

## Crime Scene Management in Criminal Investigation

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**Abstract.** Crime scene management is the first and most sensitive stage in criminal investigations. Given the role of material evidence existing at the scene for substantiating the occurrence of crime and identifying the criminal or establishing the innocence of people charged, it is highly important to maintain and investigate crime scene and to gather crime evidence existing at it. This research seeks to identify components and indices of optimal crime scene management. This research is an applied one in a descriptive-analytical form. To analyze data, single sample Wilcoxon's Test and to rate, Friedman Test were used. The intended statistical population consisted of judges and experts of crime scene investigation in the city of Tehran for the as many as 50 people. Research findings showed that optimal crime scene management components and indices were determined by using the views of experts and investigation sources, and research findings confirmed the effects of these components with the priority of "identification", "other major factors", "reconstruction", "specificity", and "sample determination" in optimally managing a crime scene. Therefore, research results showed the extent to which each of the components and major indices affected the optimal crime scene management. The most important applied recommendation of the research was concerned with the establishment of an effective coordination among actors engaged in investigating the crime scene.

**Keywords.** Crime Scene, Criminal Investigations, Identification, Reconstruction, Recognition

## 1. Introduction

Crime scene is a place where the criminal does his/her own outlawed acts for the crime commission. Crime scene investigation is the first and most sensitive stage in criminal investigations, and the basis of all criminal researches is based on the ability of crime scene investigators for recognizing the significance and role of physical evidence, both large or insignificant at crime scenes. Proper crime scene investigation is the starting point for processing and substantiating that which has occurred. Accurate processing, registration and gathering of physical evidence are constituting stages of crime scene investigation. According to Exchange theory by Edmond Locard "Locard's Exchange theory", people committing crimes leave tracks of themselves, almost forcibly, at the crime scene or before the victims or before both of which; therefore, if no evidence is found at the crime scene, before it is considered to be lack of evidence, it should be considered defective education or lack of technical facilities pertaining to crime discovery (Nejabati, 2012, p. 144). Police and criminal justice bodies working with crime scene investigations have only one opportunity for spying on and investigating a true crime scene; so, they have no room for mistakes, haste, inaccurate attention and lack of coordination (Lee, 2004, p. 5). Given the role of material evidence existing at the scene for substantiating the occurrence of crime and identifying the criminal or establishing the innocence of people charged, it is highly important to maintain and investigate crime scene and to gather crime evidence existing at it.

Judicial officials, experts and authorities engaged with crime scene investigations, offices for identification, Intelligence police detectives, police officers at police stations, forensic medics and rescue teams (emergency and fire department officials) are main actors at crime scenes. In our country, it's been for years that, due to weak management knowledge within crime scenes lack of an optimal pattern and a rational and orderly method for proper utilization of crime scene and some other unknown reasons, crime scene management faces extreme problems. The fact is according to the Intelligence Police, the average crime discovery rate was 4.7% by 2014 from a scientific point of view. An exact analysis of major criminal cases (e.g. murder armed robberies, etc.) in various areas of the country suggest this reality that a considerable number of such major cases are archived without discovering and identifying criminals and establishing criminal justice in judicial courts. Interviews conducted with relevant officials suggest that the main cause of so many failures is the improper crime scene management. Also, there are some other unknown reasons which require scientific researches. Thus, this research seeks to determine indices and components related with optimal crime scene management, and the research questions are as follows:

- What are the optimal crime scene management components and indices?
- To what extent do components or indices affect the optimal crime scene management?

Currently, a large number of police officers and forensic medics have been employed to investigate crime scenes and in criminal investigation labs. Each year, hefty amounts

of money is spent on purchasing, maintaining, and conducting technical investigations of crime scenes and analyzing material evidence gathered from crime scenes in criminal labs. However, statistics illustrate a bitter reality that crime scene investigation management is not effectively underway and it is essential to identify and offer components and indices affecting crime scene investigation via conducting scientific investigations so that, by producing relevant theoretical basics, police measures and those by other criminal justice bodies are made effective while filling existing gaps. Therefore, the main goal of this research was to identify optimal crime scene investigation management. In other words, the current paper, by investigating the current patterns of crime scene management in Iran, seeks to determine and provide components and indices affecting the optimal crime scene investigation management via using specialized criminal discussion and investigating crime scenes.

Due to extraordinary significance of crime scene investigation in criminal investigations, reputable universities of countries leading in criminal sciences and criminology, educate students in such levels as B.A. M.A. and even Doctoral with major of crime scene investigation. Each year, conferences are held with respect to special subjects and crime scene investigation. The number of books and papers released in these countries and in sites available all indicate the value and credit attached to crime scene investigation discussion in such countries. Some of these credible English books on crime scene investigation are as follows:

In a book titled "Crime scene investigation", Sutton and Truman (2009) have discussed in detail crime scene investigations. Such subjects as the philosophy and necessity of conducting a scientific investigation of crime scene, the reasons why it should be done, and that who are worthy to do this, and also crime scene management from an educational view as well as learning the process of registration and documentation have been dealt with and finally, new crime scene investigation techniques relating to special crimes have been addressed (White, 2010). In a book named "Crime scene for courthouse", such issues as crime discovery sciences, crime discover experts material evidence, crime experts qualification as elite witnesses of the court, scientific supportive organizations within England's police services, various departments related with crime scene, including department of fingerprinting, criminal photography office, criminal investigation department and techniques for investigating robbery scenes and murder scenes have been addressed.

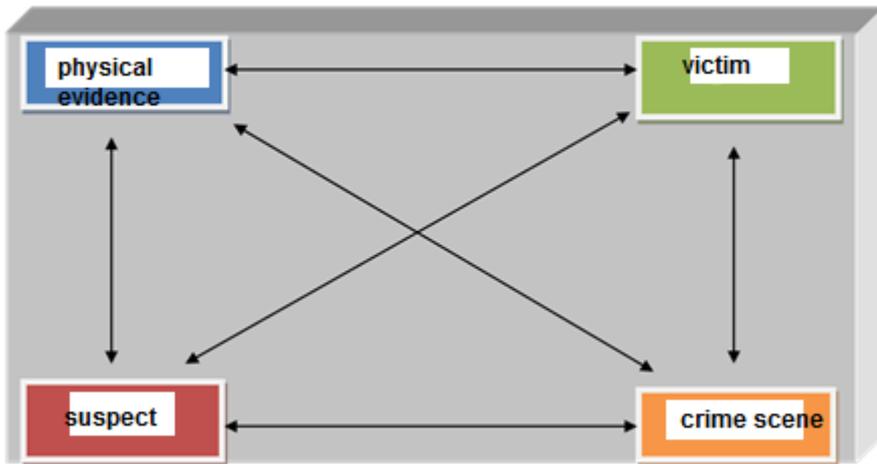
In his book titled "Applied crime scene investigation", Gardner (2006) has addressed such issues as evidence and their interpretive values, appropriate investigation of crime scene and relevant tissues, perceiving the nature of evidence and crime evidence and all sorts of tracks and impressions left behind, basic skills in investigating crime scenes, as well as advanced processing and crime investigations scenes techniques. Hess and Bennet (2006) have written a book called "Criminal investigations", whose most important themes are looking at criminal investigations main responsibilities of the investigation including taking photos, and sketching, note taking and reports searches and investigations concrete evidence, information acquisition recognition and arresting

suspects and readiness and providing cases I courts and also crime investigations against people, properties and the like. Lee (2004) wrote a book titled "Manual for crime scene", and discussed such issues as overall crime scene observations, overall crime scene methods, crime scene registration, crime scene searches patterns, gathering and protection of physical evidence, known standards for comparing and rational trees, special crime technics and finally the reconstruction of crime scenes.

In domestic crime investigation areas, the only book compiled related with crime scene investigation is the one authored by Nejaabati (2012) with the title of "Scientific police". This book refers to such various issues as scientific discovery of crimes and its chapter 2 deals with crime scenes specially, most important of which include the following issues: crime scene definition, crime scene significance, crime scene protection important, crime scene protection results, ways to investigate and document crime scenes including note taking, taking photos, and crime scene sketching, crime scene reconstruction, the most important crime evidence, foot tracks, broken glasses, blood stains, genetic identification, semen stains, saliva, hairs, fibers, weapons and left impressions, tools impression document and writings suspected, illegal addictive, fires and several other issues.

In a paper titled "Role of criminal investigations labs in scientifically discovering crime, Shirzad and Zare pur (2012) discussed the identification and explanation of the role of criminal investigation labs in scientific discovery of crimes, and the most important recommendation of this research with respect to crime scene investigation was: increasing the level of technical trainings of experts engaged in crime scene investigation in raltion to the exact crime scene investigation. Adhami, Afkhami and Saujadian (2012) addressed modern lab methods for scientific discovery of crimes in another paper. In this research, attempts were made to study various papers and method and to offer modern biological method to investigate crime scenes and to recognize criminals in criminal labs.

- **The theory of connection (continuity):** An idea known as theory of connection juncture (continuity) explains the reciprocal relationship between the crime scene, the victim, suspect, and physical evidence. Understanding relationships between these parts and elements will yield guidelines for determining the possible place of evidence and necessity of identifying evidence such that relations are established. Figure 1 shows the basic principles of connection juncture.



**Figure 1.** Theory of connection (continuity)

Theoretically, in case the link between two or more parts (crime scene, victim, suspect, and physical evidence) is established, then, then case will be easily resolved (Lee, 2004, p. 139).

- **Edmond Locard's exchange principle:** A simple expression of this principle is "any contact will leave a track" and reflects this belief that any contact between a person with the other and between a person with a place leads to the transference of material between the two sides. Most of this evidence is microscopic like dust and dirt, and they are finding and using it is up to a crime expert. According to this principle, the victim and the suspect contact each other at the crime scene and this leads to transference of evidence leaving impressions and tracks among all elements existing. When this contact ends, the crime scene will involve evidence of both- possibly in form of blood, hair, fibers and fingerprints. Similarly, each person will take away with himself/herself tracks (dust, fibers and etc.) from the crime scene and another person. It is not possible to trace all tracks and impressions. However, according to the Locard's exchange principle, such things do exist. As per this principle, some tracks or impressions are left from any activity; criminal activities are not exception. The fact that how one can find this impression. If one can find and gather these tracks and impressions by using sciences an technology, and then test then by using reliable means and tools, one can understand its nature (Bell, 2010, p. 507).
- **Similarity-unity principle:** According to this principle many natural and artificial

elements are similar to each other. Understanding these similarities exactly can help attain new information, thus reaching unity. We know that humans are similar, but we can understand through scientific (biologic) ways that although two human beings may be fully similar, but they are not the same (Platt 2007, p. 75). Also, factories and industrial products which are machineries and the same; however, as a result of usage, they can be different from each other, In other words, each material object will find its own peculiar state as a result of its usage. For example, two similar pairs of shoes or two tires belonging to two cars which are fully the same could be made different as a result of usage (Crispino, 2008, p. 56).

According to library investigations and interviews done with experts and officials in the area of crime scene investigation and criminology the most important optimal crime scene management are: determination of evidence at the crime scene, identification and determination of samples, individualization and making samples unique, reconstruction of crime scenes and other components (Elli, 2006, p. 65). Major indices pertaining to each of these components are as follow:

- **Recognition:** Recognition of material evidence at the crime scene is the cornerstone of the work whose major indices are as follows:
  - Preliminary assessment of the crime scene for determining the crime area; to estimate level of sources and equipment needed, and the like;
  - Scene documentation prior to sampling (note taking, photos, images and sketching of the crime scene);
  - Proper and accurate sampling of the scene by relevant experts and professionals;
  - Rapid and proper transference of samples to the criminal lab by observing safety principles.
- **Samples identification:** This issue is based on this assumption that all things are unique and distinct and involve some individual and group traits. For identification, the common method is to conduct statistical tests. The most important statistical experiments for identification area: comparative tests of fingerprints, comparative biological tests (blood, sperm, saliva, hair comparison and the like), comparative chemical tests of color, soil and rugs and the like and Comparative tests of weapons and tools, as well as tests done on documents and handwriting.
- **Individualization of evidence:** Individualization is created through linking of all characteristics and features in a special item through specificity experiments such as DNA. Main individualization indices and stages are as follows:
  - On time assessment of each of the sample in the criminal lab;
  - Explicit interpretation of sample assessments by the criminal lab;
  - Timely deceleration of results obtained by the criminal lab to operational and judicial units.
- **Crime scene reconstruction:** Crime scene reconstruction refers to the determination of reactions surrounding crime commission or in other words,

reconstruction of information acquired from various sources (statements by the witness, confession by the charged, statements by the living victim and examination or interpretation of physical evidence). Crime scene reconstruction includes the following three stages:

- Reconstruction of all stages and action by the criminal at crime scenes;
- Preparation of a full report of reconstruction at various stages of crime scene;
- Provision of results obtained by measures done by police experts and officials in judicial authorities.

## 2. Research Methodology

This research is an applied one due to quite useful functions that may have in crime discovery and that it to get managers of this area acquainted with optimal crime scene management components. Methodologically, it is a descriptive and analytical research. To analyze data, single sample Wilcoxon's Test and to rate, Friedman Test were used. The intended statistical population consisted of judges and experts of crime scene investigation in the city of Tehran for the as many as 50 people. All hypotheses were confirmed at confidence level of 95%. Since the intended universe in this research is unlimited, the Cochran formula was used. According to the Morgan Table, the number of 45 questionnaires was prepared, two of them were removed because of proper non-readability. In the end, 43 questionnaires were used.

In this research questionnaire, the extent to which each component and its indices affected optimal crime scene management directly was placed under question. The responders should have answered each question in the questionnaire based on a Likert scale. To infer that each dimension of this questionnaire affects the responders' choice is as follows: at least 50% of responders should maintain that the relevant dimension affects their choices; in other words, if the views of responders are greater than three in any dimension at the confidence level of 95% (moderate rate on the Likert scale is 3), one can infer that most responders have agreement over the effectiveness of that dimension on their choices.

Therefore, in this state, the intended hypothesis is confirmed and supported. To choose an appropriate statistical method, at first the normalcy of relevant variables needs to be examined. If the distribution of variables is found to be normal Student T Test s used and if normalcy assumption is not met, nonparametric single sample Wilcoxon's Test will be used. To do statistical tests SPSS 22 software is used.

### 3. Research Findings

For the optimal crime scene management, four main components and one component under the name of "Other factors" were identified, where the main indices of each of these components were specified in a questionnaire with five main questions containing 21 secondary questions equal to the number of indices, and the extent to which each of the components and indices had effects was assessed by interviewers. The results obtained from an analysis of the questionnaire questions as well as the extent to which each of these components left effects on the optimal crime scene management are as follows:

- Component "Identification" is effective in optimal crime scene management: In this component, four items (one index for each item) were used. First, by the Kolmogorov-Smirnov test, the normalcy of variables was investigated. The results from variables normalcy are provided in Table 1.

**Table 1.** Kolmogorov-Smirnov Test

Test		Identification	Question 1	Question 2	Question 3	Question 4
<b>Number</b>		43	43	43	43	<b>43</b>
<b>Normal parameters</b>	<b>Mean</b>	4/38	4/35	4/40	4/40	<b>4/37</b>
	<b>SD</b>	0/594	0/720	0/695	0/791	<b>0/725</b>
<b>Maximum Dif.</b>	<b>Absolute</b>	0/186	0/282	0/320	0/336	<b>0/319</b>
	<b>Positive</b>	0/147	0/221	0/204	0/222	<b>0/193</b>
	<b>Negative</b>	-0/186	-0/282	-0/320	-0/336	<b>-0/319</b>
<b>Statistical test</b>		0/186	0/282	0/320	0/336	<b>0/319</b>
<b>Approximate significance (Sig)</b>		0/001	0/000	0/000	0/000	<b>0/000</b>

Kolmogorov-Smirnov test results in Table 1 indicate that the significance level of all variables is less than 0.05. In other words, the assumption of variables normalcy is not accepted and to investigate this hypothesis, the single sample Wilcoxon's nonparametric test was used. The statistical hypothesis at the confidence level of 95% is defined as follows:

- **Null hypothesis:** Component identification is not effective on the optimal crime scene management
- **Alternative hypothesis:** Component identification is effective on the optimal crime scene management

Results from The single sample Wilcoxon's test are provided in table 2:

**Table 2. Single Sample Wilcoxon's Test Hypothesis Test Summary**

	Null Hypothesis	Test	Sig.	Decision
1	The median of Q1 equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
2	The median of Q2 equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
3	The median of Q3 equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
4	The median of Q4 equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
5	The median of recognition equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Results in Table 2 show that the significance level of all items pertaining to this hypothesis is less than 0.05; thus the alternative hypothesis is confirmed. To compare items, the Friedman test was used. First, via this test investigation is made whether or not there is a significant difference among various items in terms of responders. Later, in table 3, the items are rated with respect to significance based on average ratings.

**Table 3. Friedman Test Results for Comparing Items**

No.	43
Chi-square	0/922
Freedom degree	3
Error level	0/820

In table 3, since the significance level of the Friedman test is greater than 0.05; therefore, there is no significant difference among the items in the view of responders, and they cannot be rated either.

**Component "Sample determination" is effective in optimal crime scene management:** In this component, 6 items in the questionnaire were used. First, via the Kolmogorov-Smirnov test, the normalcy of variables was examined. The results from the variables normalcy are provided in Table 4.

**Table 4.** Kolmogorov-Smirnov Test

Test	Sample determination	Q 5	Q 6	Q 7	Q 8	Q 9	Q 10	
Number		43	43	43	43	43	43	
Normal parameters	Mean	3/97	3/95	4/16	4/30	3/86	4/09	3/56
	SD	0/488	0/899	0/785	0/832	0/889	0/895	0/908
Maximum dif.	Absolute	0/145	0/242	0/232	0/288	0/206	0/240	0/291
	Positive	0/123	0/177	0/210	0/201	0/206	0/155	0/197
	Negative	-0/145	-0/242	-0/232	-0/288	-0/190	-0/240	-0/291
Statistical test		0/145	0/242	0/232	0/288	0/206	0/240	0/291
Approximate significance (sig.)		0/023	0/000	0/000	0/000	0/000	0/000	0/000

Kolmogorov-Smirnov test results in Table 4 indicate that the significance level of all variables is less than 0.05. In other words, the assumption of variables normalcy is not accepted and to investigate this hypothesis, the single sample Wilcoxon's nonparametric test was used. The statistical hypothesis at the confidence level of 95% is defined as follows:

**Null hypothesis:** Component sample determination is not effective on the optimal crime scene management

**Alternative hypothesis:** Component sample determination is effective on the optimal crime scene management

Results from the single sample Wilcoxon's test are provided in Table 5:

**Table 5.** Single sample Wilcoxon's Test

**Hypothesis Test Summary**

	Null Hypothesis	Test	Sig.	Decision
1	The median of Q5 equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
2	The median of Q6 equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
3	The median of Q7 equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
4	The median of Q8 equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
5	The median of Q9 equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
6	The median of Q10 equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.001	Reject the null hypothesis.
7	The median of Identification equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Results in Table 5 show that the significance level of all items pertaining to this hypothesis is less than 0.05; thus the alternative hypothesis is confirmed. To compare items, the Friedman test was used. First, via this test investigation is made whether or not there is a significant difference among various items in terms of responders. Later, in table 7, the items are rated with respect to significance based on average ratings.

**Table 6.** Friedman Test Results for Comparing the Items

No.	43
<b>Chi-square</b>	34/490
<b>Freedom degree</b>	6
<b>Error level</b>	0/000

In table 6, since the significance level of the Friedman test was less than 0.05, there is a significant difference among the items in the view of responders, thus they can be rated against each other.

**Table 7.** Rating Items of Sample Determination

Items	Average ratings
<b>Question 7</b>	<b>4/95</b>
<b>Question 6</b>	<b>4/62</b>
<b>Question 9</b>	<b>4/22</b>
<b>Question 5</b>	<b>3/93</b>
<b>Question 8</b>	<b>3/65</b>
<b>Question 10</b>	<b>2/84</b>
<b>Sample determination</b>	<b>3/79</b>

**Component "Samples specificity" is effective in optimal crime scene management:** In this component from three items (each index for each item) in the questionnaire were used. First, with the help of the Kolmogorov-Smirnov test, the normalcy of variables was examined. The results from the normalcy of variables are provided in Table 8.

Kolmogorov-Smirnov test results indicate that the significance level of all variables is less than 0.05. In other words, the assumption of variables normalcy is not accepted and to investigate this hypothesis, the single sample Wilcoxon's nonparametric test was used. The statistical hypothesis at the confidence level of 95% is defined as follows:

**Table 8. Items Ratings Hypothesis Test Summary**

	Null Hypothesis	Test	Sig.	Decision
1	The median of Q11 equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
2	The median of Q12 equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
3	The median of Q13 equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
4	The median of individualization equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

**Null hypothesis:** Component sample specificity is not effective on the optimal crime scene management

**Alternative hypothesis:** Component sample specificity is effective on the optimal crime scene management

Results from single sample Wilcoxon's test are provided in Table 9

**Table 9. Kolmogorov – Smirnov Test Results**

Test		Sample specificity	Question 11	Question 12	Question 13
<b>Number</b>		43	43	43	<b>43</b>
<b>Norma parameters</b>	<b>Mean</b>	4/0388	4/12	3/95	<b>4/05</b>
	<b>SD</b>	0/82683	0/905	0/045	<b>0/815</b>
<b>Maximum dif.</b>	<b>Absolute</b>	0/148	0/254	0/237	<b>0/221</b>
	<b>Positive</b>	0/123	0/164	/168	<b>0/197</b>
	<b>Negative</b>	-0/148	-0/254	-0/237	<b>-0/221</b>
<b>Statistical test</b>		0/148	0/254	0/237	<b>0/221</b>
<b>Approximate significance (Sig.)</b>		0/019	0/000	0/000	<b>0/000</b>

Results in Table 9 show that the significance level of all items pertaining to this hypothesis is less than 0.05; thus the alternative hypothesis is confirmed. To compare items, the Friedman test was used. First, via this test investigation is made whether or not there is a significant difference among various items in terms of responders.

**Table 10. Friedman Test Results for Comparing the Items**

No.	43
<b>Chi-square</b>	<b>1/788</b>
<b>Freedom degree</b>	<b>3</b>
<b>Error level</b>	<b>0/617</b>

In table 10, since the significance level of the Friedman test is greater than 0.05, there is no significant difference among the items in the view of the responders and one cannot rate them against each other.

**Component "Crime scene reconstruction" is effective in the optimal crime scene management:** In this component, three items (each index for each item) were used. At first, with the help of Kolmogorov-Smirnov test, the normalcy of variables was examined.

Results from the normalcy of variables are provided in Table 11.

**Table 11:** Kolmogorov-Smirnov Test

Tests		Crime scene reconstruction	Question 14	Question 15	Question 16
<b>Number</b>		43	43	43	<b>43</b>
<b>Normal parameters</b>	<b>Mean</b>	0/0853	4/05	0/09	<b>4/12</b>
	<b>SD</b>	0/62612	0/754	0/718	<b>0/793</b>
<b>Maximum dif.</b>	<b>Absolute</b>	0/142	0/222	0/286	<b>0/232</b>
	<b>Positive</b>	0/090	0/222	0/273	<b>0/209</b>
	<b>Negative</b>	-0/142	-0/220	-0/286	<b>-0/232</b>
<b>Statistical test</b>		0/142	0/222	0/286	<b>0/232</b>
<b>Approximate significance (Sig.)</b>		0/029	0/000	0/000	<b>0/000</b>

Kolmogorov-Smirnov test results in Table 11 indicate that the significance level of all variables is less than 0.05. In other words, the assumption of variables normalcy is not accepted and to investigate this hypothesis, the single sample Wilcoxon's nonparametric test was used. The statistical hypothesis at the confidence level of 95% is defined as follows:

**Null hypothesis:** Component reconstruction is not effective on the optimal crime scene management

**Alternative hypothesis:** Component reconstruction is effective on the optimal crime scene management

Results from the single sample Wilcoxon's test are provided in Table 12

Results in Table 12 show that the significance level of all items pertaining to this hypothesis is less than 0.05; thus the alternative hypothesis is confirmed. To compare items, the Friedman test was used. First, via this test investigation is made whether or not there is a significant difference among various items in terms of responders.

**Table 12. Wilcoxon's Test Results Hypothesis Test Summary**

	Null Hypothesis	Test	Sig.	Decision
1	The median of Q14 equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
2	The median of Q15 equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
3	The median of Q16 equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
4	The median of reconstruction equals 3.000.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

**Table 13: Freidman test results for comparing the items**

No.	43
Chi-square	0/597
Freedom degree	3
Error level	0/897

In table 13, since the significance level of the Friedman test is greater than 0.05, there is no significant difference among the items in the view of responders, and one cannot rate them against each other.

**Component "Other factors" is effective in the optimal crime scene management:** In this component, 5 items (questions 17-21) were used. First with the help of the Kolmogorov-Smirnov test, the normalcy of the variables was tested. Results from the normalcy of variables are provided in Table 14.

**Table 14: Kolmogorov-Smirnov Test**

Test		Other factors	Question 17	Question 18	Question 19	Question 20	Question 21
<b>Number</b>		43	43	43	43	43	<b>43</b>
<b>Normal parameters</b>	<b>Mean</b>	4/0233	4/30	4/21	3/84	3/79	<b>3/98</b>
	<b>SD</b>	/725340	0/989	0/940	0/898	0/965	<b>0/859</b>
<b>Maximum dif.</b>	<b>Absolute</b>	0/138	0/341	0/265	0/246	0/237	<b>0/301</b>
	<b>Positive</b>	0/089	0/240	/200	0/196	0/182	<b>0/233</b>
	<b>Negative</b>	-0/138	-0/341	-0/265	-0/246	-0/237	<b>-0/301</b>
<b>Statistical test</b>		0/138	0/341	0/265	0/246	0/237	<b>0/301</b>
<b>Approximate significance (Sig.)</b>		0/038	0/000	0/000	0/000	0/000	<b>0/000</b>

Kolmogorov-Smirnov test results in Table 14 indicate that the significance level of all variables is less than 0.05. In other words, the assumption of variables normalcy is not accepted and to investigate this hypothesis, the single sample Wilcoxon's nonparametric test was used. The statistical hypothesis at the confidence level of 95% is defined as follows:

**Null hypothesis:** Component other factors is not effective on the optimal crime scene management

**Alternative hypothesis:** Component other factors is effective on the optimal crime scene management

Results from the single sample Wilcoxon's test are provided in Table 15

**Table 15. Wilcoxon's Test Results**  
**Hypothesis Test Summary**

	Null Hypothesis	Test	Sig.	Decision
1	The median of Q17 equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
2	The median of Q18 equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
3	The median of Q19 equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
4	The median of Q20 equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
5	The median of Q21 equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
6	The median of other equals 3.000	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Results in Table 15 show that the significance level of all items pertaining to this hypothesis is less than 0.05; thus the alternative hypothesis is confirmed. To compare items, the Friedman test was used. First, via this test investigation is made whether or not there is a significant difference among various items in terms of responders. Later, in table 17, the items are rated with respect to significance based on average ratings.

**Table 16. Friedman Test Results for Comparing the Items**

No.	43
Chi-square	33/378
Freedom degree	5
Error level	0/000

In table 17, since the significance level of the Friedman test is less than 0.05; thus there is a significant difference among all the items in the view of responders. Hence, one can rate them against each other.

**Table 17.** Rating Items of Sample Determination

Items	Average ratings
<b>Question 17</b>	<b>4/22</b>
<b>Question 18</b>	<b>4/08</b>
<b>Question 21</b>	<b>3/28</b>
<b>Question 19</b>	<b>2/92</b>
<b>Question 20</b>	<b>2/85</b>
<b>Other factors</b>	<b>3/65</b>

Now by using the Friedman test, it is examined whether or not there is a significant difference among the hypotheses. The Friedman test results are as follows:

**Table 18.** Freidman Test Results for Comparing the Hypotheses

No.	43
<b>Chi-square</b>	<b>12/537</b>
<b>Freedom degree</b>	<b>4</b>
<b>Error level</b>	<b>0/014</b>

In Table 18, since the significance level of the Freidman test is less than 0.05, there is a significant difference among all the items in the view of the responders and one can rate them against each other. Therefore, all the hypotheses were confirmed. The overall state of the hypotheses based on their priority is as follows (Table 19):

**Table 19.** Overall State of Hypotheses with Respect to Their Priority

Component	Kolmogorov-Smirnov test		Nonparametric Wilcoxon test	Friedman test	Status
	statistic	Sig.	Sig.	Average rates	
Identification	0.186	0/001	0/000	3.72	Confirmed
Other factors	0.138	0.038	0/000	2.90	Confirmed
Reconstruction	0.142	0.029	0/000	2.87	Confirmed
Specificity	0.148	0.019	0/000	2.86	Confirmed
Sample determination	0.145	0.023	0/000	2.65	Confirmed

## 4. Discussion and Conclusion

The main goal of this research was to identify components of the optimal crime scene management, where four main components (identification, determination sample specificity, and scene reconstruction) and one component with the heading of "Other factors" were specified. The research findings confirmed the effects of all four main components and the sole component of "other factors" in managing the crime scene optimally. Therefore, optimal crime scene management requires fivefold components as mentioned above. The indices for each of these components are summarily

elaborated on in the following:

Research findings confirmed the effects of all four main components and the sole component of "other factors" in managing the crime scene optimally, and beside these components, the component "other factors" thought to be effective in managing crime scenes optimally was placed in the second rate in an overall rating after component "identification", indices of which based on the priority of effects are:

- Full protection of the crime scene before the crime scene investigators arrive;
- Necessary actions by the first police patrol officer entering the crime scene;
- Timely presence of the inspector at crime scenes for managing the crime scenes;
- Provision of universal training to citizens in respect of crime scene protection methods;
- Establishment of previous coordination with regards to duties and the actions of various actors present at the crime scene (Police, judicial officials, forensic medics, rescue workers, etc.) in order to avoid the elimination of impressions and crime evidence.

Given the fact that in then research questionnaire, the effects of each component and its relevant indices on optimally managing the crime scene have been directly investigated and a minimum of 50% of responders maintained that the relevant dimension had effects on their choices. In other words because the mean views of responders in each dimension at the confidence level of 95% was greater than 3, thus, it is concluded that most responders had agreement over the effects of those dimensions on their choices. Thus, all hypotheses are confirmed. The extent to which each of the components and relevant indices affected were brought in previous sections.

The findings of this research confirmed the effects of the fourfold components intended by Henry Lee (2004) (with the priority of identification, reconstruction, specificity and sample determination) in optimally managing the crime scenes, indicating that along with these components, the component of "Other factors" was found to be effective in managing crime scenes optimally and in the overall rating, it was placed in the second position after that of identification. Also, research results were consistent with those of Shirzad and Zare' pur (2012), and its most important recommendation (increasing level of technical education for experts at the crime scenes in relation to an accurate examination of crime scenes).

## **5. Recommendations**

According to the research findings and the much effects of major components and indices on optimally managing crime scenes in Iran, the applied recommendations are provided as follows:

- Crime scene and identification experts are recommended to take into account fourfold indices and components, including identification, reconstruction, sample specificity and sample determination, corresponding to the findings, in their own special measures quite comprehensively.

- Various actors present at crime scenes (intelligence police officers including identification experts and investigation detectives, judicial officials, forensic officials and rescue workers) are suggested to optimally manage crime scenes while creating harmony with a multi-organization approach.
- Providing effective universal education to citizens concerning ways to protect crime scenes in form of educational serials and films in media framework is recommended to be taken in the agenda by the Police forces and judicial officers.
- Full protection of the crime scene before relevant experts arrive and major measures to be done by the first police patrol officer so that things are done smoothly.
- It is recommended that timely and effective presence of special inspectors be taken into account for managing crime scenes.

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