Study of the Relationship between Sports Efficiency Index and the Classification Performance of the Clubs of the Brazilian Championship Series A

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Abstract— The performance of soccer clubs in Brazil has shown a significant evolution in the last decade. Considering the competitiveness of the market, there is a need to act as companies using sustainable management models. In fact, the purpose of sports institutions is to obtain titles and good results that allow them to generate greater revenues and make expenses and investments in search of perpetuity and ascension of objectives. In this sense, this survey compared the Sports Efficiency Indexes with the soccer clubs' Classification Performance, in the classification tables of the Brazilian Championship in the years 2017 and 2018. In order to meet the objective, data wrapping analysis (DEA) and Kendall's correlation coefficient were applied for evaluate investment performance. The results showed that in the period analyzed there was significant parity ration in part of the results found, since many clubs reached a position in the corresponding tournament with the ranking of sports efficiency. Then, it concluded that the better is the sporting efficiency team, the better its ranking in the championship. Searching for an efficient allocation of resources, the research seeks to contribute attesting to the need for a detailed examination of expenses and investments in the perspective of better results.

I. INTRODUCTION

Considered one of the most popular sports on the planet, soccer attracts a crowd of fans, especially in Brazil, especially in the dispute for the title of the Brazilian championship (Roboredo, Aizemberg & Meza, 2015). Such popularity, in the last 20 years, has become the clubs not seen as sports organizations, becoming large corporations in view of the exorbitant revenues obtained, revenues coming mainly from sponsors, television stations, negotiation of players and tickets, among others (Ribeiro & Lima, 2012).

Currently, the literature recognizes the importance of combining financial results with the sports factor, these two elements being part of the objectives of financial and administrative management of clubs (Barros, Assaf & Sá-Earp, 2010).

A soccer club aims to achieve sporting success by winning and winning titles, but like any other entity in other sectors of the economy, to remain in operation it needs financial balance.

Due to the increase of interest in the financial situation of the clubs and their management (especially sponsors, investors, fans and government), and due to the

society's demand for more transparency in management, in 2003, Law n. 10.672/03, made it mandatory for sports entities to disclose the financial statements in newspapers with wide circulation. This made soccer, which was a sport managed partly in an amateur way, need to professionalize management (Leoncini, 2001). However, after the implementation of the legal requirement, the level of quality and the low standardization of the statements are factors that make it difficult to conduct studies, especially comparative (Dantas & Boente, 2012).

Soccer clubs seek satisfactory financial results, capable of self-maintenance and survival. Better results occur from a result of sporting success, such as championship achievements (Haas, 2003). In this scenario, the level of efficiency of the clubs, can and should be measured through performance from both perspectives (Espitia-Escuer & García-Cebrián, 2010), both in the financial search and in the sports field. In this sense, it also considered the evidence of non-financial performance indicators, the focus of the study by Benin, Diehl and Marquezan (2019) that indicate a positive relationship between the level of disclosure and the size of soccer clubs.

On the studies of investment efficiency, Dantas, Machado and Macedo (2015) complement that such practices have become one of the major goals of soccer management, taking into account the concern of clubs in reconciling spending with performance, both in economic-financial and sports achievements.

The good management of available resources, conscious of obtaining good results on the field, is believed to be the recipe of an efficient team, therefore it is questionable: in observing the results of the indicators of sports efficiency of the clubs participating in the Brazilian Championship, can be said to be the same reflected in the sports performance of teams throughout the competition?

Based on the above, this work aims to compare the rates of sports efficiency obtained through the Data Envelopment Analysis (DEA) technique, capable of evaluating the performance of a company, and perform a comparative analysis with the final positions of the teams in the classification tables of the Brazilian Championship in the years 2017 and 2018.

The choice for the Brazilian Championship is justified because it is one of the most profitable championships in the world, according to a study conducted by BDO (2018). Adding the 25 clubs, being 20 members of Series A of the Championship played in 2017 to another 5 members of Series B of the same year, it reaches an amount of R$ 5,243,000,000.00 (five billion two hundred and forty-three million reais), with an increase of 60% in the last 5 years. As for the subject, Guzmán (2006) already testified, indicating that there are few studies in the field of sports efficiency analysis, due to the difficulty in accessing the demonstrations, and even the lack of some.

II.   LITERATURE REVIEW

Soccer hasn't been seen by the market only as an activity in which groups of fans had fun watching the teams play ball and aiming for victories. The passion of the fans has always moved the sport to high levels, with the consolidation of capitalism, and since the 1980's with the media and the evolution of the media, soccer has seen profound possibilities within an economic vision. (Perruci, 2006).

Seeking to increase profits and revenues, soccer clubs have sought several ways to raise financial resources through external means, such as marketing actions with players and brand exploitation. It is known that the purpose of clubs is to achieve good results and consequently titles, but their management in the search for the maximization of good results, must effectively manage the available resources, in order to achieve satisfactory financial and sports results, aiming at the perpetuity of the business. (Pereira, Corrar, & Lima 2004).

Barajas, Fernández-Jardón and Crolley (2005) point out that in the sports environment, unlike other sectors, performance is directly connected to the invoicing, but with a refined control of expenses and costs, profit must be achieved. However, in the sports field there is still no policy that balances costs in an elucidated way.

As Espitia-Escuer and García-Cebrian (2010) state, profits maintain the survival of a club, increasing as consequence of the increase in income, which comes from sales of tickets to the stadiums, sponsors and broadcasting rights. These, magnitudes directly proportional to the performance of the clubs in the championships they compete in the season.

However, these are not only the forms of income obtained by the big clubs there is also the stock market. Dantas, Silva, Steppan, & Oliveira (2009), point out there are, approximately, 38 worldwide clubs have their shares traded on stock exchanges in several countries. In Brazil, any club has open capital in the stock market due to the club-company model has not adopted in the country. Moreover, Dawson and Dobson (2002) point as the basic theory for the study of the efficiency of the sports sector the Theory of Human Capital (Becker, 1962). According to the theory, a combination of factors generates human capital, coming from a collective and individuals, which

encompasses a set of skills, technical knowledge, and personal knowledge of the individual (Dawson & Dobson, 2002; Abeysekera & Guthrie, 2004; Unger, Rauch, Frese, & Rosenbusch 2011). About this, Unger et al. (2011) state that there are a number of positive relationships between the firm's success and human capital, as these help the firm to raise other resources, such as physical and financial capital, accumulating new skills and knowledge.

As Baroncelli and Lago (2006) approached, soccer clubs seeking to simultaneously achieve good sports results and good financial management under the perspective of Sustainable Management, should excel by establishing a "Virtuous Cycle", described in Figure 1:
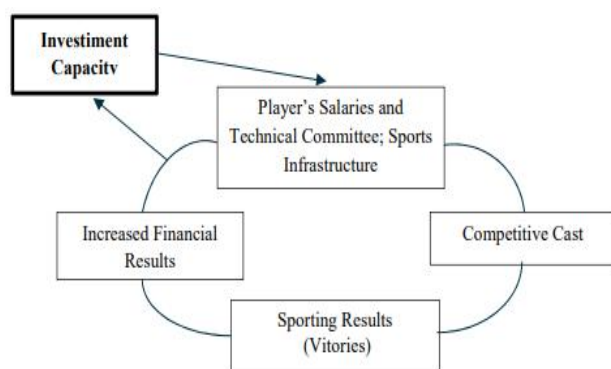

Fig.1: Virtuous cycle between sporting and financial results

Source: Adapted from Baroncelli & Lago (2006).

According to Garcia-Sanchéz (2007), the issues are discussed, based on central economic visions, mainly in relation to efficiency and effectiveness, which in the soccer economic industry, must be taken into account the fact that it is the passion of the fans for the club, driven by the good results obtained on the field, which foster this industry.

In this sense, the Index of Efficiency under the perspective outcome of the outputs of a management process, leads us to examine the possibility of reaching titles with lower spending or even more efficient allocations, while recognizing the importance of components or inputs for the calculation of the index that is based on expenditures and investments. The main components are mentioned below:

a. Cost of Social and Sports Activities - Salaries, charges and benefits to employees; Expenses with games and competitions; Right of image; Expenses with negotiations of athletes; Amortizations and retirements of rights over players; Transfer of economic rights; and Professional Services.

b. Administrative and Commercial Expenses - Salaries, charges and benefits to employees; Miscellaneous agreements (labor and tax enforcement); Advisory, consulting and participation; and Provision for contingencies.

Following Gúzman and Morrow (2007), some operational research techniques, focused on efficiency measurement, in several sectors of the economy were incorporated the performance research. As far as the sports sector is concerned, there are two objectives to be maximized: the financial result and the sports result, so most of the relevant work that was carried out on input-output analysis was concentrated on production processes.

In the last two decades, studies have relied on the Data Envolvement Analysis (DEA) method, a method capable of measuring the efficiency of decision-making units (DMU), as a technique for measuring financial and sports efficiency.

Many studies originated in the Premier League, England's first soccer division, and one of the most traditional leagues in the world. Soon after, it extended to the other major European leagues, all using the DEA as a method. However, the studies in Brazil began in the last 10 years, noting a tendency of some authors to explore the measurement field of sports and financial efficiency. Chart 1 presents the main researches that used the DEA to study the efficiency of soccer clubs, inspiring this study.

Chart 1 - Studies conducted with the DEA method.

Authors	Sample
Haas (2003)	Premier League (Inglaterra) – 2000/01
Haas, Kocher e Sutter (2004)	Bundesliga (Alemanha) – 1999/00
Guzmán (2006)	La Liga (Espanha) – 2001/02 e 2002/03
Jardin (2009)	League 1 (França) – 2004 a 2007
Barros, Assaf e Sá-Earp (2010)	Brazil – 20 clubs – 2006 e 2007
Hamidi et al. (2011)	Premier Football League (Irã) – 2009/10
Dantas e Boente (2011)	20 largest in the world (Forbes) – 2008/09
Dantas e Boente (2012)	Brazil – 14 clubs – 2006 a 2009
Nascimento et al.	Brazil – 13 clubs – 2006 a 2011

(2015)	
Dantas, Machado e Macedo (2015)	Brazil – 36 clubs – 2010 a 2012
Freitas, Farias e Flach (2017)	Brazil – 25 clubs – 2014
Salles et al. (2018)	European Football – 2015/2016

Source: Research data.

The results obtained vary according to the inputs and outputs used with the DEA method in each survey. Haas, Kocher and Sutter (2004), using as input, the wages of the players and the coach, as output, the points earned the total revenues and the average use of the stadium, did not obtain a correlation of results between the efficiency index and the placement of clubs in the German championship in the 1999/00 season. Guzmán (2006), using the Spanish league as a base, observed through the DEA that Spain's professional soccer clubs in financial performance, based on a goal to obtain revenue, few approached the efficiency frontier. While Jardin (2009) noted that in the French championship from 2004 to 2007, the best teams on the table, which had the most championship titles and consequently the highest revenues, were not efficient. Having as the first source of inefficiency of Ligue 1, the excessive investment as the main problem, in the period analyzed.

Barros, Assaf and Sá-Earp (2010), analyzed the Brazilian soccer championship in order to estimate the efficiency index with the DEA. The performance of the clubs derived from the DEA, showed that Brazilian clubs operate with a high degree of inefficiency. Always taking into account the inputs and outputs used in the research. To

Dantas and Boente (2012), through a DEA (BCC) model, seeking to analyze the efficiency of the expenditures of the main Brazilian soccer clubs in obtaining revenues, as well as whether these expenditures were important in obtaining titles in the period analyzed. Among the clubs in the sample, Internacional proved efficient in both aspects analyzed (financial and sports). Nascimento et al. (2015) through data obtained from the 13 highest revenues of Brazilian soccer clubs, in the period 2006 to 2011, using the Data Envolvement Analysis (DEA), aiming at financial efficiency, noted that Figueirense was the most efficient club in the sample, even not having won any title in the period analyzed.

Freitas, Farias and Flach (2017) analyzed the efficiency of 25 Brazilian soccer clubs in revenue generation, and the reasons that lead the clubs to obtain them. Using as input the total assets and operating costs,

and as output the operating revenue, using a sample of the years 2012, 2013 and 2014. The authors found that Gremio, Palmeiras and Vasco were not efficient in any period analyzed.

DATA ENVOLVEMENT ANALYSIS (DEA)

Data Envelopment Analysis (DEA) is a non-parametric mathematical method introduced by Charnes, Cooper and Rhodes (1978), and extended by Banker, Charnes and Cooper (1984), used to measure the efficiency of certain Decision Making Units (DMU's), in various sectors of the economy, such as business companies, government agencies, hospitals, universities, among others.

The DEA is a generalization of a work introduced by Farrell (1957), where it measures the efficiency of DMU's (Decision Making Units), which seek to obtain the best result (output/output), using the same inputs (input/input). It can be considered as a quantitative, non-parametric and empirical method, which aims to measure the level of relative efficiency, using the DMU in the estimation of the best production boundaries (Guzmán, 2006).

According to Jamasb and Pollitt (2002), the DEA may be oriented to output e input oriented, having two possibilities, Variable Returns to Scale (VRS) or as a Constant Returns to Scale (CRS). The choice of where the sample will be directed, i.e., whether it will be directed to the input, or to the output, is required. According to Macedo e Almeida (2009, p. 33) when directing the input one seeks to "maximize product quantities, that is, to maximize a linear combination of several company products". The output orientation, on the other hand, seeks to minimize the amount of inputs for production (Macedo, 2004).

The CRS or CCR model (Charnes, Cooper and Rhodes) applied when an input increase, consequently makes a proportional increase in the output. The VRS or BCC model (Banker, Charnes and Cooper) is applied when not necessarily an increase in input, makes a proportional addition to the output (Dawson, Dobson & Gerrard, 2000).

Finally, following the objectives of the research, it is necessary to distinguish the concepts of efficiency and effectiveness, we have the vision of Peña (2008) that states that efficiency, is the best way within the process, to unite the inputs to generate the maximum output (product) in the end. With the ability to minimize, in a correct way, the ratio of inputs and product, being the effectiveness linked to the achievement of a goal, understanding the capacity to achieve it, having previously desired it. (Mello et al., 2005).

III.   METHODOLOGY

The research was characterized in relation to the objective as descriptive, that according to Raupp and Beuren (2003) this type of research aims to describe the characteristics of a population and to identify relationships between variables.

As far as procedures are concerned, the research was defined as documentary, since financial statements of Brazilian soccer clubs were collected and included in the study. Gil (2009), argues that the purpose of this type of research, is to analyze the documents collected regarding the object of study, building and confirming hypotheses. As for the approach and treatment of data, this research is characterized as quantitative, using quantitative methods for data collection and analysis (Raupp & Beuren, 2006), in the case of this research, DEA and Kendall correlation.

Every year 20 clubs dispute the A and B Series of the Brasileirão, corresponding to the first and second divisions, respectively. The last 4 clubs in the Series A table, after the end of the championship, are relegated to the second division. In the B Series, the top 4 guarantee a place in the first division of the championship, obtaining the relegated clubs' place, for the dispute of the A Series next year.

Thus, the sample studied uses the financial statements of the 24 clubs that competed in the Brazilian Soccer Championship - Series A, in the years 2017 and 2018, for the collection of revenues and operating expenses. All the statements were taken from the official websites of the clubs to collect the necessary data. The survey covered the statements of the respective years as result of the sports institutions in the sample having had enough time to adjust, approve and correct their accounts and thus reflect more faithfully their results.

During the data collection, it was found that there is no uniformity in the availability of the financial statements on the clubs' websites. The statements can be found in several tabs, such as "The Club", "Transparency", "Assets". As the research did not address the issue of transparency of the statements disclosed, only the lack of homogeneity in the availability of information should be taken into account, since future research may face the difficulty of access to the statements.

Thus, as already explained, the objective of the study was to establish a comparison between the Efficiency Index of the Clubs participating in the Brazilian Cape League and the respective Classification Performances disclosed by the Brazilian Football Confederation - CBF, in the years 2017 and 2018. The efficiency indexes were obtained using the Data Envelopment Analysis (DEA) method.

The study also highlighted the importance of a Sustainable Management based on the Efficiency Index and mainly on the management of the main components, in order to achieve more perennial results.

Barros, Del Corral and Prieto-Rodriguez (2009), affirm that a characteristic in the studies conducted on the efficiency of sports entities present in the literature, does not take into account the issue of heterogeneity of the data analyzed, assuming that clubs use the same methodology. This research considered the heterogeneity of the data collected, i.e., the existence of clubs with different sizes, in this scenario the BCC model is the most propitious. (Dantas & Boente, 2012).

Typically, there are two models that was considered classic: the CCR and the BCC (MELLO et al., 2005). The CCR model, originally presented by Charnes et al. (1978), builds a linear surface in parts, not parametric, involving the data. It works with constant returns of scale, that is, any variation in inputs produces proportional variation in outputs. This model is also known as the CRS - Constant Returns to Scale model.

The BCC model, due to Banker et al. (1984), considers variable returns to scale, that is, it replaces the proportionality axiom between inputs and outputs with the convexity axiom. Therefore, this model is also known as VRS - Variable Returns to Scale. Mello et al. (2005) points out that by forcing the boundary to be convex, the BCC model allows DMUs that operate with low input values to have increasing returns to scale and those that operate with high values to have decreasing returns. Mathematically, convexity of the boundary is equivalent to an additional constraint on the data envelope, which is now the one indicated for input and output orientation.

Specifically, the BCC-VRS model is the most appropriate and used in the article. The use is justified due to the size of the clubs, so the measurement of efficiency is made according to the scale of each DMU under evaluation. These conditions are formalized by the following nomenclature: Eo is the efficiency of the DMUo in analysis, vi and uj are the weights of inputs i (i=1,...,r) and products j (j=1,...,s); xij and yjk are the inputs i and outputs j of the DMUk, with k=1,...,n; xio and yjo denote the inputs and outputs of the DMUo.

However, the model used in this article is output oriented, in this sense it received some modifications. Specifically, the modification is pointed out as follows: $\boldsymbol{h}_o = \boldsymbol{E}^1 o$ making the model so

constructed:

Orientation: *inputs*

$$MaxE_o = \sum_{j=1}^{s} u_j y_{jo} + u_*\; Bound:$$

$$\sum_{i=1}^{r} v_i x_{io} = 1$$

$$-\sum_{i=1}^{r} v_i x_{ik} + \sum_{j=1}^{s} u_j y_{jk} + u_* \le 0, \forall k$$

$$v_i, u_j \ge 0, u_* \in \mathbb{R}$$

Orientation: *outputs*

$$Minh_o = \sum_{i=1}^{r} v_i x_{io}$$

$$Bound:$$

$$\sum_{j=1}^{s} u_j y_{jo} = 1$$

$$\sum_{j=1}^{s} u_j y_{jk} - \sum_{i=1}^{r} v_i x_{ik} \le 0; \forall k$$

$$v_i, u_j \ge 0$$

The analysis of the data was made by the Data Involvement Analysis (DEA), the DEA method used will be the BCC (or VRS) - Scale Variable Return, for being entities of different sizes, and also, following the guidance of Guzmán (2006), who concludes that the BCC model is the most appropriate for measuring the efficiency of soccer clubs. The model will be output oriented, seeking to minimize the amount of inputs needed (Macedo, 2004).

In the calculation of sports efficiency, the methodology was adopted like Dantas and Boente (2012), which consists of the input being the division between expenses and revenues, multiplying them by 100, to be used as a percentage, due to the output of sports efficiency being the use of points.

These revenues are largely composed of quotas arising from TV broadcasting rights, athlete negotiations, advertising, sponsorship, box office, among others. According to the amount available, a large part of its resources is invested in the soccer department, mainly in the purchase of players' wages (Dantas & Boente, 2012).

The coach's planning and the quality of the players will have a vital effect on the results. Moreover, the quality of the coach and players depends on the available budget and hiring. (GonzálezGómez & Picazo-Tadeo, 2010).

The output of the efficiency is the percentage referring to the use of points of the club within the championship, which consists of the ratio between the amount of points earned and the number of points played (points won / 38 games x 3 points)

The performance of the sports efficiency calculation was treated in the software SIAD v3 ® - Integrated Decision Support System. The program aims to calculate all the results of the AED models (efficiency, weights, targets, benchmarks and gaps), developed by Meza et al (2003).

In order to meet the objective of this research, it is necessary to identify if there is a correlation between the ranking of the most efficient clubs based on the Data Envolvement Analysis (DEA), with the classification table at the end of the Brazilian Championship in 2017 and 2018, using the Kendall correlation, proper for ordering.

IV.　DESCRIPTION OF THE DATA

As determined in the methodology, the research makes use of some variables, which will be applied for the input and output. In the input will be the Gross Operating Revenues and the Operating Expenses derived from the professional soccer activity, taken directly from the result of each club's fiscal year, in the financial statements. According to Tables 1 and 2.

Table 1: Gross Operating Revenue 2017 and 2018

Clubs	2017	Clubs	2018
Flamengo	R$ 599.764.000,00	Palmeiras	R$ 601.987.000,00
Palmeiras	R$ 448.783.000,00	Flamengo	R$ 490.445.000,00
São Paulo	R$ 423.716.000,00	Corinthians	R$ 438.053.000,00
Corinthians	R$ 358.105.000,00	Grêmio	R$ 384.211.000,00
Grêmio	R$ 322.581.000,00	São Paulo	R$ 369.430.000,00
Atlético-MG	R$ 291.250.129,00	Cruzeiro	R$ 363.247.150,00
Cruzeiro	R$ 283.382.276,00	Internacional	R$ 293.265.830,00
Santos	R$ 258.770.000,00	Fluminense	R$ 280.562.000,00
Fluminense	R$ 212.156.000,00	Vasco	R$ 246.782.000,00
Botafogo	R$	Atlético-	R$

	208.206.000,00	MG	R$ 237.755.607,00
Vasco	R$ 183.616.000,00	Santos	R$ 191.034.000,00
Atlético-PR	R$ 130.667.064,00	Botafogo	R$ 155.524.000,00
Coritiba	R$ 119.098.299,00	Atlético-PR	R$ 150.533.609,00
Bahia	R$ 104.897.356,00	Bahia	R$ 136.107.034,00
Chapecoense	R$ 99.801.712,00	Vitória	R$ 86.645.000,00
Vitória	R$ 88.071.107,00	Sport	R$ 79.203.316,00
Sport	R$ 71.510.847,00	Chapecoense	R$ 75.129.780,00
Ponte Preta	R$ 61.770.035,00	Ceará	R$ 64.787.134,00
Avaí	R$ 59.289.801,00	América-MG	R$ 61.179.666,00
Atlético-GO	R$ 44.964.008,00	Paraná	R$ 48.774.000,00
Total	R$ 4.370.401.651,00	Total	R$ 4.754.658.144,00

Exchange rate and parity US $ / R $ = 3.3074 / 1.0000, Dec. 2017; and US $ / R $ = 3.8742 / 1.0000, Dec. 2018. Data: Quotations and Bulletins - Central Bank of Brazil.

Source: Research data.

The clubs with the highest revenues in the years studied were Flamengo in 2017, followed by Palmeiras, with a difference of over one hundred million reais. In 2018, Palmeiras had the largest revenue, followed by Flamengo. Showing the strength of the clubs in the southeast region in front of national soccer. Table 2 shows the gross operating expenses of each club

Table 2: Gross Operating Expenses 2017 and 2018

Clubs	2017	Clubs	2018
São Paulo	R$ 354.760.000,00	Palmeiras	R$ 516.966.000,00
Flamengo	R$ 351.687.000,00	Corinthians	R$ 377.659.000,00
Palmeiras	R$ 339.875.000,00	Flamengo	R$ 350.979.000,00
Corinthians	R$ 277.973.000,00	Cruzeiro	R$ 324.187.736,00
Grêmio	R$ 250.171.000,00	São Paulo	R$ 310.187.000,00
Cruzeiro	R$ 244.675.109,00	Grêmio	R$ 259.919.000,00
Atlético-MG	R$ 239.969.344,00	Fluminense	R$ 235.193.000,00
Fluminense	R$ 237.965.000,00	Internacional	R$ 214.344.899,00
Santos	R$ 197.947.000,00	Atlético-MG	R$ 205.143.129,00
Vasco	R$ 145.227.000,00	Santos	R$ 173.824.000,00
Botafogo	R$ 108.011.000,00	Vasco	R$ 136.192.000,00
Atlético-PR	R$ 106.383.968,00	Atlético-PR	R$ 119.921.854,00
Vitória	R$ 87.013.615,00	Botafogo	R$ 111.944.000,00
Bahia	R$ 86.593.056,00	Chapecoense	R$ 97.104.585,00
Chapecoense	R$ 85.031.415,00	Bahia	R$ 94.644.907,00
Ponte Preta	R$ 65.473.609,00	Sport	R$ 70.264.157,00
Sport	R$ 62.592.868,00	Vitória	R$ 67.798.000,00
Coritiba	R$ 62.304.312,00	América-MG	R$ 57.620.182,00
Avaí	R$ 35.028.181,00	Ceará	R$ 48.722.531,00
Atlético-GO	R$ 24.634.041,00	Paraná	R$ 41.627.000,00
Total	R$ 3.363.317.535,00	Total	R$ 3.814.243.998,00

Exchange rate and parity US $ / R $ = 3.3074 / 1.0000, Dec. 2017; and US $ / R $ = 3.8742 / 1.0000, Dec. 2018.

Data: Quotations and Bulletins - Central Bank of Brazil.
Source: Research data.

According to the operating expenses spent by the sample clubs shown in Table 2, in the year 2017 São Paulo was the club that spent the most in the year, followed by Flamengo. In 2018, Palmeiras was the club with the highest expenditure, when the team became Series A champion of the Brazilian Championship. Followed by Corinthians, with a difference of more than one hundred million reais, but not reflected in the position of the club in the championship, which was only 13th. Jardin (2009) in his research found that teams with more revenue were less efficient.

According to Dantas and Boente (2012), the most reliable output used in measuring financial efficiency, shows the use of points of the clubs in the championship. As this number is a percentage, it is necessary that the DEA input be a variable treated in percentage as well. In this way, expenses were divided for revenues, multiplied by 100, so that it was in a way, as an expense index. The results are showed in Table 3.

Table 3: Expense to income ratio

Clubs	2017	Clubs	2018
Botafogo	52%	Vasco	55%
Coritiba	52%	Grêmio	68%
Atlético-GO	55%	Bahia	70%
Avaí	59%	Botafogo	72%
Flamengo	59%	Flamengo	72%
Palmeiras	76%	Internacional	73%
Santos	76%	Ceará	75%
Corinthians	78%	Vitória	78%
Grêmio	78%	Atlético-PR	80%
Vasco	79%	Fluminense	84%
Atlético-PR	81%	São Paulo	84%
Atlético-MG	82%	Paraná	85%
Bahia	83%	Atlético-MG	86%
São Paulo	84%	Corinthians	86%
Chapecoense	85%	Palmeiras	86%
Cruzeiro	86%	Cruzeiro	89%
Sport	88%	Sport	89%

Vitória	99%	Santos	91%
Ponte Preta	106%	América-MG	94%
Fluminense	112%	Chapecoense	129%
Average	79%	Average	82%

Source: Research data.

The lower the percentage, the better the revenue collection in relation to the expenses for the period, or even lower was the own expense for the maintenance of operations in the period. If this number is greater than 100, it means that expenses exceeded revenues. (Dantas & Boente, 2011).

The output will be the use of the points earned by the clubs at the end of the championship, in the respective years of analysis, as described in table 4.

Table 4: Use of points disputed in Series A - Brazilian Championship 2017 and 2018

Clubs	2017	Clubs	2018
Corinthians	63%	Palmeiras	70%
Palmeiras	55%	Flamengo	63%
Santos	55%	Internacional	61%
Gremio	54%	Gremio	58%
Cruzeiro	50%	São Paulo	55%
Flamengo	49%	Atlético-PR	52%
Vasco	49%	Atlético-MG	50%
Atlético-MG	47%	Cruzeiro	46%
Chapecoense	47%	Botafogo	45%
Botafogo	46%	Santos	44%
Atlético-PR	45%	Bahia	42%
Bahia	44%	Fluminense	39%
São Paulo	44%	Ceará	39%
Fluminense	41%	Chapecoense	39%
Sport	39%	Corinthians	39%
Avaí	38%	Vasco	38%
Coritiba	38%	Sport	37%
Vitória	38%	América-MG	35%
Ponte Preta	34%	Vitória	32%
Atlético GO	32%	Paraná	20%
Average	45%	Average	45%

Source: Research data.

In the year 2017, the club with the best use of the championship was Corinthians, reflecting on the Series A title, showing above average results. The worst performance was with Atletico-GO, which in the edition ranked 20th, the last place in the competition, being relegated to Series B. In 2018, Palmeiras took the best advantage, just as in 2017, the club with the best advantage became Series A champion. Similarly at the bottom of the table, where the Parana won only 20% of the competition, was relegated to the B Series in last place.

According to the methodology explained above, it is necessary to disclose the ranking at the end of the 38 rounds of the Brazilian Soccer Championship - Series A - 2017 and 2018, for the correlation with the ranking of the most and least efficient clubs in the analysis. Table 5 presents the ranking table, released by the Brazilian Football Confederation (CBF).

Table 5: Brazilian Championship Classification - Series A - 2017 and 2018.

	2017		2018
1°	Corinthians	1°	Palmeiras
2°	Palmeiras	2°	Flamengo
3°	Santos	3°	Internacional
4°	Grêmio	4°	Grêmio
5°	Cruzeiro	5°	São Paulo
6°	Flamengo	6°	Atlético-MG
7°	Vasco	7°	Atlético-PR
8°	Chapecoense	8°	Cruzeiro
9°	Atlético-MG	9°	Botafogo
10°	Botafogo	10°	Santos
11°	Atlético-PR	11°	Bahia
12°	Bahia	12°	Fluminense
13°	São Paulo	13°	Corinthians
14°	Fluminense	14°	Chapecoense
15°	Sport	15°	Ceará
16°	Vitória	16°	Vasco
17°	Coritiba	17°	Sport
18°	Avaí	18°	América-MG
19°	Ponte Preta	19°	Vitória
20°	Atlético-GO	20°	Paraná Clube

The following shows the sporting efficiency of the clubs.

SPORTING EFFICIENCY

Table 6 shows the results of the clubs' sporting efficiency obtained by the DEA-BCC model, output orientation.

Table 6: Result of sports efficiency, output orientation

Clubs	2017	Clubs	2018
Corinthians	1	Palmeiras	1
Botafogo	1	Flamengo	1
Flamengo	0,97	Vasco	1
Santos	0,89	Grêmio	1
Palmeiras	0,89	Internacional	0,96
Grêmio	0,86	São Paulo	0,80
Coritiba	0,83	Atlético-PR	0,78
Cruzeiro	0,79	Atlético-MG	0,71
Vasco	0,78	Botafogo	0,71
Avaí	0,75	Bahia	0,69
Chapecoense	0,75	Cruzeiro	0,66
Atlético-MG	0,75	Santos	0,63
Atlético-PR	0,71	Ceará	0,60
Bahia	0,70	Fluminense	0,57
São Paulo	0,70	Corinthians	0,56
Atlético-GO	0,67	Chapecoense	0,56
Fluminense	0,65	Sport	0,53
Sport	0,62	América-MG	0,50
Vitória	0,60	Vitória	0,48
Ponte Preta	0,54	Paraná	0,29
Average	0,77	Average	0,70

Source: Research data.

According to table 6, the most efficient clubs in 2017 were Corinthians and Botafogo, the first was the Brazilian champion of the edition, obtaining the highest score with 63%. Botafogo, on the other hand, obtained a use of only 56%, but in relation to the index of

expenses/revenues, was the club in the year with the lowest index, showing that it obtained a good surplus in the exercise, consequently, obtaining the maximum level of efficiency.

In the year 2018, 4 clubs in the sample proved to be efficient, they were Palmeiras, Flamengo, Vasco and Grêmio. The first one, won the championship title, obtaining the best use. The second was the vice-champion, and still had a moderate expense index. Vasco and Gremio, as in the case of Botafogo in the previous year, did not obtain the best performance of the points, however, in face of the verification of lower rates of expenses in relation to the revenue in the year, they classified themselves as efficient.

According to the results of the Freitas, Farias and Flach (2017) survey, using a sample of the years 2012, 2013 and 2014, they found that Grêmio, Palmeiras and Vasco did not show efficiency in any period analyzed by the authors. This is a different result from the present survey, what it was identified that the previously mentioned clubs, Vasco, Grêmio and Palmeiras, were efficient in the period analyzed, 2017 and 2018.

Table 7 highlights information to check if there is a correlation between the ranking of the most efficient clubs from the Data Envolvement Analysis (DEA), with the ranking table at the end of the Brazilian Championship in the years 2017 and 2018.

Table 7: Efficiency vs. Series-A Rating Correlation

2017 Series-A DEA-BCC				2018 Series-A		DEA-BCC	
1°	Corinthians	1°	Corinthians	1°	Palmeiras	1°	Palmeiras
2°	Palmeiras	2°	Botafogo	2°	Flamengo	2°	Flamengo
3°	Santos	3°	Flamengo	3°	Internacional	3°	Vasco
4°	Grêmio	4°	Santos	4°	Grêmio	4°	Grêmio
5°	Cruzeiro	5°	Palmeiras	5°	São Paulo	5°	Internacional
6°	Flamengo	6°	Grêmio	6°	Atlético-MG	6°	São Paulo
7°	Vasco	7°	Coritiba	7°	Atlético-PR	7°	Atlético-PR
8°	Chapecoense	8°	Cruzeiro	8°	Cruzeiro	8°	Atlético-MG
9°	Atlético-MG	9°	Vasco	9°	Botafogo	9°	Botafogo
10°	Botafogo	10°	Avaí	10°	Santos	10°	Bahia
11°	Atlético-PR	11°	Chapecoense	11°	Bahia	11°	Cruzeiro
12°	Bahia	12°	Atlético-MG	12°	Fluminense	12°	Santos
13°	São Paulo	13°	Atlético-PR	13°	Corinthians	13°	Ceará
14°	Fluminense	14°	Bahia	14°	Chapecoense	14°	Fluminense
15°	Sport	15°	São Paulo	15°	Ceará	15°	Corinthians
16°	Vitória	16°	Atlético-GO	16°	Vasco	16°	Chapecoense
17°	Coritiba	17°	Fluminense	17°	Sport	17°	Sport
18°	Avaí	18°	Sport	18°	América-MG	18°	América-MG
19°	Ponte Preta	19°	Vitória	19°	Vitória	19°	Vitória
20°	Atlético-GO	20°	Ponte Preta	20°	Paraná	20°	Paraná

Source: Research data.

Analyzing the top of the chart, it can be seen that in fact the champions of the 2017 and 2018 editions obtained the maximum efficiency index, in the respective title year, followed by the clubs that obtained the best indexes, in correlation with the classification table of the year corresponding to the analysis of the statements. With the exception of Botafogo in 2017 and Vasco in 2018, that became efficient due to the lower rates of the sample, in the relation between expenses/revenues, with 52% and 55%, respectively.

At the bottom of the table, in the year 2017, two of the four clubs that were among the last placed in the ranking also obtained the lowest efficiency rates. However, in the year 2018, the four clubs that obtained the lowest rates of the sample in relation to efficiency, also remained in the last places in the ranking.

The two rankings formed between the final classification of the Series A teams and the DEA analysis resulted in Kendall's Ordinal Correlation Coefficients,

given by $x = 0.636{**}$e $x = 0.779{**}$, both showing statistical significance at the 95% level. As they are positive, it is inferred that the greater the sports efficiency of the team, the better its ranking in the Brazilian championship. Regarding sports efficiency, Benin, Diehl and Marquezan (2019) stand out, who found that sports performance is positively related to the size of the clubs, which seems natural, because the same authors point out that large clubs compete in major competitions frequently and their technical skills are high.

V.   CONCLUSION

This research sought to compare the Sports Efficiency Indexes with the soccer clubs' Classification Performance, in the Brazilian Championship's classification tables in the years 2017 and 2018. Throughout the article, the sports efficiency of the clubs was determined using the DEA method, extracting the data from their financial statements to verify their relationship with the final position of the teams in the Brazilian Soccer Championship - Series A, in the period studied.

Among the clubs analyzed in 2017, the champion of the edition, Corinthians, obtained the maximum index of efficiency, but followed by Botafogo that proved efficient in the analysis, due to its low rate of expenditures, but with only 46% of points. Of the clubs that qualified among the first, a great part presented the best Sporting Efficiency Indexes. However, Coritiba being in the seventh position of efficiency, being lowered with its seventeenth position in the table, possibly reinforcing the idea of the need for a more accurate evaluation about the allocation of resources in alignment with the results.

The year 2018 presented an evolution in the ordinal correlation coefficient. Among the clubs verified, four obtained maximum efficiency: Palmeiras, Flamengo, Vasco and Gremio. According to the previous year, one of them was the champion, Palmeiras. Flamengo was second and Gremio equaled the indicators, staying in fourth position. In the last four places, parity among the results was attested, being the teams with less efficiency, all relegated in their respective orders. However, Vasco, with the highest efficiency index was almost relegated, reaching the 5th worst ranking, presenting, in this case, a misalignment between the results, reinforcing that despite the significant influence of the achievement of sports efficiency, the strategic allocation of resources by the main components of the index should have substantial weight on the clubs' ranking positions.

It was concluded, based on the results of the ordinal correlation coefficients of Kendall that presents a relevant level of statistical significance in the order of 95%, that the greater the sporting efficiency of the team, the better its ranking in the championship. However, it was verified that there is no perfect alignment between the Sporting Efficiency Index and the Clubs' Classification Performance, that is, part of them did not obtain a position in the efficiency ranking exactly equal to their real positions in the tournament, attesting the possible presence of other factors that may also contribute to the classification results.

Thus, believing in the importance of the theme, it is suggested for future studies the analysis of the impacts that the Brazilian clubs will suffer in their indicators of sportive efficiency in face of the period of paralysis of their activities by the pandemic of the new coronavirus (Covid-19) and also, in the improvement of a Sustainable Management, the development of a study on what the nature of expenses and investments the main clubs have systematically allocated resources for the achievement of sportive efficiency.

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