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METHODOLOGY FOR PREDICTING THE RESULTS OF COMPETITIONS FOR KAYAKERS AND CANOEISTS

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ABOUT ARTICLE

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Abstract: This scientific study examines effective methodological approaches to evaluating and forecasting competition results for canoe and kayak athletes. The research analyzes athletes' functional capabilities, physical and psychological preparedness, and technical-tactical skills as the main prognostic indicators. This methodology holds practical significance for coaches in optimizing the training process and ensuring comprehensive preparation for competitions.

Relevance of the Research. At the current stage of sports development, achieving high performance in canoeing and kayaking requires an in-depth analysis of athletes' preparedness and accurate forecasting of competition results. In a competitive sports environment, evaluating each athlete's capabilities and continuously monitoring their technical, physical, psychological, and functional condition has become an integral part of modern training processes. The relevance of this topic lies in the fact that, by assessing athletes' individual capabilities through advanced diagnostic and modeling tools, it becomes possible to improve the effectiveness of training through accurate predictions related to competition performance. This, in turn, creates favorable conditions for the proper management of athletic potential, injury prevention, and achievement of peak performance results.

Research Aim. To develop scientifically grounded methodological approaches that enable accurate forecasting and preliminary assessment of competition results for canoe and kayak athletes, and to identify modeling and monitoring mechanisms that contribute to the optimization of individual training processes.

Research Objectives. 1. To summarize and analyze scientific and methodological studies related to the research topic. 2. To identify the main prognostic indicators affecting the performance of canoe and kayak athletes, including functional capacity, physical, technical, and psychological preparedness levels. 3. To analyze diagnostic and monitoring methods that can be applied for the preliminary assessment of competition results.

Research Results and Discussion. The control types of training and competitive activities of canoe and kayak athletes, as well as the condition of various phenomena and systems, always imply the presence of a defined objective. Achieving this objective is considered one of the key functions of management. Therefore, any management process can be viewed as a system of goal-oriented actions that lead to the effective attainment of the desired result. To prepare a paddler with a real chance of winning, it is essential to have a reasonably accurate understanding of the performance levels typically demonstrated by competition winners and prize-winners. This knowledge allows for more effective management decisions, assessment of training quality, and the development of strategies for team selection and preparation.

From this perspective, the aim of the study focused on developing models of canoe and kayak athletes' competitive performance was to formulate a scientifically grounded forecast of canoeists’ athletic achievements at the XXXIII Olympic Games held in Paris in 2024.

The accuracy of prediction is influenced by numerous objective and subjective factors-such as social, biological, technical, and others-which are often difficult to formalize in the final outcome and whose effects are not always possible to determine precisely.

At the same time, predictive analyses serve as a crucial scientific basis for the effective development of high-performance sports. They make it possible to compare the available resources for organizing the training process (material and technical infrastructure, informational-methodological, medical, and personnel support) with the potential for further advancement of the canoe and kayak training system, including improvements in sports equipment and methods of biological support.

The analysis revealed that Olympic results across various canoeing disciplines consistently fluctuated between 1992 and 2008, marked by alternating periods of increasing

and decreasing competitive speeds. However, the overall trend indicated a renewed rise in athletic performance, with noticeable shifts observed among canoe and kayak athletes during the Olympic Games. Charts 7 through 14 illustrate year-by-year performance indicators of winners and medalists from the 1992 to 2008 Olympics. The most effective models for forecasting race speeds in Olympic competitions have been developed for different classes of racing boats.

In conclusion, the highest race speeds among winners and medalists in canoe sprint events during the 1992–2008 Olympic Games were recorded in the men's category. During this period, athletes in the K-1 and C-1 classes demonstrated positive trends in pre-competition performance over the 1000-meter distance. Specifically, solo canoeists showed an average improvement of 5%, while athletes from Group A exhibited up to a 6% increase in speed.

During our analysis, it was found that in the K-2 and C-2 boat classes over the 1000-meter distance, race speeds increased by approximately 0.5% and 1%, respectively. In K-4 boats of both classes A and B, a more noticeable improvement in speed was recorded.

Meanwhile, in the women's Olympic canoe sprint events over 500 meters, significant changes were also observed. The most pronounced increase in competitive speed occurred during the race phase. In particular, B-class K-4 boats showed a marked improvement, with performance gains reaching up to 6%.

In addition, an increase in speed of approximately 1% was observed in individual (K-1) events. Notably, A and B class pairs (K-2) also demonstrated enhanced performance, with recorded improvements in race speed.

Thus, despite the trends identified in the dynamics of competitive speed, it is possible to forecast further growth in athletic achievements. This is primarily due to the extremely high level of competition and the increasing density of results. For example, at the 2008 Beijing Olympic Games, the leading athletes practically occupied all prize-winning positions. The difference in performance between kayakers and canoeists was within the range of 1.0–1.5 seconds, and in many cases, the gap between winners and medalists was narrowed down to mere hundredths of a second.

According to forecasts related to the Olympic Games, continuous improvement of the structural characteristics of racing boats and paddles has been identified as a key factor. In particular, the individual selection of sports equipment based on the paddlers' anthropometric characteristics, their physical fitness, and specific paddling techniques plays a crucial role in

enhancing performance efficiency. At the XXX Olympic Games, the analysis of winners' and medalists' speed indicators was carried out through scientific forecasting methods, taking into account the trends in the sport's development.

At the same time, the performance indicators of canoe sprint athletes at the XXXIII Olympic Games held in Paris in 2024 were also analyzed. The accuracy of the forecasts across various disciplines of paddle sports ranged from 95% to 100%.

In determining the 2024 Olympic medalists, a forecasting model based on distance-specific speeds was used to predict the results of kayakers and canoeists. The national kayak and canoe team participated in nine final races, securing one gold and two bronze medals. During the Paris 2024 Olympics, predictive and actual performance outcomes were analyzed for men's 1000-meter and women's 500-meter kayak and canoe events. Forecasted time and speed over the 1000-meter distance were compared with actual results. The level of accuracy between the forecasts and real performances was also examined (see Table 1).

During the 19th Asian Games, held in Hangzhou from September 23 to October 8, 2023, forecasted and actual results of canoe and kayak competitions were analyzed. The table compares predicted times and speeds with the actual performance outcomes, also indicating the accuracy levels of the forecasts.

Men's Events (1000-meter distance): C-2 (double canoe): Uzbek athletes secured first place with a finishing time of 3 minutes 43.5 seconds, which closely matched the forecast range of 3:43.3–3:45.1. The speed achieved (approximately 4.84 m/s) was also near the predicted value, with an accuracy level between 98.0% and 98.8%. The second and third place teams finished with a time of 3:49.9, slightly below the forecast range, yet the predictive accuracy remained high, ranging from 96.5% to 97.8%.

K-2 (double kayak): The first-place result was achieved in 3 minutes 25.3 seconds, with a corresponding speed of 4.87 m/s. This performance closely aligned with the predicted range, showing an accuracy level between 98.5% and 99.2%. The second and third place finishers recorded a time of 3:30.7, which was slightly slower but still maintained approximately 97% accuracy relative to the forecast.

K-4 (four-person kayak): The winning time was 3 minutes 01.5 seconds (equivalent to 5.16 m/s), indicating a highly effective performance with an accuracy of 99.0% to 99.5%. The second and third place results were 3:04.8 minutes (5.02 m/s), slightly below the predicted range, but still within a high accuracy margin.

C-1 (single canoe): The first-place athlete completed the race in 3 minutes 51.0 seconds, nearly fully matching the forecast, with 98–99% accuracy. The second and third place times were 3:54.5 minutes, reflecting 97.5–98.5% forecast precision.

K-1 (single kayak): The first-place result was 3 minutes 41.2 seconds, outperforming the forecast and even exceeding 100% predictive accuracy. The second and third place times were 3:49.9 minutes, falling slightly below the forecasted values.

Women's Events (500 meters): In the K-2 (double kayak) event, the Uzbek duo Shubina and Tanatmisheva secured the bronze medal with a time of 1:49.9 minutes. This result was very close to the predicted range, with an accuracy of 98.5–99.5%. The teams placing second and third finished in 1:52.8 minutes, also showing high accuracy levels between 97.5–98.5%.

In the K-4 (four-person kayak) event, the winning team completed the race in 1:39.9 minutes, corresponding to a prediction accuracy of 99.0–100%. The teams finishing second and third clocked in at 1:42.9 minutes, which also closely matched the forecasted outcomes. To achieve the best final result in competition, an athlete must manage their energy expenditure effectively. In this sport, the biochemical origin of energy differs for two main reasons.

On one hand, an optimal time implies a high speed, which requires overcoming significant water resistance forces—making powerful propulsion essential. On the other hand, increased physical work leads to greater fatigue, more challenging movement coordination, and consequently, reduced efficiency in utilizing the expended energy.

In this sport, it can be observed that changes in boat speed are associated with an increase in the hydrodynamic resistance of water. Using a strategy of very high speed in the first half of the race distance is also considered inefficient in terms of energy expenditure. Completing the first and second halves of the race in approximately the same amount of time results in significantly lower energy consumption while still achieving the planned result.

Conclusion. In conclusion, Uzbek canoe and kayak athletes demonstrated a high level of consistency and preparedness in their training. The minimal differences between predicted and actual results indicate that the athletes were in excellent competitive form. In most events, the prediction accuracy ranged between 97% and 100%, which also confirms the reliability of scientifically based sports forecasting methods.

Competitive distances in canoeing and kayaking differ in terms of demands, and it is crucial to complete the designated distances in a short time without technical errors. In both canoe and kayak events, the race strategy for covering the competition distance plays a key role

in achieving high-level results. The most objective and practical indicator of this strategy is the time taken to cover the intermediate segments of the race, which can be measured during competition. It is well known that the most effective tactic is to cover the race distance at an even pace. The strategy of evenly distributing movement throughout the distance has been theoretically proven as well.

Based on our analysis and observations, energy expenditure during the race is closely related to the amount of work performed and the conservation of strength for the final stretch. This is expressed through a tactical approach that ensures an even distribution of energy consumption. In the initial stages of the distance, the strategy involves minimizing energy expenditure -the paddler should use only a small portion of their energy. Achieving the planned result in a race requires accurate distribution of energy over short intervals to maintain the necessary pace at each stage. Research has shown that when this strategy is applied, the total energy expenditure over the entire distance remains very high, which underlines the importance of proper energy management throughout the race. .

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1-jadval

2023-yil 23-sentabrdan 8-oktabrgacha Xanchjou shahrida bo‘lib o‘tgan XIX Osiyo o‘yinlarida baydarka va kanoechilar bashorat qilingan va haqiqiy natijalar

Intizom		O’rni	Natija, Prognoz / Fakt	Bashorat qilinadigan tezlik, m/s Prognoz / Fakt	Prognozning aniqligi, %
Erkaklar 1000 m	C -2	1	3:43.1–3:45.1 / 3:43.5	4.94–4.90 / 4.84	98.0–98.8
		2-3	3:46.2-3–3:48.0 / 3:49.9	4.89–4.85 / 4.80	96.5–97.8
	K- 2	1	3:24.1–3:26.0 / 3:25.3	4.91–4.85 / 4.87	98.5–99.2
		2-3	3:28.2–3:30.0 / 3:30.7	4.80–4.75 / 4.73	97.2–98.1
	K- 4	1	3:00.2–3:02.0 / 3:01.5	5.20–5.15 / 5.16	99.0–99.5
		2-3	3:03.3-4–3:05.0 / 3:04.8	5.10–5.05 / 5.02	98.2–98.9
	C- 1	1	3:50.1–3:52.0 / 3:51.0	4.85–4.80 / 4.83	98.0–99.0
		2-3	3:53.3–3:55.0 / 3:54.5	4.78–4.75 / 4.76	97.5–98.5
	K- 1	1	3:42.2–3:44.0 / 3:41.2	4.95–4.90 / 4.98	99.0–100.5
		2-3	3:45.1-2–3:47.0 / 3:49.9	4.89–4.85 / 4.80	96.5–97.8
Ayollar 500 m	K -2	1	1:49.2–1:51.0 / 1:49.9	4.58–4.52 / 4.54	98.5–99.5
		2-3	1:52.3–1:54.0 / 1:52.8	4.47–4.42 / 4.43	97.5–98.5
	K- 4	1	1:38.1–1:40.0 / 1:39.9	5.10–5.00 / 5.01	99.0–100.0
		2-3	1:41.3–1:43.0 / 1:42.9	4.95–4.85 / 4.86	98.0–99.0

Izoh: K-1 bu yakka baydarkada bitta sportchi, K-2 ikki kishilik baydarkada ikki nafar sportchi, K-4 to’rt kishilik baydarka, C-1 – bu kanoe (Kanoeda sportchi bir tizzasida o’tirib bitta eshkak bilan eshadi. C-2 ikki kishilik kanoe.