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Joint Performance Indicators in Tennis

Mohaned AL Khalili[1], Majed Abdulmajeed Osaileh[2], Alexander Kuliabin[3], Osama Abdelfattah[4]

[1, 3] Department of Theory and Methodology tennis (SCOLIPE), candidate of Pedagogical Sciences, Moscow, Russia.

[2] Department Humanities and Social Sciences, Faculty of Arts and Sciences (Al-Ahliyya Amman University). Candidate of Pedagogical Sciences, Jordan.

[4] Ministry of Education, Jordan.

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Abstract

The study aimed at identifying the issue of priorities for strategic actions in tennis sport, and the relationship between the several variables in game. To achieve this, the researchers analyzed the top 20 professional tennis players on hard and clay courts. The choice of this study came due to the lack of data and studies in the international references in the game on the factors that affect match outcome in the tennis sport . Based on the bibliography review, the indicators of strategic actions were highlighted and the correlation and factor analyses of 21 variables, which were recorded from the men competitors' video recordings of the level of TOP-20Association of tennis professionals (ATP) on all surfaces. In light of the study's results, it was found that several factors represent nearly 100% of the variance in the game variables, as this data allows us to prioritize the strategic actions of the level TOP-20 ATP in tennis sport.

Keywords: Tennis, performance indicators, competitive activity, factor analysis

مؤشرات الأداء المشتركة في التنس الأرضي

مهند الخليلي[1]، ماجد عبد المجيد عسيلة[2]، ألكسندر كوليين[3]، أسامة محمود عبد الفتاح[4]

[3 ،1] الجامعة الحكومية الروسية للتربية البدنية والرياضة والشباب والسياحة/ موسكو

[2] جامعة عمان الأهلية، الأردن

[4] وزارة التربية والتعليم، الأردن

ملخّص

هدفت هذه الدراسة التعرف إلى أولويات مؤشرات الأداء والإجراءات الاستراتيجية في رياضة التنس الارضي، كذلك العلاقة بين عدد من المتغيرات المختلفة في اللعبة. ولتحقيق ذلك حلل الباحثون أفضل 20 لاعبًا من اللاعبين المحترفين في رياضة التنس الأرضي على الأسطح الصلبة والترابية. وقد جاء اختيار هذه الدراسة بسبب قلة البيانات والدراسات الموجودة في المراجع العالمية في اللعبة، حول العوامل التي تؤثر على نتيجة المباراة في رياضة التنس الأرضي. وفي ضوء مراجعة الدراسات والأبحاث السابقة، تم تسليط الضوء على المؤشرات والإجراءات الاستراتيجية وتحليل البيانات والعلاقة ودرجة الارتباط بين 21 متغيرًا من المتغيرات في رياضة التنس الأرضي، والتي تم رصدها وتحليلها من خلال تسجيلات الفيديو الخاصة باللاعبين المتنافسين من الرجال الذين يحتلون المراكز العشرين الأولى حول العالم حسب تصنيف محترفي التنس (ATP) على مختلف الأسطح. وفي ضوء نتائج الدراسة تبين أن هناك عدة عوامل تمثل ما يقرب من 100٪ من التباين في متغيرات اللعبة، حيث تتيح لنا هذه البيانات تحديد أولويات الإجراءات الاستراتيجية للاعبين الذين يحتلون المراكز العشرين الأولى في رياضة التنس.

الكلمات الدالة : التنس، مؤشرات الأداء، النشاط التنافسي، تحليل العوامل.

Introduction

The relevance of the study: by now it has developed a scientifically based technology of sports training, which is regarded by many authors as a three-pillar system that includes competitive activity, training activity, as well as out-of-competition and training factors (AL Khalili, 2016). In this regard, many authors distinguished 3 types of models in sports: model of competitive activity, the model of training activity and model of preparedness (Gaskov, 1999), (Barchukova, 1995, p.8) argues: "So as soon as the analysis of competitive activity allows you to define the objectives and content of athlete training on all the long road from beginner to master high class, study and a clear arrangement of all components and elements of competitive activity in a complex system, will allow you to maximize the quality of the process of formation of technical and tactical skills of the athletes."

Many authors agree that the athlete preparation process must be considered as a dynamic system. (Shyrkovets, 1995, p.8) claims: "the Control of higher qualification sportsmen training process is a dynamic system with a large variety of constituent elements and probabilistic behavior. Analysis of the

system is performed by decomposing it into parts with subsequent elucidation of the role of individual parts." Also (Shyrkovets, 1995, p.140) noted: "...competitive activity is not a single integral indicator "sport results" but complex representational options." (Barchukova, 1995) notes that competitive activity in individual sports can be viewed as a dynamic system consisting of multiple closely linked subsystems. (Polozov, 2003, p.3) says: "we need an information model that enables the minimum number of measured variables universal to control all others."

Nevertheless, the analysis of scientific-methodical literature on tennis shows the lack of a unified approach in the assessment of competitive activity of tennis.

Over the last 40 years so many variables cited by many authors, among them S. Belits-Geiman, A. Skorodumova, A. Naumko, A. Golenko, G.Zhukov, O. Yatsenko, I. Zhemchuzhnikov, V. Yanchuk, G. Barchukova.

Therefore, as combined performance indicators uses two variables: productive activity and stability. Of (Naumko, 1996): the resulting activity, stability, and factor of personality. (Barchukova, 1995) uses four: action's volume, action's diversity, effectiveness, action's reliability. (Yugniy, 2011) uses two: stability and efficiency. (Skorodumova, 1990) uses five: action's stability, action' versatility (in some sources the variability), productive activity, efficiency, scope of technical action. Similar differences concern the classification of the competition activities components and the classification of factors influencing competition activities in tennis. All these contradictions are required to conduct a study of all the performance indicators in tennis.

Many authors contend': "As you know any quantitative characteristic of a phenomenon or process involves also its qualitative characteristics, but not Vice versa." That is why it is necessary to study those indicators for which there is the possibility of registering as numbers. Without this it is impossible to analyze them.

The object of study: Competitive activity in tennis.

As the recognized leaders of the world tennis are players, who play in the professional world tours, we decided to conduct a study on the representatives of the TOP 20 Association of tennis professionals (ATP). The characteristics of Competition activities will serve as a model.

In addition, the tennis tournaments held on different surfaces, the main 3 of which: hard, clay and grass. Because the number of tournaments on grass is negligible compared to the other two, it seems relevant to conduct a study of the combined indicators for hard and clay courts, which include more than 90% of tournaments for professional players in tennis.

Subject of research: performance indicators strategic actions in tennis at the level of the TOP 20 Association of tennis professionals (ATP) on different surfaces.

Hypothesis of the study: it is assumed that all possible performance indicators strategic actions in tennis is possible to reduce or combine to a minimum number for the convenience management in training and competition activities.

Objective of the study is to identify the most important combined performance indicators in tennis at the level of the TOP 20 ATP on hard and clay and to determine their characteristics for different coatings.

To achieve the Objectives of the study was to solve the following tasks:

1. Select using criteria appropriate performance indicators;
2. Register data of selected indicators in male and female categories at the level of the TOP 20 ATP on hard and clay surfaces;
3. Conduct correlation and factor analyses of data;
4. Allocate combined performance indicators;
5. Comparative data analysis of combined indicators for different coatings.

Scientific novelty of the Study lies in the fact that an analysis was made of all existing strategic performance indicators in the tennis literature and selected the most important of them.

Practical significance of the Study is represented in the following positions:

1. An alternative possibility to estimate competitive activity of tennis. At the same time as integrated, in the form of a ratio game, based on the level of the game components and differentiated by major component Competitive activity (CA);
2. An alternative possibility of competitive activities building models for the TOP-20 ATP players;
3. Have the opportunity to track changes in the competitive activity patterns in tennis over time according to the combined performance indicators changes;
4. A possibility to form of so-called "information model on all players" with the assessment of Competitive activity both complex and via components, which in itself opens us greater opportunities;
5. Upon further study, we hope to track the level dynamics of the game with the combined performance indicators for the set, match, competition.

The methodological basis of our study was 2 starting position: the Marxist-Leninist dialectic and systematic approach. Same as Barchukova,1995 we consider the tennis in the form of a struggle of opposites not only as the form of the competition, but also as a struggle of maximum opposite components of Competitive activity – attack, defense, counterattack, invitations and equal game action. This is the essence of the first approach. Systemic-structural analysis allows us to consider the object of study, on the one hand, with complex positions of integral system, and on the other from the perspective of analyzing each of constituent elements (parts) taking into account their interrelation and the conditions in which the system operates. Of course, a combination of these approaches gives a qualitative result in the formation of the classification of diabetes in sport, as with the first theory, it becomes clear how it should be related to other elements of the same order in the system (as opposed in the direction of action). Moreover, the second is clear how it is possible effectively to consider competitive activity in sports (from the point of view of systems theory and systemic-structural analysis).

The purpose of the study is to identify the most important united performance indicators in tennis at the level of the TOP 20 ATP on hard and clay surfaces and to determine their characteristics for different coatings.

To achieve the objectives of study the following tasks should be solved: Identify with criteria suitable performance indicators; register the data of selected indicators in male and female categories at the level of the TOP 20 ATP on hard and clay surfaces; to conduct correlation and factor analyses of the data; to distinguish the combined performance indicators; to conduct a comparative analysis of the data.

Methods of study: the method in the most general value is the way to achieve the goal. Using the terminology of the activity theory by Leontiev, 2004 we can say: the method is a set of actions used to achieve the goal. Since this work aimed at presenting assets tasks to solve them using the following methods: analysis of scientific and methodical literature; Survey; Data registration and indicators calculation; Correlation analysis; Factor analysis; Strategic indicators association; Comparative analysis.

Analysis of scientific-methodical literature: analysis of scientific and methodological literature was carried out in the following areas: the psychology of human activity. It was necessary to know what is "activity"; what components it consists of and how to manage; it competitive activity in tennis. Here we were interested in the following questions: what is competitive activity; what is the difference between the competitive activity in tennis, and in other sports? What

structure it has; what factors determine the outcome; manage competitive activity in sports. Main question - how to control competitive activity; indicators of Competitive activity in tennis. Interested in the following questions: which Competitive activity performance indicators and components exist in the literature; are they suitable for the particular study and how they can register.

Survey: the purpose of the survey is to obtain a qualitative idea of the degree of similarity of the experts' opinions regarding the importance of various performance indicators in tennis. In our survey all the participants were asked to place the performance indicators in tennis in order of importance to the result 1 a hypothetical match from the first to the tenth. However, we did not specify whether the writing is of Competitive activity indicators, which allowed forming a broader understanding of the significance of indicators of various kinds in tennis. However, this did not prevent us to obtain data on the similarity of views on the Competitive activity indicators.11 specialists attended the survey: 3 specialists of the highest level (2 honored coaches of Russia and 1 national coach), 2 Grand level coaches, 3 master levels + and 3 specialists that do not have coaching qualifications.

The results of the survey: 9 coaches of the 11 coaches noted the technical preparedness. Three from nine put it in the first place. Others put it in different places. Among those who marked this indicator was honored coach of Russia, and the unskilled trainer. One of the honored coaches set psychological stability in fourth place; the second did not mention it. Two coaches mentioned the level of refereeing while others said noting. Both are master plus category coaches. Two coaches of 11 coaches noted the luck factor and put it in the last place. Two coaches abandoned the survey; both are honored coaches of Russia.

Data registration and indicators calculation

To calculate the strategic indicators used map data registration. Data registration map used to calculate the strategic indicators. Registration includes the following steps:

1. **Definition of strategic combat**. In our view, the analysis of competitive activity in tennis is necessary to use on both opponents, because tennis is a combination of reflection, because each player not only offers individual options but also reacts to the actions of the opponent. In our opinion, most of the information is lost when a one-way approach to the recording and analysis of Competitive activity." So, we recorded precisely strategic actions, structural parts which are the strategic actions (attack, defense, counterattack, invitation, and equal game). Only on the basis of five strategic actions, obtained 6 types of strategic actions: attack vs protection; attack vs. counter-attack; the attack vs invitation; attack vs equal game; Protection vs counter-attack; an equal game vs equal game;

Now controversial in tennis is the process of determining strategic actions. So,(Zhukov,1981`, p.52): "offensive actions suggest a sharp game in response to passively ball from the opponent. Counterattacking actions include sharp game after active attacking actions of the opponent. Protective actions include a simple hitting the ball over the net directly into the opponent. Moreover, because these strategic directions are a kind of classification, you need to select criteria on which they split, what the author does not wrote down. (Belits-Geiman, 1977) recounting competitive activity classification in tennis, he doesn't describe the splitting characteristics of strategic actions, taking them as given. At the same time he says of the 3 strategic elements in the game (attack, defense and counterattack), noting the existence of 4th such a tactical option when the opponent is forcing another to play at the net when he is playing bad there.

According to (Polozov, 2003) the most important criterion, which determines the degree of usefulness of a football player on the field is how he increased the chance to score a goal during their one-on-one moments. Transferring this statement to the tennis, we can use a similar criterion for determining strategic actions: a criterion of probabilities to score in the exchange of hits. Consider the probability to get points with different strategic actions: **Attack.** When attack the probability to score significantly higher than the previous opponent's action. The exception is the serve, because it is not retaliation; **Deface.** When defiance, hit likely to score significantly lower than the previous opponent's attack hit. Defiance attack must always follow up after opponent's attack action; **Counterattack.** When counterattack the probability of scoring the same or higher than in the previous attack hit. Counter-attacking blow as protective, always the answer to

attacking the opponent's action; **Invitation**.. Invitation. When inviting an opponent to attack, the probability of scoring at the next hit of an opponent is slightly higher than at the invitation itself. Here, it is important to clarify that the invitation is executed only after your own attacking action, action of equal game or after the invitation. The invitation is not executed after the attacking or counter attacking action of the opponent, since in this case it is impossible to distinguish the invitation action from the defensive one, to fulfill the invitation after the attacking or counterattacking action of the opponent. In this case, it seems impossible to distinguish the invitation from the defense, so we decided that a defensive action is carried out only after the opponent's attacking action, and an invitation after any other than an attacking or counter attacking action of the opponent; **Equal game**. With an equal game, opponents have roughly the same probabilities to score. It should be noted that the process of determining strategic action is still a subjective moment, since the maximum clear definition is possible only with the help of technical devices that record the angles and the speed of the ball, the point of impact of the player on the court, and then convert these values into a single indicator, the framework of which is set for each strategic action by means of a specially conducted study.

Despite this, a similar understanding of each strategic action can be achieved using the 5 terms described above. It was through them that we registered strategic actions.

2. Registration of the number of necessary attacks.

3. Registration of the number of clashes won.

4. Verification. 2 check points are executed to exclude the error due to inattention:

A. The equality of all strategic actions of one player and the other is verified;

B. The equality of the amount of single combat won by one player and the other with the number of strategic actions is verified.

5. Calculation of indicators was carried out after their registration in the program Microsoft Excel 2016 by the formulas indicated in Table 1.

Table 1 Performance indicators describing the strategic actions in tennis and the corresponding criteria available in the literature

№	Indicators	Formula	Author
1	Number of attacking actions	the ration of the attacking actions to all actions	Gaskov, 1999
2	Number of defensive actions	the ration of the defensive actions to all actions	Gaskov, 1999
3	Number of counter attacking actions	the ration of the counter attacking actions to all actions	Gaskov, 1999
4	Number of "equal games"	the ration of the "equal game" actions to all actions	Gaskov, 1999
5	Efficiency of attacking actions	the ration of the winning attacking actions to all actions	Barchukova,1981
6	Efficiency of defensive actions	the ration of the winning defensive actions to all actions	Barchukova,1981
7	Efficiency of counter attacking actions	the ration of the winning counter attacking actions to all actions	Barchukova,1981
8	Efficiency of "equal game"	the ration of the winning "equal game" actions to all actions	Barchukova,1981
9	Style by content	description below	Skorodumova, 1988
10	Universal style	the number of strategic actions involved in the game	Belits-Gaiman, 1977
11	Aggression	=number of attacking actions + number of counter attacking action/number of all actions	Gaskov, 1999
12	Effectiveness factor of attacking actions	the ration of effective attacking actions to the number of all actions	

№	Indicators	Formula	Author
13	Effectiveness factor of defensive actions	the ration of effective defensive actions to the number of all actions	
14	Effectiveness factor of counter attacking actions	the ration of effective counter attacking actions to the number of all actions	
15	Effectiveness factor of “equal game”	the ration of effective “equal game” actions to the number of all actions	
16	Effectiveness factor	the ration of all effective actions to the number of all actions	
17	Style by effectiveness	description below	
18	Style coincidence	the degree of compatibility of the player’s styles for the content of actions and their effectiveness	
19	Strategy correctness	The degree of effectiveness factor to the maximum efficiency of all components	
20	Degree of using the opportunity to aggress	the ration of the number of attacking and counter attacking actions to the number of necessary attacks	
21	feasibility of access to the court	the fact of presence or absence of replaying an opponent in at least one strategic action in more than 50% of cases	

To record the data, (Naumko, 1996) used the concept of the structural and functional unit of tennis. The author implies under the Structural-Functional Unit of Tennis 1 game, Naumko calls it "micro-game". With the help of this approach, it is convenient to analyze the game; however, we believe that it would be more effective from the point of view of the research to use two successive games as the concept of Structural-Functional Units of Tennis. Since in this case the supply factor is equalized, and the initial capabilities of the players can be considered equal. Thus, we registered for each match 2 consistently played games.

The correlation analysis: correlation analysis was made of the 2 groups of data; for each surface. In each data group revealed coefficients of linear connections for each of the 21 variable Structural-Functional Unit of Tennis (SFUT) results. It happens to be 78concept of structural-functional units of tennis results for each group.

Factor analysis: after correlation analysis, 14 to 16 variables were left depending on the surface coating that have a linear relationship with the result of the concepts of structural-functional units of tennis and fit the format for factor analysis. The data for these variables were subjected to canonical factor analysis without rotation of the axes to obtain the largest possible number of variables in each factor. For men on hard courts procedure were subjected to 14 variables. For men on clay15 variables. A total of 2 groups of data, where the objects of study in each group were critical of the strategic player's performance, winning in 39 concepts of Structural-Functional Units of Tennis. Winning data were chosen in order to identify the factors that determine dispersion of only winning the concept of structural-functional units of tennis. The players and the matches were chosen the same as for correlation analysis with the aim of eliminating distortions of data.

Combining indicators: from the point of view of were training management and competition activities, combined performance indicators, in our view, should meet the following requirements:

1. Should include the maximum possible array of variances of the data, which is determined by the number and alleged descriptiveness of those indicators that were initially selected for analysis;

2. Should be comfortable from the point of view of the athlete training management. Assuming, that is to understand instead of 21 only 5 primary factors that determined 87,03% of the variance in the data for men on hard courts, and present them in the form of indicators, it is hardly possible to understand the meaning of each of the factors. From the point of view of the athlete, training management becomes uncomfortable.

A comparative analysis: the necessity of comparative analysis is due to differentiating the joint performance indicators and strategic information between the different discharges and different finishes. Under the strategic data, we understand all data related to strategic actions in tennis and have a relationship with the athlete preparation process. Based

on the objectives of the comparative analysis, it was conducted in 2 main areas: the analysis of the joint performance and analysis of all available strategic data, which we collected at the beginning of factor analysis of the combined indicators.

From the point of view of practice, we were interested in the following questions: what are linear relationships have similar performance indicators with the results of the Structural-Functional Units of Tennis (SFUT); what are their model characteristics for different discharges and courts. In addition, how the model specifications differ from the values in the lost concept of Structural-Functional Units of Tennis? We are also interested in the question: which linear relationships have similar performance indicators between them? The answer to this question is important for a deeper understanding of the structure of the strategic actions. To answer these questions we conducted a correlation analysis of the combined performance indicators in which the objects were made by the combined values of performance indicators, determined the average values of these parameters for different discharges and coatings and tested them on the values of distraction, to ensure that the average values can be trusted. Since the model characteristics are the average values of the combined indicators in winning the concept of structural-functional units of tennis, therefore to determine differences, we compared these values with the arithmetic mean values in a lost the concept of SFUT.

Analysis of strategic data. The first question in which we were interested in – what is the role of the serve as a basic attacking technical game operation. This issue is very important, despite the fact that it does not apply to strategic action directly. Primarily because in each set and therefore in match the number of games is not necessarily even, and for the further construction of the information space in tennis, this should be taken into account, this means that we need to know the numeric expression of the factor a serve in tennis. To this end, we determined the number of won games on the serve. Used recorded number of winning games in 78the concept of Structural-Functional Units of Tennis (SFUT) for each court among players in the TOP 20 ATP. To minimize the reduction of game level factor due to the low significance of the competition we recorded data only on the Grand slam tournaments and the series “masters” for men.

Then, we define a so-called “strategic layout” in the game. Under the strategic layout, we mean the ratio of strategic actions in the game. To manage the preparation of the athlete, these data may be important, despite the presence of combined indicators that give a clear recommendation on the distribution of strategic actions.

Strategic layout, as some “control points” may be important from the point of view of establishing the trends in the development of tennis; as well as conducting special studies to show differences in content of strategic action in the game at different stages of training and at different levels of the game. Was compared the data of 32 groups (for each of the 4 strategic actions in each of the 2 surfaces; and for each of the possible outcomes of the concept of structural-functional units of tennis– all and victorious).

The indicator “feasibility of access to the court” allowed us to determine differences in the number of cases where the player has nothing to oppose the opponent on the court at the level of the TOP 20 ATP. This data allow us to indirectly judge the degree of competition in modern tennis at the study level, and as a result, when conducting special studies can be the basis for the development of a technique of distribution of forces during competition.

Organization of the study: the study consisted of 3 phases. The first phase (February – September 2016) is in it’s very early included the formulation of the problem. To this was applied a questionnaire of 11 coaches of different levels: 2 honored coaches of the Russian Federation, 1 coach of the national team, 2 Grand level coaches, 3 master +level, 3 specialists that do not have categories. The survey showed the need for this study. Then was set the hypothesis of the study, first was preliminary analysis of scientific and methodical literature on the topic, which showed the possibility of conducting this study, and allowed to verify the need for research. Then the goal was set, tasks were allocated, determined the object and subject of research; methods were selected, implemented strategic planning work.

The second phase (November 2016 – March 2017) has been associated with the selection of strategic indicators available in the literature, the allocation among the strategic performance of those which are suitable for solving problems of this work, the formation of registration data card, conclusion methods of calculation of strategic indicators and recording the data of these indicators in 1 category (men's singles) and 2 surfaces (hard and clay) among the players who occupy positions 1 through 20, inclusive of professional ATP rankings. Games on grass were not investigated because they

occupy a small fraction of professional ATP calendars.

In order to ensure that the sample was most homogeneous in the degree of using their own level of play, for the reception Grand slam tournaments were chosen, the tournament series "masters" for men. For selection of strategic indicators that are suitable for solving tasks of this work used a special criterion.

Map registration data consisted of 4 positions:

1. Number of the strategic actions by type (offensive, defensive, counter attacking, invitation sand action in equal game) and their total amount;
2. The number of wins in this activity by types and the total number of wins;
3. The number of necessary attacks;
4. Check. For further successful application of factor data analysis were recorded only structural units with a 2-0 outcome that is to say with the victory of one of the players in the structural unit. There were total 78 structural units (39 in each grade and on each surface). The result was we get 2 groups of data for correlation, factor and comparative analyses.

The third stage (April 2017) included correlation, factor and comparative data analysis, as well as the process of combining strategic indicators and identify linear relationships of the combined performance indicators with the results of the SFUT. Correlation data analysis was performed for 21 strategic indicators for the 2 data groups (men on hard courts, the men on clay courts) for 39 objects in each.

Objects were values of each indicator for the concept of Structural-Functional Units of Tennis players TOP 20 ATP. After the selection of indicators for specific criteria for the existing 2 groups of data has been applied the procedure of canonical factor analysis without rotation of the axes to obtain the maximum number of variables in each factor to facilitate further consolidation of strategic indicators. The main part of the work was to combine indicators on specially developed methodology. **The resulting 7 combined performance indicators** were analyzed for linear relationships with the results of the concept of structural-functional units of tennis and revealed correlation coefficients with each other. Then, we conducted comparative analysis of the combined indicators and strategic actions between different surfaces with the help of statistical data for men.

Results Of Study And Discussion

1. Correlation analysis.

Table 2 Coefficient of correlation of efficiency with combined indicators on different coatings

№	The name of the indicator	Hard. Men	Clay. Men	Average Value
1	The correct allocation of strategic actions	0,66	0,69	0,68
2	Efficiency of attacking actions	0,63	0,52	0,58
3	Efficiency of defensive actions	0,62	0,47	0,55
4	Efficiency of counter attacking actions	0,02	0,26	0,14
5	Efficiency of "equal game"	0,84	0,83	0,84
6	Strategy correctness	0,77	0,71	0,74

As a result of the correlation analysis, we obtained 2 groups of data for each surface that show the degree and direction of linear relationships between the studied variables and the results of the concept of structural-functional units of tennis. Ranked data are presented in the table 2

2. Factor analysis.

Table 3 Determinants of strategic performance indicators in men's singles on Hard courts (Bold and larger font of the selected factor loadings whose value >0.5 in)

Variables, Factors	Factor Loads							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1.Number of attacking action	0,91	-0,07	-0,15	-0,30	-0,09	0,00	0,10	0,04
2.Number of defensive action	-0,59	0,21	-0,43	0,48	0,11	0,22	-0,06	-0,21
3. Number of counter attacking actions	-0,18	0,46	-0,53	0,09	0,45	-0,48	0,15	0,08
4. Efficiency of attacking actions	-0,01	0,59	-0,19	0,52	-0,55	-0,08	-0,06	0,15
5. Efficiency of defensive actions	-0,19	-0,78	-0,46	0,13	-0,06	-0,16	-0,21	0,12
6. Efficiency of "equal game"	0,59	-0,32	0,10	0,63	0,17	0,08	0,29	0,00
7. Effectiveness factor of attacking actions	0,88	0,17	-0,20	-0,08	-0,33	-0,04	0,10	0,08
8. Effectiveness factor of defensive actions	-0,11	-0,78	-0,57	-0,03	-0,10	-0,02	-0,06	0,04
9. Effectiveness factor of counter attacking actions	-0,70	-0,49	0,06	-0,09	-0,26	-0,11	0,41	-0,14
10. Effectiveness factor of "equal game'	0,85	-0,21	0,14	0,15	0,25	0,15	0,06	0,28
11. Effectiveness factor	0,84	-0,11	0,03	0,33	-0,15	-0,23	0,01	-0,23
12. Aggression	0,69	0,20	-0,39	-0,49	0,00	-0,05	-0,01	-0,17
13.Strategy correctness	0,79	-0,22	0,33	0,21	0,12	-0,18	-0,25	-0,20
14. Degree of using the opportunity to aggress	0,5	0,12	-0,73	0,01	0,08	0,33	0,05	-0,09
Degree of using the opportunity to aggress	40,00	16,86	13,81	10,31	6,06	3,92	2,97	2,33
Accumulated Dispersion	40,00	56,86	70,67	80,97	87,03	90,95	93,92	96,24
Eigen value Factors	5,61	2,37	1,04	1,45	0,85	0,55	0,42	0,33

Table 4 Determinants of strategic performance indicators in men's singles on clay courts(Bold and larger font of the selected factor loadings whose value is >0,5)

Variables, Factors	Factor Loads								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Number of attacking action	**0,87**	-0,28	0,08	-0,28	-0,06	0,05	-0,18	0,06	-0,01
2. Number of defensive action	**-0,61**	0,33	-0,16	-0,13	0,08	**-0,63**	0,05	0,18	-0,03
3. Number of counter attacking actions	-0,47	-0,47	0,26	-0,33	-0,10	0,10	**0,59**	-0,01	-0,12
4.Efficiency of attacking action	0,13	**0,67**	0,30	-0,33	**0,51**	-0,03	0,03	-0,22	-0,15
5. Efficiency of defensive actions	-0,40	-0,03	**-0,61**	**-0,58**	0,03	0,11	-0,05	-0,18	-0,03
6. Efficiency of counter attacking actions	0,02	**0,72**	**0,52**	-0,21	-0,03	0,16	0,14	0,19	0,27
7. Efficiency of "equal game"	**0,73**	0,33	-0,45	0,09	-0,11	-0,09	0,17	-0,05	-0,09
8. Effectiveness factor of attacking actions	**0,87**	-0,05	0,20	-0,35	0,11	0,03	-0,17	-0,02	-0,05
9. Effectiveness factor of defensive actions	-0,48	0,04	**-0,57**	-0,52	0,12	0,18	-0,03	0,20	0,16
10. Effectiveness factor of counter attacking actions	0,23	-0,47	-0,13	0,33	**0,74**	0,01	0,15	0,03	0,12
11. Effectiveness factor of "equal game'	**0,73**	0,29	-0,35	0,15	0,02	0,06	0,13	0,30	-0,19
12. Effectiveness factor	**0,87**	0,29	-0,15	-0,04	-0,11	0,07	0,20	-0,16	0,01
13. Aggression	**0,79**	-0,28	0,12	-0,27	0,08	0,00	-0,01	0,28	-0,08
14. Strategy correctness	**0,84**	0,05	-0,30	0,14	-0,08	-0,10	0,16	-0,13	0,28
15. Degree of using the opportunity to aggress	**0,58**	-0,42	0,19	-0,41	-0,09	-0,42	0,03	-0,07	0,11

Variables, Factors	Factor Loads								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Share Dispersion	40,45	14,23	11,39	9,96	6,02	4,62	3,82	2,74	1,95
Accumulated Dispersion	40,45	54,68	66,07	76,02	82,04	86,66	90,48	93,21	95,17
Eigen value Factors	6,07	2,14	1,71	1,49	0,90	0,69	0,57	0,41	0,29

Because of the canonical factor, analysis without rotation procedures of the axes gave us 2 groups of factors that determine almost 100% of the variance in the player's data that won the concept of structural-functional units of tennis. 100% of the data for each of the groups did not work because of the outgoings of factor analysis.

For men on hard court has identified 8 factors that explain 96,24% of the variance in all the variables in the winning structural tennis units. 5 of these factors determine 87,03% of the variance in the data. Factor capacities are presented in the table 3.

For men on clay court has identified 9 factors that explain 95,17% of the variance in all the variables in the winning structural tennis units. 5 of these factors determine 82.04% of the variance in the data. Factor capacities are presented in the table 4.

Combined performance indicators in tennis

For all surfaces in the first factor, which defines the largest variance of the data, there are the following variables with significant factor loadings (>0.5) is:the number of attack actions; The number of defensive actions (with a negative sign);The correctness of the strategy; Aggression; The degree of use of the possibility of aggression; Efficiency.

Proven a positive correlation between the average number of attacking action, with the result of the SFUT, negative correlation between the average amount of defensive actions with the result of the SFUT; these variables are in one group and the main factor in all the study surfaces (table 5). Therefore, there are all prerequisites for combining them.

Table 5 Comparison of factor loadings the number of attacking and protective actions on different surfaces

Indicator	Loading Factors		Average Value
	Hard	**Clay**	
Number of attacking actions	0,91	0,87	0,89
Number of defensive actions	-0,59	0,61	-0,60

In addition to these variables in the first group, there are still a number of counter-attacking actions and a number of actions of equal game. The number of actions of equal game has no correlation with the result of the SFUT, therefore, to consider this indicator as meaningful does not make sense. The number of counter-attacking action has a very weak positive correlation in the men's games, but is not included in the first factor. This indicator has a positive correlation due to the fact that, increasing the number of counterattacking techniques automatically reduces the number of defensive actions. However, there is no significant correlation of the number of attacking and counterattacking actions among themselves, most likely due to the different conditions of their use, that is, offensive actions are always executed in much more simple terms than counterattacking. So the increase the number of counterattacking action are make sense, due to the positive correlation with the result of the SFUT, but only at the expense of reducing the number of defensive actions, and in any case not at the expense of reducing the number of attacks.

All these data do not allow us to combine all the number of actions in one. However, these data allow us to exclude a number of counter-attacking actions and number of actions of equal games from consideration and leaving only 2 variables – the number of attackers and the number of defensive actions as combined strategic indicators. Question: how to allocate the strategic actions in the match – depending on their efficiencies, that is, from one's own abilities and strengths, or in accordance with a certain model? The presence of the correct strategies in the first factor allows us to answer this question.

It turns out that proper distribution of the strategic actions is the maximum increase in the number of attacking actions and minimizing the amount of defensive. Distribute the strategic actions in tennis is required in accordance with the model. At the same time, the distribution model of the strategic actions has not quantified borders and a very clear recommendation for the player: "if you have the opportunity to attack, attack; if the opponent attacks, try to equalize the game or counter attack, no defensive action." This recommendation called "the main strategic objective for the game". It does not matter how many actions of equal game there, because on any surface in any category they do not have correlations with the match result. About the invitations we are not able to draw any conclusions, because these actions are extremely rare and do not have enough data; they need to conduct a separate study.

Thus, when determined that the correct strategy means maximizing the number of attacking and reduction of defensive actions, we can exclude this indicator from consideration as a combined performance measure. However, in the game this situation can happen, though very rarely, when the maximum increase in the number of attacks along with maximum reduction in the number of defensive actions is not the correct strategy of the game. This may be if the effectiveness of strategic play "defense against attack" of the opponent higher than the efficiency of strategic play "attack game" of the player; and then you need a different distribution of the strategic actions in the game. In this case, the indicator "correct strategy" is informative as a single figure, otherwise it just duplicates already selected, the indicator "degree of correctness of distribution of the strategic actions in the game." Note again that in the games of professional players in the TOP-20 ATP such phenomenon happens very rarely.

In our study of the registered 78 SFUT in different places on different surfaces, this situation has not met even once. In this regard, we decided to leave the figure "correct strategy" as an additional for that eventuality."Aggression" in the game means the maximum increase in the number of attacking and counter attacking actions. However, this setup has been already considered in connection with the first integrated index that is associated with the number of attacking and protective actions, in addition, this strategic indicator is included in the first factor in all places on all surfaces, so we exclude it from consideration.

The indicator "degree of use of the aggression possibility" is in the same situation as "aggression", since its meaning was already described in the games setting regarding the composition of the gaming action and it is the first factor in all places on all surfaces. We exclude from consideration.

So first combined metric has formed, which has its own formula and named us as follows: "the correct allocation of strategic action" (the table 6).

Table 6 Coefficients of correlation between the combined strategic performance indicators and the results of the concept of Structural-Functional Units of Tennis in different discharges on different coverage's and their average arithmetic values

Name of the indicator	Average Value		Average Value
Category	Hard	Clay	Hard\Clay
Effectiveness factor	0,89	0,79	0,84
Effectiveness of equal games	0,7	0,52	0,61
Efficiency of attacking actions	0,63	0,52	0,57
Efficiency of defensive actions	0,61	0,46	0,53
Degree of correctness of the distribution of the strategic actions	0,5	0,42	0,46
Efficiency of counter attacking actions	0,03	0,21	0,12
Strategy correctness	0,63	0,46	0,54
Average	0,57	0,48	0,52

Among the shown factors there is no data that would clearly point to the fact that some performance indicators on all surfaces and in all places would be the same factor. However, correlations with each other have a distinct character (table 7).

Table 7 Correlation matrix of indicators of the strategic actions effectiveness (average values for all categories and surfaces)

		1	2	3	4
1	The Effectiveness of equal games	1,00	0,33	0,31	-0,04
2	The Effectiveness of attacking actions	0,33	1,00	0,18	0,00
3	The Effectiveness of attacking actions	0,31	0,00	1,00	0,08
4	The Effectiveness of counter attacking actions	-0,04	0,00	0,08	1,00

For all categories and on all surfaces the efficiency of attack actions associated with the effectiveness of the equal game. The average correlation for all categories and surfaces is 0.33. This link shows the fact that the offensive actions often have equal games, and who will be able to increase the probability to win the ball in equal game depends largely on the outcome of the draw, because if the player got a chance to attack, he most often uses to win in the raffle.

The effectiveness of the attack is not associated with the effectiveness of counter attacking actions. This confirms various game situations with the attack and counterattack. With the effectiveness of defensive actions, attacking actions have very weak correlation. On clay men generally does not have any. These dependencies can be neglected.

The effectiveness of counter-attacking actions has a rare weak dependence with efficiencies of other strategic actions, which can also be neglected. Efficiency of equal game in all categories and all surfaces associated with the effectiveness of defensive actions. The average correlation coefficient is 0.31. This is because the player in an equal game with the opponent often performs the strikes in uncomfortable situations, which is essential for the implementation of defensive actions.

The strategic actions themselves already are categorized for ease of use in the preparation of the athlete, and because their efficiency has a high to moderate correlations with each other and the correlations have large scatter coefficients with the result of the SFUT, it was decided to leave the effectiveness of various policy actions as independent variables. Especially because, in our opinion, it is convenient from the point of management view of the athlete preparation, after all despite the fact that all actions have different correlation coefficients with the result of the SFUT to work in training over all of them is necessary, though in different proportions.

The variable “versatility style”, which is a discrete indicator, has no correlation with the result of the SFUT on all surfaces, so it is excluded from consideration for further merging. “Style coincidence” has no correlation with the result of the SFUT on all surfaces except the female on the clay (correlation coefficient is 0.26), so this variable is also excluded from consideration.

The indicator “style by content” is in different categories and on different surfaces has moderate, weak and very weak correlation coefficients with the result of the SFET. Due to non-standard formulas for calculating this indicator was not subjected to canonical factor analysis. However, we have already proven that in the game player should increase the number of attacking actions, thereby reducing the number of defensive. This fact in itself determines the value of the style by content, so we exclude it from consideration.

The indicator “style by effectiveness” has a very weak correlation with the result of the SFUT, so we exclude it from consideration.

The feasibility of the participation in the game has a moderate and weak correlation coefficients with the result of the SFUT, but it is not suitable for factor analysis due to wrong format (only possible 2 values of index – 0 and 1, i.e., there is a feasibility to play and not have a feasibility to play). Therefore, we exclude it from further consideration, the coefficients of useful actions. These indicators are combined in relation to the number of actions and their effectiveness. They show the effectiveness of each action relative to all actions. The effectiveness factor of a strategy is the sum of the coefficients are useful actions. Before the study, we assumed that it is possible to exclude from consideration the number of actions and their effectiveness by combining them with efficiency. However, the data correlation and factor analyses showed the need to use these primary indicators. Thus, it is now necessary to eliminate the coefficients of useful actions. But the

effectiveness factor of the strategy has a strong correlation with the result of the SFUT in all categories and all surfaces (average is 0.86).

Based on the formula of this variable, correlation and factor analysis we can conclude that the effectiveness factor of the strategy collects all of the primary variables, i.e., the number of activities and their effectiveness. Therefore, this indicator is integrating all combined strategic indicators. However, the efficiency would be wasteful to use alone, in isolation from other combined indicators because it does not show the components of achievements of the player. It is rational to use as an estimate of the game level of tennis as analogous to the account in a match.

In the end, in the application of the methods of the combining of strategic indicators, we got 7 variables, 5 of which are components of athletic achievements and 1 is the unifying for the other, which can be used as an estimate of the level of play similar to the account in a match; and one additional in case of nonstandard situation, the ratio of the efficiencies of the strategic actions of rivals.

The last stage of work with combined performance indicators is to develop formulas, which are convenient to calculate and easy to use combined indicators. We have adopted the following equality. All figures are expressed in % because they are all relative actions of the opponent.

4 of 7 combined performance indicators in tennis are indicators of the effectiveness of the strategic actions, and this means that not only we have the opportunity for integrated assessment of CA, but also the individual components of the strategy.

Formulas for the calculation of combined performance indicators in tennis and their expressions

1. Efficiency (%) = (number of attack * efficiency of attacking actions / 100) + (number of protective actions * protective action efficiency / 100) + (number of counter-actions * the effectiveness of counter-attacking actions / 100) + (number of invitations * the invitations efficiency / 100) + (number of actions equal to the game * the effectiveness of equal games / 100);
2. The EFFECTIVENESS of an even match (%) = number of won martial arts in action even game / number of all martial arts in action even game * 100
3. The effectiveness of the attack (%) = number of won martial arts attacks / number of all martial arts attacks * 100;
4. The EFFECTIVENESS of PROTECTIVE ACTIONS (%) = number of won combats in the protective action / number of all martial arts in the protective action * 100;
5. The DEGREE of correctness of DISTRIBUTION of the STRATEGIC ACTIONS IN the GAME (%) = number of attacks – number of protective actions;
6. The EFFECTIVENESS of COUNTER-attacking ACTIONS (%) = number of won martial arts in counterattacking actions / number of all martial arts in counterattacking actions * 100;
7. The correctness of the STRATEGY (%) = the maximum effectiveness of any strategic actions / efficiency *100.

Comparative characteristics of combined performance indicators on different surfaces

The degree of linear dependency of the combined indicators with the results of the concept of structural-functional units of tennis the concept of structural-functional units of tennis presented in table 7

Table 7 Coefficients of correlation between the combined strategic performance indicators and the results of the concept of structural-functional units of tennis in different discharges on different coverage's and their average arithmetic values

Name of the indicator	Average Value		
Category	Hard	Clay	Hard,Clay
Effectiveness factor	0,89	0,79	0,84
Effectiveness of equal games	0,7	0,52	0,61
Efficiency of attacking actions	0,63	0,52	0,57
Efficiency of defensive actions	0,61	0,46	0,53

Name of the indicator	Average Value		
Category	Hard	Clay	Hard,Clay
Degree of correctness of the distribution of the strategic actions	0,5	0,42	0,46
Efficiency of counter attacking actions	0,03	0,21	0,12
Strategy correctness	0,63	0,46	0,54
Average	0,57	0,48	0,52

The correlation coefficients are of paramount importance in assessing the significance of indicators. Data analysis allowed making us the following conclusions:

1. For all surfaces combined ranked list of indicators in descending order of their correlation coefficients with the results of the concept of Structural-Functional Units of Tennis is as follows: the effectiveness factor, the efficiency of the equal game, efficiency of attack, the effectiveness of defenses, the degree of correctness of distribution of strategic actions, effectiveness of counter attacking actions. Indicator of the correctness of the strategy we do not include in the ranked list because it is optional.

2. Significant differences between games on different surfaces have the following combined indicators: the effectiveness of equal game (0.70 on hard courts against 0,52 on clay), due to the high content of actions of equal games on the hard courts compared to clay (48,8% hard courts vs. 46.7% clay to all results of the concept of Structural-Functional Units of Tennis);effectiveness of defensive actions (0,61 hard courts against 0.46 on clay), and the effectiveness of counter-attacking actions (0,03 hard courts vs 0,21 on clay). In our opinion, the reason is a greater number of counter-attacking actions in games on the clay than in games with hard surfaces (3% vs 1.8% respectively). The difference is only 1.2%, but this is 40% of the value of the quantity counter action on the clay courts;

3. Averages arithmetic values of the correlations for all indicators combined in all categories for all surfaces have a standard deviation of only 0.03, indicating a high similarity of the results.

In General, the average arithmetic values allow us to estimate the average value for the whole sample, thus to understand the general trends. Our study reveals the following conclusions: winning data in all combined performance have advantage compared to all the concept of structural-functional units of tennis on all surfaces. The strategy of effectiveness factor has the greatest difference – 18,38%, the lowest is the effectiveness of counterattacking techniques - 4.62%. The average arithmetic values are 13.27%;between the different surfaces, there are some significant differences: the effectiveness of equal game has a bigger difference on the hard courts than on clay (19.04% vs 13,85% respectively), telling us of greater importance of the performance indicator of equal games on the hard surface than on clay. This fact is confirmed by correlation coefficients of efficiency of equal game results of the concept of structural-functional units of tennis on hard and on clay (0,75 against 0,61 respectively). The effectiveness of counter-attacking actions have a bigger difference on clay than on hard (6.95% against 2.29%, respectively). Other indicators have no significant differences. It is worth noting the fact that the effectiveness of the attacking actions have about the same difference between all results of the concept of Structural-Functional Units of Tennis and winning on solid and clay courts (15,36% vs 14,25%, respectively). The same importance of this indicator for different surfaces is confirmed by the correlation coefficients with the results of the SFET (0,58 for hard surface and 0,59 for clay).

Standard deviation is a measure of scattering of data around average. In our case, this indicator allows you to check how accurate our conclusions are based on data from average values.

This allows us to draw the following conclusions:

1. Distraction of the combined strategic performance indicators data for all results of the SFUT is more than a distraction for winning the data – the average difference for all combined indices in all places on all surfaces is 5.59% (26.39% is the value of standard deviation for all results and 20.8% is the value of standard deviation for the winning results). With the exception of indicator 2 – effectiveness of defensive actions and the effectiveness of counter-attacking actions. In the first case, the standard deviation of all SFUT results is less than the standard deviation of all the winning

results. In the second case, a similar situation in 25% of the data. We believe that this phenomenon is due to the negative correlation between the number of defensive actions and the result of the SFUT, and with low correlation number counter-attacking actions and the result of the SFUT. Of course, if you reduce the number of actions increases the total variance of the data efficiencies similar indicators, which leads to an increase in the standard deviation of these indicators. In addition, in the victorious results of SFUT number of defensive actions is much less in comparison with all the results of the SFUT. The number of counter-action is about the same;

2. There are no significant differences in standard deviations among the different categories or different surfaces. This fact proves the value of standard deviation arithmetic mean of all combined metrics in all categories on all surfaces – 0.5% with arithmetic mean of 5.59%.Thus, we were ranked joint performance indicators in descending order of their correlations with the results of the SFUT, determined their model characteristics for TOP-20 ATP, using the arithmetic mean of the indicators and tested their distraction around the average value, which showed the possibility of their use as model characteristics.

Model characteristics in the form of arithmetic mean values are presented in table 8.The results are presented in the table 8.

We were ranked joint performance indicators in descending order of their correlations with the results of the concept of Structural-Functional Units of Tennis SFUT, determined their model characteristics for TOP-20 ATP, using the arithmetic mean of the indicators and tested their distraction around the average value, which showed the possibility of their use as model characteristics. Model characteristics in the form of arithmetic mean values are presented in table 9.

Table 8 Model characteristics presented in the form of arithmetic average data of the combined strategic performance indicators for different surfaces.

№	Indicators	Hard, men	Clay, men	Average Value
1	Strategy Efficiency Factor	71,18	64,01	67,60
2	Efficiency of “equal game”	67,8	60,01	63,91
3	Efficiency of attacking actions	91,21	83,07	87,14
4	Efficiency of defensive actions	43,1	36,97	40,04
5	Degree of correct distribution of strategic actions	13,56	14,43	14,00
6	Efficiency of counter attacking actions	82,14	82,5	82,32
7	Strategy correctness	75,14		70,18

Table 9 The arithmetic average values of the combined performance indicators in all the concept of Structural-Functional Units of Tennis on different surfaces

№	Indicators	Hard, men	Clay, men	Average Value
1	Strategy Efficiency Factor	50	50	50
2	Efficiency of “equal game”	49,45	48,69	49,07
3	Efficiency of attacking actions	73,62	70,39	72
4	Efficiency of defensive actions	24,27	25,41	24,84
5	Degree of correct distribution of strategic actions	2,6	4,96	3,78
6	Efficiency of counter attacking actions	81,58	75,93	78,7
7	Strategy correctness	62,31	61,74	62

The differences of arithmetic mean values for winning and for all the concept of Structural-Functional Units of Tennis presented in table 10

Table 10 The arithmetic means of the joint performance indicators in all the concept of Structural-Functional Units of Tennis on different surfaces

№	Indicators	Hard, men	Clay, men	Average Value
1	Strategy efficiency factor	21,18	14,01	17,6
2	Efficiency of “equal game”	18,35	11,33	14,84
3	Efficiency of attacking actions	17,59	12,68	15,14
4	Efficiency of defensive actions	18,84	11,56	15,2
5	Degree of correct distribution of strategic actions	10,82	9,47	10,15
6	Efficiency of counter attacking actions	0,56	6,57	3,57
7	Strategy correctness	12,83	8,44	10,64

These data in practice are like some of the model characteristics, which show how necessary to outperform the average level of the game. The question follows what goal to set in trainings? To model characteristics of arithmetic average values of the combined indicators or the difference between the average values of the combined indicators in a winning and all SFET? For the time being we are unable to give an answer to this question, so we offer the data for both options. Correlation analysis of the dependence of values of the combined indicators among themselves showed the same directions of dependencies for all surfaces. They are presented in the table #7 as a matrix of arithmetic average values of the correlations for all surfaces.

Table 11 The matrix of arithmetic average values of the correlations of the combined performance indicators between all surfaces.

Indicators		1	2	3	4	5	6	7
1	Strategy Efficiency Factor	1,00	0,85	0,59	0,52	0,65	0,17	0,72
2	Efficiency of “equal game”	0,85	1,00	0,33	0,31	0,46	-0,04	0,72
3	Efficiency of attacking actions	0,59	0,33	1,00	0,18	0,23	0,00	0,11
4	Efficiency of attacking actions	0,52	0,31	0,18	1,00	0,17	0,08	0,39
5	Degree of correct distribution of strategic actions	0,65	0,46	0,23	0,17	1,00	0,07	0,53
6	Efficiency of counter attacking actions	0,17	-0,04	0,00	0,08	0,07	1,00	-0,19
7	Strategy correctness	0,72	0,72	0,11	0,39	0,53	-0,19	1,00

Performance indicators with each other have maximum moderate correlations, so we can say that they are close to orthogonal position in area of relationships.

In a moderate relationship of efficiencies between attacking actions and the action of equal game, there is a clear logic explanation: attacking actions often begin after the actions of equal games. Then the effectiveness of the attack depends on the effectiveness of the equal game; but not vice versa, because offensive actions could begin directly with equal game, as well as after weak response of the opponent.

On the other hand, in order in equal game not let the opponent to start an attack, you must bring your strikes near-attack power, or attacks from the opponent will be more often. That is, increasing the level of attacking actions, automatically increase the level of equal game actions.

This explains the dependence of the equal game actions from the attacker. In sum, the reasons above give a correlation coefficient of 0.33 (average for all surfaces).

In a moderate relationship of efficiencies between defensive actions and the action of equal, too, has a clear logic explanation: since the winning effect of clash for defensive actions is the effect of equal games, then learning to “equalize” the game with defense, the athlete automatically increases the level of equal game actions. Also, not allowing the opponent to start an attack due to the “equalizing” of probabilities to score during the equal game, the player is faced with situations

very close in complexity to the situations of defensive actions, which let us suggest an increase in the level of defensive actions. In sum, these factors give a correlation coefficient of 0.31. All other dependencies of the efficiencies of action are very weak or none exists. In addition, the effectiveness of equal game has a moderate correlation with a coefficient of 0.46 with the degree of correct allocation of strategic actions. It is also understandable because one of the winning effects of equal game actions is the transition to the attack and a forced weak reply of opponent from which attack starts.

Thus, we can conclude that the efficiency indicator of equal games is not only the second most important among all and first among the indicators of differentiated assessment of CA, but also has an effect on the indicators of performance of attacking and defensive actions, as well as the degree of correctness of distribution of strategic actions. That together is very important from the point of view of the training process. It is clear that for actions of equal game should be given the most attention in the training process compared to other strategic actions.

According to the formula of effectiveness factor, we can see that this index includes indicators of the effectiveness of all strategic actions and their number that is why he has such a high correlation with other indicators. The most "mysterious" figure is the efficiency of counter-attacking actions, since counter attacking actions constitute only about 2% in games of professionals. On the one hand, counterattacking actions on the main strategic objective for the game it is necessary to replace the defensive, on the other, the situation in which they are executed as hard as the defensive action.

Comparative characteristics of strategic actions on different surfaces

Comparative analysis showed different contribution of serve as the main attacking technical game operations in different categories and different surfaces. The results are shown in table 12.

Table 12 Number of the winning games on serve in different categories on different surfaces

Surface	Hard Men	Clay Men	Average Value
Number of winners (%)	78,2	74,42	76,31

As the table shows, the highest power serves display in the games of men on hard than on clay (arithmetic average of 76.31%). At the same time on the hard courts men winning his serve more often than on clay (78.2% against 74,42%, respectively). In other words, on clay courts men win his serve 3 times out of 4, and the solid is almost 4 times out of 5.

These data show, first, the prospect of increasing serve in tennis, especially on clay courts, and secondly, the needs to enhance serve return in men's tennis. Perhaps the prospect of serve return lies in the acquisition of this technical operation counter direction. We see the opportunity to enhance serve return due to the presence of a large reserve in the implementation on the example of basic strategic tactic: "if you have the opportunity to attack, then attack; if the opponent attacks, try to equalize the game or counter attack, no defensive action."

Strategic layout for all of the results of the concept of structural-functional units of tennis and winning results of concept of Structural-Functional Units of Tennis are shown in tables 13 and 14.

Table 13 Strategic layout of all results of concept of Structural-Functional Units of Tennis

Category, Strategic Action	For Attack	For defense	For Counter Attack	For Equal Game
Hard, Men	26,65	24,06	1,88	47,41
Clay, Men	28,46	23,51	3,24	44,79

Table 14 Strategic layout of the winning results of the concept of Structural-Functional Units of Tennis

Category/,Strategic Action	For Attack	For Defense	For Counter Attack	For Equal Game
Hard, Men	32,36	17,81	2,79	47,03
Clay, Men	32,76	18,34	3,91	44,99
Average Value	32,56	18,075	3,35	46,01

The differences of the strategic layout of all results of concept of Structural-Functional Units of Tennis and winning results of concept of Structural-Functional Units of Tennis shown in table 15 (all values are expressed in the form of a difference between the values of the winning layouts and layouts of all values he concept of SFUT).

Table 15 Differences in the number of strategic actions for all of the results of Structural-Functional Units of Tennis and winning results of concept of Structural-Functional Units of Tennis presented as difference between the winning and all results of the concept of Structural-Functional Units of Tennis.

Category, Strategic Action	For Attack	For Defense	For Counter Attack	For Equal Game
Hard, Men	5,71	-6,25	0,91	-0,38
Clay, Men	4,3	-5,17	0,67	0,2
Average Value	5,005	-5,71	0,79	-0,09

As the table shows, the differences have a clear focus: all winning layouts have more attacking and less defensive actions in comparison with the layout results of the all concept of Structural-Functional Units of Tennis. The winning layout and layout all of the results of the concept of Structural-Functional Units of Tennis have some difference in the number of counterattacks in favor for the winning layouts; the winning layout and layout of the all results of the concept of Structural-Functional Units of Tennis do not have significant differences in the equal game. Comparison of data on the meaning of entering the court showed no significant differences in the games of men for hard and clay surfaces (12% for hard courts and 4% for clay).

It turns out that the game on the hard surface at the level of the TOP-20 ATP, at least every tenth concept of Structural-Functional Units of Tennis is what is called “game in one gate”. According to this study, it is impossible to judge about the reasons of this phenomenon. We assume that this is due to large differences in the level of the players in the TOP-20 professional ratings on the one hand, and the impossibility of carrying out the whole match at the same level with the other. This phenomenon may be a separate area for study. In our opinion, the reason for the differences of whether to enter or not on hard and clay courts is the different effectiveness of attacking actions between these surfaces. However, this phenomenon also occurs for all results of concept of structural-functional units of tennis and winning. The difference between the average efficiencies of attacking actions for men on hard and clay surfaces for all results of the concept of Structural-Functional Units of Tennis is 3.92%. For winning results is 5.02%.

Increased efficiency show us about increasing difficulties in response to the attack on a hard surface. The same phenomenon applies to the effectiveness of counterattacking techniques. However, due to the much smaller number of them in the game (the average of all concept of Structural-Functional Units of Tennis on results in all categories on all surfaces of 2.38% and the average for the winning SFUT results in all categories on all surfaces of 3.24%), they do not have the same value as the number of attacking actions. This is reflected in the correlation coefficients data with the results of the concept of Structural-Functional Units of Tennis (average value in all categories on all surfaces with efficiency of attacking actions of 0.58%, for a counter-attacking 0,17%).

Conclusions

1. The Competitive activity system in tennis has a hierarchical structure and consists of 3 components that have a certain relationship to each other and a role in the Competitive activity system.
2. Component of highest order in competitive activity, including other components of is strategy, which is represented by the 5 possible types of actions: offensive, defensive, counterattacking, invitations, and actions of equal game. They differ in the indicator of the probability to win the ball and are maximally orthogonal to each other in area according to this indicator.
3. Combined performance indicators, being the main variables of the dynamic CA system in tennis, allow us make more efficient management of the entire system of athlete training, “expanding” and “reducing” the evaluation

system from the view of the component level to a single value throughout the system;

4. Analysis of scientific-methodical literature and the results of the survey showed that to date it has not developed a unified system of Competitive activity evaluation of players;
5. Factor and correlation analyses 21 variable characterizing strategic actions in tennis from different sides are allowed to allocate 7 combined, including all others that are maximally orthogonal to each other, the most informative from the point of view of assessment of Competitive activity in tennis and as convenient as possible for registration and evaluation. For the differentiated evaluation of Competitive activity was accepted the following indicators (in decreasing order of importance): the effectiveness of equal games, the efficiency of the attacking actions, the effectiveness of defensive actions, the degree of correct distribution of the strategic actions in the game, the effectiveness of counterattacking actions. For a complex evaluation, the effectiveness factor was taken. Well as the additional indicator of the correct strategy to use in case of nonstandard situation distribution efficiencies strategic action was taken;
6. Among the combined indicators for the differentiated assessment of competitive activity the most important is the efficiency equal of the game;
7. Comparative analysis of arithmetic average values of the combined performance indicators for winning and all of concept of Structural-Functional Units of Tennis results showed the following results: the winning data have all combined performance advantage compared to all of concept of structural-functional units of tennis in all surfaces. The efficiency of strategy has the greater difference; the lower is the effectiveness of counterattacking techniques. The arithmetic average of the differences; efficiency of equal game and counterattacking techniques are above on the hard surface than on clay.
10. Comparative analysis of strategic action between the winning results of the SFUT and all results concept of Structural-Functional Units of Tennis showed the following results: all winning layouts have more attacking and less defensive actions in comparison with the layout results of all the concept of Structural-Functional Units of Tennis; the winning layout and layout all of the results of the concept of structural-functional units of tennis have some difference in the number of counterattacks in favor of the winning layouts; the winning layout and layout all of the results of the concept of Structural-Functional Units of Tennis do not have significant differences in the quantity of the game;
11. Comparative analysis of the feasibility of enters to the court showed that, on average, for each of the categories and surfaces every tenth concept of structural-functional units of tennis is a “one-sided”, that is, all the strategic components of the player surpasses the opponents. With the exception of the game on the clay, where such phenomenon happens in 5% of cases, that is, every twentieth concept of Structural-Functional Units of Tennis is “game in one gate”.

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