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Struktura nogometa na osnovu indikatora situacione efikasnosti svjetskih prvenstava 2010, 2014, 2018. godine

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Abstract: *The aim of this research was to determine the structure of football through indicators of situational efficiency in world championship matches. The research sample consisted of 370 soccer players who played all 90 minutes of the Round of 16 matches of the three world soccer championships WC2010 (N = 124), WC2014 (N = 126) and WC2018 (N = 120). 30 variables of situational efficiency were used, which were taken from the official website of the World Football Federation (www.fifa.com). To determine the structure of football, we used factor analysis, the method of principal components with oblique direct oblimin transformation was used, and the Kaiser-Gutman criterion was used to determine the significance of the extracted factors. Analyzing the results, the explanation of the common variance was the highest at WC 2010 (83.52 %), followed by WC 2014 (81.97 %), and the lowest explained variance was at WC 2018 (76.30 %). In the structure of football at WC 2010 and WC 2014, 6 latent factors were singled out, and at WC 2018, 4 latent factors were singled out, which are differently saturated with situational indicators. We conclude that changes have occurred in the structure of football over a period of 8 years, which is shown by the number and structure of factors that have been fished out. The structure of football has changed in such a way that the number of factors has been reduced from 6 to 4, and the structure of isolated factors clearly defines modern football. Based on the results, the guidelines and standards on which football training should be based can be clearly determined, while using certain training tools, training stimuli and appropriate training loads in order to achieve a high level of physical preparation, a high level of technique in movement, a high rhythm of the game and tactical maturity of football players.*

Keywords: *top football players, indicators, situational efficiency, World Cup*

Sažetak: *Cilj ovog istraživanja bio je utvrđivanje strukture nogometa kroz indikatore situacione efikasnosti na utakmicama svjetskih prvenstava. Uzorak istraživanja činilo je 370 nogometaša koji su odigrali svih 90 minuta utakmica osmine finala tri svjetska nogometna prvenstva SP2010 (N=124), SP2014 (N =126) i SP2018 (N =120) godine. Korišteno je 30 varijabli situacione efikasnosti koje su preuzete sa oficijalne stranice Svjetske nogometne federacije (www.fifa.com). Za utvrđivanje strukture nogometa, korištena je faktorska analiza, metoda glavnih komponenata sa kosom direkt oblimin transformacijom, a za utvrđivanje značajnosti izlovanih faktora korišten je Kaiser-Gutmanovim kriterij. Analizom rezultata objašnjenost zajedničke varijanse bila najveća na SP 2010 (83,52 %), zatim na SP 2014, (81,97 %), a najmanja objašnjena varijansa bilo je na SP 2018 godine (76,30 %). U strukturi nogometa na SP 2010 i SP 2014 izdvojilo se 6 latentnih faktora, a na SP 2018 izdvojila su se 4 latentna faktora, koji su različito zasićeni sutuacionim indikatorima. Zaključujemo da su se u vremenskom razdoblju od 8 godina desile promjene u strukturi nogometa, što nam pokazuje broj i struktura izlovanih faktora. Promijenila se struktura nogometa na način da se smanjio broj faktora sa 6 na 4, a struktura izolovanih faktora jasno definiše savremeni nogomet. Na osnovu rezultat mogu se jasno odrediti smjernice i standardi na kojima treba da se bazira nogometni trening, pri tom koristeći određena trenažna sredstva, trenažne stimuluse i odgovarajuća trenažna opterećenja kako bi se postigao visok nivo fizičke pripremljenosti, visok nivo tehnike u kretanju, visok ritam igre i taktička zrelost nogometaša.*

Ključne riječi: *vrhunski nogometaši, indikatori, situaciona efikasnost, Svjetsko prvenstvo*

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INTRODUCTION

A soccer game can be considered like a complex, self-organized, unstable, unpredictable and highly dynamic system in which players from competing teams try to maintain the stability of their own attack, organize and defend the balance and destabilize the balance of the opposite team (Davids, Araujo, Correia, & Vilar, 2013; Garganta, 2009; Vilar, Araujo, Davids, & Button, 2012). In that period, football is continuously developing, especially in the direction of increasing the physical demands and loads to which football players are exposed during training and competition (Jazvin, Palić, Ademović, Skender 2021). Professional soccer players have a better developed ability to repeat sprints compared to amateurs, which confirms the previously proven role of this ability in modern soccer. (Sekulić, Ž., Ilić, N., Dragosavljević, D. 2019) The permanent development of the soccer game, year after year, leads to the fact that soccer players run more and more, and that their movements are more dynamic and faster. Top football players progress year by year in the amount and intensity of movement, which requires the need of football experts to determine what characterizes the profile of football players who play at a high level or are they are in the final stages of major competitions (Ademović, Palić, Čolakhodžić, Popo, 2021; Čolakhodžić, Đedović, Skender, Novaković and Popo, 2017; Ademović, Čolakhodžić, Talović and Kajmović, 2012). Until now, research on soccer players has mainly studied the motor and functional abilities of soccer players, certain situational parameters and their connection with success in the game, as well as the anthropological profile of individual players considering their position. The effect of situational parameters is dominantly related to the position in the game (Ademović, 2016). For a better understanding of the limitations that affect sports success, the analysis of situational performance represents a very important role in all sports and especially in sports games (Carling, Reilly and Williams, 2009). In soccer, match performance can be defined as a complex interaction of various technical, tactical, mental (Carling et al., 2009) and physiological factors (Drust, Atkinson, and Reilly, 2007). The complex movement structures of football consist of a large number of changes of direction, sprints, jumps, duels and kicks (Krustrup, Dvorak, et al., 2010), which requires a large energy consumption (Krustrup et al., 2014). It is very important to determine the factors of the latent structure of football, that is, to gain a clearer perception of what precedes the activities of football players. Knowing that structure gives us a clear picture for the implementation of such training programs, aimed at improving the physical as well as technical and tactical skills of football players, in order to meet the demands of the

UVOD

Nogometnom igrom, može se smatrati složen, samoorganiziran, nestabilan, nepredvidljiv i visoko dinamičan sistem u kojem igrači iz konkurentskih ekipa pokušavaju zadržati stabilnost vlastitog napada, organizovati i braniti ravnotežu i destabilizirati ravnotežu suprotne ekipe (Davids, Araujo, Correia, & Vilar, 2013; Garganta, 2009; Vilar, Araujo, Davids i Button, 2012). U tom razdoblju nogomet se kontinuirano razvija, posebno u smjeru povećanja fizičkih zahtjeva i opterećenja kojima su nogometaši izloženi tokom treninga i takmičenja (Jazvin, Palić, Ademović, Skender 2021). Profesionalni nogometaši imaju bolje razvijenu sposobnost ponavljanja sprinta u odnosu na amatere, što potvrđuje ranije dokazanu ulogu ove sposobnosti u savremenom nogometu. (Sekulić, Ž., Ilić, N., Dragosavljević, D. 2019) Permanentan razvoj nogometne igre, iz godine u godinu dovodi do toga da nogometaši trče sve više i više, a da su njihovi pokreti sve dinamičniji i brži. Vrhunski nogometaši iz godine u godinu napreduje u količini i intezitetima kretanja, što iziskuje potrebu nogometnih stručnjaka, da utvrde šta to karakteriše profil nogometaša koji igraju na visokom nivou ili se nalaze u završnici velikih takmičenja (Ademović, Palić, Čolakhodžić, Popo, 2021; Čolakhodžić, Đedović, Skender, Novaković i Popo, 2017; Ademović, Čolakhodžić, Talović i Kajmović, 2012). Istraživanja na nogometašima do sada su uglavnom proučavala motoričke i funkcionalne sposobnosti nogometaša, određene situacijske parametre i njihovu povezanost sa uspjehom u igri, kao i antropološki profil pojedinih igrača obzirom na njihovu poziciju. Učinak situacijskih parametara dominatno je povezan sa pozicijom u igri (Ademović, 2016). Za bolje razumjevanje ograničenja koja utiču na sportski uspjeh, analiza situacijske izvedbe predstavlja vrlo važnu ulogu u svim sportovima a posebno u sportskim igrama (Carling, Reilly and Williams, 2009). U nogometu, izvedba na utakmici može se definisati kao složena interakcija različitih tehničkih, taktičkih, mentalnih (Carling i saradnici, 2009) i fiziološki faktora (Drust, Atkinson i Reilly, 2007). Složene kretne strukture nogometa sastoje se od velikog broja promjena pravca, sprinteva, skokova, duela i udaraca (Krustrup, Dvorak, et al., 2010) što iziskuje veliku energetsku potrošnju (Krustrup et al., 2014). Jako je bitno utvrditi faktore latentne strukture nogometa, odnosno, da se stekne jasnija percepcija onoga što prethodi aktivnostima nogometaša. Poznavanje te strukture daje nam jasnu sliku za provedbu takvih trenažnih programa, usmjerenih na poboljšanje fizičke kao i tehničke i taktičke vještine nogometaša, da bi se

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game at a high level. Structural analysis provides an insight into all phases of the football game, movement structures, substructures and structural units of technique and tactics, as well as the amount and intensity of movement of football players. In addition to the structure of technical-tactical elements, structural analysis provides information on the repetition of different movements without and with the ball during a football match (Mihačić and Ujević, 2003). Knowing the structure of the football game means understanding all phases and subphases of the game flow, as well as the positions of individual players, which helps us recognize certain situations in the game. When they are going from one phase to another, it is essential that the players understand and perform tasks in the game using appropriate technical-tactical programs. Knowledge of those programs would help the selection in football clubs, and tend towards the improvement of training technology in working with younger categories. Determining the structure of that system is very difficult and demanding for the simple reason of the complexity of that structure, so there is very little research investigating the structure of the football game. Based on that, the goal of this research was to determine the structure of football through indicators of situational efficiency in world championship matches and to determine the factors that determine success in football.

METHODS OF WORK

Sample of respondents

The study was conducted on a sample of 370 top football players who played all 90 minutes of the Round of 16 matches of the three most recent World Cups (SP2010, SP2014, SP2018). The first group of respondents consisted of soccer players participating in the 1/8 finals of the World Cup 2010 (n = 124), and the participants in the eighth finals were the selections: Uruguay, South Korea, the USA, Ghana, Germany, England, Argentina, Mexico, the Netherlands, Slovakia, Brazil, Chile, Paraguay, Japan, Spain and Portugal. The second group of respondents consisted of soccer players participating in the 2014 FIFA World Cup (n=126), and the teams participating in the round of 16 were: Brazil, Chile, Colombia, Uruguay, the Netherlands, Mexico, Costa Rica, Greece, France, Nigeria, Germany, Algeria , Argentina, Switzerland, Belgium and the USA. The third group of respondents consisted of soccer players participating in the 2018 FIFA World Cup (n=120). The participants in the round of 16 of the last World Cup were: France, Argentina, Uruguay, Portugal, Spain, Russia, Croatia, Denmark, Brazil, Mexico, Belgium, Japan, Sweden, Switzerland, Colombia and England.

zadovoljili zahtijevi u igri na visokom novou. Strukturalna analiza omogućava uvid u sve faze nogometne igre, strukture kretanja, substrukture i strukturalne jedinice tehnike i taktike, kao i količine i inteziteta kretanja nogometaša. Osim strukture tehničko-taktičkih elemenata, strukturalnom analizom dobivamo informacije o ponavljanju različitih kretanja bez i s loptom tokom nogometne utakmice (Mihačić i Ujević, 2003). Poznavanje strukture nogometne igre znači razumijevanje svih faza i podfaza toka igre, kao i pozicija pojedinih igrača, što nam pomaže da prepoznamo određene situacije u igri. Kod prelaza iz jedne faze u drugu osnovno je da igrači razumiju i ostvaruju poslove u igri koristeći odgovarajuće tehničko-taktičke programe. Poznavanje tih programa pomoglo bi selekciji u nogometnim klubovima, i težilo prema poboljšanju trenažne tehnologije u radu sa mlađim kategorijama. Utvrđivanje strukture tog sistema je veoma teško i zahtjevno iz prostog razloga složenosti te strukture, tako da je veoma je malo istraživanja koja istražuju strukturu nogometne igre. Na osnovu toga, cilj ovog istraživanja je bio je utvrđivanje strukture nogometa kroz indikatore situacione efikasnosti na utakmicama svjetskih prvenstava i određivanje faktora koji determiniraju uspjeh u nogometu.

METODE RADA

Uzorak ispitanika

Ispitivanje je provedeno na uzorku od 370 vrhunskih nogometaša koji su odigrali svih 90 minuta utakmica osmine finala tri posljednja svjetska nogometna prvenstva (SP2010, SP2014, SP2018). Prvu grupu ispitanika činili su nogometaši učesnici 1/8 finala SP2010 godine (n =124), a učesnice osmine finala bile su selekcije: Urugvaj, Južna Koreja, SAD-e, Gana, Njemačka, Engleska, Argentina, Meksiko, Nizozemska, Slovačka, Brazil, Čile, Paragvaj, Japan, Španija i Portugal. Drugu grupu ispitanika činili su nogometaši učesnici Svjetskog nogometnog prvenstva 2014. godine (n=126), a ekipe učesnice osmine finala bile su: Brazil, Čile, Kolumbija, Urugvaj, Nizozemska, Meksiko, Kostarika, Grčka, Francuska, Nigerija, Njemačka, Alžir, Argentina, Švicarska, Belgija i SAD-e. Treću grupu ispitanika činili su nogometaši učesnici Svjetskog nogometnog prvenstva 2018. Godine (n=120). Učesnice osmine finala posljednjeg Svjetskog nogometnog prvenstva bile su: Francuska, Argentina, Urugvaj, Portugal, Španija, Rusija, Hrvatska, Danska, Brazil, Meksiko, Belgija, Japan, Švedska, Švicarska, Kolumbija i Engleska.

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Table 1. Basic descriptive parameters of the respondents   *Tabela 1. Osnovni deskriptivni parametri ispitanika*

VARIJABLES / VARIJABLE	WC / SP 2010 (n=124)		WC / SP 2014 (n=126)		WC / SP 2018 (n=120)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
AGE / AGE (godine)	26.77	3.70	27.35	3.536	28.15	3.72
AVIS (cm)	179.71	6.17	181.48	6.924	182.32	6.95
SEPRD (m)	10053.40	864.08	9825.37	1100.48	9777.30	1006.93
SEPRDPP (m)	5113.70	433.55	5156.68	549.52	4897.99	557.20
SEPRDDP (m)	4939.65	475.52	4661.56	885.69	4880.12	514.26
SEPRDPL (m)	4176.65	869.84	3920.21	965.51	3819.86	1267.36
SEPRDBPL (m)	4408.06	840.41	4102.44	1029.78	4502.67	1326.96
SEBRSP (No)	99.42	30.54	34.00	11.10	30.40	11.22
SEBRSPPP (No)	51.39	17.91	18.74	6.69	15.91	6.66
SEBRSPDP (No)	48.09	16.02	15.33	6.85	14.49	5.83
SEMAXB (km/h)	23.53	2.55	28.39	1.94	28.81	2.24
SEMAXBPP (km/h)	21.96	2.37	27.03	2.60	27.41	2.81
SEMAXBDP (km/h)	22.47	2.72	26.89	2.71	28.35	2.40
SEBUDO (No)	36.04	14.91	41.20	18.37	39.80	21.38
SEBNDO (No)	50.73	16.91	53.86	19.97	46.99	22.39
SEBDUDO (No)	4.37	3.01	4.00	3.43	3.92	3.35
SEBNDDO (No)	8.43	4.41	7.09	4.59	6.01	4.27
SEBSUDO (No)	23.18	10.75	27.17	13.89	26.42	16.10
SEBSNDO (No)	31.28	11.26	33.80	14.50	29.71	16.38
SEBKUDO (No)	8.44	4.75	10.02	5.79	9.48	6.52
SEBKNDO	11.98	5.26	12.89	6.70	11.43	6.91
SEPUDL (%)	68.42	11.59	74.90	10.89	82.23	9.74

Variable sample

The data was taken from the official website of the World Football Association (www.fifa.com). which presents all parameters of team success. as well as individual data on the situational efficiency of all players participating in the last three world football championships (WC 2010. WC 2014. WC 2018). To determine the structure of the football game. the following indicators were taken: AGE - age (years). AVIS - body height (cm). SEPRD - length of distance covered (m). SEPRDPP - length of distance covered in the first half (m). SEPRDDP - length distances traveled in the second half (m). SEPRDPL - length of distance traveled in possession of the ball (m). SEPRDBPL - length of distance traveled without possession of the ball (m). SEBRSP - number of sprints (No). SEBRSPPP - number of sprints in the first half (No). SEBRSPDP – Number of sprints in the second half (No). SEMAXBPP – maximum achieved speed in the first half (km/h). SEMAXBDP – maximum achieved speed in the second half (km/h). SEMAXB – maximum achieved speed (km/h). SEVANIS - weather activities - low (%). SEVASRE - weather activities - medium (%). SEVAVIS - weather activities - high (%). SEVAZI - I zone 0–7 km/h (%). SEVAZII - II zone 7–15 km/h (%). SEVAZIII – III

Uzorak varijabli

Podaci su preuzeti sa oficijalne stranice Svjetske nogometne asocijacije (www.fifa.com) na kojoj su predstavljeni svi parametri uspješnosti ekipa, kao i pojedinačni podaci o situacionoj efikasnosti svih igrača učesnika tri posljednja svjetska nogometna prvenstva (SP 2010, SP2014, SP 2018). Za utvrđivanje strukture nogometne igre uzeti su sljedeći indikatori: AGE – starosna dob (godine), AVIS – tjelesna visina (cm), SEPRD – dužina pređene distance (m), SEPRDPP – dužina pređene distance u prvom poluvremenu (m), SEPRDDP – dužina pređene distance u drugom poluvremenu (m), SEPRDPL – dužina pređene distance u posjedu lopte (m), SEPRDBPL – dužina pređene distance bez posjeda lopte (m), SEBRSP – broj sprinteva (No), SEBRSPPP – Broj sprinteva u prvom poluvremenu (No), SEBRSPDP – Broj sprinteva u drugom poluvremenu (No), SEMAXBPP – maksimalna ostvarena brzina u prvom poluvremenu (km/h), SEMAXBDP – maksimalna ostvarena brzina u drugom poluvremenu (km/h), SEMAXB – maksimalna ostvarena brzina (km/h), SEVANIS – vremenske aktivnosti – niske (%), SEVASRE – vremenske aktivnosti – srednje (%), SEVAVIS – vremenske aktivnosti – visoke (%), SEVAZI – I zona 0–7 km/h (%), SEVAZII – II zona 7–15 km/h

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zone 15–20 km/h (%). SEVAZIV – IV zone 0–25 km/h (%). SEVAZV – V zone > 25 km/h (%) . SEBUDO – number of successful additions (No). SEBNDO – number of unsuccessful additions (No). SEBDUDO – number of long successful additions (No). SEBNDDO – number of long unsuccessful additions (No). SEBSUDO – number of medium successful additions (No). SEBSNDO – number of medium unsuccessful passes (No). SEBKUDO – number of short successful passes (No). SEBKNDO – number of short unsuccessful passes (No). SEPUDL – percentage of successful ball distribution (%).

Methods of data processing

The data were processed in the software program package for social sciences (Statistical Package for Social Sciences – IBM SPSS. Version 26.0). Factor analysis determined the structure of the researched space on a given sample of respondents. Starting from the inercorrelation matrices of the variables of the researched spaces. the method of principal components (Hoteling's factorial procedure) with oblique direct oblimin transformation was used. The significance of isolated main factors was determined by the Kaiser-Gutman criterion. according to which any isolated factor whose variance or characteristic root is equal to or greater than 1 is considered significant. With the KMO and Bartlett test of sphericity. information was obtained that speaks about the suitability of the matrix of intercorrelations of manifest variables for analysis using the factor analysis method. In the tables. the characteristic roots of the matrix R are listed and marked with (Eigenvalue). The relative cumulative contributions of the characteristic roots are marked with (% of Var). Those characteristic roots are in fact variances of latent dimensions defined as main components (Čolakhodžić. E. 2021). In the assembly matrix. the coordinates are presented. i.e. parallel projections of the vector of manifest variables onto the system of latent dimensions. The values presented in the assembly table are actually the saturation of individual manifest variables with the factors marked at the top of the column. In the structure matrix. the orthogonal projections of the vector of manifest variables onto the vectors of latent dimensions are presented. The values presented in the tables are actually correlations of individual manifest variables with the factors marked at the top of the table. The structure matrix was obtained by rotating the initial coordinate system of the isolated main components from the rectangular system into oblique solutions. using the direct oblimin method.

(%), SEVAZIII – III zona 15–20 km/h (%), SEVAZIV – IV zona 0–25 km/h (%), SEVAZV – V zona > 25 km/h (%), SEBUDO – broj uspješnih dodavanja (No), SEBNDO – broj neuspješnih dodavanja (No), SEBDUDO – broj dugih uspješnih dodavanja (No), SEBNDDO – broj dugih neuspješnih dodavanja (No), SEBSUDO – broj srednjih uspješnih dodavanja (No), SEBSNDO – broj srednjih neuspješnih dodavanja (No), SEBKUDO – broj kratkih uspješnih dodavanja (No) , SEBKNDO – broj kratkih neuspješnih dodavanja (No), SEPUDL – procenat uspješnosti distribucije lopte (%).

Metode obrade podataka

Podaci su obrađeni u softverskom programski paket za društvene nauke (Statistical Package for Social Sciences – IBM SPSS, Version 26.0). Faktorskom analizom utvrđena je struktura istraživanog prostora na datom uzorku ispitanika. Polazeći od matrica inerkorelacija varijabli istraživanih prostora, korištena je metoda glavnih komponenata (Hotelingov faktorski postupak) sa kosom direkt oblimin transformacijom. Kaiser-Gutmanovim kriterijem utvrđena je značajnost izolovanih glavnih faktora prema kojem se smatra značajnom svaki izolovani faktor čija je varijanca, odnosno karakteristični korijen jednak 1 ili veći od 1. KMO and Bartlett"s testom sphericiteta dobiven je podatak koji govori o podobnosti matrice interkorelacija manifestnih varijabli za analiziranje metodom faktorske analize. U tabelama su navedeni karakteristični korjenovi matrice R i označeni sa (Eigenvalue). Relativni kumulativni doprinosi karakterističnih korjenova označeni su s oznakom (% of Var). Ti karakteristični korjenovi su u stvari varijance latentnih dimenzija definisane kao glavne komponente (Čolakhodžić, E. 2021). U matrici sklopa iznesene su koordinate, tj. paralelne projekcije vektora manifestnih varijabli na sistem latentnih dimenzija. Vrijednosti iznesene u tabeli sklopa su ustvari saturacije pojedinih manifestnih varijabli faktorima koji su označeni na vrhovima kolone. U matrici strukture iznesene su ortogonalne projekcije vektora manifestnih varijabli na vektore latentnih dimenzija. Vrijednosti iznesene u tabelama su u stvari korelacije pojedinih manifestnih varijabli s faktorima koji su označeni na vrhu tabele. Matricu strukture smo dobili rotacijom incijalnog koordinatnog sistema izolovanih glavnih komponenata iz pravouglog sistema u kose solucije, direktnom oblimin metodom.

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RESULTS

In order to determine the structure of football in the researched area (situational efficiency). a factor analysis was performed for each group of respondents. that is. for each world championship individually (WC 2010. WC 2014. WC 2018). and then a comparison was made of the obtained structures of the isolated factors of the soccer game for every world championship. A sample of 124 respondents analyzed the situational efficiency of football players participating in the World Cup 2010. The structure was analyzed by the method of principal components with oblique direct oblimin transformation. With the KMO and Bartlett's test (table 2). we obtained data that tell us about the suitability of the matrix for analysis using the factor analysis method (Sig.= .00). Using the principal components method. 6 isolated factors were extracted for soccer players at the 2010 World Cup. which consume 83.52% of the common valid variance (table 3). The first factor exhausts the most information about the applied system of variables – 35.86%. the second factor exhausts 21.35%. while the others exhaust a smaller percentage of information. The third factor consumes 9.24%. the fourth 6.97%. the fifth 5.44%. and the sixth 4.63% of the total variance. On the basis of the assembly matrix (table 4) and the structure matrix (table 5). we see that the variables of the distance traveled (SEPRD. SEPRDPP. SEPRDDP. SEPRDPL) and the variables characterizing the intensity of the game (SEVANIS. SEVASRE. SEVAVIS) were separated into the first factor. so this factor can be defined as a factor of physical demands in football. The second isolated factor can be interpreted as a factor of technical success in football. because the variables that explained the distribution of passing the ball (SEBUDO. SEBND. SEBKUDO. SEBKNDO) stood out the most. In the case of the third isolated factor. all maximum speed variables (SEMAXB. SEMAXBPP. SEMAXBDP) were extracted. so this factor was defined as a pure factor of the speed of performing football actions. The largest projections in the fourth isolated factor have the variables of successful and unsuccessful long and medium passes (SEBDUDO. SEBNDDO. SEBSUDO. SEBSNDO). which can be characterized as another factor of technical success in football. In the fifth isolated factor. one variable of the distance covered without possession of the ball (SEPRDBPL) and the percentage of ball distribution (SEPUDL) were singled out. which can be interpreted as a factor of physical demands and passing the ball. In the sixth factor. all the sprint variables (SEBRSP. SEBRSPPP. SEBRSPDP) were singled out. and it was defined as the sprint factor in soccer. Correlation of the matrix of isolated components (table 6) shows that the first factor has the highest correlation with the sixth factor (-.40). which can be characterized as a moderate correlation. while it has a low correlation with the second (.29) isolated factor.

REZULTATI

U cilju utvrđivanja strukture nogometa u istraživanom prostoru (situaciona efikasnost) urađena je faktorska analiza za svaku grupu ispitanika, odnosno za svako svjetsko prvenstvo pojadinačno (SP 2010, SP 2014, SP 2018), a nakon toga izvršena je komparacija dobivenih struktura izolovanih faktora nogometne igre za svako svjetsko prvenstvo. Na uzorku od 124 ispitanika analizirana je situaciona efikasnost nogometaša učesnika SP 2010. godine. Struktura je analizirana metodom glavnih komponenti s kosom direkt oblimin transformacijom. KMO and Bartlett's testom (tabela 2) dobili smo podatke koji nam govore o podobnosti matrice za analiziranje metodom faktorske analize (Sig.= ,00). Metodom glavnih komponenata kod nogometaša na SP 2010. godine ekstrahovano je 6 izoliranih faktora koji iscrpljuju 83,52% zajedničke valjane varijanse (tabela 3). Prvi faktor iscrpljuje najviše informacija o primijenjenom sistemu varijabli – 35,86%, drugi faktor iscrpljuje 21,35%, dok ostali iscrpljuju manji postotak informacija. Treći faktor iscrpljuje 9,24%, četvrti 6,97%, peti 5,44%, a šesti 4,63% ukupne varijanse. Na osnovu matrice sklopa (tabela 4) i matrice strukture (tabela 5) vidimo da su se u prvi faktor izdvojile varijable pređene udaljenosti (SEPRD, SEPRD-PP, SEPRDDP, SEPRDPL) i varijable koje karakterišu intenzitet igre (SEVANIS, SEVASRE, SEVAVIS), pa se ovaj faktor može definisati kao faktor fizičkih zahtjeva u nogometu. Drugi izolirani faktor se može interpretirati kao faktor tehničke uspješnosti u nogometu, jer su se najviše izdvojile varijable koje objašnjavaju distribuciju dodavanja lopte (SEBUDO, SEBND, SEBKUDO, SEB-KNDO). Kod trećeg izoliranog faktora izdvojile su se sve varijable maksimalne brzine (SEMAXB, SEMAXBPP, SEMAXBDP), pa je ovaj faktor definisan kao čistim faktorom brzine izvođenja nogometnih radnji. Najveće projekcije u četvrtom izoliranom faktoru imaju varijable uspješna i neuspješna duga i srednja dodavanja (SEBDU-DO, SEBNDDO, SEBSUDO, SEBSNDO), što se može okarakterisati kao još jedan faktor tehničke uspješnosti u nogometu. U petom izolovanom faktoru izdvojila se jedna varijabla pređene distance bez posjeda lopte (SE-PRDBPL) i procenat distribucije lopte (SEPUDL), što se može interpretirati kao faktor fizičkih zahtjeva i dodavanja lopte. U šestom faktoru izdvojile su se sve varijable sprinta (SEBRSP, SEBRSPPP, SEBRSPDP), i definisan je kao faktor sprinta u nogometu. Korelacijom matrice izoliranih komponenti (tabela 6) vidimo da prvi faktor ima najveću povezanost sa šestim faktorom (-,40), što se može okarakterisati kao umjerena povezanost, dok nisku povezanost ima s drugim (,29) izolovanim faktorom.

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Table 2. Value of KMO and Bartlett's test at the 2010 World Cup

Tabela 2. Vrijednost KMO and Bartlett's testa kod Svjetskog prvenstva 2010. godine

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.704
Bartlett's Test of Sphericity	Approx. Chi-Square	5564.296
	df	253
	Sig.	.000

Table 3. Factor analysis in the area of situational efficiency of the 2010 World Cup

Tabela 3. Faktorska analiza u prostoru situacione efikasnosti Svjetskog prvenstva 2010. godine

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	8.249	35.864	35.864	8.249	35.864	35.864	6.798
2	4.911	21.352	57.216	4.911	21.352	57.216	4.809
3	2.127	9.247	66.462	2.127	9.247	66.462	2.917
4	1.605	6.978	73.440	1.605	6.978	73.440	4.271
5	1.253	5.448	78.888	1.253	5.448	78.888	1.611
6	1.065	4.633	83.520	1.065	4.633	83.520	4.861

Table 4. Situational efficiency matrix of the 2010 World Cup

Tabela 4. Matrica sklopa situacione efikasnosti Svjetskog prvenstva 2010. godine

Varijables / Varijable	Component					
	1	2	3	4	5	6
SEPRD (m)	.905	.050	.008	-.062	.059	-.150
SEPRDPP (m)	.840	.035	-.030	-.017	-.016	-.203
SEPRDDP (m)	.878	.058	.042	-.097	.122	-.087
SEPRDPL (m)	.209	.379	.210	.236	-.314	-.265
SEPRDBPL (m)	.555	-.044	.070	.043	-.542	.100
SEBRSP (No)	.118	.070	.030	.067	.033	-.903
SEBRSPPP (No)	.016	.125	-.006	.156	-.092	-.862
SEBRSPDP (No)	.213	-.002	.068	-.059	.169	-.741
SEMAXB (km/h)	-.034	-.026	.975	.008	.165	-.006
SEMAXBPP (km/h)	.112	-.115	.502	-.100	.554	-.147
SEMAXBDP (km/h)	-.062	.078	.904	.025	-.176	.059
SEVANIS (%)	-.820	.026	.025	-.021	.065	.206
SEVASRE (%)	.988	-.077	-.061	.031	.000	.136
SEVAVIS (%)	.578	.101	-.005	.002	.006	-.509
SEBUDO (No)	.126	.564	-.071	.502	.250	.141
SEBNDO (No)	.096	.506	-.005	.546	.092	.004
SEBDUDO (No)	-.082	-.153	-.071	.934	.076	-.107
SEBNDDO (No)	-.073	-.114	.039	.945	-.188	-.087
SEBSUDO (No)	.229	.399	-.038	.515	.303	.274
SEBSNDO (No)	.233	.413	.017	.559	.122	.169
SEBKUDO (No)	-.052	.964	-.076	-.137	.054	-.090
SEBKNDO (No)	-.029	.962	.078	-.115	-.115	-.119
SEPUDL (%)	.073	.231	-.276	.219	.578	.252

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Table 5. Matrix of the situational efficiency structure of the 2010 World Cup

Tabela 5. Matrica strukture situacione efikasnosti Svjetskog prvenstva 2010. godine

Variables / Varijable	Component					
	1	**2**	**3**	**4**	**5**	**6**
SEPRD (m)	.967	.320	.145	.109	.021	-.520
SEPRDPP (m)	.927	.299	.118	.137	-.054	-.536
SEPRDDP (m)	.913	.308	.157	.074	.087	-.457
SEPRDPL (m)	.498	.493	.281	.339	-.290	-.475
SEPRDBPL (m)	.534	.044	.111	.096	-.560	-.183
SEBRSP (No)	.515	.230	.341	.061	-.029	-.962
SEBRSPPP (No)	.429	.264	.272	.151	-.134	-.879
SEBRSPDP (No)	.501	.142	.346	-.063	.098	-.841
SEMAXB (km/h)	.044	-.065	.965	-.149	.109	-.318
SEMAXBPP (km/h)	.146	-.051	.555	-.177	.491	-.318
SEMAXBDP (km/h)	.028	-.013	.879	-.103	-.207	-.253
SEVANIS (%)	-.899	-.238	-.123	-.148	.110	.528
SEVASRE (%)	.911	.213	-.021	.198	-.028	-.230
SEVAVIS (%)	.812	.329	.218	.113	-.038	-.750
SEBUDO (No)	.310	.793	-.231	.744	.362	.100
SEBNDO (No)	.337	.730	-.115	.738	.185	-.052
SEBDUDO (No)	.073	.163	-.180	.877	.098	.024
SEBNDDO (No)	.107	.163	-.065	.874	-.165	-.023
SEBSUDO (No)	.314	.653	-.231	.724	.398	.202
SEBSNDO (No)	.384	.666	-.136	.751	.210	.063
SEBKUDO (No)	.234	.924	-.086	.186	.178	-.151
SEBKNDO (No)	.293	.908	.087	.179	.000	-.255
SEPUDL (%)	.034	.393	-.436	.393	.653	.351

Table 6. Intercorrelation matrix of isolated components of situational efficiency of the 2010 World Cup

Tabela 6. Matrica interkorelacije izolovanih komponenti situacione efikasnosti Svjetskog prvenstva 2010. godine

Component	1	2	3	4	5	6
1	1.000	.294	.090	.178	-.033	-.402
2	.294	1.000	-.056	.335	.137	-.110
3	.090	-.056	1.000	-.153	-.054	-.350
4	.178	.335	-.153	1.000	.048	.053
5	-.033	.137	-.054	.048	1.000	.078
6	-.402	-.110	-.350	.053	.078	1.000

The situational efficiency of soccer players participating in the 2014 World Cup was analyzed on a sample of 126 respondents. No statistically significant results of KMO's eligibility test for further procedure were obtained at WC 2014. Regardless of the result. we performed further factor analysis procedures to determine potential isolated factors. because the purpose of factor analysis in this research was to determine the structure of the research space. According to the Keizer-Guttman criterion. a total of 81.97% of the common valid variance. which can be explained by 6 isolated factors. was exhausted from the total space of variables for football

Na uzorku od 126 ispitanika analizirana je situaciona efikasnost nogometaša učesnika SP 2014. godine. Na SP 2014. nisu dobijeni statistički značajni rezultati KMO-ovog testa podobnosti za dalju proceduru. Bez obzira na rezultat, uradili smo dalju procedure faktorske analize kako bi utvrdili potencijalne izolovane faktore, jer je svrha faktorske analize u ovom istraživanju bila da se utvrdi struktura istraživanog prostora. Iz ukupog prostora varijabli kod nogometa na SP 2014. godine po Keiser-Guttmanovom kriteriju iscrpljeno je ukupno 81,97% zajedničke valjane varijanse koja se može objasniti sa 6 izolovanih faktora (tabela 7). Kao što vidimo u matrici sklopa (tabela

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at the 2014 World Cup (table 7). As we can see in the assembly matrix (table 8) and the structure matrix (table 9). the largest part of the explained variance is consumed by the first factor. where all the variables that characterize the intensity of the game (SEVANIS. SEVASRE. SEVAVIS) and one variable of the distance covered in the first halftime (SEPRDPP). so this factor can be called the factor of physical demands in football. The second isolated factor was called the factor of technical success in football. because the variables that explained the distribution of passing the ball. namely: long successful and unsuccessful passes (SEBDUDO. SEBNDDO). medium successful and unsuccessful passes (SEBSUDO. SEBSNDO) and the percentage of successful passing the ball (SEPUDL). In the third factor. two variables of sprint (SEBRSP. SEBRSPDP) and two variables of distance covered (SEBRSPDP. SEBRSP) were separated. defined as a mixed factor of physical demands and speed of performing football actions.

8) i matrici structure (tabela 9), najveći dio objašnjene varijanse iscrpljuje prvi faktor, gdje su se izdvojile sve varijable koje karakterišu intenzitet igre (SEVANIS, SEVASRE, SEVAVIS) i jedna varijabla pređene udaljenosti u prvom poluvremenu (SEPRDPP), pa se ovaj faktor može nazvati faktor fizičkih zahtjeva u nogometu. Drugi izolirani faktor nazvan je faktor tehničke uspješnosti u nogometu, jer su se najviše izdvojile varijable koje objašnjavaju distribuciju dodavanja lopte, i to: duga uspješna i nespješna dodavanja (SEBDUDO, SEBNDDO), srednja uspješna i neuspješna dodavanja (SEBSUDO, SEBSNDO) te procenat upješnih dodavanja lopte (SEPUDL). Kod trećeg faktora izdvojile su se dvije varijable sprinta (SEBRSP, SEBRSPDP) i dvije varijable pređene udaljenosti (SEBRSPDP, SEBRSP), definisan kao mješoviti faktor fizičkih zahtjeva i brzine izvođenja nogometnih radnji. Najveće projekcije u četvrtom izoliranom faktoru imaju varijable uspješna i neuspješna dodavanja (SEBUDO, SEBNDO), uspješna i neuspješna kratka dodavanja (SEBKUDO, SEBKNDO) i pređena distanca u posjedu lopte (SEPRDPL), tako da i ovaj faktor možemo nazvati mješovitim faktorom fizičkih zahtjeva i uspješnih dodavanja lopte. U petom faktoru izdvojile su se 2 varijable maksimalne brzine (SEMAXBPP, SEMAXB) i varijabla broj sprinteva u prvom poluvremenu (SEBRSPPP), te je ovaj faktor definisan kao faktor visokog intenziteta igre. Šesti izolovani faktor može se interpretirati kao mješoviti faktor fizičkih zahtjeva i brzine izvođenja nogometnih radnji, jer se izdvojila jedna varijabla maksimalne brzine u prvom poluvremenu (SEMAXBDP) i pređene distance bez posjeda lopte (SEPRDBPL). Analizom korelacione matrice izoliranih komponenti (tabela 10) vidimo da prvi faktor ima najveću povezanost s četvrtim (,277) i trećim (,273) izolovanim faktorom.

Table 7. *Factor analysis in the area of situational efficiency of the 2014 World Cup*

Tabela 7. *Faktorska analiza u prostoru situacione efikasnosti Svjetskog prvenstva 2014. godine*

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	6.545	28.457	28.457	6.545	28.457	28.457	4.959
2	5.239	22.777	51.234	5.239	22.777	51.234	4.416
3	2.406	10.462	61.696	2.406	10.462	61.696	4.045
4	2.232	9.705	71.401	2.232	9.705	71.401	4.764
5	1.301	5.656	77.057	1.301	5.656	77.057	2.290
6	1.130	4.913	81.971	1.130	4.913	81.971	1.603

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Table 8. *Matrix of the situational efficiency assembly of the 2014 World Cup*

Tabela 8. *Matrica sklopa situacione efikasnosti Svjetskog prvenstva 2014. godine*

Variables / Varijable	Component					
	1	2	3	4	5	6
SEPRD (m)	.478	.139	.698	-.134	.115	.148
SEPRDPP (m)	.940	-.043	-.006	-.017	-.050	-.037
SEPRDDP (m)	.029	.210	.856	-.160	.181	.219
SEPRDPL (m)	.028	.225	.454	.561	-.006	-.027
SEPRDBPL (m)	.435	-.038	.095	.004	.144	.601
SEBRSP (No)	.153	-.166	.740	.162	-.307	-.180
SEBRSPPP (No)	.366	-.189	.283	.205	-.461	-.291
SEBRSPDP (No)	-.124	-.102	.938	.065	-.041	.007
SEMAXB (km/h)	-.064	.003	-.111	.025	-.752	.563
SEMAXBPP (km/h)	.051	.151	-.034	-.081	-.879	-.034
SEMAXBDP (km/h)	-.239	-.115	.202	.194	-.201	.654
SEVANIS (%)	-.921	.046	-.062	-.107	.059	.050
SEVASRE (%)	.927	.165	-.124	.014	.081	.125
SEVAVIS (%)	.760	-.201	.195	.161	-.157	-.176
SEBUDO (No)	.062	.612	-.095	.634	.054	-.065
SEBNDO (No)	.017	.539	-.043	.716	-.002	-.039
SEBDUDO (No)	-.040	.932	.102	-.168	-.084	-.018
SEBNDDO (No)	-.061	.880	.099	-.078	-.113	-.003
SEBSUDO (No)	.027	.637	-.135	.517	.081	-.122
SEBSNDO (No)	.007	.582	-.111	.599	.042	-.090
SEBKUDO (No)	.158	-.139	-.039	.869	.023	.098
SEBKNDO (No)	.086	-.258	.040	.898	-.035	.099
SEPUDL (%)	.119	.542	-.155	.099	.237	-.017

Table 9. *Situational efficiency structure matrix of the 2014 World Cup*

Tabela 9. *Matrica strukture situacione efikasnosti Svjetskog prvenstva 2014. godine*

Variables / Varijable	Component					
	1	2	3	4	5	6
SEPRD (m)	.631	.063	.810	.050	.040	.231
SEPRDPP (m)	.933	-.062	.257	.240	-.014	-.060
SEPRDDP (m)	.218	.127	.836	-.087	.071	.332
SEPRDPL (m)	.305	.295	.474	.640	-.090	-.009
SEPRDBPL (m)	.452	-.072	.279	.080	.128	.603
SEBRSP (No)	.394	-.241	.836	.250	-.482	-.066
SEBRSPPP (No)	.491	-.243	.455	.339	-.547	-.248
SEBRSPDP (No)	.149	-.173	.925	.070	-.248	.154
SEMAXB (km/h)	-.137	-.175	.097	.031	-.743	.559
SEMAXBPP (km/h)	-.019	-.029	.123	.031	-.834	-.035
SEMAXBDP (km/h)	-.156	-.185	.292	.100	-.297	.693
SEVANIS (%)	-.966	.047	-.327	-.364	.047	.068
SEVASRE (%)	.895	.173	.120	.282	.174	.064
SEVAVIS (%)	.858	-.210	.432	.366	-.210	-.159
SEBUDO (No)	.209	.755	-.110	.760	.144	-.166
SEBNDO (No)	.199	.681	-.045	.823	.056	-.128
SEBDUDO (No)	-.072	.878	.019	.010	.090	-.069

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SEBNDDO (No)	-.069	.836	.028	.086	.043	-.054
SEBSUDO (No)	.133	.771	-.182	.637	.193	-.225
SEBSNDO (No)	.141	.720	-.142	.706	.131	-.187
SEBKUDO (No)	.387	.022	.077	.877	-.059	.054
SEBKNDO (No)	.343	-.108	.159	.873	-.162	.077
SEPUDL (%)	.109	.619	-.207	.207	.369	-.097

Table 10. *Intercorrelation matrix of isolated components of situational efficiency of the 2014 World Cup*

Tabela 10. *Matrica interkorelacije izolovanih komponenti situacione efikasnosti Svjetskog prvenstva 2014. godine*

Component	1	2	3	4	5	6
1	1.000	-.011	.273	.277	.044	-.029
2	-.011	1.000	-.081	.189	.194	-.084
3	.273	-.081	1.000	.059	-.188	.147
4	.277	.189	.059	1.000	-.079	-.052
5	.044	.194	-.188	-.079	1.000	-.015
6	-.029	-.084	.147	-.052	-.015	1.000

The third group of respondents (N = 120) consisted of soccer players participating in the World Championship in 2018. where. as in the two previous championships. situational efficiency was analyzed. The structure was analyzed by the method of principal components with oblique direct oblimin transformation. The value of KMO and Bartlett's test is statistically significant (Sig =.00) and amounts to .65 (table 11). According to the Keizer-Guttman criterion. a total of 76.30% of the common valid variance. which can be explained by 4 isolated factors. was exhausted from the total space of variables for football at the WC 2018 (table 12). By analyzing the assembly matrix (table 13) and the structure of the matrix (table 14). we see that the variables of the distance covered (SEPRD. SEPRDPP. SEPRDDP. SEPRDBPL) and the variables characterizing the low intensity of the game (SEVAZ-I. SEVAZ-II. SEVAZ) were separated into the first factor -III). so this factor is called the factor of physical demands in soccer. The second isolated factor was called the factor of technical success. because the variables explaining the distribution of passing the ball (SEBUDO. SEBNDO. SEBDUDO. SEBNDDO. SEBSUDO. SEBSNDO. SEPUDL) were singled out the most. In the third factor. all sprint variables (SEBRSP. SEBRSPPP. SEBRSPDP). maximum running speed variables (SEMAXB. SEMAXBPP. SEMAXBDP) and variables characterizing high game intensity (SEVAZ-IV. SEVAZ-V) were singled out. so this factor was named the high intensity factor of the game. The fourth isolated factor is a mixed factor composed of the projections of the variables short successful and unsuccessful passes (SEBKUDO. SEBKNDO) and the distance traveled in possession of the ball (SEPRDPL). and we called it the factor of physical demands and the factor of successful passes in soccer. By

Treću grupu ispitanika (N = 120) činili su nogometaši učesnici Svejtskog prvenstva 2018. godine, gdje je kao i kod dva prethodna prvenstva analizirana situaciona efikasnost. Stuktura je analizirana metodom glavnih komponenti s kosom direkt oblimin transformacijom. Vrijednost KMO i Bartletovog testa je statistički značajna (Sig =,00) i iznosi ,65 (tabela 11). Iz ukupnog prostora varijabli kod nogometa na SP 2018. godine po Keiser-Guttmanovom kriteriju iscrpljeno je ukupno 76,30% zajedničke valjane varijanse koja se može objasniti sa 4 izolovana faktora (tabela 12). Analizom matrice sklopa (tabela 13) i strukture matrice (tabela14) vidimo da su se u prvi faktor izdvojile varijable pređene udaljenosti (SEPRD, SEPRDPP, SEPRDDP, SEPRDBPL) i varijable koje karakterišu niski intenzitet igre (SEVAZ-I, SEVAZ-II, SEVAZ-III), pa je ovaj faktor nazvan faktor fizičkih zahtjeva u nogometu. Drugi izolirani faktor nazvan je faktorom tehničke uspješnosti, jer su se najviše izdvojile varijable koje objašnjavaju distribuciju dodavanja lopte (SEBUDO, SEBNDO, SEBDUDO, SEBNDDO, SEBSUDO, SEBSNDO, SEPUDL). Kod trećeg faktora izdvojile su se sve varijable sprinta (SEBRSP, SEBRSPPP, SEBRSPDP), varijable maksimalne brzine trčanja (SEMAXB, SEMAXBPP, SEMAXBDP) i varijable koje karakterišu visok intenzitet igre (SEVAZ-IV, SEVAZ-V), pa je ovaj faktor nazvan faktor visokog intenziteta igre. Četvrti izolovani faktor je mješoviti faktor sastavljen od projekcija varijabli kratka uspješna i neuspješna dodavanja (SEBKUDO, SEBKNDO) i pređena distanca u posjedu lopte (SEPRDPL), te smo ga nazvali faktor fizičkih zahtjeva i faktor uspješnih dodavanja u nogometu. Korelacijom matrice izoliranih komponenti (ta-

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correlating the matrix of isolated components (table 15). we see that the first factor has the highest correlation with the fourth (.21) isolated factor.

bela 15) vidimo da prvi faktor ima najveću povezanost s četvrtim (,21) izolovanim faktorom.

Table 11. *The value of KMO and Bartlett's test at the World Cup 2018*

Tabela 11. *Vrijednost KMO and Bartlett's testa kod Svjetskog prvenstva 2018. godine*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.654
Bartlett's Test of Sphericity	Approx. Chi-Square	6016.898
	df	300
	Sig.	.000

Table 12. *Factor analysis in the area of situational efficiency of the 2018 World Cup*

Tabela 12. *Faktorska analiza u prostoru situacione efikasnosti Svjetskog prvenstva 2018. godine*

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	6.947	27.789	27.789	6.947	27.789	27.789	6.080
2	6.352	25.409	53.198	6.352	25.409	53.198	6.017
3	3.814	15.255	68.453	3.814	15.255	68.453	4.689
6	1.964	7.856	76.309	1.964	7.856	76.309	4.225

Table 13. *Situational efficiency assembly matrix of the 2018 World Cup*

Tabela 13. *Matrica sklopa situacione efikasnosti Svjetskog prvenstva 2018. godine*

Variables / Varijable	Component			
	1	2	3	4
SEPRD (m)	.936	.024	.087	-.094
SEPRDPP (m)	.906	.029	.091	-.045
SEPRDDP (m)	.850	.013	.077	-.136
SEPRDPL (m)	.137	.288	.062	-.628
SEPRDBPL (m)	.698	-.092	.006	.544
SEBRSP (No)	.177	-.262	.662	-.380
SEBRSPPP (No)	.176	-.284	.613	-.307
SEBRSPDP (No)	.151	-.172	.548	-.373
SEMAXB (km/h)	-.114	.169	.929	.239
SEMAXBPP (km/h)	-.057	.022	.729	.022
SEMAXBDP (km/h)	.026	.180	.867	.167
SEVAZ-I (%)	-.968	.008	.090	-.003
SEVAZ-II (%)	.924	.029	-.250	.096
SEVAZ-III (%)	.798	.072	-.003	-.139
SEVAZ-IV (%	.369	-.261	.420	-.385
SEVAZ-V (%)	-.112	-.209	.699	-.038
SEBUDO (No)	.015	.872	-.028	-.352
SEBNDO (No)	.007	.856	.016	-.365
SEBDUDO (No)	.018	.853	.026	.199
SEBNDDO (No)	-.007	.869	.107	.220
SEBSUDO (No)	-.022	.907	-.003	-.156
SEBSNDO (No)	-.018	.895	.012	-.189
SEBKUDO (No)	.096	.178	-.095	-.870
SEBKNDO (No)	.077	.111	-.071	-.893
SEPUDL (%)	.049	.545	-.146	-.068

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Table 14. *Situational Efficiency Structure Matrix of the 2018 World Cup*

Tabela 14. *Matrica strukture situacione efikasnosti Svjetskog prvenstva 2018. godine*

Varijables / Varijable	Component			
	1	**2**	**3**	**4**
SEPRD (m)	.962	-.060	.174	-.313
SEPRDPP (m)	.922	-.059	.168	-.258
SEPRDDP (m)	.885	-.056	.164	-.333
SEPRDPL (m)	.255	.347	.090	-.705
SEPRDBPL (m)	.587	-.223	.016	.404
SEBRSP (No)	.338	-.375	.786	-.469
SEBRSPPP (No)	.318	-.396	.733	-.387
SEBRSPDP (No)	.293	-.258	.648	-.454
SEMAXB (km/h)	-.101	-.064	.850	.120
SEMAXBPP (km/h)	-.001	-.141	.717	-.063
SEMAXBDP (km/h)	.049	-.040	.807	.024
SEVAZ-I (%)	-.961	.067	.006	.195
SEVAZ-II (%)	.880	-.003	-.190	-.077
SEVAZ-III (%)	.822	.027	.067	-.322
SEVAZ-IV (%	.510	-.334	.560	-.485
SEVAZ-V (%)	-.027	-.353	.742	-.077
SEBUDO (No)	.018	.924	-.178	-.469
SEBNDO (No)	.018	.901	-.129	-.484
SEBDUDO (No)	-.093	.819	-.191	.077
SEBNDDO (No)	-.117	.816	-.119	.091
SEBSUDO (No)	-.062	.930	-.189	-.273
SEBSNDO (No)	-.048	.919	-.167	-.307
SEBKUDO (No)	.262	.309	-.014	-.902
SEBKNDO (No)	.256	.241	.027	-.915
SEPUDL (%)	.006	.583	-.256	-.133

Table 15. *Intercorrelation matrix of isolated components of situational efficiency of the 2014 World Cup*

Tabela 15. *Matrica interkorelacije izolovanih komponenti situacione efikasnosti Svjetskog prvenstva 2014. godine*

Component	1	2	3	4
1	1.000	-.082	.085	-.218
2	-.082	1.000	-.226	-.134
3	.085	-.226	1.000	-.130
4	-.218	-.134	-.130	1.000

DISCUSSION

The obtained results can certainly expand our understanding of modern football. its game structure. as well as the direction of training in the training technology of football players. A large number of indicators. 30 of them in this research. which define the situational efficiency of top football players in modern football. were explained by factor analysis and summarized into a smaller number of latent. homogeneous and interdependent factors. The research partially explained the structure of the football elements of the situational performance of the displayed parameters. which

DISKUSIJA

Dobijeni rezultata mogu nam sigurno proširiti shvatanje o savremenom nogometu, njegovoj strukturi igre kao i pravac obučavanja u trenažnoj tehnologiji nogometaša. Veliki broj indikatora, u ovom istraživanju njih 30, koji definišu situacionu efikasnost vrhunskih nogometaša u savremenom nogometu, faktorskom analizom objašnjen je i sažet u manji broj latentnih, homogenih i međusobno zavisnih faktora. Istraživanje je djelomično objasnilo strukturu nogometnih elemenata situacijske izvedbe prikazanih parametara, koje opet možemo

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we can further observe through certain phases. subphases. moments of the game as well as the position of the players in the team. In the structure of football at WC 2010 and WC 2014. 6 latent factors were singled out. and at WC 2018. 4 latent factors were singled out. which are differently saturated with situational indicators. The obtained results show that the explained variance was the highest at WC 2010 (83.52 %). followed by WC 2014 (81.97 %). and the least explained variance (76.30 %) was at WC 2018. Similar research was done by Čolakhodžić. E. (2019) with the aim of determining the structure of football through situational performance indicators at the 2014 World Cup in Brazil. The obtained results show that 83.82% of the total variance was explained and that five significant latent factors were isolated. namely: the factor of football condition (52.61%). the factor of football technical-tactical success (17.11%). the factor of football technical- tactical success in the counterattack (5.24%). ball possession success factor (4.71%). football speed factor 4.12%. Sporiš. G.. Šamija. K.. Vlahović. T.. Milanović. Z.. Barišić. V.. Bonacin. D.. Talović. M. (2012) determined the latent structure of tactical means in the defense and attack phase in football defined 117 tactical means of the football game. the importance of which was assessed on 30 variables that denote the fundamental elements of the football game. Factor analysis under the component model with the Guttman-Kaiser criterion resulted in a total of five significant latent dimensions: the factor of effectiveness of the end of the attack. the factor of success in possession of the ball. the factor of efficiency of counterattacks. the factor of success of combined defense. the factor of interference and "directing" of the preparation of the opponent's attack. The research partially solved the problem of the hypothetical structure of the tactical means of the football game according to the phases and subphases of the game. the positions of the attackers and defenders. and the types (ways) of the game in defense and attack. Barišić. (2007) in his research. applying factor analysis under the component model. along with the Guttman-Kaiser criteria. obtained a total of five significant latent dimensions: the factor of efficiency of the end of the attack. the factor of the efficiency of the end of the attack. the factor of the success of possession of the ball. the success factor of the counterattack. the success factor of the combined defense. the factor of interference. direction and preparation of the opponent's attack. Gomez. M.A.. Gomez. M.. Lago-Penas. C. and Sampaio. J. (2012) analyzed the independent and interactive effects of match venue and match outcome with respect to pitch zones divided by parallel lines in width. Factor analysis was used for data processing. Four factors were obtained: the factor of the lost ball in zone 5.2. crosses in zone 4; factor hits and shots on goal in zone 5.1.

dalje posmatrati kroz određene faze, podfaze, momente igre kao i poziciju igrača u timu. U strukturi nogometa na SP 2010 i SP 2014 izdvojilo se 6 latentnih faktora, a na SP 2018 izdvojila su se 4 latentna faktora, koji su različito zasićeni sutuacionim indikatorima. Dobijeni rezultati govore da je objašnjenost varijanse bila najveća na SP 2010. (83,52 %), zatim na SP 2014. (81,97 %), a najmanje objašnjene varijanse (76,30 %) bilo je na SP 2018. godine. Slično istraživanje uradio je Čolakhodžić, E. (2019) s ciljem da se utvrdi struktura fudbala kroz pokazatelje situacionih performansi na igrama Svjetskog prvenstva 2014. u Brazilu. Dobijeni rezultati pokazuju da je objašnjeno 83,82% ukupne varijance i da se izolovalo pet značajnih latentnih faktora i to: faktor nogometne kondicije (52,61%), faktor nogometne tehničko-taktičke uspješnosti (17,11%), faktor nogometne tehničko-taktičke uspješnosti u kontranapadu (5,24%), faktor uspješnosti posjeda lopte (4,71%), faktor nogometne brzine 4,12 %. Sporiš, G., Šamija, K., Vlahović, T., Milanović, Z., Barišić, V., Bonacin, D., Talović, M. (2012) utvrđivali su latentnu strukturu taktičkih sredstava u fazi obrane i napada u nogometu definirali 117 taktičkih sredstava nogometne igre čija je važnost procijenjena na 30 varijabli koje označavaju temeljne elemente nogometne igre. Faktorskom analizom pod komponentnim modelom uz Guttman-Kaiserov kriterij dobiveno je ukupno pet značajnih latentnih dimenzija: faktor efikasnosti završnice napada, faktor uspješnosti posjeda lopte, faktor efikasnosti kontranapada, faktor uspješnosti kombinirane obrane, faktor ometanja i „usmjeravanja" pripreme protivničkog napada. Istraživanjem je djelomično riješen problem hipotetske strukture taktičkih sredstava nogometne igre prema fazama i podfazama igre, pozicijama napadača i obrambenih igrača te vrstama (načinima) igre u obrani i napadu. Barišić, (2007) u svom istraživanju primjejnujući faktorsku analizu pod komponentnim modelom, uz Guttman-Kaiserov kriterija, dobio je ukupno pet značajnih latentnih dimenzija: faktor efikasnosti završnice napada, faktor efikasnoti završnice napada, faktor uspješnosti posjeda lopte, faktor uspješnosti kontranapada, faktor uspješnosti kombinovane odbrane, faktor ometanja, usmjeravanja i pripreme protivničkog napada. Gomez, M.A., Gomez, M., Lago-Penas, C. i Sampaio, J. (2012) analizirali nezavisne i interaktvine efekte mjesta odigravanja utakmice i ishoda utakmice s obzirom na zone igrališta podijeljene paralelnim linijama po širini. Za obradu podataka je korištena faktorska analiza. Dobivena su četiri faktora: faktor izgubljene lopte u zoni 5.2, centaršutevi u zoni 4; faktor pogoci i udarci prema golu u zoni 5.1, izgubljene lopte u zoni 4 i osvojene lopte u

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lost balls in zone 4 and won balls in zone 2; factor hits and kicks towards the door in zone 5.2; the factor of the lost ball in the zone 5.1. The results of the analysis would enable the formation of a number of guidelines that can be important in the scientific foundation of the football game. and in practical terms can serve football experts in selecting the most effective content of tactical. technical and fitness training (creating training operators that will have a targeted effect on the formation of the most significant motor skills in football).

CONCLUSION

Based on the obtained results. we conclude that changes have occurred in the structure of football over a period of 8 years. which shows us the number and structure of factors that have been fished out. The structure of football has changed in such a way that the number of factors has been reduced from 6 to 4. and the structure of isolated factors clearly defines modern football. These factors that make up the structure of the football game were distinguished as: 1. Physical requirements in football. 2. Factor of technical success. 3. Factor of football speed and high intensity of the game. 4. Factor of successful passing of the ball. The structure obtained in this way clearly determines the basic factors that make up today's football. i.e. the equation of success in it. and based on it it is possible to direct training operators who will especially influence the faster development and creation of the most important abilities and skills in football. Based on the results. the guidelines and standards on which football training should be based can be clearly determined. while using certain training tools. training stimulans and appropriate training loads in order to achieve a high level of physical preparation. a high level of technique in movement. a high rhythm of the game and tactical maturity of football players. The established latent structure of football gives football experts a clearer picture of what defines success in modern football. and which. through the processes of planning and programming training programs. leads to the improvement of individual. group and team abilities and technical-tactical skills.

zoni 2; faktor pogoci i udarci prema vratima u zoni 5.2; faktor izgubljene lopte u zoni 5.1. Rezultati provedene analiza omogućili bi oblikovanje većeg broja smjernica koje mogu biti važni u naučnom utemeljenju nogometne igre, a u praktičnom pogledu mogu poslužiti nogometnim stručnjacima u odabiru najefikasnijih sadržaja taktičke, tehničke i kondicione pripreme (kreiranje trenažnih operatora koji će ciljano uticati na formiranje najznačajnijih motoričkih znanja u nogometu).

ZAKLJUČAK

Na osnovu dobijenih rezultata zaključujemo da su se u vremenskom razdoblju od 8 godina desile promjene u strukturi nogometa, što nam pokazuje broj i struktura izlovanih faktora. Promijenila se struktura nogometa na način da se smanjio broj faktora sa 6 na 4, a struktura izolovanih faktora jasno definiše savremeni nogomet. Ovi faktori koji čine strukturu nogometne igre izdvojili su se kao: 1. Fizički zahtjevi u nogometu, 2. Faktor tehničke uspješnosti, 3. Faktor nogometne brzine i visikog intenziteta igre, 4. Faktor uspješnosti dodavanja lopte. Ovako dobijena struktura nam jasno određuje osnovne faktore koji čine današnji nogomet, odnosno jednačinu uspješnosti u njemu, te je na osnovu nje moguće usmjeriti trenažne operatore koji će posebno utjecati na brže razvijanje i stvaranje najvažnijih sposobnosti i vještina u nogometu. Na osnovu rezultat mogu se jasno odrediti smjernice i standardi na kojima treba da se bazira nogometni trening, pri tom koristeći određena trenažna sredstva, trenažne stimuluse i odgovarajuća trenažna opterećenja kako bi se postigao visok nivo fizičke pripremljenosti, visok nivo tehnike u kretanju, visok ritam igre i taktička zrelost nogometaša. Utvrđena latentna struktura nogometa daje nogometnim stručnjacima jasniju sliku onoga što definiše uspješnost u savremenom nogometu, a što kroz procese planiranja i programiranja trenažnih programa vodi unaprijeđenju individualnih, grupnim i timskih sposobnosti i tehničko-taktičkih vještina.

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