

## Original Article



# Presenting a Comprehensive Model and Identifying Effective Factors in the Analysis of Combat Sports Competitions

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## ABSTRACT

Presenting a comprehensive model and identifying effective factors in the analysis of combat sports competitions was the goal of this article. For this purpose, the researchers referred to experts in the field of martial arts in Iran and collected information from them through in-depth interviews, and then the data obtained from twenty interviews and documents were coded and analyzed. The research method was qualitative. The DIMTEL technique was used to find the model levels of the key factors of the analysis of combat sports competitions and any cause and effect relationships between the criteria. The results of the grouping of the codes showed fifteen components in four levels, which include the formation of separate training workshops for trainers, the use of skilled and educated people in this field, the intelligentization of the topic of analysis, and the formation of analysis teams for different age groups in the team. According to the results of the study, the presented model can be used as a sports analysis tool for the success of martial arts coaches in guiding and leading teams. In martial sports, the coach is one of the main and central figures. In this way, the analysis of martial sports competitions were extracted and confirmed, and the framework of the study was drawn and its suitability was confirmed. The purpose of this study is to provide a comprehensive model and identify effective factors in the analysis of martial arts competitions. The researchers referred to martial arts experts and collected information from them through interviews, and then the data from the interviews were coded.

## Introduction

Today, in championship sports, the stable medal status of countries is considered one of the important indicators of the development of countries, and while providing the basis for building and promoting the national identity of countries [1], it plays a very

important role in ensuring the general vitality of the society. Relying only on financial resources is not enough to succeed in the Olympic Games. In almost all factors, most successful countries (except Brazil) have invested and have plans. The continuation of the current trend of the country's championship sport cannot be the

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basis for serious change. In all cases, intellectual and human investment can provide the basis for more stable success of the country by spending less financial resources. Due to the lack of financial resources, it is necessary to pay attention to the path [2].

Concerning athletes, the coach is the most key person. Sports coaches must continuously update their knowledge and skills to overcome the ever-changing sports environment and complex developments [3]. Having coaching qualifications and updating the knowledge of the coach is one of the factors that can evaluate the technical knowledge of the coach. One of the problems that exists in sports coaches is the feeling of not needing to learn and acquire knowledge, which makes the technical knowledge of coaches remain old. And do not keep up with the times. Likewise, the ability to implement techniques and skills by the coach can make athletes learn faster and trust the coach's skills. Technical skill is the coach's ability to make the right decisions at the right time in the competition. Another criterion for making the right decision by the coach is having technical knowledge, which ultimately leads to the success of the sports team. Planning and setting goals in various team affairs, such as training, preparatory matches, nutrition, physical fitness and health, transportation, matches, etc. are important duties of a coach [4].

Among the issues that explain the performance of coaches are financial skills. A coach can attract supporters due to the presence of that coach in the sports team with his strong presence in various media and proper communication. Similarly, popular coaches have their own special fans and many fans become interested in supporting the sports team because of the personality of the coach [5]. In martial arts, one of the ways to achieve success is goal setting and planning. The topic of sports analysis and evaluation is of high value. The coaches of the teams should be able to analyze the competitors, in fact, analyzing is for people who have reached the technical level of expertise and have completed physical education degrees. The coaches of the teams should be careful in what

positions and times the techniques used in combat sports should be implemented, that is, they should have spatial and temporal predictions and provide the required results to their subgroups. Before facing the opponents, they should be evaluated and analysis of the team or player and the opponent should be performed accordingly to achieve the desired goal. In recent years, a team has been victorious in the field that, with the thoughts of its coaches, closes all the ways to gain points on the competitors and has a plan and plan to achieve certain goals. Thus, it is very important to know the strengths and weaknesses of the team and the insider and the opponent, and having this information can help the coaches to provide appropriate solutions for better efficiency [6]. In general, the analysis process in sports competitions includes three stages, and the analysis of combat sports is not separate from these stages. The combat sports competition includes three main parts of viewing, processing, and accessing information as follows: The researcher analyzes a series of data (INPUT) obtained by observing the competition, which will be the result of this PROCESS (acquiring information (OUTPUT)) (Figure 1).



**Figure 1** The result of this process

By observing the combat sports competition with various devices such as computer, video, special forms and cassettes, the analyst or analysts provide a series of key raw data in various technical fields to the technical staff. Now, coaches should analyze these raw data according to the elites who have knowledge of combat sports in terms of various technical, tactical, physical, and psychological aspects, and finally by processing these statistics into important and important points about the team. The insider and the opponent realize that having this information, they get to know the strengths and weaknesses of the insider's and the opponent's team, and then with the help of planning on these points and continuing in training, appropriate decisions can be made [6].

## Method

Given that the purpose of this study is to provide a comprehensive model and identify effective factors in the analysis of martial arts competitions, it requires the use of mixed research methods. In this study, in the initial step, with an interpretive approach of thematic analysis, the main, and sub-themes of the research were identified in the field of the factors of the effective factors in the analysis of combat sports competitions, and after identifying the indicators, using the quantitative method of the technique Demetall analysis was used to make it valid. Therefore, mixed exploratory research method was used. The statistical population in the qualitative part of this research was formed by martial arts experts in the country, both in academic and executive environments and executive bodies. In this study, theoretical saturation was reached with 20 interviews. For the validity of the current examination, the techniques of comparing the evidence with the existing literature, ensuring that the concepts are systematically related and have internal coherence, the use of multiple sources of evidence, the rich description of the data set during its collection, the definition of the limit and the border of the research and having a key draft as well as the study of documents and documents have been used to increase the validity of the resulting data. Also, in the interview method, credibility should be considered for each of the seven stages of the research so that the obtained results are reliable and trustworthy and validity is in all seven stages in selecting the topic, designing, interviewing, copying, analyzing, and confirming, which were paid attention to in this research. Using the DIMTEL technique, which is one of the multi-criteria decision making methods, the pattern of causal relationships between the variables was identified, and eleven experts were asked to use their experience to show the effect of the factors on each other schematically. A total of 20 experts were interviewed.

## Results

### *The General Results Revealed That the Following are Influential Factors in the Analysis of Combat Sports Competitions*

To analyze the process of the martial arts competition, coaches need to observe the competition closely from the perspective of physical, technical, and psychological areas and have the necessary knowledge as follows:

- Knowledge of the theoretical foundations and having the necessary knowledge, expertise, and experience in the physical field.
- Knowledge of theoretical foundations and having the necessary knowledge, expertise, and experience in technical and tactical fields.
- Knowledge of the theoretical foundations and having the necessary knowledge, expertise, and experience in the field of psychology.

Theoretical foundations, knowledge, and expertise will be obtained with the help of reading numerous books and articles, attending various classes, discussing, and exchanging opinions with trainers and knowing their opinions in physical, technical, tactical, and psychological fields. But regarding the necessary experience, it should be mentioned that this can be achieved with the passage of time and the presence of a coach in various titles and trial and error in various conditions. The main task of most effective trainers of modern martial arts is first competition, and then training.

In this regard, in general, the goals of the analysis of combat sports competitions are divided into two general and special parts.

The general objectives of the analysis of the combat sports competition are as follow:

- Examining and recognizing the strengths and weaknesses of the team and the insider fighter, and

- Examining and recognizing the strengths and weaknesses of the team and the opponent's fighter.

The specific objectives of analyzing the combat sports competition are as follow:

- Examining and familiarizing with the level of physical fitness of both domestic and opponent players.
- Examining and familiarizing with the technical conditions of both domestic and opponent fighters.
- Examining and familiarizing with the tactical conditions of the home team and the opponent.

Examining and familiarizing with the psychological conditions of the players of the insider and the opponent according to the conditions of the match (self-confidence, personality, motivation, aggression, arousal, desire to fight, desire to win, attention, concentration, *etc.*).

#### *Different Ways of Analyzing Martial Arts Competitions*

The simplest and the most basic method in the analysis of combat sports matches is done by special markings on special parts of the game, which requires a lot of accuracy and time during the match.

In fact, in this method, each of the special behaviors in combat sports is marked by special and standard signs, which can be used to collect data after the competition is over.

In general, the analysis is done in different ways and is based on four methods:

- 1- Analysis by trainers using special forms,
- 2- Analysis using audio recording,
- 3- Analysis through video, and
- 4- Computer-aided analysis.

#### *Analysis by Trainers using Special Forms*

The trainer or analyst will be able to evaluate the match by directly observing the fight and using special forms and paying attention to the special parts of the fight and obtain raw data in this direction. Concerning the wide dimensions and complexity of the combat sports competition, the analyst should pay attention to the specific features of the fight in accordance with the goals of the technical staff in coordination with the technical staff.

#### *Analysis using Audio Recording*

By recording the report of the fight on a cassette and finally analyzing the report, the analyzer can provide useful information to the coaches after the end of the fight. The advantage of using cassettes in fight analysis is that to record objective observations in special forms, due to the speed of the game, some points may be hidden from the analyst's view, but with the help of a cassette tape, since there is no need to write and all the events are recorded with a voice recorder (words), this deficiency is minimized [7].

#### *Analysis using Video*

By watching the fight movie, you can carefully consider all the important and important points of the fight and analyze the sensitive and important behaviors of the fight as many times as you want. Therefore, the possibility of losing moments of struggle is minimized. In other words, by directly watching the match, you can see the match from different angles, but with the help of video analysis, only the place where the martial athletes are located can be seen, and other parts of the fight remain hidden from the camera [8].

#### *Computer Aided Analysis*

Today, with the advancement of technology and the application of computer science in all fields, especially sports, a significant change has been made. The advantage of using this method compared to the three mentioned methods is that in this method the error of the analyzer is

minimized, and on the other hand, it saves time and manpower very well. But the big disadvantage of this particular method compared to other methods is that the system cannot measure many special and important behaviors in the psychological field such as: sacrifice, desire to fight, forgiveness, self-confidence, attention, concentration, etc [9].

### *Tasks of the Analysis Group*

It is important to state that sometimes, due to the sensitivity of the issue, a team or group is tasked with analyzing the fight in such a way that the head of the group specifies the tasks of each analyst and each person should focus on a part of the match, an area of the field or on a certain number of players based on the group's strategy, according to his expertise. In this regard, today, along with the sending of big teams to various international group competitions, they are sent with the team for analysis, to record and record all the points of the game that are hidden from the eyes of the coaches, so that appropriate decisions can be made based on this information. For example, in the Korean national team, apart from the coaches who sit on the coaching chair while guiding, about 11 companions, each of whom has the task of analyzing the players, are sent to official matches with the national team of that country.

### *The Difference between Analysis (Processing) in Combat Sports*

A very important point that should be noted in this topic is that any raw data through exploration (analysis) of phenomena is made available, it cannot be used without processing (analysis) so that collecting these statistics without processing alone will not help in providing positive solutions. On the other hand, processing and analyzing raw data require comprehensive and complete knowledge in the subject under discussion. Analysts provide a set of statistics to the trainers by analyzing the fight of martial sports; now, the trainers, according to the elites who have the knowledge of martial sports in terms of various aspects of technique, tactical, physical, and psychological, one should analyze these raw data and use them to

understand the hidden realities of the home team and the opponent to have a proper plan to strengthen the positive points and eliminate the weak points, to finally achieve to achieve the desired goals. In other words, the interpretation of each analyst from the raw data will be dependent on the researcher's background regarding his knowledge of martial arts. Therefore, in the same direction and in three parts separately to the analysis of each field, we pay different kinds of martial arts [10].

### *Physical Analysis of Combat Sports*

Physical capabilities in combat sports have been transformed by applying different sciences and inventing scientific and modern training methods compared to previous eras in such a way that this factor has been provided to the trainers as a suitable tool so that they can apply their technical thinking easily. On the other hand, the analysis of the movement and physiological patterns of the players during the match provides the possibility for the coaches to obtain sufficient information about the physical issues by processing this data and to be able to use these patterns for optimal planning to develop physical factors to use in accordance with the reality of combat.

### *Movement by Players*

Today, combat sports players have a lot of movement during the competition, which will be completely different according to different weights. Combat athletes at lower weights usually have more displacement than higher weights [11]. According to the presented materials and data analysis models, we come to the conclusion that whenever we can use different evaluation models in combat sports and apply the results to the performance of the players, we can win over the opponent. Let's also predict his games. Analysis in combat sports is primarily knowing the opponent's plan and tactics, followed by reading the fighter's game. Therefore, using different analysis techniques, we can identify different and rare situations to gain points and note down the player's strengths and weaknesses, and we can also design operational and tactical counterattacks against

the opponent. Scientists in their research entitled: “Evaluating strategies affecting sports performance found that one of the most important success factors are coaches”, have shown that the role of coaches in sports is diverse from a teacher, teacher and friend to a consultant, coach, organizer, motivator, leader, planner, decision maker, and also the main

source of all knowledge related to sports and training (Table 1) [10].

*Summary of Identification of Effective Factors in the Analysis of Combat Sports Competitions*

The following table (Table 2) summarizes the results of the available documents regarding the identification of effective factors in the analysis of combat sports competitions.

**Table 1** Interviews in the analysis of combat sports competitions

Analysis of martial arts competitions	Formation of separate training workshops for trainers	Analysis of training by trainers using special forms	1
		Analyzing training using audio recording and recognizing the strengths and weaknesses of the team and insider fighters	2
		Analyzing training through video and recognizing the strengths and weaknesses of the team and opponent's fighters	3
		Analyzing training with the help of computer and knowing the strengths and weaknesses of the team and the opponent's fighters	4
	Using professional and educated people in this field	Having coaching qualifications	5
		Updating the trainer's knowledge	6
		Certification of technical expertise	7
	Smartening the topic of analysis	Specialization in sports science and physical education	8
		The level of physical fitness of the insider and opponent fighters according to specialized and tactical techniques	9
		The tactical conditions of the home team and the opponent match the conditions of the fight	10
		The psychological conditions of the fighting players inside and the opponent match the conditions of the match	11
	Formation of analysis teams	Adult analysis teams	12
		Youth analysis teams	13
		Junior analysis teams	14
		Minor analysis teams	15

**Table 2** Main steps and frequency extracted from all interviews

Row	Main steps	Statistics of experts in the interview	Confirmation based on the final codes obtained from the interview	Percent of abundance
1	Formation of separate training workshops for trainers	20	20	100
2	Using professional and educated people in this field	20	18	90
3	Smartening the topic of analysis	20	17	85
4	Formation of analysis teams	20	15	75

R Selective coding and open coding are performed simultaneously. In open coding, data are broken and broken to identify their features, concepts, and dimensions. In selective coding, the same data are linked again by creating relationships of each class and its subclasses in a new format [11]. Competition analysis is one of the factors of success in combat sports and has the steps of forming separate training workshops for coaches, using skilled and educated people in this field, making the subject of analysis intelligent and forming analysis teams. The success of teams depends on mental and physical factors, nutritional, technical, technical, analysis of matches, and management. The results emphasize that the role of factors analysis of combat sports competitions is decisive in the success or failure of the teams.

### Model

A model is a small part of a large object, which is functionally the same as the real object. In social sciences, models include signs and symptoms. A model is a representation of reality (Figure 2).

According to the Table 3 of the main stages obtained from all the interviews, it was ranked and proven.

### DEMATEL Method in a Structural Model

One of the most common methods used to find any cause-and-effect relationships between criteria is DEMATEL method. This technique, in addition to be able to rank and determine the importance of components, has the ability to identify influencing the behavior of other factors or components.

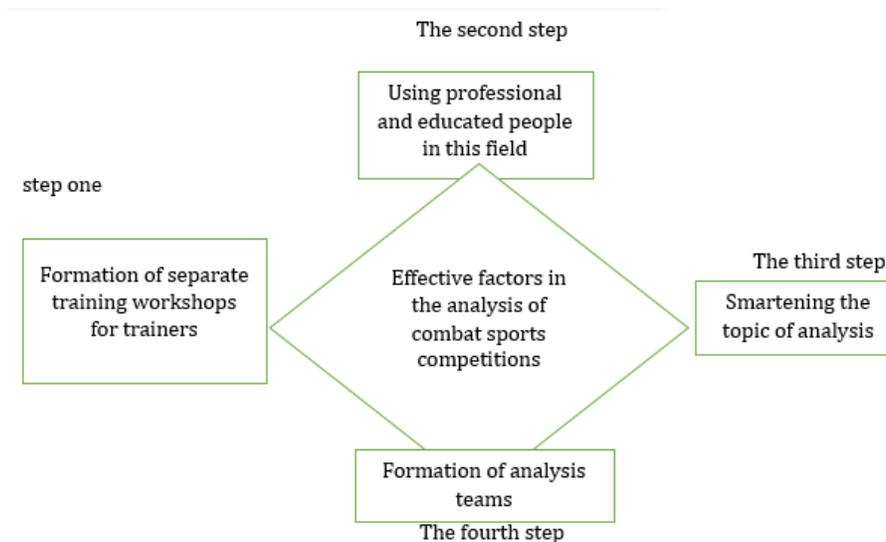
### The Pattern of Relationships Between Variables

DEMATEL technique has been used to reflect the interrelationships between the main criteria. 11 experts were initially asked to mention the effect of the items on each other. In general, in multi-criteria decision-making methods, the sample size is between 5 and 30 people.

In the first step, the main codes were named in the Table 4.

The data related to the average matrix of experts' opinions are entered in the following Table 5.

In the matrix of experts' opinions, the opinions of several experts are used and we form a direct correlation matrix with a simple arithmetic mean [1].



**Figure 2** A model is a small part of a large object, which is functionally the same as the real object

**Table 3** How to answer questions and scoring pattern

Very high effect	High effect	Low effect	Very low effect	No effect
4	3	2	1	0

**Table 4** symbols of research criteria

Criterion	Symbol
C1	Formation of educational workshops
C2	Using professional and educated people in this field
C3	Smartening the topic of analysis
C4	Formation of analysis teams

**Table 5** Calculation of matrix of experts' opinions

C4	C3	C2	C1	Than
3.15	3.21	3.98	0	C1
2.16	2.23	0	2.59	C2
2.14	0	2.26	2.47	C3
0	2.13	2.22	2.39	C4

**Sampling**

DEMATEL method requires that information be received and analyzed from experts to select a team of experts, since the purpose of generalizing the results was not discussed, the

purposeful sampling method was used. The research process was done with the cooperation of 20 experts. The calculation formula of DEMATEL technique is as follow:

$$X = \begin{bmatrix} 0 & \dots & x_{n1} \\ \vdots & \ddots & \vdots \\ x_{1n} & \dots & 0 \end{bmatrix} \tag{1}$$

$$k = \max \left\{ \max_{j=1}^n \sum_{i=1}^n x_{ij} \quad \max_{i=1}^n \sum_{j=1}^n x_{ij} \right\}; \quad N = \frac{1}{K} \times X$$

$$T = N \times (1 - N)^{-1}$$

**α Calculation**

According to the formula, the α value is obtained and multiplied by the matrix items to obtain the N matrix and normalize the M matrix.

**0.096711799**

**Normalizing Factor**

The following matrix is called the influence matrix of unscaled direct relationships.

The matrix in Table 6-8 shows the effect of unscaled direct relationships. In this step, direct relationship matrices (works) are prepared.

The matrix of relations of the total matrix is shown as Table 9-11.

**Table 6** The effect matrix of unscaled direct relationships

C4	C3	C2	C1	Than
0.304642166	0.310444874	0.384912959	0	C1
0.208897485	0.215667311	0	0.250483559	C2
0.20696325	0	0.218568665	0.238878143	C3
0	0.205996132	0.214700193	0.231141199	C4

**Table 7** I - M matrix

C4	C3	C2	C1	Than
-0.304642166	-0.310444874	-0.384912959	1	C1
-0.208897485	-0.215667311	1	-0.250483559	C2
-0.20696325	1	-0.218568665	-0.238878143	C3
1	-0.205996132	-0.214700193	-0.231141199	C4

**Table 8** Inverse matrix

C4	C3	C2	C1	Than
0.945725761	0.959241953	1.073457643	1.716621614	C1
0.702025567	0.713882143	1.587957417	0.730555098	C2
0.692267028	1.52792452	0.757720421	0.714795711	C3
1.511925542	0.68973751	0.745142527	0.700877451	C4

**Table 9** Total direct effects matrix

C4	C3	C2	C1	Than
0.945725761	0.959241953	1.073457643	0.716621614	C1
0.702025567	0.713882143	0.587957417	0.730555098	C2
0.692267028	0.52792452	0.757720421	0.714795711	C3
0.511925542	0.68973751	0.745142527	0.700877451	C4

**Table 10** Indirect matrix

C4	C3	C2	C1	Than
0.641083595	0.648797079	0.688544684	0.716621614	C1
0.493128082	0.498214832	0.587957417	0.480071539	C2
0.485303779	0.52792452	0.539151755	0.475917568	C3
0.511925542	0.483741379	0.530442333	0.469736251	C4

**Table 11** Analysis of DEMATEL indicators

Analysis of DEMATEL's indicators				
Di-Ri	Di+Ri	Ri	Di	Agents
0.832197099	6.557896845	2.862849873	3.695046972	C1
-0.42985778	5.898698233	3.164278007	2.734420225	C2
-0.19807845	5.583493807	2.890786127	2.69270768	C3
-0.20426087	5.499626927	2.851943898	2.647683029	C4

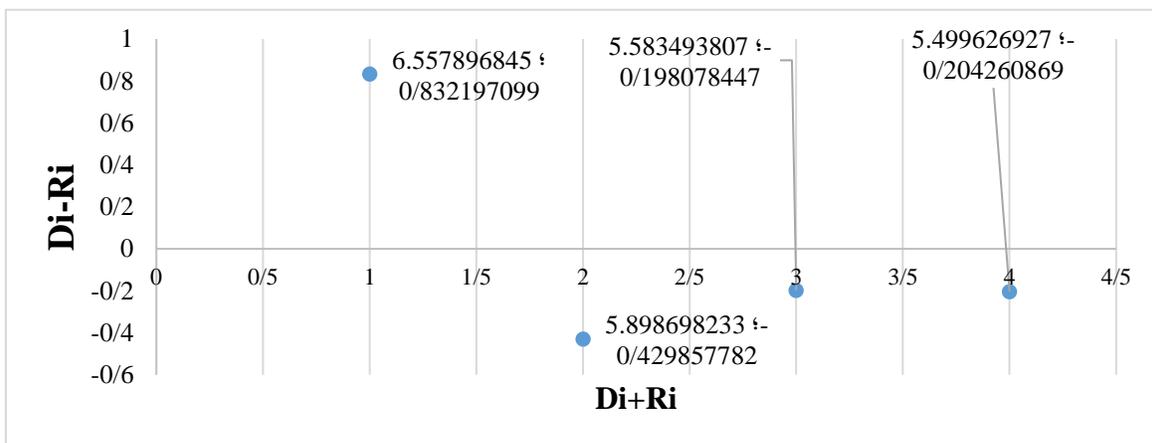
**Table 12** Threshold limit

C4	C3	C2	C1	Than
1	1	1	0	C1
0	0	0	0	C2
0	0	1	0	C3
0	0	1	0	C4

According to [Table 12](#) of the analysis of DEMATEL indicators, the criterion of forming separate training workshops for trainers is the most effective, and the use of skilled and educated people in this field is the next step.

According to the results of the above table, it can be determined which of the factors has a significant effect on which of the other factors. Threshold value can be determined based on research literature or experts' opinions ([Figure 3](#)).

The threshold value is 0.7356161



**Figure 3** Graphical chart of Cartesian DEMATEL coordinates

We find out only the relationships that are significant and their value is greater than the threshold value [10]. According to the relationship pattern, a causal diagram can be presented based on [Table 12](#).

On the horizontal line, the formation of separate training workshops for trainers is based on the Cartesian - DEMATE coordinates. The indicators that are placed above the horizontal line are classified under the title of influencing or causal indicators, as well as the

indicators that are located below the horizontal line, the intensity of their net effect is negative and they are grouped under the title of dependent indicators [10]. At the bottom of the horizontal line, the use of skilled and educated people in this field, intelligitization of the topic of analysis and the formation of analysis teams are located, and the degree of their effectiveness is higher [11]. Based on the results, it was found that the index of forming separate training workshops for trainers is the most effective component.

### Conclusion

The purpose of this study is to provide a comprehensive model and identify effective factors in the analysis of martial arts competitions. The researchers referred to martial arts experts and collected information from them through interviews, and then the data from the interviews were coded. They determined four levels in the analysis of matches, the grouping of codes. The existing experiences show that combat sports are an interdisciplinary product in the output of the whole society. The steps of these levels include these items. The initial step is the formation of separate training workshops for coaches and includes analysis training by coaches using special forms, analysis training using audio recording and recognition of the strengths and weaknesses of the team and insider fighters, analysis training through video, and recognition of strengths and weaknesses. The weakness of the opponent's team and fighters is to learn to analyze with the help of a computer and to know the strengths and weaknesses of the opponent's team and fighters. From a technical viewpoint, he specializes in sports science and physical education. The third step of intelligitization is the topic of analysis, and the level of physical fitness of the insider and opponent's fighting players is appropriate to the specialized and tactical techniques, the tactical conditions of the insider's and opponent's teams are appropriate to the fighting conditions, and the psychological conditions of the insider's and opponent's fighting players are appropriate to the match conditions. The fourth step is

actually the importance of forming analysis teams, which includes the use of analysis teams of adults, youth, teenagers, and minors in teams. The first step of forming separate training workshops for trainers has a special place in the model of identifying effective factors in the analysis of martial arts competitions. The most important feature of this step is to achieve the goals of martial arts by creating a systematic system in the discussion of analysis. It goes without saying that with the development of combat sports and its institutionalization among the people of the society, we will witness its direct and indirect effects on the country's sustainable development process.

### Suggestions

1. The impact of the analysis on the analysis of martial arts competitions should be measured with different criteria.
2. By identifying the effective factors of the analysis, analyzing the competitions and taking into account their strengths and weaknesses, plan and derive strategies.

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