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## АНАЛІЗ РЕЗУЛЬТАТІВ ВИСТУПУ ЗБІРНИХ КОМАНД УКРАЇНИ З ВІЛЬНОЇ БОРТЬБИ

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**Анотація.** Одноборства завжди були популярними видами спорту в Україні. Наші спортсмени успішно виступали на європейській та світовій арені, але в останні п'ять років чоловіча збірна України з вільної боротьби займає найнижчі позиції на європейській арені за час незалежності України. У літературі розглянуто різні підходи до аналізу виступів збірних: аналіз попередніх змагань різних вікових груп; порівняльний аналіз із результатами виступів та змагальної діяльності спортсменів інших держав; вплив зміни правил змагань; соціально-економічні показники держави тощо. Метою цієї роботи є аналіз і виявлення тенденцій результатів виступів збірної України на європейській арені і визначення факторів, що впливають на них. За час незалежності розглянуто всі виступи кадетської, юніорської та дорослої збірної на європейській арені, також соціально-економічні показники України. За цей період команда українських борців вільного стилю двічі посіла найвищі місця на чемпіонаті Європи в командному заліку та 9 разів була призером. Борці збірної України завоювали 81 медаль, але з 2014 року результати істотно знизилися. Схожа тенденція на світовій арені, отримані дані показують високий ступінь взаємозв'язку виступів дорослих команд на європейській і світовій аренах, коефіцієнт кореляції 0,59 ( $p > 0,05$  при  $r > 0,38$ ). Аналіз виступів кадетських і юніорських збірних свідчить, що досі не виникало проблем у багаторічній підготовці спортсменів, які могли б, очевидно, впливати на зниження результатів дорослої збірної на цьому етапі. Не виявлено впливу змін у правилах змагань на виступи команд. Під час аналізу взаємозв'язків виступів та соціально-економічних даних виявлено, що показники кореляції між спортивними результатами та валовим внутрішнім продуктом на душу населення, валовим національним доходом на душу населення становить 0,67 і 0,60 відповідно ( $p > 0,05$  при  $r > 0,38$ ) із затримкою на три роки. Водночас на виступи збірних могли суттєво вплинути такі події, як зміна покоління спортсменів та тренерського штабу. Потрібен подальший аналіз впливу соціально-економічних показників на спортивні результати в інших видах боротьби та одноборств.

**Ключові слова:** вільна боротьба, результати, аналіз, чемпіонат Європи, України.

## ANALYSIS OF PERFORMANCE RESULTS OF THE UKRAINIAN NATIONAL FREESTYLE WRESTLING TEAMS

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**Abstract.** During the last five years, the Men's Ukrainian National Freestyle Wrestling Team has occupied the lowest position since the independence of Ukraine. The objective of the research is to analyse and to identify tendencies of the Ukrainian National Freestyle Wrestling Teams in the European arena and to determine causes and factors influencing them. We have examined all the performances of Ukrainian Cadet, Junior and Senior National Teams over the years of independence of Ukraine in the European arena. In addition, socio-economic indicators of a country (Gross Domestic Product per capita, Gross National Income per capita) were examined with the aim of tracing their correlation with sport scores. The findings indicate that the correlation index between the results of Senior National Team in European and World arena is 0.59 (indubitable significance  $p=0.05$  at  $r>0.38$ ) that demonstrates quite a strong interrelation between performances. The carried out analysis of performances of Cadet and Junior National Teams shows that there have been no previously appeared problems in long-term stages of training of the oncoming generation, but there has been a problem in the period beginning with 2014 in the organization of national teams training of all age groups in general. The figures of correlation between sports results and Gross Domestic Product per capita, Gross National Income per capita are 0.67 and 0.60 (indubitable significance  $p=0.05$  at  $r>0.40$ ) with the setback in three years. Thus, the profound influence of global economic indicators on sporting results with the setback in several years has been discovered.

**Keywords:** freestyle wrestling, results, analysis, European championship, Ukraine.

**Introduction.** Today the popularity of Olympic and professional sport continues to grow. The competition rules constantly improve, the world contest increases, sportsmen results get better, the ever-new technologies for enhancing the impressiveness and attractiveness of sport events are applied (Smart, 2007; Schulenkorf, 2017). In Ukraine, the combat sports (boxing, types of wrestling and other martial arts) are one of the most popular sports and keep a leading position (Platonov, 2015; Order, 2016).

The analysis of performance of Ukrainian National Teams demonstrates that wrestling appears to be one of the leading sports. In the course of the independence of Ukraine freestyle wrestlers have won seven medals (one is gold) at the Olympic Games.

Unfortunately, it is worth stating that during the last four years the Ukrainian National Freestyle Wrestling Team has occupied the lowest position since the independence of Ukraine, that is why the analysis of reasons and factors which influence the performance results is required.

Identification of reasons and factors which influence the performance results of the country's teams is one of the key element of the analysis of the competitive activity and, as the result, of determining the ways of the following development and improvement of the sport (Severini, 2015). Such researches are often conducted after the termination of major competitions (Olympic Games, world and continent championships), after the termination of certain important periods (annual, Olympic cycles) or when a critical situation is created – failure in one

or in a series of competitions (Tünnemann, 2013, 2016; Lopez-González, 2014).

In general, the analysis of indices of the competitive activity is performed depending on various criteria. Thus, İmamoğlu (2017) made competition technical analysis of 12th World Universities Wrestling Championships Free style. They compare different weight groups and national teams of different countries, the authors have discovered that every weight group has its own peculiarities.

Physical fitness factors of wrestlers were analyzed (García-Pallarés, 2011) with the aim to determine differences in maximal strength and muscle power output of the arm and leg, peak and mean power, running speed, muscle extensibility, and anthropometric markers between elite and amateurs wrestlers according to the weight classes system. Based on these data, predictions of male Olympic wrestling performance were made.

Podlivaev (2004, 2010) analyzes the performance of representatives of the world's best freestyle and Greco-Roman wrestling teams at the Olympic Games in Sydney (2000) and Athens (1996). Such characteristics as indices of performance, attack and defense are under consideration. The analysis of the performance ahead of the main competitions, quantity of medals won at the world and Europe championships, as well as the comparison with other countries is carried out. Gaps in Russian sportsmen training, which have been revealed in the course of the analysis of the competitive activity, are used as a basis for the training programme in the next Olympic cycle.

Atan (2005) analyzed the 46th World Greco-Roman and the 35th World Free-Style Championships, and to examine the technique values of the National Turkish Team. The National Turkish Greco-Roman and Free-Style teams were unsuccessful to apply a technique and did not wrestle as offensively as their successful opponents. The case study enabled an analysis of the performance of the team and recommendations to be made for improvements in future competitions.

Also, one of the popular approaches in analysis and prediction of competitive events is the examination of economic, social and political aspects of countries in general and results modelling through various statistical (mathematical) approaches (Boyle, 2003).

Bredtmann (2016) in the academic studies have found a number of socio-economic variables that are reliable predictors of how well a country will do in the Olympic Games. Like population size, a country's gross domestic product (GDP) is strongly correlated with medal wins. Of course, GDP by itself has no direct impact on an athlete's performance, but it is a proxy variable for other things that do have an impact: in a wealthy country, the population can dedicate more time to leisure activities and can afford to support a class of professional athletes – both of which lead to investments in better sports infrastructure which can deliver more effective training. They used regression analysis to conduct out-of-sample predictions and different types of estimated models.

The analysis of the literature demonstrates different approaches to the estimation and analysis of performance results. Discovering patterns, tendencies of the obtained sports results and determining factors influencing them is the relevant objective of the modern sport. The obtained data will help to identify the most problematic aspects and characterize solutions.

**The objective of the given research** is to analyse and to identify tendencies of performance results of the Ukrainian National Freestyle Wrestling Teams in the European arena and to determine causes and factors influencing them.

**Material and methods.** The following research methods have been used in the paper: the analysis of scientific-methodological literature, the analysis of the official result cards, the analysis of socio-economic indicators, methods of mathematical statistics.

All the performance data is taken from the official site of the United World Wrestling (<https://unitedworldwrestling.org>). We have examined all the performances of Men's Ukrainian Cadet, Junior and Senior National Teams over the years of independence (beginning from 1993 Ukraine performs in-

dependently on the world stage). Throughout the period the National Teams have participated in 26 European championships among Seniors, 23 among Juniors and 19 among Cadets. According to the Freestyle Wrestling Competition Rules sportsmen of the age of 16 and younger are allowed at European championships for Cadets and of 20 and younger for Juniors (however age limits have been changing throughout the past decades). European Games in Baku (Azerbaijan), which were held instead of the Senior European Championship, took place in 2015.

Two criteria have been analyzed:

- an overall team placing of the national team at the specific competition, which is calculated as a sum of points for winning 1 to 5 places inclusive (in different years different quantity of places were included in the ranking) by all the sportsmen of the team;
- quantity of medals won at each competition.

Performances of the Senior National Team at world championships and the Olympic Games is considered additionally. In years of holding of the Olympics the data related to National Team performances at them was taken. In the course of statistical processing the average taken place in the specific periods of time and the mean-square deviation were calculated.

However, it should be understood that the occupied place does not fully characterize the team performance at competitions and generally the first place is not five times higher than the fifth, but these data generally describe the state of preparedness of the team.

Also, socio-economic indicators of a country were examined for tracing their correlation with sport scores, as of today (05.11.2018) the data concerning 2018 is unavailable:

- Gross Domestic Product (GDP) per capita is taken from the official site of the International Monetary Fund (<http://www.imf.org>) from 1993 to 2017 inclusive;
- Gross National Income (GNI) per capita is taken from the official site of The World Bank (<https://data.worldbank.org>) from 1993 to 2017 inclusive.

They have been considered as global socio-economic factors that influence sport results of Ukrainian National Teams. For clarity in Figure 3, socio-economic and sports data they have undergone the procedure of normalization to 0–1 with common mathematical formula  $z_i = (x_i - x_{\min}) / (x_{\max} - x_{\min})$ .

**Result and discussion.** Achievements of Senior Teams are the most significant for the country in comparison with other age groups. Over the years of independence the Ukrainian National Freestyle

Wrestling Teams have twice taken the highest place at European championships in team scoring (in 1999 and 2005) and have been 9 times in medal places (the 2nd and the 3rd places). Wrestlers of the Ukrainian National Team have won 81 medals, out of which 19 (23.5%) are gold. Consequently, it is possible to state that Ukraine occupies quite high positions in the sport in the European arena. Nevertheless, during the past few years positions of the National Team have notably faltered, in 2014 the National Team took the 8th place, which by that time was the worst result (during 21 European

championships until 2014 the lowest place occupied by the Team was the 7th place). In 2015, the Team took the 10th place winning two bronze prizes. After 2015, the Team again rose to the 8th place in 2016; in 2017 it took the 14th place (two sportsmen took fifth places, not winning any medal place) and in 2018 the Team took the 10th place. In the course of the last five years, the Ukrainian Senior National Freestyle Wrestling Team took the worst positions in all the years of performing. Fig. 1 demonstrates performances of Ukrainian Freestyle Wrestling Teams in the world and European arenas.

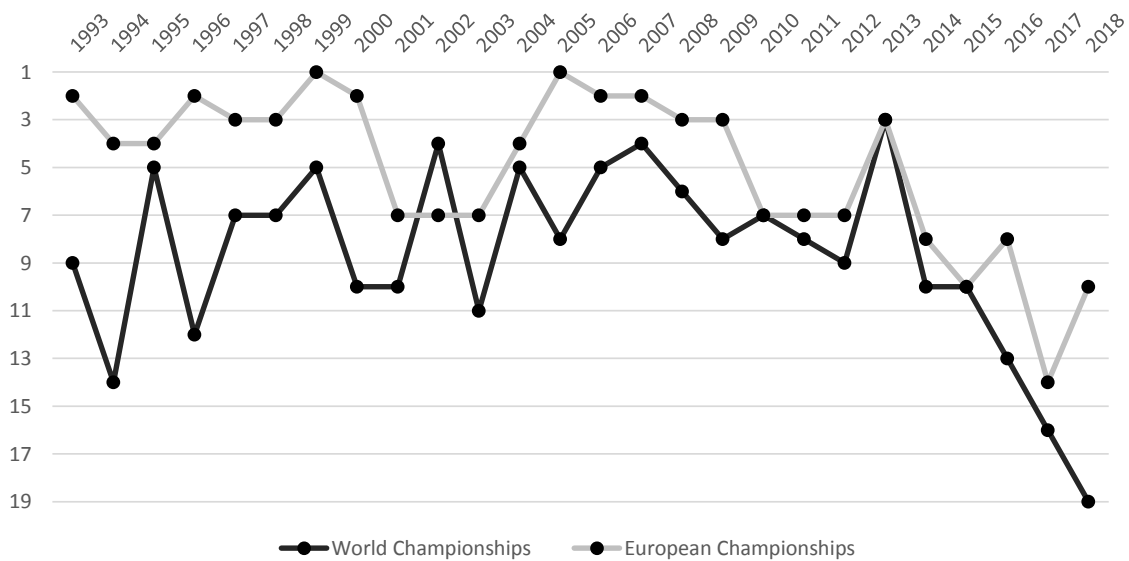


Fig. 1. Places Taken by the Ukrainian Freestyle Wrestling Team in the course of Independence of Ukraine at World and European Freestyle Wrestling Championships among Seniors.

The analysis of performances shows that similar tendency appears in the world arena, where the National Team have taken the lowest positions during the last two years (the 16th and the 19th places in 2017 and 2018 respectively). It is worth noting that the world achievements are less illustrative due to the great competition and consequently a small quantity of won medals (low data representativeness): one won (or, on the contrary, lost) place has a greater impact on the overall team placing. Nevertheless, the correlation index between the results constitutes 0.59 (indubitable significance  $p=0.05$  at  $r>0.38$ ) that demonstrates quite a strong interrelation between performances. Thus, it is possible to speak about the dramatic decline of the potential of the National Freestyle Wrestling Team during the last few years.

Let us consider some main reasons of the team performance decline. Earlier it was discovered the interrelation between results of Cadets and Juniors performances and the following achievements of sportsmen in already Senior age. The data concern-

ing results of Cadet, Junior and Senior Teams performances is shown in Fig. 2.

Examining performances of the Junior National Team, performance results from 2009 to 2013 inclusive have the greatest influence on performances of the Senior Teams after 2013, as, the authors point out (S. Latysev, 2011), wrestlers almost immediately adapt to Senior wrestling after Junior performances and reach the peak of the career at the age of 23.3 years. Within the specified period the Junior National Team took on the average  $6.6 \pm 1.1$  place (the average value and the mean-square deviation of mentioned period), while at the same time the average figure during the period of the independence of Ukraine constitutes  $5.6 \pm 2.3$  positions, i.e. the difference constitutes precisely one position. Whereas comparing the declines in performances of the Senior National Team are notably greater, in the period from 2014 to 2018 inclusive the result constitutes  $10.0 \pm 2.4$ , and  $5.0 \pm 3.3$  positions in general over the years of independence of Ukraine (the difference is 5 positions or in two times).

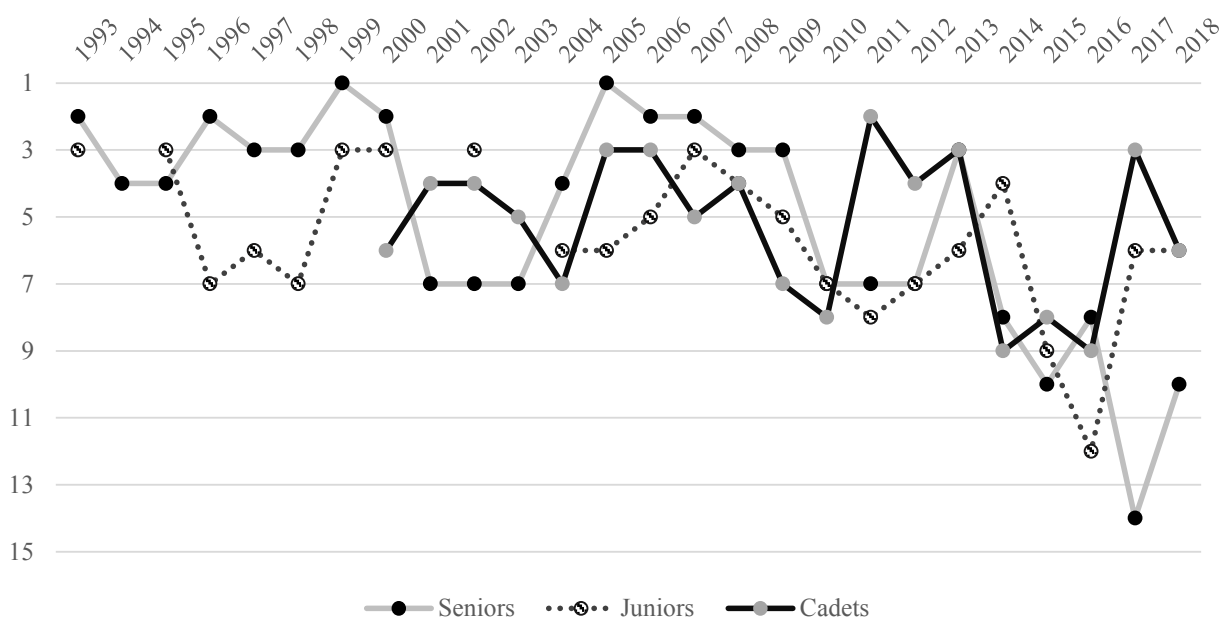


Fig. 2. Performance Results of Cadet, Junior and Senior National Freestyle Wrestling Teams at European Championships.

The performance analysis of the Cadet National Team demonstrates that the National Team in the period from 2004 to 2008 inclusive (the period that influences to the greatest degree performances of the Senior National Team in the period under consideration) took on average  $4.4 \pm 1.7$  positions, whereas in all performances the result on average constituted  $5.2 \pm 2.3$  positions.

It is worth noting that performances of the Cadet and Junior National Teams in the period from 2014 to the present day is as well below average and constitutes  $7.0 \pm 2.9$  and  $7.4 \pm 3.5$  positions respectively. However, there is a positive tendency in 2017, the Teams took the 3rd (Junior National Team) and the 6th places (Cadet National Team), but both teams achieved the 6th place in 2018. In general, the carried out analysis of performances of Cadet and Junior National Teams shows that there are no previously appeared problems in long-term stages of training of the oncoming generation, but there is a problem in the period beginning with 2014 in the organization of training of national teams of all age groups in general.

Constant changes in competition rules, intended to raise impressiveness and popularity of wrestling types, make the top-priority contribution to the competition activity. The analysis shows a significant influence of competition rules on the performance and activity of wrestlers. The last competition rules were changed in 2013 and came into full force in 2014, which could be a reason of influence of the performance of the Ukrainian National Teams. However, as the performance analysis has shown (Tünnemann, 2013, 2016; González, 2014; Laty-

sev, 2017), up to this change the competition rules had not essentially influenced the performance of the National Teams in general. Thus, this factor did not have the significant influence on the obtained results.

Performance results of national teams at large-scale competitions (Olympic Games, world championships, continent championships) are predicted on the basis of socio-economic indicators of countries. The conducted research demonstrates a strong interrelation between performances of national teams in various sports and economic, political and social indicators of a country. We have taken two socio-economic indicators: GNI per capita and GDP per capita. These two indicators in most cases are very close (the correlation index between them constitutes 0.96 for the data from 1993 to 2017). Fig. 3 shows socio-economic indicators and performances of our National Team with normalization to 0–1. It should be understood that socio-economic indicators are directly dependent (the higher is the better), and the sports results are the reverse (the smaller is the higher), because we calculated return value of sports data.

The correlation index between GNI per capita and performance results of the National Team constitutes 0.32, whereas between GDP per capita results it is only 0.23 ( $p < 0.05$  at  $r > 0.40$ ).

But if to consider the situation from the point of view of inactivity of the system of economic impacts, seeing that economic indices worsened, and consequences for dependent characteristics have an impact only after a while.

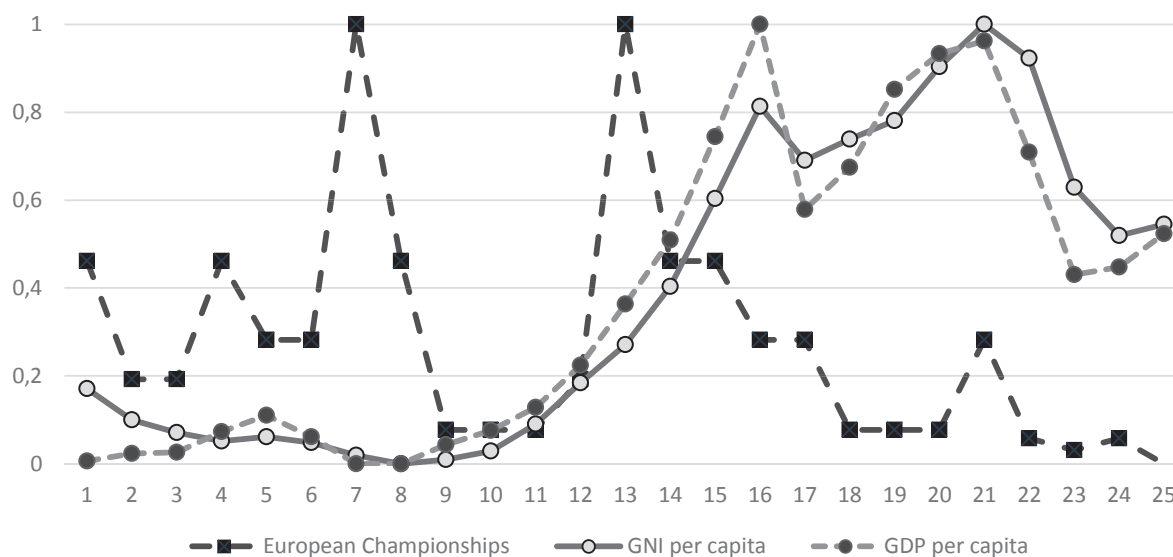


Fig. 3. Socio-economic Indicators of Ukraine and Performance Results of the Senior National Team with normalization to 0–1.

The analysis with the shift for one year (the correlation between social-economic data from 1993 to 2016 and sports data from 1994 to 2017) shows that the correlation index between performance results of the National Team and GNI; GDP indicators constitutes 0.41 and 0.26 respectively ( $p < 0.05$  at  $r > 0.40$ ). And with the shift for two years the data are 0.55 and 0.41 – that presents quite a strong interrelation ( $p < 0.05$  at  $r > 0.40$ ). And with the setback in three years it, in fact, figures rises to 0.67 and 0.60 ( $p < 0.05$  at  $r > 0.40$ ). Surely there are successful and failed performances which are not reflected by the economic tendency, but are rather explainable by internal factors of the country's National Team: actions of a coaching staff, change of sportsmen generations, successful (or, on the contrary, unsuccessful) performances by some sportsmen, etc. Fall of GNI of 39.2% from 2013 to 2016 (relative to 2013) and decrease of GDP of 38.0% from 2013 to 2017 (relative to 2013) are the greatest and coincide with the greatest falls in the performances of the Ukrainian National Teams. Generally, considering the influence of global economic indicators with the setback in several years, their profound influence on sporting results has been discovered.

However, the revealed relationship between socio-economic and sporting results may be the imposition of other factors, such as political and social, as well as a change of generations and retirement of some significant athletes, but it cannot be ruled out.

#### Conclusions and prospects for future research.

The conducted analysis demonstrates that there is seen an evident tendency for the decrease in the performance results of the Freestyle Wrestling National Teams during the last few years. Out of the considered factors the strongest interrelation (the correlation indices 0.67 and 0.60, indubitable significance  $p < 0,05$ ) is discovered with socio-economic indicators GNI per capita and GDP per capita respectively. No evident characteristics which influenced during the competition rules improvement in 2013 have been discovered. When analyzing performances of the Cadet and Junior Teams over the years of independence, the tendency for mistakes in long-term wrestlers training, that could lead to the present-day results decline of the Senior Team, is not observed. In future, it is planned to analyze the sports results in other significant sports and the relationship of socio-economic indicators to confirm or refute the data.

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