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Archives in Sport Management and Leadership
Vol. 4, No. 2, 2026, pp 1-20

Applying the Combined Methods of Optimizing the Performance Evaluation of Sports Organizations: A Model Applicable to Football Clubs and Sport Boards

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Article Info

Article type:
Research Article

Received:
15 June 2026
Revise Date:
26 June 2026
Accepted:
27 June 2026
Published online:
6 September 2026

Abstract

This study aims to provide a combined model to optimize the performance evaluation of sports organizations. Experimental-mathematical method is used in this study. The needed information has been acquired using field, library, observation, questionnaire, and interview methods. The case study and statistical population are selected from the sports board. A mixed method of data collection tools has been used to obtain the inputs and outputs of sports boards considering factors, such as the number of human resources, available information, and other limitations. The two key methods used in this study are Fuzzy Analytic Network Process (FANP) and Fuzzy Data Envelopment Analysis (FDEA), which were applied to evaluate the performance of sports organizations. In total, the six factors extracted were scored using the balanced scorecard method by distributing 20 questionnaires among experts (6 experts from the Monitoring and Assessment Unit of the Sports and Youth General Office, 4 experienced sports managers, and 10 experts and secretaries of sports boards). The findings indicate that the fuzzy analytic network approach has been able to play up more the results while strengthening the previous methods. The results showed that taekwondo, chess, and track and field teams received similar ranks, which highlights the effectiveness of the combined method in providing more accurate and balanced performance evaluations. The findings emphasize that applying the combined methods allows for more robust assessments, as it mitigates the effect of incomplete judgments that may result from relying solely on quantitative or qualitative methods.

Keywords: Fuzzy Analytic Network Process, Fuzzy Data Envelopment Analysis, Performance Evaluation, Sport Association Boards, Sports Organizations

Cite this article: Nobari, H., Hammami, R., Taşçıoğlu, R., Eken, Ö., Oliveira, R., & Mainer-Pardos, E. (2026). Applying the combined methods of optimizing the performance evaluation of sports organizations: A Model applicable to football clubs and sport boards. *Archives in Sport Management and Leadership*, *4*(2), 1-20. doi: 10.22108/asml.2026.149338.1159

2981-0523 Published by University of Isfahan

Introduction

Since the formation of the first human societies, there has been an emphasis on evaluating and measuring performance (Funck, 2025). According to the experience of successful countries, determining the strategic goals of performance, measuring performance, collecting and analyzing performance data, and applying them to improve the performance of an organization or a country with a systematic approach are considered a significant principle for the success of organizations and countries and this is performance management at micro and macro levels (Goudarzi & Hamidi, 2022). The subject of evaluation is one of those subjects that have been recognized as a fundamental task of management since classical theories until today. Today, the role of evaluation systems cannot be ignored owing to dramatic developments in management knowledge (Fantozzi et al., 2025). However, many traditional evaluation models still struggle to keep pace with the dynamic and complex requirements of contemporary organizations, especially sports organizations that operate in rapidly changing environments. The lack of an evaluation system in every organization can be one of the reasons for the inefficiency of that organization and is considered one of the symptoms of an organization's malfunction. Different organizations and institutions, with any mission, function, goals, and perspective they have, finally act at a national or international level, and they are obligated to respond to customers, clients, and stakeholders regarding the achievement level of their intended goals, and they cannot achieve their objectives without evaluating and acquiring knowledge from the progress and achievement of goals and without identifying the challenges facing the organization and issues needing remarkable improvement (Salimi et al., 2022).

Sports and physical education play a crucial role in the health of society (Sami & Labbaf, 2023). Hence, efficiency is particularly important for sports organizations. Furthermore, given the complex structure of sports organizations, which sports federations and associations (public and non-profit organizations) are a part of them, evaluation of their performance is arbitrary and more complicated than that of other organizations (Shaout & Yousif, 2014).

The necessity of evaluating the performance of sports institutions such as sports association boards, which on one hand are facing different strata of society, increasing international competition and decreasing financial support from the government, and on the other hand, it is necessary to respond clearly and explicitly to the society and relevant authorities is felt more. Therefore, the necessity of reviewing and designing the performance evaluation indicators and designing a comprehensive model and providing an appropriate tool in this field is evident owing to the traditional methods of evaluating sports organizations and the existence of weaknesses and shortcomings, such as lack of a precise and systematic model of performance evaluation, absence of comprehensive and pervasive attitude, inconsistency of the evaluation system with the strategic goals and plans, absence of comprehensive and up-to-date criteria and indicators containing all organizational aspects, being result-oriented, and impossibility of correct comparison and ranking of sports organizations (Fesanghari et al., 2021). Moreover, current evaluation methods like the balanced scorecard (BSC) and analytic hierarchy process (AHP), despite their widespread use, often fall short in addressing the multi-dimensional and interconnected nature of sports organizations. These limitations highlight the necessity for combining these methods into an integrated framework to ensure more robust evaluations (Shahin et al., 2012).

Recent studies have underscored the transformative impact of digital technologies on sports sponsorship, particularly during crises. Koronios et al. (2023) explored the role of online platforms in shaping consumer behavior towards sports sponsorship, identifying key factors that influence spectators' awareness, attitudes, and purchasing intentions. Their findings highlight the significance of online sponsorship efforts during times of crisis, showing how they can positively affect consumer behavior and enhance sponsor visibility. Similarly, Koronios et al. (2021) developed and validated a Strategic Sport Sponsorship Scale (SSSES), which emphasizes the importance of sponsorship as a strategic tool for achieving long-term competitive advantages. These studies contribute to understanding how the integration of digital technology and strategic sponsorship practices can create robust, multifaceted performance evaluation models, addressing the need for more comprehensive and contemporary frameworks in the sports sector.

Sport, as an effective power in social and economic development along with direct and indirect effects, plays a key role in the economy and politics of countries (Moslehi & Labbaf, 2024). Sports performance is a management analysis-related phenomenon; hence, sport should be regarded as a system, and its key elements should be considered an integrated system for better sports performance and management dominance in it (Wayne & Lourdes, 2000).

The goals of the sports association boards of the province are determined by sports federations, and the sports boards' goals are realized with the correct performance of the sports association boards. Sports boards

establish communication between athletes and sports federations and they provide players with the opportunity to attend national teams and international fields (Abdollahi et al., 2021).

Consequently, an appropriate and domestic long-term evaluation system and model should be developed for them to optimize the performance of sports association boards.

The balanced scorecard developed by Kaplan and Norton (1996) at Harvard Business School is undoubtedly one of the most well-known and widely used models proposed in recent years to measure performance (Eilat et al., 2006).

The widespread application of the balanced scorecard illustrates a change in management approach by managers. It means that the traditional method of managing performance is not completely comprehensive and needs more balance. This includes balancing financial and non-financial indicators, short- and long-term goals, motivational indicators, and results (Wu et al., 2019).

Determining a baseline and a standard in the evaluation process is required for the balanced scorecard and evaluation is impossible otherwise. However, setting standards for an organization can be extremely misleading. Hence, various models were proposed for performance evaluation, including analytic hierarchy process (AHP), strategic approach, total quality management, analytic network process (ANP), European Foundation for Quality Management (EFQM) Excellence Model, TOPSIS model, grey clustering analysis (GCA), and systematic approach, which are all similar cases employed as evaluation models (Savadi, 2021).

Each of these methods represents many strengths and weaknesses and will be used based on the appropriate situation. For instance, while BSC effectively integrates financial and non-financial performance metrics, it lacks the ability to manage interdependencies between evaluation criteria, which ANP addresses (Leung et al., 2006). Yet, ANP's complexity can limit its practicality in large-scale evaluations, emphasizing the need for simplified and combined methodologies. However, it can be observed that a relatively accurate evaluation is not provided in each of the cases. Therefore, researchers usually suggest combining these methods. For example, Shahin et al. (2012) combined BSC and EFQM to provide an integrated evaluation model and investigated organizational strategies and their performance using it. This combination indicates that the integrated model is able to have better performance than using each of the methods alone. Nahavandi and Sharifinia (2018) have applied the data envelopment analysis model to resolve the evaluation problems by the BSC method. This model was first introduced by Charnes et al. (1978). This experienced-based technique no longer requires the assumptions and limitations of the traditional models of efficiency measurement. Indeed, the lack of need for this model to determine parametric characteristics (form, distribution function, and production function) has been able to identify this method in achieving efficiency scores.

Then, Saaty (1996) proposed the AHP method named analytic network, which is an extended method in multi-objective decision-making to solve complex decision-making problems. This model allows considering all tangible and intangible factors and criteria in the decision-making process. The complexity of evaluation issues has prioritized the use of this method over other methods.

The analytic network process may be highly complex depending on the size of its components. Researchers have also performed numerous combined approaches. For example, Leung et al. (2006) proposed the analytic hierarchy process (AHP) and the analytic network process (ANP) with the balanced scorecard.

Eilat et al. (2006) proposed a cumulative perspective of the balanced scorecard and data envelopment analysis to assess the research and development projects. A total of 50 research and development projects were investigated in this study. A framework of combining the balanced scorecard and data envelopment analysis was presented to assess 90 companies using the research and development activities.

We have achieved a strategic model in this study by applying the balanced scorecard as a holistic system in evaluating the performance in which the techniques of fuzzy analytic network and fuzzy data envelopment analysis are used. This innovative integration aims to overcome the individual limitations of these methods and provides a comprehensive tool tailored specifically for the dynamic context of sports organizations. By implementing this strategic model for sports association boards, some solutions are provided to help to make effective decisions in order to reform and improve the evaluation system of these associations.

Although the empirical data of this study is collected from sport boards, the proposed combined framework (FANP-FDEA with BSC) is structurally transferable. With minor adjustments in input/output indicators (e.g., replacing "national team invitations" with "league performance and transfer revenues"), the same model can be directly applied to football clubs and other professional sports organizations.

In the second section of this article, the balanced scorecard, fuzzy data envelopment analysis, and analytic network process are reviewed. Although the traditional criteria examined the financial performance evaluation of companies, today they are not compatible with companies. Over time, it has been demonstrated

that financial criteria are not the only ones leading to evaluation. Rather, more proper and appropriate results should be achieved by optimizing the operational criteria. In January 1992, the school of accounting professors at Harvard University conducted one study to resolve the limitations of financial indicators in performance evaluation and introduced the balanced scorecard for the first time in the Harvard Marketing journal. The balanced scorecard is a strategic management system that can drive all capabilities at all organizational levels toward long-term goals (Kaplan & Norton, 1996). Some researchers regard this method as an executive way to transform organizational goals into performance metrics. In addition to the method, data envelopment analysis should be used, which is a nonparametric method in dealing with several inputs and outputs. DEA is a frontier analysis to assess the relative performance of the decision-making unit (DMU) with several inputs and outputs (Li et al., 2018).

Fuzzy data envelopment analysis exerts the concept of fuzzy set theory to specify uncertain data and analyzes the data using the attitude and approach of data envelopment analysis. Linear programming technique is also used in this method (Shahraji et al., 2012).

This method is considered to decide between n decision-making units with m inputs (Xij) and s outputs (yij) whose components are positively defined. All inputs and outputs are defined in a fuzzy form and as a triangular fuzzy number (Liu et al., 2019). The efficiency of the jth unit is defined as follows:

$$\theta_j = \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}}$$

The efficiency is defined as a fuzzy number, where ur and vi in this model are the weights of outputs and inputs, respectively.

$$Max\ \tilde{\theta}_0 \approx [\theta_0^L, \theta_0^M, \theta_0^U] = \left[\frac{\sum_{r=1}^{s} u_r y_{r0}^L}{\sum_{i=1}^{m} v_i x_{i0}^U}, \frac{\sum_{r=1}^{s} u_r y_{r0'}^M}{\sum_{i=1}^{m} v_i x_{i0'}^M}, \frac{\sum_{r=1}^{s} u_r y_{r0}^U}{\sum_{i=1}^{m} v_i x_{i0}^L}\right]$$

$$St: \tilde{\theta}_j \approx [\theta_j^L, \theta_j^M, \theta_j^U] = \left[\frac{\sum_{r=1}^{s} u_r y_{rj}^L}{\sum_{i=1}^{m} v_i x_{ij}^U}, \frac{\sum_{r=1}^{s} u_r y_{rj'}^M}{\sum_{i=1}^{m} v_i x_{ij'}^M}, \frac{\sum_{r=1}^{s} u_r y_{rj}^U}{\sum_{i=1}^{m} v_i x_{ij}^L}\right] \leq 1$$

$$j = 1, \dots, n, \quad u_r, v_i \geq 0,$$
$$i = 1, \dots, m, \quad r = 1, \dots, s$$

Subscript zero represents the evaluation unit. The above model can be summarized as follows until θuj becomes less than or equal to one:

$$Max\ \tilde{\theta}_0 \approx [\theta_0^L, \theta_0^M, \theta_0^U] = \left[\frac{\sum_{r=1}^{s} u_r y_{r0}^L}{\sum_{i=1}^{m} v_i x_{i0}^U}, \frac{\sum_{r=1}^{s} u_r y_{r0'}^M}{\sum_{i=1}^{m} v_i x_{i0'}^M}, \frac{\sum_{r=1}^{s} u_r y_{r0}^U}{\sum_{i=1}^{m} v_i x_{i0}^L}\right]$$

$$St: [\theta_j^u] = \left[\frac{\sum_{r=1}^{s} u_r y_{rj}^U}{\sum_{i=1}^{m} v_i x_{ij}^L}\right] \leq 1$$

$$j = 1, \dots, n, \quad u_r, v_i \geq 0, \quad i = 1, \dots, m, \quad r = 1, \dots, s$$

Linear programming method and conversion are used on the above model to achieve the best value in it:

$$Max\ \theta_0^L = \frac{\sum_{r=1}^{s} u_r y_{r0}^L}{\sum_{i=1}^{m} v_i x_{i0}^U}$$

$$Min\ \theta_0^L = \sum_{i=1}^{m} v_i x_{i0}^U + w$$

$$St: \theta_j^U = \frac{\sum_{r=1}^{s} u_r y_{rj}^U}{\sum_{i=1}^{m} v_i x_{ij}^L} \leq 1 \quad \Rightarrow st: \sum_{r=1}^{s} u_r y_{r0}^L = 1$$

$$\sum_{r=1}^{s} u_r y_{rj}^L - \sum_{i=1}^{m} v_i x_{ij}^U + w \leq 0$$

$$j = 1, \dots, n, \quad u_r, v_i \geq 0, \quad i = 1, \dots, m, \quad r = 1, \dots, s$$

$$Max\ \theta_0^L = \frac{\sum_{r=1}^{s} u_r y_{r0}^M}{\sum_{i=1}^{m} v_i x_{i0}^M}$$

$$Min\ \theta_0^M = \sum_{i=1}^{m} v_i x_{i0}^M + w$$

$$St: \theta_j^U = \frac{\sum_{r=1}^{s} u_r y_{rj}^U}{\sum_{i=1}^{m} v_i x_{ij}^L} \leq 1 \quad \Rightarrow st: \sum_{r=1}^{s} u_r y_{r0}^M = 1$$

$$\sum_{r=1}^{s} u_r y_{rj}^U - \sum_{i=1}^{m} v_i x_{ij}^L + w \leq 0$$

$$j = 1, \dots, n, \quad u_r, v_i \geq 0, \quad i = 1, \dots, m, \quad r = 1, \dots, s$$

$$\text{Max } \theta_0^L = \frac{\sum_{r=1}^{s} u_r y_{r0}^U}{\sum_{i=1}^{m} v_i x_{i0}^L}$$

$$\text{Min } \theta_0^U = \sum_{i=1}^{m} v_i x_{i0}^L + w$$

$$\text{St: } \theta_j^U = \frac{\sum_{r=1}^{s} u_r y_{rj}^U}{\sum_{i=1}^{m} v_i x_{ij}^L} \leq 1 \quad \Rightarrow \text{st: } \sum_{r=1}^{s} u_r y_{r0}^U = 1$$

$$\sum_{r=1}^{s} u_r y_{rj}^U - \sum_{i=1}^{m} v_i x_{ij}^L + w \leq 0$$

$$j = 1, \dots, n, \quad u_r, v_i \geq 0, \quad i = 1, \dots, m, \quad r = 1, \dots, s$$

By comparing these three models, it is possible to illustrate the efficiency and performance of the unit under evaluation; which is a triangular fuzzy number (Wang et al., 2009).

The comparison between the relations and mutual correlations between decision-making levels are also determined in the analytic network process. Although the hierarchy method resolves the inherent shortcomings of the measurement and evaluation steps, it does not evaluate possible internal dependencies. Inter- and intra-clusters interaction and feedback are provided in this method. The complex effects of the interactions that often exist in human societies are better represented in this way. ANP replaces the hierarchy using a feedback approach, so that, the importance of the criteria determines the importance of the alternatives; additionally, the importance of the alternatives may also affect the importance of the criteria. In the traditional analytic network process technique, accurate judgments are required. Thus, fuzzy logic and a linguistic approach can be employed to reduce the quantitative exposure to the uncertainty lying in the knowledge and judgments of decision-makers. The following figure illustrates the difference between the analytic hierarchy process and the analytic network process.

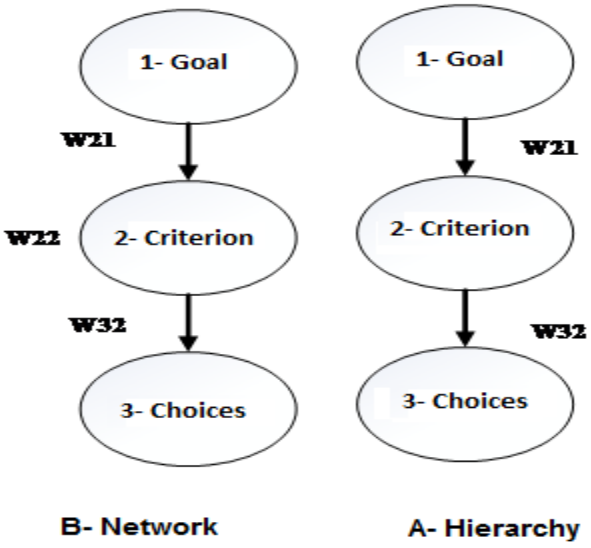

Figure 1. Difference between the hierarchy and network methods

Research Methods

An experimental-mathematical method was used in this study. The needed information was acquired using field, library, observation, questionnaire, and interview methods. The case study and statistical population were selected from the Sports Association Board in 2025. The method of combining data collection tools was used to obtain the inputs and outputs of the Sports Association Board considering factors, such as human resources, available information, and other limitations, including time. In total, the six factors extracted were scored using the balanced scorecard method by distributing 20 questionnaires among experts (6 experts from

the Monitoring and Assessment Unit of the Sports and Youth General Office, 4 experienced sports managers, 10 experts and secretaries of sports boards). Then, each part was analyzed according to the process determined in Figure 2.

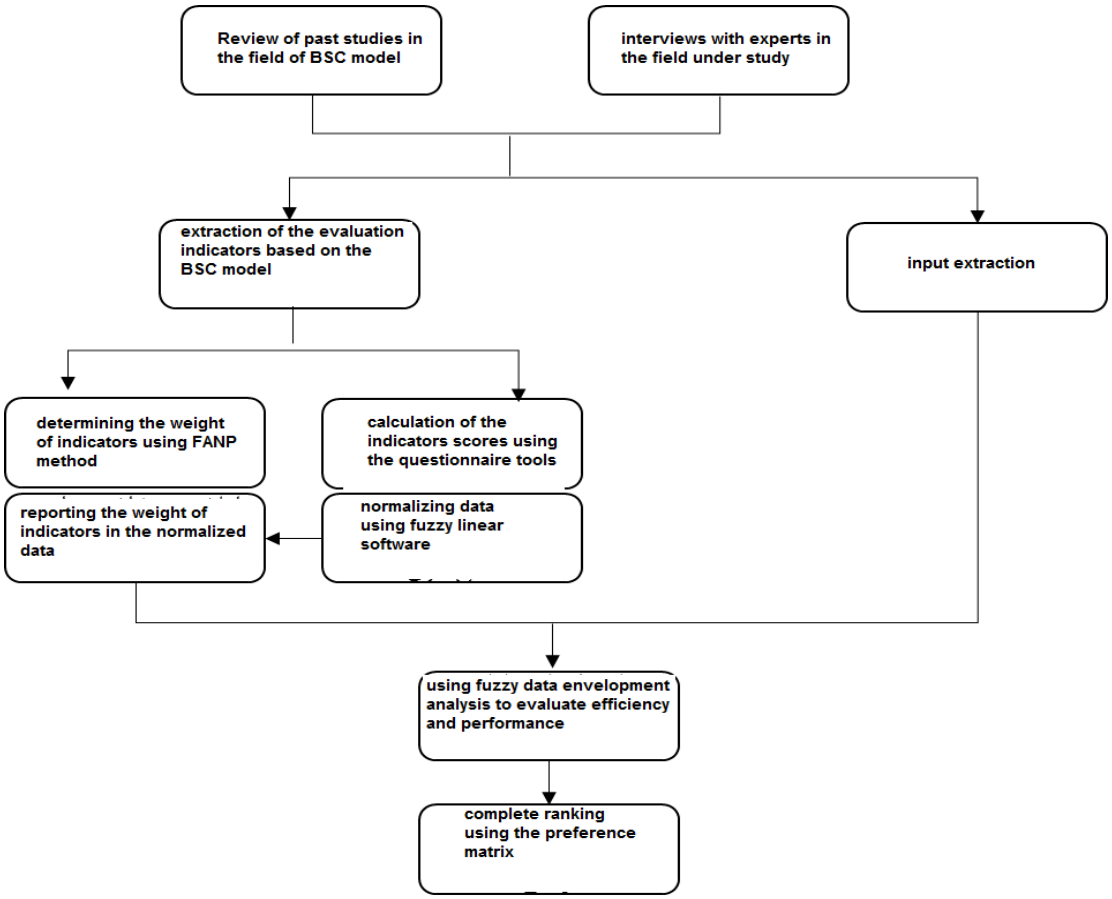

Figure 2. Process of implementing the research

The Fuzzy Analytic Network Process (FANP) is an extension of the Analytic Network Process (ANP), which incorporates fuzziness into decision-making models. This approach allows for handling uncertainty in the relationships between criteria, alternatives, and decision-makers. It is used in this study to evaluate the interdependencies and relative importance of various factors in the Sports Association Board. The Fuzzy Data Envelopment Analysis (FDEA) is a technique that applies fuzzy logic to the Data Envelopment Analysis (DEA), which is a method for assessing the efficiency of decision-making units. In FDEA, fuzzy inputs and outputs are incorporated to account for the imprecision in real-world data, providing a more robust evaluation of performance.

These two methods were utilized to analyze the data obtained through the questionnaires and interviews, helping to quantify and evaluate the performance of the Sports Association Board in a more comprehensive manner.

Findings

Determination of input and output indicators

Finally, 19 indicators (including 11 input indicators and 8 output ones) were determined to evaluate the performance of the sports association boards:

Inputs based on the perspective of internal processes: developing the standards of evaluation and establishing monitoring and evaluation systems; developing legal environment, and talent search activities; holding and hosting competitions; sending to matches; and developing human resources and public sports.

Inputs based on the perspective of growth and learning: cultural development; organizational behavior and management development; scientific and research development; research and software; and educational activities.

Outputs based on the customer perspective: inviting and joining athletes in the national team; organized population; advertisements, won titles; and improved records.

Outputs based on the financial perspective: signing an agreement with education, municipality, and broadcasting organizations, as well as various organs to develop sport, financial management, and financial resources.

After analyzing the data, the importance and prioritization of the indicators were specified based on Tables 1 and 2.

Table 1- Input indicators (Empowering indicators)

Input indicators	Inputs	Row
Talent search activities (Identifying, nurturing, and retaining the talent)	Internal processes	1
Developing the standards of evaluation and establishing monitoring and evaluation systems	Internal processes	2
Sending to matches (provincial, national, international, Asian, world championships, Olympics, and Paralympics)	Internal processes	3
Holding and hosting competitions (provincial, national, international, Asian, world championships, and national team camp)	Internal processes	4
Public sport development	Internal processes	5
Human resources development	Internal processes	6
Legal environment development	Internal processes	7
Educational activities	Growth and learning	8
Organizational behavior and management development	Growth and learning	9
Scientific and research development, research and software	Growth and learning	10
Cultural development	Growth and learning	11

The above table represents the inputs of internal processes and growth and learning.

Table 2- Outputs indicators (results)

Output indicators	Outputs	Row
Organized population	Customer	1
Inviting and joining athletes in national team	Customer	2
Won titles	Customer	3
Improved records	Customer	4
Advertisements	Customer	5
Financial resource development	Financial	6
Financial management	Financial	7
Signing an agreement with education, municipality, broadcasting organizations, as well as various organs to develop the sport	Financial	8

The above table represents the financial outputs and customers.

To apply the fuzzy analytic network process to calculate the indicators of the weights of the balanced scorecard viewpoints, the designed algorithm is implemented as follows:

Step 1: Considering the lack of dependence between the balanced scorecard viewpoints, the significance level of the balanced scorecard viewpoints is determined by each of the experts with a qualitative scale, and the viewpoints weighs are calculated using a group aggregate matrix. When several experts are involved in the evaluation process, the experts' fuzzy judgments should be aggregated; hence, a group fuzzy judgment matrix is used. There are different ways to gather experts' opinions. However, better results can be obtained by the geometric mean method.

A questionnaire designed with a fuzzy 5-point Likert scale spectrum was used to calculate the weights in this study. Then, the significance level of each index in evaluating the performance of sports association boards was determined by selecting one of the choices (absolutely appropriate, appropriate, slightly appropriate, inappropriate, and absolutely inappropriate). Eventually, the findings of the questionnaire were analyzed using a fuzzy 5-point Likert scale spectrum in the range (0-1). For this purpose, first, a table was formed by defining the linguistic variables and fuzzy numbers based on Table 3.

Table 3- Linguistic variables and their related fuzzy numbers

Fuzzy numbers (m1, mM, m2)	Linguistic variables
(0.8,1,1)	Absolutely appropriate
(0.6,0.8,1)	Appropriate
(0.3,0.5,0.7)	Slightly appropriate
(0,0.2,0.4)	Inappropriate
(0,0,0.2)	Absolutely inappropriate

According to Table 3, the value of the variables is illustrated based on the fuzzy numbers.

Determination of the significance level of indicators is calculated using the method given as an example in Table 4.

Table 4- How to calculate the significance level of indicators for the financial dimension

Results	No. of comments	Fuzzy number	Linguistic variable	
(9.6,12,12)	12	(0.8,1,1)	Absolutely appropriate	The first step: in this step, the number of responses is multiplied by the fuzzy number related to it.
(1.2,1.6,2)	2	(0.6,0.8,1)	Appropriate	
(0.3,0.5,0.7)	1	(0.3,0.5,0.7)	Slightly appropriate	
(0,0,0)	0	(0,0.2,0.4)	Inappropriate	
(0,0,0)	0	(0,0,0.2)	Absolutely inappropriate	
		(11.1,14.1,14.7)	The fuzzy numbers were added together in the second step. (Aggregate)	Second step
		(0.74,0.94,0.98)	In the third step, their fuzzy average was obtained by dividing the number of each side by the number of responses, which was 20.	The third step
		(0.74,0.94,0.98)/3=0.88	In the last step, the numbers on the left, middle, and right were added together and divided by 3, then the final number related to the significance level of each index was obtained.	The fourth step

After gathering information from 20 experts, based on the Lawshe model, the significance level of the index was calculated by determining 19 indicators (including 11 empowering indicators and 8 results indicators) to evaluate the performance of the sports association boards.

Table 5- Determination of the priority of input indicators (Empowering indicators) based on the significance level determined by experts

Significance level determined for index	Input indicators
0.85	Educational activities
0.83	Talent search activities (identifying, nurturing, and retaining the talent)
0.83	Developing the standards of evaluation and establishing monitoring and evaluation systems
0.82	Sending to matches (provincial, national, international, Asian, world championships, Olympics, and Paralympics)
0.81	Holding and hosting competitions (provincial, national, international, Asian, world championships, and national team camp)
0.81	Public sport development
0.80	Organizational behavior and management development
0.78	Human resource development
0.73	Scientific and research development, research and software
0.64	Cultural development
0.64	Legal environment development

Table (5) represents the inputs of internal processes, as well as growth and learning.

Table 6- Determination of the priority of output indicators (results) based on the significance level determined by experts

Significance level determined for index	Output indicators
0.88	Organized population
0.88	Financial resource development
0.88	Financial management
0.84	Inviting and joining athletes in national team
0.825	Won titles
0.73	Improved records
0.72	Signing an agreement with education, municipality, broadcasting and organizations, as well as various organs to develop sport
0.71	Advertisements

Table 6 represents the financial outputs and customers.

According to the above tables, considering each of the dimensions, their weights are obtained in the form of the following table:

Table 7- Normalized and unnormalized mean weight

Normalized mean weight	Unnormalized mean weight	Choices
0.24	0.75	Growth and learning
0.25	0.79	Internal processes
0.26	0.82	Financial outputs
0.25	0.80	Customer outputs

According to the results of this step, the financial dimension is considered the most important dimension, followed by internal processes, customers, and then growth and learning.

Step 2: Considering the interdependence among the dimensions of the balanced scorecard, the dependency matrix of each viewpoint of the balanced scorecard is indicated by remarking on other viewpoints by each of the experts using a qualitative scale. In addition, the interdependence weights of each viewpoint are calculated by forming the aggregate matrix and by remarking other viewpoints whose results are described in the following table:

Table 8- Weights of the balanced scorecard dimensions

				Regarding the customer outputs (4)	Regarding the financial outputs (3)	Regarding the internal processes (2)	Regarding the growth and learning (1)
Choice	Weight	Choice	Weight	Choice	Weight	Choice	Weight
Growth and Learning	0.32	Growth and Learning	0.32	Growth and Learning	0.32	Internal processes	0.33
Internal processes	0.33	Internal processes	0.35	Financial outputs	0.34	Financial outputs	0.34
Financial outputs	0.34	Customer outputs	0.34	Customer outputs	0.33	Customer outputs	0.33

Step 3: In this step, the results of each of the interdependency matrices are placed in a matrix in the form of the priority vectors and the dependence among the balanced scorecard viewpoints, and the final priority vector of each of the viewpoints of the balanced scorecard is obtained by multiplying that matrix by the priority vector.

$$\begin{array}{c} \\ (1) \\ (2) \\ (3) \\ (4) \end{array} \begin{array}{c} \begin{array}{cccc} (1) & (2) & (3) & (4) \end{array} \\ \begin{vmatrix} 1 & 0.33 & 0.34 & 0.33 \\ 0.33 & 1 & 0.34 & 0.33 \\ 0.33 & 0.35 & 1 & 0.34 \\ 0.33 & 0.33 & 0.34 & 1 \end{vmatrix} \end{array} \times \begin{vmatrix} 0.24 \\ 0.25 \\ 0.26 \\ 0.25 \end{vmatrix} = \begin{vmatrix} 0.49 \\ 0.50 \\ 0.51 \\ 0.50 \end{vmatrix} = \begin{vmatrix} 0.24 \\ 0.24 \\ 0.25 \\ 0.25 \end{vmatrix}$$

Step 4: In this step, the initial significance level is represented by the qualitative score, and the initial weights of the sub-indicators of the balanced scorecard are calculated. Then, in the next step, the final weights of the sub-indicators related to the balanced scorecard viewpoints are calculated by the following equation. Table 9 presents the results of this step.

The main inputs and outputs of this study, along with their related information are given in the following tables considering the outputs indicators weights obtained from the analytic network process technique in their data by combining these indicators into the main dimensions of the balanced scorecard as well as by combining the indicators into the two dimensions of resource and cost management.

Table 9- Initial and final weights of the indicators

Final weights of key indicators	Initial weights of key indicators	Key indicators of each dimension	dimensions BSC
0.23	0.88	Financial resource development	Financial dimension (0.26)
0.21	0.88	Financial management	
0.19	0.72	Signing an agreement with education, municipality, and broadcasting organizations, as well as various organs to develop sport	
0.22	0.88	Organized population	Customer dimension (0.25)
0.21	0.84	Inviting and joining athletes in national team	
0.20	0.82	Won titles	
0.18	0.73	Improved records	
0.17	0.71	Advertisements	
0.20	0.83	Talent search activities (identifying, nurturing, and retaining the talent)	Internal processes dimension (0.25)
0.20	0.83	Developing the standards of evaluation and establishing monitoring and evaluation systems	
0.20	0.82	Sending to matches (provincial, national, international, Asian, world championships, Olympics, and Paralympics)	
0.20	0.81	Holding and hosting competitions (provincial, national, international, Asian, world championships, national team camp)	
0.20	0.81	Public sport development	
0.19	0.78	Human resources development	
0.16	0.64	Legal environment development	
0.20	0.85	Educational activities	Growth and learning dimension (0.24)
0.19	0.80	Organizational behavior and management development	
0.17	0.73	Scientific and research development, research and software	
0.15	0.64	Cultural development	

The following tables present the main inputs and outputs of this study, along with their related information, considering the outputs indicators of the weights obtained from the analytic network process technique in their data by combining the indicators into the main dimensions of the balanced scorecard as well as by combining the indicators into the two dimensions of resource and cost management.

Table10- The main inputs of the research

Cost management	Resource management	Name of sports boards
5.180667	2.399375	Canoeing
2.833333	2.4875	Tennis
0	0	Taekwondo
7.460333	4.728125	Handball
0	0	Karate
6.037667	3.72375	Archery
4.207667	1.50875	Wushu
0	0	Track and field
7.958	2.807	Basketball
0	0	Chess
0	0	Wrestling
5.833333	4.25	Volleyball

Table 11- The main outputs of the research

Growth and learning	Internal processes	Customer	Financial	Name of the sport board
(0.031,0.031,0.031)	(0.102,0.145,0.188)	(0.113,0.149,0.173)	(0.187,0.213,0.234)	Canoeing
(0.023,0.023,0.023)	(0.091,0.131,0.173)	(0.034,0.058,0.089)	(0.221,0.26,0.262)	Tennis
(0.026,0.026,0.026)	(0.106,0.152,0.189)	(0.041,0.073,0.093)	(0.229,0.255,0.284)	Taekwondo
(0.02,0.02,0.02)	(0.091,0.131,0.173)	(0.099,0.134,0.170)	(0.223,0.237,0.282)	Handball
(0.025,0.025,0.025)	(0.106,0.152,0.189)	(0.041,0.073,0.093)	(0.228,0.256,0.286)	Karate
(0.032,0.032,0.032)	(0.103,0.144,0.181)	(0.087,0.110,0.146)	(0.117,0.213,0.234)	Archery
(0.013,0.013,0.013)	(0.093,0.135,0.18)	(0.188,0.222,0.253)	(0.200,0.223,0.245)	Wushu
(0.026,0.026,0.026)	(0.12,0.157,0.189)	(0.042,0.073,0.093)	(0.229,0.256,0.283)	Track & field
(0.023,0.023,0.023)	(0.119,0.161,0.200)	(0.08,0.116,0.152)	(0.210,0.222,0.243)	Basketball
(0.026,0.026,0.026)	(0.106,0.152,0.189)	(0.041,0.073,0.093)	(0.228,0.256,0.289)	Chess
(0.023,0.023,0.023)	(0.105,0.142,0.178)	(0.041,0.073,0.093)	(0.229,0.256,0.289)	Wrestling
(0.017,0.017,0.017)	(0.107,0.106,0.179)	(0.041,0.073,0.093)	(0.229,0.212,0.233)	Volleyball

Results of the fuzzy output-oriented BSC model

Data envelopment analysis with an output-oriented nature was used in this research to evaluate the performance of the sports association boards. As it appears that the management can control outputs more than data do, this study aims to provide managers with guidelines to improve and balance the indicators proposed in the scorecard, all of which are part of the outputs of the model. To achieve the efficiency and performance of the units with the fuzzy output-oriented BSC approach, the model suggested by Wang et al. (2009) was used.

Table 12- The efficiency (performance) scores of the sport association boards in the fuzzy output-oriented BSC model

Efficiency (Performance)	Name of the sport board	Efficiency (Performance)	Name of the sport board
(1.272,1.135,1)	Wushu	(1.475,1.27,1.065)	Canoeing
(1.001,1.001,1.001)	Track & field	(1.253,1.128,1)	Tennis
(1.356,1.123,1)	Basketball	(1,1,1)	Taekwondo
(1,1,1)	Chess	(1.485,1.153,1.078)	Handball
(1.241,1.123,1)	Wrestling	(1,1,1)	Karate
(1.457,1.27,1.065)	Volleyball	(1.509,1.3,1.09)	Archery

The sport association boards were divided into two efficient and inefficient groups using the data envelopment analysis model. Inefficient units can be ranked by gaining efficiency points; however, the sport association boards with an efficiency of 1 cannot be ranked using classical data envelopment analysis models. The preference matrix was used in the present study.

The method of achieving the preference matrix is as follows: Suppose that $\tilde{a} = (a_1, a_m, a_u)$ and $\tilde{a} = (a_1, a_m, a_u)$ are two triangular fuzzy numbers of efficiency and according to the fuzzy calculation rules, their difference is also a triangular fuzzy number with the following possible relations:

$$(a_m > b_m) \cap \left(a_l < \downarrow (a_u > b_l) \cap (a_m \leq b_m)\right), a_l \geq b_u, a_u \leq b_l$$

Therefore, we calculate the order-of-magnitude as follows:

$$P(\tilde{b} > \tilde{a})$$

$$= \begin{cases} 0, & if\ a_l \geq b_u \\ 1, & if\ a_u \leq b_l \\ 1 - \dfrac{(a_u - b_l)^2}{(a_u - b_l + b_m - a_m)(a_u - a_l + b_u - b_l)}, & if (a_u > b_l) \cap (a_m \leq b_m) \\ \dfrac{(b_u - a_l)^2}{(b_u - a_l + a_m - b_m)(a_u - a_l + b_u - b_l)}, & if (a_m > b_m) \cap (a_l < b_u) \end{cases}$$

The fuzzy efficiency can be ranked using the order-of-magnitude:

Step 1: Calculating the matrix of order-of-magnitude: Entries above the main diameter and entries below the main diameter are calculated using the two formulas provided.

$$Mp = \begin{array}{c|cccc} & \tilde{\theta}_1 & \tilde{\theta}_2 & \cdots & \tilde{\theta}_n \\ \tilde{\theta}_1 & - & P_{12} & \cdots & P_{1n} \\ \tilde{\theta}_2 & P_{21} & - & \cdots & P_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \tilde{\theta}_n & P_{n1} & P_{n2} & \cdots & - \end{array}$$

Step 2: Achieving a row of the above matrix whose order-of-magnitude is greater than or equal to 0.5 for all its entries except the entry on the main diameter. The selected row is considered a row with the highest efficiency compared to other rows.

Step 3: The row and column of the choice related to the previous step are deleted, and this continues until all rows and choices are deleted, and the ranking of the choices is conducted based on the priority of the deleted row and column. Table 13 presents the complete ranking of the sports association boards.

Table 13- Preference matrix for the complete ranking of units in the output-oriented BSC model

	Canoeing	Tennis	Taekwondo	Handball	Karate	Archery	Wushu	Track and field	Basketball	Chess	Wrestling	Volleyball	Rank ANP	DEA rank
Canoeing		0	0	0	0	0.820	0	1	0.558	0	0	1	10	11
Tennis	1		0	0	0	0.574	0	0	1	0	0	1	5	6
Taekwondo	1	1		0.402	0.542	0	0	1	0	0	1	0	1	1
Handball	1	1	0.598		0.095	0	0.575	0	0	1	0	0	8	9
Karate	1	1	1	0.900		0.640	0	0	1	1	0	0	1	1
Archery	0.180	0.426	0.458	0.624	0.359		1	0.675	1	0	0	0	10	12
Wushu	1	1	1	0.778	1	0		0.212	1	0	0	0	6	7
Track and field	0	1	1	1	1	1	0.788		1	0	0	0	3	4
Basketball	0.442	0	0	0.425	0.468	0.746	0.662	0		0	0	0	7	8
Chess	1	1	1	1	1	1	1	0	1		1	0	2	3
Wrestling	1	1	1	1	1	0.757	0.557	0.758	0.617	0		1	4	5
Volleyball	0	0	0	0	0	0.325	0.458	0.364	0.365	0.879	0		9	10

Based on Table 13, in both methods, the sport board of karate has obtained the first rank in the performance level, and volleyball, canoeing, and archery boards have gained the worst rank. The chess and track and field teams are ranked second and third in both methods.

Discussion

Performance measurement is considered one of the most important links in the chain of management and performance management in the organization and it is important to the extent that management experts believe that what cannot be measured cannot be managed (Marcos et al., 2019). The effectiveness of the executive system is the most important factor for each organization to achieve its goals. Organizations often spend considerable money to achieve their goals; however, they have low effectiveness and efficiency in achieving them. Thus, it is necessary to change and revise the attitude in the evaluation system. Since there are many evaluation systems, they should be screened in terms of their features. During the evaluation meetings with the presence of the experts and pundits in this field and after examining similar studies, it was concluded that the evaluation method should be a strategic goals-based method capable of evaluating the entire organization, and considering the important aspects of the organization, and non-financial and financial aspects.

In today's competitive world, obtaining the maximum productivity is not ideal; rather, it is necessary for organizations, regardless of their size, to improve their performance (Salimi & Khodaparast, 2018).

Önüt et al. (2009) identified the balanced scorecard method as the best and most appropriate method by investigating the comprehensive models of performance evaluation. Accordingly, the balanced scorecard dimensions were applied in this study to extract inputs and outputs indicators. A fuzzy analytic network process technique was used to obtain the relative importance of the output indicators in the evaluation. This study was performed similarly to the study by Eilat et al. (2006). This technique is convenient as, according to Leung et al. (2006), it can calculate the internal and hierarchical relationships between the balanced scorecard dimensions. Therefore, according to the findings, the sports association boards consisted of four dimensions, namely financial, customer, internal processes, and growth and learning, being consistent with the model proposed by Jalaliyoon et al. (2010) and Seyedi et al. (2012). However, the difference between the combined model proposed in this study and the other models can be associated with the type of organization under study, and it should be noted that the raison d'être for educational and service organizations, including the department of physical education of universities, is to accomplish the main assigned missions, not to earn money and profits; this can be one of the reasons for the contradiction in the research.

As observed, among the balanced scorecard dimensions in this study, the customer and financial dimensions were ranked first. Indeed, these dimensions, which have the highest weight among other dimensions, have the greatest impact on the level and order of the performance efficiency of sports association boards. The results of this section of the research are inconsistent with the results of the study by Mirfakhredini et al. (2013). They reported that the physical education administration represented good performance in terms of growth and learning and internal processes; however, it has not performed well in customer and financial dimensions. Hence, it is suggested that in the financial area, this administration should continuously analyze its financial ratios. In addition, in the area of customers, by providing preferred services and building trust in athletes and coaches, who are its main customers, it should effectively maintain its activities and communication channels with them and should always measure the satisfaction of its customers.

According to findings, the input indicators related to the finding talent and educational activities, are the most important inputs and the organized population and financial indicators are considered the most important outputs in determining the efficiency level of boards. In this study, the indicator of educational activities had the greatest effect on the efficiency of sports association boards due to excessive attention to sub-criteria of attracting professional sports coaches and managers, employing specialized coaches to find talents at elementary ages, holding provincial matches in the form of sport development through schools, holding coaching training classes and inviting domestic and foreign professional coaches, launching a high-quality and up-to-date website to introduce the athletes and insert their results. The boards should consider the necessity of training coaches, referees, and staff while following this path. The sports association boards that invest in the training of their coaches, referees, and staff are more successful than the boards that do not consider it or do not pursue it seriously. The results of this study in the field of inputs are inconsistent with the results obtained by Moreno and Lozano (2014). In their study, the consumed input (like the team budget)

had obtained the highest score than other metrics; however, growth and learning were consistent with the study conducted by Kashtidar et al. (2017), and educational activities represented the highest score.

According to the significance of finding talent, it could be mentioned that paying special attention to the development of national talent search schemes is a significant factor in developing the sport association boards and consequently in developing the country's sports upon which the required platforms are provided to actualize the potential sports talents, so that the sports endowment of the country will soon be regenerated and a proper environment for the presence of the elites in all sports levels of the country will be provided. Among the studies conducted in the field of finding talent in the country, the research by Amirtash (2005) can be mentioned. Amirtash addresses the subject of talent search and concludes that the most suitable place for finding talent is education, and sports teachers are the first ones who should do this.

The highest score in the output part was related to the indicators of the organized population and financial resource development. The results of this study in the field of financial dimension are inconsistent with the research by Asayesh et al. (2013). They concluded that lack of budget and financial facilities was considered a challenging factor in track and field. Katz (2004) examined the innovation in sport and the obstacles to its development and observed that using financial resources and advanced equipment is particularly important in developing track and field sport, since all sport association boards were evaluated in this study, and the studies by Asayesh et al. (2013).

Generally, according to the results demonstrating the importance of financial resources in evaluating the performance of the sports association boards, the heads of the sports association boards are suggested to develop their monetization strategies more effectively and to consider success in fields like monetization. Privatization leads to increased efficiency in sports. It is also suggested in the current study, so that the private sector can play an important role in the progress and development of championship sports in the province, as transferring sports facilities to the private sector is one of the opportunities for the province.

In this study, taekwondo and karate teams acquired the first place, indicating the high efficiency of the boards. The sports association boards, which have acquired a higher place in the final ranking, show indicators of better performance. The results of this study are consistent with the results obtained by Skandari Dastgiri et al. (2018). According to their results, among the efficient federations, taekwondo and football federations are regarded as important patterns and references in the performance of other federations. Furthermore, the sport association boards, such as tennis and chess, were evaluated as absolutely efficient boards due to maintaining balance in the work processes and widespread activities in developing the sports; however, they performed poorly in the championship. These boards should augment outputs and focus on the results.

Karami et al. (2022), in their research, entitled "The performance evaluation of sports association boards based on the MEA-BSC combined model with negative data", suggested two main strategies to raise the overall efficiency and to improve the performance status of the studied boards. One of the strategies is to raise the efficiency level of boards in converting the inputs used into appropriate outputs. The second one is to try to allocate the required resources to these boards. Raising and developing these resources as inputs can lead to the desired results by proper regulation, organization, and management.

By studying the Persian Gulf Pro League, Soleimani-damaneh et al. (2015) observed that the efficient use of available resources was the most important factor in the sports success of teams. It can be stated that improper enjoyment of the available resources by archery, canoeing, volleyball, handball, basketball, and wushu leads to the inefficiency of these sports' association boards. In addition, the differences observed in the effectiveness (results) and efficiency obtained for the sports association boards are consistent with the results of Guzmán (2006) and Haas (2003). They indicated that there were two main approaches increasing the efficiency of the Departments of the Ministry of Sports and Youth. One of the approaches is to raise the efficiency of all provincial departments in converting inputs into favorable outputs. In other words, the departments should try to provide the maximum outputs from the input sources by improving managerial programs and operational approaches. The second one is to focus on the sufficiency and optimality of the resource level of the departments. Having numerous resources to produce outputs leads to an increase in the size of departments, and having limited resources to produce outputs leads to the small size of departments, and in two cases, leads to the inefficiency of the Departments of the Ministry of Sports and Youth. The input assigned to each department should be based on the plans and needs of the department, thus the budget of the department is crucial.

Therefore, organizations should consider exactly the amount of input resources used, since the unfavorable size of the resources used by the organization to produce outputs can lead to the overall inefficiency of the organization.

This study has some limitations that should be addressed in future research. First, the focus on a specific type of sports organization limits the generalizability of the findings. Future studies could expand the sample to include various sports organizations across different sectors, both public and private. Additionally, the study primarily focused on budget as a key input metric, while other organizational resources, such as human capital, have been less explored. Future research could assess the role of these resources in sports performance and investigate how specific educational activities contribute to the development of talent in high-performance sports. Moreover, the impact of privatization and collaboration with the private sector on sports associations could be examined in greater detail. Exploring innovative financial models such as sponsorships, grants, and crowdfunding might also enhance the sustainability of these organizations, particularly in regions with limited financial resources. Lastly, integrating multiple evaluation frameworks and comparing the effectiveness of performance measurement models could provide deeper insights into the strategic planning processes of sports organizations. These areas offer fertile ground for further research and could lead to more robust understanding of performance evaluation in sports management.

Conclusion

Efficiency and inefficiency are quantitative issues in the performance evaluation process. The performance evaluation process can assist the manager to control the current situation, to specify the future direction, and to emulate other organizations (Salimi & Khodaparast, 2019). The model validated here on sport boards provides a practical blueprint for performance evaluation in football clubs as well, requiring only the redefinition of context-specific indicators.

According to the results, it is suggested that:

Based on the results obtained from solving different models of data envelopment analysis, the results should be provided to inefficient units, so that they are able to raise the optimal efficiency and performance of the units.

It is better to invest more in attracting customers and finally, other processes can be improved with better training and customer satisfaction.

Planning should be implemented for the sports association boards and the relationship between the goals and strategies should be determined using the main performance indicators.

The second most important factor was the financial dimension requiring managers to formulate appropriate policies in this regard.

Given that increasing the number of evaluation units contributes to the accuracy of this method, it is recommended that the number of these units should be increased in future research.

The performance changes in the boards can be compared by combining the DEA window analysis method, BSC and FANP, and consequently, more appropriate results can be obtained.

Research Limitations and Suggestions for Future Research

A limitation of this study is that the empirical data were collected exclusively from sport boards, which may affect the direct generalizability of the results to professional football clubs. Future studies can directly apply the proposed FANP-FDEA model to professional football clubs by replacing the current sport board indicators (e.g., talent search in schools, national team invitations) with football-specific indicators (e.g., academy efficiency, league ranking, match-day revenue, player transfer values). This would test the generalizability of the model across different types of sports organizations.

Acknowledgments

The authors thank everyone who contributed to this article.

Conflicts of Interest

There is no conflict of interest.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Statement on the Use of AI

Gemini AI was used for grammatical improvement of this article.

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