the centers of crimes and social problems due to the creation of small housing away from city officials. Material and cultural poverty, crowding and unemployment, drug trafficking and addiction are among the factors that provide the context for youth delinquency and to reduce social security (Kamyar, 2000). High density of housing in slum areas surrounding the city leads to specific crimes. The high cost of housing in the city and some people's inability to provide it collaterally, cause social costs such as diseases, crimes, insecurity in cities (ibid, 15). Crimes committing is different between the tenants and the landlords; As far as Baldwin and Botomez have stated, tenants are somewhat more likely to commit crime than landlords (Walmsly, 1988). Crowds and population density reduce social security. Population growth leads to a situation in which public organizations and government agencies such as police could not have full control over the situation and this makes social control weaker and chaos and lawlessness get increased. Different immigrants to the cities make them far from normal integration. Migration weakens social bonds. Nostalgia, economic pressures and frustrations of life increase the former values and can provide situations to commit crimes (Dehghan, 2002).

Physical Factors

One of the factors leading to security in the cities is physical factors. It means the design of cities has great impacts on increasing or decreasing security. Checkered design of cities is one of the aggravating factors and reduces the amount of security. This design creates escaping passages in cities. The new structure of apartment settlement and urbanization in which people do not know each other and are strangers to them, criminals can easily get into the neighborhoods; commit the crime; and escape through the places they want. In terms of traffic, checkered design is problematic and residents' security will be at risk (Aliabadi, 2002). Fewer crowds in an area are other factors in reducing security and causing crime

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prone situations. In fact, criminals refuse committing crime in an environment visible to public. To prevent crime prone situations they can be moved in order to provide citizens opportunity to move in the environment. So quiet environment disappears and the severity of the crime prone situations gets reduced. For example, in the deserted streets, the possibility of child abduction is high however children still need a place to play so they play in streets or allays. Some parks with suitable playyards for children can be designed in the neighborhoods so that children can play in an enclosed and safe place while it attracts other people to reduce crime prone situation as well.

Dark neighborhoods are other factors causing crime opportunities in urban areas. Criminas usually tend to commit the crimes in dark places and away from public eyes. In light places and under public eyes the criminals do not dare to commit crime resulting in reduced immunogenicity of crime.

Environmental Irregularities

Another complicating factor is environmental irregularities which mean there is no regular relationship in the city. For example, when there are undecided crowds in a place - as many different people standing and waiting in a place – the crime possibility will be high. Environmental irregularities may be resulted in social factors as well as instability of urban regulations. This chaos makes the urban environment uncertain. When it takes place in a city, the model of construction and streets gets chaotic and the service will be poor (Ibid, 8).

Political Factors

Another factor in reducing or increasing security is political factors. Government policies in localizing assets and resources in some big cities or capital cause retardation or underdevelopment for other towns and villages and provide preliminary migration from villages to cities which brings urban problems including suburbanization and etc, therefore the rate of urban crime gets increased and urban security decreased. In advanced industrial countries, equitable distribution of resources and assets in different cities, reduce rural-urban migration and crime rates have been much lower level. While in our country before Islamic revolution, in the first development plans, especially in the fourth development plan in the '40s, Growth pole policies (centralized policies) made the cities deprived of facilities and public and private funds and the great migration to the center of the country.

MATERIALS AND METHODS

Methodology

According to the nature of the city as a complex social - spatial system, the most appropriate approach in the structure of the research model is the use of the process of combining methods which can be studied through an organized case study. The process of combining methods makes it possible to use quantitative methods with qualitative methods and to avoid discrimination. This method is currently emphasized in the process of urban studies and urban planning.

Data Collection Tools

Applying library resources including: (documents, books, statistics, maps and all related resources);
Using the World Wide Web due to the topic novelty in order to get the latest scientific information in the field of the present study;
Field operation including going to the site, field observation to inform the central part of the city

Variety of Cluster Analysis Techniques (Hotspots)

Spot locations: The main types of cluster contain a number of events occurred in various places, the places with the highest number of criminal incidents are defined as hotspots.

Division techniques: This technique frequently called “K means” divides all parts that have been assigned to clusters and are shown in ellipses.

Density techniques (intensity): This technique identifies clusters by searching for focusing events intensity. One of the algorithms in this field is applying nuclear density method.

Risk -based techniques: This technique identifies pleasents related to a variable in fundamental risk such as populations, employees or active target.

Other techniques: Other methods used less include land areas used for areas not for events.

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Hierarchical techniques: it is to view tree diagram in which two or more events classified first based on some criteria. Based on the above reasons and data access, hierarchical methods are used to detect hotspots for crime prevention.

Levels of Analysis and Focus of Urban Crime Centers Methodology

In each location study, scale and size of the study have an important role in the analysis, tools, theoretical basis, results and objectives of the study. Crime analysis is an important executive process to identify and understand the crime and involves the collection and analysis of data reported from incidents of crime, victim and criminals' characteristics and information developed in this field used in the actions related to the prevention and detection of the crime. In general, geographical investigations of crime in Qazvin city are done through one of the two following analytical methods:

Correlation Analysis

In this method of analysis, the relationship between crimes and some individual, social, economic characteristics of cities are evaluated. This method was first utilized by "Shaw" and "McKay" in the study of urban crime in 1942.

They found crime rates are high in those parts of the city in which social ills such as poverty, population excitation, and population heterogeneity are more. Therefore, the individual and social characteristics including age variables, gender, ethnicity, race, income, facilities, employment and some physical features such as population density, quality and type and amount of rental housing in relation to the type and number of crime will be studied in the mentioned analysis. Therefore the crime comparison and matching get possible in different areas of the city. Those who have chosen this method of analysis for the study of geography and crime include Bayern and Samson (1986), Bersik and Grasmik (1993), Rayes and Tonozy (1986) Askogany (1990) (Kalantari, 2001).

Analysis of Crime Opportunities

This method was first utilized by Jefri (1971) and then Heris (1973). This method is based on the analysis of direct factors and effective place condition in urban crimes. In other words, the place characteristics according to a potential criminal's point of view diagnosed useful for crime committing will be studied. It seems that a criminal in dealing with the place is always faced with the questions: what amenities and facilities are available here for a crime? What kind of crimes can be followed in the place? How can they escape from the scene of the crime quickly? The potential crime prone areas can be marked through applying the method of crime opportunities and studying place condition and spatial patterns increasing the possibilities of crime committing in the city. Routine activity theories of rational choice and environmental criminology are formed and expanded based on the analysis of crime opportunities opportunities for crime (ibid: 68).

Crime Mapping in Qazvin

In the following functional form, it was decided to insert the various types of crimes in the GIS software by cluster analysis while the crowded zones of cities were inserted in the software as well. Then the ellipse of the standard deviation was drawn and in the next map the classification of different areas of crimes was studied by using clustering tools: (Map indicating livestock theft in the city of Qazvin in the form of population density of point, clustering and standard deviation ellipses). Maps are attached in the appendices. (Deviation ellipse center is located on Tarigh Alghods street).

Analytic hierarchy process begins with the identification and prioritization of decisions. These elements include objectives, criteria, or specifications and possible options can be used to prioritize. The process to identify elements and relationships leading to the creation of a hierarchical structure is called the hierarchy. The hierarchy of structures is due to summarizing decision-making elements (Options and decision criteria) in different levels (Bowen, 1993). So, the first step in the analytic hierarchy process is creating a hierarchical structure of matter being investigated, in which the objectives, criteria, options and the relationship between them are shown.

The Steps of Hierarchy Analysis Process

Hierarchy analysis process is a strong and simple method in making decision and one of the most efficient techniques for making decisions. This technique is based on pair comparisons and makes it possible for

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managers to review various scenarios. This method provides the hierarchy analysis of complex issues and it is also based on the following steps:

- A hierarchical structure

Crime based on the type of crimes:

- Typical crimes
- Important crimes
- Crimes of rape
- Violent crimes

Types of crime in terms of structural diversity:

- Security crimes
- Economic crimes
- Social crimes
- Crime classification

Table of Frequency

In this study, the effects table contains the most essential information to assess the problem and is considered as a basis for a multi- criteria approach. An effects table consists of a set of solutions, measures and impacts. The names of the solutions in the first row contain the cities of blocks (area) listed. The list of criteria mentioned in the first column of the table is the type of crime including robbery of homes, shops, banks, etc. The other part of the table shows crime rate (per region and per type of crime). Different types of crimes such as crime frequency related to security, economy, and society, shown in 5 police stations in Qazvin as it is clear from figure 1.

Assessing the Crime Density

In this section, two methods for the assessment are introduced:

- Crime evaluation based on crime per unit of region (full number of events reported in each region).
- Crime evaluation based on the crime intensity (the block number expressed as a rate per 1,000 inhabitants in the area).

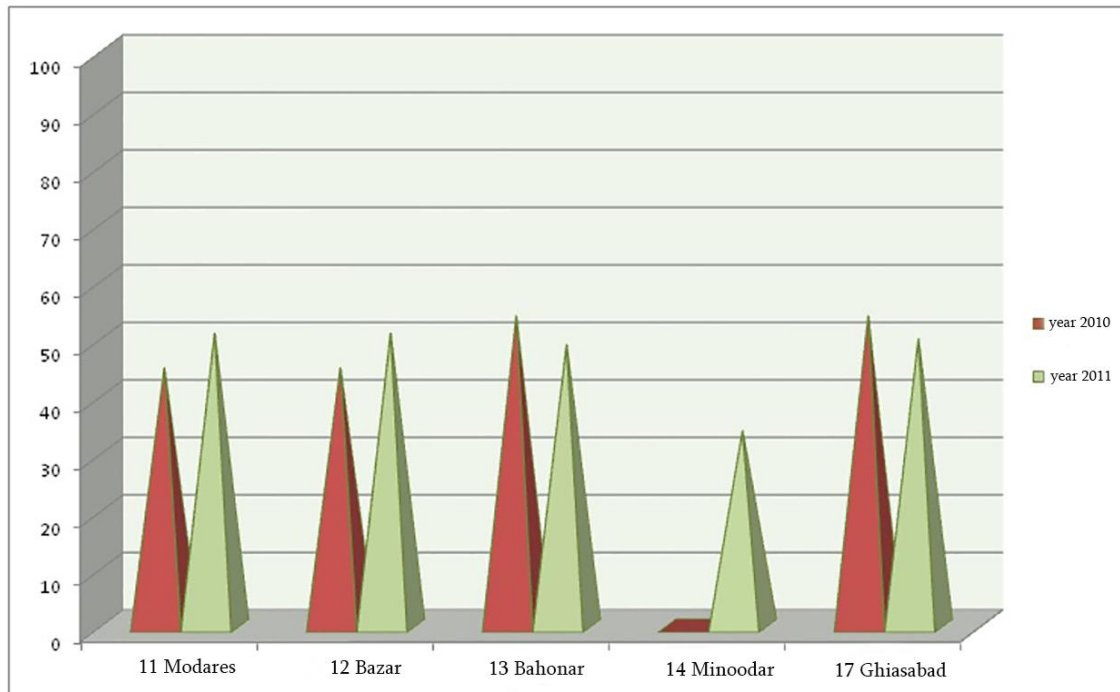


Figure 1: Diagram of the percent of discovery to the crime committing in the police stations in the city of Qazvin in compare to 2010-2011

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Crime Evaluation based on the Crime per Police Station

Normalization: This process is according to the MCE process. Due to the different nature of the temperature criterion, criterion scores are incompatible due to differences in measurement units and scales. Scores (rank) change into a common measure by normalization. Veedg (1983) said this is a mechanical approach of rescaling the value. He defined 3 types of normalization:

- Transfer to 0-1 with increasing pressure
- Transfer to 0-1 with the scale characteristics referred as the maximum
- Transfer to 0-1 with the distance (entering) characteristics referred as the distance (entering).

In this study the methods of " scale ratio " used for file storage (like the second case above) or the score of each row in the effects table (5-4-3-2-1-4) shown by a line with the highest score in the effects table relating to the measure are divided and in the standardization of an evaluation matrix was analyzed by using a weighted sum (or any other method), which uses high scores of the boundary are very useful.

$$\left\{ \frac{\text{line } i}{\text{Total line}} = N \right\}$$

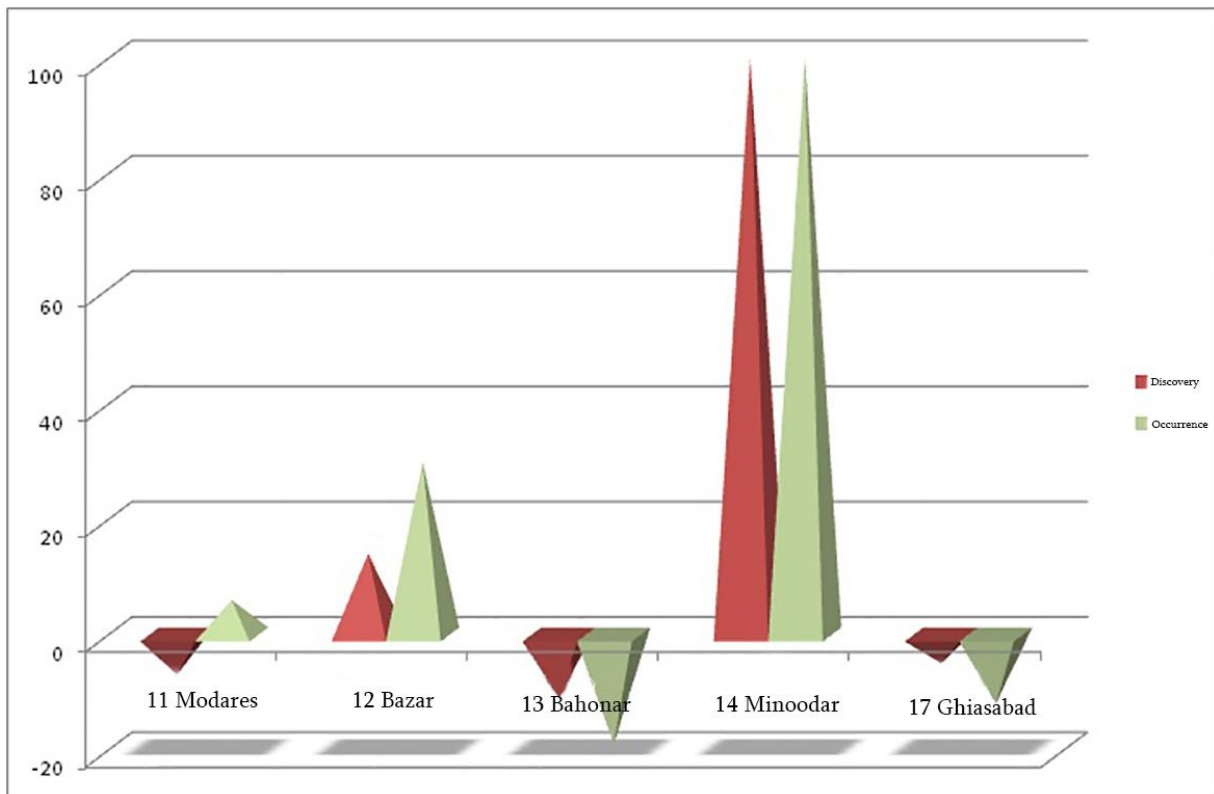


Figure 2: Diagram of the statistics of crime increase and decrease in the police stations in the city of Qazvin in compare to 2010-2011

Consensus Method

This method is the total weight of a simple method and frequently used. This procedure produces a ranking of Bernuyeh effects (the total weight of scores of the solutions). As the first step, all socres of the effects were normalized and then the sum of each row were measured and divided based on the type of the crime (the number of columns) shown in table 4-1. Rank order of the solutions was obtained by final absorbance of values normalized by the weight of each criterion).

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$$\left. \begin{array}{l} \text{Index of each criterion} = i \\ \text{Weight of each criterion} = w \\ \text{Normalized score of each criterion} = C \end{array} \right\} \text{Total evaluation } \leftarrow (i) = \sum_{i=1}^n w_i * C_i$$

The result equals to a value in which if it is zero it means there is no crime in the area but 1 stands for a hotspot in the area.

The overall evaluation of the crime rate: the final ranks within the crime classification and preferring that a crime gets more importance in compare to another crime is created in this section.

Table 1: Ranking the goals of police stations in the city of Qazvin in 2010-2011

Security		Economic		Social	
Place	Rank	Place	Rank	Place	Rank
Police station 11	4.8	Police station 11	40.5	Police station 11	14.2
Police station 12	23	Police station 12	51.62	Police station 12	25.4
Police station 13	2.2	Police station 13	45.62	Police station 13	12.6
Police station 14	25.6	Police station 14	24.12	Police station 14	6.6
Police station 17	11.6	Police station 17	48	Police station 17	24.2

Security Evaluation

Table 2: Security crimes in the city of Qazvin

Gheyasabad 17	Minoodar 14	Bahonar 13	Bazar 12	Modares 11	Crime type	crime
138	25	95	73	84	Burglary	Security
0	0	0	0	0	Bank	
4	0	2	1	6	Car plate	
0	0	1	0	0	Motorcycle plate	
1	0	3	3	0	Loads	
28.6	5	20.25	15.4	18	Total	
5	1	4	2	3	Ranking the crime based on the given data	

Security Evaluation

Table 3: Economic crimes in the city of Qazvin

Gheyasabad 17	Minoodar 14	Bahonar 13	Bazar 12	Modares 11	Crime type	crime
0	0	0	0	0	Shop (jeweler)	Economic
38	2	38	36	42	Shop (other)	
62	20	76	60	92	Automobile	
75	7	105	134	101	Motorcycle	
116	8	65	70	152	Inside the automobile	
104	39	156	154	119	Parts and equipment	
2	1	2	4	4	Livestock and poultry	
238	73	115	135	216	Other robberies	
79.37	18.75	69.62	74.12	90.75	Total	
4	1	2	3	5	Ranking the crime based on the given data	

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Social Evaluation

Table 4: Economic crimes in the city of Qazvin

Gheyasabad	Minoodar	Bahonar	Bazar	Modares	Crime type	crime
17	14	13	12	11		
11	3	4	23	18	Private places	Social
4	0	3	3	1	Public places	
19	1	12	12	60	Bag lifting	
1	0	7	10	19	Pick pocket	
13	1	13	27	56	Shop lifter	
9.6	1	7.8	15	30.8	Total	
1	1	2	4	5	Ranking the crime based on the given data	

RESULTS AND DISCUSSION

Data Analysis

In crime evaluation, based on the criteria stated as can be observed are weak and strong in the three following dimensions:

Security crimes: police station 17 with the most and police stations 13, 11, 12, and 14 are in the following orders in this field of crime which indicates the number of security crime have decreased if we move away from the impact of the crowds and social mobility towards residential places in Mino. However, these high rates are exceptionally associated with University Street and Ghiasabad Avenue surrounding police station 17. It shows that overpopulation communication in the areas affect the distribution of this rate of crime. Highlights of this issue can be Molasdara area in which people are living with a high level of livelihood. And in this area and the previous arears mentioned it can be expected that the level of social life in such cases to be high.

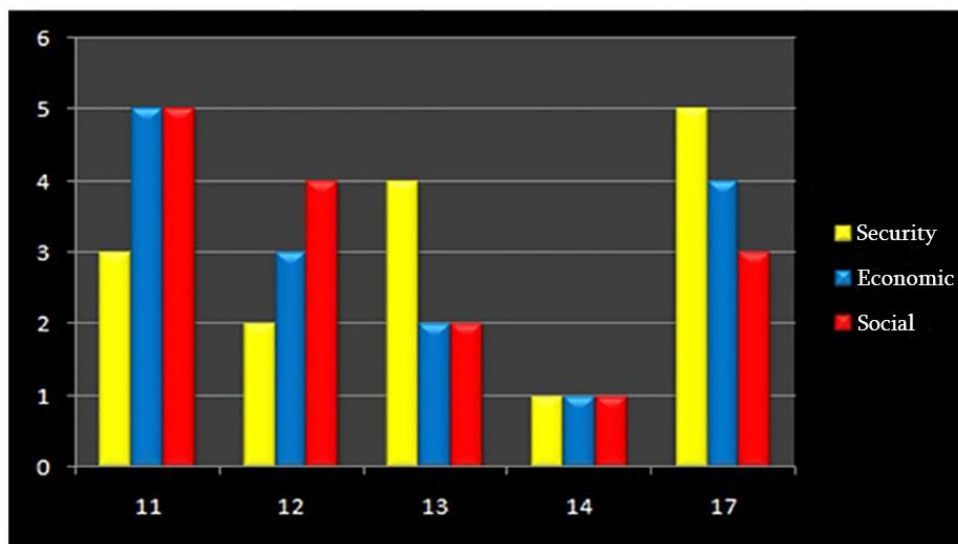


Figure 3: The overall evaluation of the crime rate in the city of Qazvin

Economic crimes: police station 11 with the most and police stations 17, 12, 13, and 14 are in the following orders in this field of crime and it is evident that why most economic center are located in this part of the city and the centralization of this issue can be seen more in the areas with this level of social life. It should be noted that another important factor resulted in this situation is the presence of economic centers which have had direct influence.

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Social crimes: police station 11 with the most and police stations 12, 17, 13, and 14 are in the following orders in this field of crime. This issue with respect to the dispersion and the relationship of these crimes with earlier crimes indicating the fact that these parts of the city have been influenced by the crowds and unlike previous cases crowds has not led to the same situation. In general, a few points can be mentioned: High rate of crime in many cases is repeated in the three types of crimes and indicates the fact pointed in analysis of the crime triangle. It says a crime occurs when a vulnerable target motivated meet each other in a suitable environment (Falsen & Clarke, 1998).

In the circumstances of the crime, it can be noted again that if the potential criminals with proper purpose in the same time and place without capable guards get together then crime happens. Hence, in these areas, the bustle of the urban population and their inappropriate tissue should also be noted which lead to the following inevitable results. High rates of crimes in police station 17 and 11 and also low rates of crimes in police station 14 has a geographical reason in urban areas which is population mobility has more impact on crime committing than population settlements.

Describing Strategies

As mentioned, several factors can reduce social security in cities. A question raised here is how urban security can be achieved from different economic, social, cultural, political, and structural aspects? To answer the question the following strategies can be mentioned:

- Structural and physical improvement of the urban poor and marginalized areas;
- Equitable spatial distribution of income, wealth and power in the city for all citizens;
- Using public participation in the development and implementation of urban plans for preventing urban problems;
- Proportional distribution of different urban applications such as cultural, educational, health and recreational accessibility of different classes of citizens to these applications;
- Identify crime -prone areas and take the necessary measures to combat and prevent them in these places;
- Following environmental standards and preventing construction in the suburban agricultural lands;
- Preventing land and housing speculation and creating conditions for people living in suburban areas to achieve adequate housing;
- Meeting basic needs such as food, water, shelter, income, safety and job for the entire population;
- Increasing the cultural and awareness level of the citizens, especially in urban slum areas;
- Improving the quality and easy access to public transportation in the city and increasing existing capacity in order to meet the needs of citizens fast and easily;
- Optimization and reorganization of old tissues and urban, development of economic infrastructure and urban services and activities in order to increase employment and economic security of the city;
- A minimum level of public health and health care, to the extent that such services are available to everyone;
- Solving the problems of urban traffic and pollution such as noise pollution, visual and air pollution , and particular attention to sustainable urban development;
- Preventing the creation of urban spaces without urban defense through the following measures:
 - Physical action: changing in the form of space, raising the light and visibility of space, changing the location of urban furniture which are the gathering place of the citizens such as telephone booths and newstands (omitting the form by enclosing them and U and L spaces engulfed and preventing people such as the homeless from these places, the optimal use of the empty places under the supports of the overbridges to fill the space, coordinating the extent, type, and amount of space in its current performance and the like.
 - Legal action: dismantling stalls of vendors and their gathering place especially in areas surrounding large markets, reducing the concentration of population by forcing people to coordinate with performance
 - Performance measures: activation of abandoned buildings, changing the application of abandoned buildings or enclosing them

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Conclusion and Discussion

In the analysis of the crime, firstly, the types of crime must be identified. Secondly, the classification and its prevalence in different areas can be acquired. Afterthat, the factors affecting the crime rate to increase are analyzed. Then, deal with this phenomenon in different ways according to the facilities available. Finally, the feedback should be collected from the actions against any type of crime and act based on the results in improving facilities or the method of applying equipment to omit roots of crime in the perennial programs. In this paper, some factors of the crime and its prevalence in Qazvin province have been identified and studied and then some suggestions were given to improve the situation of each case. The predominant features of the study was to investigation was done based on the precise statistical data from the information center of police in Qazvin province which provides effective results in improving the situation. In the field of security crimes: police station 17 with the most and police stations 13, 11, 12, and 14 are in the following orders in this field of crime which indicates the number of security crime are decreased if to move away from the impact of the crowds and social mobility towards residential places in Mino to move out of this crime will be reduced. However, these high rates are exceptionally associated with University Street and Ghiasabad Avenue surrounding police station 17. It shows that overpopulation communication in the areas affect the distribution of this rate of crime.

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