SUMMARY

THE IMPACT OF INDIVIDUAL SPORTS EVENTS ON THE FINAL DECATHLON RESULT AT DIFFERENT STAGES OF A SPORTS CAREER

The decathlon is probably one of the most difficult and demanding athletic events. It has been held since the end of 1911. The complexity of this form of multi-discipline contest caused by the number and diversity of its component events, the difficult and time-consuming training process and the multitude of factors affecting the final result, made it often the subject of scientific research.

The main objective of the study was to analyze the career progression of the best decathletes in Poland and worldwide, leading to the investigation of the impact of individual component events on the final decathlon result at four stages of career development and within three periods of the history of men's multi-discipline events (1985–2015, 1968–1984, 1960–1967).

The collected research material including data on the 1533 best starts in every year of the selected athletes' careers contained information on the final result and partial results achieved in individual decathlon events. The collected data were assigned to three research protocols (taking into account the age, subsequent years of starts and the years before and after achieving the personal best) and four stages of athlete's development (junior, adolescent, sports championship and the period of results decrease).

To characterize the changes taking place in the course of athletes' careers, among others basic measures and statistical tests (ANOVA), segmental recurrence model and time series analysis (single-base and chain indices) were used. In addition, the analysis of Pearson's linear correlation was used to determine the impact of individual component events on the final result and examine the relationships between the components.

In this study, advanced mathematical models for predicting theoretical development of Polish and foreign athletes' careers (artificial neural networks – RBF) and examining the complexity and internal structure of the decathlon (principal components analysis – PCA) were also used.

The analysis of the career development of leading Polish and world's athletes carried out in this study made it possible to determine the optimal age of sports championship, to show which groups of athletes or stages of sports development significantly differentiate the levels of final and partial results achieved. Moreover, numerous and statistically significant

relationships between the ten component events that also affect the final result and definition of factors determining the internal decathlon structure associated with the results achieved were observed. Furthermore, the application of RBF networks enabled the modeling and estimation of the theoretical development of decathlon careers.

The conducted analyzes and the results obtained made it possible to formulate the following conclusions:

- The duration of sport career of athletes competing today (period 1985–2015) is prolonged, and the optimal age of decathlonists, at which they achieve record results (both in the group of the world's and Poland's best decathletes) is 27 years. Leading athletes competing today need about 10 years to achieve the best results.

- The segmental regression model depicted the continuous and dynamic progress of the results achieved in the initial and subsequent years of the career, which lasts until the athlete achieves results at the highest level. After this period, there is a continuous decrease in the level of average final results.

- In the group of the world's best athletes, the results obtained in partial events significantly differentiate the subsequent stages of sports development. Taking into account the individual events, stage II is characterized by the best results in the 1500 m run, stage III features the dominance of the most speed and strength-speed events, and at stage IV, the best shot put and pole vault (technical skills) results are achieved.

- The impact of component events on the final decathlon result changes throughout the whole period of "sports ontogeny". Currently (1985–2015), the most important are results in speed events (100 m, long jump, 400 m, 110 m hurdles), as well as in shot put and pole vault.

- The relationships between individual events have a motor basis. The relationships between speed events (100 m – long jump – 400 m – 110 m hurdles) are important, and their strength increases in subsequent periods of research (from 1968 to 2015). The weakest relationships with other events were observed in difficult technical events (high jump and pole vault) and in the 1500 m run.

- The analysis of the principal components allowed for the use of multi-dimensional structures in the grouping of events having similar importance in the context of the final result. The data indicate the dominance of factors combining speed and strength (in the period after 1985) and strength and speed (period up to 1984). The package of events in

which fitness abilities dominate, includes mainly short runs (100 m, 400 m, 110 m hurdles), long jump, as well as throws (mainly shot put and discus throw).

- Theoretical estimation of the development of partial results based on artificial neural networks makes it possible to determine the point increases in the component events in relation to age, stage of the sports career and the current sport performance level. The RBF network suggests a dynamic development of such events as pole vault, long jump, 110 m hurdles and discus throw (first stage of development), a clear, even development in the 7th year of a sports career and regress (apart from throws) at the final stage of sports championship.

- The analysis of sports championship development divided into four training stages makes it possible to assess the correctness of the results development and result predictions in relation to specific groups of the decathlonists. The correlation relationships as well as the results of multidimensional analyzes allow for organization of trainings combining training units and individual training cycles.