

What makes the difference? Analysis of the 2014 World Cup

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ABSTRACT

FIFA World Cup tournaments have historically been comprehensively analysed by numerous authors. The present study perpetuates the dissection of the biggest football event in analyzing some of indicators related to success during the 2014 World Cup in Brazil. We sought to identify indicators which best discriminate between winning and losing teams and between qualified and non-qualified teams for the second round. We found that winning teams scored more goals (ES 0.57), had more attempts (ES 0.3), a lower rate of attempt per goal (ES 0.59), a lower rate of attempt on target per goal (ES 0.53), a higher rate of attempts on target per attempt (ES 0.34) and a lower number of yellow cards per game (ES 0.24). Qualified teams differentiated by scoring more goals (ES 0.50), a lower rate of attempts per goal (ES 0.50), a lower rate of attempts on target per goal (ES 0.48) and a higher rate of attempts on target per attempt (ES 0.29). These were the only indicators related to success among a list of 55. Possession, pass efficiency, defensive metrics or patterns of play were not a mark of success. None of the athletic indicators observed had an impact on winning or qualifying during the 2014 World Cup. This study revealed that shooting efficiency was the factor that made the difference during the 2014 FIFA World Cup. **Key words:** FOOTBALL, WORLD CUP, PERFORMANCE INDICATORS.

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INTRODUCTION

In football, the World Cup (WC) has the status of the ultimate prize. It is the biggest single-sport event and the place to compare the best teams and the best players. It is also the competition that set the trends in terms of tactics and playing style. Winning teams are closely scrutinized in order to identify some of the key factors underpinning success. In 1965, the Technical Development Committee of FIFA decided that a selected group of coaches should make a technical study after each World Cup. The purpose was to collect factual data and opinion for analyzing the performance of the teams and the evolution of the game. Hence, for the last WC 2014 in Brazil, the FIFA Committee published a detailed report where successful coaches analyzed the technical and tactical trends in a chapter called "*What makes the difference*"? The database published in this last Technical Report is impressive and the selected coaches have used it to support their tactical opinion. Coaches cannot recall all the important facts of a match (Franks and Miller 1986, Hughes 1997). Today the tactical analysis and the comprehension of the game are enhanced through the additional information provided by quantitative analyses and without these tactical and technical numbers, authoritative comments may miss some accuracy. Yet, whatever the size of the database and the technological advances, opinion is not knowledge, at least from a statistical point of view. Football is not just a game of opinion or a numbers' game, it is also a game that has long been studied by sport scientists and exercise physiologists attempting to describe and explain the determinants of football success.

At roughly the same period when the FIFA committee started to publish their analysis, Reep and Benjamin (1968) published their landmark work in the Journal of the Royal Statistical Society. While recognizing that chance dominates the game and that football was a game as much reliant on fortune and randomness as it is on ability, the authors wanted scientific analysis to provide a way to alter the balance between chance and skill through noticeable patterns leading to goal scoring.

Subsequently, statistical interest on technical, tactical and physical aspects of the game has been steadily rising over the past decades. The search for the 'winning formula' became more and more a scientific quest. Scientists may help to answer the question: what makes the difference? Or to put it another way may give some clues to the main question: what are the key performance indicators for success in football?

Behind the victory is the fact that the winning teams have scored one goal more than their opponents and it is no surprise that goal scoring has received considerable attention in quantitative research and that the major purpose of analyzing the technical aspect of a football match is to correlate the technical elements with the match score (Dufour 1993). For World Cup alone, studies on goal scoring have been many: WC 1982 (Jinshan 1993), WC 1986 (Hughes et al. 1988, Olsem 1988), WC 1990 (Yamanaka et al. 1995, Hughes et Franks 2005), WC 1994 (Stanhope 2001, Hughes et Franks 2005), WC 1998 (Grehaigne 1998, Grant et al. 1999), WC 2002 (Castellano et al. 2012, Lawlor et al. 2003, Low et al. 2002, Szwarc 2004), WC 2006 (Sajadi et Rahnama 2007, Xu et al. 2007, Acar, 2009, Castellano 2012), WC 2010 (Castellano 2012, Delgado-Bordonau et al. 2013). A major problem with goal scoring observations is the low number of goals in football. The goal is scarce and the variance of score is not large enough to identify a robust relation with other different metrics (Lago and Martin 2007). That's why many times observations on the number of shots on goal or the number of shots on target or any derived observations (e.g. rate of shots on target per number of shots) are analyzed along with the number of goal scored.

For a shot to be successful, the team needs to place the player who takes the shot in a good position. The number of passes (Scoulding et al. 2004, Saito et al. 2013), the rate of successful passes and the percentage of ball possession (Castellano et al. 2012, Collet 2013) are indicators that can be related to the capacity to

create opportunities. The patterns of attacks, the way teams utilize the pitch space (e.g. wings and central zone; attacking, midfield and defensive third) have also been studied in relation with goal scoring during World Cups (Low et al. 2002, Hughes et al. 1988, Barreira et al. 2014). Corners and crosses are also used as indicators of offensive pressure (Low et al. 2002, Castellano et al. 2012).

Defensive indicators have not been studied as much as offensive indicators. Goals and shots conceded but also crosses and corners conceded are a mark of defensive quality but these data are in fact the flip side of goals scored, shots, corners and crosses of the opponent teams and do not bring new information when comparing successful and unsuccessful teams. The same could be said for ball possession because when a team possesses the ball, the opponent team cannot attack and it can be considered as a defensive mean. The number of times a team is caught offside may reflect the tactical defensive quality (Castellano et al. 2012). As the main purpose with fouls is to prohibit the opponent team from playing their game, from gaining ground and shooting from favorable position in order to score goals, it is often used as a specific defensive indicator (Papahristodoulou 2008).

Apart from studies devoted to analyze the performance during World Cups, others indicators have been include the number of interceptions and clearances during games (Shafizadeh et al. 2013, Araya and Larkin 2014).

Athletic metrics during football games have been the subject of many studies. The emergence of sophisticated multiple-camera methods and global positioning systems changed data access from a quantitative and a qualitative perspective. Total distance covered, distance covered at high intensity, at sprint intensity, number of sprints and distance covered in and without ball possession are now common data. Yet, there are few detailed data for World Cups events (Clemente et al. 2013, Dufour 2014). Moreover, studies have primarily focused either on technical / tactical indicators or athletic indicators and little attention has been paid to the interaction between both kinds of indicators, i.e. in which way athletic performance may influence football performance (Barnes, et al. 2014, Bradley et al. 2013, Dufour et al. 2016).

Finally, there are different ways for analyzing success in football during a given competition. A game by game analysis may be used to differentiate between winning and losing teams (Castellano et al. 2012). But in a competition such as the World Cup with a group and a final stage, teams can also be separated between teams who do or do not reach the second stage (Delgado-Bordonau et al. 2013). Depending on the way the study is done, the sample differs for a given competition. Games ending with a draw are excluded to differentiate between winners and losers in a game by game analysis. Games played for the second stage aren't taken into account when distinguishing between teams who qualify or not for the second stage. According to the method used, what makes the difference may differ.

The purpose of this study was to analyze the performance indicators related to success in the 2014 World Cup. Therefore, our analysis was twofold. Firstly, we sought to identify the team's indicators which best discriminate between winning and losing. Secondly, we examine the indicators associated with the qualification for the second stage of the competition. To achieve a more complete view of performance, we combined technical / tactical data and athletic data.

METHODS

Teams and Match data

Match performance data were collected from the 2014 World Cup in Brazil (64 games). To discriminate between winning and losing teams, games finishing with a draw at the end of normal time were withdrawn (47 games). Only the games of the first stage were used to differentiate between 16 qualified and 16 non-qualified teams (48 games).

Data collection and analysis

The collected data were provided by the technology called Matrics from Deltatre AG, a private company dedicated to the performance assessment of soccer teams using a semi-automated multi-camera recognition system. We downloaded the raw data from the official website (www.fifa.com).

The list of indicators used and their definition are represented in Table 1.

Table 1. List of indicators and their definition.

	TECHNICAL / TACTICAL INDICATORS
Goals	Number of scored goals
Total attempts	Number of attempts
Total attempts on target	Number of any attempt per game that a) goes into the net b) would have gone into the net but for being stopped by a goalkeeper's save c) would have gone into the net but for being stopped by a defender who is the last man.
Total attempts off target	Number of any goal attempt where the ball is going wide of the target, misses or hits the woodwork
Rate of total attempts per goal	Calculation of total attempts divided by all goals
Rate of attempts on target per goal	Calculation of attempts on target divided by all goals
Rate of attempts on target per total attempts	Calculation of attempts on target divided by all attempts
Dangerous attacks	Number of time the team enters the attacking third of the pitch
Delivery in penalty area	Number of time the team delivers the ball in the penalty area
Clearances	Number of defensive actions where a player kicks the ball away from his own goal with no intended recipient of the ball
Crosses	Number of passes from a wide position into a specific area in front of the goal
Corners	Number of corner kicks.
Offsides	Number of time a player is deemed to be in an offside position
Recovered balls	Number of time a player wins back the ball when it has gone loose or where the ball has been played directly to him
Fouls committed	Number of time a player fouls an opponent
Yellow cards	Number of time a player is shown a yellow card
Ball possession	Percentage of time the team held the ball
Passes speed	Calculation of the total number of passes attempted divided by the team possession time
Total passes completed	Sum of all intentional balls played successfully from one player to another (crosses excluded)
Total passes attempted	Number of intentional balls from one player to another (crosses excluded)
Passes completion rate	Number of completed passes divided by the number of attempted passes
Long pass completed	Number of successful passes over 30m.
Long passes attempted	Number of passes over 30m attempted
Rate of long passes	Calculation of the number of long passes attempted divided by the number of passes attempted
Completion rate long passes	Calculation of the long passes completed divided by the number of long passes attempted
Medium passes completed	Number of successful passes between 10m and 30m.

TECHNICAL / TACTICAL INDICATORS	
Medium passes attempted	Number of passes between 10 and 30m attempted
Rate of medium passes	Calculation of the number of medium passes attempted divided by the number of passes attempted
Completion rate medium passes	Calculation of the medium passes completed divided by the number of medium passes attempted
short passes completed	Number of successful passes under 10m.
short passes attempted	Number of passes under 10m attempted
Rate of short passes	Calculation of the number of short passes attempted divided by the number of passes attempted
Completion rate short passes	Calculation of the short passes completed divided by the number of short passes attempted
Left side attack	Percentage of time the team enters the opponent half through the left side of the pitch
Middle attack	Percentage of time the team enters the opponent half through the centre of the pitch
Right side attack	Percentage of time the team enters the opponent half through the right side of the pitch
Defensive area	Percentage of touches in the defensive zone
Central area	Percentage of touches in the middle zone
Offensive area	Percentage of touches in the offensive zone
ATHLETIC INDICATORS	
Total distance	Sum of the distance covered by each player of the team (goalkeeper included) per game
Total distance in ball possession	Sum of the distance covered by each player of the team (goalkeeper included) with the ball
Total distance without ball possession	Sum of the distance covered by each player of the team (goalkeeper included) without the ball
Rate dist. possession / dist. no possession	Total distance in ball possession divided by total distance without ball possession
Distance ball non in play	Sum of the distance covered by each player while the ball is out of play
Rate of time ball non in play	Sum of the distance covered by each player while the ball is out of play divided by sum of the distance covered by each player of the team.
% time at low activity	Mean of the percentage of time spent by each player under 11 km/h
% time at medium activity	Mean of the percentage of time spent by each player between 11 and 15 km/h
% time at high activity	Mean of the percentage of time spent by each player over 15 km/h
Top speed	Highest speed recorded during the game
Total distance covered (no GK)	Sum of the distance covered by each player of the team (goalkeeper excluded)
Distance covered low activity (no GK)	Sum of the distance covered by each player of the team under 11km/h (goalkeeper excluded) per game.
Distance covered medium activity (no GK)	Sum of the distance covered by each player of the team between 11 and 15 km/h (goalkeeper excluded)
Distance covered high activity (no GK)	Sum of the distance covered by each player of the team over 15km/h (goalkeeper excluded)
Mean Top speed	Mean of maximum speed of each player
Number of sprint	Sum of players activities over 18 km/h

Statistical analysis

Firstly, a descriptive analysis of data (means, standard deviation (SD), Min, Max) was done for each indicator concerning the two different analysis. Before using parametric statistical test procedures, the assumptions of normality were verified. To discriminate between winning (WIN) and losing teams (LOSE) and between qualified (QUAL) and non-qualified teams (NON-QUAL), a one-way ANOVA was performed and effect size (ES) were calculated to emphasize the size of the difference with values of 0 to 0.20, 0.20 to 0.50, 0.50 to 0.80, and > 0.80 considered to represent trivial, small, medium, and large differences respectively (Cohen

1988). Statistical analysis was performed using Statistica software (version 10, Statsoft) and the significance level was set at $P < 0.05$.

RESULTS

Goals (ES 0.57), total attempts on target (ES 0.30), rate of total attempts per goal (ES 0.59), rate of attempts on target per goal (ES 0.53), rate of attempts on target per total attempts (ES 0.34) and yellow cards (ES 0.24) were the indicators that discriminated winning and losing teams during the 2014 FIFA World Cup.

Goals (ES 0.50), rate of total attempts per goal (ES 0.50), rate of attempts on target per goal (ES 0.48) and rate of attempts on target per total attempts (ES 0.29) were the indicators differentiating teams who qualified for the second stage from teams that were eliminated.

Table 2. Descriptive data (mean, standard deviation, maximum, minimum).

N = 47	Mean WIN	Mean LOSE	SD WIN	SD LOSE	Max WIN	Max Lose	Min WIN	Min LOSE	F	p	Cohen's d Effect size
Goals	2.49	0.62	1.27	0.64	7.00	2.00	1.00	0.00	81.628	0.000	0.57
Total attempts	13.79	12.06	4.08	4.58	23.00	23.00	7.00	3.00	3.715	0.057	0.16
Total attempts on target	8.96	6.55	3.17	3.05	18.00	13.00	4.00	0.00	14.049	0.000	0.30
Total attempts off target	4.83	5.51	2.45	2.61	10.00	13.00	1.00	2.00	1.698	0.196	0.11
Rate of total attempts per goal	5.53	11.92	2.37	5.27	11.50	23.00	2.00	3.00	30.640	0.000	0.59
Rate of attempts on target per goal	3.46	6.70	1.34	3.12	6.50	13.00	1.33	1.00	22.713	0.000	0.53
Rate of attempts on target per total attempts	0.65	0.53	0.13	0.16	0.95	0.80	0.33	0.00	16.698	0.000	0.34
Dangerous attacks	37.77	37.81	11.42	11.74	87.00	65.00	22.00	7.00	0.000	0.986	0.00
Delivery in penalty area	8.87	7.96	3.86	4.12	19.00	19.00	2.00	1.00	1.235	0.269	0.09
Clearances	13.77	12.06	7.08	6.61	33.00	31.00	3.00	3.00	1.452	0.231	0.10
Crosses	17.13	18.60	7.90	6.92	43.00	31.00	7.00	6.00	0.918	0.341	0.08
Corners	5.06	5.04	3.03	2.08	12.00	9.00	1.00	0.00	0.002	0.968	0.00
Offsides	2.15	2.17	1.90	2.21	7.00	11.00	0.00	0.00	0.003	0.960	0.00
Recovered balls	39.91	38.53	7.73	6.20	64.00	50.00	27.00	25.00	0.916	0.341	0.08
Fouls committed	21.49	21.49	9.98	9.99	43.00	54.00	5.00	5.00	0.000	1.000	0.00
Yellow cards	1.06	1.60	0.84	0.92	3.00	4.00	0.00	0.00	8.481	0.005	0.24
% ball possession	50.91	49.09	7.55	7.55	70.00	64.00	36.00	30.00	1.379	0.243	0.10
Passes speed	0.30	0.30	0.02	0.02	0.35	0.37	0.25	0.25	0.117	0.733	0.03
Total passes completed	391.8	368.6	121.8	91.4	725.0	579.0	185.0	136.0	1.093	0.299	0.08
Total passes attempted	509.4	486.3	118.0	91.5	819.0	705.0	317.0	242.0	1.128	0.291	0.09
Passes completion rate	0.76	0.75	0.07	0.06	0.89	0.86	0.58	0.56	0.339	0.562	0.05
Long pass completed	45.87	41.45	12.93	10.35	80.00	72.00	21.00	23.00	3.358	0.070	0.15
Long passes attempted	79.17	73.74	14.31	12.58	114.00	111.00	56.00	50.00	3.810	0.054	0.16
% long passes	0.16	0.16	0.03	0.03	0.22	0.24	0.08	0.09	0.464	0.498	0.06
Completion rate long passes	0.58	0.56	0.11	0.09	0.81	0.75	0.34	0.38	0.564	0.455	0.06
Medium passes completed	247.6	233.6	85.4	65.0	496.0	372.0	107.0	77.0	0.792	0.376	0.07
Medium passes attempted	304.2	290.8	84.9	65.4	545.0	415.0	182.0	124.0	0.736	0.393	0.07

N = 47	Mean WIN	Mean LOSE	SD WIN	SD LOSE	Max WIN	Max Lose	Min WIN	Min LOSE	F	p	Cohen's d Effect size
% medium passes	0.59	0.59	0.04	0.04	0.67	0.68	0.53	0.51	0.092	0.762	0.03
Completion rate medium passes	0.80	0.79	0.06	0.06	0.92	0.90	0.59	0.62	0.302	0.584	0.05
short passes completed	98.30	93.49	34.20	30.92	190.00	211.00	42.00	36.00	0.511	0.476	0.06
short passes attempted	125.98	121.68	34.59	33.12	216.00	246.00	64.00	59.00	0.379	0.540	0.05
% short passes	0.25	0.25	0.03	0.04	0.31	0.35	0.17	0.18	0.099	0.754	0.03
Completion rate short passes	0.77	0.76	0.07	0.05	0.90	0.88	0.65	0.61	0.607	0.438	0.06
% attack origin left	35.15	36.70	8.87	11.24	59.00	71.00	14.00	19.00	0.535	0.466	0.06
% attack origin centre	19.67	18.13	6.66	8.58	33.00	41.00	5.00	0.00	0.928	0.338	0.09
% attack origin right	44.76	45.04	10.02	9.89	70.00	65.00	27.00	28.00	0.019	0.892	0.01
% balls played defensive area	27.80	27.43	6.08	6.33	41.00	44.00	13.00	17.00	0.082	0.776	0.02
% balls played central area	53.37	53.48	5.33	4.50	65.00	63.00	43.00	41.00	0.011	0.916	0.01
% balls played offensive area	18.98	19.30	3.59	5.15	31.00	29.00	13.00	6.00	0.124	0.725	0.03
Total distance	107396	106068	5656	7074	119337	120561	95052	92577	1.010	0.318	0.09
Total distance in ball possession	38110	35785	6912	5878	51550	49159	26601	22357	3.085	0.082	0.14
Total distance without ball possession	37565	39059	6331	7899	53670	55762	21992	26578	1.023	0.314	0.09
Rate dist. possession / dist. no possession	1.06	0.96	0.32	0.28	2.12	1.55	0.62	0.44	2.349	0.129	0.12
Distance ball non in play	31720	31224	4600	4973	42375	42691	20686	20915	0.253	0.616	0.04
% Distance ball non in play	0.30	0.30	0.05	0.05	0.43	0.43	0.19	0.19	0.011	0.918	0.01
% time at low activity	83.89	83.85	1.66	1.95	87.00	87.00	79.00	79.00	0.013	0.909	0.01
% time at medium activity	7.57	7.61	0.93	1.00	10.00	10.00	5.00	6.00	0.046	0.830	0.02
% time at high activity	8.54	8.54	0.94	1.17	11.00	11.00	7.00	6.00	0.000	1.000	0.00
Top speed	31.35	31.21	0.94	0.93	33.08	33.52	29.20	29.23	0.504	0.480	0.06
Total distance covered (no GK)	102959	101747	4894	6426	113490	114303	91976	89243	1.035	0.312	0.09
Distance covered low activity (no GK)	59766	58888	2135	2425	64177	63766	54317	54325	3.396	0.069	0.16
Distance covered medium activity (no GK)	16154	16095	1689	2013	19979	20417	12259	12735	0.023	0.879	0.01
Distance covered high activity (no GK)	26995	26765	2617	3357	33258	35310	22928	20261	0.135	0.715	0.03
Mean Top speed	27.05	27.46	2.10	0.74	28.88	29.06	14.01	25.63	1.541	0.218	0.09
Number of sprint	357.28	354.15	46.58	52.04	470.00	491.00	279.00	264.00	0.092	0.762	0.03

One-Way ANOVA results (F, p) and Effect Size for the analysis between winning and losing teams during the 2014 FIFA World Cup (significant results in bold).

Table 3. Descriptive data (mean, standard deviation, maximum. minimum).

N = 16	Mean QUAL	Mean NON QUAL	SD QUAL	SD NON QUAL	Max QUAL	Max NON QUAL	Min QUAL	Min NON QUAL	F	p	Cohen's d Effect size
Goals	1.88	0.94	0.75	0.43	3.33	1.67	0.67	0.33	18.949	0.000	0.50
Total attempts	12.96	13.02	3.47	3.26	20.67	19.67	8.33	7.33	0.003	0.958	0.01
Total attempts on target	8.13	7.21	2.68	1.89	13.00	10.00	4.33	4.00	1.247	0.273	0.15
Total attempts off target	4.83	5.81	1.47	2.07	7.67	11.67	2.67	3.33	2.375	0.134	0.23
Rate of total attempts per goal	8.08	17.00	4.52	9.02	22.00	40.00	4.00	8.20	12.508	0.001	0.50
Rate of attempts on target per goal	4.91	9.13	2.58	4.05	12.50	17.00	2.50	4.60	12.342	0.001	0.48
Rate of attempts on target per total attempts	0.62	0.56	0.09	0.08	0.80	0.66	0.44	0.41	4.642	0.039	0.29

N = 16	Mean QUAL	Mean NON QUAL	SD QUAL	SD NON QUAL	Max QUAL	Max NON QUAL	Min QUAL	Min NON QUAL	F	p	Cohen's d Effect size
Dangerous attacks	36.92	39.27	9.57	7.32	56.67	47.33	23.00	24.67	0.611	0.440	0.11
Delivery in penalty area	8.10	8.31	3.39	2.36	16.33	11.33	3.33	3.67	0.041	0.841	0.03
Clearances	12.52	12.10	3.70	3.63	21.00	22.33	4.67	7.00	0.103	0.750	0.05
Crosses	17.15	18.98	5.32	3.88	26.67	24.67	9.00	12.00	1.239	0.275	0.15
Corners	4.69	5.17	1.40	1.34	8.00	7.33	1.67	2.00	0.978	0.331	0.14
Offsides	2.13	2.19	1.09	1.74	4.67	7.00	0.33	0.67	0.015	0.904	0.02
Recovered balls	39.46	40.77	3.21	4.14	46.00	48.00	35.00	35.33	1.003	0.325	0.15
Fouls committed	22.02	20.65	5.46	3.53	30.33	25.67	13.67	14.00	0.716	0.404	0.11
Yellow cards	1.17	1.50	0.57	0.50	2.00	2.33	0.33	0.67	3.077	0.090	0.24
% ball possession	50.19	49.81	6.27	5.56	61.00	56.00	42.00	35.00	0.032	0.859	0.03
Passes speed	0.30	0.30	0.02	0.02	0.34	0.34	0.26	0.27	0.036	0.850	0.03
Total passes completed	381.21	388.25	94.44	92.80	597.33	572.33	262.00	201.33	0.045	0.833	0.03
Total passes attempted	500.46	507.17	93.20	91.56	706.67	696.67	365.00	316.67	0.042	0.839	0.03
Passes completion rate	0.75	0.76	0.05	0.05	0.85	0.85	0.68	0.64	0.031	0.861	0.03
Long pass completed	44.79	42.71	9.07	8.13	63.00	57.00	33.00	28.67	0.468	0.499	0.10
Long passes attempted	79.33	75.92	11.01	8.92	105.00	90.33	59.67	60.67	0.930	0.343	0.13
% long passes	0.16	0.15	0.04	0.03	0.29	0.20	0.11	0.10	0.627	0.435	0.11
Completion rate long passes	0.57	0.56	0.09	0.06	0.69	0.67	0.38	0.45	0.055	0.815	0.03
Medium passes completed	242.21	245.85	68.93	59.11	404.67	346.33	156.67	121.00	0.026	0.873	0.02
Medium passes attempted	301.25	303.38	70.12	60.00	463.00	391.33	205.67	172.33	0.008	0.927	0.01
% medium passes	0.60	0.60	0.03	0.03	0.66	0.64	0.56	0.54	0.021	0.885	0.02
Completion rate medium passes	0.80	0.80	0.04	0.05	0.87	0.89	0.74	0.70	0.232	0.633	0.07
short passes completed	94.17	99.69	22.92	34.46	141.67	199.00	65.00	51.67	0.285	0.598	0.08
short passes attempted	121.96	127.88	24.44	34.76	169.33	231.33	86.33	80.33	0.310	0.582	0.09
% short passes	0.24	0.25	0.02	0.03	0.28	0.33	0.21	0.21	0.532	0.471	0.11
Completion rate short passes	0.77	0.77	0.04	0.06	0.84	0.86	0.72	0.64	0.000	0.998	0.00
% attack origin left	37.75	35.59	7.05	6.42	60.00	48.00	28.33	26.00	0.818	0.373	0.13
% attack origin centre	17.97	18.41	4.92	4.98	26.33	25.67	10.33	11.33	0.063	0.804	0.04
% attack origin right	43.91	45.69	6.81	7.68	57.00	59.67	29.67	32.67	0.482	0.493	0.10
% balls played defensive area	27.76	27.41	4.93	4.34	36.00	36.67	18.00	21.00	0.047	0.831	0.03
% balls played central area	53.88	53.58	3.35	3.09	60.33	58.33	47.67	47.67	0.065	0.800	0.04
% balls played offensive area	18.55	19.22	2.98	2.92	22.67	24.33	13.33	13.33	0.408	0.528	0.09
Total distance	107139	106699	4449	6865	113945	118112	100349	95792	0.046	0.831	0.03
Total distance in ball possession	37296	37367	5036	5816	47906	46420	29906	26008	0.001	0.971	0.01
Total distance without ball possession	38528	38898	4407	5218	48128	51853	31596	30533	0.047	0.830	0.03
Rate dist. possession / dist. no possession	0.99	0.98	0.21	0.21	1.37	1.33	0.70	0.54	0.008	0.929	0.01
% time at low activity	83.79	83.77	1.15	1.80	86.00	86.67	81.67	80.00	0.002	0.969	0.01
% time at medium activity	7.61	7.73	0.69	0.78	9.00	9.33	6.33	6.33	0.193	0.664	0.06
% time at high activity	8.59	8.50	0.61	1.05	9.67	10.67	7.67	7.00	0.095	0.760	0.05
Top speed	31.38	31.09	0.72	0.60	32.66	32.29	30.19	30.06	1.464	0.236	0.17
Total distance covered (no GK)	102896	102513	4056	6148	109528	112434	96664	92767	0.043	0.837	0.03
Distance covered low activity (no GK)	59544	59391	1474	1992	62486	62729	56107	56015	0.062	0.806	0.04
Distance covered medium activity (no GK)	16198	16452	1418	1931	18861	20077	13580	13246	0.179	0.675	0.06
Distance covered high activity (no GK)	27130	26670	1846	2973	31016	32745	24642	22689	0.276	0.603	0.08
Mean Top speed	27.39	27.11	0.25	1.34	27.87	28.81	26.94	22.67	0.705	0.408	0.14
Number of sprint	356.41	351.01	29.94	37.06	444.00	411.50	318.33	277.00	0.205	0.654	0.07

One-Way ANOVA results (F, p) and Effect Size for the analysis between qualified and non-qualified teams during the 2014 FIFA World Cup (significant results in bold).

DISCUSSION

Technical / tactical indicators

As scoring more goals than the opponent team is the essence of a competitive game, it is no surprise that winning teams (ES 0.57) and qualified teams (ES 0.50) scored more goals. Castellano et al. (2012) found that winning and losing teams scored respectively 2.2 and 0.4 goals per game during the 2002, 2006 and 2010 World Cups while for the present study the scoring performance was 2.49 and 0.62. With 1.88 and 0.96 goals scored for qualified and non-qualified teams, our results are higher than those found by Delgado-Bordonau et al. (2013) during the 2010 FIFA World Cup with 1.7 and 0.7 goal scored. These higher scoring performances are due to a higher rate of goal scoring during the 2014 World Cup. With 171 goals scored, the 2014 World Cup was the World Cup with the most goals (equaling the 1998 World Cup). 2.67 goals per game was also the highest since 64 teams qualified for the World Cup.

While it takes an attempt to score a goal, total attempts was not an indicator that distinguished winning and qualified teams. This is in line with the results found by Delgado-Bordonau et al. (2013) comparing successful and unsuccessful teams during the 2010 World Cup but contrasts with those found by Castellano et al (2012) for the 2002 and 2006 World Cups. Data from the Spanish La Liga (Lago-Ballesteros and Lago-Pena 2010), Italian Serie A (Rampinini et al. 2007) and English Premier League (Araya et Larkin 2014) also found that the total attempts was a determining factor of success. In the same vein, we observed that unsuccessful teams produced as many dangerous attacks and deliveries in the penalty area as successful ones. Moreover, there were no differences for clearances and ball recoveries which are a mark of offensive pressure. Putting the opponent under pressure does not automatically translate on the scoreboard. Quantity of attempts, of attacks, deliveries in penalty area or offensive pressure does not always make the difference. Quality plays an important role. Winning teams had more attempts on target (ES 0.3) which is in line with previous results as we found no studies indicating that success was not related with the number of attempts on target. The fact that qualified and non-qualified teams did not differentiate in the number of attempts on target in our study was surprising (ES 0.15). In the same time, a trend toward more attempts off-target for non-qualified teams appeared (ES 0.24 but a non-significant result through ANOVA analysis probably due to the size of the sample) which could be interpreted as a mark of a better efficiency for qualified teams. This trend did not appear in the analysis comparing winning and losing teams. During the 2014 World Cup, winning teams didn't shoot less off-target than losing teams in line with the result found by Castellano et al. (2012) for the 2002, 2006 and 2010 World Cups. This discrepancy between our two ways of analyzing success could mean that what makes the difference between winning and losing and between qualification and non-qualification differs, at least concerning the determinant role played by the capacity to increase the number of shots on target and decrease the number of shots off-target. It is also worth to note that the calculated effect size for shooting performances were rather small indicating that the number of attempts on and off target were not robust indicators for qualifying success during the 2014 World Cup.

Conversely, efficiency was. The number of attempts needed to score a goal was lower for winning (ES 0.59) and qualified teams (0.50) in line with previous studies (Szwarc 2004, Lago-Ballesteros and Lago-Peñas 2010, Lago-Peñas et al. 2010^a, Delgado-Bordonau et al. 2013). The rate of attempts on target per goal was also lower for winning (ES 0.53) and qualified teams (0.48). The rate of attempts on target per attempts was also discriminative but with smaller effect size (0.34 and 0.29). In this regard, Lago-Ballesteros et Lago-Peñas (2010)^a found for the Spanish La Liga that while the rate of shots per goal was a mark of success, the rate of shots on target per shot wasn't. Together, success depends on accuracy. It is not so much the number of shots but their quality that makes the difference. As Papahristodoulou (2007) put it, shots on goal do not

belong to "*more-is-better-case*" because considering as raw data, shots not converted into goals may reflect the inability of players to score.

For the remaining technical / tactical indicators, yellow cards were the only indicator that differentiated winning (ES 0.24) and qualified-teams (ES 0.24. not significant) with less-successful teams receiving more cautions, a result that wasn't observed during the 2002, 2006 and 2010 World Cups (Castellano et al. 2012). Less-successful teams did not commit more fouls which corroborated results from previous studies (Lago-Peñas et al. 2010^a, Castellano et al. 2012, Araya et Larkin 2014).

Ball possession is a vivid debate largely influenced by the Barcelona's style of play under Guardiola. It has been suggested to be linked with success but our result showed that successful teams did not have a higher possession rate contrary to what was observed during the 2006 and 2010 World Cups (Castellano et al. 2012). Collet (2012) indicated that to answer the question if football is or is not a retention game, one should differentiate between competitions. While some domestic league showed a relationship between ball retention and team success (English Premier League, Ligue 1 and Bundesliga) this did not appear for World Cups tournaments. The author also showed that the link was driven by the best teams and when the '*crème de la crème*' was omitted, there was no link between ball retention and success. While the percentage of ball possession is probably the most frequent data published during football games, its relationship to performance is complex. It is under influence of situational variables. Many studies (Lago-Peñas and Martin 2007, Lago-Peñas et al. 2010^b and Paixao et al. 2012) have examined the causal mechanism behind teams' possession and underlined that it depends on game status with possession rate being for example higher when the team lose.

Ball possession is strongly correlated with the number of passes per game (Collet 2012) and it is no surprise that winning and qualified teams did not differentiate during the 2014 World Cup. Contrary to the 2010 World Cup (Saito et al. 2013) we observed no differences for pass attempts and pass completion. More surprising is the fact that passing accuracy was not a mark of success. Whatever the passes' distance (short, medium or long), passing accuracy was not better for successful or qualified teams while Collet (2012) and Araya and Larkin (2014) indicated that it was a mark of success. The poor performance of high-rank FIFA teams such England, Italy and Spain (teams with a pass completion above average) could explain the observations collected during the 2014 World Cup. No difference was evident concerning crosses. Lago-Peñas et al. (2010)^a observed that in the Spanish La Liga, successful teams crossed less than unsuccessful ones. We detected no differences in line with what Araya and Larkin (2014) observed.

Considering corners, except for the 2006 World Cup (Castellano et al. 2012), studies found no relationship between the number of corners won and success (Lago-Ballesteros et al. 2010, Castellano et al. 2012, Araya et Larkin 2014). Our results also showed no link.

Considering the style of play we couldn't find an indicator related to success. No pattern emerged from the data collected and the percentage of short, medium and long passes was non-discriminant. While Araya et Larkin (2014) found that successful teams produced more short passes in the English Premier League 2012/2013 season, it was not the case during the 2014 World Cup. Hence, a distinction related to success between a direct-style and a short-pass-style could not be observed. When looking at the speed of pass, no difference was evident. While expert coaches underlined the need for speed to beat the opponent, the rate of passes per unit of time couldn't support the notion. Neither the width of the pitch (left / centre / right) nor the area (defensive / middle / offensive) had an impact on success. During the 2014 World Cup, the better

teams did not use more of center of the pitch nor the flanks and didn't play proportionally more in the offensive third of the pitch.

Athletic indicators

Finally, none of the athletic indicators had an impact on success for differentiating winning and qualified teams. Total distance covered has been shown to be non-discriminative during the 2010 World Cup (Clemente et al. 2013). No correlation was found between total distance covered and league ranking or goal scored in Bundesliga (Dufour et al. 2016) and the absence of impact on performance was also described for Champion's League games (Dufour 2014). Conversely, Rampinini et al. (2009) studying the Italian Serie A found that less-successful teams covered more distance. Observing the evolution of performances in the English Premier League over 7 seasons (2006-07 to 2012-13) Barnes et al. (2014) showed that distance covered varied in a trivial magnitude while other technical and athletic indicators presented a large increase over this period. Total distance covered is an indicator often observed while the information it provides in the explanation of the success of a team is relatively low.

To add some information, some studies have distinguished the distance with and without possession. Rampinini et al. (2009) presented data showing that unsuccessful teams in the Serie A covered more distance without possession. Dufour (2014) presented the same conclusion for the 2010 World Cup. The more a team ran without the ball, the less it ran with the ball. Hence Spain, the winning team was the team who ran the least without possession and the most with the ball. The author named it "*the quantity of quality*". Our results do not sustain these observations. Winning teams and qualified teams didn't cover more distance in ball possession during the 2014 World Cup.

Observing the English Premier League, Barnes et al. (2014) noted that over 7 seasons distance covered at high intensity increased by 30% and the number of sprint by 85%. These observations suggest that intensity and speed are more and more the landmark of high level performance in football. Our data couldn't detect any relationship between intensity and performance. Considering the distance at low, medium and high intensity, the percentage of distance spent at low, medium and high intensity, the number of sprints and the maximal speed, no significant differences were evident. Rampinini et al. (2009) and Di Salvo et al. (2009) showed that in Serie A and Premier League, unsuccessful teams not only covered more distance than successful ones but they also covered more distance at high intensity. Dufour et al. (2016) observed a correlation between passing accuracy and distance ran at high and sprint intensity in Bundesliga. During the 2014 World Cup, no difference could be detected. Intensity wasn't related to success.

General discussion

Confronted with the scarcity of indicators sufficiently relevant to characterize success during the 2014 World Cup, our results lead us to interpret the comments of Pollard and Reep (1997) differently. They pointed out that "*soccer coaches, players, fans, and the media are deeply skeptical and often suspicious, to the point of paranoia, at the suggestion that a statistician might have something useful to offer [...]*". The authors suggested that data and statisticians may help to crack the football code and find formulae or patterns sufficiently robust to explain performance in football. Relying on a large collection of data, football would fit a model of the form "*Goals Scored = $\alpha + \beta \times \text{Shots on Goal} + \gamma \times \text{Ball Possession}$* " (Panaretos 2012). Our study and the lack of homogeneity in the analysis of literature draws another picture. Owing to its fortuitous nature, it is still very problematic to identify precisely the factors resulting in victory or defeat in football. The current results showed that some indicators were related to success but it added no real new knowledge. The fact that accuracy and efficiency in front of the goal play a role for beating the opponent has been known for a

long time. Today as yesterday, chance does dominate the game. Football still continues to resist statistics and is all but a numbers game (Dufour 2014). Being skeptic is not a sign of paranoia but a matter of fact.

CONCLUSION

This study revealed that shooting efficiency was the factor that made the difference between winning and losing teams and between qualified and non-qualified teams during the 2014 FIFA World Cup. The quality of the attempts and not the quantity was related to success. The best teams performed better in the 3 following variables: attempts per goal – attempts on target per goal – attempts on target per attempt. The second main finding of this study was the absence of relationship of many technical and athletic indicators with success. Ball possession, passing quantity and quality were not discriminative. The patterns of play observed had no impact on performance. Distance covered, either with or without the ball, either at low or high intensity were not connected to victory. While the 2014 World Cup was the most data-collected World Cup, the numbers provided by FIFA were not sufficient to explain what made the difference for beating an opponent or qualifying for the stage of 16. Expert coaches who commented during the 2014 World Cup were informed with data. Should they have used it to support their analysis, uncertainty may have emerged, at least from a statistical point of view.

REFERENCES

1. Acar, M.F., Yapicioglu, B., Arikan, N., Yalcin, N., Ates, N., Ergun, M. (2009): Analysis of goals scored in the 2006 World Cup. In Science and Football VI. Eds: Reilly T. and A. F. Korkusuz AF. London: Routledge, 235 – 242.
2. Araya, J.A.; Larkin, P (2014): Key performance variables between the top 10 and bottom 10 teams in the English Premier League 2012/13 season. *Human Movement, Health and Coach Education*, 2(1), 17 - 29.
3. Armatas, V., Yiannakos, A., & Sileloglou, P. (2007): Relationship between time and goal scoring in soccer games: Analysis of three World Cups. *International Journal of Performance Analysis in Sport*, 7(2), 48 – 58.
4. Armatas, V., Yiannakos, A., Papadopoulou, S., Dimitrios Skoufas, D. (2009): Evaluation of goals scored in top ranking soccer matches: Greek Superleague 2006-07. *Serb J Sports Sci.*, 3(1), 39-43
5. Balyan, M., Vural, F., Catikkas, F., Yucel, T., Afacan, S., Atik, E. (2007): Technical analysis of 2006 World Cup soccer champion Italy. *J. Sports Sci. Med., suppl.* 10, 4 - 5.
6. Barnes, C., Archer, D.T., Hogg, B., Bush, M., Bradley, P.S. (2014): The evolution of Physical and Technical Performance Parameters in the English Premier League. *Int. J. Sports Med.*, 35, 1 – 6.
7. Barreira, D., Garganta, Machado, J.I., Anguera, M.T. (2014): Effects of ball recovery on top-level soccer attacking patterns of play. *Rev. Bras. Cineantropom Desempenho Hum.*, 16(1), 36 – 46.
8. Bradley, P.S., Lago-Penas, C., Rey, E., Gomez Diaz, A. (2013): The effect of high and low percentage ball possession on physical and technical profiles in English FA Premier League soccer matches. *J. Sports Sci.*, 31(12), 1261 -1270.
9. Castellano, J., Casamichana, D., Lago-Penas, C. (2012): The Use of Match Statistics that Discriminate Between Successful and Unsuccessful Soccer Teams. *Journal of Human Kinetics*, 31, 139 - 147.
10. Clemente, F.M., Couceiro, M.S., Martins, F.M.L., Ivanova, M.O., Mendes, R. (2013): Activity Profiles of Soccer Players During the 2010 World Cup. *Journal of Human Kinetics*, 38, 201-211.
11. Cohen, J. (1988): *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NJ: Erlbaum Associates, 1988. pp. 567.

12. Collet, C. (2013): The possession game? A comparative analysis of ball retention and team success in European and international football, 2007–2010. *J. Sports Sci.*, 31(2), 123 - 136.
13. Delgado-Bordonau, J., Domenech-Monforte, C., Guzmán, J., & Mendez-Villanueva, A. (2013). Offensive and defensive team performance: relation to successful and unsuccessful participation in the 2010 Soccer World Cup. *Journal of Human Sport and Exercise*, 8(4), 894-904. doi:<https://doi.org/10.4100/jhse.2013.84.02>.
14. Di Salvo, V., Gregson, W., Atkinson, G., Tordoff, P., Drust, B. (2009): Analysis of high intensity activity in Premier League soccer. *Int J Sports Med.*, 30(3), 205 - 212.
15. Dufour W. (1993): Computer-assisted scouting in soccer. In: Science and Football II. Eds: Reilly T, Clarys J. and Stibbe A. London: E. and F.N. Spon, 160-166.
16. Dufour, M. (2014): L'Enigme Athlétique. Eds Volodalen.
17. Dufour, M., Phillips, J. (2016): Do athletic metrics correlate with technical metrics in football? A four seasons Bundesliga analysis. *Football Science*, vol 13.
18. Grant, A.G., Williams, A.M., Reilly, T. (1999): Analysis of the goals scored in the 1998 World Cup. *J Sport Sci.*, 17, 826 - 827.
19. Gréhaigne, J.F. (1998): Time distribution of goals in soccer: Some championships and the 1998 World Cup. In: Notational analysis of sport IV. Eds: Hughes M. and Tavares, F. Porto: Portugal. 41 - 52.
20. Hughes, M., Robertson, K., Nicholson, A. (1988): Comparison of patterns of play of successful and unsuccessful teams in the 1986 World Cup for soccer. In: Science and Football I. Eds: Reilly T, Lees A, Davis K. and Murphy WJ. London: E. and F.N. Spon, 363 - 367.
21. Hughes, M., Franks, I. (2005): Analysis of passing sequences, shots and goals in soccer. *Journal of Sports Sciences*, 23(5), 509 – 514.
22. Jinshan, X., Xiakone, C., Yakamaka, K., Matsumoto, M. (1993): Analysis of the goals in the 12th World Cup. In: Science and Football II. Eds: Reilly T, Clarys J. and Stibbe A. London: E. and F.N. Spon, 203 - 205.
23. Lago-Ballesteros, J., Lago-Peñas, C. (2010): Performance in Team Sports: Identifying the Keys to Success in Soccer. *Journal of Human Kinetics*, 25, 85 – 91.
24. Lago-Peñas, C., Martin, R. (2007): Determinants of possession of the ball in soccer. *Journal of Sports Sciences*, 25(9), 969 – 974.
25. Lago-Peñas, C., Martin, R. (2007): Determinants of possession of the ball in soccer. *Journal of Sports Sciences*, 25(9), 969 – 974.
26. Lago-Peñas, C., Lago-Ballesteros, J., Dellal, A., Gómez, M. (2010)a: Game-related statistics that discriminated winning, drawing and losing teams from the Spanish soccer league. *Journal of Sports Science and Medicine*, 9, 288 - 293.
27. Lago-Peñas, C., Dellal, A. (2010)b: Ball Possession Strategies in Elite Soccer According to the Evolution of the Match-Score: the Influence of Situational Variables. *Journal of Human Kinetics*, 25, 93-100.
28. Lawlor, J., Low, D., Taylor, S., Williams, A.M. (2003): The FIFA World Cup 2002: an analysis of successful versus unsuccessful teams. *J. Sport Sci.*, 22, 500 - 520.
29. Low, D., Taylor, S., Williams, M. (2002): A Quantitative Analysis of Successful and Unsuccessful Teams. *Insight*, 4(5), 86 – 88.
30. Olsem, E. (1988): An analysis of goal scoring strategies in the World Championship in Mexico, 1986. In: Science and Football I. Eds: Reilly T, Lees A, Davis K. and Murphy WJ. London: E. and F.N. Spon, 1988, 373 - 376.

31. Paixao, P., Sampaio, J., Duarte, R. (2012): The Differential Effect of the Evolving Game Status in the Passing Sequences of Top-Level European Football Teams. Conference: International Congress on Sports Science Research and Technology Support. Vilamoura, Algarve, Portugal, pp. 20 – 21.
32. Panaretos, V. (2012): A statistical analysis of the European Soccer Champions League, Joint Statistical Meetings – Section on Statistics in Sports, 2600-2602
33. Papahristodoulou, C. (2007): The relative efficiency of UEFA Champion's League scorers. MPRA Paper, 4943.
34. Papahristodoulou, C. (2008): An analysis of UEFA Champions League match statistics. *Int. J. Applied Sports Sci.*, 20(1), 67 - 93.
35. Partridge, D., Mosher, R.E., Franks, I.M. (1993): A computer assisted analysis of technical performance- a comparison of the 1990 World Cup and intercollegiate soccer. In: Science and Football II. Eds: Reilly T, Clarys J. and Stibbe A. London: E. and F.N. Spon, 221 - 231.
36. Pollard, R., Reep, C. (1997). Measuring the effectiveness of playing strategies at soccer. *Journal of the Royal Statistical Society: Series D (The Statistician)*, 46, 541 – 550.
37. Rampinini, E., Impellizzeri, F.M., Castagna, C., Coutts, A.J., Wisløff, U. (2009): Technical performance during soccer matches of the Italian Serie A league: Effect of fatigue and competitive level. *J. Sci. Med. Sport*, 12(1), 227 – 233.
38. Reep, C., & Benjamin, B. (1968). Skill and chance in association football. *Journal of the Royal Statistical Society, A*, 131, 581 – 585.
39. Rowlinson, M., O'Donoghue, P. (2009): Performance profiles of soccer players in the 2006 UEFA Champions League and the 2006 FIFA World Cup tournaments. In: Science and Football VI. Eds: Reilly T. and Korkusuz AF. London: Routledge, 229 - 234.
40. Saito, K.; Yoshimura, M.; Ogiwara, T. (2013) Pass appearance time and pass attempts by teams qualifying for the second stage of FIFA World Cup 2010 in South Africa. *Football Science*, 10, 65 – 69.
41. Sajadi, N., Rahnama, N. (2007): Analysis of goals in 2006 FIFA World Cup. *J. Sports Sci. Med.*, suppl. 10, 3.
42. Scoulding, A., James, N., Taylor, J.B. (2004): Passing in the soccer World Cup 2002. *Int. J. Perform. Anal. Sport*, 4, 36 - 41.
43. Shafizadeh, M., Taylor, M., Lago Peñas, C. (2013): Performance Consistency of International Soccer Teams in Euro 2012: a Time Series Analysis. *Journal of Human Kinetics*, 38, 213 – 225.
44. Stanhope, J. (2001): An investigation into possession with respect to time, in the soccer world cup 1994. In: Notational Analysis of Sport III. Ed: Hughes MD. Cardiff, UK: UWIC. 155 - 162.
45. Szwarc A. (2004): Effectiveness of Brazilian and German teams and the teams defeated by them during the 17th FIFA WORLD CUP. *Kinesiology*, 36, 83 - 89.
46. Werlayne, S., Soares, L. (2013): Analysis of goals in soccer World Cups and the determination of the critical phase of the game. *Physical Education and Sport Vol. 11(3)*, 247 – 253.
47. Xu, J., Shen, J., Zhou, X. (2007): Offensive and defensive characteristics of 18th FIFA World Cup. *J. Sports Sci. Med.*, Suppl. 10: 203.
48. Yamanaka, K., Hughes, M., & Lott, M. (1993). An analysis of playing patterns in the 1990 World Cup for association football. In Science and Football (edited by T. Reilly, A. Lees, K. Davids and W. Murphy), pp. 206 – 214. London: E & FN Spon.