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Research article

TECHNICAL AND TACTICAL ANALYSIS OF GOAL SCORING PATTERNS IN THE 2018 FIFA WORLD CUP IN RUSSIA

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Abstract. *The aims of this research are to record and analyze the goals scored during the 64 matches in the 21st World Cup in Russia in 2018, to highlight those factors that are directly related to the teams' effectiveness in scoring, to record the goals approved after the use of new technologies, video assistant referee and goal line technology, as well as their effect on the outcome of the game. Chi-square and univariate general linear methods were used for the data analysis. Statistical difference is observed in the number of goals scored between the two halves ($X^2=8.699$, $p<0.005$). A comparable percentage of scoring in most of the periods with the exceptions of the periods in overtime, the period from the 16th to 30th min, the additional time of the first and second half and the period from the 76th to 90th min of the game was determined ($p<0.01$). The teams that scored first won 71.4% matches, lost 9.5% and had a tie 19% of the matches ($X^2=42.000$, $p<0.001$). Most of the goals were scored following a corner kick (24), penalty (22) and free kick scored non-directly (16), which were significantly different from free kick scored directly (6) and throw in (2) ($X^2=26.857$, $p<0.001$). 19 goals were scored from cross, 19 from a long-range shot (8 of them with the "inner foot"), 18 from a forward pass and 12 from cutback. Statistical differences between the first four groups and all of the others are determined ($X^2=27.818$, $p<0.01$). Significant differences were found between the goals that "began" from the offensive third, the middle and the defensive third ($X^2=73.645$, $p<0.001$). 58.9% of the goals are scored following positional play, which is significantly different compared to the counterattack (29.5%) and direct play (11.6%) ($X^2=32.611$, $p<0.001$). Over 59 goals were scored from "the inner part of the foot" or "place", and 31 from header, which were significantly different from the other types of shots ($X^2=89.254$, $p<0.001$).*

Key words: Soccer, Goal, Match Analysis, Long-Range Shot, Video Assistant Referee

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INTRODUCTION

Match analysis is vital in team sports in order to understand the constraints that promote sporting success (Carling, Reilly, & Williams, 2009). In soccer, match performance is multifactorial and is characterized by the interaction of technical, tactical, physical, physiological, and psychological components (Stolen, Chamari, Castagna & Wisloff, 2005). Game analysis is used for the assessment of the characteristics of each team, which is of great importance for every coach so as to understand the strengths and weaknesses of both the opponent and his team (Lago-Penas, Lago-Ballesteros & Rey, 2011). Coaches have to pay attention to physical condition and to maintain their players' concentration until the end of the match (Michailidis, Mandroukas, Vardakis, & Metaxas, 2018).

Research on international soccer coaches showed that they could only remember 42% of the corrections needed to be made in a soccer match (Hughes & Franks, 2005). These studies show that the observations processed by normal human memory become a very unreliable source of information when it comes to feedback of an event or a match (Hughes & Franks, 2005). On the other hand, an objective assessment derived from video analysis offers, as much as possible, analytical, realistic and more accurate information illustrating the performance profile of the team and players in real game conditions (Hohmann & Rommel, 1994).

One of the most studied variables are the goals because they are critical for the success of the team (Cachay & Thiel, 2000). Recently, several researchers have studied the goals of the World Cup because of the importance this event has in the world of soccer (Marques, 2012). The world cup is the last step of development and a reflection of the level of modern soccer, serving as a parameter for a variety of studies on various subjects that are related to football (Silva & Campos, 2006)

The 2018 FIFA World Cup in Russia has seen a huge transformation thanks to the innovative technology being put to work in ways football has never seen before. There are a number of tools that operate in the background to provide extra support and information to the referees and other teams on their decisions. The most important are: Video Assistant Referee (VAR), Goal Line Technology (GLT), Electronic Performance & Tracking System and the Wearables.

The main aim of this research is to record and analyze the goals achieved in the 21st World Cup in Russia in 2018 and to highlight those factors that are directly related to the teams' effectiveness in scoring. The secondary aim is to record the goals scored after the use of the new technologies (VAR & GLT), as well as their effect on the outcome of the game.

METHODS

Sample

We analyzed all the soccer matches (64) from the final phase of the World Cup 2018 in which a total of 169 goals were scored, without including the goals scored during the penalty process.

Experimental design

All the matches were recorded from whole game television broadcasts. The matches were analyzed through systematic observation according to Lames (1991, 1994) and Singer & Willimczik (2002). For the recording, a game observation leveled board was used which was based on past studies (Loy, 1995, 1992; Theis, 1992a, 1992b). Every game was analyzed by two experienced observers who were specially trained for accurate and reliable data recording. The analysis variables were:

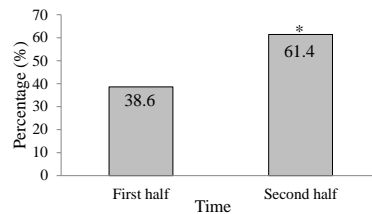
- Time in minutes of goals scored (0-15, 15-30, 30-45, 45+, 46-60, 61-75, 76-90, 90+, extra time);
- First goal impact on the game outcome for the scoring team (win, draw, defeat);
- Type of play (open play, set play);
- Action prior to goal in open play goals;
- Style of open play (positional play, direct play, counterattack).
- Type of set play (corner or following a corner, free kick scored directly, free kick scored non-directly, penalty, throw-in);
- Initiation zone of attack (defensive third, middle third, offensive third);
- Number of passes leading up to goal (1, 2, 3, 4, 5, 6, 7, 8+);
- Shot type (shot, inner part of the foot, outer part of the foot, header, another part of body, penalty, own goal);
- Number of goals after the use of VAR or GLT;
- Effect of the goals via VAR or GLT on the game outcome.

Statistical analysis

All of the data were analyzed using the statistical package for PC SPSS 25.0. Firstly, a descriptive analysis of the data was conducted (frequency, average, standard, deviation). Furthermore, a Chi-square analysis was used to determine the statistically significant differences, and the level of significance was set at $p < 0.05$. The univariate general linear model was used to compare the differences between group means.

RESULTS

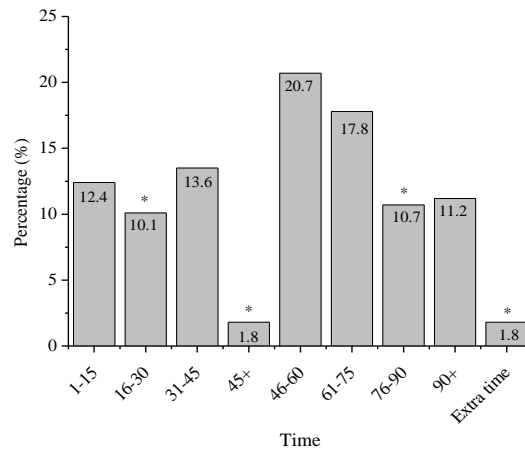
In total, 169 goals were scored in 64 matches of this tournament which is, on average, 2.64 goals per match. Only one of these matches ended goalless (Denmark vs. France). In the first half, 64 goals were scored, in the second, 102 and 3 goals were scored in extra time of the game. Statistical differences were observed between the two halves ($X^2=8.699$, $p < 0.005$).



**denotes a significant difference with first half ($p < 0.05$)*

Fig 1 Time of goals, divided by half of the game

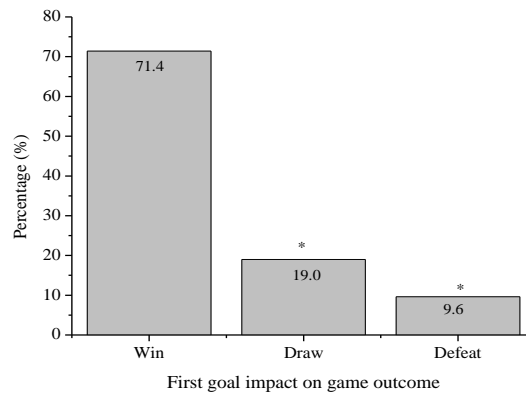
Concerning the goals scored from 15min periods of play, 21 goals were scored from the 1st to the 15th min, 17 goals from the 16th to the 30th min, 23 goals from the 31st to the 35th min, 3 goals in over time for the first half. In the second half, 35 goals were scored from the 46th to the 60th min, 30 goals from the 61st to the 75th min, 18 goals from the 76th to the 90th min, 19 goals in over time of the second half and 3 goals in the extra time. Statistical analyses showed a comparable percentage of scoring in most of the periods with exceptions of the periods in over time, the period from the 16th to the 30th min, the additional time of the first and second half and the period from the 76th to the 90th min of the game ($p < 0.01$, Figure 2).



*denotes a significant difference with the next periods: 1-15, 31-45, 46-60, 61-75, 90+ ($p < 0.01$)

Fig. 2 Time of goals, divided by 15min periods

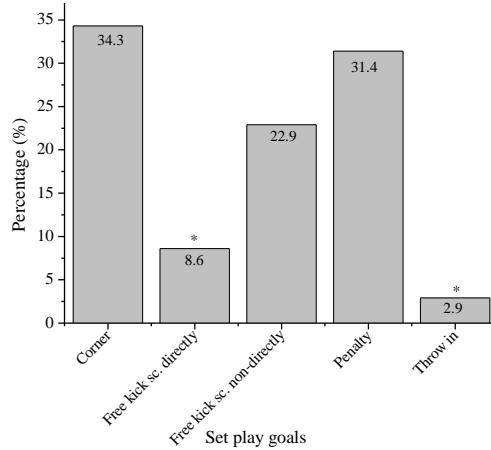
As expected, the results showed that the first goal is of critical importance to the outcome of the match. Specifically, for the teams that scored first, results showed that they won 71.4%, lost 9.5% and had a tie inn 19% of the matches ($X^2=42.000$, $p < 0.001$).



*denotes a significant difference with win ($p < 0.01$)

Fig. 3 First goal impact on game outcome

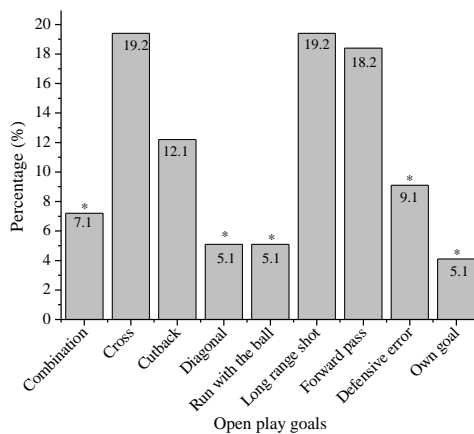
Most of the goals (58.6%) were scored during open play while the rest of them (41.4%) were scored after a set play ($X^2=4.976, p<0.05$). Analyzing the type of set play (Figure 4), most of the goals were scored following a corner kick (24), penalty (22) and free kick scored non-directly (16), which were significantly different from free kick scored directly (6) and throw-in (2) ($X^2=26.857, p<0.001$).



*denotes a significant difference with corner, penalty and free kick scored non-directly ($p<0.001$)

Fig. 4 Percentage of action prior to goal scoring in set-play

Regarding the action prior to goal in open play goals, 19 goals were scored from cross, 19 from a long-range shot (8 of them with the “inner foot”), 18 from a forward pass and 12 from cutback. Data analysis showed statistical differences between the first four groups and all of the others ($X^2=27.818, p<0.01$).



*denotes a significant with cross, long-range shot, forward pass and cutback ($p<0.01$)

Fig. 5 Percentage of actions prior to goal in open play goals

Figure 6A shows the mean number of passes to goal. Figure 6B shows the initiation zone of the attack, where 108 goals began from the offensive third, 39 from the middle third and 22 from the defensive third. Significant differences were found between the offensive third and the middle and the defensive third ($X^2=73.645$, $p<0.001$).

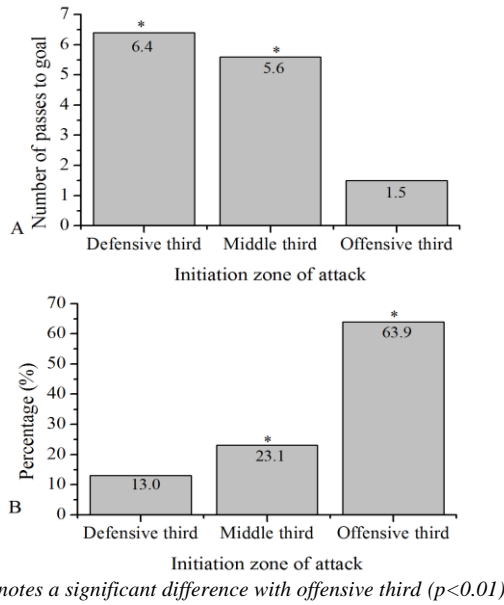


Fig. 6 A. Mean number of passes leading up to a goal in regards to the initiation one of the attack. B. Percentage of the initiation zone of attack

In regards to the style of open play, statistical analyses showed that 58.9% of the goals scored following positional play, which were significantly different compared to the counterattack (29.5%) and direct play (11.6%) ($X^2=32.611$, $p<0.001$).

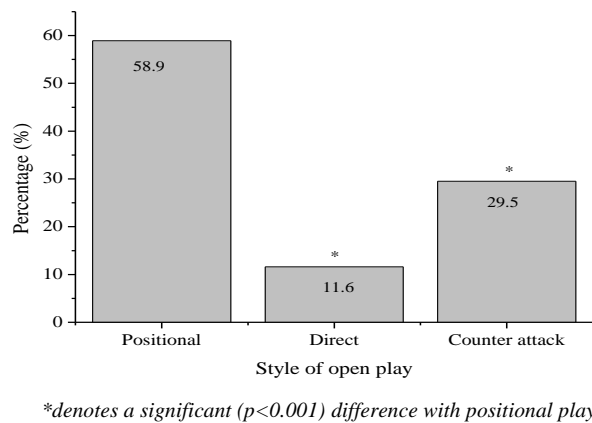
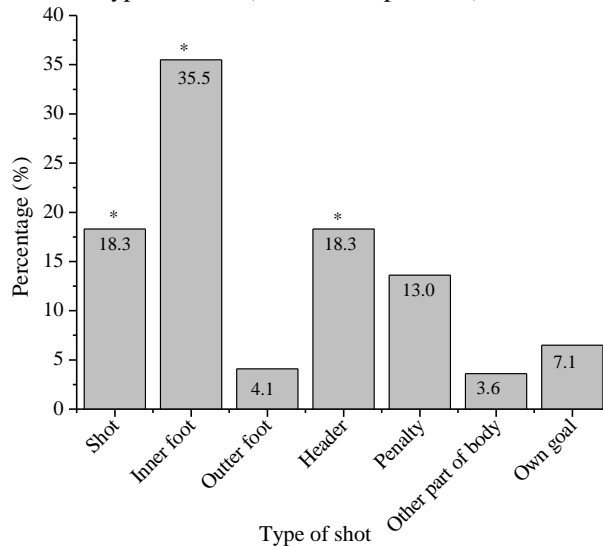


Fig. 7 Style of open play

Figure 8 shows the type of shot, where over 59 goals were scored from “the inner part of the foot” or “place”, 31 goals from shot and 31 from header, which were significantly different from the other types of shot ($X^2=89.254, p<0.001$).



*denotes a significant ($p<0.001$) difference with outer foot, penalty, other part of body, own goal

Fig. 8 Type of shot to the goal

Table 1 illustrates the number of passes leading up to goal. The mean number of passes leading up to a goal was 2.98.

Table 1 Number of passes leading up to a goal

Number of passes	Frequency	Percentage %
0-4	129	76.3
5-8+	40	23.7
0	46	27.2
1	44	26.0
2	18	10.7
3	10	5.9
4	11	6.5
5	11	6.5
6	8	4.7
7	1	0.6
8+	20	8.9

Regarding goals scored with the use of new technologies, 13 goals (7.6% of the total goals) were scored after the use of VAR and 2 goals (1.1% of total goals) after the use of GLT. However, the impact of these goals on the game outcome were crucial. All but one of these goals (93.3%) influenced the game outcome, the time which they were scored (Table 2).

Table 2 Goals after the use of new technologies

Goal with new technologies	Frequency (n)	Percentage % of total goals	Influence on outcome (%)
VAR	13	7.6	92.3
GLT	2	1.1	100.0
Total	15	8.7	93.3

VAR = Video assistant referee; GLT = Goal line technology

DISCUSSION

The scoring rate in the 21st World Cup held in Russia in 2018 averaged 2.67 goals per game. This is the second biggest in the “modern” World Cup era, which began in 1998 with 32 teams competing in a total of 64 matches.

As mentioned above, the goals scored were time dependent. More goals were scored in the 2nd half, while 15min period analyses showed that more goals were scored in the beginning and at the end of the 2nd half (46th-60th min and 76th-90th+ min). Similar results in reference to World Cups were mentioned by other researchers as well (Michailidis, 2014; Njororai, 2013; Armatas, Yiannakos, & Sileloglou, 2007). In a study conducted to analyze the time of goals scored in all the World Cups since 1934, it was illustrated that 54.4% of the goals were scored in the 2nd half with a higher incidence (19.6%) in the final 15 minutes of play (Leite, 2013). This time period (76th-90th min) was characterized by the researchers as the “critical” phase of the game. In this time period the increased number of goals that were scored could be explained by the deterioration in physical conditioning, the tactical play, fluid balance and lapses in concentration (Armatas et al., 2007). In the World Cup 2018, despite the fact that most of the goals (37) were scored during the time period between 76th -90th+ min. Further analyses showed that more than half (19) of these goals scored in the stoppage time of the 2nd half. Thus, a “late” goal trend was observed in the World Cup 2018 with 11.2% of the total goals scored in the stoppage time of the 2nd half, which is the largest percentage in history. The results of the present study indicate the importance of scoring first in the outcome of the game. From the total of 63 matches in which goals were scored, the team that scored first managed to win 71.4% of the matches. This result is in agreement with other studies conducted in World Cups or European Championships (Michailidis, 2014; Michailidis, Michailidis, & Primpa, 2013; Armatas & Yiannakos, 2010; Njororai, 2004). When a team scores the first goal, there is an improvement in performance and the players have more self-confidence and passion (Jones & Harwood, 2008; Olsen & Larsen, 1997). Moreover, tactical changes with more attention in defense were observed when a team was in the lead (Njororai, 2007).

Regarding the type of play, most of the goals (58.6%) were scored during open play while the rest of them (41.4%) were scored after a set play. Njororai (2013) mentioned that in the World Cup 2010 open play yielded a total of 110 (75.86%) goals, while set pieces directly and indirectly led to 35 (24.14%) goals. Furthermore, other studies revealed that most goals were scored in open play, while set plays led to 25-35% of the goals (Armatas & Yiannakos, 2010; Mitrotasios & Armatas, 2014; Njororai, 2004; Yiannakos & Armatas, 2006). The decrease in scoring in open play could be attributed to the emphasis on well-organized defending (Njororai, 2013). In the few weeks that

national teams have to prepare for a major tournament, it is much easier to train and adopt defensive positions than it is for players to take attacking movements on board. According to Mombaerts (2000), goals arising from set plays, which amount to 41% of playing time, are becoming increasingly decisive and can determine the outcome of a match between teams of the same level. In the World Cup 2018, despite the fact that fewer goals (41.4%) were scored after set plays in comparison to open play, this proportion is the largest in history. The improvement in the success rate of set plays could be attributed to the increased number of fouls being spotted, the vigilance of the referees to notice infringements by defenders, the introduction of a video assistant referee, improved delivery of dead-ball situations and better preparation on the part of the offensive teams for the set plays. Our findings provide further evidence on the significance of practicing both offensive and defensive set plays because of their potential productivity. As far as the type of set plays is concerned, results revealed a greater rate of occurrence of goals after corner-kicks (34.3%), free kicks (scored directly and non-directly, 31.6%) and penalties (31.4%). Yiannakos & Armatas (2006) found the following percentages: corner-kicks 40%, free kicks 30%, penalties 25% and throw-ins 5%. Njororai (2013) in his study on the World Cup 2010 indicated that 28.57% of the goals resulted from corner-kicks, 42.86% from free kicks and 25.71% from penalties. Although a comparison of the studies provides dissimilar results as far as percentages are concerned, it is evident that corner-kicks and free-kicks produce more goals during a football match. The increased success rate of penalty kicks observed in our study could be explained partly due to the VAR.

In reference to open play, most goals were scored following a cross (19.4%), a long-range shot (19.4%) or a forward pass (18.4%). The high percentage of cross as the last action prior to goal was mentioned by other studies as well (Tousios, Michailidis, Mandroukas, Mikikis, & Metaxas, 2018; Mitrotasios & Armatas, 2014). Smith & Lyons (2017) observed that a through pass was the most successful action to score a goal, in a study of World Cups between 2002 and 2014. In another study of the World Cup, Michailidis (2014) found that most goals were scored after a short pass. Currently, teams are well organized in defense and it is not easy for the offensive teams to score following the combination of play or dribbling. However, crosses and through passes could be used to break down the opponents' defensive block. One way to counter compact defending is to score a goal with a long shot. In our study we found that most goals were scored in this manner. The preparation of players to deal with compact defense and the improvement in their shooting technique are probably the main reasons for this result and this is more evident when taking into account the type of shot, where 43% of goals were scored with long shots (with the "inner part of the foot"). In soccer, kicking with the inside of the foot is more accurate than kicking with other parts of the foot, such as the instep, front, and outside of the foot (Nagano, Kato, & Fukuda, 2006). Shot accuracy is considered an independent predictor for team success (Rumpf, Silva, Hertzog, Farooq, & Nassis, 2015). At this point, it is very important to practice long range shots mainly using the "inner part of the foot", as they seem to be a vital weapon to break down compact defending.

An important feature in football over time is the style of play. The results showed that 58.9% of the goals were scored following positional play, 29.5% following counter-attack and 11.6% following direct play. Similar results were mentioned by Mitrotasios & Armatas (2014) in a study of Euro 2012, where 60% of the goals were scored from positional play, 20% from counterattacks and 20% from direct play. Therefore, positional

play plays a critical role in goal scoring and coaches could involve different types of small sided matches in training in order to progress playing in this way. Small sided matches (SSGs) increase the difficulty in performing technical actions and it is of the utmost importance for coaches to understand the differences between positional roles by varying the rules of SSGs (Dellal, Drust, & Lago, 2012). Yiannakos & Armatas (2006) found that counter-attacks occurred less frequently (20.3%) in comparison to organized offenses (44.1%) and set-plays (35.6%). In another study, Armatas, Yiannakos, Ampatis, & Sileloglou (2005) found that despite the relative low frequency of counter-attacks in modern football (4.9%), it is an effective attacking strategy as 16.9% of counter-attacks resulted in a goal, whereas only 11.1% of organized offenses led to a goal. Wright, Atkins, Polman, Jones, and Sargeson (2011), in a study conducted on the English Premier League, highlighted the significance of the transitions in play or counter attacks in football. The researchers found that transitions in play accounted for 63% of all goals scored and well over half of all attempts in scoring. In our study, 29.5% of the goals were scored following counterattacks. Considering the high proportion of goals following counter attacks within this study, this might explain the importance of this strategy in football.

The initiation zone of attack or the ball recovery zone seem to play a crucial role in modern football in terms of scoring. The results of the present study showed that 63.9% of goals were scored from the possession regained in the offensive third, 23.1% from the middle and 13% from the defensive third. A recent study of Tousios et al. (2018) showed that 43% of the goals in Euro 2012 were scored following ball recovery in the offensive third, and in Euro 2016, there was a 4% increase (47%). In the technical report of the Champions League 2016-2017 it was mentioned that 61.3% of the total goals were scored following ball recovery in the offensive third. Furthermore, in the present study, we found that the mean number of passes to the goal after regaining possession in the offensive third was 1.5, whereas in the middle third it was 5.6 and 6.4 in the defensive third. These findings suggest that high pressing and direct ball recovery is a new trend, providing greater chances of scoring. Patterns of direct ball recovery increase attacking play efficacy, namely through ball recover by a defensive behavior followed by a pass related to goal scoring and shots on target, respectively (Barreira, Garganta, Machado, & Anguera, 2014). Moreover, in the technical report of Euro 2016, it was mentioned that there was a downward trend in successful build-ups originating in the middle third, which resulted in 45.5% of the goals scored in 2008, 38% in 2012 and 33% in 2016. This decline suggests that teams may be increasingly focusing on putting high pressure on the ball carrier and rapid transitioning from offense to defense, corroborating our findings.

In this study, it was observed that 76.3% of the goals were scored via short (0-4) passing sequences thereby supporting the results of previous studies. Reep & Benjamin (1968) established that 80% of goals resulted from a sequence of 3 passes or less, while Bate (1988) demonstrated that 79% come from moves of 4 passes or less. Hughes & Franks (2005) analyzed passing sequences, shots and goals in the 1990 and 1994 World Cups and found similar results. In a recent study, Wright et al. (2017) mentioned that 85% of the goals were scored via short (0-4) passing sequences. However, this result is probably not correlated with direct play because as mentioned above only 11.6% of the goals came from this style of play. The mean number of passes leading up to goal in the World Cup 2018 was 2.98. In the technical report of the Champions League 2016-17 it was observed that the average of 3.72 passes prior to the goal was 5.6% lower than in 2014-15. This

decrease might be linked to high pressing and rapid transitioning to a defensive block when the ball possession is lost. To our knowledge, this is the first study to record the goals scored via the use of new technologies, as well as their impact on game outcome. In the present study, the effect of VAR and GLT on goal scoring and on game outcome was analyzed. GLT was one of the first technological innovations, used in the World Cup 2014 as well, whereas VAR was used for the first time in a World Cup tournament in 2018. Within this study, VAR was used to confirm 13 goals (including penalties) and GLT was used to verify 2 goals. Both of them contributed to 8.7% of total goals. All but one of these goals influenced the game outcome or the time the goal was scored. Consequently, VAR had a decisive impact on goal scoring. Most of the goals (60%) via VAR were scored due to a penalty kick. Thus, coaches should be aware of the above mentioned findings and train players to defend clearly and carefully inside the penalty area.

CONCLUSIONS

The main limitation of the present study is that it is based on one specific soccer tournament. However, the results of this study provide useful information for coaches in order to design training sessions similar to the actual game and adapt game styles relevance to match status. Coaches have to ascertain that players maintain physical fitness and concentration to the very end of the match. Moreover, not only should coaches prompt players to score the first goal, but also prepare them to deal with the situation when the opponent takes the lead. Moreover, the exercises should implement long-range shots with the “inner part of the foot” and small sided matches. Teams have to press the opponents in the offensive third and also transition rapidly to a defensive block when ball possession is lost. Finally, with the introduction of VAR, coaches should train players to defend clearly and effectively inside the penalty area.

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TEHNIČKA I TAKTIČKA ANALIZA OBRAZACA POSTIZANJA POGODAKA NA FIFA SVETSKOM KUPU 2018 U RUSIJI

Ciljevi ovog istraživanja su da se zabeleže i analiziraju golovi postignuti na 64 utakmica u okviru Svetskog kupa 2018 u Rusiji, da se istaknu oni faktori koji su u direktnoj vezi sa efikasnošću timova, da se snime pogotci odobreni upotrebom novih tehnologija, video asistenta sudije i tehnologije gol linije, kao i da se utvrdi njihov uticaj na ishod igre. U analizi podataka korišćeni su Chi-kvadrat test i univarijantni opšti linearni metodi. Statistička razlika utvrđena je u broju postignutih golova između dva poluvremena ($X^2=8.699$, $p<0.005$). Uporedivi procenat postizanja pogodaka, sa izuzetkom perioda dodatnog vremena, perioda od 16. do 30. min i perioda od 76. do 90. min igre je utvrđen ($p<0.01$). Timovi koji su prvi postigli pogodak pobedili su u 71,4% slučajeva, izgubili 9.5% i odigrali nerešeno 19% mečeva ($X^2=42.000$, $p <0.001$). Većina golova postignuta je nakon udarca iz ugla (24), penala (22) i slobodnog udarca, ne direktno u gol (16), što se značajno razlikovalo od golova iz slobodnog udarca upućenog direktno u gol (6) i ubacivanja lopte (2) ($X^2=26.857$, $p<0.001$). 19 pogodaka postignuto je iz trka, 19 sa velike razdaljine (8 od njih udarcem unutrašnjim delom stopala), 18 nakon dodavanja unapred i 12 udarcem petom. Utvrđene su statističke razlike između prve četiri grupe i svih ostalih ($X^2=27.818$, $p<0.01$). Utvrđene su značajne razlike između broja golova koji su „započeli“ sa ofanzivne trećine, srednje i defanzivne trećine terena ($X^2=73.645$, $p<0.001$). 58.9% golova postignuto je posle pozicione igre, što je u poređenju sa kontranapadom (29.5%) i direktnom igrom (11.6%) statistički značajno različito ($X^2=32.611$, $p<0.001$). Preko 59 golova postignuto je "unutrašnjim delom stopala" ili "iz mesta" i 31 pogodak nakon udarca glavom, što predstavlja statistički značajnu razliku u odnosu na ostale udarce ($X^2=89.254$, $p <0.001$).

Ključne reči: fudbal, gol, analiza utakmica, udarci velikog dometa po lopti, video asistent sudija