



Identifying and ranking key performance indicators in football clubs

Kianoush Rahmati^{1,*}

¹ *Master's Degree in Physical Education (Sports Sciences), Islamic Azad University, Gorgan Branch, Iran*

ARTICLE INFO	ABSTRACT
<p><i>Received: 1 March 2023</i></p> <p><i>Reviewed: 14 March 2023</i></p> <p><i>Revised: 7 April 2023</i></p> <p><i>Accept: 5 May 2023</i></p>	<p>Key performance indicators are actually measurable variables based on which we can measure the success rate of an organization in reaching defined key goals. In order to create key performance indicators, steps, and standards must be passed, each of which is of great importance. Based on how the key performance indicator (KPI) is defined and determined, it is possible to measure the performance of a person, department, process, campaign, or strategic goals of a brand. In fact, KPIs can be considered for different industries and for different levels of each business. Considering the importance of football clubs and their high social impact, the purpose of this research is to investigate these key performance indicators in order to grow and improve their comprehensive performance. In order to extract data, a literature review was used. Data refinement and prioritization were done using the fuzzy decision-making method, and the opinions of active experts in clubs and football players were used. The results show that indicators based on infrastructure development are among the most important indicators and should be given special attention.</p>
<p>Keywords: <i>key performance indicators, performance improvement, sports development, football clubs, sports management</i></p>	

* Corresponding Author: Kia.rahmati57@yahoo.com

1. Introduction

Key performance indicators (KPI) are a set of measurable indicators that play a vital role in knowing how much a system is achieving its goal. These indicators are very important for monitoring and evaluating the performance of a system, organization, business or brand. Football clubs in the world define key performance indicators at several different levels to measure their success in achieving goals. At a high level, they focus on the overall performance of the club, and lower level indicators focus on processes in departments such as training, marketing, or logistics [1].

At the organizational and industrial level, increasing productivity can create more competition and lead to company growth. At the individual level, the growth of productivity can lead to the improvement of the quality of life, increase of free time and individual progress in the organization. In this regard, managers of football sports clubs today, in order to achieve goals such as building stronger and better teams, only determine indicators of increasing productivity by hiring athletes and coaches who can afford them and building new sports complexes with modern facilities. In other words, today football clubs are more than a simple sports organization [2] because they have turned into complex business units. The organizational structure of sports clubs is due to extensive activities such as facilities, large stadiums, factors related to fans (merchandising and ticket sales), commercial activities and features related to the media, which are related to the main activity. In addition, they have distanced themselves from traditional activities.

It is necessary to realize the goals and determine the effective indicators in increasing productivity, it is necessary to know all the effective factors in organizational and individual productivity.

It is necessary to realize the goals and determine effective indicators in increasing productivity, to know all the effective factors in organizational and individual productivity, and in this direction, different researches have been done [3]. Also, in some articles, instead of economic factors, in order to evaluate the level of productivity in Professional football uses sports variables in matches such as shots at the goal, duration of ball control, points scored, etc., which until now has not been a complete research considering all effective variables (economic and non-economic) in evaluating productivity. Professional football clubs have not been done. There is no way to explain the sports performance and success of football clubs and it is generally agreed upon, and each researcher has explained the factors affecting sports performance and success according to his expertise and from a different perspective [4]. Some researchers consider financial resources to be the most important, some emphasize on talent acquisition and talent cultivation, some consider sports facilities and equipment as key, some others believe in the political power and political will of statesmen, some people consider the role of specialized human resources such as managers and coaches to be important. They know and some have a wiser view and point to physical abilities, training, nutrition, psychological skills and heredity in sports success. Due to the fact that the sports performance of football clubs also affects their economic and social performance, in this research we are looking for an answer to the question of what are the factors of sports performance and success. It affects football clubs and what is the priority of these key performance indicators [5].

According to the above, the structure of this paper is as follows: In the second part, the literature review is presented. In the third part, the research method is presented. Analytical results are presented in the fourth part and finally the conclusion will be presented in the last part.

2. Literature Review

Today, productivity as a competitive advantage forms the backbone of an organization. And organizations need to improve productivity in order to influence the quality of life of societies. Therefore, deciding how to improve productivity with the increasing complexity of the current environment is a big challenge for managers, which has become a global concern and its understanding is possible only in the context of the dependence between different elements [6].

In organizational studies in the field of sports, the performance of a football team has been examined according to its goals in three main parts: sports performance or competition results, economic performance or financial results, and social performance or results related to creating entertainment for the public. The scores of each season show the level of sports performance of each team, which leads to the ranking at the end of the season, and for the teams at the top and bottom of the ranking table, access to prestigious continental cups and relegation to the lower category are followed. The annual turnover is also considered a standard for evaluating the financial performance of each team, which includes ticket sales, television broadcast rights, business, sponsors, and donations. Social performance is also measured by the number of spectators or fans attracted to a club [7].

An important issue in measuring the performance of football teams by organizations organizing professional leagues is one-sided attention to sports performance or competition results; So that in the ranking of the teams, only the obtained points are considered, regardless of the facilities and resources spent by them. In other words, if we want to describe the performance of football teams based on two indicators of efficiency and effectiveness, the method of scoring and ranking professional football leagues shows sports effectiveness (achieving the goal of the sport) [8].

But the criterion of efficiency (not wasting available resources in the sports competition of the league) is ignored. In order to solve this shortcoming, researchers in the field of sports management evaluate the performance of sports teams, including football, in comparison with their potential and based on the criterion of efficiency. The study of the research literature shows that researchers have mainly used the data coverage analysis method to measure the potential and efficiency of football teams. This method is a deterministic non-parametric technique for estimating the efficiency frontier, and its main purpose is to measure and compare the efficiency of a number of similar decision-making units, such as sports teams participating in a league, which have different amounts of consumption inputs and production outputs. The score calculated using this method for the football team shows the maximum score or rank that can be obtained from different combinations of inputs [9].

In competitive sports, where the goal is to gain points and rank, the potential is the concept of potential team performance, i.e. potential points and rank for a sports team, which is expected for that team, according to the available resources and compared to other competitors. However, there are different views on what creates the expectation of potential points or rank or what should be considered in calculating points and potential rank. Some researchers, in research with the aim of determining the areas of potential improvement in the performance of England's first league football teams, using the method of data coverage analysis, the salaries and wages paid by each team to players and coaches as inputs and points earned and income. They have considered each team as output and reported these results [10].

Some researchers in research titled "Evaluating the performance of Iranian football teams using linear programming" used the data envelopment analysis method to calculate the efficiency of the teams. In

the mentioned research, the salary paid to coaches, players, and support staff in the form of three inputs and points earned, the number of spectators of each team's games, and the total income of the team have been processed as three outputs. According to the mentioned background, it should be said that the financial structure of most of the teams present in the professional football league of Iran is also such that due to the use of government credits and public budgets, they employ players and coaches without any conditions or accountability. It is said that according to the belief of many experts, the waste of financial resources leads to a decrease in the performance and quality of games [11].

Only sports results are taken into consideration in team performance evaluation. As a result, because the performance of the teams is not evaluated according to their potential, on the one hand, managers of rich teams or relying on public funds, in order to win the league, do any kind of reasonable and unreasonable expenses, and on the other hand, proper performance Teams with medium and weak facilities are ignored. These issues lead to the promotion of cost management and the concealment of managerial weaknesses governing football teams [12]. The key performance indicators and the correct understanding of these indicators in an organization can lead to the growth of that organization, and football clubs are no exception to this. In order to analyze these indicators and evaluate them, the most important key performance indicators in football clubs, the most important indicators have been extracted from the subject literature. This KPI is shown in Table 1.

These indicators have been refined using the opinions of experts and active coaches in the field of football.

Table 1. Key performance indicators of football clubs.

Education W1	Teaching science related to football W11 Football Academy W12
Equipment and facilities W2	Grass field and football hall W21 Tools and Equipment W22 Complementary equipment W23
Strategic Management W3	Planning W31 Proper structure W32 Leadership W33 Financial ability W34

- **Teaching science related to football:** including knowledge of modern training methods, advanced bodybuilding training, proper nutrition training, ways to improve physical fitness, advanced training science, professional lifestyle training, healthy lifestyle training, holding training workshops for players, coaches, and managers, seminars, workshops and The importance of regular sleep. Guiding talents, nurturing talents, supporting talents, covering talents, and training talents are also included in this category [13].

- **Football Academy:** Establishing football schools, equipping football schools, paying special attention to football schools, training talents in football schools, and using knowledgeable and experienced coaches in the academy.
- **Grass field and football hall:** High-quality grass field, a suitable training ground. Hall for training in bad weather, having a standard stadium, and training camp.
- **Tools and Equipment:** Standard ball, shoes, and other football clothing, equipment such as tactical board, funnel and plastic cones, mannequin, TRX, balance board, various types of jumping hurdles, plastic rod, and rod base, various ray bands, and...
- **Complementary equipment:** Equipped gym, swimming pool with full facilities, medical and physiotherapy room, massage room, sauna and Jacuzzi for recovery, dining room, dormitory.
- **Planning:** Planning, short-term plans, medium-term plans, long-term plans, having a plan and plan, being purposeful, having a vision, dreaming, having a strategy, alternative strategies, and mission [14].
- **Proper structure:** Timely decision-making, teamwork, partnership, consultation, quick decisions, group decisions, creativity and innovation, talent search committee, basic teams committee, marketing department, legal department, procurement department, financial administration department, specialization, financial and information transparency, Agility, speed of action, away from bureaucracy, the existence of different instructions (legal, financial, technical, administrative), ownership structure and club administration.
- **Leadership:** Stimulating coaches and players, creating motivation, being an expert in internal and external communication, resolving conflicts, guiding, and solving problems.
- **Financial ability:** Partnership with financial and non-financial sponsors, contracts with sponsors, main sponsors, production sponsors, secondary sponsors, and sponsors who support with money. Sponsors who provide equipment and services.

3. Research Methodology

Due to the vague and imprecise nature of data and information in real life and making decisions based on this inaccurate and uncertain information, the modeling process of many phenomena may not be done properly and efficiently. In order to solve the ambiguity and inaccuracy of individual judgments, the theory of fuzzy sets was proposed to introduce linguistic conditions (phrases) in the decision-making process. A linguistic variable is a variable whose value is expressed by linguistic expressions. The concept of these variables is very useful in relation to conditions that are complex and not well defined, because they can be logically described in somewhat common mathematical relationships. Expressions such as "not very clear", "maybe, probably", are expressions that are used in Our daily lives are all heard and the similarity of all of them is that they are more or less associated with uncertainty. If the fuzzy nature of decisions is not taken into account, the different results of daily problems can be misleading [15].

The theory of fuzzy sets has a tendency towards uncertainties caused by inaccuracies or ambiguities, in fact, the main advantage and contribution of the theory of fuzzy sets is their ability to provide ambiguous data. This theory also allows mathematical and programming operators to be applied to fuzzy domains. A fuzzy set is a class of subjects with a continuum of membership degrees. This set is determined by the membership function, which determines a degree of membership in the range between zero and one for each subject (member) [16].

The fuzzy AHP method is one of the multi-criteria decision-making methods (MADM), which is a subset of the multi-criteria decision-making method. The traditional AHP (early version of AHP),

which has been used so far, requires accurate judgments. But due to the complexity and uncertainty in real decision-making issues, it is often unrealistic or even impossible to provide accurate judgments. Therefore, it is much more realistic and practical if this possibility can be provided to the decision maker to use inaccurate judgments using fuzzy logic instead of accurate judgments [17].

In 2004, Mikhailov presented a new approach to calculating weights in the fuzzy AHP method, and he called this method fuzzy prioritization. One of the most important features of this method is the calculation of the compatibility rate in the fuzzy state. The weights in this method are obtained from solving a non-linear optimization model [18].

In this method, it is assumed that fuzzy pairwise comparisons are triangular fuzzy numbers. The deterministic vector of weight (priority) $w = (w_1, w_2, \dots, w_n)$ is extracted in such a way that the priority rate is almost within the range of the basic fuzzy judgments. In other words, the weights are determined in such a way that the following relationship is established.

$$l_{ij} \lesssim \frac{w_i}{w_j} \lesssim u_{ij} \quad (1)$$

Any deterministic weight vector (w) with a degree applies to the above fuzzy inequalities, which can be measured through the linear membership function of the following relationship (in terms of the unknown rate):

$$\mu_{ij} \left(\frac{w_i}{w_j} \right) = \begin{cases} \frac{(w_i / w_j) - l_{ij}}{m_{ij} - l_{ij}} & \frac{w_i}{w_j} \leq m_{ij} \\ \frac{u_{ij} - (w_i / w_j)}{u_{ij} - m_{ij}} & \frac{w_i}{w_j} \leq m_{ij} \end{cases} \quad (2)$$

Considering the specific form of the membership functions, the fuzzy prioritization problem becomes a nonlinear optimization problem as follows.

$$\begin{aligned} & \max \lambda \\ & \text{Subject to :} \\ & (m_{ij} - l_{ij})\lambda w_j - w_j + l_{ij}w_j \leq 0 \\ & (u_{ij} - m_{ij})\lambda w_j + w_i - u_{ij}w_j \leq 0 \\ & i = 1, 2, \dots, n-1, \quad j = 2, 3, \dots, n \quad j > i, \\ & \sum_{k=1}^n w_k, \quad w_k > 0, \quad k = 1, 2, \dots, n \end{aligned} \quad (3)$$

Positive optimal values for index λ (objective function) it indicates that all the ratios of weights apply completely in the initial judgment, but if this index is negative, it can be understood that the fuzzy judgments are strongly inconsistent and the ratios of weights are almost applied in these judgments.

4. Research findings

The process related to the ranking of the key performance indicators in football clubs in this study is divided into two main parts:

- 1- Determining the matrix of pairwise comparisons based on the integration of experts' opinions
- 2- Using mathematical modeling in order to rank and obtain the weight of indicators in the research model.

By placing the data obtained from expert opinion in the non-linear model (3) as a model providing weights and ranks based on hierarchical analysis and solving the model using LINGO software, the weight, and rank of the KPI were obtained in general dimensions as well as in exclusive categories. The calculation results related to solving the non-linear model for general categories and individual indicators are shown in tables (2) to (5).

Table 2: Weight and ranking of the main categories

Category	Code	Weight	Rank	The OF(λ)
Education	W1	0.39421	1	0.41251
Equipment and facilities	W2	0.33251	3	
Strategic Management	W3	0.34002	2	

Table 3: Weight and ranking of the Education categories

Category	Code	Weight	Rank	The objective function(λ)
Teaching science related to football	W11	0.52154	2	0.54211
Football Academy	W12	0.46148	1	

Table 4: Weight and ranking of the Equipment and facilities categories

Category	Code	Weight	Rank	The objective function(λ)
Grass field and football hall	W21	0.42517	1	0.35214
Tools and Equipment	W22	0.21012	3	
Complementary equipment	W23	0.35142	2	

Table 5: Weight and ranking of the Strategic Management categories

Category	Code	Weight	Rank	The objective function(λ)
Planning	W31	0.25941	1	0.51241
Proper structure	W32	0.24517	3	
Leadership	W33	0.24321	4	
Financial ability	W34	0.25412	2	

As it can be seen in tables (2) to (5), a positive value for the compatibility index indicates acceptable compatibility of the matrices. The normalized calculation results are shown in Table number (6).

Table 6: Normal weight and final ranking

Category	Weight	Requirements	Weight	Normal weight	Rank
Education	0.39421	Teaching science related to football	0.52154	0.177334	1
		Football Academy	0.46148	0.156912	2
Equipment and facilities	0.33251	Grass field and football hall	0.42517	0.141373	3
		Tools and Equipment	0.21012	0.069867	8
		Complementary equipment	0.35142	0.116851	4

Strategic Management	0.34002	Planning	0.25941	0.102262	5
		Proper structure	0.24517	0.096648	7
		Leadership	0.24321	0.095876	9
		Financial ability	0.25412	0.100177	6

As shown in Table 6, the growth and development of education in football clubs have the highest priority and special attention should be paid to club managers and football trustees in this field. The development of education and the creation of basic academies can create a better position for the club and bring higher economic and social growth. Figure 1 shows the prioritization of key performance indicators in football clubs.

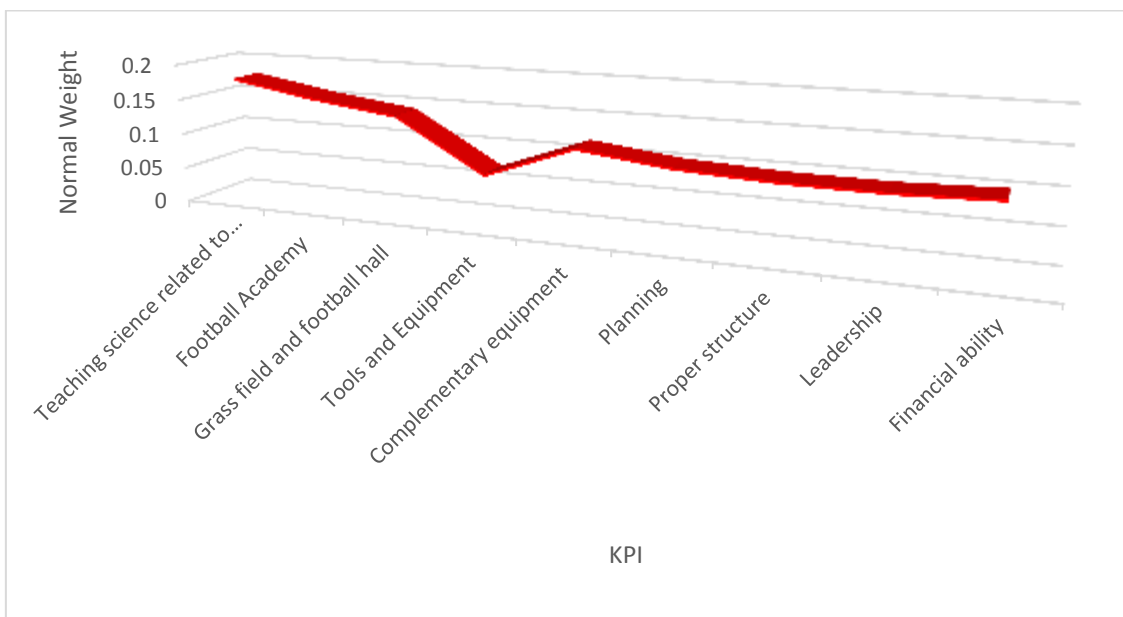


Fig. 1. Prioritization of key performance indicators in football clubs.

As seen in Figure 1, the development of training and development of the academy in football clubs has the highest priority.

5. Conclusion

The sports performance and success of football clubs, in addition to creating enthusiasm in the society, has economic, socio-cultural and even political effects for the target society. The performance of football clubs can be analyzed in three economic, social and sports areas. The meaning of economic performance; The ability to generate income and profitability, the meaning of social performance; Promoting football and attracting spectators and fans, and sports performance means the results, points earned, ranks, titles, championships, and in general, the successes achieved by clubs in domestic and foreign competitions. In different countries of the world, the organizational structure of football consists of several levels, football teams and clubs usually start their activities at the amateur level and try to climb to higher and professional levels with proper planning. In this way, some football teams and clubs reach higher levels by considering the factors affecting success and progress

in sports. For this reason, in this research, it has been tried to examine and evaluate the most important key indicators of success in order to improve performance.

The performance of football clubs can be analyzed in three economic, social and sports areas. The meaning of economic performance; The ability to generate income and profitability, the meaning of social performance; Promoting football and attracting spectators and fans, and sports performance means the results, points earned, ranks, titles, championships, and in general, the successes achieved by clubs in domestic and foreign competitions. In different countries of the world, the organizational structure of football consists of several levels, football teams and clubs usually start their activities at the amateur level and try to climb to higher and professional levels with proper planning. In this way, some football teams and clubs reach higher levels by considering the factors affecting success and progress in sports. For this reason, in this research, it has been tried to examine and evaluate the most important key indicators of success in order to improve performance.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflicts of Interest

The author declares no conflict of interest related to this publication.

References

- [1] Hyndman, N., & Liguori, M. (2023). 'Be a game changer and keep the ball rolling': exploring linkages between football clubs, charitable foundations and doing good. *Accounting, Auditing & Accountability Journal*, (ahead-of-print).
- [2] Gong, B., Zhou, C., Gómez, M. Á., & Buldú, J. M. (2023). Identifiability of Chinese football teams: A complex networks approach. *Chaos, Solitons & Fractals*, 166, 112922.
- [3] Herold, D. M., Harrison, C. K., & Bukstein, S. J. (2023). Revisiting organizational identity and social responsibility in professional football clubs: the case of Bayern Munich and the Qatar sponsorship. *International journal of sports marketing and sponsorship*, 24(1), 56-73.
- [4] Toma, P., & Campobasso, F. (2023). Using data analytics to capture the strategic and financial decision-making of Europe's top football club. *Technological Forecasting and Social Change*, 186, 122116.
- [5] Oliva-Lozano, J. M., Martínez-Puertas, H., Fortes, V., López-Del Campo, R., Resta, R., & Muyor, J. M. (2023). Is there any relationship between match running, technical-tactical performance, and team success in professional soccer? A longitudinal study in the first and second divisions of LaLiga. *Biology of Sport*, 40(2).
- [6] Hughes, M., Caudrelier, T., James, N., Redwood-Brown, A., Donnelly, I., Kirkbride, A., & Duschene, C. (2012). Moneyball and soccer-an analysis of the key performance indicators of elite male soccer players by position. *Journal of Human Sport and Exercise*, 7(2), 402-412.
- [7] Zhou, W., Yu, G., You, S., & Wang, Z. (2023). An Improved Passing Network for Evaluating Football Team Performance. *Applied Sciences*, 13(2), 845.

- [8] Wing, C. E., Turner, A. N., & Bishop, C. J. (2020). Importance of strength and power on key performance indicators in elite youth soccer. *The Journal of Strength & Conditioning Research*, 34(7), 2006-2014.
- [9] Brito de Souza, D., López-Del Campo, R., Blanco-Pita, H., Resta, R., & Del Coso, J. (2019). An extensive comparative analysis of successful and unsuccessful football teams in LaLiga. *Frontiers in Psychology*, 10, 2566.
- [10] Modric, T., Versic, S., Sekulic, D., & Liposek, S. (2019). Analysis of the association between running performance and game performance indicators in professional soccer players. *International journal of environmental research and public health*, 16(20), 4032.
- [11] Gamble, D., Bradley, J., McCarren, A., & Moyna, N. M. (2019). Team performance indicators which differentiate between winning and losing in elite Gaelic football. *International Journal of Performance Analysis in Sport*, 19(4), 478-490.
- [12] Toukabri, M., & Toukabri, M. (2022). Football industry accounting as a social and organizational practice: from the implementation of the CSR process to integrated reporting. *Systemic practice and action research*, 1-29.
- [13] Perechuda, I., & Čater, T. (2022). Influence of stakeholders' perception on value creation and measurement: the case of football clubs. *Sport, Business and Management: An International Journal*, 12(1), 54-76.
- [14] Mourad, N., Assem Tharwat, D., Habib, A. M., Wafik, D., & Hamed, M. A. (2022). Appraising the economic efficiency of European football teams: Evidence from covid-19 crisis using data envelop analysis. *Journal of Positive School Psychology*, 6(8), 4383-4403.
- [15] Nozari, H., Szmelter-Jarosz, A., & Ghahremani-Nahr, J. (2022). Analysis of the Challenges of Artificial Intelligence of Things (AIoT) for the Smart Supply Chain (Case Study: FMCG Industries). *Sensors*, 22(8), 2931.
- [16] Aliahmadi, A., Nozari, H., & Ghahremani-Nahr, J. (2022). AIoT-based sustainable smart supply chain framework. *International journal of innovation in management, economics and social sciences*, 2(2), 28-38.
- [17] Tavakkoli-Moghaddam, R., Ghahremani-Nahr, J., Samadi Parviznejad, P., Nozari, H., & Najafi, E. (2022). Application of internet of things in the food supply chain: a literature review. *Journal of applied research on industrial engineering*, 9(4), 475-492.
- [18] Nozari, H., Fallah, M., Szmelter-Jarosz, A., & Krzemiński, M. (2021). Analysis of security criteria for IoT-based supply chain: a case study of FMCG industries. *Central European Management Journal*, 29(4).

