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# Crime Prevention Through Environmental Design: Numerical investigation of environmental factors affecting security in sports facilities

# Prevención del delito mediante el diseño ambiental: Investigación numérica de los factores ambientales que impactan la seguridad en las instalaciones deportivas

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**Abstract.** Sports are one of the most essential categories of developed and developing societies, among which football, as the most popular sport in the world, receives special attention from governments. Therefore, to increase the attendance of people in stadiums, it is necessary for the managers to identify the factors influencing the attendance of spectators, both psychological and internal factors, as well as external and environmental factors, and to design and implement a written and specific strategy and plan. Having a sense of security is one of the influential factors in creating satisfaction in the audience. Due to the high cost of building sports facilities and spaces, care should be taken about many factors and variables, especially the correct location of such spaces, to enable easier access, fairer distribution, and greater security. Therefore, this research aims to analyze the environmental factors that affect security in sports facilities with the approach of crime prevention through environmental design in stadiums. The instrument in this research is a questionnaire on security in sports facilities with the effectiveness of crime prevention through environmental design. Finally, the artificial neural network system method was used in MATLAB (A 2018) and SPSS (V24) software to analyze the data and answer the research questions. Environmental factors of access, light and illumination, readability, visibility and natural surveillance, repair and maintenance, dynamics, functional disorders, and guide signs respectively had a positive effect on security and crime prevention through environmental design in sports facilities. Therefore, sports directors and architects must pay attention to these indicators in the design of sports stadiums.
**Keywords:** Stadiums, Sport Management, Sports Events, CPTED Approach, Neural Networks.

**Resumen.** Los deportes son una de las categorías más esenciales de las sociedades desarrolladas y en desarrollo, entre las cuales el fútbol, como deporte más popular del mundo, recibe especial atención por parte de los gobiernos. Por tanto, para incrementar la asistencia de público a los estadios, es necesario que los gestores identifiquen los factores que influyen en la asistencia de espectadores, tanto psicológicos e internos, como externos y ambientales, y diseñen e implementen un plan escrito y específico. estrategia y plan. Tener una sensación de seguridad es uno de los factores influyentes a la hora de generar satisfacción en la audiencia. Debido al elevado coste que supone la construcción de instalaciones y espacios deportivos, se deben cuidar muchos factores y variables, especialmente la correcta ubicación de dichos espacios, para permitir un acceso más fácil, una distribución más justa y una mayor seguridad. Por ello, esta investigación tiene como objetivo analizar los factores ambientales que afectan la seguridad en las instalaciones deportivas con el enfoque de la prevención de delitos a través del diseño ambiental en los estadios. El instrumento de esta investigación es un cuestionario sobre seguridad en instalaciones deportivas con la efectividad de la prevención de delitos a través del diseño ambiental. Finalmente, se utilizó el método del sistema de redes neuronales artificiales en los softwares MATLAB (A 2018) y SPSS (V24) para analizar los datos y responder las preguntas de investigación. Los factores ambientales de acceso, luz e iluminación, legibilidad, visibilidad y vigilancia natural, reparación y mantenimiento, dinámica, trastornos funcionales y señales guía respectivamente tuvieron un efecto positivo en la seguridad y prevención de delitos a través del diseño ambiental en instalaciones deportivas. Por tanto, los directores deportivos y arquitectos deben prestar atención a estos indicadores en el diseño de estadios deportivos.
**Palabras claves:** Estadios, Gestión Deportiva, Eventos Deportivos, CPTED Enfoque, Redes Neuronales.

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## Introduction

The name sports are always associated with health and wellness, and sports are needed to provide a healthy, clean, and pollution-free environment. Therefore, issues such as health, welfare, services, and education should be considered in the construction and equipping of sports facilities (Siedentop & Van der Mars, 2022). Sports facilities provide good opportunities for different societal groups' emotional, cognitive, perceptual, and social development (Wankel & Berger, 1990). Creating a safe place for users of sports facilities is one of the essential tasks of the directors of these facilities (Fried & Kastel, 2020a). Location is one of the most important planning considerations for any sports facility. Even a good quality sports complex will only succeed if individuals use it, know its location, and travel there (Schwarz, Westerbeek, Liu, Emery, & Turner, 2016a). The security of sports facilities and the maintenance of order and security in stadiums during competitions is one of the most critical concerns of sports directors in the current situation because the feeling of security and spectator satisfaction is the most essential and primary source of income for clubs. Moreover, sports teams are achieved by creating a calm and safe environment and, as a result, will increase their number (Hall, Cooper, Marciani, & McGee, 2011a).

Sports facilities are the platform for performing sports activities, and their quality can directly impact the performance of exercises and holding sports competitions. The construction of sports facilities requires great care and tact, so mistakes and negligence occur in the planning, designing, building, and equipping of sports facilities can save time, energy, and budget, adversely affecting future performance and recreation (Schwarz, Westerbeek, Liu, Emery, & Turner, 2016b). As they developed communities, ordinary

people had to travel long distances to see their favorite sports. This way, the stadiums became more significant, and their capacity increased to accommodate more spectators. However, sports directors had trouble controlling the large crowd coming remotely, as no one, including the local community, riot police, or the stadium's director, was prepared (Wakefield & Sloan, 1995). We have always considered this issue a problem today, but this problem dates back decades ago. Crowd control has been done on trial and error, and many mistakes have been made. However, eventually, we will achieve a correct and principled method to effectively design and manage the stadium. Stadium design solutions have been explored, but the only issue that always comes up is the stadium's location. This means we can move most stadiums away from the city center or build them in the suburbs (Chahardovali, Watanabe, & Dastrup, 2023).

The Sports institutions, in cooperation with the police and other security forces, are equipping stadiums and gyms with possible planning and continuous efforts in the face of possible catastrophic and abnormal events. However, stadiums and gyms are not entirely safe during competitions, and many athletes and coaches go to gyms in fear. This harms sports teams' performance, and the rate of sports injuries increases. The assessment and control of hazards bring comfort, cheerfulness, and security to spectators in sports environments (Rai, Foroughi, Itani, & Singh, 2023). The participation of athletes and spectators' acceptance of competitions improves with increasing security at all levels. Despite this, the offenders exploit to harm sports and pollute the sports environments to create harmful consequences. As a result, the main goals of sports directors and officials are to evaluate safety issues and update safety training and safety of all sports environments. Sports safety and security training programs for staff holding events can be a good program. The primary training is a supplementary training program for the existing training program and a screening instrument for event staff (Spaaij & Schulenkorf, 2014).

One of the newest and most practical approaches in the field of security is the crime prevention approach using environmental design (CPTED) (Ruirui, Jing, Hao, Xiao, & Yee, 2023). Based on studies and surveys conducted in the field of environmental safety studies in urban spaces, the CPTED approach, which is based on the prevention of crimes based on design principles, can be used optimally in urban environments. CPTED theory is based on the claim that with proper design and practical application of the environment, and by improving the quality of the living environment, crime can be prevented, and the fear of crime can be overcome (Ismail, Jing, Yee, & Shafiei, 2023).

One of the conditions for people to be present in public spaces is to ensure their sense of security (Francis, Giles-Corti, Wood, & Knuiman, 2012). Physical abnormalities are among the factors affecting the reduction of users' sense of security in public spaces. The level of security in society is determined based on three leading indicators: no visual harassment, no verbal harassment, and no physical harassment (Skogan, 1992). The primary purpose of sports facilities management is a comprehensive investment and special attention of executive directors in securing sports facilities and spaces and educating people about security issues to establish security and increase safety in sports competitions. Sports directors, especially protection and safety officials, should use standards and indicators to determine safety priorities based on their particular importance in stadiums and carefully evaluate how to establish safety and well-being in each match. Predicting imminent events and trying to change the status quo is crucial to achieving the desired situation by adhering to standards and securing sports facilities (Al Mohannadi, 2023). This research, doing for the investigation of the appropriate design and effective use of the space and environment built in Takhti stadium of Tabriz, which leads to the reduction of criminal opportunities, the reduction of the fear of crime, and the improvement of the quality of life, for these reasons we have used the first generation of the prevention approach crime has been used through environmental design. The second generation also emphasizes a socio-economically balanced and ultimately urban society for all sections of society. All the indicators of the third generation in the form of these components emphasize the principles of sustainable green design.

It can be said the CPTED theory is a new approach that has a long history. This theory is a product of the 1960s and beyond in the United States. Perhaps never had the built environment's impact on crime been addressed so much (Schneider, 2005). It was after this decade that, because of the work of Jane Jacobs in the life and death of America's great cities, Schelmo Angel in the prevention of crime through urban design, Elizabeth Wood with the book "Social aspects of housing in urban development, this theory and the relationship between environment and crime became more apparent. Crime can be defined through environmental design as "appropriate design and effective use of space and environment, which reduces criminal opportunities, increases fear of crime and improve quality of life" (Wood, 1961). This theory is based on the idea that human behavior in the environment is influenced by the design of that environment, which emphasizes that by optimizing the opportunities of the observer, a clear definition of the territory and creating a positive image of the environment can be prevented criminals from committing a crime (Larimian, Zarabadi, & Sadeghi, 2013).

CPTED theory has three generations (Komal & Radhika, 2023). This theory has evolved over the years to include the evolution of this approach, including the first generation CPTED from 1960 to 1970, focusing on physical environmental modifications to achieve security. The second generation, since 1980, began with the critique of the first generation for its absolute attention to physical reform and suggested the use of psychological and social aspects as one of the main pillars of security. In fact, given that the CPTED approach focused mainly on the physical

modifications of the artificial environment and paid less attention to the psychological and social aspects of the environment. In 1980, a group of thinkers criticized what CPTED theorists had hitherto believed to be based on their lack of attention to Jacobs's theory of "street-watching eyes" and based this principle on psychological aspects. And the social environment has been paid particular attention to. The third generation has been proposed since 2000 with a multilateral model of security expansion to maintain security in residential areas (Mihinjac & Saville, 2019). In the CPTED planning and design process, the participation of vulnerable groups in society is related to the concept of the second generation of CPTED, which includes the social dimension of CPTED. Some debates have surrounded the social dimension of CPTED, such as participation, because empirical evidence has not yet shown that it reduces crime (Lee, Park, & Jung, 2016). Finally, due to the importance of security in sports facilities such as stadiums, as well as their basic construction, the first generation of this approach was used. This case has been studied in the field of urban planning and its impact on security but is a pioneer in the field of sports. Therefore, the current research aims to analyze the environmental factors affecting security in sports facilities using the CPTED approach in takhti stadium of Tabriz, Iran.

## Materials and Methods

### *Participants*

Research method in terms of purpose, this study is in the category of applied research and terms of nature, is considered analytical-descriptive. Three hundred individuals participated in this research and the statistical population was the users of takhti stadium in Tabriz. The mean age was (mean=26,98 years); SD=6,27 and the gender frequency percentage was 67% male and 33% female in Tabriz, Iran. To obtain the sample, the gender variable was blocked. To determine the sample size of users of takhti stadium in Tabriz, after conducting a preliminary study on 30 people from the statistical population of users and determining the variance of the population, the following formula was used:

$$N = \frac{Z^2 S^2}{D^2} \quad (1)$$

To determine the sample size in nonexperimental studies, the allowable error value (d) should be considered. This value is often 0.05. In addition, the reliability coefficient should also be determined, which is 0.95 in most educational research. In this formula, $Z$ is the value of a standard variable. According to the reliability coefficient, which in the conditions of confidence level is 0.95, is equal to 1.96 and s2 is the variance of the studied variable, and $D$ is an error.

$$n = \frac{1/96^2 \times 0/448^2}{0/05^2} = 300 \quad (2)$$

### *Instruments*

The instrument of this research was a security questionnaire in sports facilities with crime prevention through environmental design (CPTED) approach. Strategies for this approach include creating appropriate access and mobility, increasing space oversight, increasing ownership (strengthening natural territories), supporting activities, environmental readability/management, maintenance, and consolidation (Minnery & Lim, 2005; Rezavandzayeri, 2019).

This questionnaire is designed as a range of 5 Likert options from very high to very low, which for a very high score is 5, for a high score is 4, for a medium score is 3, for a low score is 2, and for a meager score is 1. In the current questionnaire, questions 1-5 are for the access perspective, questions 6-15 for the visibility and natural surveillance perspective, questions 16-22 for light and illumination, questions 23-26 for the readability perspective, and 27-29 for the perspective of the dynamics, 30-37 for the functional disorders, 38-44 for the guide signs and 45-50 for the repair and maintenance.

### *Procedures*

The necessary permits were obtained from sports organization of East Azerbaijan in Iran. After all permissions were obtained. The questionnaire was distributed to the users of the stadium, so three hundred questionnaires were collected. All participants and responses to the questionnaires had at least one year of experience with sports activities in sports facilities. The data was collected between August and October 2022.

### *Statistical analysis*

In this study, descriptive and inferential statistical methods using SPSS software and artificial neural networks using MATLAB A 2018 software were used to analyze the data and answer the research questions.

### *Implementation of artificial neural network models*

The neural network consists of 5 parts: input, weights, bias, performance function, and output. The weights and biases can be adjusted, and the designer chooses the performance function. Based on the selection of the performance function and the type of learning algorithm, the parameters of weight and bias are adjusted, and learning means that by changing the weight and bias, a logical relationship between inputs and outputs is found (Khodadadi, Talatahari, & Gandomi, 2023). The minimum number of layers is 3: input layer, hidden layer, and output layer. The number of additional layers depends on the accuracy and result of the output data, and the number of neurons in the input layer depends on the number of inputs. The number of neurons in the middle layer depends on the judgment and skill of the network designer (Mistry, Strock, Liu, Young, & Menon, 2023).

*Histogram diagram*

The method that can be used to analyze the results of different methods is to draw a histogram diagram of abso-

lute error frequency distribution. The more similar the error frequency histogram of a modeling method is to the normal distribution, the better the performance of the used method. The histogram of the neural network and step-by-step regression methods are also close to the normal distribution, indicating that these methods differ from under or over simulator (Peeples, Xu, & Zare, 2021).

*Regression diagram*

The regression diagram shows the network's accuracy in predicting each component's impact on the security of sports facilities. In addition, this diagram shows the closeness of the network outputs to the fundamental values; the closer the points are to the diagonal axis of the diagram and accumulate, the closer the output values are to the actual values (Tretiak, Schollmeyer, & Ferson, 2023).

For all components, 300 data, 210 data for training, 45 data for validation, and 45 data for testing have been used, with ten neurons in the hidden layer and one neuron in the output layer. In the following, you can see the histogram and regression diagrams of all the components of the security questionnaire in sports facilities with the approach of crime prevention through environmental design with Levenberg, Bayesian and Scale methods.

## Results

Table 1 shows, indicators such as average, standard deviation, and the maximum and minimum limits for all eight investigated components, including components of access, visibility and natural surveillance, light and illumination, readability, dynamics, functional disorders, guide signs and repair and maintenance for the takhti stadium was reviewed.

Table 1.
Descriptive statistics of research factors.

| Factors | Items* | Alpha* | Min | Max | Mean | SD |
|---|---|---|---|---|---|---|
| Access | 5 | 0.86 | 13.00 | 25.00 | 23.29 | 2.51 |
| Visibility and natural surveillance | 10 | 0.79 | 19.00 | 48.00 | 40.98 | 4.46 |
| Light and illumination | 7 | 0.81 | 11.00 | 35.00 | 28.65 | 3.00 |
| Readability | 4 | 0.81 | 10.00 | 20.00 | 18.25 | 2.10 |
| Dynamics | 3 | 0.71 | 13.00 | 15.00 | 11.79 | 1.81 |
| Functional disorders | 8 | 0.71 | 20.00 | 40.00 | 32.14 | 3.39 |
| Guide signs | 7 | 0.88 | 13.00 | 35.00 | 29.86 | 3.79 |
| Repair and maintenance | 6 | 0.82 | 13.00 | 30.00 | 26.92 | 2.82 |

Note1: *Items show the number of questions in each factor of questionnaire.
Note2: *Alpha shows the alpha Cronbach in each factor of questionnaire.

Table 2 shows, the results of the artificial neural network system for each of the components of the security questionnaire in sports venues with the approach of crime prevention through environmental design, and the results have been analyzed with the three methods of levenberg, bayesian and scale. The prediction and results of network training showed the components of access (9.97756e-1), light and illumination (9.97452e-1), readability (9.97259e-1), visibility and natural surveillance (9.96742e-1), repair and maintenance (9.94685e-1), dynamics (9.93611e-1), functional disorders (9.92697e-1) and guide signs (9.72597e-1) respectively from the most to the least, it has had an impact on security and crime prevention through environmental design in sports facilities.

Table 2.
The results of network training, for all components of security in sports facilities with crime prevention through environmental design.

| Variables | Sample | MSE | R |
|---|---|---|---|
| Access | 210 (TR) | *1.59944e-10 **1.40304e-12 ***2.09880e-3 | *9.99999e-1 **9.99999e-1***9.97756e-1 |
| | 45 (V) | *2.53425e-4 **0.0000e-0 ***1.68596e-9 | *9.99541e-1 **0.0000e-0***9.99999e-1 |
| | 45 (TE) | *2.05536e-5 **1.68596e-9***3.15637e-3 | *9.99970e-1 **9.99999e-1***9.90383e-1 |
| Visibility and natural surveillance | 210 (TR) | *4.00960e-11 **1.83741e- 13***4.47799e-3 | *9.99999e-1 **9.99999e-1***9.96742e-1 |
| | 45 (V) | *1.69075e-6 **0.0000e-0 ***5.35227e-3 | *9.99997e-1 **0.0000e-0 ***9.86915e-1 |
| | 45 (TE) | *1.07731e-7 **1.06873e- 10***8.44957e-3 | *9.99999e-1 **9.99999e- 1***9.83805e-1 |
| Light and illumination | 210 (TR) | *5.66308e-12 **1.46173e-9***1.09260e-3 | *9.99999e-1 **9.99999e-1 ***9.97452e-1 |
| | 45 (V) | *5.83092e-11 **0.0000e-0 ***4.15268e-3 | *9.99999e-1 **0.0000e-0 ***9.89671e-1 |
| | 45 (TE) | *7.48086e-11 **1.92814e-6 ***1.44844e-3 | *9.99999e-1 **9.99998e-1 ***9.96151e-1 |
| Readability | 210 (TR) | *2.99882e-8 **4.28766e-13 ***1.28130e-3 | *9.99999e-1 **9.99999e-1 ***9.97259e-1 |
| | 45 (V) | *6.68771e-6 **0.0000e-0 ***3.33942e-3 | *9.99992e-1 **0.0000e-0 ***9.94361e-1 |
| | 45 (TE) | *9.50735e-7 **1.64430e-11 ***1.47047e-3 | *9.99997e-1 **9.99999e-1 ***9.97551e-1 |
| Dynamics | 210 (TR) | *1.00516e-9 **1.40620e-8 ***5.10986e-3 | *9.99999e-1 **9.99999e-1 ***9.93611e-1 |
| | 45 (V) | *5.32435e-8 **0.0000e-0 ***4.04553e-3 | *9.99999e-1 **0.0000e-0 ***9.93765e-1 |
| | 45 (TE) | *2.72721e-8 **2.15033e-8 ***3.95604e-3 | *9.99999e-1 **9.99999e-1 ***9.93623e-1 |
| Functional disorders | 210 (TR) | *1.09260e-12 **2.93220e-13 ***4.24336e-4 | *9.99999e-1 **9.99999e-1 ***9.92697e-1 |
| | 45 (V) | *3.85329e-10 **0.0000e-0 ***7.80433e-4 | *9.99999e-1 **0.0000e-0 ***9.98128e-1 |
| | 45 (TE) | *1.10934e-11 **7.48877e-13 ***4.70916e-3 | *9.99999e-1 **9.99999e-1 ***9.90217e-1 |
| Guide signs | 210 (TR) | *5.18377e-12 **1.81887e-13 ***1.57199e-2 | *9.99999e-1 **9.99999e-1 ***9.72597e-1 |
| | 45 (V) | *5.73172e-6 **0.0000e-0 ***3.83060e-2 | *9.99995e-1 **0.0000e-0 ***9.21969e-1 |
| | 45 (TE) | *2.37723e-7 **2.57973e-12 ***1.87154e-2 | *9.99999e-1 **9.99999e-1 ***9.83635e-1 |
| Repair and maintenance | 210 (TR) | *3.25550e-8 **3.47267e-13 ***4.02204e-3 | *9.99999e-1 **9.99999e-1 ***9.94685e-1 |
| | 45 (V) | *1.85504e-7 **0.0000e-0 ***1.70743e-3 | *9.99999e-1 **0.0000e-0 ***9.95817e-1 |
| | 45 (TE) | *2.28841e-7 **4.95404e-7 ***7.07676e-3 | *9.99998e-1 **9.99999e-1 ***9.88376e-1 |

**Note 1:** * Levenberg ** Bayesian *** Scaled. Note 2: (TR): Training (V): Validation (TE): Testing

Figure 1 Shows, the network training predicts that respectively, the components of access, light and illumination, readability, and visibility and natural surveillance, have a positive effect on security and crime prevention in sports facilities.

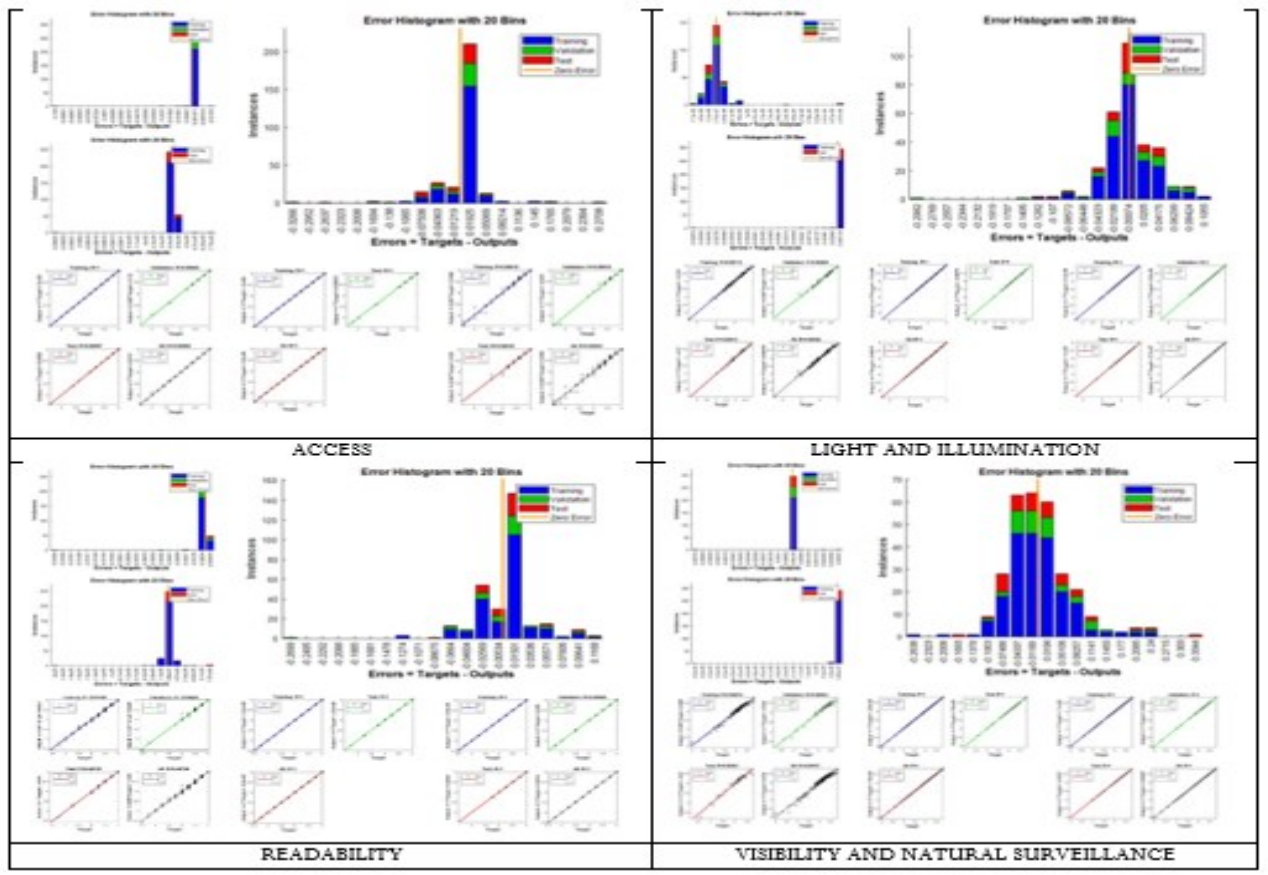


Figure 1. Histogram and Regression diagram for the components of Access, Light and illumination, Readability and Visibility and natural surveillance.

Figure 2 Shows, the network training predicts that respectively, the components of repair and maintenance, dynamics, functional disorders and guide signs, have a positive effect on security and crime prevention in sports facilities.

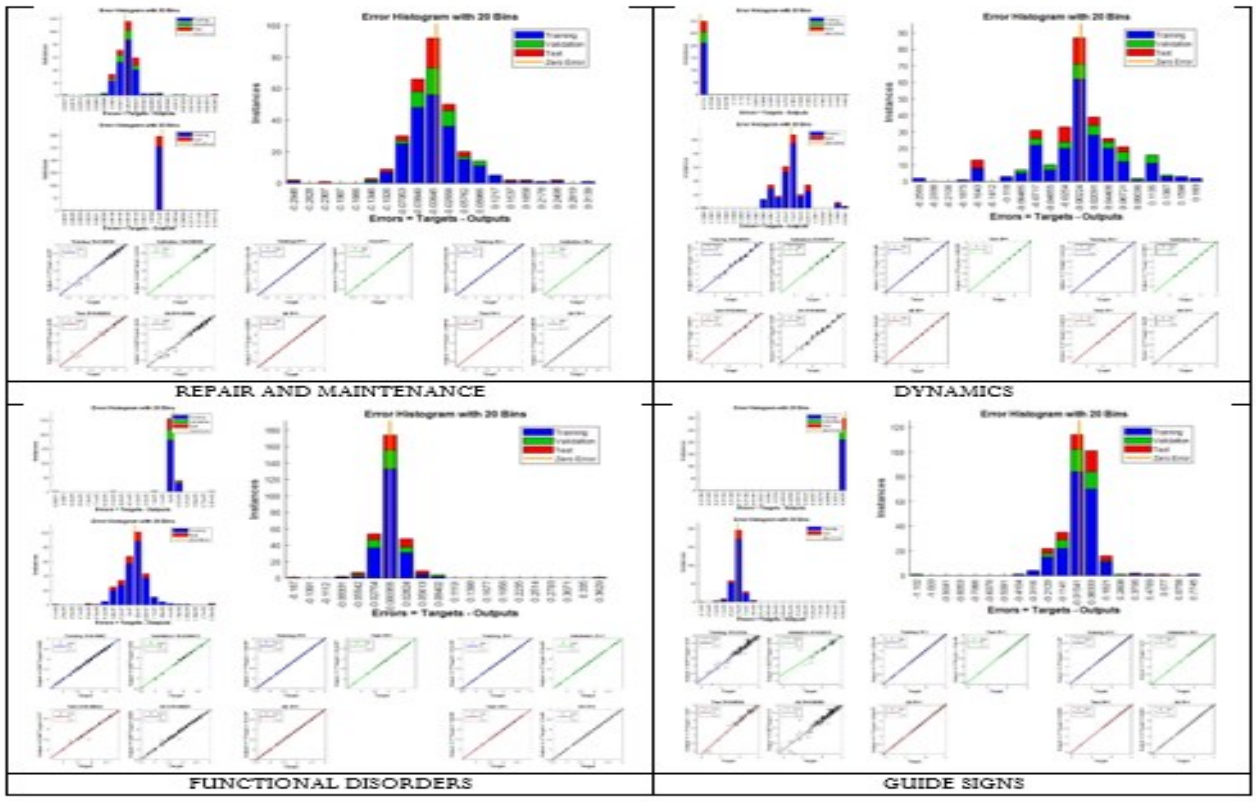


Figure 2. Histogram and Regression diagram for the components of Repair and maintenance, Dynamics, Functional disorders and Guide signs

## Discussion

In this section, by studying the questions in the research, obtained results with the previous results have been studied, and the obtained results have been explained. Research has shown that according to the results obtained from the system of artificial neural networks, network training predicted that the access index is one of the critical factors in preventing crime in stadiums. The sports facilities should be located so the user groups can access them in the shortest possible distance and time (Gallardo, Almagro Nieto, Martinez Moreno, Zurita Ortiz, & Macia Andreu, 2022). Also, the most crucial criterion in locating sports spaces is ease of access. This criterion applies to all sports centers, from the smallest to the largest. Without a proper access network, there will be broad traffic disputes around the sports center. Also, training facilities should have suitable sports facilities for easier access. That is, the design of educational facilities should be considered and implemented so that the public can use the sports space and place during the holidays (Ahmadi, Honari, Shahlaee, Kargar, & Ghafouri, 2022; Fried & Kastel, 2020b). On the other hand, the index of natural vision and supervision is one of the critical factors in preventing crime in stadiums. This indicator refers to the presence of a security guard on the premises and the monitoring of places by surveillance cameras (Chalmers & Frosdick, 2011).

These results align with the results of (Seifi, Abdullah, Haron, & Salman, 2019) natural monitoring in line with the security of urban spaces. They indicate that spaces and places with good natural visibility and monitoring have a high level of security (Koskela, 2003). Based on the interpretations obtained from the research analysis, it can be predicted that the light and brightness index is one of the critical factors in preventing crime in stadiums. Adequate lighting and lighting in sports facilities prevents crime and miscellaneous people from entering the stadium by realizing that the ambient light is appropriate and likely to be seen, so the lighting should be fixed and resistant to damage. These results, with the results of research based on the effectiveness of appropriate light and brightness in the security and quantity and quality of light, are essential factors in providing lighting. It affects the citizens' sense of security. In other words, light and illumination affect large stadiums, places, and entertainment centers, so today, light is suitable for sports environments. Media and television activities are also of great importance. Proper lighting in places makes it possible to plan more and use them optimally (Culley & Pascoe, 2009; Geliot, Coesfeld, & Kyba, 2022; Uhrich & Koenigstorfer, 2009). Also, the readability of spaces reveals how to access public places such as public parking lots and clearly defines entrances and exits so that everyone quickly understands the information in the space. Good readability and atmosphere eliminate the need for safety, aesthetics, and navigation (Erçin & Al Hindwan, 2023; Gibson, 2009; Vaitkevičiūtė, 2019). On the other hand, if a space is not used due to insecurity, that space loses its dynamism, which can create a favorable environment for crime in the said space due to reduced social control. It also disrupts the performance of spaces and causes functional disorders in nearby places.

In line with this research, the use of signs and guides and timely repair and maintenance of sports facilities are factors influencing the security of sports facilities. Therefore, any sign or logo can help to recognize different areas of sports facilities and prevent people from getting confused when accessing administrative and sports spaces. The main sports facilities, traffic sign boards, safety and security warning boards, and indicator boards leading to the primary and emergency entrances and exits of sports facilities significantly prevent crime and create safety and security. These results are in line with the research results of (Cozens, Hillier, & Prescott, 2001; Duignan, Pappalepore, Smith, & Ivanescu, 2022; Hall, Cooper, Marciani, & McGee, 2011b; Wood, 1961) and indicate that signs and boards provide easy access for users to spaces as well as times of crisis and Danger, signs show emergency routes to users. The repair and maintenance index are one of the essential factors to prevent crime in stadiums. They are considering that we always believe that prevention is better than cure. Therefore, the necessary measures should be taken before any accident occurs. These results align with the research results of (Andrade, Muñoz, & Rosell, 2023; Kurland, Johnson, & Tilley, 2014; Youssef, 2022) It is suitable for urban spaces and administrative and sports places, and any possible dangers and crimes are also prevented. Finally, the present results proved that compliance with the components of crime prevention through environmental design positively affects the security of sports facilities. One of the main strengths of this paper is its innovation in the field of sport. This study also had the limitation that the researcher was not allowed to enter the women's training area to distribute further questionnaires due to the laws of the country. The researcher was only allowed to distribute the questionnaires to them outside the sports facilities and complete the questionnaires. Other limitations of this study include the lack of resources in the area of security and crime prevention in sports facilities through environmental design, which posed a challenge to the researcher.

## Conclusion

Environmental factors of access, light and illumination, readability, visibility and natural surveillance, repair and maintenance, dynamics, functional disorders, and guide signs respectively had a positive effect on security and crime prevention through environmental design in sports facilities. Therefore, sports directors and architects must pay attention to these indicators in the design or rebuilding of sports stadiums.

## Conflicts of interest

The authors certify that there is no conflict of interest

with any financial organization regarding the material discussed in the paper.

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