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How to evaluate the financial performance of soccer clubs

Using multicriteria decision analysis (MCDA) methods and industry-specific factors to evaluate the financial performance of ten of the biggest soccer clubs in Europe

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by
Jan Trost
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Abstract

Professional soccer is the most popular sport in the world with growing social and economic importance. It has constructed its own sector and is a continuously enlarging economy, making it mandatory for the stakeholders in this industry to be able to evaluate the financial performance of soccer clubs. This thesis aims to detect how the financial performance of soccer clubs can be evaluated. For this purpose, multicriteria decision analysis (MCDA) methods and industry-specific factors are used to evaluate the financial performance of ten of the biggest soccer clubs in Europe for the seasons ending 2018, 2019, and 2020. To be precise, five different MCDA methods are used as well as a Performance Assessment Model (PAM), which includes sporting performance indicators into the calculation. Furthermore, the correlation between financial and sporting performance is being examined. The results show that the use of a multitude of MCDA methods, while also considering sporting performance indicators next to financial ratios, is the best way to evaluate the financial performance of soccer clubs. Additionally, there are other non-financial indicators influencing the financial performance of a soccer club that have to be taken into consideration as well. There is no statistically significant correlation between financial and sporting performance, but they influence each other indirectly due to a club's strategies and objectives.

Keywords: Financial Performance, Management, Multicriteria Decision Analysis, Soccer, Sporting Performance

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List of Abbreviations

COPRAS – Complex Proportional Assessment

EPL – English Premier League

FFP – Financial Fair Play

FRS – Financial Reporting Standard

GRA – Grey Relational Analysis

IASB – International Accounting Standards Board

IFRS – International Financial Reporting Standards

KPI – Key Performance Indicators

MCDCA – Multicriteria Decision Analysis

OPS – Overall Performance Score

PAM – Performance Assessment Model

PROMETHEE II – Preference Ranking Organization Method for Enrichment of Evaluation II

PSG – Paris Saint Germain

SAW – Simple Additive Weighting

S&P 500 – Standard and Poor's 500

TOPSIS – Technique for Order Preference by Similarity to Ideal Solution

UEFA – Union of European Football Association

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1. Introduction

1.1 Problem Description and Motivation

Professional soccer (Amer.; Brit.: football) has a growing social, media, and economic importance, being the most popular sport in the world (Kuper and Szymanski, 2018) with an undeniable social content (Barajas et al., 2018). Although soccer is a game and leisure and entertainment tool, it has become a phenomenon that is under the influence of various interest groups and trails large masses. Analyzing its historical development, it can be seen that it constructed its own sector and is a continuously enlarging economy (Ecer and Boyukaslan, 2014). Research activity surrounding professional soccer and team sports is therefore heavily linked to the field of economics and principally the concepts of uncertainty of outcome, competitive balance, and profit, utility and win maximization (Wilson, 2017), as well as contest management, collaboration and competition, and performance measurement (Chadwick, 2009).

The world of contemporary sport presents a complex challenge for sport management as the product it delivers to participants and fans is idiosyncratic (Smith and Steward, 2010), meaning that it is specific to this industry. While professional sport in large parts is just another form of business, it holds a set of special features that demands customized practices to ensure its effective operation (Smith and Steward, 2010; Wilson, 2017). As such, it is much more than just a business and is influenced by its rich history, emotional connection, tribal links, and social relevance. Furthermore, there are two main twin objectives in soccer and sport in general. The first is to maintain a high level of on-field performance, meaning to maximize the sporting performance, and the second is to maximize off-field financial and commercial business operations, in other words financial performance (Wilson, 2017). To operate successfully within the sport business, sport managers have to strategically position themselves between these two objectives and balance both, on- and off-field performance.

To evaluate the financial stability and performance of soccer clubs, it is important to understand how sporting and financial performance and factors correlate to and influence each other. Also, it is necessary to know which methods and ratios can be used to evaluate the financial performance of soccer clubs by considering multiple criteria, as well as other non-financial, industry-specific factors which are extremely difficult to measure and distinguish in the financial results of a club. Such factors are fan loyalty, ownership structures and thus club strategies and objectives, Financial Fair Play (FFP), licensing and salary cap regulations, manager changes, media and globalization, divergent rules

between leagues, transfer rules, different legal and accounting characteristics, and more (Barajas et al., 2017; Chadwick, 2009; Parganas et al., 2017; Wilson, 2017; Wilson and Plumley, 2018).

1.2 Research Question and Hypotheses

Due to the increasing commercialization of soccer and the increasing groups of interest (Ecer and Boyukaslan, 2014), being able to evaluate the financial performance of soccer clubs in a business context, for decision-making purposes as well as for investment decisions, has become mandatory for the stakeholders in the soccer industry. Therefore, the research question that is tried to be answered in this thesis is how to evaluate the financial performance of soccer clubs, using multicriteria decision analysis (MCDA) methods and industry-specific factors to evaluate the financial performance of ten of the biggest soccer clubs in Europe. This research question aims to figure out what methods can be used to evaluate the financial performance of a soccer club and which method is best suited for that, which of the analyzed soccer clubs shows the best financial performance within the analyzed time period, i.e. the 2017-2020 seasons, and try to find an answer to the question to what extent sporting and financial performance are correlated to each other.

The underlying hypotheses are (1) that there is a positive correlation between sporting and financial performance, meaning that when a club performs well in terms of their financial performance, they also have a better sporting performance; and (2) that there are other non-financial factors that influence the financial performance of a soccer club which are difficult to measure and therefore making it challenging to get reliable and accurate ("real world") results.

1.3 Methodology and Structure

This research is conducted both qualitatively and quantitatively. In terms of qualitative research, a literature review is being conducted, analyzing the papers by Chadwick (2009), Kuper and Szymanski (2018), and Wilson (2017) to evaluate the specific industry in which soccer operates, the business of soccer, and, in accordance with the papers by Barajas et al. (2017), Ecer and Boyukaslan (2014), and Plumley et al. (2017), how to evaluate the financial and sporting performance of soccer clubs. In order to detect the methods which can be used to evaluate the financial and sporting performance of soccer clubs, the papers by Barajas et al. (2017), Ginevičius and Podvieszko (2013), and

Zopounidis (1999) are being analyzed for further information about the MCDA methods, as well as the paper by Ecer and Boyukaslan (2014) for the Grey Relational Analysis (GRA) approach, and the paper by Plumley et al. (2017) for their Performance Assessment Model (PAM). Furthermore, the paper by Wilson and Plumley (2018) is used as a basis for the analysis of specific accounting standards in professional soccer and how to assess the value of a player in a club's balance sheet. Official reports such as the benchmark reports by the Union of European Football Association (UEFA) (2018) or Deloitte (2021), and the annual statements of the ten soccer clubs analyzed in this paper are also being used for further information about the industry of soccer, its current status, as well as for the clubs' and industry's revenue and debt figures.

Quantitative research is being conducted in the form of empirical research. Five different MCDA methods are being calculated, namely the Simple Additive Weighting (SAW), Complex Proportional Assessment (COPRAS), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Preference Ranking Organization Method for Enrichment of Evaluation II (PROMETHEE II), and GRA method, as well as the PAM method by Plumley et al. (2017). They are calculated with the help of 13 different ratios – three profitability ratios, three stability ratios, three coverage ratios, one liquidity ratio, and three spending level ratios. For the PAM model, three sporting performance indicators are being used next to the 13 financial ratios, namely league points, total game variance, and attendance spread. The methods are applied to ten of the biggest soccer clubs in Europe, based on their revenue (as of 2020), for the seasons of 2017/18, 2018/19, and 2019/20. The clubs analyzed are FC Barcelona, Real Madrid CF, Manchester United FC, Liverpool FC, Manchester City FC, Tottenham Hotspur, Juventus FC, Arsenal FC, Borussia Dortmund, and Everton FC. The results of the methods used are ultimately compared, taking into account their strengths and weaknesses in order to determine which method is most suitable for evaluating the financial performance of soccer clubs, while also considering other, non-financial and sporting, factors that influence the financial performance as well. Beside the evaluation of the financial performance of soccer clubs, the correlation between financial and sporting performance is being evaluated as well, using the Spearman's rank correlation test and regression analysis.

The three quality criteria of quantitative research, namely validity, reliability, and objectivity, are fulfilled. Ratio analysis and MCDA methods can be used to evaluate the financial stability and performance of a company, in this case of a soccer club, proving the validity of this research. The research can also be replicated, with different clubs and for different industries, different methods and ratios, and for a different period, proving the research's reliability. In terms of objectivity, the use of financial ratios and the mathematical calculation of the used methods, as well as the use of the Spearman's rank

correlation test and regression analysis do not allow any subjectivity in the calculation process. The three quality criteria of qualitative research are transparency, intersubjectivity, and range, all of which are fulfilled as well. Since all relevant findings of the topic and thus the main working steps of this thesis are being documented in chapters two and three, the research is transparent. The criteria of intersubjectivity are fulfilled since all findings are being interpreted and discussed in chapter four. The criteria of range are met as well, since the industry of soccer and its specific characteristics, as well as the other factors influencing the financial performance of a soccer club, will be the same or at least similar in future research with a similar approach. Furthermore, inductive research is applied in this thesis, developing the first hypothesis of this thesis based on the findings of other researchers in this field, and the second hypothesis based on the findings of this bachelor thesis. For the empirical research, only clubs that are among the biggest European soccer clubs and that provide a financial statement for the three analyzed seasons with all data needed for calculating the financial ratios used for the methods in this thesis have been chosen for this research.

The present thesis is structured as follows: The second chapter gives a comprehensive overview of the literature reviewed and forms the theoretical foundation of this research. It is divided into four subchapters, explaining the industry and business of soccer, the measurement of performance in the soccer industry, and accounting in soccer. Afterward, the empirical analysis is being conducted in chapter three, explaining the different methods used for the calculations, and showing their results. Chapter four provides the discussion, where all findings and results are summarized and interpreted, and where limitations of this thesis are being explained and suggestions for further research are made. Last, a conclusion summarizing the findings of this research is presented in chapter five.

2 Literature Review

2.1 The Industry of Soccer

Sport has variously developed across the world as a ceremony, a celebration, a physical pursuit, a leisure activity, and increasingly a business too, with a history that is arguably one of the richest of all human activities. By the turn of the millennium, in the light of technological and media change and under the influence of internationalization and globalization, business-oriented thinking began to pervade across numerous sports, one of which was soccer (Chadwick, 2009). With globalization, there has been an accelerated period of growth in the development of the soccer industry by reducing the barriers and differences between countries and emphasizing the connections between them (Wilson

and Plumley, 2018). The industry of professional soccer differs from other business industries and sectors, in its economic as well as financial characteristics (Chadwick, 2009; Barajas et al., 2017). A very important characteristic is that it is deeply socioculturally embedded, which means that common traditions, habits, patterns, and beliefs are involved. This creates highly distinctive and often unique challenges for sport managers. For example, in the case of fan loyalty to certain sport brands and soccer clubs, managers simultaneously face the juxtaposition of major commercial and managerial opportunities and the constraints of history and heritage. When managers seek to target new customers, secure a new market entry, or build a global fan base, such loyalties often pose a serious challenge. Also, sport management is as likely to have a social-psychological foundation as much as it has an economic one, which can be seen by the continuing predilection of some executives for engaging in sport sponsorships on the basis of the “hobby motive” (Chadwick, 2009).

Furthermore, Barajas et al. (2017) state in their paper that big soccer clubs have a financial management with high revenues, high investment in sports staff, and a permanent economic imbalance that is anomalous in comparison to other business sectors, presenting further characteristics of this industry. Additionally, there are divergent rules between national leagues, as well as significant differences among countries in taxation, transfer rules, limitations on the number of foreign players on the pitch, and various legal and accounting characteristics. Although the differences among countries exist in other business sectors as well, the divergent rules between national leagues allow financial and sporting imbalances between soccer clubs and teams. In order to gain revenues, though, it is necessary to have an attractive and demanded sporting event, for which competition needs to be uncertain and balanced (Barajas et al., 2017; Chadwick, 2009; Morrow, 2013; Neal, 1964; Vöpel, 2013). To have a competition in the first place, a minimum of two clubs is required to create the main products of the industry: matches and championships. In addition to the competition, cooperation among the participants therefore is necessary to ensure an attractive competition, making not only soccer, but professional sport in general a peculiar economy (Barajas et al., 2017; Chadwick, 2009; Neale, 1964). Cooperation between the teams is also necessary and sought for by the clubs due to the joint nature of production in soccer (players, matches, and championships). Therefore, different to other industries, it does not pay for one team to establish a position as a monopoly supplier in the soccer industry (Plumley et al., 2017; Wilson, 2017). This also means that sport managers have to preserve the strength of uncertainty, which leads to the management challenge how games, leagues, competition, and tournaments can be managed to ensure that uncertainty, balance, and equity are promoted. However, it has to be mentioned that, although the principles of uncertainty of outcome

and competitive balance dictate that higher levels of interest will be the results of close competition, there is evidence indicating that revenues have grown against a backdrop of a moderate decline in competitive balance (Wilson, 2017). This shows the strong fan loyalty to a club, but may well present a longer-term challenge for not only soccer, but sport in general as well.

Historically, sport itself as well as soccer have always been product-led, meaning it has been about what happened on the field of play, the athletes involved in it, and the management of them, that have largely dictated the product offering (Chadwick, 2009). This means that the management objectives of soccer clubs differ from other industries too, since profit is not a common priority here (Barajas et al., 2017). Wilson (2017) agrees and argues that professional soccer clubs ultimately operate under multiple objectives, to become financially sustainable or to make a profit. He explains that there are two main objectives, (1) to maintain a high level of performance on the field and (2) to maximize commercial operations off the field in pursuit of revenue growth (Chadwick, 2009; Wilson, 2017). Additionally, there is a practical management dilemma for these professional soccer clubs, since they must strategically position themselves to maximize performance both on and off the pitch, whilst satisfying a number of different stakeholders at the same time (Wilson, 2017). Central to this dilemma are the principles of competitive balance, uncertainty of outcome, as well as profit and utility maximization (Chadwick, 2009; Leach and Szymanski, 2015; Plumley et al., 2017; Sloane, 2015; Wilson, 2017). Thus, to be successful, soccer clubs have to balance on-field success with business performance (Chadwick, 2009; Wilson, 2017), which will be defined and discussed in the following subchapter.

2.2 Soccer as a Business

Soccer clubs are unusual businesses. Although generally constituted as limited liability companies and hence ostensibly operating within the same legal and governance framework as companies in other economic industries, they exist in a peculiar emotional and social space, with unusual strong relationships between the clubs and their stakeholders (Morrow, 2003; Guzman and Morrow, 2007; Wilson, 2017). These relationships can have an impact on business behavior and decision-making, for example the desire for on-field success, which is likely to have an impact on the business decision-making (Morrow, 2003; Plumley et al., 2017). Wilson (2017) agrees, adding that soccer is an industry that craves on-field success but rejects standard business concepts and is dominated by irrational and emotional decisions.

In the USA, the governing body employs several strategies to ensure that soccer, among other sports, retains its essential elements, which are the uncertainty of outcome, competitive balance, collaboration, the on- and off-field products, and performance measurement, while still serving the needs of the increasingly dynamic market in which soccer operates. These strategies include a combination of franchising, the implementation of a draft system for acquiring players, and a salary cap to ensure parity in player salaries. However, the so-called “American model” of sport and soccer is completely different from the European model, where approaches to the macro-management of sport and soccer are essentially *laissez-faire*¹. Because of soccer's rich history, but also because of European Union principles like the promotion of freedom of movement, the strategies used in the American model, such as franchising and salary caps, are either socially unacceptable in Europe or illegal under European law (Chadwick, 2009). An issue of the European model though is that problems concerning uncertainty and competitive balance have emerged (Chadwick, 2009; Wilson, 2017). This is also because of the increasing internationalization and globalization, since larger soccer clubs can operate more effectively on a global scale and therefore are able to gain access to new markets and resources, which consequently reinforce and strengthen their playing and market positions. On the other hand, internationalization and globalization have also driven the benefit of technology and media as an increasingly important and valuable tool in the soccer industry (Chadwick, 2009; Woolfe et al., 2002). They allow fans and spectators to watch the game of their favorite teams from anywhere across the world without the need to go to the stadium. This also means higher broadcasting revenues for all clubs, as well as a larger fan base and higher fan loyalty. Another benefit of technology and media is that clubs can interact more with their fans, for example through social media, which also builds fan loyalty (Parganas et al., 2017).

Nowadays, revenues from soccer clubs are originated in different ways, such as broadcasting rights, sponsorships, merchandising, and also through ticket sales, which was the only source of revenue for football clubs for many decades (Szymanski, 2015). The continued growth in revenues, from €13.90 billion² in 2006 to €29.60 billion in 2019 in European soccer alone (Statista, 2021a), equivalent to a growth of 113% within that period, is explained to be due to better contracts of broadcasting rights and the increase in the transfer values of players (Barajas et al., 2017; Morrow, 2013; Vöpel, 2013). In the case of the English Premier League (EPL), their broadcasting rights developed from

¹ *Laissez-faire* is the idea that businesses should be free to develop without the involvement or control of the government and that people should be free to choose how to do things, without too much control from someone in authority (Definition by Cambridge Academic Content Dictionary, 2021 [Accessed 13 October 2021]).

² Currencies have been converted as follows: £ / \$ = 1,36 (10.10.2021); € / \$ = 1,16 (10.10.2021); \$ / € = 0,88 (01.12.2021).

roughly €233 million in 1992 to €6.22 billion in 2019 (Sports Business Institute Barcelona, 2019), which is an increase of 2570%. In terms of player transfer values, the average player value in the EPL increased from €4.04 million in 2005 to €17.94 million in 2021³, equivalent to an increase of more than 344% in the EPL during that period. These new revenues have brought with them new business and ownership models, increased levels of expenditures on infrastructure, pressure on governance structures, and managers to a new challenge for league intensity (Wilson, 2017). One of these new business models, and thus another way for soccer clubs to expand their financial capabilities, is a new behavior in the soccer industry known as "financial doping" (Barajas et al., 2017), where, due to the extremely competitive market and the common goal of maximizing wins, clubs have welcomed wealthy individuals that invest in a club, enabling them to buy better players and thus increase sportive success (Peeters and Szymanski, 2014). Barajas et al. (2017) and Wilson (2017) agree that soccer clubs seek to increase revenues and earnings to allow for greater investment and spending on players rather than financial gains. Examples of such cash injections by wealthy individuals are Chelsea FC, where Roman Abramovich took over in 2003, Manchester City FC, purchased by the Abu Dhabi Group under Mansour bin Zayed Al Nahyan in 2008, or Manchester United FC, acquired by the Glazer Family in 2005, in English soccer alone (Plumley et al., 2017). Although the case of Manchester United FC is slightly different to those of Chelsea FC and Manchester City FC, since they were purchased through a method of debt financing, they also spend their revenues mainly on sport staff (players and coaches) like any other club, which not only leads to an increase in income for clubs, but is also considered the key factor in the financial imbalance in the soccer industry (Morrow, 2013; Peeters and Szymanski, 2014). This is because at a macro-level, due to the global nature of technology, connected to broadcasting and merchandising revenues, resources flow to a small group of soccer teams that are the most attractive and win more games and trophies than other teams, providing them with strategic and financial benefits while crowding out others (Chadwick, 2009).

From a fundamental business position, professional sport teams should strive to operate as sustainable businesses focused on long-term growth, rather than short-term profits and trophy acquisition through immediate cash infusions (Plumley et al., 2017). This is contrasted though by the twin objectives in soccer, to maintain a high level of on-field performance, and to maximize off-field commercial business operations (Chadwick, 2009; Plumley et al., 2017; Wilson et al., 2013; Wilson, 2017). There is evidence that there has not only been a significant revenue growth in soccer, principally driven by broadcasting, with less reliance on match day income, but a continuation of spiraling

³ Figures taken from *transfermarkt.com* [Accessed 16 October 2021].

expenses and, in some cases, levels of debt as well (Wilson, 2017). As Wilson (2017) states: "Financial discipline is an essential element to grow the game both on and off the pitch". The move away from traditional forms of game-day revenue to an era dominated by broadcasting (Szymanski, 2015) poses an acute challenge too, as written by Wilson (2017). He points out that broadcasting revenues are in many ways unearned, and that if they are eliminated, they can lead to major financial difficulties. This could be witnessed during the Covid-19 pandemic in the 2019/20 season, when clubs were not allowed to play anymore and no longer generated broadcasting and match day revenues. Even after clubs were allowed to play again, the traditional form of match day revenue still held off, which led to a huge financial crisis, not only for many of the big clubs, but especially for smaller ones across all European leagues.

Although soccer is widely referred to as an actual business nowadays, there are also some critical voices concerning the business side of soccer. In their book, Kuper and Szymanski (2018) argue that soccer is neither a big nor a good business, arguably not even business as all. For their assertion that soccer is not a big business, they give the example of United Natural Foods, an American company with €23.74 billion in revenues in 2020 (Macrotrends, 2021) which has not made it into the Standard and Poor's 500 (S&P 500), an index that lists the 500 biggest American companies. For comparison: Apple is currently the biggest company in the S&P500, with €241.86 billion in revenues in 2020 (Statista, 2021b), more than ten times bigger than those of United Natural Foods. And still, United Natural Foods, although not considered one of the biggest 500 companies in the US alone, is still a much larger business than any soccer club on earth. As of 2020, Barcelona FC is the biggest soccer club in terms of revenue not only in Europe, but in the world, with a recognized revenue of €758 million. That's only 3% of United Natural Foods' revenue, and only 0.3% of Apple's. Kuper and Szymanski (2018) also refer to Alex Fynn (1998), who noted in the 1990s that the average EPL club had about the same revenue as a single British supermarket store. Soccer clubs have since grown and generated much higher revenues, but the annual turnover of an average EPL club is still less than that of some Tesco superstores in 2018, they argue. Although they acknowledge that it feels like a contradiction, since soccer actually is huge, with some of the most famous people on earth being soccer players and the World Cup final as the most watched television program in history, they argue that soccer clubs cannot make money out of the sport itself. In fact, the world earns more from soccer in the form of broadcasting, newspaper reports, internet sites, computer games, etc. than the clubs themselves (Kuper and Szymanski, 2018).

They also state that soccer is not only a small business, but a bad one too, as soccer clubs are mostly "run by people who do what they do because they have always done it

that way” (Kuper and Szymanski, 2018, p. 3), with entrepreneurs dipping into soccer that keep making the same mistakes and promising to run the clubs like businesses, before disappearing a few seasons later. Kuper and Szymanski (2018) found that from 1992 until 2008, 40 of England’s 92 professional soccer clubs had been involved in insolvency proceedings, some even more than once. What they also found though was, although being “incompetently run” (Kuper and Szymanski, 2018, p. 73), soccer clubs never go bust. In the years before the global economic crisis in 2008, people worried a lot more about the survival of soccer clubs than that of banks, yet it was many of the world’s largest banks that disappeared, while soccer clubs remained stable. This is also due to cooperation in soccer (Barajas et al., 2017; Chadwick, 2009; Neale, 1964), as clubs help others in difficult times because they know they cannot operate without opponents (Kuper and Szymanski, 2018). Another reason why soccer clubs never disappear is that, due to the introduction of the procedure of administration by the British Insolvency Act of 1986 in England for example, they could just enter insolvency to wipe off their debts. That way, clubs in England could run up unpayable debts, go insolvent, and a few months later, they would be fine and able to sign new expensive players again.

In most industries, a bad business goes bankrupt, but soccer clubs almost never do and always survive. No matter how much money they waste, someone will always bail them out (Kuper and Szymanski, 2018), whether it is the fans, a bank with a new credit, or a wealthy individual buying the club and investing new money in it. Debt accumulation of European soccer clubs though is an increasing source of concern for soccer authorities (Drut and Raballand, 2012; Wilson and Plumley, 2018). The significant levels of debt clubs are leveraged by are often in the form of interest free loans from their owners, with a high proportion spent on player acquisitions and wages. As of 2020, the ten clubs analyzed in this thesis are spending on average €326 million (Ø 62.7% of the clubs’ total revenue) on wages, showing the imbalance between revenue and costs (Plumley et al., 2017; Wilson and Plumley, 2018), and supporting Kuper and Szymanski’s (2018) hypothesis that soccer is a bad business. According to UEFA (2020), the accumulated net debt of all clubs in Europe’s top 20 leagues raise from €7.14 billion in 2017 to €8.67 billion in 2018. In 2021, the accumulated net debt of the twelve clubs with the highest debts alone was €7.62 billion (sport1, 2021), showing the concerning development of debt accumulation in the soccer industry.

But Kuper and Szymanski (2018) not only argue that soccer is neither a big nor a good business, they also argue that soccer may not be a business at all. While a business usually tries to be profitable, in soccer it is the case that a club that tries to make profit and lives within its means usually does not perform well on the pitch, since no large investments would be made to sign or hold the best playing talents (Kuper and

Szymanski, 2018). In the case of Tottenham Hotspur, when Alan Sugar became chairman in 1991 with the aim to live within the club's means and stay profitable, they did not win any trophy except one solitary League Cup in the ten years he ran them. But not only did they disappoint on the pitch, but they only made about €2.64 million a year too, at least within Sugar's first six years. The reason for that is when a club does not invest enough money into its team, they will win fewer matches than their free-spending rivals. Fans will desert them, watch fewer matches, since watching them becomes less attractive, what will further cut into their profits (Kuper and Szymanski, 2018). As Kuper and Szymanski (2018) state, the case of Tottenham Hotspur illustrates a paradox: when business people try to run a soccer club like a business, performance on and off the field suffers.

Furthermore, if a club wants to make profits, they would have to spend less than they earn, meaning that they would have to limit their players' wages, ending up in a poorer on-field performance, since paying high wages wins matches as Kuper and Szymanski (2018) argue. It is a trade-off: if a club wants to win matches and trophies, they have to forget maximizing profits. If they want to maximize profits, they have to give up hope of trophies (Kuper and Szymanski, 2018; Plumley et al., 2017). For that reason, soccer clubs, which are usually win maximizers (Wilson, 2017), spend what it takes to win matches and way more than a hard-headed businessman, not caring about profits, and therefore building up the high amounts of debt which can be witnessed in the soccer industry. Debt that often cannot be repaid to a club's creditors. Therefore, Kuper and Szymanski (2018) argue that the business of soccer is playing soccer, not making profit, what should be the actual objective of a business, meaning soccer is not an actual business.

However, the assertion that soccer might not even be an actual business at all, because many, if not most, clubs are not making profit, cannot be supported. One definition of business by Investopedia for example is the following: "The term business refers to an organization or enterprising entity engaged in commercial, industrial, or professional activities. Businesses can be for-profit entities or they can be non-profit organizations that operate to fulfill a charitable mission or further a social cause." (Investopedia, 2021a). As Chadwick (2009), Barajas et al. (2017), Morrow (2003), Wilson (2017), and many others note, there is a huge social relevance in the sport of soccer, binding together a broad, unique, sociocultural, economic, and commercial constituency. Moreover, it is a profession that generates income for the clubs by engaging in commercial activities. And although soccer might not be a very profitable and therefore "good" business, just as it might not be a very big business compared to other business sectors, even though the whole industry of soccer generates much more revenues and profits than just the clubs

alone as Kuper and Szymanski (2018) state themselves, soccer can be referred to as actual business.

2.3 Measuring Performance in the Soccer Industry

Within the soccer industry, there are two types of performances that can be measured (Plumley et al., 2017; Wilson, 2017). First there is the financial performance of the clubs, indicating how well a club operates in a business context, and second there is the sporting performance, indicating how well a club performs on the field, given its resources (Kuper and Szymanski, 2018).

2.3.1 Measuring the Financial Performance of Soccer Clubs

Measuring the financial performance of soccer clubs is not only very important for managers, credit lenders, and investors, but also for competitors in the sector of soccer. Due to the increasing commercialization and the increasing amount of interest groups in the soccer industry, it has become mandatory to be able to evaluate the financial performance of soccer clubs in a business context, for decision-making purposes, investment decisions, defining financial policies, obtaining required sources, and measuring financial adequacy (Ecer and Boyukaslan, 2014). The use of financial ratios in the process of financial performance evaluation is very common, also in the soccer industry, because they present the information that are necessary for decision-making as a summary to researchers. Additionally, financial ratios present the strengths and weaknesses of the firms in terms of liquidity, development, and profitability (Ecer and Boyukaslan, 2014; Singh and Schmidgall, 2002). The microeconomic theory, which represents the classical modeling of decision problems in operations research, consisting in formulating an optimization (maximization or minimization) problem under specific constraints, has largely adopted a single objective function, which is the principle of utility maximization for consumers and profit maximization for firms (Bhaskar, 1979; Zopounidis, 1999). Bhaskar (1979) has presented three points of criticism regarding the use of the single objective function for firms, which are: first, there exist alternatives to the profit maximization approach which are based on equally simple hypotheses and which can better explain reality; second, the profit maximization or any other equally simple hypothesis is too naïve to explain the complex process of decision-making; and third, the real-world firms do not have suitable information to enable them to maximize their profits (Bhaskar, 1979).

The single objective functions, or univariate financial analyses, are often used by many firms and researchers in making performance appraisal meaningful, and focus on the state of a ratio at a moment, producing temporary results by comparing the ratio found with others (Ecer and Boyukaslan, 2014). The issue with these univariate financial analyses is that they have some limitations, for example that they only focus on a very limited number of ratios at a time, or that they depend on the assumption that there are linear relationships between the variables (Guzmán and Morrow, 2007). Also, formulating the problem in terms of seeking the optimum, financial decision makers get involved in a very narrow problematic, often irrelevant to the real decision problem. Furthermore, financial decisions are taken by humans and not by models, and, in order to solve problems, it becomes necessary to take into consideration their preferences, experiences, and knowledge (Zopounidis, 1999). Therefore, methods having new and more flexible structures have been developed, namely the MCDA methods, which take multiple ratios and criteria into consideration (Barajas et al., 2017; Zopounidis, 1999).

In their paper, Ecer and Boyukaslan (2014) used the GRA approach, which is one of the MCDA methods, to identify the importance level of financial indicators that measure the financial performance of soccer clubs. The most important advantage of GRA presented by the authors is that it presents realistic and well-directed solutions to problems with few data. For their research, they focused on soccer clubs from the Turkish league. Explicitly, the teams that the authors were analyzing in their paper are Besiktas, Galatasaray, Fenerbahçe, and Trabzonspor, all of which are listed on the Istanbul stock exchange. For their approach, they selected eleven financial ratios that take place within the context of liquidity, liability, and profitability indicators. For decision-making, both liquidity and profitability ratios should be high, while liability ratios should be low. With the help of these eleven financial ratios, they were able to conduct the GRA⁴. This method can be used in decision-making in situations where there are many criteria, by ordering the samples as to the relation grade. It allows separating important variables in groups between themselves and determining the level of the relation between each factor. The authors found that the most important financial indicator is the liability indicator, followed by profitability and liquidity indicators. Barajas et al. (2017) also adapted the MCDA to the soccer industry and used four different MCDA methods to classify the financial situation of soccer clubs, providing a fast and efficient technique in decision-making to the stakeholders in the soccer industry in the end. Since the GRA is one MCDA already examined by Ecer and Boyukaslan (2014), Barajas et al. (2017) focused in their paper on the SAW, COPRAS, TOPSIS, and PROMETHEE II method. From the results of these four methods, they set out a classification of entities. The ratios they used to calculate their examined

⁴ The methods presented in this part of the work are explained in more detail in chapter 3.

MCDA methods are profitability, stability, coverage, liquidity, and spending level ratios, with a total of 13 different ratios. On that basis, they classified the top ten largest European soccer clubs for the fiscal years of 2011-2013. The results show that for this period, Bayern Munich was the best performing club in terms of their financial ratios, followed by Arsenal, Manchester United, and Dortmund. The results also show that this is a stable industry in which stability and sustainability are increasingly improving.

2.3.2 Evaluating the Sporting Performance of Soccer Clubs

Sport is distinctive in the way that it binds together a broad, unique, sociocultural, economic, and commercial constituency, that often has a far-reaching impact on communities, identity and self-esteem, lifestyles, and the environment. As such, it has developed the need to identify and use other measures of performance that influence the financial performance of a soccer club as well (Chadwick, 2009). In his PhD, Wilson (2017) analyzed some factors affecting the financial performance in English professional team sports. By measuring the performance of individual teams/clubs (sporting and non-sporting), factors that affect the performance of individual teams/clubs (ownership and management), and the impact of the performance of individual teams/clubs on the league as a whole (competitive balance), it allowed the identification of where clubs and leagues sit on the theoretical continuum of profit, utility, and win maximization: strategies on how to position a club (Leach and Szymanski, 2015; Wilson, 2017; Wilson et al., 2013). The author found that there is a new environment for professional team sports, where nowadays revenues mainly occur due to broadcasting revenues, costs due to wages and transfer fees, where private funding is the main investment source, where clubs are more often owned by foreign than domestic investors, and where there are FFP, licensing, and salary cap regulations. The additional revenues are mainly spent on player transfer fees, registration fees, and wages, which leads to a disparity of sporting and non-sporting performances and thus to competitive imbalances (Barajas et al., 2017; Plumley et al., 2017; Wilson, 2017; Wilson and Plumley, 2018). This, however, depends on a club's strategies and objectives (profit, utility or win maximization), which can change due to the takeover by new owners or new events that occur, such as the introduction of FFP regulations.

The findings also suggest that financial and sporting performance, or profit and utility maximization, are not dichotomous variables, but a continuum along which clubs place themselves and move backwards and forwards to a greater or lesser extent (Plumley et al., 2017; Wilson, 2017; Wilson and Plumley, 2018). As Wilson (2017) also found, this continuum on which clubs operate on is determined by owners' objectives, revenues,

regulations, competition, and sporting outcomes, with clubs moving along the continuum depending on the influence of these factors. Another factor that affects the performance of a club seems to be the change of a manager, which means compensation for the club and therefore can have a negative impact on the financial performance. This, however, is only true for clubs in the top half of a leagues' table pushing for European qualifications or competing for the title, as Wilson (2017) found out. The findings suggest that a change of manager is very likely to improve performance in the bottom half of the table and potentially save a team from relegation, which is connected to a reduction in revenue of tens of millions of dollars due to lower broadcasting revenues (in the EPL approximately €60.8 million per club (Deloitte, 2021)). Therefore, a change in the manager can potentially have a positive impact on the financial performance of these clubs.

The presence of non-financial objectives and indicators also raises the question of how to measure the sporting performance of soccer clubs (Guzman and Morrow, 2007) in line with their pursuit of the twin objectives (Chadwick, 2009; Wilson, 2017), which can potentially conflict with each other (Plumley et al., 2017). It consequently leads to the involvement of an abundance of statistics in contemporary sporting competition too, including soccer (Sloane, 2015). To evaluate the sporting performance of soccer clubs, potential measurement indicators, amongst others, are league points, total games and total game variance, total win ratio, medals and trophies won, attendance spread, as well as revenue per average spectator (Chadwick, 2009; Plumley et al., 2017). Plumley et al. (2017) devised and tested a statistical model in their paper to measure both, the financial and sporting performance of professional soccer clubs, which can be used as an analytical tool to check for the performance of the clubs and identify where they can be considered at risk. The model they developed is the PAM. It outlines a composite index score that presents a club's performance in relation to its competitors. They applied the model to a group of 21 clubs from the EPL between 1992 and 2013 to identify performance trends. The PAM was originally made up of 18 different variables, nine financial and nine sporting, with equal weights applied to each variable. After their first tests, the authors restated the PAM in order to get more reliable results, for which they used a justified weighting system that considers the different measures in the model as well as current regulations in the industry, and for which they reduced the amount of financial and sporting variables, since some of them showed a strong correlation with other variables. Eventually, their final model consists of five financial and three sporting variables. Each analyzed team was ranked in a league rank system against each other for each variable and then weighted, resulting in an overall performance score (OPS) in the end, which allowed an accurate comparison between the clubs. The results show that a few clubs have created an imbalance within English soccer, with evidence of a financial crisis at individual

clubs. They also found that a better financial health is moderately and positively associated with better sporting performance in the EPL. Another result of their research is that the overall performance of the soccer clubs appears to vary over time in cycles, where sometimes clubs have a successful period spanning over a number of years before declining for a period of time (Plumley et al., 2017; Wilson and Plumley, 2018).

Since especially financial performance indicators and ratios are influenced by the accounting techniques and standards applied in the financial reports of the clubs, as well as by regulations set by the UEFA, the specific accounting standards that are used and exercised in the soccer industry are discussed in the following.

2.4 Accounting in Soccer

The international aspect of accounting is of vital importance to sport, given that many areas of this industry are not confined to a club's national regulatory framework. The globalization of soccer, particularly the integration of various multinational and intercultural sponsors and broadcasters, has provided a platform to establish and maintain a worldwide audience, putting international accounting and the financial performance of soccer clubs firmly in the spotlight (Wilson and Plumley, 2018).

In their paper, Wilson and Plumley (2018) considered the role that finance and accounting play in shaping the soccer business by incorporating a number of key themes, including regulatory frameworks and legal requirements, the balance between income and costs, exploring financial strategies and performance, and examining financial health through recognized industry techniques to evaluate the business performance of soccer clubs. In terms of regulatory frameworks and legal requirements, they state that the foundations are the same for all clubs, with soccer clubs having to conform to a set of International Financial Reporting Standards (IFRS), which have been established by the International Accounting Standards Board (IASB) (Wilson and Plumley, 2018). However, there are different financial regulations and frameworks in the individual leagues in Europe that also must be applied by the clubs and which can broadly differ from each other (Drut and Raballand, 2012). For example, the German League Bundesliga exerts a powerful financial control on clubs, while in England, Italy, and Spain, there are no strict financial control rules managed by the leagues. In these leagues, soccer clubs operate as common commercial companies, meaning they are free to borrow, that allow wealthy individuals to buy a club and invest in them (Wilson and Plumley, 2018). Since this is not allowed in the German Bundesliga to an extent such as in England or Italy, due to the so-called "50+1" rule, stating that a corporation can only acquire a license to participate

in the Bundesliga if the respective parent club holds a majority stake in the corporation, meaning at least 51% (DFL, 2018), this also causes a competitive imbalance between German soccer clubs and those of other leagues. Without financial controls as in England, Italy, and Spain, though, there is a higher risk that financial problems occur, too. Historically, financial problems have been common during the development of professional soccer, including issues such as tax avoidance, non-payment of liabilities, and creative accounting techniques, for which the clubs use complex methods to maintain strong profit margins or financial control, legal or otherwise. Accordingly, without a strong regulatory framework, it would be increasingly difficult to ensure that soccer clubs were playing by the rules (Wilson and Plumley, 2018).

Most issues with soccer and accounting are concerned with the valuation of player contracts and players as assets, and therefore their subsequent value, to the soccer business. The valuation of assets (players) to a professional soccer club is especially relevant when a club is in a dangerous financial situation or close to liquidation or administration and may wish to sell some of its most prized assets to cover costs or to lower debt levels. Following the introduction of Financial Reporting Standard (FRS) 10, a method reclassifying how professional clubs could value their players and report them on the balance sheet was presented, providing a degree of consistency in the area of intangible assets and the possibility to compare the financial results of professional sport teams (Amir and Livne, 2005; Wilson and Plumley, 2018). A fundamental principle of FRS 10 is that soccer clubs should record the player registration fees on their balance sheets as an amortized value based on the length of the player's contract, similar to the concept of Net Book Value, where an asset is depreciated equally throughout its useful life span. However, as Wilson and Plumley (2018) further remark, unusual assets such as soccer player contracts make it increasingly difficult to estimate the useful economic life and amortization, since a player's value varies over time (Amir and Livne, 2005; Wilson and Plumley, 2018). For example, when a player is bought for a small amount of money at a young age, they then develop and rise in value, and at the end of their career, their value will decline again, which means that there is a low-high-low pattern of amortization (Wilson and Plumley, 2018). This makes it increasingly difficult to classify the exact value of intangible assets to a soccer company.

As already mentioned before, many clubs are leveraged by significant levels of debt, with an average of 61.5% of revenues spent on wages, and an imbalance between revenue and costs at clubs across Europe in recent years (Plumley et al., 2017; Wilson and Plumley, 2018). In an attempt to address this imbalance, the UEFA has introduced FFP regulations in 2013/14 across the European game in an attempt to reduce the reliance on debt and borrowings, and to make clubs spend within their means, meaning to not

overspend on sporting staff and encouraging them to operate on the basis of their own revenues (Barajas et al., 2017; Plumley et al., 2017; Wilson and Plumley, 2018). It has brought about an increase of pressure on clubs to become more financially prudent and sustainable (Plumley et al., 2017; Wilson et al., 2013). The cornerstone of FFP is the break-even requirement, which is designed to help clubs across Europe to achieve a more sustainable balance between their costs and revenues whilst also encouraging investment for the long-term benefit of soccer, as well as limiting the number of cash injections by wealthy individuals together with their no-overdue payables regulation (Barajas et al., 2017; UEFA, 2012; Plumley et al., 2017; Wilson, 2017; Wilson and Plumley, 2018). UEFA's FFP also aims to provide a common legislative scenario with homogeneous regulations that act on equal terms for all teams. However, it applies only to those clubs that participate in competitions promoted by the UEFA, such as the Champions League or the European League (Barajas et al., 2017). There have been high-profile examples of fines handed to clubs who have not fulfilled the break-even requirement recently, such as Manchester City FC in England or Paris Saint Germain (PSG) in France. Another example is Chelsea FC, who got a two-year ban on the transfer market because they disobeyed the FFP regulations.

3 Empirical Analysis

3.1 Samples

The ten European soccer clubs used for the empirical analysis in this thesis have been taken from the 30 biggest soccer clubs in the world, based on their revenue in 2020 (Insider Monkey, 2021; Yahoo Finance, 2021). Since some clubs such as FC Bayern Munich (third-biggest club in the world; €671.95 million in revenues in 2020 (Insider Monkey, 2021)), PSG (seventh-biggest club in the world; €572.66 million in revenues in 2020 (Yahoo Finance, 2021)), and Chelsea FC (eighth-biggest club in the world; €497.51 million in revenues in 2020 (Yahoo Finance, 2021)) do not provide comprehensive financial reports to the public with all the necessary data needed for the ratio analyses in this thesis, the next biggest clubs in terms of revenue have been chosen. Therefore, the ten clubs analyzed in this thesis, as shown in Table 1, are FC Barcelona, Real Madrid CF, Manchester United FC, Liverpool FC, Manchester City FC, Tottenham Hotspur, Juventus FC, Arsenal FC, Borussia Dortmund, and Everton FC.

FC Barcelona and Real Madrid CF both are from the Spanish League Primera División. Manchester United FC, Liverpool FC, Manchester City FC, Tottenham Hotspur, Arsenal FC and Everton FC are from the EPL. Juventus FC plays in the Italian League Lega Nazionale Professionisti Serie A, and Borussia Dortmund plays in the German

Bundesliga. All marks of the clubs such as FC and CF will be excluded from the names from this point onwards in the thesis.

Table 1: Revenues of all analyzed clubs in 2020.

Club	Revenue (as of 2020)	Market Value	Ranking (based on revenues)
Barcelona	€757.67 million	€4.19 billion	First
Real Madrid	€733.00 million	€4.18 billion	Second
Manchester United	€615.00 million	€3.61 billion	Fourth
Liverpool	€591.87 million	€3.61 billion	Fifth
Manchester City	€581.65 million	€3.50 billion	Sixth
Tottenham Hotspur	€472.00 million	€2.03 billion	Ninth
Juventus	€421.48 million	€1.72 billion	Tenth
Arsenal	€411.00 million	€2.47 billion	Eleventh
Dortmund	€387.30 million	€1.67 billion	Twelfth
Everton	€224.57 million	€579.71 million ⁵	17 th

The clubs have been analyzed for the seasons 2017/18, 2018/19, and 2019/20. Except for Everton, all clubs have participated either in the UEFA Champions League or in the UEFA European League during the three analyzed seasons, allowing an accurate comparison between them, since all of them act under UEFA's FFP regulations. Everton only participated in the UEFA Europa League in the 2017/18 season, but is therefore also subject to FFP regulations, allowing for a comparison with the other clubs.

3.2 Multicriteria Decision Analysis

3.2.1 MCDA Methods

MCDA methods are useful and appropriate for measuring management and financial stability (Barajas et al., 2017; Stanujkic et al., 2013), establishing the best alternative on the same scenario (Ginevičius and Podvezko, 2013; Podvezko, 2011). The main result of MCDA is the integration of the values of different variables along with their proportional weights in a single magnitude (Podvezko, 2011). According to Zopounidis (1999), the MCDA is based on qualitative criteria, through ratios and weights, improving the

⁵ Original currency was US-dollar; Currency was converted at a rate of \$ / € = 0,88 (01.12.2021).

decision-making process by reducing subjectivity and solving financial problems in a realistic context. He states that MCDA is a “set of methods which allow the aggregation of several evaluation criteria in order to choose, rank, sort or describe a set of alternatives”. They provide tools to the decision maker that enable them to advance in solving a decision problem, where several, often conflicting multiple criteria must be taken into consideration (Zopounidis, 1999), describing major aspects of the analyzed industry (Ginevičius and Podvieszko, 2013); for the purpose of this thesis of the soccer industry. In general, the investment decision process consists of four main stages: perception, formulation, evaluation, and choice; with the financial theory, which analyzes short- and long-term decisions from an optimization perspective, that intervenes only in the stages of evaluation and choice. This makes it limited, because it remains within these two stages, and unrealistic, for the reason that it is only based on financial criteria.

MCDA on the other hand intervenes in the whole process of investment and decision-making, from the stages of perception and formulation, contributing to the identification of possible actions and to the definition of a set of potential actions, to the stages of evaluation and choice, offering a much more realistic methodological framework than the financial theory, by introducing both quantitative and qualitative criteria (Zopounidis, 1999). The main advantages that MCDA methods offer in financial management are the ability to structure complex valuation problems, the introduction of quantitative and qualitative criteria in the valuation process, and the transparency of the valuation that allows for a better argumentation in financial decisions (Zopounidis, 1999). Ginevičius and Podvieszko (2013) agree and add that the advantages become more and more evident wherever complexity in creating an objective is involved, thus considerably improving the risk-return modelling. Another advantage of the MCDA methods is that they do not only allow the use of a wide range of multidimensional criteria, but they also express the evaluation results in the clear form of ranking tables (Ginevičius and Podvieszko, 2013), allowing a fast and easy comparison between the entities. Furthermore, as stated by Barajas et al. (2017), the MCDA methods shall provide a “fast and efficient technique in decision-making”, that stakeholders in the soccer industry can use to evaluate the financial performance of soccer clubs, considering FFP by UEFA (2012) as well. There are several methods that can be used in MCDA, with the SAW, COPRAS, TOPSIS, and PROMETHEE methods being just a few of the many that can be used (Triantaphyllou and Sanchez, 1997; Zopounidis, 1999).

As stated by Ginevičius and Podvieszko (2013), there is no single best MCDA method, which guarantees precision of evaluation, with each method having its own specific features and logic. Therefore, discrepancies in the results of the evaluation obtained by each method may occur. Only the simultaneous use of several MCDA methods can

increase the reliability of the results (Ginevičius and Podvieszko, 2013). The four MCDA methods used by Barajas et al. (2017) in their research, which are the SAW, COPRAS, TOPSIS, and PROMETHEE II method, as well as the GRA approach used in Ecer and Boyukaslan's (2014) research, are used for evaluating the financial performance of the ten chosen European soccer clubs in this thesis. Based on the results of these methods, a classification of the units is established, with the average cumulative criteria for each club determined by each of the above methods forming the basis for the final ranking.

Literature suggests that the choice of ratios for calculating the MCDA methods is largely down to the discretion of individual researchers, rather than rigorously tested scientific protocols. It actually appears like that researchers opt for certain ratios or variables that fit best within the context of their research, the study, and the industry in which a business operates (Plumley et al., 2017; Wilson, 2017). Across a variety of industries, researchers have incorporated similar areas of financial performance in their ratio analyses, namely debt, liquidity, and profitability (Wilson, 2017). The ratios should be of limited number, which can be achieved, for example, by dividing the ratios into core categories, thus creating a hierarchy, and then filling each category with the best representative ratios, keeping in mind that the selected ratios should not be correlated or over-excessive (Ginevičius and Podvieszko, 2013). Zopounidis (1999) presents a methodology in his paper developed by Bernard Roy in 1985, which can help to decide on which criteria to use in MCDA. This methodology comprises four levels: Level 1: Object of the decision and spirit of recommendation or participation; Level 2: Analyzing consequences and developing criteria; Level 3: Modeling comprehensive preferences and operationally aggregating performances; and Level 4: Investigating and developing the recommendation. The ratios used for the chosen methods in this thesis have been taken from the research of Barajas et al. (2017), which are profit, stability, coverage, liquidity, and spending level ratios, as shown and explained in Table 2. After expressing the values of the chosen criteria in quantitative terms, the weights of criteria have to be determined as well. Next to the choice of ratios, determining their weights is also largely based on eliciting knowledge from the employed experts and researchers, who define quantitative criteria and determine their weights in relation to the goals of the evaluation (Ginevičius and Podvieszko, 2013). Therefore, the values have been weighted with their respective weights within each criterion (ω) as suggested by the research of Barajas et al. (2017) (Table 2). Every criterion must be defined as maximizing or minimizing. The maximum values of maximizing criteria are considered to be the best, while the minimum values are the best for minimizing criteria (Barajas et al., 2017; Ginevičius and Podvieszko, 2013). Ratios that are maximizers are marked with a (+) in Table 2 and ratios functioning as minimizers are marked with a (-).

Table 2: List of ratios used for the MCDA methods to evaluate the financial performance of soccer clubs.

Criterion	Code	Ratio	Explanation	Weight	Criterion weight (ω)
Profit	NP/OP (+)	Net profit / Operating profit	Supports the clubs to obtain a positive financial result	0,030	0,15
	OP/OR (+)	Operating profit / Operating revenues	Shows operating activities and the best operating result at a certain level of revenues	0,060	
	TOR/TA (+)	Total operating revenues / Total assets	Assists clubs that best manage their operating activity	0,060	
Stability	STD/TL (-)	Short-term debt / Total liabilities	Measures the weight of short-term debt regarding the total debt	0,100	0,30
	LTD/TL (-)	Long-term debt / Total liabilities	Estimates debt that clubs should meet long-term regarding total liabilities	0,100	
	WC/CA (+)	Working capital / Current assets	Computes the short-term solvency of a club	0,100	
Coverage	E/TL (+)	Equity / Total liabilities	Calculates the net guarantees of the club on the total amount of creditors	0,080	0,20
	NCA/TL (+)	Non-current assets / Total liabilities	The higher the non-current assets, the greater the guarantee against debt	0,080	
	TA/TD (+)	Total assets / Total debt	Indicates the level of dependency on third parties of the club	0,040	
Liquidity	CSTD/CL (+)	(Cash + short-term debt) / Current liabilities	Measures the ability of the club to meet their payments in a very short time and with highly liquid assets	0,050	0,05
Spending level	W/OR (-)	Wages / Operating revenues	Adjusts personnel costs by exclusively weighting it on operating revenues	0,150	0,30
	W/TR (-)	Wages / Total revenues	Weights staff costs based on revenues regarding total revenues	0,075	
	W/OE (-)	Wages / Operating expenses	Allows to obtain the proportion of operating expenditures that is intended to staff	0,075	

3.2.1.1 SAW Method

The Simple Additive Weighting (SAW) method is the oldest, best known and thus most commonly used MCDA method (Ginevičius and Podvezko, 2013; Hwang and Yoon, 1981; Simanaviciene and Ustinovichius, 2010), in which the researcher designates the weight for each criterion (Afshari et al., 2010; Barajas et al., 2017). The method is applied after the normalization of data (Formula 2 or 3) and transformation of values in case if there are negative ones (Formula 4). The evaluation of S_j is expressed in convenient relative values, making the unity in total $\sum_{j=1}^n S_j = 1$. The alternatives are ranked in the decreasing order in accordance with the value of the cumulative criterion of the method S_j (Afshari et al., 2010; Ginevičius and Podvezko, 2013; Goodridge, 2016). The final result of the method is derived from the sum of the product of the relative weights for the value of each criterion (Formula 1) (Barajas et al., 2017). The SAW method is expressed as the following:

$$S_j = \sum_{i=1}^m \omega_i r_{ij} \quad (1)$$

where S_j is the cumulative criterion; ω_i are the weights of the criteria; m is the number of the chosen criteria; r_{ij} are normalized values of the criteria; i - is the index for the criteria; and j - is the index for the alternatives (Podvezko and Podvezko, 2015). The normalization of criteria is carried out by the following formulas:

Normalization of maximizing criteria:

$$\tilde{r}_{ij} = \frac{r_{ij}}{\max_j r_{ij}} \quad (2)$$

Normalization of minimizing criteria:

$$\tilde{r}_{ij} = \frac{\min_j r_{ij}}{r_{ij}} \quad (3)$$

In the case that there are negative values present, both of the above-mentioned types of normalization require an a-priori transformation of negative values into positive ones (Formula 4). This can be carried out by the formula shown below:

$$\tilde{r}_{ij} = 1 + r_{ij} + \min_j r_{ij} \quad (4)$$

Barajas et al. (2017) write in their paper that, as an advantage of the SAW method, it is easy to use, hence its popularity. One limitation of this method though is its scarce

theoretical foundation. Another limitation pointed out by Podvezko (2011) is that all values of the criteria must be positive. A transformation of negative values into positive ones can also introduce distortions, as the result depends on the magnitude of the shift of the set values of the criteria (Podvezko and Podvezko, 2015).

3.2.1.2 COPRAS Method

The Complex Proportional Assessment (COPRAS) method was created by Zavadskas and Kaklauskas (1996) and can be applied to the evaluation of both maximizers and minimizers criteria without any prior processing (Barajas et al., 2017; Ginevičius and Podvezko, 2013; Podvezko, 2011). The cumulative criterion of this method has two components, with one of them, S_j^+ , being designed to comprise the maximizing criteria and, identical to the respective additive of the cumulative criterion, of the SAW method S_j (Formula 5). The cumulative criterion of the COPRAS method is expressed by the following formula:

$$Z_j = S_j^+ + \frac{S_{\min}^- \sum_{j=1}^n S_j^-}{S_j^- \sum_{j=1}^n \frac{S_{\min}^-}{S_j^-}} \quad (5)$$

with $S_j^+ = \sum_{i=1}^m \omega_i^+ r_{ij}^+$ representing the contribution of the j -th alternative's maximizing weighted values of the normalized criteria r_{ij}^+ . The contribution of minimizing criteria is represented by the other component, where $S_j^- = \sum_{i=1}^m \omega_i^- r_{ij}^-$, which is j -th alternative's weighted sum of minimizing values of the normalized criteria r_{ij}^- . The minimal value of all minimizing criteria is $S_{\min}^- = \min_j S_j^-$.

3.2.1.3 TOPSIS Method

The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method is considered the best solution when the distance with the best hypothetical solution V^+ is the shortest, while the distance from the worst hypothetical solution V^- is the longest (Formula 7, 8) (Barajas et al., 2017; Behzadian et al., 2012; Ginevičius and Podvezko, 2013; Pavić and Novoselac, 2013; Yue, 2014). This method does not require a transformation of minimizers' criteria to maximizers (Ginevičius and Podvezko, 2013; Ren et al., 2007). The normalization of criteria transforms a vector to the unit vector in the TOPSIS method by the following formula:

$$\tilde{r}_{ij} = \frac{r_{ij}}{\sqrt{\sum_{j=1}^n r_{ij}^2}} \quad (6)$$

where \tilde{r}_{ij} is the normalized value of the i -th criterion for the j -th alternative.

The distances of each i -th alternative to the best and worst hypothetical solution are calculated as shown below:

$$D_j^+ = \sqrt{\sum_{i=1}^m (\omega_i \tilde{r}_{ij} - V_i^+)^2} \quad (7)$$

$$D_j^- = \sqrt{\sum_{i=1}^m (\omega_i \tilde{r}_{ij} - V_i^-)^2} \quad (8)$$

The cumulative criterion C_j^+ ($0 \leq C_j^+ \leq 1$) of the TOPSIS method is calculated as follows:

$$C_j^+ = \frac{D_j^-}{D_j^+ + D_j^-} \quad (9)$$

The ranking is made in decreasing order, meaning the highest value corresponds to the best alternative, and the lowest value to the worst (Ginevičius and Podvezko, 2013; Ren et al., 2007).

3.2.1.4 PROMETHEE II Method

The Preference Ranking Organization Method for Enrichment of Evaluation (PROMETHEE) methods differ from other multicriteria methods by the depth of their intrinsic logic and by the use of the preference functions, which make a basis of the methods (Brans and Vincke, 1985; Ginevičius and Podvezko, 2013). They integrate the values of the selected criteria and their weights in a more sophisticated way by using preference functions with few parameters (Dachowski and Gałek, 2020; Ginevičius and Podvezko, 2013). While the PROMETHEE I method provides a partial preorder of the set alternatives, the PROMETHEE II method offers a total preorder, helping the decision-makers to finalize the decision-making process with the selection of the best solution and offering a clear view of relations between the alternatives (Barajas et al., 2017). In their paper, Barajas et al. (2017) cite Fernández (2011), who explains the advantages of the

PROMETHEE II method over other MCDA methods. These advantages are the ability to assess qualitative aspects of the alternatives through a proper function of preference, the fact it is simple and easy to understand for the decision maker, and that the information about each alternative and the evaluation criteria considered are limited to the alternatives considered, without additional parametric information (Fernández, 2011, cited in Barajas et al., 2017, p. 153). The PROMETHEE methods use the preference functions' $p(d)$ values instead of normalized values of the criteria \tilde{r}_{ij} (Formula 10). The values of the functions account for the level of preference of one alternative over another, thus ensuring clear advantages of the method over other MCDA approaches. The need for transforming the minimizing criteria into maximizing ones and the negative values of the criteria into the positive ones is eliminated (Barajas et al., 2014; Dachowski and Gałek, 2020; Ginevičius and Podvieszko, 2013). The preference function of the PROMETHEE II is expressed as the following:

$$p_i(d) = \begin{cases} 0, & \text{when } d_i \leq p_i \\ \frac{d_i - q_i}{s_i - q_i}, & \text{when } q_i < d_i \leq s_i \\ 1, & \text{when } d_i \geq s_i \end{cases} \quad (10)$$

The preference function ranges in the interval $0 < p(d) < 1$. q and s display the boundary parameters for each criterion i , chosen by decision-makers, with q_i chosen for the lower and s_i for the upper boundary, for example. The PROMETHEE II method yields the cumulative criterion of evaluation F_j and ranges the alternatives in the decreasing order in respect of the values F_j (Ginevičius and Podvieszko, 2013).

3.2.2 Results

Taking the financial statements of the ten soccer clubs analyzed (Barcelona, Real Madrid, Manchester United, Liverpool, Manchester City, Tottenham Hotspur, Juventus, Arsenal, Dortmund, and Everton) as a basis for calculation, the tables of the financial ratios for the seasons 2017/18, 2018/19, and 2019/20, showing the decision matrices for calculation⁶, including the financial position among the clubs according to the results of the SAW, COPRAS, TOPSIS, and PROMETHEE II method, are presented below (Table 3.1, 3.2, 3.3).

⁶ Figures taken from the clubs' financial statements.

Table 3.1: Financial ratios and results of the MCDA methods of ten of the largest soccer clubs in Europe, depending on their revenue (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	40,38%	69,59%	-77,31%	1457,49%	-47,10%	134,44%	-4,06%	-134,62%	78,90%	13,36%
OP/OP (+)	3,23%	5,99%	7,44%	1,60%	-4,43%	22,07%	-0,30%	-10,42%	6,73%	-51,81%
TOR/TA (+)	67,67%	73,88%	38,14%	68,30%	41,73%	29,28%	69,97%	39,49%	112,88%	49,44%
STD/TL (-)	67,18%	42,31%	30,04%	50,26%	28,88%	21,73%	40,47%	23,90%	24,88%	52,81%
LTD/TL (-)	20,21%	12,28%	42,46%	18,49%	9,24%	52,48%	50,21%	35,30%	4,81%	14,95%
WC/CA (+)	-189,40%	-29,90%	-12,35%	-56,44%	-13,67%	-66,39%	-89,26%	46,32%	12,74%	-59,20%
E/TL (+)	12,62%	45,41%	27,50%	31,25%	61,88%	25,79%	9,32%	40,80%	70,31%	32,24%
NCA/TL (+)	76,79%	67,45%	73,26%	67,88%	74,59%	86,94%	78,43%	30,12%	71,48%	66,83%
TA/TD (+)	114,44%	183,18%	137,93%	145,46%	262,31%	134,76%	110,28%	168,94%	336,79%	147,59%
CSTD/CL (+)	105,91%	141,26%	152,10%	103,08%	107,99%	135,65%	105,34%	194,07%	149,96%	104,69%
W/OR (-)	-76,94%	-57,58%	-50,18%	-57,93%	-51,88%	-38,77%	-49,26%	-59,53%	-34,83%	-76,91%
W/TR (-)	-59,99%	-53,54%	-47,97%	-57,93%	-51,57%	-38,77%	-64,23%	-59,07%	-34,58%	-76,91%
W/OE (-)	59,60%	56,49%	52,47%	58,87%	49,39%	49,75%	60,88%	53,91%	37,06%	50,66%
S _j	131,90%	104,04%	156,67%	121,17%	96,34%	176,55%	185,64%	140,66%	80,93%	112,87%
Z _j	9,54%	7,57%	5,21%	11,05%	11,27%	2,64%	8,43%	9,25%	11,28%	23,76%
C _j	62,87%	42,33%	38,00%	43,68%	44,05%	40,51%	48,85%	39,27%	36,45%	64,07%
F _j	-9,13%	6,10%	-4,68%	-1,37%	9,99%	-10,87%	-16,12%	3,37%	19,13%	3,59%

Table 3.2: Financial ratios and results of the MCDA methods of ten of the largest soccer clubs in Europe, depending on their revenue (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	25,81%	70,73%	21,80%	5837,76%	-45,52%	67,44%	-6,79%	82,94%	74,00%	87,85%
OP/OP (+)	3,82%	7,17%	7,97%	0,12%	-4,14%	22,07%	-2,61%	-8,25%	5,19%	-67,82%
TOR/TA (+)	61,67%	75,18%	41,91%	71,59%	45,52%	27,19%	65,99%	42,51%	92,16%	47,21%
STD/TL (-)	50,56%	41,53%	28,66%	48,95%	28,67%	23,69%	41,47%	26,71%	25,07%	41,97%
LTD/TL (-)	39,68%	11,67%	43,60%	17,71%	7,32%	52,49%	55,21%	30,68%	3,96%	17,58%
WC/CA (+)	-70,64%	-14,58%	-10,44%	-100,77%	-3,00%	-157,71%	-117,86%	2,10%	2,31%	-48,08%
E/TL (+)	9,76%	46,80%	27,74%	33,34%	64,01%	23,82%	3,32%	42,61%	70,97%	40,45%
NCA/TL (+)	70,37%	63,76%	74,05%	75,62%	72,16%	90,81%	79,76%	72,71%	74,33%	71,66%
TA/TD (+)	110,81%	187,97%	138,40%	150,01%	277,85%	131,28%	103,43%	174,23%	344,52%	167,94%
CSTD/CL (+)	123,05%	132,94%	171,74%	110,30%	138,31%	130,76%	102,71%	167,78%	144,55%	116,44%
W/OR (-)	-64,54%	-52,21%	-52,99%	-58,14%	-58,91%	-38,77%	-51,30%	-59,39%	-45,26%	-87,79%
W/TR (-)	-54,64%	-46,06%	-50,90%	-58,14%	-58,58%	-38,77%	-48,49%	-59,01%	-44,50%	-87,79%
W/OE (-)	55,60%	49,09%	55,12%	58,21%	56,26%	49,74%	65,73%	54,86%	46,89%	52,31%
S _j	176,09%	105,01%	178,16%	127,96%	96,63%	202,16%	220,34%	146,36%	79,63%	122,31%
Z _j	7,07%	8,23%	6,33%	12,49%	10,28%	7,07%	8,93%	9,40%	11,12%	19,09%
C _j	44,35%	37,34%	34,28%	45,61%	40,99%	46,50%	48,06%	38,61%	36,73%	65,18%
F _j	-13,20%	3,97%	-1,29%	-3,05%	11,80%	-14,07%	-23,54%	12,44%	22,35%	4,59%

Table 3.3: Financial ratios and results of the MCDA methods of ten of the largest soccer clubs in Europe, depending on their revenue (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	97,54%	78,64%	-387,93%	56,16%	78,97%	160,23%	-16,34%	48,28%	101,89%	79,82%
OP/OP (+)	-11,70%	0,06%	1,03%	-143,40%	-33,36%	-10,18%	-12,22%	-28,72%	-10,51%	-94,27%
TOR/TA (+)	48,15%	56,91%	36,79%	65,40%	43,80%	20,92%	48,72%	36,83%	81,00%	49,56%
STD/TL (-)	65,83%	33,41%	28,79%	42,01%	34,81%	29,46%	36,96%	25,18%	23,67%	66,73%
LTD/TL (-)	31,78%	29,43%	45,82%	30,11%	7,83%	52,40%	42,72%	40,97%	17,36%	14,36%
WC/CA (+)	-163,31%	-30,51%	-77,19%	-30,06%	-51,73%	-95,59%	-56,24%	-11,67%	-60,25%	-99,19%
E/TL (+)	2,39%	37,16%	25,39%	27,88%	57,36%	18,14%	20,32%	36,85%	58,97%	18,91%
NCA/TL (+)	75,00%	74,40%	83,75%	67,70%	77,06%	84,94%	77,33%	32,35%	85,23%	66,50%
TA/TD (+)	102,45%	159,14%	134,03%	138,65%	234,51%	122,16%	125,51%	158,35%	243,73%	123,32%
CSTD/CL (+)	116,72%	128,17%	112,94%	147,49%	104,66%	140,99%	101,47%	146,64%	102,71%	122,54%
W/OR (-)	-56,97%	-59,35%	-55,80%	-66,46%	-73,46%	-46,26%	-47,24%	-67,98%	-52,43%	-86,07%
W/TR (-)	-68,78%	-50,37%	-53,85%	-66,46%	-72,97%	-46,26%	-45,22%	-67,98%	-51,28%	-86,07%
W/OE (-)	50,72%	50,23%	54,39%	58,13%	54,81%	41,99%	62,61%	52,87%	46,50%	44,30%

S _j	130,15%	112,08%	133,00%	122,65%	92,69%	140,27%	133,88%	122,06%	103,16%	107,67%
Z _j	10,15%	10,02%	4,96%	11,38%	11,38%	10,96%	8,59%	8,66%	13,20%	10,69%
C _j	51,97%	31,46%	44,13%	46,88%	42,33%	40,92%	35,22%	36,28%	36,21%	56,99%
F _j	-16,42%	6,03%	-8,61%	1,68%	17,65%	-10,38%	-17,03%	8,10%	15,70%	3,28%

In the following, resulting from the outcomes of the application of the four MCDA methods used for this research on the clubs presented above for the seasons 2017/18, 2018/19, and 2019/20, rankings classifying the selected clubs according to the MCDA methods for the analyzed periods are shown below (Table 4.1, 4.2, 4.3).

Table 4.1: Classification of selected clubs according to the MCDA methods for the season 2017/18.

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Method										
SAW S _j	5	8	3	6	9	2	1	4	10	7
COPRAS Z _j	5	8	9	4	3	10	7	6	2	1
TOPSIS C _j	2	6	9	5	4	7	3	8	10	1
PROMETHEE II F _j	8	3	7	6	2	9	10	5	1	4
Cumulative classification	20	25	28	21	18	28	21	23	23	13
Classification 2017/18	3	8	9_10	4_5	2	9_10	4_5	6_7	6_7	1

Table 4.2: Classification of selected clubs according to the MCDA methods for the season 2018/19.

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Method										
SAW S _j	4	8	3	6	9	2	1	5	10	7
COPRAS Z _j	9	7	10	2	4	8	6	5	3	1
TOPSIS C _j	5	8	10	4	6	3	2	7	9	1
PROMETHEE II F _j	8	5	6	7	3	9	10	2	1	4
Cumulative classification	26	28	29	19	22	22	19	19	23	13
Classification 2017/18	8	9	10	2_4	5_6	5_6	2_4	2_4	7	1

Table 4.3: Classification of selected clubs according to the MCDA methods for the season 2019/20.

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Method										
SAW S _j	4	7	3	5	10	1	2	6	9	8
COPRAS Z _j	6	7	10	3	2	4	9	8	1	5
TOPSIS C _j	2	10	4	3	5	6	9	7	8	1
PROMETHEE II F _j	9	4	7	6	1	8	10	3	2	5
Cumulative classification	21	28	24	17	18	19	30	24	20	19
Classification 2017/18	6	9	7_8	1	2	3_4	10	7_8	5	3_4

The results show that for the season 2017/18, Everton performed best, with Manchester City in second place and Barcelona in third place. The worst performing clubs were Manchester United and Tottenham, sharing the last place. In the 2018/19 season, Everton still performed best, with Arsenal, Juventus, and Liverpool sharing the second place and Manchester United coming last again. For the season 2019/20, Liverpool came in first

place, Manchester City came in second, and Tottenham and Everton shared third place. The worst performing club in that season was Juventus. The results from the ratio analyses show that there was an improvement in the financial situation for most clubs, consistent with a continuous improvement in European soccer over the last decade (Deloitte, 2021). Only in the season 2019/20 there was a decrease in the financial performance of all clubs, which is likely due to the Covid-19 pandemic causing a suspension of play in all leagues of the analyzed clubs, with wage cuts and missing revenues from match days, that continued to be missing after they were allowed to play again, but without spectators for almost one more year. As the classification of the selected clubs according to the MCDA methods for the seasons 2017/18 (Table 4.1), 2018/19 (Table 4.2), and 2019/20 (Table 4.3) show, the only clubs improving their position year over year within the analyzed period compared to the other clubs were Liverpool (from fourth to second to first) and Tottenham (from ninth to fifth to third). Clubs performing consistently (within the range of three places in the ranking) were Everton (rank one to three), Dortmund (rank five to seven), and Real Madrid (rank eight to nine). The biggest decrease in the financial performance in the 2019/20 season compared to the other clubs analyzed took Juventus, from second place in 2018/19 to last place in 2019/20, followed by Arsenal, also from second place in 2018/19 to seventh in 2019/20.

3.3 The Grey Relational Analysis Approach

The GRA approach presented in the paper by Ecer and Boyukaslan (2014) is based on ranking alternatives as to their relation grade. This method can be used in decision-making by ordering the criteria according to their relation grade when there are many criteria, especially used when samples are small and when the sample distribution is not known. It was first introduced by Ju-Long (1982), who called the two elements in a specific system or the similarities or differences between two sub-systems “grey relation”. The term “grey” here either means a lack of information or not being known at all, with the GRA benefiting from measuring the development in the changes of similarities and differences between the elements (Ecer and Boyukaslan, 2014; Ju-Long, 1982). The GRA method allows the determination of the level of the relation between each factor that occurs in a grey system and the compared factor series. One of the purposes of this method is the separation of important variables in groups between themselves by recognizing unimportant ones among various variables, allowing variables in one group to become related to each other and thus can be separated from other groups.

In the first step, a decision matrix must be constructed:

$$X_i = \begin{bmatrix} x_1(1) & x_1(2) & \cdots & x_1(n) \\ x_2(1) & x_2(2) & \cdots & x_2(n) \\ \vdots & \vdots & \ddots & \vdots \\ x_n(1) & x_n(2) & \cdots & x_n(n) \end{bmatrix} \quad (11)$$

In step two, the referential series of $x_0 = (x_0(1), x_0(2), \dots, x_0(j), \dots, x_0(n))$ with j entities must be generated, and x_i as the compared series of $x_i = (x_i(1), x_i(2), \dots, x_i(j), \dots, x_i(n))$, where $i = 1, 2, \dots, m$.

In the third step, the data sets have to be normalized. The data can be treated as one of three types: larger-is-better (Formula 12), smaller-is-better (Formula 13), and nominal-is-better (Formula 14) (Ecer and Boyukaslan, 2014). For larger-is-better transformations, $x_i(j)$ can be transformed to $x_i^+(j)$. The formula is defined as:

$$x_i^+ = \frac{x_i(j) - \min_j x_i(j)}{\max_j x_i(j) - \min_j x_i(j)} \quad (12)$$

where $\max_j x_i(j)$ is the maximum value and $\min_j x_i(j)$ the minimum value of entity j .

For smaller-is-better, the formula to transform $x_i(j)$ to $x_i^-(j)$ is:

$$x_i^- = \frac{\max_j x_i(j) - x_i(j)}{\max_j x_i(j) - \min_j x_i(j)} \quad (13)$$

For nominal-is-best, if the target value is $x_{0b}(j)$ and $\max_j x_i(j) \geq x_{0b}(j) \geq \min_j x_i(j)$, then the formula is the following:

$$x_i^* = \frac{|x_i(j) - x_{0b}(j)|}{\max_j x_i(j) - x_{0b}(j)} \quad (14)$$

After these operations, the decision matrix becomes as shown below:

$$X_i = \begin{bmatrix} x_1^*(1) & x_1^*(2) & \cdots & x_1^*(n) \\ x_2^*(1) & x_2^*(2) & \cdots & x_2^*(n) \\ \vdots & \vdots & \ddots & \vdots \\ x_n^*(1) & x_n^*(2) & \cdots & x_n^*(n) \end{bmatrix} \quad (15)$$

After normalizing the data, the distance of $\Delta(j)$, which is the absolute value of the difference between x_0^* and x_i^* at the j -th point, must be computed. The formula is:

$$\Delta_{0i}(j) = |x_0^*(j) - x_i^*(j)| = \begin{bmatrix} \Delta_{01}(1) & \Delta_{01}(2) & \cdots & \Delta_{01}(n) \\ \Delta_{02}(1) & \Delta_{02}(2) & \cdots & \Delta_{02}(n) \\ \vdots & \vdots & \ddots & \vdots \\ \Delta_{0m}(1) & \Delta_{0m}(2) & \cdots & \Delta_{0m}(n) \end{bmatrix} \quad (16)$$

In step five, the grey relational equation is applied to the computed grey relational coefficient $\gamma_{0i}(j)$ using the following equation:

$$\gamma_{0i}(j) = \frac{\Delta_{min} + \xi \Delta_{max}}{\Delta_{0i}(j) + \xi \Delta_{max}} \quad (17)$$

where $\Delta_{max} = \max_i \max_j \Delta_{0i}(j)$, $\Delta_{min} = \min_i \min_j \Delta_{0i}(j)$, and $\xi \in [0,1]$.

In step six, the degree of the grey coefficient Γ_{0i} is computed. If the weights (ω_i) of criteria are equally distributed, the degree of the grey coefficient Γ_{0i} is computed as:

$$\Gamma_{0i} = \frac{1}{n} \sum_{j=1}^n \gamma_{0i}(j) \quad (18)$$

If the weights (ω_i) of criteria are differently distributed, the degree of the grey coefficient Γ_{0i} is computed as:

$$\Gamma_{0i} = \frac{1}{n} \sum_{j=1}^n [\omega_i(j) \gamma_{0i}(j)] \quad (19)$$

For decision-making processes, if any alternative has the highest Γ_{0i} value, then it is the most important one. Therefore, priorities of preferences can be ranked in accordance with Γ_{0i} values (Ecer and Boyukaslan, 2014).

Table 5.1: Results of the GRA method for the season 2017/18.

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Γ	4,17%	4,21%	3,94%	3,99%	4,565%	4,16%	3,60%	4,51%	5,59%	4,567%
Rank	6	5	9	8	3	7	10	4	1	2

Table 5.2: Results of the GRA method for the season 2018/19.

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Γ	3,49%	4,32%	4,20%	3,81%	4,77%	4,16%	3,18%	4,49%	5,73%	4,67%
Rank	9	5	6	8	2	7	10	4	1	3

Table 5.3: Results of the GRA method for the season 2019/20.

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Γ	3,70%	4,58%	4,13%	4,32%	5,25%	4,44%	3,77%	4,73%	5,54%	4,93%
Rank	10	5	8	7	2	6	9	4	1	3

The results show that Dortmund performed best in each analyzed season, with Manchester City and Everton in second and third place. In the seasons 2017/18 and 2018/19, Juventus performed the worst, while Barcelona ranked last in the 2019/20 season. The results also present similar performances for most clubs over all three analyzed seasons. Only Barcelona shows a steady decrease in their financial performance over the analyzed period.

3.4 The Performance Assessment Model

Plumley et al. (2017) devised and tested the PAM as a robust statistical model in their paper to conduct data analysis over longitudinal time periods and measure both, the financial and sporting performance of professional soccer clubs. It has been developed using recognized statistical techniques to minimize covariance, and it can be used as an analytical tool to check for performance health makers to detect where clubs may be considered at risk. The PAM model can also be used to quantify club objectives, help analysts to find out how clubs are performing based on economic principles, as well as governing bodies and decision makers within the sport industry and the respective sports to inform policy and set new regulations. The PAM outlines a composite index score that presents a club's performance in relation to its competitors. Plumley et al. (2017) applied the model to a set of 21 clubs from the EPL between 1992-2013 to identify trends in performance. The original model, namely neutral model, was made up of 18 different variables, nine financial and nine sporting, with equal weights applied to each variable. It takes its origins from the FOrNeX model (Andrikopolous and Kaimenakis, 2009), which outlines an approach to model the intellectual capital of a soccer club. For both dimensions of performance, financial and sporting, a weight is assigned which sums up to 1. The performance of the soccer club analyzed is displayed as the weighted average of both of these performances.

Within those two dimensions of performance, Plumley et al. (2017) used a number of indicators. As of the financial indicators, they were finalized through a discussion with several experts in the field and through a cross-reference of Deloitte's suggested key performance indicators (KPI) for a soccer club. For the sporting performance indicators,

they devised measures accurately describing how on-field success/failure can be captured in a series of indicators that are logical, and for which the raw data is publicly available. All indicators are weighted and sum up to 1, so that each club has a dimension score for each subdomain, for which they used a hypothetical league rank column, that is then used to calculate the OPS for each club. A lower OPS is more desirable, with the perfect score for each indicator being 1. The league rank for each subdomain is derived from how well a club is performing in comparison to the other clubs on the examined indicator. For each subdomain, the league rank will range from 1 (best performance) to n (worst performance), with n being categorized by how many teams are analyzed, which are ten in this thesis. After their first tests, the authors restated the PAM model to get more reliable results, for which they used a justified weighting system that considers the different measures in the model as well as current regulations in the industry, and for which they reduced the amount of financial and sporting variables, since some of them showed a strong correlation with other variables. Eventually, their final model consisted of five financial and three sporting variables.

To allow a better comparison between the different MCDA methods and the PAM model, the financial indicators used for analyzing the ten clubs for the seasons 2017/18, 2018/19, and 2019/20 with the help of the MCDA methods are being used for calculating the PAM model as well instead of the indicators used by Plumley et al. (2017), including their weights. For the sporting indicators, the three indicators used by Plumley et al. (2017) will be used, including their set weights, which are league points (the amount of points a club acquires through sporting performance in a given season), total game variance (the difference between the fixed number of games a club is guaranteed to play versus the actual number they played (including all league games and domestic and international cup competitions)), and attendance spread (the difference between the highest and lowest match attendances at home expressed as an absolute figure). While league points and total game variance are maximizing criteria, attendance spread is a minimizing criterion. The total weights are relative to the number of indicators in each dimension, resulting in 0,8125 for the financial indicators and 0,1875 for the sporting indicators. All indicators used for the final model for this analysis are shown below in Table 6.

Table 6: List of financial and sporting indicators used in the PAM model to evaluate the overall performance of soccer clubs.

Dimension	Criterion/Indicator	Weights	Total Weights
Financial Indicators	NP/OP (+)	0,030	0,8125
	OP/OR (+)	0,060	
	TOR/TA (+)	0,060	
	STD/TL (-)	0,100	
	LTD/TL (-)	0,100	
	WC/CA (+)	0,100	
	E/TL (+)	0,080	
	NCA/TL (+)	0,080	
	TA/TD (+)	0,040	
	CSTD/CL (+)	0,050	
	W/OR (-)	0,150	
	W/TR (-)	0,075	
W/OE (-)	0,075		
Sporting Indicators ⁷	League Points	0,333	0,1875
	Total Game Variance	0,333	
	Attendance Spread ⁸	0,333	

In order to get an OPS, every club must be ranked against each other for each criterion, allowing a rank within the league rank system among the clubs. The position each club receives for a criterion will then be multiplied with the corresponding weight of that criterion to get a score, allowing the calculation of the OPS (Table 7.1, 7.2, 7.3).

Table 7.1: OPS for all analyzed clubs for the season 2017/18.

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Financial Performance Score	7,795	4,980	5,070	6,410	4,200	4,585	6,845	5,825	1,980	7,310
Sporting Performance Score	3,663	4,662	4,662	4,662	2,664	7,659	2,997	6,993	7,659	9,324
OPS	7,0203	4,9204	4,9935	6,0823	3,9120	5,1614	6,1235	6,0440	3,0448	7,6876
Rank	9	3	4	7	2	5	8	6	1	10

Table 7.2: OPS for all analyzed clubs for the season 2018/19.

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Financial Performance Score	7,685	4,335	5,365	6,280	5,450	4,630	6,790	5,520	1,935	7,010
Sporting Performance Score	4,662	6,660	6,993	3,996	3,330	6,327	4,662	5,328	4,995	7,992
OPS	7,1182	4,7709	5,6703	5,8518	5,0525	4,9482	6,3910	5,4840	2,5088	7,1941
Rank	9	2	6	7	4	3	8	5	1	10

⁷ The data for the sporting indicators has been taken from wikipedia.com.

⁸ The data for the attendance spread, including highest and lowest attendance on home match days, has been taken from wikipedia.com and footballwebpages.co.uk.

Table 7.3: OPS for all analyzed clubs for the season 2019/20.

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Financial Performance Score	6,955	4,225	5,610	5,895	5,815	4,775	5,715	5,695	2,985	7,330
Sporting Performance Score	7,326	5,994	4,995	4,662	4,329	7,326	2,997	5,328	5,661	5,994
OPS	7,0246	4,5567	5,4947	5,6638	5,5364	5,2533	5,2054	5,6262	3,4868	7,0795
Rank	9	2	5	8	6	4	3	7	1	10

The results show that Dortmund is the best performing team considering both financial and sporting performance in every analyzed season. This is due to their outstanding financial performance, being almost twice as good as the second-best performing club in every season. Real Madrid is also very consistent at the top, coming in third place in the 2017/18 season and second in the seasons 2018/19 and 2019/20, with a healthy balance between financial and sporting performance. On the other half of the table, Everton finished last in every season, closely followed by Barcelona, both with one of the worst financial performances among the analyzed clubs. While Barcelona still performed worse financially in the 2017/18 and 2018/19 seasons than Everton, Everton recorded the worst sporting performance in that years, consistent with their poor positioning in the league table and consequently their absence in European cup competitions most of the time. Liverpool also shows very consistent results, with one of the best sporting performances throughout the three seasons, but still placing in seventh and eighth place due to their financial performances.

3.5 The Correlation between Sporting and Financial Performance in Soccer

Since there are two types of performance in soccer, sporting (on-field) and financial (off-field) performance, there remains the question in how far they are correlated to each other. In the literature there is a partial recognition that they may be linked (Cornwell et al., 2001; Plumley et al., 2017; Sloane, 2015; Szymanski and Kuypers, 1999; Wilson, 2017), but the outputs are mixed. As these authors highlight, there remains a pragmatic problem with the debate surrounding which one is cause and effect (Wilson, 2017). Plumley et al. (2017) agree and state that profit and utility maximization ultimately represent motivations, and that there is not a unique relationship between motivation and outcome, since a poor financial performance not necessarily implies utility maximization (Plumley et al., 2017). Soccer clubs share the same imperative concerning the need to pay wages to invest in the development of player talents in order to achieve winning performances that not only satisfy shareholders and investors, but also to keep the sport attractive and the people interested and willing to pay for its product (Chadwick, 2009; Kuypers and

Szymanski, 1999; Plumley et al., 2017). Smith and Steward (2010) argue that success in team sports therefore is a function of a strong stream of revenue, primarily because teams have to pay the best wages to secure the best playing talents. In the FC Bayern Munich documentation "Behind the Legend" (2021), the financial director of Bayern Munich, Jan-Christian Dreesen, also said that "titles are not won via the cost side, but via the revenue side" (Dreesen, 2021, Behind the Legend, episode 6). As such, irrespective of what owners actually want to do, they must balance the financial and sporting objectives of the club accordingly in order to maximize playing success (Wilson and Plumley, 2018). In the case of Chelsea after they were purchased by Abramovich in 2003, in the light of the subjectivity surrounding profit and utility maximization, when they moved toward the win maximizing end of the continuum (Wilson, 2017), the data does depict a trade-off between financial and sporting performance when the owner was attempting to strengthen playing talents to drive success on the pitch (Plumley et al., 2017). Similar evidence can be found in the case of Manchester City after they were purchased by Abu Dhabi's Sheikh Mansour bin Zayed Al Nahyan in 2008.

Kuypers and Szymanski (1999) though found little evidence of a significant relationship between changes in profit and changes in the league's table position after analyzing 40 soccer clubs between 1978-1997. Kuper and Szymanski (2018) also analyzed the correlation between changing league position and changing profits of EPL teams between 1993-2012, finding no significant correlation between the two factors. They argue that it is not the way that winning matches can help a club make profit, but rather the other way around: if a club finds new revenues, that can help them win matches. Sakinç et al. (2017) also tested the relationship between sporting success and financial performance based on the data of 22 European soccer clubs listed on stock exchange markets for the period of 2005-2014. They used the Spearman's rank coefficient, finding a weak but positive correlation. The coefficient was so low though that they could not conclude that there is a positive and statistically significant correlation between sporting and financial performance. Plumley et al. (2017) also found a weak, but statistically significant, positive correlation between sporting and financial performance after analyzing 22 EPL clubs between 1992-2013. Although some literature suggests that there should be a negative correlation between sporting and financial performance of a soccer club, since more money must be invested to secure the best playing talents and with them success on the pitch (Barajas et al., 2014; Cornwell et al., 2001; Wilson, 2017), and since sporting performance can have an impact on the financial performance of a soccer club as found by Kuypers and Szymanski (1999), Plumley et al. (2017), and Smith and Steward (2010), the hypothesis is that, based on the statistical findings by Kuypers and Szymanski (1999), Plumley et al. (2017), and Sakinç et al. (2017), there is a positive correlation

between the financial and sporting performance of a soccer club. In order to test this hypothesis, the correlation of the sporting performance resulting from the PAM method as well as the financial performance resulting not only from the PAM, but also from the other tested methods will be statistically derived in the following, using the Spearman's Rank Correlation Test, which measures the correlation between two non-linear variables, in this case between sporting and financial performance.

The Spearman's correlation coefficient r_s (Formula 20), which is used to assess how well the relationship between two variables can be described using a monotonic function, is calculated with the following formula:

$$r_s = \rho_{R(X),R(Y)} = \frac{cov(R(X),R(Y))}{\sigma_{R(X)}\sigma_{R(Y)}} \quad (20)$$

where ρ denotes the Pearson correlation coefficient, applied to the rank variables $R(X)$ and $R(Y)$; $cov(R(X),R(Y))$ is the covariance of the rank variables; and $\sigma_{R(X)}$ and $\sigma_{R(Y)}$ are the standard deviations of the rank variables.

Squaring r_s allows the calculation of the coefficient of determination R^2 , which explains how much of the variability in sporting performance can be explained by the variability in financial performance and vice versa. To evaluate the probability of receiving results that support the alternative hypothesis of a positive correlation between sporting and financial performance while assuming that the null hypothesis is true, which is that there is no correlation between the variables, the p-value (Formula 21) is used. It is the probability of obtaining results at least as extreme as the observed results of a statistical hypothesis test, assuming that the null hypothesis is correct (Investopedia, 2021b). With a significance level of $\alpha = 0,05$ (or 5%), which is the probability of rejecting the null hypothesis when it is true, a p-value of $p \geq 0,05$ indicates that the null hypothesis cannot be rejected, while a p-value of $p < 0,05$ means that the null hypothesis can be rejected and that there is evidence for the alternative hypothesis, which is that there is a positive correlation between sporting and financial performance. Calculating the p-value from a Z-statistic, it is expressed as the following formula:

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} \quad (21)$$

with \hat{p} being the sample proportion; p_0 being the assumed population proportion in the null hypothesis; and n being the sample size. In order to find the corresponding level of p from the z-value obtained, the z-table has to be examined.

To evaluate whether there is a correlation between sporting and financial performance, the Spearman's Rank Correlation Test, the coefficient of determination, and the p-value have to be determined for all the methods used for evaluating the financial and sporting performance for the analyzed clubs during the analyzed period. While for the PAM method there already is a financial performance score next to the sporting one, such a financial performance score has been determined for the other MCDA methods as well, by multiplying the financial results with the total weight of financial performance of 0,8125, receiving a score that can be compared to the sporting score already determined for the PAM method. The results when using the average scores from all analyzed seasons for all the methods used are shown below in Table 8.

Table 8: Results of the Spearman's Rank Correlation Test and Regression Analysis for all methods used (2017-2020).

Method	Spearman's correlation coefficient (r_s)	Coefficient of determination (R^2)	Probability value (p-value)
SAW	-0,1437	0,0206	0,3460
COPRAS	0,3124	0,0976	0,1896
TOPSIS	0,2939	0,0864	0,2049
PROMETHEE II	0,1830	0,0335	0,3064
GRA	0,3972	0,1579	0,1278
PAM	-0,0775	0,0060	0,4158

The results of Spearman's correlation coefficient show that for the COPRAS, TOPSIS, PROMETHEE II, and GRA method, there is a weak, but positive correlation between the average sporting and financial performance score for all analyzed seasons. According to the results of the SAW and PAM methods, there is a weak, but negative correlation between the variables. Since for the PAM method r_s is between 0 and -0,1, though, it is not statistically significant, meaning that it is so small that no correlation can be concluded. The results of the coefficient of determination show that with the PAM method, only 0,6% of the change in sporting performance can be explained by the change in financial performance, while with the GRA method, 15.79% of the change in sporting performance can be explained by the change in financial performance. The GRA method has the largest coefficient of determination out of the analyzed methods, but it is still not large enough to conclude that there is a significant correlation. For that reason, the p-value has been determined by performing a one-tailed analysis. Since the p-value of all methods is larger than 0,05, the null hypothesis cannot be rejected with a significance level of $\alpha = 0,05$, meaning that there is no statistically significant correlation between sporting and financial performance. Looking at the financial and sporting results of all

used methods⁹, it can be seen that for no method a decreasing financial score automatically indicates either a decreasing or increasing sporting score and vice versa, supporting the findings that there is no statistically significant correlation between the variables.

Taking into consideration the findings of Kuper and Szymanski (2018) and the expertise of Dreesen (2021), it has been assumed that sporting performance is the response or outcome variable, therefore the cause, while financial performance is the explanatory or predictor variable, meaning the effect. This, however, cannot be statistically derived, as already described by other authors, since there is no statistically significant correlation, for which one can be the predictor value of the other. This supports Plumley et al.'s (2018) assumption, that profit and utility maximization ultimately represent motivations, and that there is not a unique relationship between motivation and outcome. The absence of a statistically significant correlation between sporting and financial performance may as well explain the problematic surrounding the debate which of these factors is cause and which is effect. If there is no correlation, neither one of them is the cause nor effect of the other one. In this case, it can no longer be assumed that sporting performance is the cause and financial performance the effect.

4 Discussion

4.1 Summary and Interpretation of Results

In order to answer the research question “how to evaluate the financial performance of soccer clubs”, six different methods have been analyzed: five MCDA methods, which are the SAW, COPRAS, TOPSIS, PROMETHEE II, and GRA method; and the PAM method. Furthermore, the correlation between financial and sporting performance has been examined. In this chapter, the results of all used methods are being summarized and interpreted, taking into consideration the specific industry in which soccer operates, the business of soccer, as well as accounting standards and UEFA standing orders. Also, limitations of the research and methods used as well as their impact on the results of this thesis are being discussed. In the end, recommendations for further research are being proposed based on the results and limitations of this thesis.

To evaluate the financial performance of soccer clubs, using univariate ratio analysis is not sufficient, since they only focus on a very limited number of ratios at a specific moment in time and depend on the assumption that there are linear relationships between the analyzed variables (Ecer and Boyukaslan, 2014; Guzmán and Morrow, 2007). When

⁹ Calculations and results can be seen in the appendix.

analyzing a soccer club, multiple variables and indicators have to be taken into consideration. This is because of the specific nature of the soccer industry, where profit is not the common objective, revenues are mainly being earned through broadcasting rights and spent on wages for sporting staff, and clubs often being leveraged by high amounts of debt (Barajas et al., 2017; Kuper and Szymanski, 2018; Wilson, 2017). If univariate ratio analysis is used that only takes liquidity indicators into consideration, for example, spending level or profitability indicators would be ignored, which can influence the overall financial performance of a club to the better or worse. Therefore, MCDA methods have been developed, which have new and more flexible structures and take multiple criteria into consideration (Barajas et al., 2017; Zopounidis, 1999). They measure the financial stability and performance of a company by establishing the best alternative on the same scenario (Barajas et al., 2017; Ginevičius and Podvezko, 2013; Podvezko, 2011). They are based on qualitative criteria, through ratios and weights, improving the decision-making process by reducing subjectivity and solving financial problems in a realistic context (Zopounidis, 1999).

The main advantages that MCDA methods provide in financial management are the possibility of structuring complex evaluation problems, the introduction of both quantitative and qualitative criteria in the evaluation process, as well as the transparency in the evaluation, allowing a better argumentation in financial decisions (Zopounidis, 1999). Another advantage of the MCDA methods is that they do not only allow the use of a wide range of multidimensional criteria, but that they can also express the evaluation results in the clear form of ranking tables (Ginevičius and Podvezko, 2013), allowing a fast and easy comparisons between the entities. There are various MCDA methods that can be used, but there is no single best MCDA method which guarantees precision of evaluation, with each method having its own specific features and logic. Therefore, discrepancies in the results of the evaluation obtained by each method may occur. Only the simultaneous use of several MCDA methods can increase the reliability of the results (Ginevičius and Podvezko, 2013).

The methods that were chosen for analysis in this thesis are the SAW, COPRAS, TOPSIS, and PROMETHEE II method (Barajas et al., 2017), as well as the GRA approach (Ecer and Boyukaslan, 2014). While the SAW method presents an easy method to use, and therefore being the most popular one as well, all values of the criteria must be positive, and a transformation of negative values into positive ones can introduce distortions as the result depends on the magnitude of the shift of the set values of criteria (Podvezko and Podvezko, 2015). Spending level ratios such as wages/operating revenues or wages/total revenues, which are minimizing criteria and used in this thesis, but have negative values, could be influenced by a transformation of negative values to positive

ones and distort the results. The COPRAS method can be applied to the evaluation of both maximizers and minimizers criteria without any prior processing (Barajas et al., 2017; Ginevičius and Podvezko, 2013; Podvezko, 2011), just like the TOPSIS method (Ginevičius and Podvezko, 2013; Ren et al., 2007). The disadvantage of the COPRAS method is that it is less stable than the SAW and COPRAS method in the cases of data variation and more sensitive to slight variations of data, which can lead to different rankings compared to other methods. This can be seen at the classification of some of the selected clubs (Table 4.1, 4.2, 4.3), although the results of every method differ from those of the other methods in some cases, sometimes displaying the complete opposite rank (for example Dortmund), while being consistent again for other clubs (for example Liverpool, Manchester United or Everton).

While the TOPSIS method also does not require the processing of negative value like the COPRAS method, with the computation process being straightforward and depicted in a simple mathematical form, the disadvantage of it is the phenomenon of rank reversal, where the alternatives' order of preference changes when an alternative is added to or removed from the decision problem, leading to the order of preferences being totally inverted (Socorro García-Cascales and Teresa Lamata, 2012), which can make the validity of this method debatable. The method was used in this thesis anyway, since no alternative has been added or removed during the calculation process. The PROMETHEE II method differs from the other MCDA methods by the depth of its intrinsic logic and by the use of the preference functions, which form a foundation of the method (Brans and Vincke, 1985; Ginevičius and Podvezko, 2013). The advantages of this method are the ability to assess qualitative aspects of the alternatives through a proper function of preference, that it is simple and easy to understand for the decision maker, and that the information required to operate is limited to that of each alternative and the evaluation criteria considered, without additional parametric information (Fernández, 2011, cited in Barajas et al., 2017, p. 153). The limitations of this method are rank reversal as well, and that complete orders for the PROMETHEE II method are required (Majdi, 2013). Since the results and therefore classification and ranking of the clubs differ among all used methods to some extent, and due to the different advantages, limitations, and calculation approaches of all methods, the results of the methods used have been combined and accumulated, which allows for a ranking with less deviation and increased reliability, as pointed out by Ginevičius and Podvezko (2013).

The GRA approach is another MCDA method taken into consideration in this thesis. One of the purposes of this method is the separation of important variables in groups between themselves by recognizing unimportant ones among various variables. This allows variables in one group to become related to each other and thereby can be separated from

other groups. The disadvantage of this method is that it assumes that the optimal alternative is chosen through calculating the largest relative relational degree from the positive ideal solution, considering the largest grey relational coefficient from the positive ideal solution, which neglects the smallest grey relational coefficient from the negative ideal solution. Also, it cannot tackle decision problems with incomplete weight information (Lei et al., 2019). Compared to the results of the other MCDA methods, the results of the GRA method are closest to those of the PROMETHEE II method, looking only at the three analyzed seasons (Table 9.1, 9.2, 9.3).

Looking at the results of the financial ratios for the seasons 2017/18, 2018/19, and 2019/20, they indicate that Dortmund should have performed the best over the three seasons, because they have the most amount of the best performances in each category in every season, while not having any of the worst performances in any of the categories in the analyzed period. Yet the results of the SAW and TOPSIS method indicate that they have one of the worst performances in all three seasons (Table 3.1, 3.2, 3.3). Also, the results of the SAW method indicate that Juventus, despite the fact of only having some of the worst performances and ratios with no single best performance, placing in first place in the 2017/18 and 2018/19 season. According to the TOPSIS method, Everton placed first in every season; again, with only some of the worst performances and no single best performance in any category or for any ratio. Of course, the weights have to be considered as well. In accordance with the set weights by Barajas et al. (2017) that were used for calculations, stability and spending level ratios have the highest weights with 0,30 (Table 2), which is why it is assumed that they are the most important indicators too. This is also because stability ratios focus on debt levels, and spending level ratios on how wages are distributed and how high wages are in relation to a club's revenue; both key factors for the financial imbalance in the soccer industry (Kuper and Szymanski, 2018; Morrow, 2013; Peeters and Szymanski, 2014). In terms of stability ratios, Dortmund performed the best in two out of three ratios in the 2017/18 and 2018/19 seasons, and in one in the 2019/20 season, while Barcelona had most of the worst performances in this category over all three seasons. Nevertheless, Dortmund ranked tenth and ninth according to the SAW and TOPSIS method in the seasons 2017/18 and 2018/19, while Barcelona performed second best in the 2017/18 and 2019/20 seasons according to the TOPSIS method, otherwise ranking in the midfield between fourth and fifth place. Also, in terms of spending level ratios, Dortmund performed the best at all three ratios in the 2017/18 season, while Everton, ranking first in all three seasons analyzed according to the TOPSIS method, in total has most of the worst performances in that category over that time (Table 3.1, 3.2, 3.3).

Both methods, SAW and TOPSIS, therefore do not seem to represent the results of the financial ratios accurately. A reason in case of the SAW method could be that the transformation of negative values into positive ones introduced distortions that influence the results and rankings. In case of the TOPSIS method, it seems like that rank reversal actually occurred, since a reversed ranking would reflect the results of the financial ratios more. As already explained does rank reversal occur where the alternatives' order of preference changes when an alternative is added to or removed from the decision problem. But since no alternative was added or removed, no evidence can be found that rank reversal is the reason for the results. According to the results of the PROMETHEE II method, Dortmund ranked first in the 2017/18 season, followed by Manchester City in second and Real Madrid in third place. Behind them, Everton finishes fourth, Arsenal fifth, Liverpool sixth, and Manchester United seventh. In the last three positions there are Barcelona in eighth, Tottenham in ninth, and Juventus in tenth place. Out of the remaining MCDA methods used by Barajas et al. (2017), the COPRAS method shows the most similar results to those of the PROMETHEE II method, with a maximum deviation of five rank positions, while the SAW and TOPSIS method have a deviation by up to nine ranking positions in all three seasons (Table 4.1, 4.2, 4.3).

Out of the four analyzed MCDA methods by Barajas et al. (2017), the GRA method has, as already written, the most similar results to those of the PROMETHEE II method as well. They show that Dortmund performs best in all three seasons, with Manchester City and Everton in second and third place in that period. Juventus performed the worst overall, ranking last in the seasons 2017/18 and 2018/19, and ninth in season 2019/20. They are followed by Barcelona, ranking sixth in 2017/18, ninth in 2018/19, and last in 2019/20 (Table 5.1, 5.2, 5.3). Overall, the results of the GRA seem to represent the results of the financial ratios in most parts.

In the soccer industry, evaluating only the financial performance of soccer clubs is not enough, since there are non-financial factors that can influence the financial performance. These non-financial factors include ownership structures and thus club strategies and objectives, FFP, licensing, and salary cap regulations, manager changes, media and globalization, fan loyalty, divergent rules between leagues, transfer rules, limitations on the number of foreign players on the pitch, different legal and accounting characteristics, cooperation and competition, and more (Barajas et al., 2017; Chadwick, 2009; Parganas et al., 2017; Wilson, 2017; Wilson and Plumley, 2018). Another non-financial factor is the performance on the pitch, meaning the sporting performance of a soccer team. Potential measurement indicators for sporting performance are league points, total games and total game variance, total win ratio, medals and trophies won, attendance spread, revenue per average spectator, and more (Chadwick, 2009; Plumley

et al., 2017). While some non-financial factors are difficult to measure, in particular fan loyalty, sporting performance indicators can be measured, since there is data available to the public.

Non-financial performance indicators have to be considered mainly because they influence the financial performance of a soccer club. As the correlation analysis in chapter 3.5 shows, it cannot be concluded that there is a statistically significant correlation between sporting and financial performance. The PAM has a Spearman's correlation coefficient of $r_s = -0,0775$, which shows that there is a slightly negative, but, since being between 0 and -0,1, statistically non-significant correlation. The coefficient of determination is $R^2 = 0,006$, meaning that only 0,6% of the changes in sporting performance can be explained by the changes in financial performance, which is also not significant. A p-value of 0,4158 means that the null hypothesis cannot be rejected with a significance level of $\alpha = 0,05$, since it is above 0,05, which means that there is no correlation between the two variables. And although the results of the COPRAS, TOPSIS, PROMETHEE II, and GRA method support the alternative hypothesis of a positive, although weak correlation between sporting and financial performance, one result refuting the alternative hypothesis means that it has to be rejected, and that the null hypothesis cannot be rejected. It must be mentioned though that, in order to be able to evaluate the correlation between the two variables, the final results of the financial ratios of the MCDA methods had to be transformed into a financial performance score to allow a comparison to the sporting performance score evaluated with the PAM method. This could have led to a distortion of the financial performance results and therefore of the results of the correlation analysis. Also, taking only ten samples into consideration makes the results insignificant and does lead to false results, therefore making the regression analysis in this thesis inaccurate and meaningless.

The correlation analysis shows that there is no direct correlation between the two factors, but a club's performance is influenced by its strategies and objectives. As Plumley et al. (2017) and Wilson (2017) explain, there is a continuum between utility maximization (sporting performance) and profit maximization (financial performance), along which clubs place themselves to a greater or lesser extent. This continuum is determined by owners' objectives, revenues, regulations, competition, and sporting outcomes. This means that favoring sporting performance leads to a negligence of financial objectives and performance. The club is focusing more on winning matches than making profit. Therefore, sporting performance is indirectly influencing the financial performance of a club and vice versa. As already explained in chapter 3.5, the absence of a statistically significant correlation between sporting and financial performance may as well explain the problematic surrounding the debate which of these factors is cause and which is

effect. If there is no correlation, neither one of them is the cause nor effect of the other one. Since there is no direct, but indirect relation between the two factors, it is also possible that it is not clear which of them is cause and which is effect, and that authors have found different answers surrounding this debate due to the reason that it is dependent on where a club places itself on the continuum of profit and utility maximization. If a club prioritizes utility maximization, then it is also more likely that sporting performance is the cause and financial performance the effect. If it prioritizes profit maximization, then financial performance is more likely the cause and sporting performance the effect. This presents a topic that must be examined in more detail in further research.

To conclude the explanation about the need to evaluate and consider non-financial indicators when evaluating the financial performance of a soccer club, non-financial indicators, including the sporting performance, must be considered since they indirectly influence the financial performance of a soccer club due to a club owner's strategies and objectives. Not including them means not getting a picture broad enough to explain everything a stakeholder would need to know about a club in the soccer industry in a decision-making process. In an attempt to evaluate the financial performance of soccer clubs while considering sporting performance indicators as well, Plumley et al. (2017) have created the PAM method. The sporting indicators used for the analysis are league points, total game variance, and attendance spread, all equally weighted with 0,333. The sum of the evaluated financial and sporting performance scores for each club amount to the OPS, with a lower score being more desirable.

The results show that Dortmund has the best OPS in all three seasons, with Real Madrid in second place in the 2018/19 and 2019/20 seasons, and third in 2017/18, ranking second overall. Everton records the worst overall performance according to the PAM method, placing last in every season, followed by Barcelona in ninth place (Table 7.1, 7.2, 7.3). While Everton had one of the worst financial and sporting performance score in all three seasons, therefore placing last as well, Dortmund did not have the best sporting performance score too, especially in the 2017/18 season, but still placed first due to a financial performance score that is much better than that of any other club. This is also favored by the fact that the total of all financial performance indicators has a higher weight as the total of all sporting performance indicators. Nevertheless, due to their exceptional financial performance, Dortmund would still place first in every season if the weights are equally distributed with 0,5. Manchester City and Juventus record the best sporting performances, with Juventus finishing first in the Italian Serie A in all three analyzed seasons, and Manchester City finishing first in the EPL in the seasons 2017/18 and 2018/19, and second in the 2019/20 season, explaining their good sporting performance scores. The worst sporting performances are recorded by Everton and Tottenham

over the period of all three analyzed seasons. The results of the PAM method are similar to those of the GRA and PROMETHEE II method in most parts, although some major deviations occur in the case of Everton, for example, placing last according to the results of the PAM method, but second and third according to GRA, and fourth and fifth according to PROMETHEE II. Similar deviations, although not as strong, can be observed in the cases of Tottenham and Arsenal as well (Table 9.1, 9.2, 9.3).

Table 9.1: Overview of the rankings of all analyzed methods (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Method										
SAW	5	8	3	6	9	2	1	4	10	7
COPRAS	5	8	9	4	3	10	7	6	2	1
TOPSIS	2	6	9	5	4	7	3	8	10	1
PROMETHEE II	8	3	7	6	2	9	10	5	1	4
GRA	6	5	9	8	3	7	10	4	1	2
PAM	9	3	4	7	2	5	8	6	1	10

Table 9.2: Overview of the rankings of all analyzed methods (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Method										
SAW	4	8	3	6	9	2	1	5	10	7
COPRAS	9	7	10	2	4	8	6	5	3	1
TOPSIS	5	8	10	4	6	3	2	7	9	1
PROMETHEE II	8	5	6	7	3	9	10	2	1	4
GRA	9	5	6	8	2	7	10	4	1	3
PAM	9	2	6	7	4	3	8	5	1	10

Table 9.3: Overview of the rankings of all analyzed methods (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Method										
SAW	4	7	3	5	10	1	2	6	9	8
COPRAS	6	7	10	3	2	4	9	8	1	5
TOPSIS	2	10	4	3	5	6	9	7	8	1
PROMETHEE II	9	4	7	6	1	8	10	3	2	5
GRA	10	5	8	7	2	6	9	4	1	3
PAM	9	2	5	8	6	4	3	7	1	10

In order to find out which of the analyzed soccer clubs performed the best over the entire analyzed period, in this case over the seasons 2017-2020, a cumulative classification of the classifications of each method and for each season has been evaluated, allowing for a ranking that takes all methods into consideration. Then, the classification for each club and for each year is summed up, allowing for a cumulative classification of all analyzed clubs for all seasons considering the results of all used methods¹⁰ (Table 10).

¹⁰ Cumulative classifications considering all analyzed methods for each year are shown in the appendix (Table A.8.1, A.8.2, A.8.3).

Table 10: Cumulative classification of all analyzed clubs for all seasons (2017-2020) considering the results of all used methods.

Year	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
2017/18	6	4	9	7	1	8	9	4	2	3
2018/19	10	6	9	7	2	8	8	2	1	4
2019/20	10	4	8	4	2	3	9	7	1	4
Cumulative Classification	26	14	26	18	5	19	26	13	4	11
Classification	8_10	5	8_10	6	2	7	8_10	4	1	3

Combining the results of each method and for each year, Dortmund was the best performing soccer club, with Manchester City ranking second, Everton third, and Arsenal fourth. They are followed by Real Madrid in fifth, Liverpool in sixth, and Tottenham in seventh place. Barcelona, Manchester United, and Juventus share the last place as the worst performing clubs over the three analyzed seasons. When excluding the SAW and TOPSIS method, which do not seem to accurately represent the results of the financial ratios and strongly deviate from the results of the COPRAS and PROMETHEE II method, the final ranking actually does not change significantly. The maximum deviation of the final ranking for any club is two rank positions, with Dortmund and Manchester City still in first and second place, and Barcelona, Juventus, and Manchester United still in the last three places (Table 11). Therefore, it can be recorded that excluding individual methods does not change the final results much, and including as many MCDA methods as possible, as proposed by Ginevičius and Podviezko (2013), could be a moderate way to get accurate results with a low standard deviation when evaluating the financial performance of soccer clubs. Since non-financial indicators have to be considered as well, the approach of the PAM method looks to be an adequate and suitable method too, by including not only the financial indicators, but also the sporting ones into the calculation. Since none of the MCDA methods used in this thesis or any other MCDA method in the literature considers sporting performance, a combination of the MCDA methods and the PAM approach, by including the sporting performance indicators into the calculation as tried in the correlation analysis in this thesis already, could be the best way to get results most closely to the “real world” results. Such a new approach of the MCDA methods would need to be adjusted in future research, though.

Table 11: Cumulative classification of all analyzed clubs for all seasons (2017-2020) considering the results of all used methods excluding SAW and TOPSIS method.

Year	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
2017/18	8	3	7	6	2	8	10	5	1	4
2018/19	10	4	6	8	2	6	9	3	1	5
2019/20	10	3	8	7	2	5	8	4	1	5
Cumulative Classification	28	10	21	21	6	19	27	12	3	14
Classification	10	3	7_8	7_8	2	6	9	4	1	5

While the sporting performance can be measured due to available data, as can be seen by the approach of the PAM method, there are still other non-financial factors that have to be considered. FFP, licensing, and salary cap regulations, for example, already have an influence on the numbers and figures in the financial statements of the clubs analyzed during the three seasons, due to the accounting regulations by the UEFA, and therefore are taken into consideration for the calculations in this thesis already. Other factors such as a change in manager can be measured as well, or the effect of globalization and media on the financial figures. As Wilson (2017) states, any change in manager would cost compensation for a club and therefore has a negative impact on the financial performance. Since no analyzed club in this thesis was playing against relegation during the analyzed period, none of them would have benefited from a managerial change from a financial perspective, if Wilson's (2017) findings are true. But, looking at the clubs and their development of performance over the three seasons, a change of manager did not lead to a significant decrease in the financial performance of any club, even though each was ranking at least at the top half of their tables. The only club that had a significant decrease in its financial performance after a new manager signed for the club was Juventus, where former and current manager Massimiliano Allegri left the club in 2019. Allegri left the club by himself though, meaning that the club did not have to pay a compensation for him, indicating that the decrease in financial performance was not caused by the change in manager. Furthermore, only looking at the development of the overall financial performance of a soccer club after a change in manager does not necessarily imply that it has a positive or negative impact, since other circumstances and factors have an influence on the financial performance as well, making it difficult to determine the portion of impact a change in manager would have compared to other factors.

The same applies for any other, theoretically measurable, non-financial factor, such as FFP, salary cap regulations, globalization, or transfer rules. For globalization, a change of the overall financial performance or single ratios after a club exposes and introduces itself to a new country, for example in their pre-season, and therefore increasing their fan basis and with them revenue streams, only is a small part of the total financial performance that cannot clearly be separated from the other factors that have an impact as well, such as transfer rules. Transfer rules are directly influenced by the FFP regulations by the UEFA, since clubs have to balance their spending and live within their means, with a maximum debt accumulation of €5 Million per assessment period (three years) (UEFA, 2012), meaning they cannot spend as much as they might want to on transfer fees and wages. Additionally, there are different transfer regulations in the individual leagues, including differences in the administration processes and fees. So, although these non-financial factors that have an impact on the financial performance, directly or

indirectly, can be measured, it is difficult to determine the exact portion of impact one of them has on the overall financial performance of a soccer club alone.

Further factors that cannot be measured that easily are, for example, fan loyalty. The attendance spread of a club on a match day could be one measure, but this figure only takes into consideration a few fans and does not represent the whole fan community of a club. The amount of merchandising, match day, and broadcasting revenues could also be seen as a measurement of fan loyalty, since a greater number of fans means higher revenues (Parganas et al., 2017; Wilson, 2017). But not every decrease in this kind of revenues automatically indicates a decrease in fan loyalty, since there are other factors that can influence these reductions in revenues as well. For example, one reason could be an increase in unemployment in a region, leading to a decrease in income of the people living in this region, which is why they cannot visit their favorite team anymore or purchase merchandising products. But this does not imply that these people are not loyal to their club anymore. Fan loyalty influences the financial performance of soccer clubs by their bond to a club's heritage, history, and tradition (Chadwick, 2009), which can have an impact on the business behavior and decision-making of a club, for example the desire for on-field success rather than maximizing off-field business operations (Morrow, 2003; Plumley et al., 2017). Another example are major commercial and managerial opportunities, such as targeting new customers or markets, which often conflict with the fans' understanding of heritage, history, and tradition, meaning that these opportunities often cannot be realized by the managers, leading to potential unearned revenues, which again are only difficult to determine and measure.

Therefore, taking all of this into consideration, to evaluate the financial performance of soccer clubs, it is important for stakeholders to not only look at the financial statements, ratios, and analyses, which can be done via MCDA methods as presented in this thesis, but also to consider a club's strategies and objectives, where they sit on the continuum of utility and profit maximization, and how this influences the sporting and financial performance of a club. This also means that sporting performance indicators have to be evaluated and considered, for which Plumley et al. (2017) provided an approach with their PAM method. Furthermore, it is necessary to take the league of the analyzed club into account, since transfer rules and accounting standards might differ, as well as the impact and limitations for a club due to FFP regulations, and, most importantly, the role fans play in the soccer industry and how they influence the decision-making processes of managers and thus the financial performance of a club. Since the exact portion of impact of an individual non-financial factor cannot be determined easily, these factors have to be observed separately from the financial and sporting indicators in order to see

whether they influence the results, if yes by how much, and in how far they differ in comparison to other clubs.

When evaluating the financial performance of soccer clubs, it is also crucial to keep in mind the special industry and environment in which soccer operates, where profit is not a priority, but rather win maximization, implying that it is a rather unprofitable business for investors as well (Kuper and Szymanski, 2018), and that it cannot easily be compared to other business sectors too.

4.2 Restrictions and Limitations

In an attempt to answer the underlying research question of how to evaluate the financial performance of soccer clubs, by using MCDA methods and other non-financial factors that affect the financial performance, the first restriction to this research was the unavailability of adequate financial reports and indicators from some of the biggest European soccer clubs. Bayern Munich, for example, third-biggest club in Europe in 2021 based on revenues, only provides a short summary of their earnings and expenses, which does not include all necessary data and financial indicators needed to conduct MCDA and evaluate the financial ratios used for it. The same applies for PSG (seventh-biggest club), Chelsea (eighth-biggest club), Atlético Madrid (13th-biggest club), and Inter Milan (14th-biggest club). Another limitation are the different accounting standards. Some clubs only provide a consolidated financial statement, including other parts and departments of the club as well, such as their Basketball or Youth teams, which differ in size and availability between the clubs. Therefore, the results of the financial performance of the analyzed soccer clubs are also including and depending on the results of the other departments of a club, which differ between the clubs and might influence the final results and rankings of the clubs. Concerning the correlation analysis, in order to be able to evaluate the correlation between sporting and financial performance, the final results of the financial ratios of the MCDA methods had to be transformed into a financial performance score to allow a comparison to the sporting performance score evaluated with the PAM method. This could have led to a distortion of the financial performance results and therefore of the results of the correlation analysis. Also, taking only ten samples into consideration makes the results of the regression analysis insignificant and probably led to false results that are inaccurate and meaningless.

Also, there is a circumstance not considered in this research, which is the influence of the Covid-19 pandemic on the financial figures of the 2019/20 season, and in how far it not only influenced each club differently, but also how changes in UEFA, domestic

league, and governmental regulations as a result of Covid-19 changed and influenced the financial performances. For the reasons of the increased influence of Covid-19, changes in accounting and reporting standards because of it, and, connected to that, further limited access to current financial reports, the season 2020/2021 could not be included in this research. Although influenced by Covid-19 as well, the season 2019/20 could not be excluded from this research, because some clubs do not provide the 2016/17 report to the public anymore, and only using two seasons for the analysis, in this case 2017/18 and 2018/19, would not have provided enough and therefore credible results.

The different accounting regulations set by each domestic league also posed a challenge, because some positions include different figures or are displayed differently on the balance sheet or income statement. This also could have influenced some results of the financial ratios to a small degree. Since the analyzed clubs are from different leagues, it is also difficult to exactly evaluate the sporting performance of a club in relation to another club from a different league, because the results and scores can differ due to the different amount of set games a club can play, for example. Connected to that, another restriction of the applied sporting performance indicators of the PAM method in this thesis is that it does not necessarily differentiate between games played and games won, meaning that a team winning the UEFA Champions League might have the same sporting performance score as the runners-up team, although being more successful.

4.3 Suggestions for Further Research

In order to get more accurate results in the analyses with less space for errors, the sporting indicators should be reassessed, allowing for a clear differentiation between games won and games lost as well, for example with the help of the Total Win Ratio. Also, to minimize the standard deviation in MCDA, an expansion of the methods could be done, using more MCDA methods to get more reliable results. Including more clubs and expanding the analyzed time period would also allow for a better ranking of the clubs and could give a more reliable answer to the question of which soccer club is the best performing one in terms of financial and sporting performance. Including more clubs would also allow a much more reliable and accurate correlation test and regression analysis. Furthermore, a new approach of the MCDA methods incorporating sporting performance indicators in addition to the financial performance indicators, as in the PAM method, could be applied and further adapted in future research. To understand the development of the financial performance of soccer clubs better, as well as changes in clubs' objectives and the reasons for them, further research should consider the influence that Covid-

19 has on these factors. As already mentioned before, a topic that could be examined in further research is the debate surrounding which of the sporting and financial performance is cause and effect, under the assumption that these factors influence each other only indirectly, and that the outcome of this debate is dependent on where a club sits on the continuum of profit and utility maximization.

Another interesting topic for further research is the differences between European and North American soccer due to the different sport systems, structures, and objectives, and how the financial performance of soccer clubs changes due to these disparities. For further discussions surrounding the criticism about whether soccer is an actual business or not, additional qualitative research could be applied in future research, questioning or interviewing professional soccer players, as well as managers and experts of the field about their perceptions of modern soccer and its industry and business.

5 Conclusion

In this thesis, six different methods have been analyzed: five MCDA methods, which are the SAW, COPRAS, TOPSIS, PROMETHEE II, and GRA method; and the PAM method, as well as other non-financial, industry-specific factors, in an attempt to answer the research question of how to evaluate the financial performance of soccer clubs. For the methods, 13 different financial ratios were analyzed and evaluated for ten of the biggest soccer clubs in Europe, based on their revenue in 2021, for the seasons 2017/18, 2018/19, and 2019/20. The soccer clubs analyzed in this thesis are Barcelona, Real Madrid, Manchester United, Liverpool, Manchester City, Tottenham Hotspur, Juventus, Arsenal, Dortmund, and Everton. Furthermore, the correlation between financial and sporting performance was examined.

The MCDA methods were used because multiple variables and indicators have to be taken into consideration when analyzing soccer clubs, due to the specific industry of soccer. They have been developed with new and more flexible structures, improving the decision-making process by reducing subjectivity and solving financial problems in a realistic context. Also, they allow a fast and easy comparison, not only between soccer clubs, but between any entities, by expressing the evaluation results in the form of a ranking table. When using the MCDA methods, there is no single best method that guarantees a precision of evaluation, because every method has its own specific features, logic, and limitations, which can lead to discrepancies in the results evaluated by each method. Therefore, including as many MCDA methods as possible in the evaluation process is a moderate way to get accurate results with a low standard deviation when

evaluating the financial performance of soccer clubs. In this thesis, a cumulative classification of the rankings of each of the methods used and for each season has been evaluated for every club, allowing for a ranking that considers all methods.

To determine which club was the best performing one within the three analyzed seasons, the rankings for each club and for each season was summed up, allowing for a cumulative classification of all analyzed clubs for all seasons, considering the results of all used methods. The results show that Dortmund was the best performing soccer club, with Manchester City ranking second, Everton third, and Arsenal fourth, followed by Real Madrid in fifth, Liverpool in sixth, and Tottenham in seventh place. Barcelona, Manchester United, and Juventus share the last place as the worst performing clubs over the three seasons analyzed. Due to the specific characteristics of the soccer industry, which is deeply socioculturally embedded, with a broad, unique, sociocultural, economic, and commercial constituency, and where profit is not the common objective of managers, evaluating the financial performance of soccer clubs by considering financial performance indicators alone is not enough. There are other non-financial factors that influence the financial performance and that have to be considered as well. Performing a correlation analysis, the results indicate that there is no direct, statistically significant correlation between financial and sporting performance. But since a club's performance is influenced by its strategies and objectives, where there is a continuum between financial performance (profit maximization) and sporting performance (utility maximization) along which the clubs place themselves to a greater or lesser extent, meaning that when a club prioritizes sporting performance, they neglect their financial performance and objectives and vice versa, it is assumed that these two factors influence each other indirectly via a club's strategies and objectives. Therefore, since non-financial indicators have to be considered as well, the approach of the PAM method by Plumley et al. (2017) also seems to be an adequate and suitable method by including not only the financial but also the sporting indicators in the calculation.

Since none of the MCDA methods used in this thesis or any other MCDA method in the literature considers sporting performance, a combination of the MCDA methods and the PAM approach, by including the sporting performance indicators into the calculation as tried in the correlation analysis in this thesis already, could be the best way to get results most closely to the "real world" results. Other non-financial indicators next to the sporting performance of a soccer club that have to be considered as well include ownership structures and clubs' strategies and objectives, FFP, licensing, and salary cap regulations, manager changes, media and globalization, fan loyalty, divergent rules between the leagues, different legal and accounting standards, transfer rules, and more. While some of these factors are more difficult to measure than others, due to the unavailability of

adequate units of measurement, such as for fan loyalty, it is also grueling to exactly determine the portion of impact that one of these factors has on the financial performance of a soccer club individually. Therefore, when evaluating the financial performance of a soccer club, it is important to take all of these factors, financial and non-financial, into consideration. Since it is often not clear to what extent a single factor influences the performance of a club, they have to be observed separately to the financial performance, to see whether they influence the results, if yes by how much, and in how far they differ in comparison to other clubs.

In conclusion, using the MCDA approach with as many MCDA methods as possible for more accurate and reliable results with a lower standard deviation, but also including sporting indicators next to the financial ratios is the best way to evaluate the financial performance and stability of a soccer club. Since there are other non-financial indicators next to the sporting performance that influence the financial performance of a soccer club and which are difficult to measure, stakeholders of the industry have to consider them as well, although separately, to receive more accurate and “real world” results and indications as to how well a club is performing in comparison to other clubs.

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Appendix A: Calculations

Appendix A.1: SAW Calculations

Season 2017/18

Table A.1.1.1: Financial ratios of ten of the largest soccer clubs in Europe, depending on their revenue, expressed as absolute numbers (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,4038	0,6959	-0,7731	14,5749	-0,4710	1,3444	-0,0406	-1,3462	0,7890	0,1336
OP/OR (+)	0,0323	0,0599	0,0744	0,0160	-0,0443	0,2207	-0,0030	-0,1042	0,0673	-0,5181
TOR/TA (+)	0,6767	0,7388	0,3814	0,6830	0,4173	0,2928	0,6997	0,3949	1,1288	0,4944
STD/TL (-)	0,6718	0,4231	0,3004	0,5026	0,2888	0,2173	0,4047	0,2390	0,2488	0,5281
LTD/TL (-)	0,2021	0,1228	0,4246	0,1849	0,0924	0,5248	0,5021	0,3530	0,0481	0,1495
WC/CA (+)	-1,8940	-0,2990	-0,1235	-0,5644	-0,1367	-0,6639	-0,8926	0,4632	0,1274	-0,5920
E/TL (+)	0,1262	0,4541	0,2750	0,3125	0,6188	0,2579	0,0932	0,4080	0,7031	0,3224
NCA/TL (+)	0,7679	0,6745	0,7326	0,6788	0,7459	0,8694	0,7843	0,3012	0,7148	0,6683
TA/TD (+)	1,1444	1,8318	1,3793	1,4546	2,6231	1,3476	1,1028	1,6894	3,3679	1,4759
CSTD/CL (+)	1,0591	1,4126	1,5210	1,0308	1,0799	1,3565	1,0534	1,9407	1,4996	1,0469
W/OR (-)	-0,7694	-0,5758	-0,5018	-0,5793	-0,5188	-0,3877	-0,4926	-0,5953	-0,3483	-0,7691
W/TR (-)	-0,5999	-0,5354	-0,4797	-0,5793	-0,5157	-0,3877	-0,6423	-0,5907	-0,3458	-0,7691
W/OE (-)	0,5960	0,5649	0,5247	0,5887	0,4939	0,4975	0,6088	0,5391	0,3706	0,5066

Next, the negative values have to be transformed into positive ones.

Table A.1.1.2: Transformation of negative values into positive ones (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,4038	0,6959	1,2676	14,5749	1,1631	1,3444	1,0141	1,4661	0,7890	0,1336
OP/OR (+)	0,0323	0,0599	0,0744	0,0160	0,9787	0,2207	0,9986	0,9498	0,0673	0,7503
TOR/TA (+)	0,6767	0,7388	0,3814	0,6830	0,4173	0,2928	0,6997	0,3949	1,1288	0,4944
STD/TL (-)	0,6718	0,4231	0,3004	0,5026	0,2888	0,2173	0,4047	0,2390	0,2488	0,5281
LTD/TL (-)	0,2021	0,1228	0,4246	0,1849	0,0924	0,5248	0,5021	0,3530	0,0481	0,1495
WC/CA (+)	2,6932	1,2673	1,1104	1,5046	1,1222	1,5935	1,7980	0,4632	0,1274	1,5292
E/TL (+)	0,1262	0,4541	0,2750	0,3125	0,6188	0,2579	0,0932	0,4080	0,7031	0,3224
NCA/TL (+)	0,7679	0,6745	0,7326	0,6788	0,7459	0,8694	0,7843	0,3012	0,7148	0,6683
TA/TD (+)	1,1444	1,8318	1,3793	1,4546	2,6231	1,3476	1,1028	1,6894	3,3679	1,4759
CSTD/CL (+)	1,0591	1,4126	1,5210	1,0308	1,0799	1,3565	1,0534	1,9407	1,4996	1,0469
W/OR (-)	0,8226	0,8672	0,8843	0,8664	0,8804	0,9106	0,8864	0,8627	0,9197	0,8226
W/TR (-)	0,8615	0,8764	0,8892	0,8662	0,8809	0,9105	0,8517	0,8636	0,9202	0,8224
W/OE (-)	0,5960	0,5649	0,5247	0,5887	0,4939	0,4975	0,6088	0,5391	0,3706	0,5066

Maximum/Minimum Values:

Table A.1.1.3: Maximum/minimum values of the financial ratios of all clubs after transformation using the SAW method (2017/18).

2017/18	Max/Min Values
NP/OP (+)	14,5749
OP/OR (+)	0,9986
TOR/TA (+)	1,1288
STD/TL (-)	0,2173
LTD/TL (-)	0,0481
WC/CA (+)	2,6932
E/TL (+)	0,7031
NCA/TL (+)	0,8694
TA/TD (+)	3,3679
CSTD/CL (+)	1,9407
W/OR (-)	0,9197
W/TR (-)	0,9202
W/OE (-)	0,3706

Normalized Decision Matrix:

Table A.1.1.4: Normalized decision matrix of the SAW method (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,0277	0,0477	0,0870	1,0000	0,0798	0,0922	0,0696	0,1006	0,0541	0,0092
OP/OR (+)	0,0323	0,0600	0,0745	0,0160	0,9801	0,2210	1,0000	0,9512	0,0674	0,7514
TOR/TA (+)	0,5995	0,6545	0,3379	0,6051	0,3697	0,2594	0,6199	0,3498	1,0000	0,4380
STD/TL (-)	3,0916	1,9471	1,3824	2,3129	1,3290	1,0000	1,8624	1,0999	1,1450	2,4303
LTD/TL (-)	4,2017	2,5530	8,8274	3,8441	1,9210	10,9106	10,4387	7,3389	1,0000	3,1081
WC/CA (+)	1,0000	0,4706	0,4123	0,5586	0,4167	0,5917	0,6676	0,1720	0,0473	0,5678
E/TL (+)	0,1795	0,6459	0,3911	0,4445	0,8801	0,3668	0,1326	0,5803	1,0000	0,4585
NCA/TL (+)	0,8833	0,7758	0,8427	0,7808	0,8579	1,0000	0,9021	0,3464	0,8222	0,7687
TA/TD (+)	0,3398	0,5439	0,4095	0,4319	0,7789	0,4001	0,3274	0,5016	1,0000	0,4382
CSTD/CL (+)	0,5457	0,7279	0,7837	0,5311	0,5564	0,6990	0,5428	1,0000	0,7727	0,5394
W/OR (-)	0,8944	0,9430	0,9615	0,9421	0,9572	0,9901	0,9638	0,9381	1,0000	0,8945
W/TR (-)	0,9362	0,9524	0,9664	0,9414	0,9574	0,9895	0,9256	0,9385	1,0000	0,8938
W/OE (-)	1,6082	1,5243	1,4158	1,5885	1,3327	1,3424	1,6427	1,4547	1,0000	1,3670

For normalizing the data, the transformed financial ratio has been divided by the maximum or minimum value of that financial ratio of all clubs. Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.1.1.5: Weighted normalized decision matrix and results of the SAW method (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,000831	0,001432	0,002609	0,030000	0,002394	0,002767	0,002087	0,003018	0,001624	0,000275
OP/OR (+)	0,001941	0,003599	0,004470	0,000961	0,058804	0,013261	0,060000	0,057070	0,004044	0,045085
TOR/TA (+)	0,035969	0,039270	0,020273	0,036304	0,022181	0,015563	0,037192	0,020990	0,060000	0,026279
STD/TL (-)	0,309158	0,194708	0,138242	0,231293	0,132904	0,100000	0,186240	0,109986	0,114496	0,243028
LTD/TL (-)	0,420166	0,255301	0,882744	0,384407	0,192100	1,091060	1,043867	0,733888	0,100000	0,310811
WC/CA (+)	0,100000	0,047055	0,041230	0,055865	0,041668	0,059168	0,066759	0,017199	0,004730	0,056781
E/TL (+)	0,014359	0,051668	0,031290	0,035557	0,070408	0,029344	0,010604	0,046423	0,080000	0,036683
NCA/TL (+)	0,070660	0,062066	0,067412	0,062461	0,068636	0,080000	0,072169	0,027716	0,065774	0,061495
TA/TD (+)	0,013592	0,021756	0,016382	0,017276	0,031154	0,016005	0,013098	0,020065	0,040000	0,017529
CSTD/CL (+)	0,027287	0,036394	0,039187	0,026557	0,027822	0,034949	0,027140	0,050000	0,038636	0,026972
W/OR (-)	0,134162	0,141444	0,144227	0,141312	0,143587	0,148518	0,144573	0,140710	0,150000	0,134173
W/TR (-)	0,070218	0,071432	0,072480	0,070605	0,071802	0,074211	0,069420	0,070391	0,075000	0,067033
W/OE (-)	0,120615	0,114321	0,106186	0,119138	0,099953	0,100681	0,123206	0,109100	0,075000	0,102523
S_j	1,318958	1,040447	1,566732	1,211738	0,963414	1,765529	1,856355	1,406555	0,809304	1,128669
Rank	5	8	3	6	9	2	1	4	10	7

Season 2018/19

Table A.1.2.1: Financial ratios of ten of the largest soccer clubs in Europe, depending on their revenue, expressed as absolute numbers (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,2581	0,7073	0,2180	58,3776	-0,4552	0,6744	-0,0679	0,8294	0,7400	0,8785
OP/OR (+)	0,0382	0,0717	0,0797	0,0012	-0,0414	0,2207	-0,0261	-0,0825	0,0519	-0,6782
TOR/TA (+)	0,6167	0,7518	0,4191	0,7159	0,4552	0,2719	0,6599	0,4251	0,9216	0,4721
STD/TL (-)	0,5056	0,4153	0,2866	0,4895	0,2867	0,2369	0,4147	0,2671	0,2507	0,4197
LTD/TL (-)	0,3968	0,1167	0,4360	0,1771	0,0732	0,5249	0,5521	0,3068	0,0396	0,1758
WC/CA (+)	-0,7064	-0,1458	-0,1044	-1,0077	-0,0300	-1,5771	-1,1786	0,0210	0,0231	-0,4808
E/TL (+)	0,0976	0,4680	0,2774	0,3334	0,6401	0,2382	0,0332	0,4261	0,7097	0,4045
NCA/TL (+)	0,7037	0,6376	0,7405	0,7562	0,7216	0,9081	0,7976	0,7271	0,7433	0,7166
TA/TD (+)	1,1081	1,8797	1,3840	1,5001	2,7785	1,3128	1,0343	1,7423	3,4452	1,6794
CSTD/CL (+)	1,2305	1,3294	1,7174	1,1030	1,3831	1,3076	1,0271	1,6778	1,4455	1,1644
W/OR (-)	-0,6454	-0,5221	-0,5299	-0,5814	-0,5891	-0,3877	-0,5130	-0,5939	-0,4526	-0,8779
W/TR (-)	-0,5464	-0,4606	-0,5090	-0,5814	-0,5858	-0,3877	-0,4849	-0,5901	-0,4450	-0,8779
W/OE (-)	0,5560	0,4909	0,5512	0,5821	0,5626	0,4974	0,6573	0,5486	0,4689	0,5231

Next, the negative values have to be transformed into positive ones.

Table A.1.2.2: Transformation of negative values into positive ones (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,2581	0,7073	0,2180	58,3776	0,7520	0,6744	0,9630	0,8294	0,7400	0,8785
OP/OR (+)	0,0382	0,0717	0,0797	0,0012	0,9867	0,2207	0,9916	0,9735	0,0519	0,7818
TOR/TA (+)	0,6167	0,7518	0,4191	0,7159	0,4552	0,2719	0,6599	0,4251	0,9216	0,4721
STD/TL (-)	0,5056	0,4153	0,2866	0,4895	0,2867	0,2369	0,4147	0,2671	0,2507	0,4197
LTD/TL (-)	0,3968	0,1167	0,4360	0,1771	0,0732	0,5249	0,5521	0,3068	0,0396	0,1758
WC/CA (+)	1,4077	1,0841	1,0602	1,5815	1,0173	1,9101	1,6802	0,0210	0,0231	1,2775
E/TL (+)	0,0976	0,4680	0,2774	0,3334	0,6401	0,2382	0,0332	0,4261	0,7097	0,4045
NCA/TL (+)	0,7037	0,6376	0,7405	0,7562	0,7216	0,9081	0,7976	0,7271	0,7433	0,7166
TA/TD (+)	1,1081	1,8797	1,3840	1,5001	2,7785	1,3128	1,0343	1,7423	3,4452	1,6794
CSTD/CL (+)	1,2305	1,3294	1,7174	1,1030	1,3831	1,3076	1,0271	1,6778	1,4455	1,1644
W/OR (-)	0,9212	0,9363	0,9353	0,9290	0,9281	0,9527	0,9374	0,9275	0,9447	0,8928
W/TR (-)	0,9333	0,9438	0,9379	0,9290	0,9285	0,9527	0,9408	0,9279	0,9457	0,8928
W/OE (-)	0,5560	0,4909	0,5512	0,5821	0,5626	0,4974	0,6573	0,5486	0,4689	0,5231

Maximum/Minimum Values:

Table A.1.2.3: Maximum/minimum values of the financial ratios of all clubs after transformation using the SAW method (2018/19).

2018/19	Max/Min Values
NP/OP (+)	58,3776
OP/OR (+)	0,9916
TOR/TA (+)	0,9216
STD/TL (-)	0,2369
LTD/TL (-)	0,0396
WC/CA (+)	1,9101
E/TL (+)	0,7097
NCA/TL (+)	0,9081
TA/TD (+)	3,4452
CSTD/CL (+)	1,7174
W/OR (-)	0,9527
W/TR (-)	0,9527
W/OE (-)	0,4689

Normalized Decision Matrix:

Table A.1.2.4: Normalized decision matrix of the SAW method (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,0044	0,0121	0,0037	1,0000	0,0129	0,0116	0,0165	0,0142	0,0127	0,0150
OP/OR (+)	0,0385	0,0723	0,0804	0,0012	0,9950	0,2226	1,0000	0,9817	0,0523	0,7884
TOR/TA (+)	0,6692	0,8158	0,4548	0,7768	0,4939	0,2950	0,7160	0,4613	1,0000	0,5123
STD/TL (-)	2,1342	1,7531	1,2098	2,0663	1,2102	1,0000	1,7505	1,1275	1,0583	1,7716
LTD/TL (-)	10,0202	2,9470	11,0101	4,4722	1,8485	13,2551	13,9419	7,7475	1,0000	4,4394
WC/CA (+)	0,7369	0,5676	0,5551	0,8280	0,5326	1,0000	0,8796	0,0110	0,0121	0,6688
E/TL (+)	0,1375	0,6594	0,3909	0,4698	0,9019	0,3356	0,0468	0,6004	1,0000	0,5700
NCA/TL (+)	0,7749	0,7021	0,8154	0,8327	0,7946	1,0000	0,8783	0,8007	0,8185	0,7891
TA/TD (+)	0,3216	0,5456	0,4017	0,4354	0,8065	0,3811	0,3002	0,5057	1,0000	0,4875
CSTD/CL (+)	0,7165	0,7741	1,0000	0,6422	0,8053	0,7614	0,5981	0,9769	0,8417	0,6780
W/OR (-)	0,9670	0,9828	0,9818	0,9752	0,9742	1,0000	0,9839	0,9736	0,9917	0,9372
W/TR (-)	0,9797	0,9907	0,9845	0,9752	0,9746	1,0000	0,9875	0,9741	0,9927	0,9372
W/OE (-)	1,1858	1,0469	1,1755	1,2414	1,1998	1,0608	1,4018	1,1700	1,0000	1,1156

For normalizing the data, the transformed financial ratio has been divided by the maximum or minimum value of that financial ratio of all clubs. Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.1.2.5: Weighted normalized decision matrix and results of the SAW method (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,000133	0,000363	0,000112	0,030000	0,000386	0,000347	0,000495	0,000426	0,000380	0,000451
OP/OR (+)	0,002311	0,004338	0,004823	0,000073	0,059702	0,013354	0,060000	0,058902	0,003140	0,047303
TOR/TA (+)	0,040150	0,048945	0,027285	0,046608	0,029635	0,017702	0,042962	0,027676	0,060000	0,030736
STD/TL (-)	0,213423	0,175306	0,120979	0,206627	0,121022	0,100000	0,175053	0,112748	0,105825	0,177163
LTD/TL (-)	1,002020	0,294697	1,101010	0,447222	0,184848	1,325505	1,394192	0,774747	0,100000	0,443939
WC/CA (+)	0,073694	0,056757	0,055506	0,082797	0,053258	0,100000	0,087960	0,001099	0,001209	0,066878
E/TL (+)	0,011002	0,052755	0,031270	0,037582	0,072154	0,026851	0,003742	0,048032	0,080000	0,045597
NCA/TL (+)	0,061993	0,056170	0,065235	0,066618	0,063570	0,080000	0,070265	0,064055	0,065482	0,063130
TA/TD (+)	0,012865	0,021824	0,016069	0,017417	0,032259	0,015242	0,012009	0,020229	0,040000	0,019498
CSTD/CL (+)	0,035825	0,038704	0,050000	0,032112	0,040267	0,038069	0,029903	0,048847	0,042084	0,033900
W/OR (-)	0,145046	0,147416	0,147266	0,146276	0,146128	0,150000	0,147591	0,146036	0,148752	0,140576
W/TR (-)	0,073474	0,074299	0,073834	0,073138	0,073096	0,075000	0,074066	0,073054	0,074449	0,070288
W/OE (-)	0,088932	0,078519	0,088164	0,093106	0,089987	0,079559	0,105134	0,087748	0,075000	0,083669
S_j	1,760868	1,050094	1,781553	1,279577	0,966315	2,021628	2,203372	1,463599	0,796322	1,223129
Rank	4	8	3	6	9	2	1	5	10	7

Season 2019/20

Table A.1.3.1: Financial ratios of ten of the largest soccer clubs in Europe, depending on their revenue, expressed as absolute numbers (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,9754	0,7864	-3,8793	0,5616	0,7897	1,6023	-0,1634	0,4828	1,0189	0,7982
OP/OR (+)	-0,1170	0,0006	0,0103	-1,4340	-0,3336	-0,1018	-0,1222	-0,2872	-0,1051	-0,9427
TOR/TA (+)	0,4815	0,5691	0,3679	0,6540	0,4380	0,2092	0,4872	0,3683	0,8100	0,4956
STD/TL (-)	0,6583	0,3341	0,2879	0,4201	0,3481	0,2946	0,3696	0,2518	0,2367	0,6673
LTD/TL (-)	0,3178	0,2943	0,4582	0,3011	0,0783	0,5240	0,4272	0,4097	0,1736	0,1436
WC/CA (+)	-1,6331	-0,3051	-0,7719	-0,3006	-0,5173	-0,9559	-0,5624	-0,1167	-0,6025	-0,9919
E/TL (+)	0,0239	0,3716	0,2539	0,2788	0,5736	0,1814	0,2032	0,3685	0,5897	0,1891
NCA/TL (+)	0,7500	0,7440	0,8375	0,6770	0,7706	0,8494	0,7733	0,3235	0,8523	0,6650
TA/TD (+)	1,0245	1,5914	1,3403	1,3865	2,3451	1,2216	1,2551	1,5835	2,4373	1,2332
CSTD/CL (+)	1,1672	1,2817	1,1294	1,4749	1,0466	1,4099	1,0147	1,4664	1,0271	1,2254
W/OR (-)	-0,5697	-0,5935	-0,5580	-0,6646	-0,7346	-0,4626	-0,4724	-0,6798	-0,5243	-0,8607
W/TR (-)	-0,6878	-0,5037	-0,5385	-0,6646	-0,7297	-0,4626	-0,4522	-0,6798	-0,5128	-0,8607
W/OE (-)	0,5072	0,5023	0,5439	0,5813	0,5481	0,4199	0,6261	0,5287	0,4650	0,4430

Next, the negative values have to be transformed into positive ones.

Table A.1.3.2: Transformation of negative values into positive ones (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,9754	0,7864	12,1697	0,5616	0,7897	1,6023	1,4705	0,4828	1,0189	0,7982
OP/OR (+)	1,0508	0,0006	0,0103	1,6224	1,1448	1,0442	1,0530	1,1246	1,0456	1,4091
TOR/TA (+)	0,4815	0,5691	0,3679	0,6540	0,4380	0,2092	0,4872	0,3683	0,8100	0,4956
STD/TL (-)	0,6583	0,3341	0,2879	0,4201	0,3481	0,2946	0,3696	0,2518	0,2367	0,6673
LTD/TL (-)	0,3178	0,2943	0,4582	0,3011	0,0783	0,5240	0,4272	0,4097	0,1736	0,1436
WC/CA (+)	2,0339	1,1932	1,4887	1,1903	1,3275	1,6052	1,3561	1,0739	1,3814	1,6280
E/TL (+)	0,0239	0,3716	0,2539	0,2788	0,5736	0,1814	0,2032	0,3685	0,5897	0,1891
NCA/TL (+)	0,7500	0,7440	0,8375	0,6770	0,7706	0,8494	0,7733	0,3235	0,8523	0,6650
TA/TD (+)	1,0245	1,5914	1,3403	1,3865	2,3451	1,2216	1,2551	1,5835	2,4373	1,2332
CSTD/CL (+)	1,1672	1,2817	1,1294	1,4749	1,0466	1,4099	1,0147	1,4664	1,0271	1,2254
W/OR (-)	0,9206	0,9173	0,9223	0,9074	0,8977	0,9356	0,9342	0,9053	0,9270	0,8801
W/TR (-)	0,9042	0,9298	0,9250	0,9074	0,8984	0,9356	0,9370	0,9053	0,9286	0,8801
W/OE (-)	0,5072	0,5023	0,5439	0,5813	0,5481	0,4199	0,6261	0,5287	0,4650	0,4430

Maximum/Minimum Values:

Table A.1.3.3: Maximum/minimum values of the financial ratios of all clubs after transformation using the SAW method (2019/20).

2019/20	Max/Min Values
NP/OP (+)	12,1697
OP/OR (+)	1,6224
TOR/TA (+)	0,8100
STD/TL (-)	0,2367
LTD/TL (-)	0,0783
WC/CA (+)	2,0339
E/TL (+)	0,5897
NCA/TL (+)	0,8523
TA/TD (+)	2,4373
CSTD/CL (+)	1,4749
W/OR (-)	0,9356
W/TR (-)	0,9370
W/OE (-)	0,4199

Normalized Decision Matrix:

Table A.1.3.4: Normalized decision matrix of the SAW method (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,0802	0,0646	1,0000	0,0461	0,0649	0,1317	0,1208	0,0397	0,0837	0,0656
OP/OR (+)	0,6477	0,0004	0,0063	1,0000	0,7056	0,6436	0,6491	0,6932	0,6445	0,8686
TOR/TA (+)	0,5944	0,7026	0,4542	0,8074	0,5407	0,2583	0,6015	0,4547	1,0000	0,6119
STD/TL (-)	2,7812	1,4115	1,2163	1,7748	1,4706	1,2446	1,5615	1,0638	1,0000	2,8192
LTD/TL (-)	4,0587	3,7586	5,8519	3,8455	1,0000	6,6922	5,4559	5,2324	2,2171	1,8340
WC/CA (+)	1,0000	0,5866	0,7319	0,5852	0,6527	0,7892	0,6667	0,5280	0,6792	0,8004
E/TL (+)	0,0405	0,6302	0,4306	0,4728	0,9727	0,3076	0,3446	0,6249	1,0000	0,3207
NCA/TL (+)	0,8800	0,8729	0,9826	0,7943	0,9041	0,9966	0,9073	0,3796	1,0000	0,7802
TA/TD (+)	0,4203	0,6529	0,5499	0,5689	0,9622	0,5012	0,5150	0,6497	1,0000	0,5060
CSTD/CL (+)	0,7914	0,8690	0,7657	1,0000	0,7096	0,9559	0,6880	0,9942	0,6964	0,8308
W/OR (-)	0,9841	0,9805	0,9858	0,9699	0,9595	1,0000	0,9985	0,9677	0,9908	0,9407
W/TR (-)	0,9650	0,9923	0,9872	0,9684	0,9587	0,9985	1,0000	0,9662	0,9910	0,9393
W/OE (-)	1,2079	1,1962	1,2953	1,3844	1,3053	1,0000	1,4911	1,2591	1,1074	1,0550

For normalizing the data, the transformed financial ratio has been divided by the maximum or minimum value of that financial ratio of all clubs. Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.1.3.5: Weighted normalized decision matrix and results of the SAW method (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,002405	0,001939	0,030000	0,001384	0,001947	0,003950	0,003625	0,001190	0,002512	0,001968
OP/OR (+)	0,038861	0,000022	0,000381	0,060000	0,042338	0,038617	0,038945	0,041593	0,038670	0,052114
TOR/TA (+)	0,035667	0,042156	0,027252	0,048444	0,032444	0,015496	0,036089	0,027281	0,060000	0,036711
STD/TL (-)	0,278116	0,141149	0,121631	0,177482	0,147064	0,124461	0,156147	0,106379	0,100000	0,281918
LTD/TL (-)	0,405875	0,375862	0,585185	0,384547	0,100000	0,669221	0,545594	0,523244	0,221711	0,183397
WC/CA (+)	0,100000	0,058663	0,073193	0,058523	0,065268	0,078921	0,066672	0,052799	0,067920	0,080041
E/TL (+)	0,003242	0,050412	0,034445	0,037823	0,077816	0,024609	0,027567	0,049992	0,080000	0,025654
NCA/TL (+)	0,070398	0,069835	0,078611	0,063546	0,072331	0,079728	0,072585	0,030365	0,080000	0,062419
TA/TD (+)	0,016814	0,026117	0,021996	0,022755	0,038487	0,020048	0,020598	0,025988	0,040000	0,020239
CSTD/CL (+)	0,039569	0,043450	0,038287	0,050000	0,035480	0,047796	0,034399	0,049712	0,034819	0,041542
W/OR (-)	0,147608	0,147076	0,147869	0,145488	0,143925	0,150000	0,149781	0,145149	0,148622	0,141109
W/TR (-)	0,072373	0,074426	0,074038	0,072632	0,071906	0,074884	0,075000	0,072462	0,074324	0,070445
W/OE (-)	0,090593	0,089718	0,097148	0,103828	0,097898	0,075000	0,111830	0,094433	0,083055	0,079126
S_j	1,301520	1,120825	1,330036	1,226452	0,926905	1,402732	1,338831	1,220587	1,031635	1,076683
Rank	4	7	3	5	10	1	2	6	9	8

Appendix A.2: COPRAS Calculations

For calculations, the same matrices with the financial ratios expressed as absolute numbers (see Table A.1.1.1, A.1.2.1, and A.1.3.1) will be used as a basis for each analyzed season.

Season 2017/18

Normalized Decision Matrix:

Table A.2.1.1: Normalized decision matrix of the COPRAS method (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,0264	0,0455	-0,0505	0,9519	-0,0308	0,0878	-0,0027	-0,0879	0,0515	0,0087
OP/OR (+)	-0,1623	-0,3010	-0,3739	-0,0804	0,2226	-1,1090	0,0151	0,5236	-0,3382	2,6035
TOR/TA (+)	0,1145	0,1251	0,0646	0,1156	0,0706	0,0496	0,1184	0,0668	0,1911	0,0837
STD/TL (-)	0,1757	0,1106	0,0785	0,1314	0,0755	0,0568	0,1058	0,0625	0,0651	0,1381
LTD/TL (-)	0,0776	0,0472	0,1630	0,0710	0,0355	0,2015	0,1928	0,1355	0,0185	0,0574
WC/CA (+)	0,4139	0,0653	0,0270	0,1234	0,0299	0,1451	0,1951	-0,1012	-0,0278	0,1294
E/TL (+)	0,0353	0,1272	0,0770	0,0875	0,1733	0,0722	0,0261	0,1142	0,1969	0,0903
NCA/TL (+)	0,1107	0,0972	0,1056	0,0978	0,1075	0,1253	0,1130	0,0434	0,1030	0,0963
TA/TD (+)	0,0657	0,1052	0,0792	0,0835	0,1506	0,0774	0,0633	0,0970	0,1934	0,0847
CSTD/CL (+)	0,0815	0,1087	0,1170	0,0793	0,0831	0,1043	0,0810	0,1493	0,1153	0,0805
W/OR (-)	0,1389	0,1040	0,0906	0,1046	0,0937	0,0700	0,0889	0,1075	0,0629	0,1389
W/TR (-)	0,1102	0,0983	0,0881	0,1064	0,0947	0,0712	0,1179	0,1085	0,0635	0,1412
W/OE (-)	0,1126	0,1068	0,0992	0,1113	0,0934	0,0940	0,1151	0,1019	0,0700	0,0958

For normalizing the data, the financial ratio has been divided by the sum of all values of that financial ratio of all clubs. Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.2.1.2: Weighted normalized decision matrix and results of the COPRAS method (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,000791	0,001364	-0,001515	0,028558	-0,000923	0,002634	-0,000080	-0,002638	0,001546	0,000262
OP/OR (+)	-0,009739	-0,018060	-0,022432	-0,004824	0,013357	-0,066543	0,000905	0,031417	-0,020291	0,156211
TOR/TA (+)	0,006873	0,007503	0,003874	0,006937	0,004238	0,002974	0,007106	0,004011	0,011464	0,005021
STD/TL (-)	0,017565	0,011063	0,007854	0,013141	0,007551	0,005682	0,010581	0,006249	0,006505	0,013808
LTD/TL (-)	0,007760	0,004715	0,016304	0,007100	0,003548	0,020151	0,019280	0,013555	0,001847	0,005741
WC/CA (+)	0,041394	0,006535	0,002699	0,012335	0,002988	0,014510	0,019508	-0,010123	-0,002784	0,012938
E/TL (+)	0,002827	0,010172	0,006160	0,007000	0,013862	0,005777	0,002088	0,009140	0,015750	0,007222

NCA/TL (+)	0,008855	0,007778	0,008448	0,007827	0,008601	0,010025	0,009044	0,003473	0,008243	0,007706
TA/TD (+)	0,002628	0,004207	0,003168	0,003341	0,006024	0,003095	0,002533	0,003880	0,007735	0,003390
CSTD/CL (+)	0,004073	0,005433	0,005850	0,003964	0,004153	0,005217	0,004051	0,007464	0,005767	0,004026
W/OR (-)	0,020839	0,015596	0,013591	0,015690	0,014052	0,010501	0,013342	0,016124	0,009434	0,020831
W/TR (-)	0,008262	0,007374	0,006607	0,007978	0,007103	0,005340	0,008846	0,008135	0,004763	0,010592
W/OE (-)	0,008449	0,008008	0,007438	0,008345	0,007001	0,007052	0,008630	0,007642	0,005253	0,007181
S_j⁺	0,057703	0,024931	0,006251	0,065139	0,052300	-0,022310	0,045155	0,046623	0,027430	0,196777
S_j⁻	0,062876	0,046755	0,051794	0,052255	0,039255	0,048726	0,060679	0,051705	0,027802	0,058153
S_{min}⁻/S_j⁻	0,442174	0,594630	0,536778	0,532044	0,708246	0,570580	0,458177	0,537706	1,000000	0,478079
Z_j	0,095441	0,075682	0,052064	0,110547	0,112747	0,026387	0,084259	0,092515	0,112777	0,237580
Rank	5	8	9	4	3	10	7	6	2	1

with:

	S_{jmin}	Sum
S_j⁺	-0,022310	0,5
S_j⁻	0,027802	0,5
S_{min}⁻/S_j⁻	/	5,858414

Season 2018/19

Normalized Decision Matrix:

Table A.2.2.1: Normalized decision matrix of the COPRAS method (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,0042	0,0114	0,0035	0,9391	-0,0073	0,0108	-0,0011	0,0133	0,0119	0,0141
OP/OR (+)	-0,1047	-0,1965	-0,2185	-0,0033	0,1135	-0,6050	0,0715	0,2262	-0,1423	1,8591
TOR/TA (+)	0,1080	0,1317	0,0734	0,1254	0,0797	0,0476	0,1156	0,0745	0,1614	0,0827
STD/TL (-)	0,1415	0,1162	0,0802	0,1370	0,0802	0,0663	0,1161	0,0748	0,0702	0,1175
LTD/TL (-)	0,1418	0,0417	0,1558	0,0633	0,0262	0,1875	0,1972	0,1096	0,0141	0,0628
WC/CA (+)	0,1362	0,0281	0,0201	0,1943	0,0058	0,3041	0,2272	-0,0040	-0,0045	0,0927
E/TL (+)	0,0269	0,1290	0,0765	0,0919	0,1764	0,0657	0,0092	0,1174	0,1956	0,1115
NCA/TL (+)	0,0944	0,0856	0,0994	0,1015	0,0968	0,1219	0,1070	0,0976	0,0997	0,0962
TA/TD (+)	0,0620	0,1052	0,0775	0,0840	0,1555	0,0735	0,0579	0,0975	0,1929	0,0940
CSTD/CL (+)	0,0919	0,0993	0,1283	0,0824	0,1033	0,0977	0,0767	0,1253	0,1080	0,0870
W/OR (-)	0,1134	0,0917	0,0931	0,1021	0,1035	0,0681	0,0901	0,1043	0,0795	0,1542
W/TR (-)	0,0999	0,0842	0,0931	0,1063	0,1071	0,0709	0,0887	0,1079	0,0814	0,1605
W/OE (-)	0,1022	0,0903	0,1014	0,1070	0,1035	0,0915	0,1209	0,1009	0,0862	0,0962

For normalizing the data, the financial ratio has been divided by the sum of all values of that financial ratio of all clubs. Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.2.2.2: Weighted normalized decision matrix and results of the COPRAS method (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,000125	0,000341	0,000105	0,028174	-0,000220	0,000325	-0,000033	0,000400	0,000357	0,000424
OP/OR (+)	-0,006283	-0,011793	-0,013109	-0,000197	0,006809	-0,036299	0,004293	0,013569	-0,008536	0,111546
TOR/TA (+)	0,006481	0,007901	0,004404	0,007524	0,004784	0,002857	0,006935	0,004467	0,009685	0,004961
STD/TL (-)	0,014151	0,011624	0,008022	0,013701	0,008025	0,006631	0,011607	0,007476	0,007017	0,011747
LTD/TL (-)	0,014176	0,004169	0,015577	0,006327	0,002615	0,018753	0,019725	0,010961	0,001415	0,006281
WC/CA (+)	0,013619	0,002811	0,002013	0,019429	0,000578	0,030407	0,022724	-0,000405	-0,000445	0,009270
E/TL (+)	0,002152	0,010319	0,006117	0,007351	0,014114	0,005252	0,000732	0,009395	0,015649	0,008919
NCA/TL (+)	0,007554	0,006845	0,007949	0,008118	0,007746	0,009748	0,008562	0,007805	0,007979	0,007693
TA/TD (+)	0,002481	0,004209	0,003099	0,003359	0,006221	0,002939	0,002316	0,003901	0,007714	0,003760
CSTD/CL (+)	0,004596	0,004966	0,006415	0,004120	0,005166	0,004884	0,003837	0,006267	0,005399	0,004349
W/OR (-)	0,017005	0,013756	0,013962	0,015319	0,015522	0,010215	0,013517	0,015648	0,011925	0,023131
W/TR (-)	0,007493	0,006317	0,006981	0,007973	0,008034	0,005317	0,006650	0,008093	0,006103	0,012040
W/OE (-)	0,007668	0,006770	0,007602	0,008028	0,007759	0,006860	0,009065	0,007566	0,006467	0,007214
S_j^+	0,030726	0,025599	0,016994	0,077877	0,045200	0,020115	0,049365	0,045401	0,037802	0,150923
S_j^-	0,060494	0,042637	0,052143	0,051348	0,041954	0,047776	0,060564	0,049744	0,032927	0,060413
S_{min^-}/S_j^-	0,544290	0,772259	0,631466	0,641239	0,784819	0,689188	0,543667	0,661921	1,000000	0,545024
Z_j	0,070666	0,082267	0,063330	0,124931	0,102789	0,070687	0,089259	0,093972	0,111182	0,190916
Rank	9	7	10	2	4	8	6	5	3	1

with:

	S_{jmin}	Sum
S_j^+	0,016994	0,5
S_j^-	0,032927	0,5
S_{min^-}/S_j^-	/	6,813872

Season 2019/20

Normalized Decision Matrix:

Table A.2.3.1: Normalized decision matrix of the COPRAS method (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,3281	0,2645	-1,3050	0,1889	0,2657	0,5390	-0,0550	0,1624	0,3428	0,2685
OP/OR (+)	0,0341	-0,0002	-0,0030	0,4177	0,0972	0,0297	0,0356	0,0837	0,0306	0,2746
TOR/TA (+)	0,0987	0,1166	0,0754	0,1340	0,0897	0,0429	0,0998	0,0755	0,1660	0,1015
STD/TL (-)	0,1702	0,0864	0,0744	0,1086	0,0900	0,0762	0,0955	0,0651	0,0612	0,1725
LTD/TL (-)	0,1016	0,0941	0,1465	0,0963	0,0250	0,1675	0,1366	0,1310	0,0555	0,0459
WC/CA (+)	0,2417	0,0452	0,1142	0,0445	0,0766	0,1415	0,0832	0,0173	0,0892	0,1468
E/TL (+)	0,0079	0,1225	0,0837	0,0919	0,1891	0,0598	0,0670	0,1215	0,1944	0,0623
NCA/TL (+)	0,1036	0,1027	0,1156	0,0935	0,1064	0,1173	0,1068	0,0447	0,1177	0,0918
TA/TD (+)	0,0664	0,1032	0,0869	0,0899	0,1521	0,0792	0,0814	0,1027	0,1581	0,0800
CSTD/CL (+)	0,0953	0,1047	0,0922	0,1205	0,0855	0,1152	0,0829	0,1198	0,0839	0,1001
W/OR (-)	0,0931	0,0970	0,0912	0,1086	0,1200	0,0756	0,0772	0,1111	0,0857	0,1406
W/TR (-)	0,1129	0,0827	0,0884	0,1091	0,1198	0,0759	0,0742	0,1116	0,0842	0,1413
W/OE (-)	0,0982	0,0972	0,1053	0,1125	0,1061	0,0813	0,1212	0,1024	0,0900	0,0858

For normalizing the data, the financial ratio has been divided by the sum of all values of that financial ratio of all clubs. Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.2.3.2: Weighted normalized decision matrix and results of the COPRAS method (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,009844	0,007936	-0,039151	0,005668	0,007970	0,016171	-0,001649	0,004873	0,010283	0,008056
OP/OR (+)	0,002045	-0,000010	-0,000180	0,025065	0,005831	0,001779	0,002136	0,005020	0,001837	0,016477
TOR/TA (+)	0,005919	0,006996	0,004523	0,008040	0,005384	0,002572	0,005989	0,004528	0,009957	0,006092
STD/TL (-)	0,017017	0,008636	0,007442	0,010860	0,008998	0,007615	0,009554	0,006509	0,006119	0,017250
LTD/TL (-)	0,010160	0,009409	0,014649	0,009627	0,002503	0,016753	0,013658	0,013099	0,005550	0,004591
WC/CA (+)	0,024168	0,004515	0,011423	0,004448	0,007655	0,014146	0,008323	0,001727	0,008916	0,014679
E/TL (+)	0,000630	0,009799	0,006695	0,007352	0,015126	0,004784	0,005358	0,009718	0,015551	0,004987
NCA/TL (+)	0,008284	0,008218	0,009251	0,007478	0,008512	0,009382	0,008542	0,003573	0,009414	0,007345
TA/TD (+)	0,002658	0,004129	0,003477	0,003597	0,006084	0,003169	0,003256	0,004108	0,006323	0,003199
CSTD/CL (+)	0,004767	0,005234	0,004612	0,006023	0,004274	0,005758	0,004144	0,005989	0,004195	0,005004
W/OR (-)	0,013963	0,014546	0,013676	0,016289	0,018004	0,011338	0,011578	0,016661	0,012850	0,021095
W/TR (-)	0,008467	0,006201	0,006629	0,008182	0,008983	0,005695	0,005567	0,008369	0,006313	0,010596
W/OE (-)	0,007364	0,007293	0,007897	0,008440	0,007958	0,006097	0,009091	0,007676	0,006752	0,006432
S_j^+	0,058315	0,046817	0,000651	0,067671	0,060836	0,057761	0,036099	0,039534	0,066476	0,065840

S_j^-	0,056972	0,046086	0,050294	0,053396	0,046447	0,047498	0,049448	0,052314	0,037583	0,059963
S_{min}^-/S_j^-	0,659685	0,815511	0,747275	0,703854	0,809164	0,791265	0,760061	0,718418	1,000000	0,626772
Z_j	0,101533	0,100244	0,049607	0,113783	0,113848	0,109599	0,085893	0,086601	0,131990	0,106902
Rank	6	7	10	3	2	4	9	8	1	5

with:

	S_{jmin}	Sum
S_j^+	0,000651	0,5
S_j^-	0,037583	0,5
S_{min}^-/S_j^-	/	7,632004

Appendix A.3: TOPSIS Calculations

For calculations, the same matrices with the financial ratios expressed as absolute numbers (see Table A.1.1.1, A.1.2.1, and A.1.3.1) will be used as a basis for each analyzed season.

Season 2017/18

Normalized Decision Matrix:

Table A.3.1.1: Normalized decision matrix of the TOPSIS method (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,0273	0,0471	-0,0523	0,9868	-0,0319	0,0910	-0,0027	-0,0911	0,0534	0,0090
OP/OR (+)	0,0550	0,1020	0,1267	0,0272	-0,0754	0,3758	-0,0051	-0,1774	0,1146	-0,8822
TOR/TA (+)	0,3367	0,3676	0,1898	0,3398	0,2076	0,1457	0,3481	0,1965	0,5616	0,2460
STD/TL (-)	0,5206	0,3278	0,2328	0,3894	0,2238	0,1684	0,3136	0,1852	0,1928	0,4092
LTD/TL (-)	0,2067	0,1256	0,4343	0,1891	0,0945	0,5368	0,5136	0,3611	0,0492	0,1529
WC/CA (+)	-0,7832	-0,1236	-0,0511	-0,2334	-0,0565	-0,2745	-0,3691	0,1915	0,0527	-0,2448
E/TL (+)	0,0992	0,3570	0,2162	0,2457	0,4864	0,2027	0,0733	0,3207	0,5527	0,2534
NCA/TL (+)	0,3428	0,3011	0,3270	0,3030	0,3330	0,3881	0,3501	0,1345	0,3191	0,2983
TA/TD (+)	0,1935	0,3098	0,2332	0,2460	0,4436	0,2279	0,1865	0,2857	0,5695	0,2496
CSTD/CL (+)	0,2516	0,3356	0,3613	0,2449	0,2565	0,3222	0,2502	0,4610	0,3562	0,2487
W/OR (-)	-0,4274	-0,3199	-0,2788	-0,3218	-0,2882	-0,2154	-0,2737	-0,3307	-0,1935	-0,4273
W/TR (-)	-0,3407	-0,3040	-0,2724	-0,3290	-0,2928	-0,2202	-0,3647	-0,3354	-0,1964	-0,4367
W/OE (-)	0,3535	0,3350	0,3112	0,3492	0,2929	0,2951	0,3611	0,3197	0,2198	0,3005

For normalizing the data, the financial ratio has been divided by the square root of the sum of all values squared of that financial ratio of all clubs, with:

2017/18	$\sum_{j=1}^n r_{ij}^2$	$\sqrt{\sum_{j=1}^n r_{ij}^2}$
NP/OP (+)	218,1562	14,7701
OP/OR (+)	0,3449	0,5873
TOR/TA (+)	4,0397	2,0099
STD/TL (-)	1,6655	1,2905
LTD/TL (-)	0,9557	0,9776
WC/CA (+)	5,8479	2,4182
E/TL (+)	1,6183	1,2721
NCA/TL (+)	5,0177	2,2400
TA/TD (+)	34,9714	5,9137
CSTD/CL (+)	17,7202	4,2095
W/OR (-)	3,2402	1,8001
W/TR (-)	3,1011	1,7610
W/OE (-)	2,8429	1,6861

Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.3.1.2: Weighted normalized decision matrix and results of the TOPSIS method (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,000820	0,001413	-0,001570	0,029603	-0,000957	0,002731	-0,000082	-0,002734	0,001603	0,000271
OP/OR (+)	0,003300	0,006120	0,007601	0,001635	-0,004526	0,022547	-0,000306	-0,010645	0,006876	-0,052931
TOR/TA (+)	0,020201	0,022055	0,011386	0,020389	0,012457	0,008741	0,020888	0,011789	0,033697	0,014759
STD/TL (-)	0,052056	0,032785	0,023277	0,038945	0,022378	0,016838	0,031359	0,018519	0,019279	0,040921
LTD/TL (-)	0,020673	0,012561	0,043432	0,018913	0,009452	0,053682	0,051360	0,036108	0,004920	0,015292
WC/CA (+)	-0,078322	-0,012364	-0,005107	-0,023339	-0,005653	-0,027454	-0,036911	0,019154	0,005268	-0,024481
E/TL (+)	0,007936	0,028557	0,017294	0,019652	0,038915	0,016219	0,005861	0,025658	0,044216	0,020275
NCA/TL (+)	0,027425	0,024089	0,026164	0,024243	0,026639	0,031050	0,028010	0,010757	0,025528	0,023868
TA/TD (+)	0,007741	0,012390	0,009330	0,009839	0,017743	0,009115	0,007459	0,011427	0,022780	0,009983
CSTD/CL (+)	0,012580	0,016779	0,018066	0,012244	0,012827	0,016112	0,012512	0,023051	0,017812	0,012435
W/OR (-)	-0,064114	-0,047982	-0,041815	-0,048273	-0,043232	-0,032307	-0,041048	-0,049606	-0,029024	-0,064089
W/TR (-)	-0,025550	-0,022803	-0,020430	-0,024672	-0,021964	-0,016512	-0,027355	-0,025158	-0,014728	-0,032756
W/OE (-)	0,026511	0,025128	0,023339	0,026186	0,021969	0,022130	0,027080	0,023980	0,016485	0,022534
D_j^+	0,000820	0,001413	-0,001570	0,029603	-0,000957	0,002731	-0,000082	-0,002734	0,001603	0,000271
D_j^-	0,003300	0,006120	0,007601	0,001635	-0,004526	0,022547	-0,000306	-0,010645	0,006876	-0,052931
$D_j^+ + D_j^-$	0,020201	0,022055	0,011386	0,020389	0,012457	0,008741	0,020888	0,011789	0,033697	0,014759
C_j	0,628655	0,423257	0,379992	0,436786	0,440498	0,405137	0,488480	0,392718	0,364528	0,640722
Rank	2	6	9	5	4	7	3	8	10	1

with:

2017/18	V_j^+	V_j^-
NP/OP (+)	-0,002734	0,029603
OP/OR (+)	-0,052931	0,022547
TOR/TA (+)	0,008741	0,033697
STD/TL (-)	0,016838	0,052056
LTD/TL (-)	0,004920	0,053682
WC/CA (+)	-0,078322	0,019154
E/TL (+)	0,005861	0,044216
NCA/TL (+)	0,010757	0,031050
TA/TD (+)	0,007459	0,022780
CSTD/CL (+)	0,012244	0,023051
W/OR (-)	-0,064114	-0,029024
W/TR (-)	-0,032756	-0,014728
W/OE (-)	0,016485	0,027080

Season 2018/19

Normalized Decision Matrix:

Table A.3.2.1: Normalized decision matrix of the TOPSIS method (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,0044	0,0121	0,0037	0,9995	-0,0078	0,0115	-0,0012	0,0142	0,0127	0,0150
OP/OR (+)	0,0523	0,0982	0,1091	0,0016	-0,0567	0,3022	-0,0357	-0,1129	0,0711	-0,9285
TOR/TA (+)	0,3249	0,3961	0,2208	0,3771	0,2398	0,1432	0,3476	0,2239	0,4855	0,2487
STD/TL (-)	0,4319	0,3548	0,2448	0,4181	0,2449	0,2024	0,3542	0,2282	0,2141	0,3585
LTD/TL (-)	0,3775	0,1110	0,4148	0,1685	0,0696	0,4994	0,5253	0,2919	0,0377	0,1673
WC/CA (+)	-0,2970	-0,0613	-0,0439	-0,4237	-0,0126	-0,6631	-0,4956	0,0088	0,0097	-0,2022
E/TL (+)	0,0741	0,3555	0,2107	0,2533	0,4862	0,1809	0,0252	0,3237	0,5391	0,3073
NCA/TL (+)	0,2974	0,2695	0,3130	0,3196	0,3050	0,3838	0,3371	0,3073	0,3142	0,3029
TA/TD (+)	0,1818	0,3083	0,2270	0,2461	0,4558	0,2153	0,1697	0,2858	0,5651	0,2755
CSTD/CL (+)	0,2870	0,3100	0,4005	0,2572	0,3226	0,3050	0,2395	0,3913	0,3371	0,2716
W/OR (-)	-0,3502	-0,2833	-0,2875	-0,3155	-0,3196	-0,2104	-0,2783	-0,3222	-0,2456	-0,4763
W/TR (-)	-0,3077	-0,2594	-0,2866	-0,3274	-0,3299	-0,2183	-0,2731	-0,3323	-0,2506	-0,4944
W/OE (-)	0,3219	0,2842	0,3191	0,3370	0,3257	0,2880	0,3806	0,3176	0,2715	0,3029

For normalizing the data, the financial ratio has been divided by the square root of the sum of all values squared of that financial ratio of all clubs, with:

2018/19	$\sum_{j=1}^n r_{ij}^2$	$\sqrt{\sum_{j=1}^n r_{ij}^2}$
NP/OP (+)	3411,2325	58,4058
OP/OR (+)	0,5335	0,7304
TOR/TA (+)	3,6032	1,8982
STD/TL (-)	1,3705	1,1707
LTD/TL (-)	1,1048	1,0511
WC/CA (+)	5,6560	2,3782
E/TL (+)	1,7331	1,3165
NCA/TL (+)	5,5981	2,3660
TA/TD (+)	37,1656	6,0964
CSTD/CL (+)	18,3855	4,2878
W/OR (-)	3,3967	1,8430
W/TR (-)	3,1534	1,7758
W/OE (-)	2,9832	1,7272

Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.3.2.2: Weighted normalized decision matrix and results of the TOPSIS method (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,000133	0,000363	0,000112	0,029986	-0,000234	0,000346	-0,000035	0,000426	0,000380	0,000451
OP/OR (+)	0,003138	0,005890	0,006547	0,000099	-0,003401	0,018129	-0,002144	-0,006777	0,004263	-0,055710
TOR/TA (+)	0,019493	0,023763	0,013247	0,022629	0,014388	0,008594	0,020859	0,013437	0,029131	0,014922
STD/TL (-)	0,043189	0,035475	0,024482	0,041813	0,024490	0,020236	0,035424	0,022816	0,021415	0,035851
LTD/TL (-)	0,037751	0,011103	0,041480	0,016849	0,006964	0,049938	0,052526	0,029188	0,003767	0,016725
WC/CA (+)	-0,029703	-0,006131	-0,004390	-0,042372	-0,001261	-0,066314	-0,049558	0,000883	0,000971	-0,020217
E/TL (+)	0,005931	0,028440	0,016857	0,020260	0,038898	0,014475	0,002018	0,025894	0,043128	0,024581
NCA/TL (+)	0,023793	0,021558	0,025038	0,025569	0,024399	0,030705	0,026968	0,024585	0,025132	0,024230
TA/TD (+)	0,007271	0,012333	0,009081	0,009843	0,018231	0,008614	0,006786	0,011432	0,022605	0,011019
CSTD/CL (+)	0,014349	0,015502	0,020026	0,012862	0,016128	0,015248	0,011977	0,019565	0,016856	0,013578
W/OR (-)	-0,052528	-0,042493	-0,043127	-0,047319	-0,047946	-0,031554	-0,041752	-0,048336	-0,036836	-0,071450
W/TR (-)	-0,023077	-0,019454	-0,021498	-0,024556	-0,024741	-0,016375	-0,020480	-0,024923	-0,018795	-0,037078
W/OE (-)	0,024143	0,021316	0,023935	0,025276	0,024430	0,021599	0,028542	0,023822	0,020361	0,022715
D_j^+	0,084845	0,099119	0,102629	0,080976	0,096269	0,099293	0,084630	0,094547	0,109804	0,055852
D_j^-	0,067609	0,059064	0,053536	0,067900	0,066874	0,086306	0,078320	0,059469	0,063734	0,104532
$D_j^+ + D_j^-$	0,152454	0,158183	0,156165	0,148875	0,163143	0,185600	0,162950	0,154016	0,173538	0,160384
C_j	0,443470	0,373392	0,342818	0,456084	0,409911	0,465014	0,480637	0,386124	0,367261	0,651760
Rank	5	8	10	4	6	3	2	7	9	1

with:

2018/19	V_j^+	V_j^-
NP/OP (+)	-0,000234	0,029986
OP/OR (+)	-0,055710	0,018129
TOR/TA (+)	0,008594	0,029131
STD/TL (-)	0,020236	0,043189
LTD/TL (-)	0,003767	0,052526
WC/CA (+)	-0,066314	0,000971
E/TL (+)	0,002018	0,043128
NCA/TL (+)	0,021558	0,030705
TA/TD (+)	0,006786	0,022605
CSTD/CL (+)	0,011977	0,020026
W/OR (-)	-0,071450	-0,031554
W/TR (-)	-0,037078	-0,016375
W/OE (-)	0,020361	0,028542

Season 2019/20

Normalized Decision Matrix:

Table A.3.3.1: Normalized decision matrix of the TOPSIS method (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,2077	0,1674	-0,8259	0,1196	0,1681	0,3411	-0,0348	0,1028	0,2169	0,1699
OP/OR (+)	-0,0655	0,0003	0,0058	-0,8030	-0,1868	-0,0570	-0,0684	-0,1608	-0,0589	-0,5279
TOR/TA (+)	0,2970	0,3510	0,2269	0,4033	0,2701	0,1290	0,3005	0,2271	0,4996	0,3057
STD/TL (-)	0,5029	0,2552	0,2199	0,3209	0,2659	0,2250	0,2823	0,1924	0,1808	0,5098
LTD/TL (-)	0,2938	0,2721	0,4236	0,2784	0,0724	0,4844	0,3949	0,3788	0,1605	0,1328
WC/CA (+)	-0,6504	-0,1215	-0,3074	-0,1197	-0,2060	-0,3807	-0,2240	-0,0465	-0,2400	-0,3950
E/TL (+)	0,0218	0,3387	0,2315	0,2542	0,5229	0,1654	0,1852	0,3359	0,5376	0,1724
NCA/TL (+)	0,3209	0,3183	0,3583	0,2897	0,3297	0,3634	0,3309	0,1384	0,3647	0,2845
TA/TD (+)	0,2016	0,3131	0,2637	0,2728	0,4614	0,2403	0,2469	0,3115	0,4795	0,2426
CSTD/CL (+)	0,2986	0,3279	0,2890	0,3774	0,2678	0,3607	0,2596	0,3752	0,2628	0,3135
W/OR (-)	-0,2891	-0,3011	-0,2831	-0,3372	-0,3727	-0,2347	-0,2397	-0,3449	-0,2660	-0,4367
W/TR (-)	-0,3494	-0,2559	-0,2735	-0,3376	-0,3707	-0,2350	-0,2297	-0,3453	-0,2605	-0,4372
W/OE (-)	0,3084	0,3055	0,3308	0,3535	0,3333	0,2554	0,3807	0,3215	0,2828	0,2694

For normalizing the data, the financial ratio has been divided by the square root of the sum of all values squared of that financial ratio of all clubs, with:

2019/20	$\sum_{j=1}^n r_{ij}^2$	$\sqrt{\sum_{j=1}^n r_{ij}^2}$
NP/OP (+)	22,0603	4,6968
OP/OR (+)	3,1889	1,7858
TOR/TA (+)	2,6291	1,6215
STD/TL (-)	1,7136	1,3091
LTD/TL (-)	1,1700	1,0817
WC/CA (+)	6,3044	2,5109
E/TL (+)	1,2034	1,0970
NCA/TL (+)	5,4624	2,3372
TA/TD (+)	25,8367	5,0830
CSTD/CL (+)	15,2757	3,9084
W/OR (-)	3,8845	1,9709
W/TR (-)	3,8753	1,9686
W/OE (-)	2,7040	1,6444

Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.3.3.2: Weighted normalized decision matrix and results of the TOPSIS method (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,006230	0,005023	-0,024778	0,003587	0,005044	0,010234	-0,001044	0,003084	0,006508	0,005098
OP/OR (+)	-0,003931	0,000020	0,000346	-0,048181	-0,011209	-0,003420	-0,004106	-0,009650	-0,003531	-0,031674
TOR/TA (+)	0,017817	0,021059	0,013614	0,024200	0,016208	0,007741	0,018028	0,013628	0,029973	0,018339
STD/TL (-)	0,050288	0,025522	0,021993	0,032092	0,026592	0,022505	0,028234	0,019235	0,018082	0,050976
LTD/TL (-)	0,029380	0,027208	0,042360	0,027836	0,007239	0,048443	0,039494	0,037876	0,016049	0,013276
WC/CA (+)	-0,065041	-0,012151	-0,030742	-0,011972	-0,020602	-0,038071	-0,022399	-0,004648	-0,023996	-0,039504
E/TL (+)	0,001743	0,027100	0,018516	0,020332	0,041831	0,013229	0,014819	0,026874	0,043005	0,013791
NCA/TL (+)	0,025672	0,025467	0,028667	0,023173	0,026377	0,029074	0,026470	0,011073	0,029174	0,022763
TA/TD (+)	0,008062	0,012523	0,010547	0,010911	0,018455	0,009613	0,009877	0,012461	0,019180	0,009705
CSTD/CL (+)	0,014932	0,016397	0,014448	0,018868	0,013389	0,018037	0,012981	0,018760	0,013140	0,015676
W/OR (-)	-0,043358	-0,045170	-0,042468	-0,050581	-0,055908	-0,035207	-0,035953	-0,051738	-0,039903	-0,065505
W/TR (-)	-0,026204	-0,019190	-0,020516	-0,025320	-0,027801	-0,017624	-0,017228	-0,025899	-0,019537	-0,032791
W/OE (-)	0,023133	0,022910	0,024807	0,026513	0,024999	0,019151	0,028556	0,024114	0,021208	0,020205
D_j^+	0,072906	0,090193	0,078277	0,073348	0,080473	0,085476	0,084788	0,088481	0,090655	0,057800
D_j^-	0,078891	0,041400	0,061831	0,064744	0,059073	0,059191	0,046104	0,050383	0,051467	0,076572
$D_j^+ + D_j^-$	0,151796	0,131593	0,140107	0,138091	0,139546	0,144667	0,130892	0,138865	0,142122	0,134372
C_j	0,519713	0,314609	0,441310	0,468846	0,423321	0,409153	0,352231	0,362823	0,362132	0,569850
Rank	2	10	4	3	5	6	9	7	8	1

with:

2019/20	V_j^+	V_j^-
NP/OP (+)	-0,024778	0,010234
OP/OR (+)	-0,048181	0,000346
TOR/TA (+)	0,007741	0,029973
STD/TL (-)	0,018082	0,050976
LTD/TL (-)	0,007239	0,048443
WC/CA (+)	-0,065041	-0,004648
E/TL (+)	0,001743	0,043005
NCA/TL (+)	0,011073	0,029174
TA/TD (+)	0,008062	0,019180
CSTD/CL (+)	0,012981	0,018868
W/OR (-)	-0,065505	-0,035207
W/TR (-)	-0,032791	-0,017228
W/OE (-)	0,019151	0,028556

Appendix A.4: PROMETHEE II Calculations

For calculations, the same matrices with the financial ratios expressed as absolute numbers (see Table A.1.1.1, A.1.2.1, and A.1.3.1) will be used as a basis for each analyzed season.

Season 2017/18

Normalized Decision Matrix:

Table A.4.1.1: Normalized decision matrix of the PROMETHEE II method (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,1099	0,1283	0,0360	1,0000	0,0550	0,1690	0,0820	0,0000	0,1341	0,0929
OP/OR (+)	0,7450	0,7823	0,8020	0,7229	0,6413	1,0000	0,6972	0,5602	0,7924	0,0000
TOR/TA (+)	0,4592	0,5335	0,1060	0,4667	0,1489	0,0000	0,4867	0,1221	1,0000	0,2411
STD/TL (-)	0,0000	0,5472	0,8172	0,3723	0,8427	1,0000	0,5877	0,9523	0,9307	0,3162
LTD/TL (-)	0,6769	0,8433	0,2102	0,7130	0,9071	0,0000	0,0476	0,3604	1,0000	0,7873
WC/CA (+)	0,0000	0,6767	0,7511	0,5641	0,7455	0,5218	0,4248	1,0000	0,8575	0,5524
E/TL (+)	0,0541	0,5917	0,2981	0,3596	0,8618	0,2700	0,0000	0,5162	1,0000	0,3758
NCA/TL (+)	0,8214	0,6570	0,7592	0,6646	0,7826	1,0000	0,8502	0,0000	0,7279	0,6461
TA/TD (+)	0,0184	0,3218	0,1221	0,1553	0,6712	0,1081	0,0000	0,2590	1,0000	0,1647
CSTD/CL (+)	0,0311	0,4196	0,5387	0,0000	0,0540	0,3580	0,0248	1,0000	0,5152	0,0177
W/OR (-)	1,0000	0,5403	0,3645	0,5486	0,4049	0,0936	0,3427	0,5866	0,0000	0,9993
W/TR (-)	0,6003	0,4479	0,3163	0,5516	0,4014	0,0990	0,7004	0,5785	0,0000	1,0000
W/OE (-)	0,0537	0,1843	0,3531	0,0844	0,4824	0,4673	0,0000	0,2926	1,0000	0,4291

For normalizing the data, the financial ratio has been subtracted by the minimum value of that ratio and then divided by the difference between the maximum and minimum value, with:

2017/18	Min	Max
NP/OP (+)	-1,3462	14,5749
OP/OR (+)	-0,5181	0,2207
TOR/TA (+)	0,2928	1,1288
STD/TL (-)	0,2173	0,6718
LTD/TL (-)	0,0481	0,5248
WC/CA (+)	-1,8940	0,4632
E/TL (+)	0,0932	0,7031
NCA/TL (+)	0,3012	0,8694
TA/TD (+)	1,1028	3,3679
CSTD/CL (+)	1,0308	1,9407
W/OR (-)	-0,7694	-0,3483
W/TR (-)	-0,7691	-0,3458
W/OE (-)	0,3706	0,6088

Next, the difference between a club and each different club has been calculated for every club. All negative values have then been exchanged with the value 0, before all weights were applied. The sum of all weighted normalized and transformed values have then been put in a MxM-matrix, where an entering and leaving flow have been calculated and added to get the results:

Table A.4.1.2: MxM-matrix and results of the PROMETHEE II method (2017/18).

2017/18	Barcelona	Real Madrid	Man. United	Liverpool	Man. City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton	Leaving Flow φ^+
Barcelona	/	0,093541	0,191675	0,086789	0,133769	0,268810	0,174642	0,195619	0,202498	0,073093	0,157826
Real Madrid	0,230635	/	0,159441	0,103057	0,075812	0,262361	0,237463	0,151268	0,114631	0,151203	0,165097
Man. United	0,231743	0,062414	/	0,122599	0,034439	0,119090	0,162301	0,080858	0,082661	0,153198	0,116589
Liverpool	0,156610	0,035782	0,152351	/	0,085137	0,239707	0,181737	0,148866	0,149633	0,092383	0,138023
Man. City	0,305848	0,110797	0,166450	0,187396	/	0,262383	0,286270	0,183771	0,095215	0,198298	0,199603
Tottenham	0,251768	0,108224	0,061980	0,152845	0,073261	/	0,161319	0,129329	0,063661	0,178856	0,131249
Juventus	0,112723	0,038448	0,060313	0,049997	0,052270	0,116442	/	0,109715	0,103935	0,100407	0,082694
Arsenal	0,308174	0,126728	0,153345	0,191601	0,124247	0,258926	0,284190	/	0,172016	0,206101	0,202814
Dortmund	0,457257	0,232296	0,297353	0,334572	0,177896	0,321428	0,430399	0,314220	/	0,365143	0,325618
Everton	0,187603	0,128619	0,227641	0,137073	0,140729	0,310409	0,276837	0,208056	0,224893	/	0,204651
Entering Flow φ^-	0,249151	0,104094	0,163394	0,151770	0,099729	0,239951	0,243907	0,169078	0,134349	0,168743	
$\varphi(a)$	-0,091325	0,061002	-0,046805	-0,013747	0,099874	-0,108701	-0,161212	0,033736	0,191269	0,035909	
Rank	8	3	7	6	2	9	10	5	1	4	

Season 2018/19

Normalized Decision Matrix:

Table A.4.2.1: Normalized decision matrix of the PROMETHEE II method (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,0121	0,0198	0,0114	1,0000	0,0000	0,0192	0,0066	0,0218	0,0203	0,0227
OP/OR (+)	0,7970	0,8342	0,8431	0,7558	0,7084	1,0000	0,7254	0,6627	0,8122	0,0000
TOR/TA (+)	0,5307	0,7386	0,2266	0,6834	0,2821	0,0000	0,5972	0,2358	1,0000	0,3081
STD/TL (-)	0,0000	0,3361	0,8150	0,0599	0,8147	1,0000	0,3383	0,8876	0,9486	0,3197
LTD/TL (-)	0,3030	0,8496	0,2265	0,7317	0,9344	0,0531	0,0000	0,4786	1,0000	0,7342
WC/CA (+)	0,5441	0,8945	0,9203	0,3558	0,9668	0,0000	0,2490	0,9987	1,0000	0,6851
E/TL (+)	0,0952	0,6427	0,3610	0,4438	0,8971	0,3030	0,0000	0,5808	1,0000	0,5489
NCA/TL (+)	0,2444	0,0000	0,3804	0,4384	0,3105	1,0000	0,5915	0,3309	0,3908	0,2921
TA/TD (+)	0,0306	0,3507	0,1450	0,1932	0,7235	0,1155	0,0000	0,2937	1,0000	0,2676
CSTD/CL (+)	0,2947	0,4379	1,0000	0,1100	0,5157	0,4063	0,0000	0,9426	0,6061	0,1989

W/OR (-)	0,5257	0,2742	0,2901	0,3951	0,4109	0,0000	0,2556	0,4206	0,1324	1,0000
W/TR (-)	0,3237	0,1487	0,2475	0,3951	0,4041	0,0000	0,1983	0,4129	0,1169	1,0000
W/OE (-)	0,5377	0,8832	0,5632	0,3992	0,5027	0,8487	0,0000	0,5770	1,0000	0,7123

For normalizing the data, the financial ratio has been subtracted by the minimum value of that ratio and then divided by the difference between the maximum and minimum value, with:

2018/19	Min	Max
NP/OP (+)	-0,4552	58,3776
OP/OR (+)	-0,6782	0,2207
TOR/TA (+)	0,2719	0,9216
STD/TL (-)	0,2369	0,5056
LTD/TL (-)	0,0396	0,5521
WC/CA (+)	-1,5771	0,0231
E/TL (+)	0,0332	0,7097
NCA/TL (+)	0,6376	0,9081
TA/TD (+)	1,0343	3,4452
CSTD/CL (+)	1,0271	1,7174
W/OR (-)	-0,8779	-0,3877
W/TR (-)	-0,8779	-0,3877
W/OE (-)	0,4689	0,6573

Next, the difference between a club and each different club has been calculated for every club. All negative values have then been exchanged with the value 0, before all weights were applied. The sum of all weighted normalized and transformed values have then been put in a MxM-matrix, where an entering and leaving flow have been calculated and added to get the results:

Table A.4.2.2: MxM-matrix and results of the PROMETHEE II method (2018/19).

2018/19	Barcelona	Real Madrid	Man. United	Liverpool	Man. City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton	Leaving Flow ϕ^+
Barcelona	/	0,070406	0,066983	0,060508	0,040447	0,214386	0,178092	0,041510	0,074510	0,065960	0,090311
Real Madrid	0,227918	/	0,148046	0,176203	0,064076	0,306457	0,321275	0,107760	0,024975	0,145591	0,169144
Man. United	0,195795	0,119347	/	0,194004	0,042806	0,220544	0,280440	0,017658	0,054995	0,170769	0,144040
Liverpool	0,142928	0,101111	0,147611	/	0,067152	0,277147	0,235004	0,095701	0,093487	0,108895	0,141004
Man. City	0,301121	0,167238	0,174667	0,245406	/	0,370997	0,415776	0,093602	0,063311	0,203610	0,226192
Tottenham	0,221780	0,156339	0,099125	0,202121	0,117717	/	0,233845	0,105390	0,065142	0,205270	0,156303
Juventus	0,065590	0,051261	0,039125	0,040082	0,042600	0,113948	/	0,046299	0,040646	0,086686	0,058471
Arsenal	0,159129	0,097726	0,222161	0,041809	0,306876	0,367682	0,082309	/	0,171802	0,560204	0,223300
Dortmund	0,412586	0,205539	0,264258	0,349142	0,140712	0,395823	0,491224	0,211504	/	0,326427	0,310802
Everton	0,274052	0,196172	0,250048	0,234568	0,151028	0,405968	0,407281	0,171014	0,196445	/	0,254064

Entering Flow φ^-	0,222322	0,129460	0,156892	0,171538	0,108157	0,296995	0,293916	0,098938	0,087257	0,208157
$\varphi(a)$	-0,132011	0,039685	-0,012852	-0,030534	0,118035	-0,140691	-0,235446	0,124362	0,223544	0,045907
Rank	8	5	6	7	3	9	10	2	1	4

Season 2019/20

Normalized Decision Matrix:

Table A.4.3.1: Normalized decision matrix of the PROMETHEE II method (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,8856	0,8512	0,0000	0,8101	0,8518	1,0000	0,6779	0,7958	0,8936	0,8533
OP/OR (+)	0,9119	0,9933	1,0000	0,0000	0,7619	0,9224	0,9083	0,7940	0,9201	0,3402
TOR/TA (+)	0,4532	0,5990	0,2641	0,7403	0,3808	0,0000	0,4627	0,2648	1,0000	0,4767
STD/TL (-)	0,0209	0,7738	0,8811	0,5741	0,7413	0,8655	0,6914	0,9649	1,0000	0,0000
LTD/TL (-)	0,4626	0,5154	0,1476	0,5001	1,0000	0,0000	0,2172	0,2565	0,7862	0,8535
WC/CA (+)	0,0000	0,8758	0,5679	0,8787	0,7358	0,4466	0,7061	1,0000	0,6796	0,4228
E/TL (+)	0,0000	0,6145	0,4065	0,4505	0,9715	0,2784	0,3169	0,6090	1,0000	0,2920
NCA/TL (+)	0,8065	0,7952	0,9720	0,6685	0,8455	0,9945	0,8506	0,0000	1,0000	0,6458
TA/TD (+)	0,0000	0,4013	0,2235	0,2562	0,9347	0,1395	0,1632	0,3957	1,0000	0,1477
CSTD/CL (+)	0,3314	0,5802	0,2492	1,0000	0,0693	0,8588	0,0000	0,9815	0,0269	0,4578
W/OR (-)	0,2690	0,3288	0,2396	0,5074	0,6832	0,0000	0,0246	0,5456	0,1550	1,0000
W/TR (-)	0,5767	0,1261	0,2113	0,5200	0,6793	0,0255	0,0000	0,5572	0,1483	1,0000
W/OE (-)	0,5766	0,6004	0,3986	0,2173	0,3783	1,0000	0,0000	0,4724	0,7813	0,8880

For normalizing the data, the financial ratio has been subtracted by the minimum value of that ratio and then divided by the difference between the maximum and minimum value, with:

2019/20	Min	Max
NP/OP (+)	-3,8793	1,6023
OP/OR (+)	-1,4340	0,0103
TOR/TA (+)	0,2092	0,8100
STD/TL (-)	0,2367	0,6673
LTD/TL (-)	0,0783	0,5240
WC/CA (+)	-1,6331	-0,1167
E/TL (+)	0,0239	0,5897
NCA/TL (+)	0,3235	0,8523
TA/TD (+)	1,0245	2,4373
CSTD/CL (+)	1,0147	1,4749
W/OR (-)	-0,8607	-0,4626
W/TR (-)	-0,8607	-0,4522
W/OE (-)	0,4199	0,6261

Next, the difference between a club and each different club has been calculated for every club. All negative values have then been exchanged with the value 0, before all weights were applied. The sum of all weighted normalized and transformed values have then been put in a MxM-matrix, where an entering and leaving flow have been calculated and added to get the results:

Table A.4.3.2: MxM-matrix and results of the PROMETHEE II method (2019/20).

2019/20	Barcelona	Real Madrid	Man. United	Liverpool	Man. City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton	Leaving Flow φ^+
Barcelona	/	0,035743	0,118690	0,099232	0,042338	0,155159	0,170727	0,115503	0,064458	0,050221	0,094674
Real Madrid	0,270175	/	0,181990	0,140118	0,086423	0,228881	0,235964	0,133443	0,077739	0,223213	0,175327
Man. United	0,202799	0,031667	/	0,128586	0,048912	0,112452	0,134229	0,090120	0,033325	0,180499	0,106954
Liverpool	0,279643	0,086097	0,224889	/	0,082396	0,276347	0,258302	0,107732	0,149296	0,164762	0,181052
Man. City	0,387412	0,197064	0,309877	0,247058	/	0,390563	0,356277	0,231007	0,148181	0,247204	0,279405
Tottenham	0,234194	0,073484	0,107378	0,174971	0,124524	/	0,159289	0,132963	0,061325	0,184606	0,139193
Juventus	0,173629	0,004433	0,053022	0,080792	0,014104	0,083155	/	0,086777	0,002644	0,150543	0,072122
Arsenal	0,116453	0,223454	0,144764	0,103376	0,271371	0,301319	0,169017	/	0,242908	0,582221	0,239431
Dortmund	0,382592	0,161440	0,267350	0,287018	0,121241	0,300423	0,317877	0,269708	/	0,312150	0,268866
Everton	0,283108	0,221668	0,329278	0,217238	0,135017	0,338458	0,380529	0,258353	0,226904	/	0,265617
Entering Flow φ^-	0,258890	0,115005	0,193026	0,164265	0,102925	0,242973	0,242468	0,158401	0,111864	0,232824	
$\varphi(a)$	-0,164215	0,060322	-0,086072	0,016786	0,176480	-0,103780	-0,170346	0,081031	0,157002	0,032793	
Rank	9	4	7	6	1	8	10	3	2	5	

Appendix A.5: GRA Calculations

For calculations, the same matrices with the financial ratios expressed as absolute numbers (see Table A.1.1.1, A.1.2.1, and A.1.3.1) will be used as a basis for each analyzed season.

Season 2017/18

Normalized Decision Matrix:

Table A.5.1.1: Normalized decision matrix of the GRA method (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,1099	0,1283	0,0360	1,0000	0,0550	0,1690	0,0820	0,0000	0,1341	0,0929
OP/OR (+)	0,7450	0,7823	0,8020	0,7229	0,6413	1,0000	0,6972	0,5602	0,7924	0,0000
TOR/TA (+)	0,4592	0,5335	0,1060	0,4667	0,1489	0,0000	0,4867	0,1221	1,0000	0,2411
STD/TL (-)	0,0000	0,5472	0,8172	0,3723	0,8427	1,0000	0,5877	0,9523	0,9307	0,3162
LTD/TL (-)	0,6769	0,8433	0,2102	0,7130	0,9071	0,0000	0,0476	0,3604	1,0000	0,7873
WC/CA (+)	0,0000	0,6767	0,7511	0,5641	0,7455	0,5218	0,4248	1,0000	0,8575	0,5524
E/TL (+)	0,0541	0,5917	0,2981	0,3596	0,8618	0,2700	0,0000	0,5162	1,0000	0,3758
NCA/TL (+)	0,8214	0,6570	0,7592	0,6646	0,7826	1,0000	0,8502	0,0000	0,7279	0,6461
TA/TD (+)	0,0184	0,3218	0,1221	0,1553	0,6712	0,1081	0,0000	0,2590	1,0000	0,1647
CSTD/CL (+)	0,0311	0,4196	0,5387	0,0000	0,0540	0,3580	0,0248	1,0000	0,5152	0,0177
W/OR (-)	1,0000	0,5403	0,3645	0,5486	0,4049	0,0936	0,3427	0,5866	0,0000	0,9993
W/TR (-)	0,6003	0,4479	0,3163	0,5516	0,4014	0,0990	0,7004	0,5785	0,0000	1,0000
W/OE (-)	0,0537	0,1843	0,3531	0,0844	0,4824	0,4673	0,0000	0,2926	1,0000	0,4291

All ratios range between the minimum value of 0 and the maximum value of 1. After normalization the deviation sequence has been calculated, subtracting the values from the normalized decision matrix from the maximum value 1. Then the grey relational coefficient has been calculated:

Table A.5.1.2: Grey relational coefficient of the GRA method (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,3597	0,3645	0,3415	1,0000	0,3460	0,3757	0,3526	0,3333	0,3661	0,3554
OP/OR (+)	0,6622	0,6967	0,7163	0,6434	0,5823	1,0000	0,6228	0,5320	0,7066	0,3333
TOR/TA (+)	0,4804	0,5173	0,3587	0,4839	0,3701	0,3333	0,4934	0,3629	1,0000	0,3972
STD/TL (-)	0,3333	0,5248	0,7322	0,4434	0,7607	1,0000	0,5481	0,9128	0,8783	0,4224
LTD/TL (-)	0,6075	0,7614	0,3877	0,6353	0,8433	0,3333	0,3443	0,4387	1,0000	0,7015
WC/CA (+)	0,3333	0,6073	0,6676	0,5342	0,6627	0,5112	0,4650	1,0000	0,7783	0,5276
E/TL (+)	0,3458	0,5505	0,4160	0,4384	0,7834	0,4065	0,3333	0,5082	1,0000	0,4448
NCA/TL (+)	0,7368	0,5931	0,6750	0,5985	0,6970	1,0000	0,7695	0,3333	0,6476	0,5855

TA/TD (+)	0,3375	0,4244	0,3629	0,3718	0,6033	0,3592	0,3333	0,4029	1,0000	0,3745
CSTD/CL (+)	0,3404	0,4628	0,5202	0,3333	0,3458	0,4378	0,3389	1,0000	0,5077	0,3373
W/OR (-)	1,0000	0,5210	0,4403	0,5255	0,4566	0,3555	0,4320	0,5474	0,3333	0,9986
W/TR (-)	0,5557	0,4752	0,4224	0,5272	0,4551	0,3569	0,6254	0,5426	0,3333	1,0000
W/OE (-)	0,3457	0,3800	0,4359	0,3532	0,4913	0,4841	0,3333	0,4141	1,0000	0,4669

Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.5.1.3: Applied weights and results of the GRA method (2017/18).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,010791	0,010935	0,010246	0,030000	0,010380	0,011270	0,010578	0,010000	0,010982	0,010661
OP/OR (+)	0,039735	0,041803	0,042978	0,038607	0,034937	0,060000	0,037370	0,031923	0,042395	0,020000
TOR/TA (+)	0,028824	0,031040	0,021521	0,029034	0,022205	0,020000	0,029607	0,021773	0,060000	0,023831
STD/TL (-)	0,033333	0,052477	0,073224	0,044337	0,076067	0,100000	0,054805	0,091283	0,087826	0,042236
LTD/TL (-)	0,060749	0,076138	0,038766	0,063535	0,084327	0,033333	0,034426	0,043875	0,100000	0,070155
WC/CA (+)	0,033333	0,060728	0,066765	0,053422	0,066269	0,051117	0,046504	0,100000	0,077826	0,052762
E/TL (+)	0,027665	0,044040	0,033280	0,035074	0,062674	0,032521	0,026667	0,040657	0,080000	0,035581
NCA/TL (+)	0,058942	0,047449	0,053999	0,047879	0,055761	0,080000	0,061560	0,026667	0,051808	0,046843
TA/TD (+)	0,013499	0,016976	0,014515	0,014873	0,024131	0,014369	0,013333	0,016116	0,040000	0,014978
CSTD/CL (+)	0,017020	0,023140	0,026008	0,016667	0,017289	0,021890	0,016947	0,050000	0,025386	0,016866
W/OR (-)	0,150000	0,078145	0,066051	0,078828	0,068486	0,053326	0,064805	0,082107	0,050000	0,149787
W/TR (-)	0,041680	0,035643	0,031681	0,039541	0,034133	0,026766	0,046901	0,040697	0,025000	0,075000
W/OE (-)	0,025929	0,028502	0,032696	0,026490	0,036850	0,036311	0,025000	0,031059	0,075000	0,035016
Γ_{oi}	0,041654	0,042078	0,039364	0,039868	0,045655	0,041608	0,036039	0,045089	0,055863	0,045670
Rank	6	5	9	8	3	7	10	4	1	2

Season 2018/19

Normalized Decision Matrix:

Table A.5.2.1: Normalized decision matrix of the GRA method (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,0121	0,0198	0,0114	1,0000	0,0000	0,0192	0,0066	0,0218	0,0203	0,0227
OP/OR (+)	0,7970	0,8342	0,8431	0,7558	0,7084	1,0000	0,7254	0,6627	0,8122	0,0000
TOR/TA (+)	0,5307	0,7386	0,2266	0,6834	0,2821	0,0000	0,5972	0,2358	1,0000	0,3081
STD/TL (-)	0,0000	0,3361	0,8150	0,0599	0,8147	1,0000	0,3383	0,8876	0,9486	0,3197
LTD/TL (-)	0,3030	0,8496	0,2265	0,7317	0,9344	0,0531	0,0000	0,4786	1,0000	0,7342
WC/CA (+)	0,5441	0,8945	0,9203	0,3558	0,9668	0,0000	0,2490	0,9987	1,0000	0,6851
E/TL (+)	0,0952	0,6427	0,3610	0,4438	0,8971	0,3030	0,0000	0,5808	1,0000	0,5489

NCA/TL (+)	0,2444	0,0000	0,3804	0,4384	0,3105	1,0000	0,5915	0,3309	0,3908	0,2921
TA/TD (+)	0,0306	0,3507	0,1450	0,1932	0,7235	0,1155	0,0000	0,2937	1,0000	0,2676
CSTD/CL (+)	0,2947	0,4379	1,0000	0,1100	0,5157	0,4063	0,0000	0,9426	0,6061	0,1989
W/OR (-)	0,5257	0,2742	0,2901	0,3951	0,4109	0,0000	0,2556	0,4206	0,1324	1,0000
W/TR (-)	0,3237	0,1487	0,2475	0,3951	0,4041	0,0000	0,1983	0,4129	0,1169	1,0000
W/OE (-)	0,5377	0,8832	0,5632	0,3992	0,5027	0,8487	0,0000	0,5770	1,0000	0,7123

All ratios range between the minimum value of 0 and the maximum value of 1. After normalization the deviation sequence has been calculated, subtracting the values from the normalized decision matrix from the maximum value 1. Then the grey relational coefficient has been calculated:

Table A.5.2.2: Grey relational coefficient of the GRA method (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,3360	0,3378	0,3359	1,0000	0,3333	0,3377	0,3348	0,3383	0,3379	0,3384
OP/OR (+)	0,7112	0,7510	0,7612	0,6719	0,6316	1,0000	0,6455	0,5972	0,7270	0,3333
TOR/TA (+)	0,5158	0,6567	0,3926	0,6123	0,4106	0,3333	0,5538	0,3955	1,0000	0,4195
STD/TL (-)	0,3333	0,4296	0,7300	0,3472	0,7296	1,0000	0,4304	0,8165	0,9069	0,4236
LTD/TL (-)	0,4177	0,7687	0,3926	0,6508	0,8841	0,3456	0,3333	0,4895	1,0000	0,6529
WC/CA (+)	0,5231	0,8257	0,8625	0,4370	0,9378	0,3333	0,3997	0,9974	1,0000	0,6136
E/TL (+)	0,3559	0,5832	0,4390	0,4734	0,8293	0,4177	0,3333	0,5439	1,0000	0,5257
NCA/TL (+)	0,3982	0,3333	0,4466	0,4710	0,4204	1,0000	0,5504	0,4277	0,4508	0,4139
TA/TD (+)	0,3403	0,4350	0,3690	0,3826	0,6439	0,3611	0,3333	0,4145	1,0000	0,4057
CSTD/CL (+)	0,4148	0,4708	1,0000	0,3597	0,5080	0,4572	0,3333	0,8971	0,5594	0,3843
W/OR (-)	0,5132	0,4079	0,4133	0,4525	0,4591	0,3333	0,4018	0,4632	0,3656	1,0000
W/TR (-)	0,4251	0,3700	0,3992	0,4525	0,4563	0,3333	0,3841	0,4599	0,3615	1,0000
W/OE (-)	0,5196	0,8107	0,5337	0,4542	0,5013	0,7677	0,3333	0,5417	1,0000	0,6348

Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.5.2.3: Applied weights and results of the GRA method (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,010081	0,010133	0,010077	0,030000	0,010000	0,010130	0,010044	0,010148	0,010137	0,010153
OP/OR (+)	0,042673	0,045061	0,045672	0,040312	0,037899	0,060000	0,038732	0,035829	0,043618	0,020000
TOR/TA (+)	0,030950	0,039404	0,023558	0,036737	0,024633	0,020000	0,033230	0,023730	0,060000	0,025171
STD/TL (-)	0,033333	0,042958	0,072996	0,034720	0,072957	0,100000	0,043040	0,081647	0,090685	0,042362
LTD/TL (-)	0,041772	0,076871	0,039263	0,065079	0,088408	0,034556	0,033333	0,048954	0,100000	0,065295
WC/CA (+)	0,052308	0,082570	0,086255	0,043700	0,093776	0,033333	0,039969	0,099738	0,100000	0,061357
E/TL (+)	0,028474	0,046659	0,035118	0,037870	0,066348	0,033418	0,026667	0,043515	0,080000	0,042055
NCA/TL (+)	0,031856	0,026667	0,035727	0,037681	0,033629	0,080000	0,044028	0,034213	0,036061	0,033114

TA/TD (+)	0,013611	0,017401	0,014761	0,015305	0,025755	0,014446	0,013333	0,016579	0,040000	0,016228
CSTD/CL (+)	0,020741	0,023539	0,050000	0,017985	0,025399	0,022859	0,016667	0,044854	0,027968	0,019214
W/OR (-)	0,076979	0,061183	0,061988	0,067882	0,068861	0,050000	0,060270	0,069486	0,054840	0,150000
W/TR (-)	0,031881	0,027751	0,029939	0,033941	0,034219	0,025000	0,028808	0,034495	0,027113	0,075000
W/OE (-)	0,038969	0,060800	0,040028	0,034065	0,037600	0,057579	0,025000	0,040627	0,075000	0,047608
Γ_{oi}	0,034894	0,043154	0,041952	0,038098	0,047653	0,041640	0,031779	0,044909	0,057340	0,046735
Rank	9	5	6	8	2	7	10	4	1	3

Season 2019/20

Normalized Decision Matrix:

Table A.5.3.1: Normalized decision matrix of the GRA method (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,8856	0,8512	0,0000	0,8101	0,8518	1,0000	0,6779	0,7958	0,8936	0,8533
OP/OR (+)	0,9119	0,9933	1,0000	0,0000	0,7619	0,9224	0,9083	0,7940	0,9201	0,3402
TOR/TA (+)	0,4532	0,5990	0,2641	0,7403	0,3808	0,0000	0,4627	0,2648	1,0000	0,4767
STD/TL (-)	0,0209	0,7738	0,8811	0,5741	0,7413	0,8655	0,6914	0,9649	1,0000	0,0000
LTD/TL (-)	0,4626	0,5154	0,1476	0,5001	1,0000	0,0000	0,2172	0,2565	0,7862	0,8535
WC/CA (+)	0,0000	0,8758	0,5679	0,8787	0,7358	0,4466	0,7061	1,0000	0,6796	0,4228
E/TL (+)	0,0000	0,6145	0,4065	0,4505	0,9715	0,2784	0,3169	0,6090	1,0000	0,2920
NCA/TL (+)	0,8065	0,7952	0,9720	0,6685	0,8455	0,9945	0,8506	0,0000	1,0000	0,6458
TA/TD (+)	0,0000	0,4013	0,2235	0,2562	0,9347	0,1395	0,1632	0,3957	1,0000	0,1477
CSTD/CL (+)	0,3314	0,5802	0,2492	1,0000	0,0693	0,8588	0,0000	0,9815	0,0269	0,4578
W/OR (-)	0,2690	0,3288	0,2396	0,5074	0,6832	0,0000	0,0246	0,5456	0,1550	1,0000
W/TR (-)	0,5767	0,1261	0,2113	0,5200	0,6793	0,0255	0,0000	0,5572	0,1483	1,0000
W/OE (-)	0,5766	0,6004	0,3986	0,2173	0,3783	1,0000	0,0000	0,4724	0,7813	0,8880

All ratios range between the minimum value of 0 and the maximum value of 1. After normalization the deviation sequence has been calculated, subtracting the values from the normalized decision matrix from the maximum value 1. Then the grey relational coefficient has been calculated:

Table A.5.3.2: Grey relational coefficient of the GRA method (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,8138	0,7706	0,3333	0,7248	0,7713	1,0000	0,6082	0,7100	0,8245	0,7732
OP/OR (+)	0,8501	0,9867	1,0000	0,3333	0,6774	0,8656	0,8450	0,7082	0,8622	0,4311
TOR/TA (+)	0,4777	0,5550	0,4046	0,6582	0,4468	0,3333	0,4820	0,4048	1,0000	0,4886
STD/TL (-)	0,3380	0,6885	0,8079	0,5400	0,6590	0,7881	0,6183	0,9345	1,0000	0,3333
LTD/TL (-)	0,4820	0,5078	0,3697	0,5001	1,0000	0,3333	0,3898	0,4021	0,7005	0,7734
WC/CA (+)	0,3333	0,8010	0,5364	0,8048	0,6543	0,4746	0,6298	1,0000	0,6095	0,4642

E/TL (+)	0,3333	0,5647	0,4572	0,4764	0,9462	0,4093	0,4226	0,5612	1,0000	0,4139
NCA/TL (+)	0,7210	0,7094	0,9470	0,6013	0,7639	0,9892	0,7699	0,3333	1,0000	0,5853
TA/TD (+)	0,3333	0,4551	0,3917	0,4020	0,8845	0,3675	0,3740	0,4528	1,0000	0,3697
CSTD/CL (+)	0,4279	0,5436	0,3998	1,0000	0,3495	0,7797	0,3333	0,9644	0,3394	0,4798
W/OR (-)	0,4062	0,4269	0,3967	0,5037	0,6122	0,3333	0,3389	0,5239	0,3717	1,0000
W/TR (-)	0,5416	0,3639	0,3880	0,5102	0,6092	0,3391	0,3333	0,5303	0,3699	1,0000
W/OE (-)	0,5415	0,5558	0,4540	0,3898	0,4457	1,0000	0,3333	0,4866	0,6957	0,8170

Next, the ratios have to be multiplied with their corresponding weights.

Results:

Table A.5.3.3: Applied weights and results of the GRA method (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,024415	0,023118	0,010000	0,021744	0,023140	0,030000	0,018246	0,021300	0,024735	0,023195
OP/OR (+)	0,051008	0,059205	0,060000	0,020000	0,040644	0,051938	0,050698	0,042494	0,051733	0,025866
TOR/TA (+)	0,028660	0,033298	0,024275	0,039492	0,026805	0,020000	0,028922	0,024288	0,060000	0,029317
STD/TL (-)	0,033804	0,068852	0,080788	0,054001	0,065901	0,078807	0,061832	0,093446	0,100000	0,033333
LTD/TL (-)	0,048199	0,050780	0,036972	0,050006	0,100000	0,033333	0,038977	0,040207	0,070046	0,077338
WC/CA (+)	0,033333	0,080097	0,053644	0,080480	0,065430	0,047465	0,062979	0,100000	0,060949	0,046419
E/TL (+)	0,026667	0,045174	0,036580	0,038114	0,075692	0,032743	0,033809	0,044896	0,080000	0,033112
NCA/TL (+)	0,057682	0,056753	0,075759	0,048106	0,061115	0,079132	0,061596	0,026667	0,080000	0,046828
TA/TD (+)	0,013333	0,018203	0,015668	0,016080	0,035382	0,014701	0,014961	0,018110	0,040000	0,014790
CSTD/CL (+)	0,021393	0,027179	0,019988	0,050000	0,017474	0,038987	0,016667	0,048219	0,016972	0,023989
W/OR (-)	0,060927	0,064038	0,059507	0,075560	0,091827	0,050000	0,050834	0,078583	0,055762	0,150000
W/TR (-)	0,040617	0,027294	0,029098	0,038263	0,045694	0,025432	0,025000	0,039773	0,027744	0,075000
W/OE (-)	0,040612	0,041685	0,034049	0,029234	0,033431	0,075000	0,025000	0,036491	0,052176	0,061272
Γ_{oi}	0,036973	0,045821	0,041256	0,043160	0,052503	0,044426	0,037655	0,047267	0,055393	0,049266
Rank	10	5	8	7	2	6	9	4	1	3

Appendix A.6: PAM Calculations

Season 2017/18

Table A.6.1.1: Financial and sporting ratios of ten of the largest soccer clubs in Europe, depending on their revenue, expressed as absolute numbers (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,4038	0,6959	-0,7731	14,5749	-0,4710	1,3444	-0,0406	-1,3462	0,7890	0,1336
OP/OR (+)	0,0323	0,0599	0,0744	0,0160	-0,0443	0,2207	-0,0030	-0,1042	0,0673	-0,5181
TOR/TA (+)	0,6767	0,7388	0,3814	0,6830	0,4173	0,2928	0,6997	0,3949	1,1288	0,4944
STD/TL (-)	0,6718	0,4231	0,3004	0,5026	0,2888	0,2173	0,4047	0,2390	0,2488	0,5281
LTD/TL (-)	0,2021	0,1228	0,4246	0,1849	0,0924	0,5248	0,5021	0,3530	0,0481	0,1495
WC/CA (+)	-1,8940	-0,2990	-0,1235	-0,5644	-0,1367	-0,6639	-0,8926	0,4632	0,1274	-0,5920
E/TL (+)	0,1262	0,4541	0,2750	0,3125	0,6188	0,2579	0,0932	0,4080	0,7031	0,3224
NCA/TL (+)	0,7679	0,6745	0,7326	0,6788	0,7459	0,8694	0,7843	0,3012	0,7148	0,6683
TA/TD (+)	1,1444	1,8318	1,3793	1,4546	2,6231	1,3476	1,1028	1,6894	3,3679	1,4759
CSTD/CL (+)	1,0591	1,4126	1,5210	1,0308	1,0799	1,3565	1,0534	1,9407	1,4996	1,0469
W/OR (-)	-0,7694	-0,5758	-0,5018	-0,5793	-0,5188	-0,3877	-0,4926	-0,5953	-0,3483	-0,7691
W/TR (-)	-0,5999	-0,5354	-0,4797	-0,5793	-0,5157	-0,3877	-0,6423	-0,5907	-0,3458	-0,7691
W/OE (-)	0,5960	0,5649	0,5247	0,5887	0,4939	0,4975	0,6088	0,5391	0,3706	0,5066
League Points (+)	0,8158	0,6666	0,7105	0,6579	0,8772	0,6754	0,8333	0,5526	0,5392	0,4298
Total Game Variance (+)	0,9516	0,9538	0,8871	0,8889	0,9048	0,8730	0,9474	0,9091	0,8571	0,7391
Attendance Spread (-)	2,0262	2,1499	1,3845	1,1123	1,2018	3,5260	1,4019	3,3066	1,5151	2,2501

In the next step, the clubs have been ranked in a league rank system for each criterion in relation to the ratios of the other clubs.

Table A.6.1.2: League ranking system of the results of all financial and sporting indicators of all clubs (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	5	4	9	1	8	2	7	10	3	6
OP/OR (+)	5	4	2	6	8	1	7	9	3	10
TOR/TA (+)	5	2	9	4	7	10	3	8	1	6
STD/TL (-)	10	7	5	8	4	1	6	2	3	9
LTD/TL (-)	6	3	8	5	2	10	9	7	1	4
WC/CA (+)	10	5	3	6	4	8	9	1	2	7
E/TL (+)	9	3	7	6	2	8	10	4	1	5
NCA/TL (+)	3	8	5	7	4	1	2	10	6	9
TA/TD (+)	9	3	7	6	2	8	10	4	1	5
CSTD/CL (+)	7	4	2	10	6	5	8	1	3	9

W/OR (-)	10	6	4	7	5	2	3	8	1	9
W/TR (-)	8	5	3	6	4	2	9	7	1	10
W/OE (-)	9	7	5	8	2	3	10	6	1	4
League Points (+)	3	6	4	7	1	5	2	8	9	10
Total Game Variance (+)	2	1	7	6	5	8	3	4	9	10
Attendance Spread (-)	6	7	3	1	2	10	4	9	5	8

After every club has been ranked for each criterion against the other clubs, all ranks are multiplied with the weight of their indicators. The results of each club are then added, resulting in a financial and sporting score. Those scores are multiplied with their corresponding total weights and added up, so that an overall performance score is received.

Results:

Table A.6.1.3: Weighted financial and sporting score and the overall performance score of each club (2017/18).

2017/18	Barcelona	Real Madrid	Man. United	Liverpool	Man. City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton	Total Weights
0,03	0,150	0,120	0,270	0,030	0,240	0,060	0,210	0,300	0,090	0,180	Financial 0,8125
0,06	0,300	0,240	0,120	0,360	0,480	0,060	0,420	0,540	0,180	0,600	
0,06	0,300	0,120	0,540	0,240	0,420	0,600	0,180	0,480	0,060	0,360	
0,1	1,000	0,700	0,500	0,800	0,400	0,100	0,600	0,200	0,300	0,900	
0,1	0,600	0,300	0,800	0,500	0,200	1,000	0,900	0,700	0,100	0,400	
0,1	1,000	0,500	0,300	0,600	0,400	0,800	0,900	0,100	0,200	0,700	
0,08	0,720	0,240	0,560	0,480	0,160	0,640	0,800	0,320	0,080	0,400	
0,08	0,240	0,640	0,400	0,560	0,320	0,080	0,160	0,800	0,480	0,720	
0,04	0,360	0,120	0,280	0,240	0,080	0,320	0,400	0,160	0,040	0,200	
0,05	0,350	0,200	0,100	0,500	0,300	0,250	0,400	0,050	0,150	0,450	
0,15	1,500	0,900	0,600	1,050	0,750	0,300	0,450	1,200	0,150	1,350	
0,075	0,600	0,375	0,225	0,450	0,300	0,150	0,675	0,525	0,075	0,750	
0,075	0,675	0,525	0,375	0,600	0,150	0,225	0,750	0,450	0,075	0,300	
0,333	0,999	1,998	1,332	2,331	0,333	1,665	0,666	2,664	2,997	3,330	Sporting 0,1875
0,333	0,666	0,333	2,331	1,998	1,665	2,664	0,999	1,332	2,997	3,330	
0,333	1,998	2,331	0,999	0,333	0,666	3,330	1,332	2,997	1,665	2,664	
Financial Score	7,795	4,980	5,070	6,410	4,200	4,585	6,845	5,825	1,980	7,310	
Sporting Score	3,663	4,662	4,662	4,662	2,664	7,659	2,997	6,993	7,659	9,324	
OPS	7,0203	4,9204	4,9935	6,0823	3,9120	5,1614	6,1235	6,0440	3,0448	7,6876	
Rank	9	3	4	7	2	5	8	6	1	10	

Season 2018/19

Table A.6.2.1: Financial and sporting ratios of ten of the largest soccer clubs in Europe, depending on their revenue, expressed as absolute numbers (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,2581	0,7073	0,2180	58,3776	-0,4552	0,6744	-0,0679	0,8294	0,7400	0,8785
OP/OR (+)	0,0382	0,0717	0,0797	0,0012	-0,0414	0,2207	-0,0261	-0,0825	0,0519	-0,6782
TOR/TA (+)	0,6167	0,7518	0,4191	0,7159	0,4552	0,2719	0,6599	0,4251	0,9216	0,4721
STD/TL (-)	0,5056	0,4153	0,2866	0,4895	0,2867	0,2369	0,4147	0,2671	0,2507	0,4197
LTD/TL (-)	0,3968	0,1167	0,4360	0,1771	0,0732	0,5249	0,5521	0,3068	0,0396	0,1758
WC/CA (+)	-0,7064	-0,1458	-0,1044	-1,0077	-0,0300	-1,5771	-1,1786	0,0210	0,0231	-0,4808
E/TL (+)	0,0976	0,4680	0,2774	0,3334	0,6401	0,2382	0,0332	0,4261	0,7097	0,4045
NCA/TL (+)	0,7037	0,6376	0,7405	0,7562	0,7216	0,9081	0,7976	0,7271	0,7433	0,7166
TA/TD (+)	1,1081	1,8797	1,3840	1,5001	2,7785	1,3128	1,0343	1,7423	3,4452	1,6794
CSTD/CL (+)	1,2305	1,3294	1,7174	1,1030	1,3831	1,3076	1,0271	1,6778	1,4455	1,1644
W/OR (-)	-0,6454	-0,5221	-0,5299	-0,5814	-0,5891	-0,3877	-0,5130	-0,5939	-0,4526	-0,8779
W/TR (-)	-0,5464	-0,4606	-0,5090	-0,5814	-0,5858	-0,3877	-0,4849	-0,5901	-0,4450	-0,8779
W/OE (-)	0,5560	0,4909	0,5512	0,5821	0,5626	0,4974	0,6573	0,5486	0,4689	0,5231
League Points (+)	0,7632	0,5965	0,5789	0,8509	0,8596	0,6228	0,7895	0,6140	0,7451	0,4737
Total Game Variance (+)	0,9836	0,9048	0,8548	0,8413	0,9531	0,9206	0,8947	0,8923	0,8491	0,8235
Attendance Spread (-)	2,2947	1,8194	1,3499	1,2134	1,6987	3,4730	1,3722	1,2463	1,2310	1,2897

In the next step, the clubs have been ranked in a league rank system for each criterion in relation to the ratios of the other clubs.

Table A.6.2.2: League ranking system of the results of all financial and sporting indicators of all clubs (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	7	5	8	1	10	6	9	3	4	2
OP/OR (+)	5	3	2	6	8	1	7	9	4	10
TOR/TA (+)	5	2	9	3	7	10	4	8	1	6
STD/TL (-)	10	7	4	9	5	1	6	3	2	8
LTD/TL (-)	7	3	8	5	2	9	10	6	1	4
WC/CA (+)	7	5	4	8	3	10	9	2	1	6
E/TL (+)	9	3	7	6	2	8	10	4	1	5
NCA/TL (+)	9	10	5	3	7	1	2	6	4	8
TA/TD (+)	9	3	7	6	2	8	10	4	1	5
CSTD/CL (+)	7	5	1	9	4	6	10	2	3	8
W/OR (-)	9	4	5	6	7	1	3	8	2	10
W/TR (-)	6	3	5	7	8	1	4	9	2	10
W/OE (-)	7	2	6	9	8	3	10	5	1	4

League Points (+)	4	8	9	2	1	6	3	7	5	10
Total Game Variance (+)	1	4	7	9	2	3	5	6	8	10
Attendance Spread (-)	9	8	5	1	7	10	6	3	2	4

After every club has been ranked for each criterion against the other clubs, all ranks are multiplied with the weight of their indicators. The results of each club are then added, resulting in a financial and sporting score. Those scores are multiplied with their corresponding total weights and added up, so that an overall performance score is received.

Results:

Table A.6.2.3: Weighted financial and sporting score and the overall performance score of each club (2018/19).

2018/19	Barcelona	Real Madrid	Man. United	Liverpool	Man. City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton	Total Weights
0,03	0,210	0,150	0,240	0,030	0,300	0,180	0,270	0,090	0,120	0,060	Financial 0,8125
0,06	0,300	0,180	0,120	0,360	0,480	0,060	0,420	0,540	0,240	0,600	
0,06	0,300	0,120	0,540	0,180	0,420	0,600	0,240	0,480	0,060	0,360	
0,1	1,000	0,700	0,400	0,900	0,500	0,100	0,600	0,300	0,200	0,800	
0,1	0,700	0,300	0,800	0,500	0,200	0,900	1,000	0,600	0,100	0,400	
0,1	0,700	0,500	0,400	0,800	0,300	1,000	0,900	0,200	0,100	0,600	
0,08	0,720	0,240	0,560	0,480	0,160	0,640	0,800	0,320	0,080	0,400	
0,08	0,720	0,800	0,400	0,240	0,560	0,080	0,160	0,480	0,320	0,640	
0,04	0,360	0,120	0,280	0,240	0,080	0,320	0,400	0,160	0,040	0,200	
0,05	0,350	0,250	0,050	0,450	0,200	0,300	0,500	0,100	0,150	0,400	
0,15	1,350	0,600	0,750	0,900	1,050	0,150	0,450	1,200	0,300	1,500	
0,075	0,450	0,225	0,375	0,525	0,600	0,075	0,300	0,675	0,150	0,750	
0,075	0,525	0,150	0,450	0,675	0,600	0,225	0,750	0,375	0,075	0,300	
0,333	1,332	2,664	2,997	0,666	0,333	1,998	0,999	2,331	1,665	3,330	Sporting 0,1875
0,333	0,333	1,332	2,331	2,997	0,666	0,999	1,665	1,998	2,664	3,330	
0,333	2,997	2,664	1,665	0,333	2,331	3,330	1,998	0,999	0,666	1,332	
Financial Score	7,685	4,335	5,365	6,280	5,450	4,630	6,790	5,520	1,935	7,010	
Sporting Score	4,662	6,660	6,993	3,996	3,330	6,327	4,662	5,328	4,995	7,992	
OPS	7,1182	4,7709	5,6703	5,8518	5,0525	4,9482	6,3910	5,4840	2,5088	7,1941	
Rank	9	2	6	7	4	3	8	5	1	10	

Season 2019/20

Table A.6.3.1: Financial and sporting ratios of ten of the largest soccer clubs in Europe, depending on their revenue, expressed as absolute numbers (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	0,9754	0,7864	-3,8793	0,5616	0,7897	1,6023	-0,1634	0,4828	1,0189	0,7982
OP/OR (+)	-0,1170	0,0006	0,0103	-1,4340	-0,3336	-0,1018	-0,1222	-0,2872	-0,1051	-0,9427
TOR/TA (+)	0,4815	0,5691	0,3679	0,6540	0,4380	0,2092	0,4872	0,3683	0,8100	0,4956
STD/TL (-)	0,6583	0,3341	0,2879	0,4201	0,3481	0,2946	0,3696	0,2518	0,2367	0,6673
LTD/TL (-)	0,3178	0,2943	0,4582	0,3011	0,0783	0,5240	0,4272	0,4097	0,1736	0,1436
WC/CA (+)	-1,6331	-0,3051	-0,7719	-0,3006	-0,5173	-0,9559	-0,5624	-0,1167	-0,6025	-0,9919
E/TL (+)	0,0239	0,3716	0,2539	0,2788	0,5736	0,1814	0,2032	0,3685	0,5897	0,1891
NCA/TL (+)	0,7500	0,7440	0,8375	0,6770	0,7706	0,8494	0,7733	0,3235	0,8523	0,6650
TA/TD (+)	1,0245	1,5914	1,3403	1,3865	2,3451	1,2216	1,2551	1,5835	2,4373	1,2332
CSTD/CL (+)	1,1672	1,2817	1,1294	1,4749	1,0466	1,4099	1,0147	1,4664	1,0271	1,2254
W/OR (-)	-0,5697	-0,5935	-0,5580	-0,6646	-0,7346	-0,4626	-0,4724	-0,6798	-0,5243	-0,8607
W/TR (-)	-0,6878	-0,5037	-0,5385	-0,6646	-0,7297	-0,4626	-0,4522	-0,6798	-0,5128	-0,8607
W/OE (-)	0,5072	0,5023	0,5439	0,5813	0,5481	0,4199	0,6261	0,5287	0,4650	0,4430
League Points (+)	0,7193	0,7632	0,5789	0,8684	0,7105	0,5175	0,7281	0,4912	0,6765	0,4298
Total Game Variance (+)	0,8361	0,8361	0,9524	0,8636	0,9516	0,8254	0,9123	0,8571	0,8519	0,8431
Attendance Spread (-)	2,2865	1,4523	1,4520	2,0181	1,3898	1,1809	1,1759	1,1359	1,2502	1,0079

In the next step, the clubs have been ranked in a league rank system for each criterion in relation to the ratios of the other clubs.

Table A.6.3.2: League ranking system of the results of all financial and sporting indicators of all clubs (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
NP/OP (+)	3	6	10	7	5	1	9	8	2	4
OP/OR (+)	5	2	1	10	8	3	6	7	4	9
TOR/TA (+)	6	3	9	2	7	10	5	8	1	4
STD/TL (-)	9	5	3	8	6	4	7	2	1	10
LTD/TL (-)	6	4	9	5	1	10	8	7	3	2
WC/CA (+)	10	3	7	2	4	8	5	1	6	9
E/TL (+)	10	3	6	5	2	9	7	4	1	8
NCA/TL (+)	6	7	3	8	5	2	4	10	1	9
TA/TD (+)	10	3	6	5	2	9	7	4	1	8
CSTD/CL (+)	6	4	7	1	8	3	10	2	9	5
W/OR (-)	5	6	4	7	9	1	2	8	3	10
W/TR (-)	8	3	5	6	9	2	1	7	4	10
W/OE (-)	5	4	7	9	8	1	10	6	3	2

League Points (+)	4	2	7	1	5	8	3	9	6	10
Total Game Variance (+)	8	8	1	4	2	10	3	5	6	7
Attendance Spread (-)	10	8	7	9	6	4	3	2	5	1

After every club has been ranked for each criterion against the other clubs, all ranks are multiplied with the weight of their indicators. The results of each club are then added, resulting in a financial and sporting score. Those scores are multiplied with their corresponding total weights and added up, so that an overall performance score is received.

Results:

Table A.6.3.3: Weighted financial and sporting score and the overall performance score of each club (2019/20).

2019/20	Barcelona	Real Madrid	Man. United	Liverpool	Man. City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton	Total Weights
0,03	0,090	0,180	0,300	0,210	0,150	0,030	0,270	0,240	0,060	0,120	Financial 0,8125
0,06	0,300	0,120	0,060	0,600	0,480	0,180	0,360	0,420	0,240	0,540	
0,06	0,360	0,180	0,540	0,120	0,420	0,600	0,300	0,480	0,060	0,240	
0,1	0,900	0,500	0,300	0,800	0,600	0,400	0,700	0,200	0,100	1,000	
0,1	0,600	0,400	0,900	0,500	0,100	1,000	0,800	0,700	0,300	0,200	
0,1	1,000	0,300	0,700	0,200	0,400	0,800	0,500	0,100	0,600	0,900	
0,08	0,800	0,240	0,480	0,400	0,160	0,720	0,560	0,320	0,080	0,640	
0,08	0,480	0,560	0,240	0,640	0,400	0,160	0,320	0,800	0,080	0,720	
0,04	0,400	0,120	0,240	0,200	0,080	0,360	0,280	0,160	0,040	0,320	
0,05	0,300	0,200	0,350	0,050	0,400	0,150	0,500	0,100	0,450	0,250	
0,15	0,750	0,900	0,600	1,050	1,350	0,150	0,300	1,200	0,450	1,500	
0,075	0,600	0,225	0,375	0,450	0,675	0,150	0,075	0,525	0,300	0,750	
0,075	0,375	0,300	0,525	0,675	0,600	0,075	0,750	0,450	0,225	0,150	
0,333	1,332	0,666	2,331	0,333	1,665	2,664	0,999	2,997	1,998	3,330	Sporting 0,1875
0,333	2,664	2,664	0,333	1,332	0,666	3,330	0,999	1,665	1,998	2,331	
0,333	3,330	2,664	2,331	2,997	1,998	1,332	0,999	0,666	1,665	0,333	
Financial Score	6,955	4,225	5,610	5,895	5,815	4,775	5,715	5,695	2,985	7,330	
Sporting Score	7,326	5,994	4,995	4,662	4,329	7,326	2,997	5,328	5,661	5,994	
OPS	7,0246	4,5567	5,4947	5,6638	5,5364	5,2533	5,2054	5,6262	3,4868	7,0795	
Rank	9	2	5	8	6	4	3	7	1	10	

Appendix A.7: Correlation between financial and sporting performance

Figure A.7.1: Plot of the average sporting and financial performance scores using the PAM method.

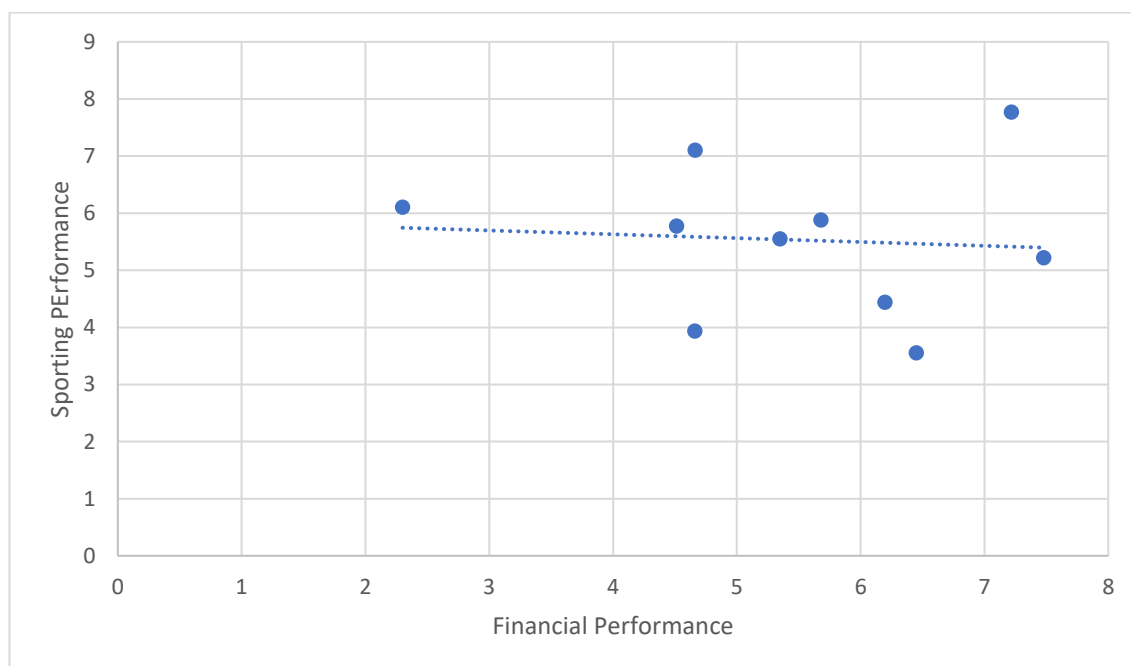


Table A.7.1.1: Results of the Spearman's Rank Correlation Test on the PAM method.

PAM	2017/18		2018/19		2019/20		Average	
	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance
Barcelona	7,795	3,663	7,685	4,662	6,955	7,326	7,478	5,217
Real Madrid	4,980	4,662	4,335	6,660	4,225	5,994	4,513	5,772
Man. United	5,070	4,662	5,365	6,993	5,610	4,995	5,348	5,550
Liverpool	6,410	4,662	6,280	3,996	5,895	4,662	6,195	4,440
Man. City	4,200	2,664	5,450	3,330	4,329	5,815	4,660	3,936
Tottenham	4,585	7,659	4,630	6,327	4,775	7,326	4,663	7,104
Juventus	6,845	2,997	6,790	4,662	5,715	2,997	6,450	3,552
Arsenal	5,825	6,993	5,520	5,328	5,695	5,328	5,680	5,883
Dortmund	1,980	7,659	1,935	4,995	2,985	5,661	2,300	6,105
Everton	7,310	9,324	7,010	7,992	7,330	5,994	7,217	7,770
Coefficient (r_s)	-0,17228		-0,03206		0,00257		-0,07745	
N	10		10		10		10	
T-statistic	0,49468		0,09072		0,00728		0,21973	
Degree of freedom (DF)	8		8		8		8	
p-value	0,31706		0,46497		0,49718		0,41579	

Table A.7.1.2: Summary of the regression results of the PAM method.

Regression Statistics	
Multiple R	-0,077454365
R Square	0,005999179
Adjusted R Square	-0,118250924
Standard Error	1,61134486
Observations	10

ANOVA

	Degree of Freedom (DF)	Sum of Squares (SS)	Median of Sum of Squares (MS)	Test Statistic (F)	Significance F
Regression	1	0,125363769	0,125363769	0,04828	0,83158
Residual	8	20,77145805	2,596432257		
Total	9	20,89682182			

	Coefficients	Standard Error	t-Stat	P-Value	Lower 95%	Upper 95%
Intercept	5,944135204	2,303722586	2,580230468	0,0326	0,63174	11,2565
Sporting Performance	-0,089223656	0,406052783	-0,219734132	0,83158	-1,0256	0,84714

Figure A.7.2: Plot of the average sporting and financial performance scores using the SAW method.

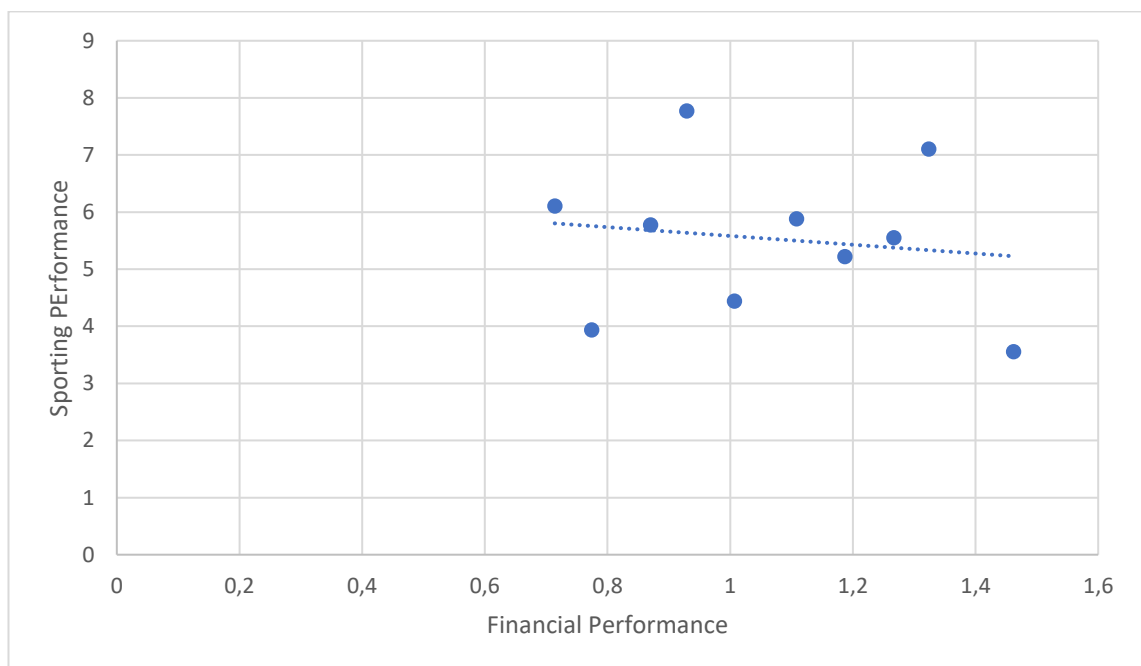


Table A.7.2.1: Results of the Spearman's Rank Correlation Test on the SAW method.

SAW	2017/18		2018/19		2019/20		Average	
	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance
Barcelona	1,072	3,663	1,431	4,662	1,058	7,326	1,187	5,217
Real Madrid	0,845	4,662	0,853	6,660	0,911	5,994	0,870	5,772
Man. United	1,273	4,662	1,448	6,993	1,081	4,995	1,267	5,550
Liverpool	0,985	4,662	1,040	3,996	0,997	4,662	1,007	4,440
Man. City	0,783	2,664	0,785	3,330	0,753	5,815	0,774	3,936
Tottenham	1,435	7,659	1,643	6,327	0,896	7,326	1,324	7,104
Juventus	1,508	2,997	1,790	4,662	1,088	2,997	1,462	3,552
Arsenal	1,143	6,993	1,189	5,328	0,992	5,328	1,108	5,883
Dortmund	0,658	7,659	0,647	4,995	0,838	5,661	0,714	6,105
Everton	0,917	9,324	0,994	7,992	0,875	5,994	0,929	7,770
Coefficient (r_s)	-0,1364		0,10998		-0,38768		-0,1437	
N	10		10		10		10	
T-statistic	0,38944		0,31297		1,18954		0,41071	
Degree of freedom (DF)	8		8		8		8	
p-value	0,35356		0,38115		0,13417		0,34603	

Table A.7.2.2: Summary of the regression results of the SAW method.

<i>Regression Statistics</i>	
Multiple R	0,143699659
R Square	0,020649592
Adjusted R Square	-0,101769209
Standard Error	0,259580326
Observations	10

ANOVA

	<i>Degree of Freedom (DF)</i>	<i>Sum of Squares (SS)</i>	<i>Median of Sum of Squares (MS)</i>	<i>Test Statistic (F)</i>	<i>Significance F</i>
Regression	1	0,01136598	0,01136598	0,16868	0,69207
Residual	8	0,539055567	0,067381946		
Total	9	0,550421547			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t-Stat</i>	<i>P-Value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	1,212765881	0,371119228	3,267860539	0,01139	0,35696	2,06857
Sporting Performance	-0,026865656	0,065413256	-0,410706594	0,69207	-0,1777	0,12398

Figure A.7.3: Plot of the average sporting and financial performance scores using the COPRAS method.

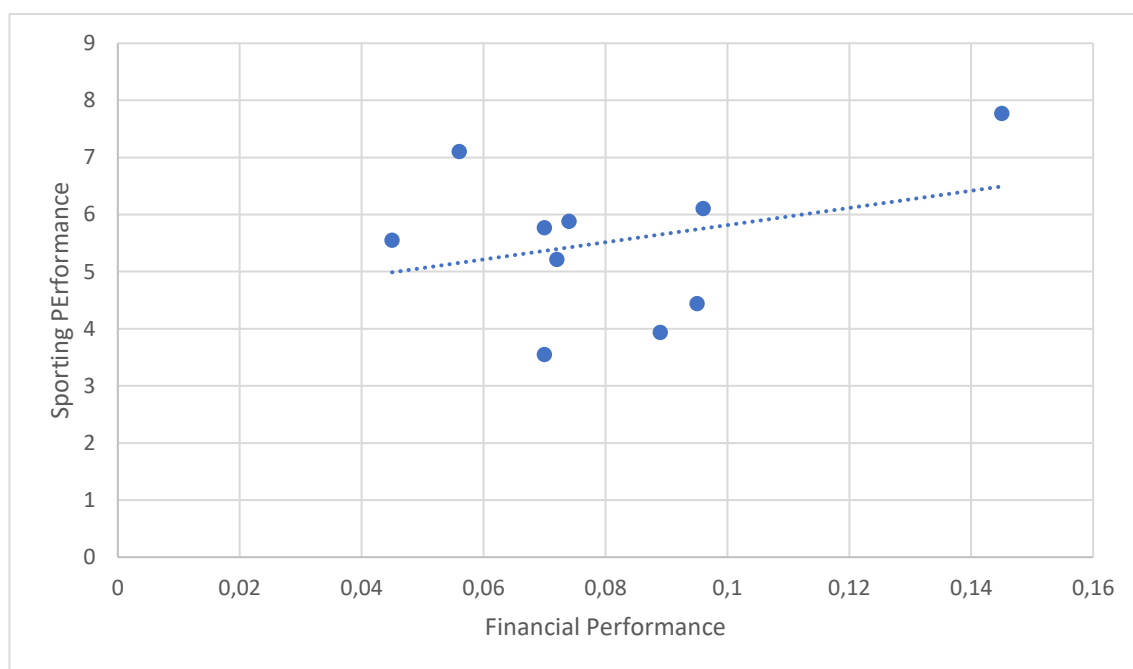


Table A.7.3.1: Results of the Spearman's Rank Correlation Test on the COPRAS method.

COPRAS	2017/18		2018/19		2019/20		Average	
	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance
Barcelona	0,078	3,663	0,057	4,662	0,083	7,326	0,072	5,217
Real Madrid	0,062	4,662	0,067	6,660	0,081	5,994	0,070	5,772
Man. United	0,042	4,662	0,052	6,993	0,040	4,995	0,045	5,550
Liverpool	0,090	4,662	0,102	3,996	0,092	4,662	0,095	4,440
Man. City	0,092	2,664	0,084	3,330	0,093	5,815	0,089	3,936
Tottenham	0,021	7,659	0,057	6,327	0,089	7,326	0,056	7,104
Juventus	0,069	2,997	0,073	4,662	0,070	2,997	0,070	3,552
Arsenal	0,075	6,993	0,076	5,328	0,070	5,328	0,074	5,883
Dortmund	0,092	7,659	0,090	4,995	0,107	5,661	0,096	6,105
Everton	0,193	9,324	0,155	7,992	0,087	5,994	0,145	7,770
Coefficient (r_s)	0,39378		0,22957		0,33447		0,3124	
N	10		10		10		10	
T-statistic	1,21169		0,66713		1,00385		0,93016	
Degree of freedom (DF)	8		8		8		8	
p-value	0,1301		0,26173		0,17242		0,18975	

Table A.7.3.2: Summary of the regression results of the COPRAS method.

Regression Statistics	
Multiple R	0,312401057
R Square	0,09759442
Adjusted R Square	-0,015206277
Standard Error	0,027876455
Observations	10

ANOVA

	Degree of Freedom (DF)	Sum of Squares (SS)	Median of Sum of Squares (MS)	Test Statistic (F)	Significance F
Regression	1	0,000672339	0,000672339	0,86519	0,3795
Residual	8	0,006216774	0,000777097		
Total	9	0,006889113			

	Coefficients	Standard Error	t-Stat	P-Value	Lower 95%	Upper 95%
Intercept	0,045087064	0,039854671	1,131286821	0,2907	-0,0468	0,13699
Sporting Performance	0,006534136	0,007024761	0,930157735	0,3795	-0,0097	0,02273

Figure A.7.4: Plot of the average sporting and financial performance scores using the TOPSIS method.

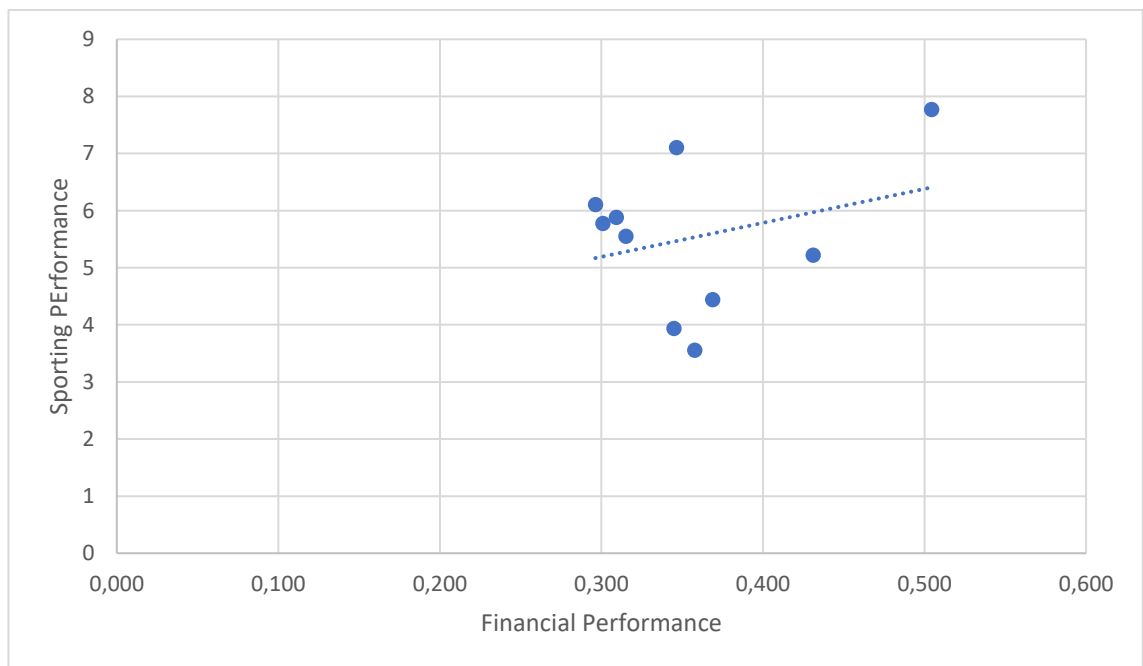


Table A.7.4.1: Results of the Spearman's Rank Correlation Test on the TOPSIS method.

TOPSIS	2017/18		2018/19		2019/20		Average	
	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance
Barcelona	0,511	3,663	0,360	4,662	0,422	7,326	0,431	5,217
Real Madrid	0,344	4,662	0,303	6,660	0,256	5,994	0,301	5,772
Man. United	0,309	4,662	0,279	6,993	0,359	4,995	0,315	5,550
Liverpool	0,355	4,662	0,371	3,996	0,381	4,662	0,369	4,440
Man. City	0,358	2,664	0,333	3,330	0,344	5,815	0,345	3,936
Tottenham	0,329	7,659	0,378	6,327	0,332	7,326	0,346	7,104
Juventus	0,397	2,997	0,391	4,662	0,286	2,997	0,358	3,552
Arsenal	0,319	6,993	0,314	5,328	0,295	5,328	0,309	5,883
Dortmund	0,296	7,659	0,298	4,995	0,294	5,661	0,296	6,105
Everton	0,521	9,324	0,530	7,992	0,463	5,994	0,504	7,770
Coefficient (r _s)	0,02884		0,32412		0,33028		0,29394	
N	10		10		10		10	
T-statistic	0,0816		0,96907		0,98971		0,86983	
Degree of freedom (DF)	8		8		8		8	
p-value	0,46849		0,18045		0,17565		0,20487	

Table A.7.4.2: Summary of the regression results of the TOPSIS method.

<i>Regression Statistics</i>	
Multiple R	0,293944576
R Square	0,086403414
Adjusted R Square	-0,027796159
Standard Error	0,06628182
Observations	10

ANOVA

	<i>Degree of Freedom (DF)</i>	<i>Sum of Squares (SS)</i>	<i>Median of Sum of Squares (MS)</i>	<i>Test Statistic (F)</i>	<i>Significance F</i>
Regression	1	0,003323956	0,003323956	0,7566	0,40973
Residual	8	0,035146237	0,00439328		
Total	9	0,038470193			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t-Stat</i>	<i>P-Value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0,277147954	0,094762412	2,924661241	0,01915	0,05863	0,49567
Sporting Performance	0,014528528	0,016702767	0,869827653	0,40973	-0,024	0,05305

Figure A.7.5: Plot of the average sporting and financial performance scores using the PROMETHEE II method.

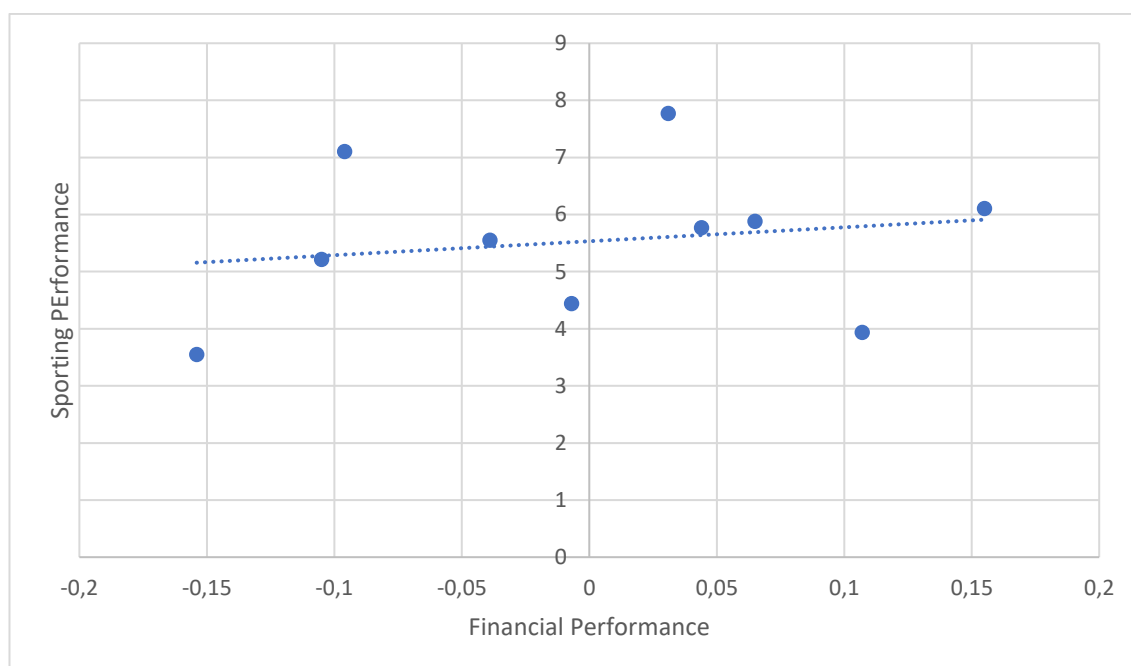


Table A.7.5.1: Results of the Spearman's Rank Correlation Test on the PROMETHEE II method.

PROMETHEE II	2017/18		2018/19		2019/20		Average	
	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance
Barcelona	-0,074	3,663	-0,107	4,662	-0,133	7,326	-0,105	5,217
Real Madrid	0,050	4,662	0,032	6,660	0,049	5,994	0,044	5,772
Man. United	-0,038	4,662	-0,010	6,993	-0,070	4,995	-0,039	5,550
Liverpool	-0,011	4,662	-0,025	3,996	0,014	4,662	-0,007	4,440
Man. City	0,081	2,664	0,096	3,330	0,143	5,815	0,107	3,936
Tottenham	-0,088	7,659	-0,114	6,327	-0,084	7,326	-0,096	7,104
Juventus	-0,131	2,997	-0,191	4,662	-0,138	2,997	-0,154	3,552
Arsenal	0,027	6,993	0,101	5,328	0,066	5,328	0,065	5,883
Dortmund	0,155	7,659	0,182	4,995	0,128	5,661	0,155	6,105
Everton	0,029	9,324	0,037	7,992	0,027	5,994	0,031	7,770
Coefficient (r_s)	0,30316		-0,0063		0,05562		0,29394	
N	10		10		10		10	
T-statistic	0,89981		0,01781		0,15757		0,86983	
Degree of freedom (DF)	8		8		8		8	
p-value	0,19725		0,49311		0,43935		0,20487	

Table A.7.5.2: Summary of the regression results of the PROMETHEE II method.

Regression Statistics	
Multiple R	0,183009367
R Square	0,033492428
Adjusted R Square	-0,087321018
Standard Error	0,102993243
Observations	10

ANOVA

	<i>Degree of Freedom (DF)</i>	<i>Sum of Squares (SS)</i>	<i>Median of Sum of Squares (MS)</i>	<i>Test Statistic (F)</i>	<i>Significance F</i>
Regression	1	0,002940687	0,002940687	0,27722	0,61281
Residual	8	0,084860865	0,010607608		
Total	9	0,087801552			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t-Stat</i>	<i>P-Value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-0,075612395	0,147248343	-0,513502517	0,62148	-0,4152	0,26394
Sporting Performance	0,013665276	0,025953906	0,526520982	0,61281	-0,0462	0,07352

Figure A.7.6: Plot of the average sporting and financial performance scores using the GRA method.

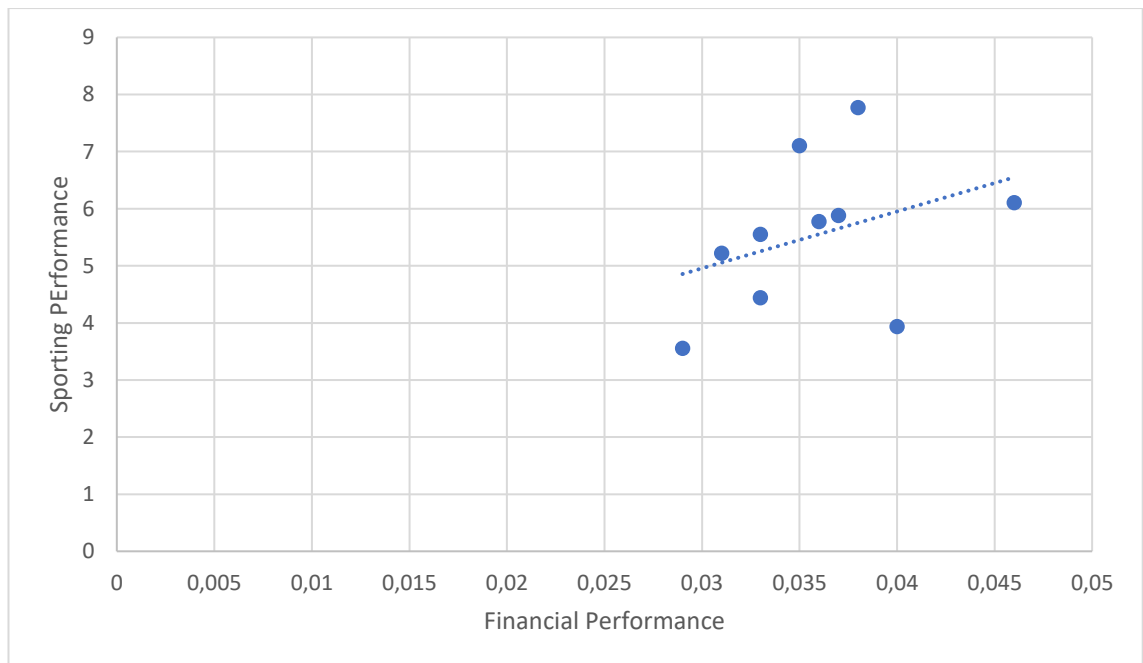


Table A.7.6.1: Results of the Spearman's Rank Correlation Test on the GRA method.

GRA	2017/18		2018/19		2019/20		Average	
	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance	Financial Performance	Sporting Performance
Barcelona	0,034	3,663	0,028	4,662	0,030	7,326	0,031	5,217
Real Madrid	0,034	4,662	0,035	6,660	0,037	5,994	0,036	5,772
Man. United	0,032	4,662	0,034	6,993	0,034	4,995	0,033	5,550
Liverpool	0,032	4,662	0,031	3,996	0,035	4,662	0,033	4,440
Man. City	0,037	2,664	0,039	3,330	0,043	5,815	0,040	3,936
Tottenham	0,034	7,659	0,034	6,327	0,036	7,326	0,035	7,104
Juventus	0,029	2,997	0,026	4,662	0,031	2,997	0,029	3,552
Arsenal	0,037	6,993	0,037	5,328	0,038	5,328	0,037	5,883
Dortmund	0,045	7,659	0,047	4,995	0,045	5,661	0,046	6,105
Everton	0,037	9,324	0,038	7,992	0,040	5,994	0,038	7,770
Coefficient (r _s)	0,52075		0,13546		0,17164		0,39722	
N	10		10		10		10	
T-statistic	1,72532		0,38671		0,49278		1,22423	
Degree of freedom (DF)	8		8		8		8	
p-value	0,06138		0,35453		0,3177		0,12785	

Table A.7.6.2: Summary of the regression results of the GRA method.

<i>Regression Statistics</i>	
Multiple R	0,39721924
R Square	0,157783125
Adjusted R Square	0,052506015
Standard Error	0,004749831
Observations	10

ANOVA

	<i>Degree of Freedom (DF)</i>	<i>Sum of Squares (SS)</i>	<i>Median of Sum of Squares (MS)</i>	<i>Test Statistic (F)</i>	<i>Significance F</i>
Regression	1	3,38129E-05	3,38129E-05	1,49874	0,25569
Residual	8	0,000180487	2,25609E-05		
Total	9	0,0002143			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t-Stat</i>	<i>P-Value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0,027502426	0,006790783	4,049963913	0,00368	0,01184	0,04316
Sporting Performance	0,00146533	0,001196939	1,224230796	0,25569	-0,0013	0,00423

Appendix A.8: Classification of analyzed soccer clubs considering all methods

Table A.8.1: Cumulative classification considering all analyzed methods (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
MCDA	3	8	9	4	2	9	4	6	6	1
GRA	6	5	9	8	3	7	10	4	1	2
PAM	9	3	4	7	2	5	8	6	1	10
Cumulative Classification 17/18	18	16	22	19	7	21	22	16	8	13
Classification 17/18	6	4_5	9_10	7	1	8	9_10	4_5	2	3

Table A.8.2: Cumulative classification considering all analyzed methods (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
MCDA	8	9	10	2	5	5	2	2	7	1
GRA	9	5	6	8	2	7	10	4	1	3
PAM	9	2	6	7	4	3	8	5	1	10
Cumulative Classification 18/19	26	16	22	17	11	15	20	11	9	14
Classification 18/19	10	6	9	7	2_3	5	8	2_3	1	4

Table A.8.3: Cumulative classification considering all analyzed methods (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
MCDA	6	9	7	1	2	3	10	7	5	3
GRA	10	5	8	7	2	6	9	4	1	3
PAM	9	2	5	8	6	4	3	7	1	10
Cumulative Classification 19/20	25	16	20	16	10	13	22	18	7	16
Classification 19/20	10	4_6	8	4_6	2	3	9	7	1	4_6

Appendix A.9: Classification of analyzed soccer clubs considering all methods (except SAW and TOPSIS method)

Table A.9.1.1: Classification of selected clubs according to the MCDA methods for the season 2017/18 excluding SAW and TOPSIS method.

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Method										
COPRAS Z_j	5	8	9	4	3	10	7	6	2	1
PROMETHEE II	8	3	7	6	2	9	10	5	1	4
Cumulative classification	13	11	16	10	5	19	17	11	3	5
Classification 2017/18	7	5_6	8	4	2_3	10	9	5_6	1	2_3

Table A.9.1.2: Classification of selected clubs according to the MCDA methods for the season 2018/19 excluding SAW and TOPSIS method.

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Method										
COPRAS Z_j	9	7	10	2	4	8	6	5	3	1
PROMETHEE II	8	5	6	7	3	9	10	2	1	4
Cumulative classification	17	12	16	9	7	17	16	7	4	5
Classification 2018/19	9_10	6	7_8	5	3_4	9_10	7_8	3_4	1	2

Table A.9.1.3: Classification of selected clubs according to the MCDA methods for the season 2019/20 excluding SAW and TOPSIS method.

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
Method										
COPRAS Z_j	6	7	10	3	2	4	9	8	1	5
PROMETHEE II	9	4	7	6	1	8	10	3	2	5
Cumulative classification	15	11	17	9	3	12	19	11	3	10
Classification 2019/20	8	5_6	9	3	1_2	7	10	5_6	1_2	4

Table A.9.2.1: Cumulative classification considering all analyzed methods excluding SAW and TOPSIS method (2017/18).

2017/18	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
MCDA	7	5	8	4	2	10	9	5	1	2
GRA	6	5	9	8	3	7	10	4	1	2
PAM	9	3	4	7	2	5	8	6	1	10
Cumulative Classification 17/18	22	13	21	19	7	22	27	15	3	14
Classification 17/18	8_9	3	7	6	2	8_9	10	5	1	4

Table A.9.2.2: Cumulative classification considering all analyzed methods excluding SAW and TOPSIS method (2018/19).

2018/19	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
MCDA	9	6	7	5	3	9	7	3	1	2
GRA	9	5	6	8	2	7	10	4	1	3
PAM	9	2	6	7	4	3	8	5	1	10
Cumulative Classification 18/19	27	13	19	20	9	19	25	12	3	15
Classification 18/19	10	4	6_7	8	2	6_7	9	3	1	5

Table A.9.2.3: Cumulative classification considering all analyzed methods excluding SAW and TOPSIS method (2019/20).

2019/20	Barcelona	Real Madrid	Manchester United	Liverpool	Manchester City	Tottenham Hotspur	Juventus	Arsenal	Dortmund	Everton
MCDA	8	5	9	3	1	7	10	5	1	4
GRA	10	5	8	7	2	6	9	4	1	3
PAM	9	2	5	8	6	4	3	7	1	10
Cumulative Classification 19/20	27	12	22	18	9	17	22	16	3	17
Classification 19/20	10	3	8_9	7	2	5_6	8_9	4	1	5_6

Declaration of Authenticity

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Rheinberg, 08.01.2022

Place, Date

A handwritten signature in black ink, appearing to read 'J. Trost', written over a horizontal line.

Signature