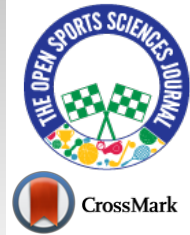




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## RESEARCH ARTICLE

### ModK: Formula for Determining the Best Season and Career of a Football Player by Objective Indicators

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#### Abstract:

##### Introduction:

Football is a team sport, but the idol or best football player of the moment or any time is a common pursuit within the sports community. Different strategies are applied in order to find out the top player. The aim of this study is to introduce an objective proposal for the career measurement of football players.

##### Methods:

A total of 50 players ranked the best of the 21<sup>st</sup> century, and 14, ranked the best of the 19/20 season of European and world football, had their careers and seasons measured through a formula named ModK. Descriptive statistics characterized the careers and seasons. The Pearson's Correlation Coefficient test was used for the variables used in the formula with the reference ranking, and ModK was performed to measure the strength of association of the rankings.

##### Results:

The values of the scores obtained by the ModK formula showed moderate correlation ( $r=0,416$ ) with the reference ranking. All variables used in the formula showed higher correlations with the ranking ModK formula when compared to the reference ranking.

##### Conclusion:

The ModK formula is proven to be effective in evaluating the career or full season of football athletes in an exclusively objective manner, presenting an acceptable correlation with a ranking created by experts.

**Keywords:** Ranking properties, Sports, Athlete development, ModK formula, Football, Professional sport.

#### Article History

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## 1. INTRODUCTION

In team sports, nothing is more important for the fans than their clubs and teams, but there is a great interest in defining the best player of the club, championship, country, of the century or the current season, as if athletes are the priorities, especially in football.

Rankings and comparisons created by journalists and professionals from all fields are often centered around players. However, almost all lists have, in whole or in part, subjective evaluation criteria. Although data, such as the number of goals or titles, are accounted for variables, such as “brilliance,” “magic,” “decision-making,” and even aspects of personality or

life outside the sport, weigh on the choice of the greatest player. Friendliness, political positions, socio-economic influence in teams or the sport, or even marketing and popularity are examples of how off-game characteristics can be decisive in the career judgement of athletes when they should not be considered, or at least should not be prioritized in the evaluation of sports performance alone.

Considering the professional career, numerous variables interfere with sports performance. Obviously, sports talent is a determining factor, especially in sports initiation, transition, and early years of a professional career. However, factors such as intrinsic motivation, physical, technical and tactical conditioning, and interaction with their teammates are just some of the individual variables that interfere with performance and consequently with the career of some of the best professionals in the sport. Variables that are difficult to control

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also impact careers, such as possible injuries and their treatments, career management (choice of the best clubs for their performance), the management of the club itself (members of the technical committee or the team itself), championships played, and even chance (nationality and other random events that are unpredictable and difficult to measure).

Still, creating an objective evaluation method of easy understanding for the whole public is of great value, especially if we look for variables that indirectly represent all types of variables cited. Therefore, the general objective of this study is to present an objective proposal to measure the career of football players. The specific goal is to create a ranking system of careers of professional football athletes from the results generated.

## 2. MATERIALS AND METHODS

### 2.1. ModK

In football, the data collected can be classified into three types:

- 1- Report-type data, usually collected on websites and magazines and present basic data of matches (goals, line-up, time of goals, *etc.*)
- 2- Event-type data. This type of data seeks to gather all the information of the games, with more details than the first type (leg used to score, time played, region that the athlete concentrated his match, kicks and plays, *etc.*), and
- 3- type is defined as tracking. It consists of working with various game moments seeking to understand why certain events happen [1].

The purpose of this article initially correlates with the second type since it focuses on more comprehensive data for the analysis and calculations. An equation was developed in order to create an athletes' overall performance score. This equation was named Modk formula. The methodological steps for the creation of the equation are presented below.

#### 2.1.1. Basic Assumptions of ModK

The main purpose of the formula is to create a score for any player of any era or location, as long as the necessary information is available. The variables used have the following characteristics:

- 1- Quantitative objectives,
- 2- Feasible collection, regardless of the time and source of the data,
- 3- Of outcome, that is, data related to the most relevant events of the game (*e.g.*, goals and assists),
- 4- Obtained in all professional football matches, from friendly matches to championship finals, of matches involving clubs and national teams,
- 5- Individual variables, except for titles.

The following are the five sets of variables that produce the formula, presented in each component in descending order of values.

#### 2.1.1.1. Individual Indicators in National Teams and Clubs

- 1- Hat-tricks
- 2- Penalties defended (for goalkeepers only)
- 3- Goals
- 4- Assists
- 5- Clean sheets (exclusively for defensive players)
- 6- Matches played

Each individual attribute has its specific value. The criteria used to define the values are the importance of the attribute and the frequency in which they occur during the game.

**EXPLANATION:** When it comes to the performance and career of an athlete, individual production will weigh in any analysis. These are attributes that are present in the career, regardless of whether these indicators resulted in a win, draw, or loss of the matches played.

#### 2.1.1.2. Indicators of Games and Titles in National Teams (Descending Score Order)

- 1- World Cup
- 2- Continental Football Championships
- 3- World Cup Qualifiers
- 4- Qualifiers of Continental Championships
- 5- Nation League Euro
- 6- Olympics
- 7- Confederations Cup
- 8- Other tournaments and friendly matches of national teams

#### 2.1.1.3. Indicators of Games and Titles in Clubs (Descending Score Order)

- 1- Club World Cup
- 2- Continental Club Championship
- 3- Continental Super Cup
- 4- Second Continental Club Championship
- 5- National Championships
- 6- National Super Cup
- 7- National Cup
- 8- Regional Championships
- 9- Friendly Matches
- 10- Second Division Nationals (half the value of the national championship) and Third Division Nationals (one-third of the national championship value)

**EXPLANATION:** Individual contributions are expected to bring collective sporting results. In the case of football, it is to turn goals, assists, or defended penalties into victories and, consequently, into titles.

#### 2.1.1.4. The Impact of the Athlete on Clubs and National Teams

This concept was created specifically for the ModK formula. In this concept, the impact is the result of the arithmetic mean between the short-term impact (subtraction between titles won by the athlete during his time in the club

and titles won before the athlete's arrival with a similar time interval) and the long-term impact, added to the relative value of the titles won by the athlete and the total number of titles won by the club. This is also valid for the country's national team. In addition to that, it is stipulated that:

- 1- Mathematically, it is possible for an athlete to have a negative impact simply by winning fewer titles during his time, compared to the period before his arrival. However, for the calculation, negative values will be replaced by ZERO.
- 2- There will be moments when the original formula cannot be used, as some of the tournaments are more recent, and a club would not win them before a certain athlete arrives. In case there are no previous similar tournaments, the calculation will be carried out by subtracting the titles during the athlete's presence and after the athlete's presence, in a period equal to the athlete's time in the club.

**2.1.1.5. Usage of Points per Match**

**EXPLANATION:** It is the simplest and the most objective data of the athlete's "effectiveness" in relation to the club in which he plays. It presents the average of how many points are earned during the presence of this athlete in the team. The usage of points, when analysed in a relative way (%), works as an adjustment in the calculation of the points per season.

**2.1.2. Values, Weights, and Adjustments of the Formula.**

All individual attributes and titles have their values adjusted according to the championship played, which vary according to their importance. Data, such as country, continent, and time of the match and title, also serve as an adjustment.

1) **Country:** The values adopted are the ones related to the European coefficient (UEFA), which defines the number of vacancies in the teams, for each country, for the main European competitions. Therefore, each country has its own value [2]. The same strategy was previously adopted for the South American countries, and the researchers themselves made the calculations. In other continents, the values of the countries were obtained in the form of tertiles.

2) **Continents:** The definition is based on the intercontinental matches between the clubs. The continent with the highest number of wins is assigned the highest value, while for the other continents, their values adjust proportionally to the number of wins against the most victorious continent. This adjustment is carried out for both clubs and teams.

3) **Season:** In matches between clubs, the adjustment is made every ten years, considering the average value of clubs according to their coefficient. In national teams, the adjustments are made every three cup cycles (twelve years). These periods are chosen because they represent the average time of a career in high performance. In regard to national teams, the period of twelve years is considered to suit the Cup cycles. However, no World Cups were held between 1940-1949, so the adjustment was the same as the period between 1930-1940. It has been defined that Europe and South

America have the same value, while other continents present half of that value for the period before this. Regarding clubs, the values of Europeans and South American ones are the same until 1959 (and the other continents present half of that value). From the 1960s onwards, the values are adjusted every 10 years, as official tournaments between teams from these continents have become frequent.

**2.2. ModK Proposed Formula**

After the first considerations on the quantity and quality of the available data, it has been decided that the formula should be structured in a way that could be easily interpreted and calculated. Its definition is presented below:

Formula:

$$ModK = \frac{\Sigma Comp}{\Sigma X_{pseason} Use}$$

Where:

Comp= Components. Use= relative usage of the points disputed in the season

In the case of the components, all the information is divided into six groups:

- 1<sup>st</sup> and 2<sup>nd</sup> components (individual values in clubs and national teams)

Comp 1 and 2

$$= \Sigma Seaso_n \{ (\Sigma Mtch * wt_{mtch} * wt_{chmp}) + (\Sigma goals * wt_{goals} * wt_{chmp}) + (\Sigma Assis * wt_{assis} * wt_{chmp}) + (\Sigma Htt * wt_{htt} * wt_{chmp}) + (\Sigma Pen * wt_{pen} * wt_{chmp}) * wt_{country} * wt_{continent} * wt_{time} \}$$

Where: Seaso<sub>n</sub>= Season. Chmp=Championship. Mtch=matches. Goal=goal. Assis =assists. Htt=Hat-trick. Pen=penalties defended.

- 3<sup>rd</sup> and 4<sup>th</sup> components (values of titles in clubs and national teams)

Comp 3 and 4

$$= \Sigma Temp_n [ \Sigma (title * wt_{chmp} * 10 * wt_{country} * wt_{continent} * wt_{time}) * \sim 1 - 4$$

**2.2.1. Proportion of Matches Played in the Season**

~1 above 40 matches= \*1; ~2above 30 matches= \*0,5; ~3above 20 matches=\* 0,25; ~4less than 20 matches=\*0,1

- 5<sup>th</sup> and 6<sup>th</sup> components (impact of the presence of the athlete on titles and clubs)

Comp 5 and 6=  $\Sigma teamError!$  Indicador não definido./2

#in case the value is negative, replace it with ZERO

- Usage of points: the season-weighted average of the usage of points per competition

$$Usage_{career} = \Sigma seasons \left[ \frac{\Sigma (Usage * Weight_{championships} * matches_{championships})}{\Sigma Weights * matches} \right]$$

Table 1 shows the relative difference of current scoring values for individual attributes, the weight of the championship, and titles of clubs and national teams.

**Table 1. Relative values of individual attributes, championships, and titles for sports career calculation by ModK formula.**

Individual attributes	Championships' weight	Title's weight
Match=reference	Friendly games=reference	Regional and secondary cups
Match without conceding goals (goalkeeper)=-65%	Regional and secondary cups=+20%	National Cup=25%
Match without conceding goals (defenders)=-35%	National Cup= +50%	National Championship=66.67%
Assist=+50%	National Championship=+100%	National Super Cup=46%
Goal=+100%	National Super Cup=+75%	Secondary Continental Cup=157%
Penalty defended=+150%	Secondary Continental Cup=209%	Main Continental Cup=296%
Hat-trick=+200%	Main Continental Cup=375%	Continental Super Cup=226%
	Continental Super Cup=292%	Club World Cup=296%
	Club World Cup=375%	Confederations Cup=565%
	Confederations Cup=267%	Olympic Games=375%
	Olympic Games=470%	Nations League=660%
	Nations League=359%	Qualifiers Continental NV
	Qualifiers Continental=474%	Qualifiers Cup=NV
	Qualifiers Cup=618%	Continental Cup of Nat. Teams=850%
	Cont. Cup of Nationals=1041%	World Cup=1485%
	World Cup=1801%	Other tournaments=10%

**2.2.2. First Proposal for the Usage of the Formula: Comparison with “The Independent's” Magazine Ranking: 50 Best of the XXI Century**

The Independent magazine published a ranking in 2018 of the top 100 football players of the 21<sup>st</sup> Century. The present article compared the ranking of the top 50 players' list according to “The Independent” [3] with the scores generated by the formula.

**2.2.3. Second Proposal for the Usage of the Formula: “The Best” and “UEFA” Awards Season 2019/20**

Annually, France Football magazine and the UEFA draw up lists with 11 and 10 players, respectively, bringing together those players who stood out the most, and the journalists, coaches, and professional players choose the best player of the season through votes. The ModK formula was used to calculate the score of each player during the 2019/20 season.

**2.2.3.1. Data Collection**

Data were collected from open sports websites specializing in football (Transfermarkt and Soccerstats). From entering data into a spreadsheet, the Modk formula was applied to each player.

**2.2.3.2. Statistical Analysis**

The descriptive analysis was used to describe the mean, standard deviation, and minimum and maximum values of all the individual variables used in the formula. In the first proposal, the lists were compared with the difference in the position of each player in both lists. In addition to that, the Pearson correlation test was performed for “The Independent” list with each variable used in the formula, as well as with the score of each player from the proposed formula. For the tests, values of  $\alpha$ ,  $\beta$ , and power of the test of 5%, 20% and 80% were adopted, respectively, with a significance level of  $p < 0.05$ . For the second proposal, only the descriptive analysis of the data

was performed, presenting the results and stratification in a) individual values, b) titles, and c) impact. Data analysis was performed in the statistical package SPSS, version 23.

**3. RESULTS**

Table 2 shows the 50 best players of the 21<sup>st</sup> century, according to The Independent magazine and the alternative order by the ModK formula, in addition to the individual data of the athletes used for the calculation of the career score. Only one player remained in the same position on both lists (Henry, in the 7<sup>th</sup> position). Cristiano Ronaldo (1<sup>st</sup>) and Oliver Kahn (46<sup>th</sup>) were the athletes who had the least significant positive change in positions (one position). Lionel Messi (2<sup>nd</sup>), Xavi (4<sup>th</sup>) losing one position, and Pavel Nedved (47<sup>th</sup>) losing three positions, were those who had the least significant negative change in their positions. Roberto Carlos (6<sup>th</sup>, +32), Iker Casillas (8<sup>th</sup>, +24), and Zlatan Ibrahimovic (22<sup>nd</sup>, +19) were the players who advanced their positions the most, while Canavarró (48<sup>th</sup>, -38), Ronaldinho (41<sup>st</sup>, -37), and Philipp Lahm (49<sup>th</sup>, -35) were those who lost positions the most. The biggest differences between players, through scores, were found between Messi (2<sup>nd</sup>) and Iniesta (3<sup>rd</sup>), 1856 points, and between Xavi (4<sup>th</sup>) and Sérgio Ramos (5<sup>th</sup>), with 1191 points. The difference between Francesco Totti (38<sup>th</sup>) and Ashley Cole (39<sup>th</sup>) was of less than one point, while the differences between Alessandro Del Piero (23<sup>rd</sup>) and Rivaldo (24<sup>th</sup>), Didier Drogba (31<sup>st</sup>) and John Terry (32<sup>nd</sup>), and Roy Keane (43<sup>rd</sup>) Wayne Rooney (44<sup>th</sup>) were of three points.

Table 2 clearly shows the tendency for players with offensive characteristics to be predominant in the list (18 attackers, eight attacking midfielders, six defensive midfielders, and 18 defenders, with four of them being goalkeepers); however, according to the formula presented, there was a noticeable change in relation to the concentration of offensive players in the first positions in the ranking. While

in the version of The Independent magazine, the best defensive player was in the tenth position and among the best 20, and six defenders were positioned between the 11<sup>th</sup> and the 20<sup>th</sup> places, the ModK formula ranking had four defensive athletes featuring among the ten highest scorers (Sérgio Ramos 5<sup>th</sup>, Roberto Carlos 6<sup>th</sup>, Iker Casillas 8<sup>th</sup>, Puyol 9<sup>th</sup> Paolo Maldini 10<sup>th</sup>), and nine defenders among the 20 best positioned, with two goalkeepers among them.

In Table 2, it was possible to observe that some objective data present a direct association with the position in the list, such as the usage of points by athletes, except for Kylian Mbappé (76.3%, third-highest usage and 36<sup>th</sup> on the list) and Neymar Jr (71%, ninth highest usage and 29<sup>th</sup> on the list). On the other hand, the average variable of the positions (the only original ordinal variable in the list according to the formula criteria) practically presents a linear association, with the main players having the lowest average of positions, exception made for Zlatan Ibrahimovic (15<sup>th</sup> in the list, but 5<sup>th</sup> in the average of positions). In Component 1 (individual indicators), the highest

scorers are in the following order: Lionel Messi, Cristiano Ronaldo, Raúl, Suárez, and Ibrahimovic, while in Component 2 (titles), the order is as follows: Dani Alves, Iniesta, Busquets, Xavi, and Cristiano Ronaldo. Finally, in the impact component, the order is Iniesta, Xavi, Cristiano Ronaldo, Paolo Maldini, and Messi.

Another important finding in Table 2 concerns the World Cup achievement by athletes. Among the top ten scorers, only Cristiano Ronaldo, Lionel Messi, and Paolo Maldini did not win this title. In regard to the most important title in world football, of the 50 athletes listed, 23 have won the World Cup, and only one, Ronaldo Nazário, has won the title twice. For practical purposes, in a tactical scheme defined in 4-3-3, the selected ones would be Iker Casillas (goalkeeper), Paolo Maldini (left-back/defender), Puyol (defender), Sergio Ramos (defender), and Roberto Carlos (left-back), Busquets (defensive midfielder), Xavi (attacking midfielder), and Iniesta (attacking midfielder), Messi (right-winger), Cristiano Ronaldo (left winger), and Henry (centre-forward).

Table 2. Final score, “The Independent” ranking, absolute and relative values of the variables in the formula (n=50).

Player	ModK Score	ModK Rank	TI Rank	Matches	Goals	Assists	Hat-tricks	Clean Sheet	percent points	Titles	Individual Score	Title Score	Impact Score	PPG	Position Average
Cristiano Ronaldo	10665	1	2	1000	725	257	54	0	74.0	32	6464.9	754.1	3445.8	10.7	6.5
Lionel Messi	10186	2	1	856	697	306	54	0	76.3	33	6614.3	724.6	2847.5	11.9	7.5
Andres Iniesta	8316	3	5	850	80	182	0	0	73.0	37	2793.8	912.4	4610.3	9.8	15.2
Xavi Hernandez	7823	4	3	990	121	236	2	0	69.7	31	2995.1	789.3	4038.4	7.9	13.2
Sergio Ramos	6454	5	12	855	115	45	0	293	69.7	24	2933.5	779.0	2741.8	7.5	18.2
Roberto Carlos	6175	6	38	868	106	125	0	296	62.7	24	2587.4	652.5	2935.1	7.1	19.8
Thierry Henry	6162	7	7	911	411	193	12	0	63.7	19	3295.3	505.3	2361.9	6.8	16.1
Iker Casillas	6123	8	32	1049	0	0	0	440	70.0	25	3014.6	709.2	2399.3	5.8	19.5
Carles Puyol	5909	9	25	696	22	16	0	303	69.3	26	2110.1	659.1	3139.5	8.5	23.4
Paolo Maldini	5783	10	27	1026	40	43	0	365	61.7	23	2358.5	519.9	2904.1	5.6	23.1
Ronaldo Nazario	5647	11	6	621	413	82	13	0	64.0	20	2803.7	701.0	2141.9	9.1	20.2
Sergio Busquets	5545	12	17	684	17	45	0	257	78.0	33	2123.9	856.9	2051.0	8.1	22.0
Dani Alves	5493	13	26	880	64	177	0	0	71.3	40	2659.9	911.1	1921.8	6.2	18.3
Manuel Neuer	5387	14	28	738	0	0	0	348	72.3	23	2375.2	445.7	2638.2	7.3	23.8
Samuel Eto'o	5342	15	21	815	408	122	7	0	57.6	21	3162.5	378.0	1801.0	6.6	23.0
Luka Modric	5327	16	22	699	77	123	0	0	68.0	22	2392.3	426.3	2508.0	7.6	25.2
Gianluigi Buffon	4989	17	13	1087	0	0	0	484	67.3	24	3154.2	362.8	1296.3	4.6	25.4
Zinedine Zidane	4964	18	8	717	148	145	5	0	60.7	17	2145.2	492.5	2326.6	6.9	25.9
Arjen Robben	4906	19	30	703	246	194	4	0	73.7	33	2949.9	443.9	1511.8	7.0	17.5
Zlatan Ibrahimovic	4896	20	39	870	528	202	20	0	70.3	33	3457.4	326.6	1111.6	5.6	16.2
Raul Gonzales	4809	21	24	1019	429	143	11	0	63.7	21	3741.1	332.0	736.0	4.7	22.5
Alessandro Del Piero	4793	22	42	869	342	110	9	0	62.3	16	2439.4	358.7	1995.3	5.5	25.2
Luis Figo	4498	23	15	771	143	193	0	0	66.3	27	2760.1	363.3	1374.7	5.8	24.0
Davi Villa	4412	24	33	741	389	90	8	0	59.7	15	2437.1	368.1	1607.0	6.0	27.0

(Table 2) contd....

Player	ModK Score	ModK Rank	TI Rank	Matches	Goals	Assists	Hat-tricks	Clean Sheet	percent points	Titles	Individual Score	Title Score	Impact Score	PPG	Position Average
Luis Suárez	4381	25	16	709	457	261	26	0	69.3	18	3690.3	277.6	413.1	6.2	21.4
Paulo Scholes	4377	26	34	775	166	83	2	103	68.7	29	2472.6	399.6	1505.2	5.6	22.4
Rivaldo Ferreira	4326	27	37	521	230	89	7	0	62.0	22	2626.5	443.6	1256.3	8.3	25.5
Andrea Pirlo	4234	28	11	872	86	143	0	323	60.3	21	2264.4	440.3	1529.5	4.9	25.9
Neymar Jr.	4149	29	20	497	310	186	17	0	70.7	21	2624.8	402.8	1121.6	8.3	21.1
Michael Ballack	4102	30	48	702	193	113	1	0	65.7	16	2319.8	207.1	1574.7	5.8	29.5
John Terry	3939	31	35	828	73	33	0	385	68.0	17	2140.1	209.6	1589.1	4.8	29.8
Didier Drogba	3909	32	49	770	357	135	8	0	62.7	19	1972.5	340.4	1722.7	5.1	27.4
Alessandro Nesta	3888	33	41	701	13	2	0	186	64.0	22	1431.2	427.8	2029.3	5.5	31.8
Patrick Vieira	3746	34	40	735	62	66	0	104	65.3	23	1754.6	492.9	1498.6	5.1	29.1
Kylian Mbappe	3703	35	43	217	130	78	7	0	76.3	11	2136.7	233.5	1333.1	17.1	28.6
Frank Lampard	3703	36	23	995	294	191	6	0	63.7	14	2778.3	158.9	765.7	3.7	28.4
Francesco Totti	3396	37	31	842	316	203	2	0	58.3	6	2260.9	167.6	967.9	4.0	32.2
Kaká	3279	38	9	617	189	163	2	0	64.7	13	2087.5	413.4	778.2	5.3	31.7
Ashley Cole	3204	39	46	795	15	77	0	256	63.7	16	1793.1	225.5	1185.8	4.0	35.1
Ronaldinho G	3165	40	4	621	226	182	9	0	61.7	16	2091.3	362.8	711.0	5.1	31.8
Steven Gerrard	3153	41	18	862	212	152	3	0	59.3	11	2495.2	154.1	503.7	3.7	33.4
Javier Zanetti	3141	42	50	980	25	18	0	310	61.7	17	1896.5	237.3	1028.8	3.2	34.5
Oliver Kahn	3006	43	47	868	0	0	0	322	65.3	24	1723.3	398.1	816.1	3.5	32.2
Fabio Cannavaro	3000	44	10	810	20	6	0	308	58.7	9	1564.2	211.7	1046.3	3.7	38.7
Andriy Shevchenko	2829	45	19	624	298	85	5	0	63.7	17	2411.9	174.1	320.6	4.5	33.7
Wayne Rooney	2823	46	29	873	365	189	9	0	63.7	18	2205.0	238.5	379.9	3.2	28.1
Royne Kayne	2801	47	36	600	77	33	0	200	65.3	19	1638.1	219.3	944.0	4.7	35.9
Pavel Nedved	2782	48	45	639	138	82	0	0	65.7	15	1694.5	162.2	1087.7	4.4	37.1
Philipp Lahm	2581	49	14	765	27	94	0	214	69.7	22	1492.5	393.4	695.2	3.4	31.9
N'Golo Kante	2446	50	44	702	22	21	0	66	59.3	5	1327.8	180.1	938.4	6.6	38.9

Table 3. General characteristics of the greatest football athletes of the 21<sup>st</sup> century submitted to the Modk formula (n = 50).

Variables	N	Average	Standard Deviation	Minimum	Maximum
ScoreModk	50	4699.5	1767.49	2446	10665
Matches	50	784.7	159.65	217	1087
Goals	46	213.5	180.33	13	725
Assists	46	124.2	74.61	2	306
Hat-tricks	46	6.6	11.81	0	54
Clean Sheets	20	278.2	108.84	66	484
Usage of points	50	66.1	5.06	58	78
Titles	50	21.2	7.57	5	40
Pts 1 <sup>st</sup> component	50	2418.5	954.27	1063	6236
Pts 2 <sup>nd</sup> component	50	409.4	206.2	140	911
Pts 3 <sup>rd</sup> component	50	1612.4	897.02	321	4429

Table 3 shows the mean, standard deviation, minimum and maximum values of the objective variables analysed and used in the formula. On average, in order to be among the top 50 athletes of the 21<sup>st</sup> century, a player needs to reach almost 800 matches in his career, usage of points close to 65%, be directly involved in almost 350 goals (between assists and goals), and finish over 270 clean sheets. In addition to that, players belonging to the list have, on average, won 21 club or national team titles in their careers. Regarding total score, the athletes have, on average, reached 4699 points, approximately 44% of the score of the first place, such as Cristiano Ronaldo (10665 points).

Table 4 shows the correlations of the original variables and components of the formula with the final position of The Independent magazine and the final ModK score. The original variables (first seven) demonstrate that the goals, clean sheets, usage of points, and the number of titles did not show significant association with the final position of the players in the magazine’s ranking. On the other hand, assists and hat-tricks had statistically significant correlations and moderate classification. However, these two variables showed a lower association according to the criteria of The Independent magazine when compared to the ModK formula. When the variables in the ModK formula were analysed, either individually or by components, all showed an association with The Independent magazine's ranking; however, all variables presented greater association when tested with the ModK score. Considering the classification of correlations, The Independent's ranking has shown five low correlations, being four raw variables (matches, goals, usage of points, and the number of titles) and points per match, in addition to nine

moderate correlations, being three raw variables (assists, hat-tricks, matches without conceding a goal), added to the points of goals, points of assists, all individual components, the component of titles, the component of impact, and the average of positions. The ModK score, on the other hand, did not show any low correlation. Among the original variables, four presented moderate classification (matches, goals, assists, and clean sheets) and three presented high correlation (hat-trick, usage of points and number of titles). Whereas, predictably, among the variables that make up the formula, four presented high correlation (points of goals, points of assists, points of titles, and points per match), two presented very high correlation (every individual component and component of impact on the club/national team), and one variable presented an almost perfect correlation (average of positions).

On the other hand, Fig. (1) represents the points generated by the ModK score for the UEFA trophy and “The Best FIFA” competitors in the 2019/20 season. Despite having different origins, both lists deal with practically the best players in Europe. While the UEFA final list featured eight athletes, the “The Best” final list featured 11 athletes. Fourteen athletes were analysed in total. Robert Lewandowski showed the highest score and average points per game (PPG), confirming the trend of winning both awards of the season. Total points and average points have very similar order, except for an inversion between the eighth player, Manuel Neuer (260 points and PPG=5.09) with the ninth, Kevin De Bruyne (245 points and PPG=5.11), in addition to Neymar Jr. who, in spite of reaching only the eleventh position (211 points), had the third-highest PPG of 7.81.

**Table 4. Bivariate correlation table of the variables investigated with the position of The Independent magazine and ModK formula.**

Variables Analysed	The Independent			ModK (r=0.416)		
	r	P	Classification	R	P	Classification
Matches	-0.161	0.264	Lower	0.370**	0.008	Moderate
Goals	-0.276	0.053	Lower	0.445**	0.002	Moderate
Assists	-0.459	0.001	Moderate	0.485**	0.001	Moderate
Hat-tricks	-0.356	0.011	Moderate	0.617**	0.000	High
Clean sheets	-0.339	0.143	Moderate	0.466*	0.038	Moderate
Usage of points	-0.186	0.195	Lower	0.510**	0.000	High
Amt of Titles	-0.260	0.068	Lower	0.684**	0.000	High
Pts. Goals	-0.330	0.019	Moderate	0.563**	0.000	High
Pts. Assists	-0.445	0.001	Moderate	0.519**	0.000	High
Individual component	-0.477**	0.000	Moderate	0.813**	0.000	Very High
Component of titles	-0.380**	0.006	Moderate	0.681**	0.000	High
Component of impact	-0.307*	0.030	Moderate	0.836**	0.000	Very High
Pts. Per match	-0.255	0.074	Lower	0.622**	0.000	High
Average of positions	0.467**	0.001	Moderate	-0.907**	0.000	Almost Perfect

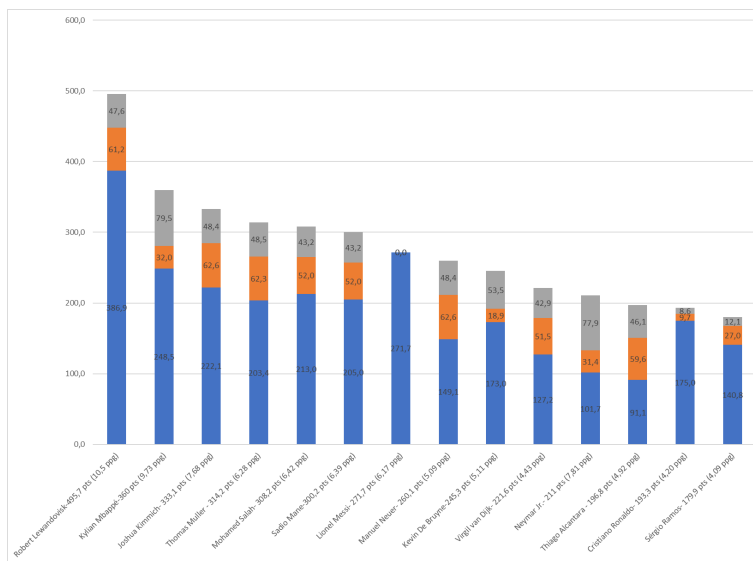


Fig. (1). The score for the 2019/20 season of the 14 players nominated for the best in UEFA and FIFA.

4. DISCUSSION

The ModK formula was created to evaluate the seasons and careers of football players in an objective and simple way. The moderate correlation with the ranking developed by experts and published by The Independent magazine shows that the proposal accords with its initial goal. In addition to that, its power of discrimination between the positions of the ranking generated by the scores has been made clear.

One of the biggest tasks of creating the formula was to gather data of a quantitative nature to avoid elements of subjectivity that could impact the classification of athletes. Furthermore, objective data needs to be feasible for collection at different times. Although the list created represents the 21<sup>st</sup> century, some players started their careers in the late 1980s, but the data collection was still feasible. Therefore, it is plausible to believe that the careers of athletes who played before the 1980s could be evaluated using the formula. We considered that it is reasonable to compare players from different decades because the rules are essentially the same, except for the creation of the yellow and red cards in the late 1960s (FIFA World Cup 1970) [4] and the change in the weight of points, from two to three points in case of victory, which was already in place in the 1990s (FIFA World Cup 1994) [5]. In this sense, we consider that such changes did not cause drastic alterations in the concept of career attributed to the formula. The points issued are simple to adjust by simply treating the oldest wins with the current value, whereas the amount of red and yellow cards are not a part of the analysed variables.

Previous publications have sought to establish metrics and rankings related to the performance of professional soccer players. These publications used complex modeling, adjustments based on direct matches or variables related to economic efficiency. In addition to football, American football [6], golf [7], basketball [8], and baseball [9] have already had their proposals for performance evaluation published. By comparing the proposals, the study by Oukil and Govindaluri (2017) [10] was the one closest to the present study because it

refers to the creation of a final performance score of football players at the end of a season. However, there are differences between the two formulas: the formula by the researchers mentioned includes only attackers. Besides, subjective variables, such as the opinion of football experts, are considered for the comparison of the analysed athletes. Technical and economic efficiencies are also used in the formula, and, finally, process variables are accounted for. The ModK formula works exclusively with the outcomes of the game. On the one hand, these differences favour the main objective of Oukil and Govindaluri's (2017) formula, since the authors intended to demonstrate which would be the most efficient attacker to be hired, according to the potential of financial investment. It is completely possible to find an efficient athlete who has, in absolute numbers, few titles, assists or goals that is close to what is expected by the athlete's profile (considering age, position, the championship in which he competes, etc.) In the ModK formula, the absolute production of the athlete's career is measured. In this sense, an athlete who has 15 national titles has achieved a better result compared to a player who has obtained 12 titles, but at a salary 50% lower, or who has scored 15 goals over 20, but with half the shoot-outs.

In the ModK formula, the predominant factor for higher scores, even for an athlete with fewer titles or goals, is the championship in which these events took place (1<sup>st</sup> component of the formula), the titles won (2<sup>nd</sup> component of the formula), and the impact that these titles brought to the clubs in which the athlete played, in the short and long term (3<sup>rd</sup> component of the formula).

As for the type of athletes analysed, unlike Oukil and Govindaluri's formula (2017) [10], the ModK formula classifies the performance of athletes of any position from different eras, continents, and countries. In this sense, the ModK formula is broader and contemplates all players of the modality. The presence of variables exclusive to defensive players (penalties defended or clean sheets) is the strategy used



to compensate for the more remarkable presence of variables that favor offensive positions (goals, assists and hat-tricks). It is evident that offensive players have a significant role in the game, which is observed even from an economic point of view, where attacking or offensive midfield players get higher-value contracts. However, football is a team sport of great technical-tactical complexity, which makes all players indispensable components for the performance of a team during a game or season.

In this context, it is considered that the ModK formula is effective, as, by observing the list of the greatest careers, it was possible to line up a complete team with the first 12 of the ranking, each in their original position, where only Ronaldo Nazário would be excluded from the 11 members, although he has the 11<sup>th</sup> position in the ranking. For comparison purposes, in The Independent's magazine ranking, it would be necessary to pick the 26<sup>th</sup> position (Dani Alves) in order to complete the line-up in 4-3-3. The simplicity of the formula is also an advantage, as it allows an easy understanding of the data for those interested in it that may not be familiar with complex mathematical calculations, since the ModK formula can be summarized in a set of summed data, adjusted by season, continent, country, and usage of points. The formula shows practically only simple mathematical operations (sum, subtraction, multiplication, and division). Finally, the ModK formula has a dynamic and cumulative component of points, which allows the observation of the evolution of players at every season, surpassing contemporary opponents, or those who have already ended their careers. In addition, the formula allows the adjustment of the value of the championships according to the quality of football in a given country by the time of the data. In this way, the formula allows comparison and even locates in the timeline, the season in which a prominent player of the 2010s accumulated enough points to surpass the career of a former player of the 1980s.

Through the formula, based on the results, it is possible to observe the predominance of players who were part of the biggest Spanish clubs, or Spanish players who are present in a good part of summons for their national team in the first twenty years of the 21<sup>st</sup> century, and this is totally justifiable. From 2000/01 until the 2019/20 season, out of 40 European tournament finals (UEFA Champions League-UCL and UEFA Cup), Spanish teams were present in 21 and had won 19 titles, well ahead of the next country, was England (15 finals and 8 titles). Such titles were focused on five Spanish teams: Barcelona, Real Madrid, Sevilla, Atlético de Madrid, and Valencia, in addition to Alavés, Athletic Bilbao, and Espanyol, which reached the finals of the main European competitions. Therefore, it is foreseeable that athletes who were part of these clubs are present in the list of the 50 greatest players of the century and that Spanish competitions have a higher value than the others. Among the top 10, only Paolo Maldini did not play in any of the Spanish clubs, and only 14 of the 50 players did not play in Spanish or English clubs. In addition to that, the Spanish national team has led the main national championships for the longest time, with titles at Euro 2008 and 2012, as well as the 2010 World Cup.

By analysing the top 10 players in the ModK list, it is

possible to note that half of them have had achievements from the Spanish national team and Spanish clubs in their careers, such as Iniesta, Xavi and Puyol (Barcelona), Casillas (Real Madrid) and Sergio Ramos (Real Madrid and Sevilla). However, in addition to the Spanish clubs and the Spanish national team, all athletes mentioned have spent long periods in clubs and national teams, which shows us that regularity at a high level is a preponderant factor for a victorious career. The athletes mentioned have been absolute first-team players throughout their career, or at least at its peak, in the main world clubs and national teams, having won titles in both cases. The three athletes who do not fit into this combination have had exceptional individual performances in clubs that have compensated for the absence or few numbers of titles in their respective teams, such as Paolo Maldini, Lionel Messi, and Cristiano Ronaldo. Combined, the three athletes, who have never played together, have 13 UCL titles.

Paolo Maldini is found to be an unquestionable first-team for 20 seasons at AC Milan (IT), having won seven national championships, five European club championships, three Club World Cups, in addition to having participated in four World Cups, with a second-place in 1994. Among the defenders on the list, Maldini is the second defender with the highest number of clean sheets and fourth overall, and he is also the athlete with the fourth-highest impact among the 50 athletes.

The other two players are the greatest athletes of the last decades of world football. Lionel Messi, second on the list, with the second position in the 2014 World Cup, and also in the 2007, 2015, and 2016 (commemorative edition) America Cup representing Argentina, compensates for the absence of titles for the Argentine national team with three world titles and four European club titles for Barcelona, as well as 10 Spanish titles and 16 other titles for his only club to date. His individual performance with the highest score on the list has a direct relationship with his main opponent, Cristiano Ronaldo. The portuguese player's arrival at Real Madrid in the 2009/10 season coincided with a sharp increase in goals and assists by the argentine, as well as by the portuguese player himself. Both spent the second decade of the century alternating individual awards and achievements for their clubs, as well as fuelling the great rivalry between the two biggest Spanish clubs. In the specific comparison between the two greatest careers, Cristiano Ronaldo stands out for being the star of the only achievements in the history of Portugal's national team (Euro 2016 and League of Nations 2019) in addition to the second position for the Portuguese national team at the Euro 2004. As for the clubs, Cristiano Ronaldo has five world and continental titles, four for Real Madrid (three consecutive times) and one for Manchester United. It is only in national titles that Cristiano Ronaldo presents values that are lower than Lionel Messi's, with seven titles won in three different teams. In absolute numbers of the ModK formula, the difference between them until the end of the 2019/20 season was 478 points, resulting in a difference of less than 4.5% between careers. Considering that Lionel Messi is two years younger and has played three seasons less in his career and Lionel Messi's own average of PPG is higher than Cristiano Ronaldo's, the result on the greatest career of the 21<sup>st</sup> century is certainly undefined.

There are big differences between The Independent magazine's list and the ModK rankings. Among the biggest positive changes, two of them directly involve the "first-team line-up" of the ModK, while the third biggest change would put the athlete among the 22 selectable ones. Roberto Carlos (BR) had his career ranked as the sixth greatest of the 21<sup>st</sup> century (a difference of 32 positions). He holds first and second position in World Cups (2002 and 1998), six national titles (two Brazilian and four Spanish), and four UCL, among his main titles. Furthermore, in almost 10 years as an undisputed first-team of Real Madrid, in addition to Brazilian and Turkish teams, the player, defensive by his position, has scored more than 100 goals in his career. In the ranking, he is the second-highest defensive scorer, inferior only to Sérgio Ramos (5<sup>th</sup> in the overall ranking). In addition to that, in more than 50% of the individual attributes evaluated, the former left-back is at the top half of the ranking. The second athlete with the highest difference was Iker Casillas (24 positions and 8<sup>th</sup> on the list). The goalkeeper, first-team for 15 years at Real Madrid, was the second defender with the highest number of clean sheets, as well as being the second player with the highest number of matches in his career (in both variables, the first-place was Buffon). What kept Casillas to occupy the position of best goalkeeper career of the century from the Italian was the amount (only one more) and the score of the titles, already indicating a substantial difference (709 x 362 points), as the Spanish goalkeeper has two Euro Cups, three UCLs and three Club World Cups, and these are titles that the Italian goalkeeper did not achieve in his victorious career. The third player is still active and at a high-performance level, *i.e.*, Zlatan Ibrahimovic (a difference of 19 positions and 20<sup>th</sup> on the list).

The Swedish has robust individual numbers, which explains the fifth-best position in the average of all position variables. Ibrahimovic is the third-highest scorer on the list, with the sixth-higher number of assists and fourth-higher number of hat-tricks. When it comes to titles, he has the sixth position in the number of titles. His position is not the highest only due to the lack of continental club titles (only one Europa League for Manchester United (EN)) or Swedish national team titles, but the centre-forward has 11 national titles in four countries and five different teams.

Two defenders and one attacking midfielder stand out among those encountering losses in positions. Cannavaro, captain of the 2006 World Cup champion team (Italy), lost 34<sup>th</sup> position when compared to the list of The Independent magazine, appearing in the 44<sup>th</sup> position. According to the data, the former defender is the ninth defender with more clean sheets but is only the 48<sup>th</sup> in the usage of points, number of titles, and indicators of the first component, in addition to being the 46<sup>th</sup> in PPG. In the top half, Canavarro ranks the 24<sup>th</sup> highest in the number of professional matches. Philipp Lahm is the second defender with a big loss of positions when comparing the rankings (35 positions), in 49<sup>th</sup> place. The World Cup champion right-back for Germany and multi-champion for Bayern Munich, his only club, has as his best data the thirteenth best usage of points and the fact that he is the fifteenth defender with more clean sheets. However, Lahm is

only 47<sup>th</sup> in the first component, 29<sup>th</sup> in the second component, and 46<sup>th</sup> in the third component. The third player, probably with the most controversial result, is Ronaldinho, losing 36<sup>th</sup> position and ending up as 40<sup>th</sup> on the list. The recognized talent of the attacking midfielder, champion of the 2002 World Cup, star of the first continental title of Barcelona in the 21<sup>st</sup> century (2005/06) and of plays and anthological matches in the past decade, has as best indicators nine Hat-tricks (10<sup>th</sup>) and 182 assists (13<sup>th</sup>). However, Ronaldinho is only 45<sup>th</sup> in the number of matches played, 42<sup>nd</sup> in the usage of points, 36<sup>th</sup> in the 1<sup>st</sup> component, 32<sup>nd</sup> in the second component, and 44<sup>th</sup> in the third component.

There are two hypotheses for the differences in positions. The first is that such players, although world champions for their clubs or national teams, have not had the regularity in titles throughout their career compared to other athletes on the list. Canavarro, for example, played for 20 seasons, and among them, 18 in Europe, but has only won eight titles (excluding individual titles). Philipp Lahm, who played only one season for Stuttgart (GER) and another 13 for Bayern Munich, has won titles continuously, but this high frequency of domestic titles of the greatest German team is very common, regardless of Lahm's presence in the team. This ended up generating a relatively low athlete impact, even with many titles achieved. In addition to that, the number of goals, although not being a variable that is directly linked to the function of the former right-back and midfielder's position, was small when compared to other defender players on the list (39<sup>th</sup> overall and ninth among defenders in the number of goals). Ronaldinho, despite all the quality shown in the matches, has a lack of regularity at a high level throughout his career as a bias. Ronaldinho played professionally in 17 seasons. However, excluding the first three professional seasons, in which he played in his country, the attacking midfielder played nine seasons in European territory, the first seven at a very high level, two seasons at a level just below his talent playing for Milan, and from that, five more seasons in championships below the European level, based on the comparison of data and values used in the formula and the perception and economic indicators of public nature of the sport (Brazil and Mexico). Considering that from the 2010s, this technical and financial difference between the main football continents has only widened; it is noticed that Ronaldinho played more than 1/3 of his career in championships below the elite of the sport, a period that justifies such a sharp drop when comparing the rankings. The second hypothesis is based on how the players' careers are evaluated by experts and fans in general. It is possible that rankings such as that of The Independent magazine will end up considering exclusively how much athletes have achieved at the pinnacle of their careers, excluding the regularity of the career and the reasonable amount of seasons, games, and championships, overestimating their best seasons and underestimating, or even excluding, the rest of their careers. There is also the subjective question when creating these lists, based almost exclusively on the voting by athletes, former athletes, and other professionals involved in the sport, each with their perception of the best game, championship, and actions.

The points per game variable (PPG) also stands out among the different data for being considered a measurement of career potential. It is possible to notice a type of players' efficiency by adjusting the sum of the three components of the formula to the number of matches played. Ronaldo Nazário, for example, was the 11<sup>th</sup> in the general classification, even though he was only the 44<sup>th</sup> in the number of matches played. Considering his overall score, his average was the sixth-highest, which in some ways indicates that the athlete achieved excellent results with a relatively short career. Rivaldo (23<sup>rd</sup> overall and 5<sup>th</sup> in PPG) and Neymar (29<sup>th</sup> overall and 7<sup>th</sup> in PPG) also stand out, but the one player who stands out from all of them in this variable is Kylian Mbappé. Although he is occupying the 35<sup>th</sup> overall position, the fact that he was champion in the last World Cup, having 130 goals (27<sup>th</sup>) until the end of the 2019/20 season, with only five seasons as a professional, places him with the highest average of PPG on the list, showing a great possibility of future historical achievements in the Frenchman's career.

Table 2, with the list of the 14 highlights of the 2019/20 season, breaks down the sources of the first, second, and third components, as well as the total score of all athletes. Usually, the individual indicators turn out to be the greatest source of points, but that does not always mean achieving the best placements, since, just like in football, the individual indicators are not enough for collective success, as well as the regularity and number of titles of a club. In this case, the one who had the highest individual score was Robert Lewandowski, also chosen as the best player in Europe and the world by UEFA and FIFA, respectively. However, considering only the first component, the second-highest scorer was Lionel Messi, who in the overall qualification was only the seventh-placed. This is because his team did not win any title in that season, and there was not any tournament involving the Argentine national team. Meanwhile, the athlete with the third-highest individual value (Kylian Mbappé) contributed directly to Paris Saint Germain's triple crown and UCL's vice-championship. Neymar, PSG's technical leadership, reached the 11<sup>th</sup> overall position, hampered by injuries during the season, but his importance to the French club can be measured by his PPG, the third-largest, losing only to his club mate, Mbappé, and the “best in the world,” Lewandowski. Another point to be observed in Fig. (1) is the values of titles and impacts, which change greatly between clubs and even between players of the same team, but in a smaller magnitude. The greatest values of titles, of course, were those of Bayern's athletes, and their small differences come from the usage of points by each athlete. However, the biggest impact figures are not from the German club but from PSG and Manchester City. This is because they are clubs with a much lower total number of titles than Bayern. Therefore, the same number of titles won greatly impacts clubs with fewer titles won in the short and long term.

## 5. CONSIDERATIONS

The ModK formula has the exclusive use of quantitative variables as its main characteristic, avoiding the use of subjective, perceived or even moral variables. However, this does not mean that the present proposal of career analysis is superior to other strategies, or that subjective matters, such as actions, opinions, and attitudes of athletes in sport or in public

and private life, should not weigh in the choice of the greatest idols, personalities, and football careers. Our proposal aims to develop a different way of measuring a career, in a totally predictable way, possibly observing every match, simplified and dynamic, contemplating all the sporting events of the athlete in question. It is evident that the admiration of other athletes towards the effort, dedication, and the overcoming of different barriers for long seasons, as well as the respect that certain players have for the sport, their colleagues, fans, media, and society, make some exceptional athletes reach the status of an idol.

Currently, Lionel Messi and Cristiano Ronaldo fit, both in individual performance, as well as in the moral and subjective variables presented, as great idols of the sport, serving as an example for current and future professional athletes. It is also possible to note, especially in the media, that players of exceptional talents, but with questionable behavior towards society, may damage their image, and this does not collaborate with the possibility of achieving the maximum status of “greatest player” in the world. Still, even without considering such information, the ModK formula has assigned the highest scores to the best players, and, apparently, the players with the highest scores are those who present or have presented during their careers an inspiring image, both sportively and behaviorally (dedication, discipline, overcoming challenges, among others).

Among the difficulties in applying the ModK formula, the search for enough data to fit the equation is one of the main ones. At least in countries with a football tradition, there is usually a national championship (by points scored) and one or two cups with draws decided in two matches, as well as one or two matches involving the champions of these competitions from the previous season. However, in Brazil, there are state and regional championships that have been taking place since the beginning of the 20<sup>th</sup> century, other tournaments that are less than 20 years old, and there are also those that preceded the national championship but currently do not exist. The explanation for all these championships lies in the continental dimension of the country and the development of professional teams at different levels according to each region. Still, all these championships were awarded points, similar in value to the secondary cup tournaments of the main European countries, even considering that some Brazilian state tournaments, such as “Paulista” and “Carioca,” in the 1950s and 1960s, simply had levels of performance that were just as good or superior to those of the main European national championships (taking into consideration that these regional championships included the vast majority of athletes who were champions of 1958, 1962, and 1970 World Cups).

Another difficulty was found in the quality and quantity of the data sources. Although it is currently relatively simple to obtain all the data used in the formula through websites on football (Transfermarkt being the main one found), data prior to the 2000s are more diffuse. Among the variables used in the formula, the number of assists is undoubtedly the most complex to be obtained when the data is older than 30 years. Since the proposal of the ModK formula is to allow the career evaluation of any athlete of different eras and countries, other

sources and methodologies will be needed in order to search for information, such as old newspapers, matches or moments of matches that were recorded in video or audio, club or player pages on the internet, among others.

Finally, the list of the 50 players featured in this article includes the greatest players of the century according to The Independent magazine, but not necessarily of the 50 highest scorers in ModK. It is possible that players on the magazine's top 50 list could score enough points to be on the formula's top 50 list. Athletes who advanced and lost many positions under the ModK formula have been observed. In this sense, it would be reasonable to consider some athletes with great chances to enter the top 50 scorers' list, such as Karim Benzema, Pepe, Marcelo, Ryan Giggs, Sergio Aguero, Gerard Pique, Juninho, Cafu, Romario, and the most recent "best in the world", Robert Lewandowski. All of these, except for Romario, are among the 100 greatest of the century according to the ranking and present numbers, such as individual data, titles, high impact, or even the three components mentioned, that are high enough to make it to the 50 greatest of the century's list, according to the ModK formula.

## CONCLUSION

We conclude that the ModK formula proved to be effective in evaluating the career or full season of football athletes in an exclusively objective manner, presenting an acceptable correlation with a ranking created by the experts. In addition to that, the formula was able to rank the 50 players in detail, even showing major or minor differences between each position achieved by the athletes, giving a clear notion of the difference between the careers of the athletes cited. Finally, the formula demonstrated its simplicity, ease of interpretation, and dynamism, once the ranking can change at each end of the season, according to the athletes' performance.

## ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

## HUMAN AND ANIMAL RIGHTS

Not applicable.

## CONSENT FOR PUBLICATION

Not applicable.

## AVAILABILITY OF DATA AND MATERIALS

Not applicable.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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## REFERENCES

- [1] Davis J, Bransen L, Decroos T, Robberechts P, Van Haaren J, *et al.* Assessing the performances of soccer players. In: International Symposium on Computer Science in Sport. Springer. 2019.
- [2] UEFA. Union of European Football Associations Country coefficients | UEFA Coefficients 2021. Available from: <https://www.uefa.com/memberassociations/uefarankings/country/#/yr/2021>
- [3] Independent T. We reveal the greatest player of our 21st century countdown 2019. Available from: <https://www.independent.co.uk/sport/football/premier-league/century-countdown-100-list-messi-ronaldo-zidane-ronaldinho-a9160546.html>
- [4] IFAB. International football association board minutes of the 1970 annual meeting of the international football association board. 1970.
- [5] IFAB. The International Football Association. Annual General Meeting.
- [6] Xia V, Jain K, Krishna A, Brinton CG, *et al.* A network-driven methodology for sports ranking and prediction. In 2018 52nd Annual Conference on Information Sciences and Systems (CISS) 2018; 1-6. [<http://dx.doi.org/10.1109/CISS.2018.8362324>]
- [7] Koenigsberg A, Pilgrim J, Baker J. Generational differences in the ranking pathways of top 100 ranked golfers. *J Sports Sci* 2020; 38(18): 2047-53. [<http://dx.doi.org/10.1080/02640414.2020.1769814>] [PMID: 32497485]
- [8] Asghar FA, Asif MU, Nadeem MA, Nawaz MA, Idrees MU, *et al.* A novel approach to ranking national basketball association players. *Journal of Global Economics, Management and Business Research* 2018; 176-83.
- [9] Daud A, Hussain A, Abbasi RA, Al johani NR, Amjad T, Dawood H, *et al.* Region-wise ranking of sports players based on link fusion. *Companion Proceedings of the The Web Conference 2018* 2018; 259-66. [<http://dx.doi.org/10.1145/3184558.3186335>]
- [10] Oukil A, Govindaluri SM. A systematic approach for ranking football players within an integrated DEA-OWA framework. *MDE Manage Decis Econ* 2017; 38(8): 1125-36. [<http://dx.doi.org/10.1002/mde.2851>]