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Dynamics of the Competitiveness of Russian Male and Female Pole Vaulters During the 2020–2024 Olympic Cycle

The level of competitiveness in pole vaulting reflects not only athletic performance but also the effectiveness of athlete development within the discipline. This study examines changes in the competitive dynamics of Russian male and female pole vaulters during the 2020–2024 Olympic cycle and identifies factors associated with these changes. The analysis was based on official results from the Russian Indoor and Outdoor Athletics Championships. Competitive dynamics were assessed using a combination of literature review, comparative analysis of competition results, calculation of competitiveness coefficients, statistical analysis, and expert consultations with experienced pole vault specialists. The results indicate a gradual decline in competitiveness in the women's event, accompanied by lower performance density and a widening gap between leading athletes and the remainder of the field. In contrast, the men's event demonstrated relatively stable competitive characteristics throughout the study period. These findings provide an empirical assessment of the current state of the discipline and may contribute to improving long-term athlete development, optimizing competition planning, and monitoring the effectiveness of pole vault development programmes.

Keywords: pole vault, athletics, competitiveness, competitive performance, competitiveness coefficient, athletic reserve, Olympic cycle, competition results.

Introduction

Pole vault is one of the most technically demanding disciplines in athletics [1]. High athletic performance in this event depends not only on athletes' physical fitness but also on technical proficiency, psychological resilience, the quality of training facilities and equipment, and the effective organization of the training process [2, 3, 4]. The high level of competition at major championships places increasing demands on athlete preparation systems and necessitates continuous analysis of the factors determining successful competitive performance [5].

For many years, the Russian pole vault school has maintained a leading position in international athletics. Russian athletes have repeatedly won medals at the Olympic Games, World Championships, and European Championships, setting world records and contributing substantially to the development of the discipline. These achievements demonstrate the effectiveness of the national athlete development system and its significant contribution to the advancement of pole vaulting.

In recent years, however, Russian athletics has undergone substantial changes in its competitive environment. Limited participation of Russian athletes in international competitions, modifications to the national competition calendar, and generational changes among elite athletes have affected the intensity of domestic competition [6]. Under these circumstances, an objective assessment of the competitiveness of the discipline has become increasingly important for identifying development trends and evaluating the depth of the national talent pool.

Recent studies have primarily focused on improving pole vault technique, optimizing training methodologies, and analyzing competitive performance [2]. However, changes in the competitiveness of Russian pole vaulters throughout the 2020–2024 Olympic cycle have received relatively little attention. Most published studies have been limited to analyses of individual competition results or the performances of elite athletes, whereas comprehensive evaluations of changes in the competitive environment remain scarce [7].

The competitiveness of a sports discipline can be regarded as an integrated indicator reflecting its level of development, the depth of the athletic reserve, and the intensity of competitive rivalry. Analysis of its dynamics provides not only an assessment of elite athletic performance but also an understanding of broader developmental trends and changes occurring within the athlete preparation system.

Therefore, a comprehensive investigation of the competitiveness of Russian male and female pole vaulters based on the results of the major national competitions held during the 2020–2024 Olympic cycle is warranted.

The aim of the study was to examine the dynamics of the competitiveness of Russian male and female pole vaulters during the 2020–2024 Olympic cycle and to identify the factors influencing its changes.

Materials and Methods

The aim of this study was to examine the dynamics of the competitiveness of Russian male and female pole vaulters during the 2020–2024 Olympic cycle and to identify the factors influencing its development [8, 9].

The empirical basis of the study consisted of the official results of the Russian National Indoor and Outdoor Athletics Championships held between 2020 and 2024. The analysis included performances of athletes specializing in pole vault who held sports qualifications ranging from Candidate for Master of Sport (CMS) to Master of Sport of International Class (MSIC). The study covered ten national championships (five indoor and five outdoor competitions) conducted during the 2020–2024 Olympic cycle. The final dataset comprised 4,560 individual performances.

To achieve the study objective, a combination of complementary research methods was employed. A review and synthesis of the scientific literature were conducted to establish the current state of knowledge and identify existing approaches to evaluating competitive performance in athletics. Official competition results were analyzed to compile a database of athletes' performances and to conduct comparative analyses [10]. Comparisons of competition results across different years enabled the identification of changes in competitiveness throughout the Olympic cycle.

When interpreting the findings, consideration was given to the structure of the national competition calendar, changes in participant composition, and external factors that could influence the competitive environment.

Competitiveness was quantitatively assessed using a Competitiveness Coefficient (CompC), which reflects the density of athletes' performances within a competition [11, 12]. The coefficient was calculated separately for each championship, enabling year-to-year comparisons of competitiveness throughout the Olympic cycle. CompC was determined as the ratio between the cumulative performances of athletes ranked in the upper half and those ranked in the lower half of the final competition standings [13].

An increase in CompC indicated greater performance density and a higher level of competitive rivalry, whereas a decrease reflected reduced competitiveness of the discipline and a widening performance gap between the leading athletes and the remaining competitors.

The use of CompC made it possible to evaluate not only the performance level of elite athletes but also the depth of the national talent pool and the developmental trends of the discipline throughout the study period.

Statistical analyses were performed using Microsoft Excel and Statistica software. Mean values, absolute changes, and CompC values were calculated. The results are presented in tables and figures to illustrate changes in competitiveness in both men's and women's pole vault events.

To support the qualitative interpretation of the findings, consultations were conducted with experienced pole vault coaches and specialists involved in the preparation of high-performance athletes. Their expert opinions were used exclusively to assist in interpreting the results and were not included as an independent source of statistical evidence.

Only the official results of the Russian National Championships published by the Russian Athletics Federation were included in the analysis. Athletes who recorded No Valid Result (NVR) and performances subsequently invalidated by official decisions of the judging panel were excluded from the dataset. These selection criteria ensured data comparability and enhanced the reliability of the findings [14].

Results and Discussion

The dynamics of athletic performance in men's and women's pole vault were analyzed using the official results of the Russian National Athletics Championships held during the 2020–2024 Olympic cycle. The best performances achieved during this period are presented in Tables 1 and 2.

Table 1

**Top 12 performances in the women's pole vault at
the Russian National Championships during the 2020–2024 Olympic cycle**

Place	2020i	2021i	2022i	2022	2023	2023i	2024	2024i
1	4.92	4.75	4.65	4.91	4.70	4.62	4.73	4.73
2	4.65	4.65	4.55	4.65	4.55	4.55	4.45	4.63
3	4.60	4.55	4.45	4.45	4.50	4.55	4.45	4.63
4	4.55	4.55	4.45	4.35	4.40	4.45	4.45	4.35
5	4.45	4.45	4.45	4.25	4.30	4.45	4.35	4.35
6	4.45	4.35	4.35	4.25	4.30	4.35	4.35	4.20
7	4.35	4.35	4.25	4.10	4.30	4.20	4.35	4.20
8	4.25	4.25	4.25	4.10	4.20	4.05	4.20	4.20
9	4.10	4.10	4.10	4.10	4.20	4.05	3.70	3.90
10	4.10	4.10	4.10	4.10	4.10	3.90	3.70	-
11	3.95	3.95	4.10	3.90	4.10	-	-	-
12	3.90	3.95	3.95	3.65	4.10	-	-	-

Table 2

**Top 12 performances in the men's pole vault at the Russian National Championships
during the 2020–2024 Olympic cycle**

Place	2020i	2021	2021i	2022	2022i	2023	2023i	2024	2024i
1	5.65	5.80	5.55	5.70	5.75	5.87	5.65	5.72	5.82
2	5.55	5.55	5.55	5.65	5.55	5.82	5.65	5.72	5.77
3	5.55	5.55	5.45	5.60	5.45	5.77	5.45	5.60	5.66
4	5.55	5.45	5.45	5.40	5.30	5.50	5.45	5.50	5.53
5	5.45	5.45	5.45	5.40	5.30	5.40	5.30	5.30	5.53
6	5.45	5.45	5.30	5.40	5.30	5.30	5.30	5.30	5.45
7	5.30	5.35	5.30	5.30	5.15	5.30	5.30	5.30	5.45
8	5.30	5.35	5.15	5.30	5.15	5.30	5.30	5.30	5.45
9	5.30	5.15	5.15	5.30	5.15	5.15	5.30	5.30	5.30
10	5.30	5.15	5.15	5.15	5.15	5.15	5.30	5.15	5.30
11	5.30	5.15	5.15	5.15	5.15	-	5.15	4.60	5.15
12	5.00	5.00	5.15	5.15	5.15	-	5.00	4.60	5.00

The results demonstrate that the highest performances remained consistently high in both the men's and women's events throughout the study period. However, the distribution of performances within each group revealed notable differences in competitive density. In the women's event, while the leading athletes continued to achieve elite-level results, performances among lower-ranked competitors showed greater variability, indicating a gradual decline in the overall competitiveness of the discipline. In contrast, men's pole vault demonstrated a more homogeneous distribution of results, reflecting a relatively stable competitive environment.

To quantify changes in competitiveness, the Competitiveness Coefficient (CompC) was calculated separately for men's and women's competitions (Tables 3 and 4). This indicator reflects the density of

athletes' performances within each championship and enables comparisons across different years of the Olympic cycle.

Table 3

**Competitiveness Coefficient (CompC) for Women's Pole Vault
at the Russian National Championships (2020–2024)**

2020i	2021i	2022i	2022i	2022	2023	2023i	2024	2024i
0.89	0.90	0.92	0.92	0.89	0.93	0.60	0.59	0.44

Table 4

**Competitiveness Coefficient (CompC) for Men's Pole Vault
at the Russian National Championships (2020–2024)**

2020i	2021	2021i	2022	2022i	2023	2023i	2024	2024i
0.94	0.93	0.94	0.94	0.94	0.62	0.95	0.91	0.93

In the women's event, CompC remained relatively high between 2020 and 2022, ranging from 0.89 to 0.93. A marked decline was observed from 2023 onwards, with the coefficient decreasing to 0.60 at the 2023 Indoor Championships, 0.59 at the 2024 Outdoor Championships, and 0.44 at the 2024 Indoor Championships. These findings indicate a substantial reduction in performance density and an increasing performance gap between the leading athletes and the remaining competitors [15].

A different pattern was observed in the men's event. With the exception of one isolated decrease during the 2023 Outdoor Championships (CompC = 0.62), competitiveness remained consistently high throughout the Olympic cycle, with coefficient values generally ranging between 0.91 and 0.95. These results suggest that men's pole vault maintained a stable competitive structure and a sufficient depth of high-level athletes.

Figures 1 and 2 illustrate the temporal changes in CompC for women's and men's competitions, respectively. The graphical analysis confirms the contrasting trends observed in the coefficient analysis. Women's pole vault demonstrated a progressive decline in competitiveness, whereas the men's event maintained a relatively stable level of competitive density throughout the study period.

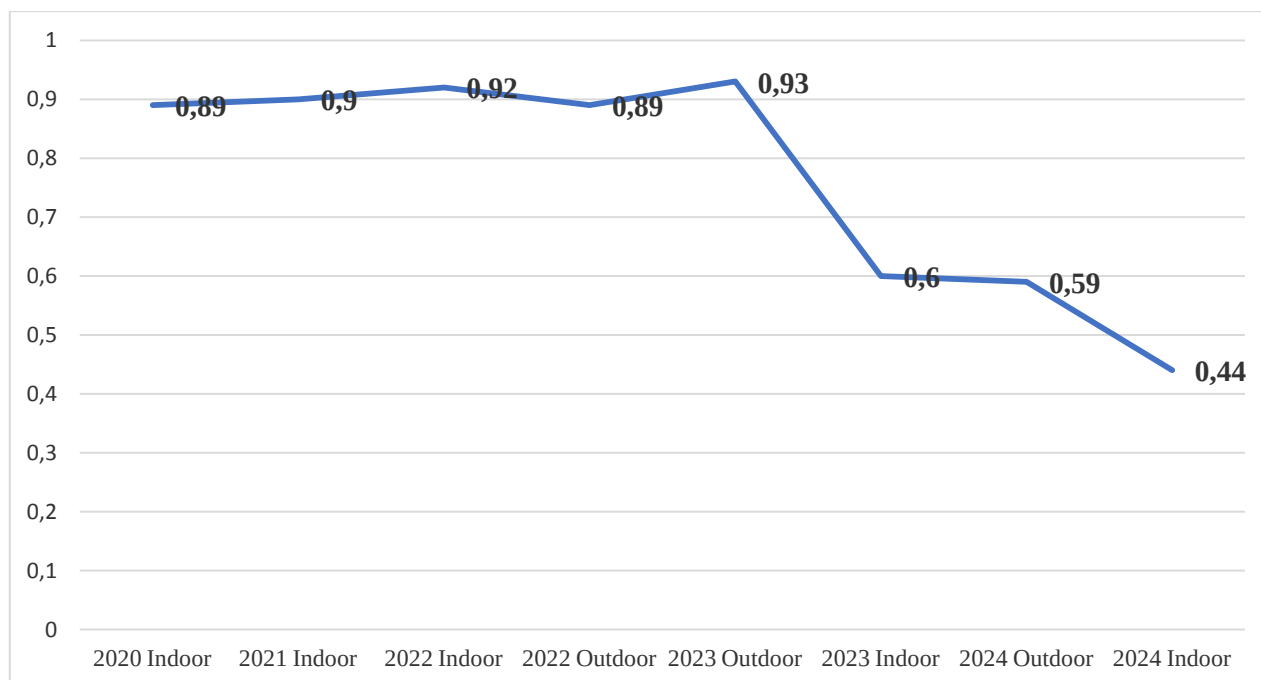


Figure 1. Dynamics of the Competitiveness Coefficient (CompC) in Women's Pole Vault at the Russian National Championships during the 2020–2024 Olympic Cycle

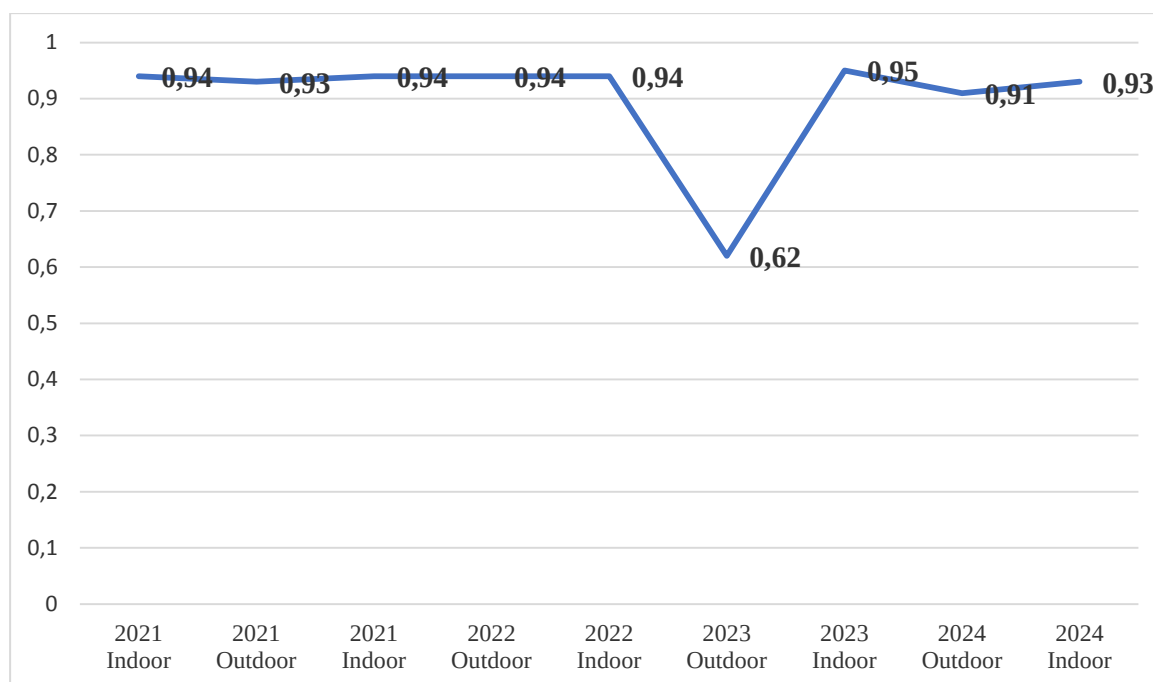


Figure 2. Dynamics of the Competitiveness Coefficient (CompC) in Men's Pole Vault at the Russian National Championships during the 2020–2024 Olympic Cycle

The present findings indicate divergent developmental trends in Russian pole vault during the 2020–2024 Olympic cycle. Although the performance level of the leading female athletes remained consistently high, the decreasing competitiveness coefficient suggests a reduction in the overall depth of the discipline. One possible explanation is the decline in the number of athletes participating in national championships. The expert consultations suggested that financial limitations faced by regional sports organizations could have influenced athlete participation in national competitions [16]. Several coaches noted that travelling to championships held in distant regions had become more difficult because of restricted funding. This explanation is consistent with the competition data. Championships conducted in Moscow and Chelyabinsk, where long-established pole vault training centres are located, attracted considerably more competitors than those held in Yekaterinburg. These differences in participation indicate that the geographical location of competitions, together with available financial support, may influence the competitive field [17].

The situation in the men's event differed from that observed in the women's competition. Throughout the 2020–2024 Olympic cycle, the level of competitiveness remained relatively stable. Leading athletes consistently achieved high performances, while new competitors regularly entered the national rankings. Taken together, these observations suggest that the current athlete development system continues to provide a sufficient reserve of talented male pole vaulters [5].

During the consultations, experts also discussed several issues that may become increasingly important in the coming years. Although regional training centres continue to produce successful athletes, specialists expressed concern about the gradual retirement of experienced coaches and the declining number of qualified coaching personnel. If this tendency continues, it may affect the continuity of athlete preparation and reduce the effectiveness of long-term training programmes. Similar concerns have been described in studies devoted to other sports, where the preservation of coaching expertise is regarded as an essential factor for maintaining competitive performance [18].

The changes observed in the women's event appear to be associated with several additional factors. One of them is the retirement of athletes who had represented Russia successfully at the international level for many years. Their departure reduced the number of competitors capable of achieving performances comparable with international standards, contributing to a wider gap between the leading athletes and the rest of the field. Experts also reported that fewer young women have recently chosen to specialize in pole vault. In their opinion, the limited opportunity to compete at major international events may have weakened motivation among young athletes and made the discipline less attractive as a long-term sporting career [7].

Conclusion

Analysis of the Russian National Athletics Championships over the 2020–2024 Olympic cycle showed that the men's and women's pole vault events followed different patterns of development. These differences were reflected in both the Competitiveness Coefficient (CompC) and the distribution of athletes' performances, indicating changes in the overall structure of national competition.

In the women's event, the leading athletes maintained consistently high performance levels throughout the Olympic cycle, whereas the gap between the leaders and the remaining competitors gradually widened. Together with the decline in the CompC, this suggests a gradual reduction in competitive depth. As fewer athletes approached the performance level of the leaders, opportunities for further progress through internal competition became more limited.

A different picture emerged in the men's event. Although the CompC varied slightly between individual championships, these fluctuations were not accompanied by meaningful changes in the overall distribution of performances. Across the Olympic cycle, a relatively broad group of athletes continued to compete at a consistently high level, indicating that the men's discipline retained both competitive stability and sufficient performance depth.

Overall, the analysis indicates that the two events followed different developmental paths during the Olympic cycle.

The present findings do not allow causal conclusions. Nevertheless, the observed trends may be associated with broader organizational and structural characteristics of the national athlete development system.

The methodological approach presented in this study may be used to monitor changes in competitiveness and to assist in evaluating athlete development programmes and national competition systems. Future studies should include longer observation periods, comparisons with international competitions, and further refinement of competitiveness indicators for technically demanding athletics events.

References

- 1 Yeadon, M. R., & Pain, M. T. G. (2023). Fifty years of performance-related sports biomechanics research. *Journal of Biomechanics*, 155, 111666. <https://doi.org/10.1016/j.jbiomech.2023.111666>
- 2 Frère, J., L'Hermette, M., Slawinski, J., & Tourny-Chollet, C. (2010). Mechanics of pole vaulting: A review. *Sports Biomechanics*, 9(2), 123–138. <https://doi.org/10.1080/14763141.2010.492430>
- 3 Gorbunov, V. A. (2020). *Sports-applied gymnastics in the system of specialized training means for pole vaulters* [Candidate of Sciences dissertation abstract] [in Russian].
- 4 Yagodin, V. M., & Nazarov, A. P. (2008). *Bases of young pole vaulters' preparation (Theoretical and methodological aspects)*. Moscow: Fizkultura i Sport [in Russian].
- 5 McKay, A. K. A., Stellingwerff, T., Smith, E. S., Martin, D. T., Mujika, I., Goosey-Tolfrey, V. L., Sheppard, J., & Burke, L. M. (2022). Defining training and performance caliber: A participant classification framework. *International Journal of Sports Physiology and Performance*, 17(2), 317–331. <https://doi.org/10.1123/ijsp.2021-0451>
- 6 Rees, T., Hardy, L., Güllich, A., Abernethy, B., Côté, J., Woodman, T., Montgomery, H., Laing, S., & Warr, C. (2016). The Great British Medalists Project: A review of current knowledge on the development of the world's best sporting talent. *Sports Medicine*, 46(8), 1041–1058. <https://doi.org/10.1007/s40279-016-0476-2>
- 7 Turner, K. J., Trowell, D., Millett, E. L., Bonacci, J., Kremer, P., Pickering, C., & Saunders, N. (2025). Can current metrics characterise or differentiate between elite track and field athletes within the sprints, hurdles, high jump, long jump and triple jump? A systematic review. *Sports Medicine*, 55(10), 2567–2594. <https://doi.org/10.1007/s40279-025-02284-5>
- 8 Haugen, T., Seiler, S., Sandbakk, Ø., Tønnessen, E., & Holmberg, H. -C. (2019). The training and development of elite sprint performance: An integration of scientific and best practice literature. *Sports Medicine — Open*, 5, Article 44. <https://doi.org/10.1186/s40798-019-0221-0>
- 9 Gross, M., Büchler Greeley, N., & Hübner, K. (2020). Prioritizing physical determinants of international elite pole vaulting performance. *Journal of Strength and Conditioning Research*, 34(1), 162–171. <https://doi.org/10.1519/JSC.0000000000003053>
- 10 World Athletics (2024). Competition and technical rules 2024 edition. Retrieved from <https://worldathletics.org/about-iaaf/documents/book-of-rules>
- 11 Vincent, W. J., & Weir, J. P. (2021). *Statistics in kinesiology* (5th ed.). Human Kinetics.
- 12 O'Donoghue, P. (2015). *An introduction to performance analysis of sport*. Routledge.
- 13 Hughes, M., & Bartlett, R. (2002). The use of performance indicators in performance analysis. *Journal of Sports Sciences*, 20(10), 739–754. <https://doi.org/10.1080/026404102320675602>
- 14 McGarry, T., Anderson, D. I., Wallace, S. A., Hughes, M. D., & Franks, I. M. (2002). Sport competition as a dynamical self-organizing system. *Journal of Sports Sciences*, 20(10), 771–781. <https://doi.org/10.1080/026404102320675620>

- 15 Dunn, E. L., Lawrence, G. P., Gottwald, V. M., & Hardy, J. (2025). Thirty years of longitudinal talent development research: A systematic review and meta-aggregation. *International Review of Sport and Exercise Psychology*, 18(2). <https://doi.org/10.1080/1750984X.2024.2309623>
- 16 Baker, J., Cobley, S., Schorer, J., & Wattie, N. (Eds.). (2020). *Routledge handbook of talent identification and development in sport*. Routledge.
- 17 Güllich, A., & Barth, M. (2024). Effects of early talent promotion on junior and senior performance: A systematic review and meta-analysis. *Sports Medicine*, 54(3), 697–710. <https://doi.org/10.1007/s40279-023-01957-3>
- 18 Collins, D., MacNamara, Á., & McCarthy, N. (2016). Super champions, champions, and almos: Important differences and commonalities on the rocky road. *Frontiers in Psychology*, 6, Article 2009. <https://doi.org/10.3389/fpsyg.2015.02009>

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