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Influencing factor analysis of soccer's scoring rate based on mathematical statistics analysis

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ABSTRACT

With the continuous development of world football and the mutual exchange and integration, the gap between the teams is getting smaller and smaller, the game is more competitive, training requirements of each team are higher, and the scientific training is the foundation to improve the level of the team. This paper conducts statistics and the relevant factor analysis on the 620 goals of 244 games in the 15th to 18th World Cup Finals, identifies the best goal area, and makes recommendations for offensive tactics. Through surveys the primary four factors influencing the goals are the shot area, the offensive way, the game time and the place kick goal. Then it conducts classified statistics on the 620 goals in accordance with the four factors, analyzes the data and finds out the reason of the laws. Finally, recommendations are made based on the rules, designed to make a contribution to the improvement of the football level and promote the development of football. © 2014 Trade Science Inc. - INDIA

KEYWORDS

Data statistics;
Factor analysis;
Shot zone;
Scoring rate.

INTRODUCTION

In offensive and defensive combat of football, the attack is the main theme of the football game; the shooting goal is the focus of offensive and defensive conflicts in football game; With the mutual exchange and integration of the world football level, whether it is war between each play or the overall play, the gap between the team is smaller, and the competition is more intense. The World Cup is the football matches with the world's highest level, which can best reflect the characteristics of world football and plays a guiding role for the development of modern football; so this paper conducts statistical analysis for the scoring data of the World Cup, in order to make recommendations to improve the scor-

ing rate and contribute to the development of the world football.

For the relevant factor analysis of soccer goals, many predecessors have made efforts, where Yang Ling (2012) used "factor analysis" to study the goal tactics characteristics of modern football, and pointed out that the possession percentage largely determine the scoring rate; passing success rate is a very important factor to guarantee ball possession percentage. Offensive launching zone has distinctive characteristics; we should properly use a long pass fast break. Launch time in front court is one sign of powerful attack force, also one of the factors to get more goals^[1]. Liu Jian (2001) on analyzed the fumble factors of the 15th and the 16th World Cup, pointed out that in various fumble factors, the

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loosely marking, not sealed shot angle and defeat of grabbing points is the main reason; the formation of single-tool being broken, the penalty kick and the inaccuracy of position selection are the important factors of ball fumble. The amount of fumble goals affect the team's rankings and achievements; stable defense line is a prerequisite for the team to get success; at the present that advocates attacking football, the defense is particularly important; blindly attack cannot replace defense; the team with relatively weak overall strength should strengthen the defense even more^[2]. Bai Hong-zhou (2005) studied the goal characteristic for the 2004 European Football Championship, indicated that in the final pass before a goal, the directly foot passing is the main technical way passing before the ball, the goal way is still foot shot goal-oriented, wherein the direct positioning foot shot is the main way to score, it is recommended that the training of direct handling technology should be strengthened^[3].

On the basis of the previous studies, this paper uses a mathematical statistics method to conduct correlation analysis on the four factors of the shot area, offensive way, game time, the place kick goals by combining the 620 goals of the 244 games in the 15th~18th World Cup Finals, find out the law and reason, puts forward targeted suggestions for football training from the four aspects, and aims at promoting the development of world football.

SHOTS ZONING

By combining the shot characteristics of players, the venue is divided as shown in Figure 1.

we can see in football game the best shooting area is in the range of 30 meters before the goal enclosed by the penalty corner, namely the region in the penalty area and before the penalty area is the main scoring area, especially the area between the goal area and the penalty points; rank each zone in descending order of the

goals are:

Zone 1: the area between the goalpost of the goal line and the goal corner with the same side extending into the venues.

Zone 2: the area between the goal area corner and the penalty area corner extending into the venues, the area as enclosed by EFGH in Figure 1

Zone 3: the area between the direction extending of the two vertex angles into the venue of the penalty area and the kick-off circle, 30 meters from the end line, the area as enclosed by BCGH in Figure 1.

Other zones: the zone other than the zone 1, zone 2 and zone 3 (see Figure 1) (zone 4, 5, 6 and 7).

ANALYSIS OF THE FACTORS AFFECTING GOAL

There are many factors that affect the goals, the paper conducts the statistics for the goal condition of the 15th to 18th World Cup, carries through statistical division on the success goal kick from five aspects of goal zone, the goal time, place kick goal, goals of dif-

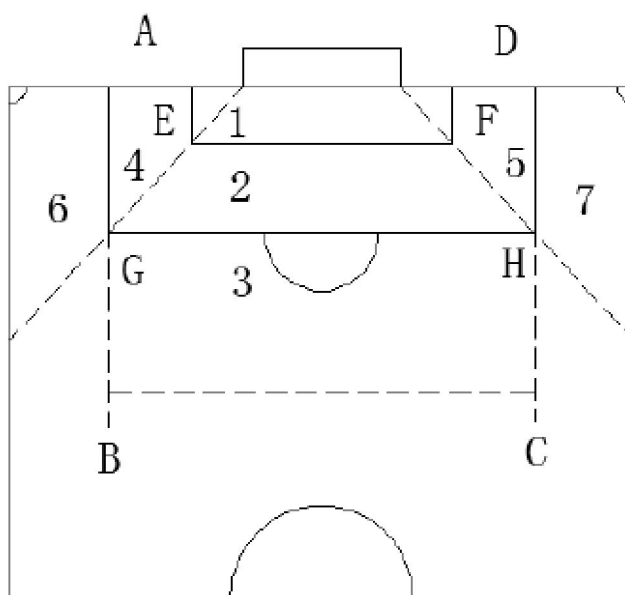


Figure 1 : Division of soccer venues

TABLE 1 : The goal statistics of each zone from the 15th to 18th world cup

Number of sessions	Zone 1	Proportion	Zone 2	Proportion	Zone 3	Proportion	Other zones	Proportion
15 th session	26	18.40%	81	57.40%	26	18.40%	8	5.80%
16 th session	40	23.40%	97	56.70%	24	14.00%	10	5.90%
17 th session	30	18.60%	100	62.10%	19	11.80%	12	7.50%
18 th session	30	20.40%	81	54.40%	23	15.60%	13	9.60%

ferent technical ways and the attack ways, conducts analysis and study on the various factors.

The impact analysis of different shot zones on scoring rate

The goal statistics of each zone from the 15th to 18th World Cup is shown in TABLE 1 below.

Figure 2 is obtained according to TABLE 1.

It is evident from Figure 2 that the goal proportion of each zone is basically the same in four World Cups; so the data have stability, the goal numbers of each zone obey Poisson distribution and satisfy the following relationship:

$$P(X = K) = \frac{e^{-\lambda} \lambda^k}{k!} \tag{1}$$

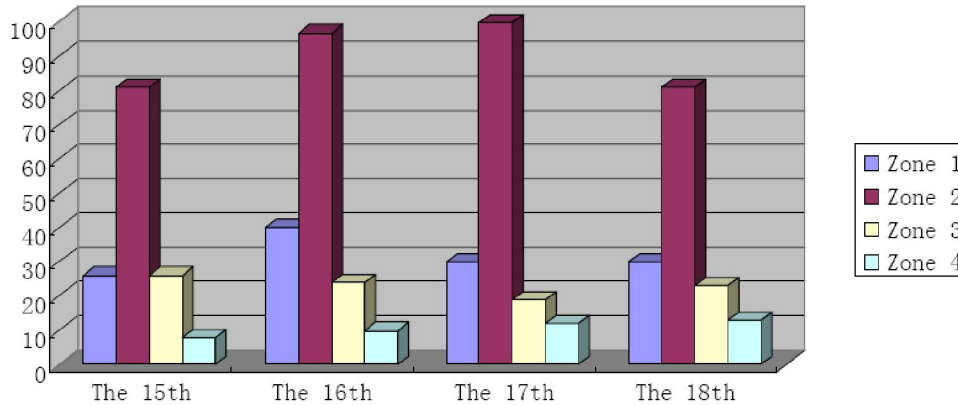


Figure 2 : Histogram of the goals in each zone

The expectation of Poisson distribution is:

$$E\zeta = \sum_{m=0}^{\infty} m \frac{\lambda^m}{m!} e^{-\lambda} \tag{2}$$

For this article, the goal sample expectation of zone one is:

$$E_1 = \frac{1}{4} \sum_{i=15}^{18} x_i \tag{3}$$

Parameter x_i represents the goals of zone one in each World Cup. Similarly the expectations of zone 2, zone 3 and other zones can be drawn. Thus the percentage formula of each zone’s goals can be drawn:

$$\eta = \frac{1}{4} \sum_{i=1}^4 E_i \times 100\% \tag{4}$$

Thus the percentage of the goals in specific districts

can be calculated according to the formula (4). By combining Figure 2 it is easy to know that zone 2 is the shot region with the highest scoring rate, accounting for about 58% of the total goals of each zone. Zone 1 and zone 3 are more close to each other, respectively accounting for around 20% and 15%. Other regions account for about 7%.

The influence of different attack methods on the scoring rate

Football game has a variety of offensive ways, including attack in the middle, attack on the wings, and attack of place kick. The explanation of the various attack methods and the relationship between the shot zones is shown in above 2.1. Different attack methods have great effects on the scoring. By statistics we can obtain TABLE 2.

Figure 3 is obtained according to TABLE 2.

TABLE 2 : The goals statistics from the 15th to the 18th World Cup

Number of sessions	Round	Total Goals	Goals per game	Attack in the Middle		Attack on the wings		Attack of place kick	
				Goals	Proportion	Goals	Proportion	Goals	Proportion
15th session	52	141	2.71	79	56%	17	12%	45	32%
16th session	64	171	2.67	83	49%	28	16%	60	35%
17th session	64	161	2.52	53	35%	58	36%	47	29%
18th session	64	147	2.29	62	41%	37	25%	48	34%

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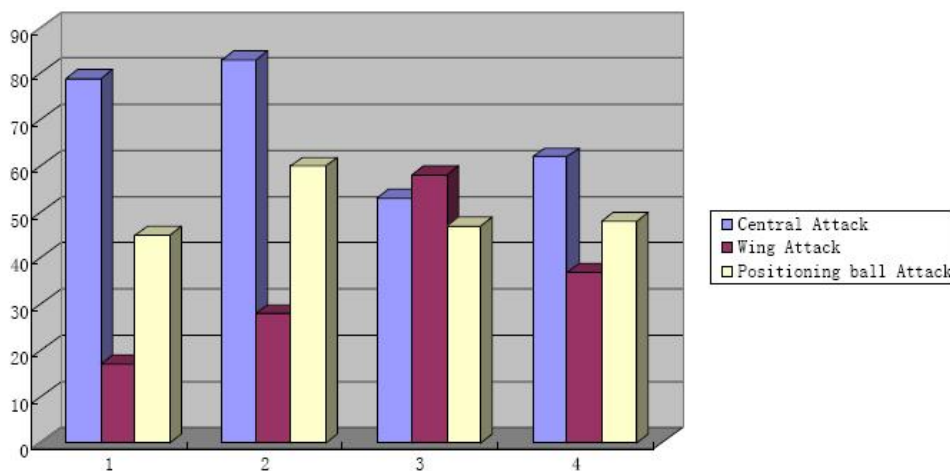


Figure 3 : The goals of different attack lines from the 15th to 18th World Cup

As can be seen from Figure 3 that the shooting areas have remarkable features, mainly the goals of middle zone 1, zone 2 and zone 3 are much higher, and the goals of two wings are quite few. The total goals in the zone 1, zone 2 and zone 3 of the Fourth World Cups are 577, accounting for 93.1% of the total goals of the four World Cups. In the 15th World Cup the shooting goals in the penalty zone are 112, accounting for 79.4% of the total goals; and the 16th World Cup shot into 152 balls, accounting for 88.9% of the total goals; the 17th World Cup shot into 136 balls, accounting for 84.5% of the total goals; the 18th World Cup shot into 125 balls, accounting for 81.0% of the total goals, which is significantly higher than the goals shot outside the penalty area. According to the distribution of the goal area, we should conduct special shooting training with pertinence. With the continuous expansion of the defensive scope, the place kick ball and long shots are an effective means of breaking the tight defense, but also an effective way to culture athletes' confidence, imagination and innovation. Thus, the penalty area is the ideal area to score a goal, and the penalty area is a high-risk zone.

Attack in the Middle has more threat and immediacy than attack on the wings, so the enemy team will

heavily guard the middle zone, and attack is more difficult than attack on the wings. But once the breakthrough successes, the threat to the enemy is far more than the attack on the wings; so the attack in the middle is not easy to get scoring chances, but the possibility of scoring is big once getting the chance. Attack on the wings have a lot of shooting opportunities due to fewer defensive players, but due to the direct shot angle of attack on the wing is small, the shot difficulty is great and it is very difficult to hit the goal. The players usually take the attack on the wings, uses the means of passing in the middle after breaking the defensive line of the other side, and creates more scoring chances; the ultimate goal of attack on the wings is still spreading to the middle road and reaching the outflank shot purposes. It is an auxiliary play of attack in the middle, so the middle and the wings need to combine with each other, create a more flexible point of attack and achieve better results; in all the goals of the four World Cups, the goals of attack on the wings are 140, accounting for 22.6 percent of the total goals; the goals of attack in the middle are 275, accounting for 44.4% of the total goals.

By TABLE 3, the wing scoring rate of the 17th and the 18th has increased over that of the 15th and the 16th, and the middle scoring rate of the 17th and the

TABLE 3 : The goal time statistics from the 15th to the 18th world cup

Number of sessions	Round	Total Goals	1~15 (min)	16~30 (min)	31~45 (min)	46~60 (min)	61~75 (min)	76~90 (min)
15th session	52	141	23	18	24	23	23	27
16th session	64	171	25	19	28	31	24	45
17th session	64	161	27	17	25	27	31	31
18th session	64	147	24	26	24	21	11	29

18th has declined over that of the 15th and the 16th; the goals of the attack in the middle reduce, indicating that with the development of football, as well as technological improvements of the tactics, both teams are more concerned about the defense in the middle of the game, defense level in the middle is more intensive. Thus the two wing zones have gradually become an important offensive line to create breaking opportunities. The increasing of combined attack in the middle road and on the wings explains that comprehensive attack has become the development trend of modern football offense.

The influence of time factors on the scoring rate

In football game by the effect of psychological factors and physical factors, the goal time has some regularity. In this paper, it divides the 90 minutes by 15 minutes for a time period and gets six time periods. The goal statistics of different time segment from the 15th to the 18th World Cup can be obtained in TABLE 3.

According to TABLE 3, do a line chart for the scoring time and number of goals and obtain the Figure 4.

As can be seen in Figure 4 the goal laws of each period is basically at first declining substantially rising again and then declining and rising again. This is because in the first 1 ~ 15min of the race of, both teams don not know enough about each other, don't under-

stand each other's attack as well as the players' level. Therefore defensive mistakes are prone to appear, resulting in greater number of goals. In the 16 ~ 30min of the game, the two began to know each other, know each other 's offensive way and start a targeted defense, and thus the total goals of both sides reduce, with the passing of the game time, offense and defense between each other, the two teams can better understand each other; so the total goals have the risen trend again; in the 61 ~ 75min of the race, physical agility declines, the total goals have a downward trend again; for the last 15min of the game, except for the 17th World Cup, the goals are basically same with that of the 61 ~ 75min, for the other sessions this period has the highest scoring of this World Cup. This is because with the end time of the game approaches, the backward team's mood to win is extremely urgent, thus affecting athletes' play skills and tactics; the team falling behind will fully attack, increase the scoring rate, but due to the full attack, defense will drop, which creates the opportunity to quickly counterattack for the opposite side. So the final 15 minutes of the game is the peak of the goal number in the whole game. Through the above analysis the following recommendations can be given: before the game the team should gather information of hostile team or watch video game of hostile team, strengthen each other's understanding, know ourselves,

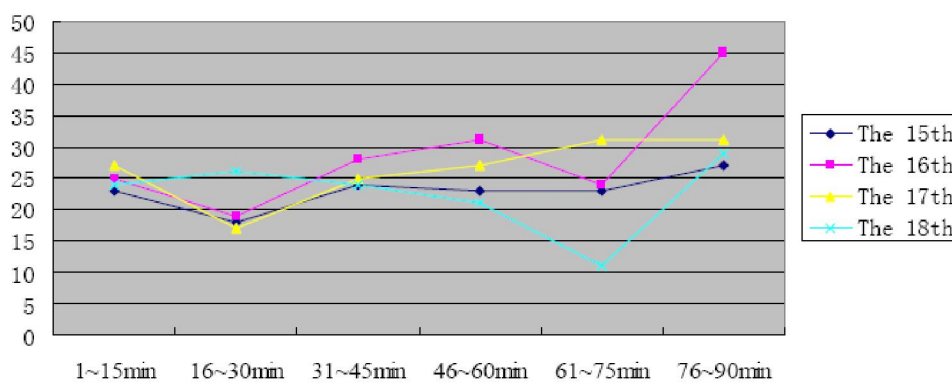


Figure 4 : The line chart statistics of the scoring time from the 15th to 18th world cup

TABLE 4 : The statistics of the place kick goal from the 15th to 18th sessions

Number of sessions	Total	Proportion	Penalties	Direct free kick	Corner kick	Foul ball
15th session	45	31.90%	15	6	8	2
16th session	60	35.10%	17	5	23	1
17th session	47	30.00%	13	5	13	1
18th session	54	36.70%	13	6	15	5

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obtain scoring advantage at the beginning of the game; besides athletes need to strengthen physical training, enhance endurance, thus result in the physical advantage at latter half of the race. In the last 15min of the game, the players must make sure to maintain a good state of mind, can strengthen the attack, but must not let up the defense and let the other party get the goal opportunity.

The effect of the place kick on the scoring rate

The place kick goal is important means to create scoring opportunities; the place kick is often a shortcut to open up the situation and win victory; in modern increasingly fierce competition, the participating parties have considerable strength, the tactics goals are more difficult; thus the place kick goals will be regarded as a sensible way of scoring, and the place kick is divided into the penalty kick, direct free kick, corner kick and foul ball. The placement goal statistics from the 15th to 18th sessions can be obtained in TABLE 4.

From TABLE 4, in the recent sessions of the World Cup, the proportion of placement Goals accounts for about one-third; the place kick has become an important technical means; from the means of the goal, the proportion of place kick is large; it indicates that in the fast-paced, high-intensity combat course of soccer, in the case of getting the place kick penalty, body function is in a big contrast adjustment stage; the loophole is quite large and the tactic of the place kick varies, which makes the defense more difficult, thus the breaking opportunities are more, so each team should strengthen

the training of place kick, focus on the training of each player's place kick ability.

By combining with TABLE 4, sum the data of penalty kick, direct free kick, corner kick and foul ball contained in the place kick, analyze and obtain the Figure 5.

Figure 5 shows that, the penalty kick and the corner kick occupy a larger proportion of the place kick; in the training we should pay attention to the training of the penalty kick and the corner kick.

The penalty kick in place kick is the best chance to score, the penalty distance is close to the goal, the shot angle varies, and it is difficult for goalie to defense. Once obtaining a penalty opportunity, the scoring rate will be greatly enhanced, so athletes should strengthen the penalties technical training, goalkeeper should strengthen the training of the defensive penalty ability.

The corner kick in place kick is also a good opportunity to score, but by statistical data the success rate of the corner kick in recent World Cups is lower, in the penalty corner, the success rate of shot is about 3%. The success rate of the corner kick is lower, mainly because the teams have strengthened the defense, implement the close-marking defense, the rest of the team protect to cover position, and the offensive players are less, which is not conducive to attack. Therefore, in the training of corner kick, the defensive side should strengthen the close-marking defense strategy; the offensive side needs to keep a good attitude in spite of being outnumbered, you cannot panic, strengthen walk, see the opportunity and quickly shot to avoid the

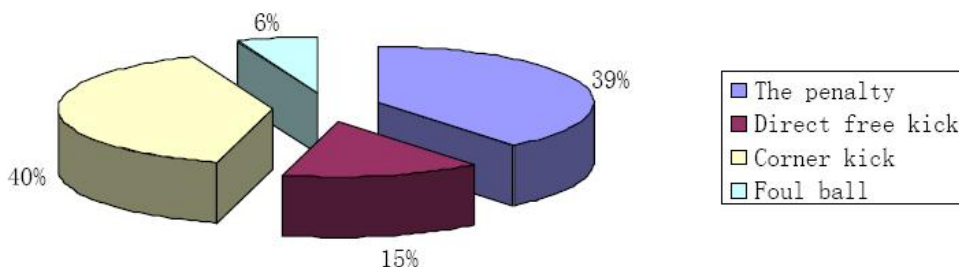


Figure 5 : The proportion of each type of goals

formation of pack-line defense of the other side.

CONCLUSIONS

This paper studies the factors that affect the football goals by combining the data statistical and handling

knowledge, and gives some reasonable suggestions for these factors; it divides the football venues into zones, by combining related data of goals, we can see in football game the best shooting area is in the range of 30 meters before the goal enclosed by the penalty corner, between the goalpost of the goal line and the goal cor-

ner with the same side in the venues, namely the region in the penalty area and before the penalty area is the main scoring area, especially the area between the goal area and the penalty points; rank each zone in descending order of the goals are: 1 middle road in the penalty area (Zone 1 and zone 2); (2) the middle road before the penalty area (Zone 3); 3 two wings of the penalty area (zone 4 and zone 5); 4 goals on the two wings; 5 goals of other regions; by analysis on the time factor of the goals the final 15min is the peak period of goals, each team should strengthen its grasp of this 15min.

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