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ARTICLES

PARTIAL LEAST SQUARES – PATH MODELLING FOR EFFICIENCY ASSESSMENT IN THE COLOMBIAN PROFESSIONAL FOOTBALL LEAGUE

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ABSTRACT. This research develops a production function to evaluate the teams' efficiency in the Colombian professional soccer league. The designed methodology uses the concepts of structural equations and Data Envelope Analysis. In the development of the research, primary information associated with the sports and financial performance of the 20 Colombian Professional soccer teams was collected, with which a structural equation model was established that was empirically validated to evaluate the efficiency of each football team finally holistically. As result of this research, it can be pointed out that the proposed PLS structural model validates the hypotheses about the relationships between the latent variables. Similarly, the results show that the best Colombian soccer teams for the analyzed period are Medellín, Tolima, Nacional, and Junior.

Keywords: football; structural equations; data envelopment analysis; partial least squares

1 INTRODUCTION

The professional football league in Colombia (FPC) has been highlighted in 2019 as the fifth best league in the world in the annual ranking given by the International Federation of Football History and Statistics (IFFHS), beating national tournaments of recognized prestige such as The League of Portugal, France, Holland, Argentina, and Germany. The IFFHS ranking considers variables associated with the sports performance of teams in international cups, the market value and transfers of players and variables related to sports performance.

From the economic point of view, football is vital for the dynamism of employment and finance in Colombia, given its contribution to the Gross Domestic Product of 0.11%. In addition, the sale of Colombian players abroad represented in 2019 more than 60 million dollars in foreign

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exchange earnings, becoming the eighth largest exporter of players worldwide and consolidating 284 players who play in 137 clubs of the main leagues in 93 countries. Many of these players were trained and made their debuts on one of the FPC teams, which demonstrates the league's ability to generate revenue to ensure the long-term sustainability of the tournament. Therefore, the dimension of business related to football and a positive relationship between sports and financial results, make it necessary to have objective tools for decision-making, which allow efficient management of resources in an environment of high competitiveness (Kern et al., 2012).

One of the aspects when analyzing efficiency in a specific context is to define the variables associated with the inputs and outputs of the production function. In other contexts, such as manufacturing, the production function is determined by the physical or organizational interaction of the variables to create a product. However, in the context of football, there is no universal definition of the production function, which is why several authors have proposed productive structures for football based on particular contexts: Tournament structure (All against all, playoff), tournament periodicity (semiannual, annual) and sports results. The multi-stage production approach is used in different studies (Bini et al., 2019; Galariotis et al., 2018) to define the productive function in football, this approach considers the systematic association of variables for the overall evaluation of efficiency, considering successive interactions between each construct of variables. Other studies look at efficiency in football leagues worldwide (Carmichael et al., 2017; Villa and Lozano, 2016; Zelenkov and Solntsev, 2017).

Considering what was previously raised in this research, the following problem questions arise to answer the analyzed: How to establish a Colombian Professional Football League production function? How to validate the Colombian professional football league's production function through PLS-PM (Partial Least Square – Structural Equation Modeling) structural equations? How to evaluate efficiency for the previously proposed production function? Consequently, from the above questions arise as objectives of this research: i) Define a production structure for the Colombian professional soccer league, ii) Validate the production function of the Colombian professional soccer league through structural equations and iii) Evaluate the efficiency for each team of the Colombian professional soccer league through Data Envelope Analysis.

2 THEORETICAL BACKGROUNDS

As mentioned above, this research is based on two methodologies: Partial Least Square – Path Modelling (PLS-PM) and Data Envelopment Analysis (DEA).

2.1 Structural equations: Partial Least Squares Path Modeling (PLS-PM)

PLS-PM models are used to analyze a system of relationships with multiple blocks of variables. Each block of variables represents a latent variable within the data matrix X, containing n observations and p variables (Cataldo et al., 2017; Martínez-Ruiz and Aluja-Banet, 2013). Thus, the matrix X is divided into J mutually exclusive blocks (X1, X2, X3... Xj). Each Block Xj contains K variables (Xj1, Xj2, ... Xjk). It should be noted that latent variables are those that cannot

be measured directly, therefore, a block of Xj variables is used to estimate the latent variable LVj (Sharma et al., 2018). On the other hand, structural model relationships are treated as linear relationships and can be represented by the formula (1).

$$LV_j = \beta_0 + \sum_{\{i=j\}} \beta_{\{ji\}} LV_i + error_j \tag{1}$$

The subscripts i of LVj refer to all the latent variables that will predict LVj The β_{ij} coefficients are the coefficients of the structural model, and these represent the magnitude and direction of the relationships between the latent response variable LVj and the predictors LVi, The β_0 represents the intercept and error to the residuals of the model (Benitez et al., 2020; McIntosh et al., 2014).

2.2 Efficiency in the context of football

The overall efficiency levels calculated through the DEA models are broken down into Technical Efficiency and Scale Efficiency (Benicio and Mello, 2020; De La Hoz et al., 2021). This approach identifies the sources of inefficiency, which may be given by the misuse of resources in or in the non-identification of critical resources. Thus, the overall technical efficiency is evaluated through the constant returns-to-scale (CRS) (see Equation 2), the local technical efficiency through the variable returns-to-scale (VRS) (see Equation 5). Finally, scale efficiency is obtained by dividing the constant returns-to-scale over the variable returns-to-scale: Scale efficiency = CRS/VRS (Benicio and Mello, 2019).

$$\underset{u,v}{maxh_o} = \frac{\sum_{r=1}^{s} u_r y_{ro}}{\sum_{i=1}^{m} v_i x_{io}} \tag{2}$$

Subject to

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1 j = 1, \ldots, n \tag{3}$$

$$u_r, v_i \geq 0 r, i = 1, \ldots, m \tag{4}$$

$$\underset{u,v,k}{maxh_o} = \frac{u^T y_o + k_o}{v^T x_o} \tag{5}$$

Subject to

$$\frac{u^T Y_j + k_o}{v^T X_j} \leq 1 j = 1, \ldots, n \tag{6}$$

$$u^T, v^T \geq I\varepsilon i, j = 1, \ldots, m \tag{7}$$

$$k_o, free \tag{8}$$

The efficiency analysis for football contexts is determined by the type of data available in the study. For example, Barros et al. (2010) develop an analysis of the cost of efficiency for teams in France's professional football league, finding two groups clearly differentiated according to operational performance and the adoption of strategies adjusted to the characteristics of the clubs. In turn, in the research developed by Yue et al. (2014), a statistical model is proposed to define the

critical parameters that estimate the result of a match in the Bundesliga, defining the relationship between shots on goal and goals scored as the critical factor to analyze the result of a match. In this sense, it is evident how efficiency and productivity have become topics of interest to the administrators of sports organizations, both in the strategic and operational phases.

At present, it is unthinkable for a football team to participate in a professional competition without data and information on the performance of rivals (Lam et al., 2017). For example, Morgulev et al. (2018) synthesize data-driven analysis at three levels, i) Field level (athletes, coaches, and referees); ii) Management analysis and decision-making; iii) Analysis of sports, economic and psychological data. For their part, Barros, and Santos (2003) analyze the productivity of sports organizations in Portugal through the Data Envelopment Analysis, separating total productivity into technical efficiency and technological change, finding that only a small group of federations show simultaneous improvements in both levels of productivity. On the other hand, in a complementary approach to the research stated above, Espitia-Escuer and García-Cebrián (2008) develop an analysis of the evolution of total productivity for the teams of the Spanish first division, identifying the existing relationships between the values of efficiency and the game strategy adopted by the teams. Likewise, Ghio et al. (2019) developed an analysis of the financial efficiency of Italian football teams for the period 2005-2015, evaluating the efficiency of clubs in compliance with UEFA Financial Fair Play, showing how Financial Fair Play has not improved the average financial efficiency of teams, however it has contributed to equalizing the differences between large and small teams. Thus, Data Envelopment Analysis is identified as a tool to determine the sources of inefficiency at the level of teams and players and provide directions for improvement.

2.3 Structure of the Colombian Professional Football League

The FPC league is the top division of professional football in Colombia. It is composed of 20 participating teams. The tournament has a semiannual format, divided into three phases of competition. The first phase is an all-against-all round, in the second phase the top 8 finishers of the all-against-all phase are divided into two groups, thus playing a play-off to define the finalists of the tournament. The last phase of the tournament is the grand finale, where two round-trip matches are played between the finalists of the tournament. The semiannual format of the tournament generates two champions per year, however, the statistics to define the teams qualified to the international cups (Libertadores and Suramericana) and the two teams that are relegated to the second category are obtained by the sum of the points obtained in the two tournaments of the year. Therefore, data corresponds to the 2018 season, aggregating the results of the two tournaments in the all-against-all phase. From the administrative point of view, since the issuance of the Sports Law in 2011, Colombian professional football teams were forced to become sports corporations; therefore, they are obliged to report their financial statements to the National Business Information System of Colombia. This structural change, in theory, allowed the depersonalization of the clubs, preventing the teams from becoming the petty cash of the leaders on duty, and generating the control mechanisms over the income and expenses of the teams to avoid bad

administrative practices (Cabrera, 2014). Thus, the production process proposed for Colombian football is an adaptation of Galariotis et al. (2018), where the economic results of the teams are considered an output of their financial and sporting performance. In summary, it is proposed that the origin of the sports performance of Colombian football clubs has its origin in their financial results, the product of non-operational activities such as television admission and the sale of players.

3 METHODOLOGY

This research was approached from a logical positivist epistemological foundation, so initially purposeful rational research was carried out to establish the production function of the latent variables, which was subsequently validated through a quantitative factic analysis that allowed to establish a robust structural equation structure, which facilitated defining the causal relationships between the input and output variables of the production model for football teams. What finally helped to carry out an empirical analysis of the information generated by each of the football clubs of the Colombian professional league, in addition, allowed to establish the levels of efficiency of each team. With the above it was possible to establish the performance of each football team of the Colombian professional league. For its part, for the population of this research is taken all the 20 football teams of the Colombian professional league. And as primary information was based on the historical information of the year 2018-2 of the Colombian professional soccer league, generated and consolidated by the manager of the Football League DIMAYOR.

The proposal for the production function model considered the characteristics of the FPC in the generation and distribution of income. According to the production function each relationship explains a characteristic or dimension of the soccer team (DMU). For example, Financial-Sports Success (FSS) is achieved by having a good Attacking (ATA) and Defending (DEF) block. In this relationship it is observed that the latent variables ATA and DEF are inputs for the output variable FSS. On the other hand, to have a good attack it is necessary to have a Creation block (CRE) and for a good defense it is necessary to have a good Intensity of Play (INT). Considering the above, it can be said that the logic of the relationships in the production function determines the role of a latent variable as a resource or output of another variable. In the Colombian Professional Football League case, the largest proportion of the teams' income is given by the payment of television rights. However, the teams receive the television rights according to their classification into two categories, in the first category are the so-called Class A teams, to belong to this category a team had to be a founding member of the professional league in its beginnings or have played five consecutive years in the first category. Class B equipment are those that do not meet either of the two aforementioned conditions. Thus, 80% of the money of the annual television contract is divided equally among the 25 Class A teams, and the remaining 20% among 11 Class B teams. This allocation of resources creates an imbalance in the performance of the professional league, and this is how there are teams in the second division that, because they are Class A members, receive the same resources as the teams traditionally known as large, that is, they have second-

tier expenses, but first-division revenues. The disproportion is such that a Class A computer can receive up to three times more television revenue than a Class B computer.

Considering previous research works, we have identified three approaches to the production function of football.

- The first considers each match as the study unit, and the efficiency is assessed considering only variables related to the game, such as corner kicks, penalty, goals, time possession and match output (Gökgöz & Yalçın, 2021; Pérez-González et al., 2021; Villa & Lozano, 2016).
- The second approach considers the team as the study unit, assuming that the variations in the outputs are in some way responsibility of the team's management (Miragaia et al., 2019; Rossi et al., 2019; Terrien & Andreff, 2020).
- The third approach considers the players as the study unit. Involving specific variables related to player's performance (Oukil & Govindaluri, 2017; Santín, 2014; Tiedemann et al., 2011).

Thus, the production function proposed for the Colombian football league is a combination of the first and the second approach and is described under the following criteria: i) the financial resources that allow to acquire or train creative players, ii) the financial resources that allow to acquire or train high-intensity players, iii) transform the intensity of play into a defensive strategy, iv) transform the intensity of play into an offensive strategy, v) transform game creation into an offensive strategy, vi) transform a defensive strategy into sporting successes, vii) transform an offensive strategy into sporting successes. Consequently, considering the production function proposed for Colombian football, there are six latent variables and 12 manifest variables (see Table 1). Considering the DEA as a non-parametric model, we develop the PLS-PM, which being parametric model allows to identify and validate the production function. Therefore, the link between DEA and PLS-PM allows estimating efficiency with the certainty of a validated relation among the variables.

In the specialized literature, there are different studies where some of the productive interactions proposed in this article have been analyzed.

Table 1 – Latent and manifest variables.

Latent variable	Manifest variable
Financial Situation (FS)	Assets and Income
The intensity of play (INT)	Corner kicks in favor (CAF) and Ball disputes won (BDW)
Defense (DEF)	Goals against (away) (GA_AW) and Goals against home (GA_HO)
Creation (CRE)	Effective Centers (EFF_CEN) and Effective Passes (EFF_PAS)
Attack (ATA)	Away goals (GF_AWA) and Home goals (GF_HO)
Financial-sports success (FSS)	Number of total wins (TW) and Total Points (TP)

3.1 Method

To achieve the objectives proposed in this research, the following stages were developed i) identification of football teams with their latent variables, ii) establishment of a production function with input and output variables to analyze the levels of causality, iii) validation of the proposed production function iv) consolidation of the information associated with the variables to be analyzed, v) evaluation of the efficiency of the teams of the Colombian football league, vi) conclusions. For the development of the PLS-PM model, the R software (R Core Team, 2013) and the PLS-PM library have been used (Sanchez, 2013). The final model is presented in Figure 1. Latent variables are ellipsoid-shaped and manifest variables are rectangles. In the representation of each variable is the information of the criterion Dillon-Goldstein's Rho and the value of the R2, the coefficients of the Bji model are found in the arrows that connect the latent variables and the weight of the factors in the lines that connect the manifest variables with their respective latent variable. In the same way, the DEA R library was also used (Coll-Serrano et al., 2018).

Now, regarding the configuration of the DEA model, it should be noted that according to the demonstration by Cooper et al. (2006), the results of an output-oriented DEA model are equivalent to the input-oriented model. However, each articulation is made using the output-oriented model (maximizing outputs), i.e., making adequate use of the least amount of resources to obtain a maximum level of outputs (each articulation of the model is interpreted in the results and discussion chapter) (Visbal-Cadavid et al., 2019).

On the other hand, the assumptions of scale generate an interpretation of the efficiency of the situation (contextualized in the chapter on results). The constant scale explains the overall efficiency of the system, i.e., how all the components of the organization are articulated to generate these outputs. The variable scale explains the pure technical efficiency, i.e., it focuses on the quantities or use of resources. And finally, performance at scale explains the growth of outputs relative to inputs. So, according to these subtle differences, decision-making must be made taking into account the efficiency approaches of the systems.

On the other hand, the research creates an empirical production function to explain efficiency in the sports context, this model is validated by PLS-PM analysis and then the DEA tool is used to calculate the efficiency of sports teams. In other words, the objective of the articulation of the tools is first to validate the production function used and then to calculate efficiency. Traditionally, the efficiency of a system's DMUs is calculated without validating that the established relationships are correct. So, in this sense, the contribution of the research is to provide a methodology to validate the production function used.

4 RESULTS AND DISCUSSION

The estimation of latent variables through manifest variables was developed using a reflective approach. Therefore, it is considered that the manifest variables belonging to a block are positively correlated, consequently, the adequacy of the proposed production function for the FPC was evaluated through the Dillon-Goldstein indicator. As shown in Table 2, all the variables for

this indicator present values higher than the commonly accepted level of 0.7 (Martínez-Ruiz and Aluja-Banet, 2013), evidencing the internal consistency of the manifest variables in relation to their respective latent variable. The reliability of the model to represent financial-sports success is evidenced by the value of R^2 equal to 0.876 (see Table 2). To assess the validity of model convergence, the average variance extracted (AVE) must be greater than 0.5 (Hair et al., 2012). Therefore, the PLS structural model validates all hypotheses about the interactions of the production function proposed for the professional football league in Colombia. Consequently, it is now possible to evaluate the efficiency levels for each of the relationships confirmed in the structural model.

Table 2 – Proposed structural model Professional Football League in Colombia.

Variable	Type	R^2	Communality	Average redundancy	AVE
SF	Exogenous	0,000	0,903	0,000	0,903
INT	endogenous	0,643	0,865	0,556	0,865
CRE	endogenous	0,406	0,650	0,264	0,650
DEF	endogenous	0,321	0,692	0,222	0,692
ATA	endogenous	0,593	0,623	0,370	0,623
EFD	endogenous	0,876	0,996	0,872	0,996

The efficiency analysis results for the professional football league in the 2018-1 season using the DEA model are presented in Table 3. In DEA models the maximum possible efficiency value is one, i.e., the equipment is at the frontier of efficiency. From there, values less than one represent a lower level of equipment efficiency. Table 3 shows the results for the three types of efficiency, global (CRS), local (VRS) and scale (SE) for the seven relationships of the proposed production function. In addition to the efficiency results, the position obtained by the team in the Leaderboard at the end of the season and the value of the team's budget are presented. For its part, it is evident how financial resources do not determine the final classification. Finally, the analysis of the stages of the production function allows to explain the reasons that can lead to the success of a team.

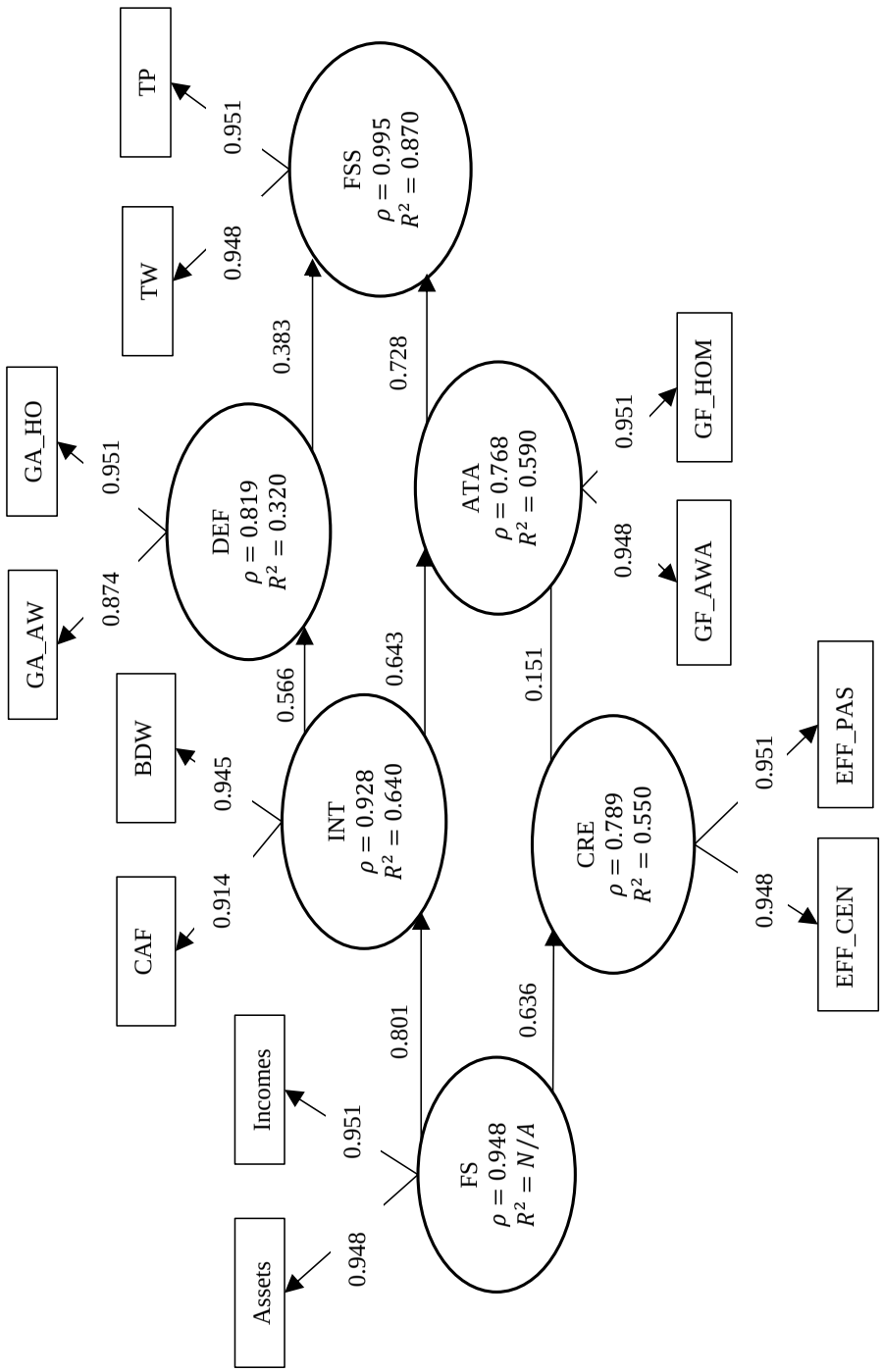

Figure 1 – Structural equation model proposed for Professional Football League in Colombia.

Table 3 – Results of the Data Envelope Analysis model.

DMU	FS - INT			FS - CRE			INT - ATT			INT - DEF			CRE - ATT			ATT - FSS			DEF - FSS			Rank	Incomes
	CRS	VRS	SE	CRS	VRS	SE	CRS	VRS	SE	CRS	VRS	SE	CRS	VRS	SE	CRS	VRS	SE	CRS	VRS	SE		
Medellín	0,22	0,67	0,33	0,25	1	0,25	0,56	1	0,56	0,75	0,75	0,99	0,53	1	0,53	0,91	0,89	1,03	0,4	0,73	0,54	1	5,9
Tolima	0,34	1	0,34	0,34	1	0,34	0,9	0,95	0,95	0,41	0,71	0,57	0,71	1	0,71	1	1	1	1	1	1	2	3,8
Nacional	0,11	1	0,11	0,11	1	0,11	0,79	0,93	0,85	0,5	0,73	0,68	1	0,86	1,16	0,81	1	0,81	0,88	1	0,88	3	11,8
Junior	0,1	0,3	0,34	0,11	1	0,11	0,80	0,87	0.91	0,47	0,73	0,64	0,9	0,94	0,95	0,91	0,92	0,99	0,88	0,92	0,95	4	14,5
Once_Caldas	0,57	0,81	0,7	0,61	1	0,61	0,86	1	0,86	0,45	0,86	0,53	0,91	1	0,91	0,83	0,92	0,9	0,6	0,71	0.84	5	2,1
La_Equidad	0,41	0,68	0,61	0,34	1	0,34	0,72	0,89	0,8	0,64	0,84	0,76	0,82	0,73	1,12	0,82	1	0,82	0,62	1	0,62	6	2,7
Rionegro_A	0,71	0,74	0,95	0,62	0,97	0,64	0,64	1	0,64	0,99	1	0,99	0,76	0,87	0,88	0,91	1	0,91	0,33	0,74	0,45	7	1,9
Cali	0,32	0,93	0,34	0,27	0,31	0,88	0.86	1	1,16	0,67	0,74	0,91	1	0,95	1,06	0,87	1	0,87	0,67	0,94	0,71	8	3,5
Bucaramanga	0,96	1	0,96	0,89	1	0,89	0,87	0,98	0,89	1	0,95	1,05	0,83	0,99	0,83	0,75	0,9	0,83	0,26	0,89	0,29	9	1,6
Santa_Fé	0,13	0,75	0,17	0,14	0,24	0,58	0,83	0,84	0,99	0,98	0,74	1,32	0,72	1	0,72	0,71	0,81	0.87	0,51	1	0,51	10	12,8
Huila	1	1	1	1	1	1	0,8	0,99	0,81	0,82	0,92	0,89	0,74	0,82	0,91	0,77	1	0,77	0,4	0,94	0,42	11	1,4
Millonarios	0,12	0,26	0,45	0,12	0,3	0,38	0,8	0,82	0.97	0,76	0,79	0,97	0,83	0,88	0,95	1	0,84	1,2	0,61	0,78	0,78	12	10,5
Patriotas	0,5	0,5	0,99	0,55	1	0,55	0,82	1	0,82	1	1	1	0,69	0,82	0,85	0,62	1	0,62	0,2	0,68	0,3	13	1,9
América	0,43	1	0,43	0,46	1	0,46	1	0,9	1,11	0,59	0,88	0,67	0,93	0,79	1,17	0,8	0,8	1	0,58	0,59	0.98	14	4,6
Envigado	0,56	0,6	0,94	0,58	0,6	0,97	0,79	1	0,79	0,54	0,99	0,55	0,72	1	0,72	1	1	1	1	0,66	1,51	15	1,5
Alianza_P	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0,67	0,73	0,92	0,35	0,53	0,65	16	0,9
Jaguares	0,75	0,81	0,93	0,84	1	0,84	0,87	1	0,87	0,67	1	0,67	0,66	0,97	0,68	1	1	1	0,71	0,58	1,24	17	1,2
Chicó	0,83	0,83	0,99	0,86	1	0,86	1	0,99	1,01	0,89	1	0,89	1	0,97	1,03	0,94	1	0,94	0,46	0,5	0,91	18	1,1
Pasto	0,94	1	0,94	0,88	0,84	1,04	0,85	0,95	0,9	0,44	0,95	0,46	0,94	0,85	1,11	0,95	1	0,95	0,82	0,75	1,09	19	1,4
Leones	1	1	1	1	1	1	0,91	1	0,91	0,94	1	0,94	0,98	0,97	1,02	0,88	1	0,88	0,81	0,61	1,32	20	1

The results show how two of the three teams that are efficient in the stages related to financial success (FS – CRE and FS – INT), are those that have been relegated to the second division (Huila and Leones). That is, it can be inferred that a responsible management of financial resources related to the non-hiring of big stars can complicate a team's competitiveness. This can be explained by inflation and speculation in players' salaries and valuation, causing teams to invest in players much more than is financially reasonable to obtain sustainable results. Thus, Huila and Leones have players who adjusted to their financial situation respond efficiently, however, they have problems in the generation of play concerning success (DEF, ATA) and present an inefficient operation (CRS value), probably these results are due to not having a sufficient number of players who can score goals.

On the other hand, an interesting case is Deportes Tolima, a team with a modest budget that achieves technical efficiency in the stages that relate the constructs of defense and attack with financial-sporting success. However, this institution should review the financial management according to the stages related to the intensity and creation of the game. It is important to point out the particularities of the Colombian tournament in relation to the results, considering that the first eight classified of the tournament all against all are those who will later dispute the championship, this situation distorts the competitive structure between the teams, since there is no advantage for the first classified compared to the other seven finalists.

Thus, the champion of the tournament was the Junior of Barranquilla, which was not efficient in any of the phases of the proposed production function and is also the team with the highest income of the championship. The analysis carried out shows that the teams at the top of the standings do not present the best results of overall efficiency in the management of their financial resources for the construction of a competitive team. An important aspect that should be noted is that the stages with the worst levels of efficiency for teams are the phases of Creativity (CRE) – Attack (ATA) and Defense (DEF) – Financial-sports success (FSS). Firstly, it is evident how there are only three efficient teams, which shows the difficulties of the teams present to generate goal plays.

The results obtained are aligned with the previous research of Baroncelli and Lago (2006), in this research two categories of teams were identified, leaders and small, which differ by their ability to transform sports results into income, in our research the classification of teams is given by the ability to transform economic resources into sports success. For their part, Barros et al. (2010), in an analysis of efficiency in the context of Brazilian football identify that clubs with similar asset structures may have different operational strategies, which is in accordance with the results of this research, where they find that the 4 teams with the highest revenue value have very different sports and efficiency results.

5 CONCLUSIONS

The research presents a structure for the analysis of efficiency in football teams. Proposing and validating the following stages. i) Definition of sports and economic variables for efficiency anal-

ysis; ii) Validation of a production function for Colombian football using empirical data from the 2018-2 tournament using PLS-PM; and iii) Calculation of the efficiency of the participating teams using the Data Envelope Analysis. The proposed structure allows the teams an objective view of financial and sports performance, allowing to generate planning and improvement scenarios.

Based on the established production function, it is possible to explain the set of interactions of the FPC: teams with solid finances hire players with high levels of intensity and creativity that effectively contribute to improving performance in defense and attack. Therefore, in the Colombian league, the teams that present financial solids can improve the sporting results.

The proposed methodological structure is replicable and reproducible to any other professional football tournament. The proposed structure generates a consistent analysis to analyze the performance of the teams that lose the category. The validation of sports relationships through the PLS-PM model makes it possible to add new contextual variables in future research.

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