



Regional basic sports qualification method: economic and statistical provisions

UDC 796.078, 51-78



PhD, Associate Professor **A.V. Litvin**¹
 PhD, Associate Professor **A.N. Lashkarev**¹
¹Udmurt State University, Izhevsk

Corresponding author: litvin-andrey@mail.ru

Abstract

Objective of the study was to develop a regional basic sports selection/ qualification method using modern economic mathematics to match the findings with the actual basic sports reported by the regional sports authorities, with the Udmurt Republic taken for the case study.

Methods and structure of the study. It was in 2013 that the national Ministry of Sports issued a basic sports qualification procedure for the constituents of the Russian Federation effective for four-year periods.

We mined the input data for our basic sports qualification method in the annual governmental statistical reports 1-FK of 2014-2017 and 2018-2020 submitted by the Udmurt Republic regional executive offices to the Ministry of Sports. The yearly data arrays in these reports are provided in matrices with 73 lines that list the local sports and 18 columns with 14 statistical indices plus 3 expert ones. The sport discipline priority for basic sports qualification is specified in a binary column as 0 for non-basic and 1 for basic sports. We applied the commonly used data mining technique to find the potential correlations and logics in the input data arrays.

Results and conclusion. The study demonstrated benefits of the new regional basic sports qualification method that takes into account the actual progress indices of every sport discipline for the prior periods.

Keywords: *basic sports, region, statistical report, factor analysis, linear model, weight matrix, forecast.*

Background. "Basic sports" are defined by the relevant Federal Law as "the sports disciplines listed in programs of Olympic Games, Paralympic Games, Deaflympic Games, plus other sports favored by the Russian Federation constituents in their areas with respect to the popular historic traditions, progresses of the local sports leaders, their qualifications for the national sports teams and successes of the latter in the national and international championships" [4]. As provided by the valid budgeting regulations, basic sports are in special priority in the federal and regional budgets. It should be mentioned, however, that some sports popular in one or another region demonstrate a high popularity and progress regardless of whether or not they are formally financed by the budgets.

Objective of the study was to develop a regional basic sports selection/ qualification method using

modern economic mathematics to match the findings with the actual basic sports reported by the regional sports authorities, with the Udmurt Republic taken for the case study.

Methods and structure of the study. It was in 2013 that the national Ministry of Sports issued a basic sports qualification procedure for the constituents of the Russian Federation effective for four-year periods [5]. Table 1 gives the basic sports reported by the Udmurt Republic government for two such periods.

The above Table shows little differences of the periods that may be interpreted as indirectly indicative of some inertia, tradition or stereotypes in the relevant regional decision-making process.

We mined the input data for our basic sports qualification method in the annual governmental statistical reports 1-FK of 2014-2017 and 2018-2020 submitted

Table 1. Basic sports reported by the Udmurt Republic for two four-year periods

2014-2017	2018-2021
Basketball*	Biathlon
Biathlon	Boxing*
Mountain biking	Mountain biking
Cycling races	Cycling races
Handball	Handball
Track and Field Athletics	Judo*
Cross-country skiing	Track and Field Athletics
Table tennis*	Cross-country skiing
Swimming	Swimming
Rifle shooting	Rifle shooting
Bench shooting	Artistic gymnastics*
Figure skating*	Bench shooting
Football	Football

*unrepeated (period-specific) sports

by the Udmurt Republic regional executive offices to the Ministry of Sports [3, 6]. The yearly data arrays in these reports are provided in matrices with 73 lines that list the local sports and 18 columns with 14 statistical indices plus 3 expert ones. The sport discipline priority for basic sports qualification is specified in a binary

column as 0 for non-basic and 1 for basic sports. We applied the commonly used data mining technique [1, 2, 7] to find the potential correlations and logics in the input data arrays.

Results and discussion. Having processed the data arrays, we calculated the weight matrices that show linear correlations of the input indices with a few implicit factors. Table 2 hereunder gives the weight matrix for 2014-2017.

The above Table shows the first three factors (P1, P2, P3) as the most informative. The machine algorithm ranks the factors in a descending order by their contributions, with the strong linear correlations bolded in the Table. Thus, P1 factor shows a significant correlation with the following six indices: sports facilities, sports organizations, coaches, athletes, sporting population and total finance; that means that the factor may be used as indicative of the sport popularity. Note that it shows no significant linear correlation with the competitive success and priority rates of the sports. Furthermore, P2 factor shows insignificant linear correlations (above 0.7 in absolute value) with the indices. Some correlation can be found for the athletes in the sporting population and the 1-3 places won in the national competitions – indicative of the sport

Table 2. Weight matrix for 2014-2017

Index	P1	P2	P3
National championships	-0,35	0,27	-0,08
Sports facilities	-0,83	0,36	-0,01
Local sporting population	-0,76	0,31	0,23
Active athletes in the local sporting population	-0,17	-0,62	-0,24
Sports organizations	-0,78	-0,1	-0,19
Sports popularity	-0,23	0,28	-0,83
Sports management/ coordination difficulty	0,01	0,17	-0,89
Accessibility	-0,54	-0,06	-0,11
Total finance, RUR thousand	-0,94	0,04	0
Athletes	-0,94	0,05	0,01
Coaches	-0,95	0,1	-0,02
Competitions	-0,59	-0,3	0,05
Referees	-0,65	0,15	0,16
Local qualifiers for the national teams	-0,55	-0,46	0,33
1-3 places won in the national championships	-0,54	-0,62	-0,11
1-3 places won in the international championships	-0,23	-0,58	-0,23
Basic 14	-0,4	0,37	0,29

Table 3. Weight matrix for 2018-2021

Index	P1	P2	P3
National championships	-0,33	-0,05	-0,06
Sports facilities	-0,82	-0,28	-0,14
Local sporting population	-0,77	-0,25	0,14
Active athletes in the local sporting population	0,18	0,44	-0,15
Sports organizations	-0,83	0,28	-0,1
Sports popularity	-0,27	0,04	-0,89
Sports management/ coordination difficulty	-0,02	0,19	-0,89
Accessibility	-0,55	0	-0,02
Total finance, RUR thousand	-0,94	-0,09	0,01
Athletes	-0,94	-0,09	0,01
Coaches	-0,95	-0,09	-0,03
Competitions	-0,5	0,12	0,16
Referees	-0,62	-0,18	0,15
Local qualifiers for the national teams	-0,21	0,87	0,22
1-3 places won in the national championships	-0,37	0,79	0,23
1-3 places won in the international championships	-0,18	0,84	-0,07
Basic 18	-0,44	-0,12	0,17

**Table 4. Modeled (M) indices versus the sport priority rates (PR)**

2014-2017	M1	PR1	2018-2021	M2	PR2
Track and Field Athletics	1,18	1	Track and Field Athletics	1,22	1
Football	1,11	1	Rifle shooting	1,06	1
Mountain biking	0,95	1	Cycling races	1,01	1
Rifle shooting	0,85	1	Judo	1,00	1
Cycling races	0,83	1	Swimming	0,86	1
Swimming	0,82	1	Football	0,78	1
Biathlon	0,76	1	Artistic gymnastics	0,75	1
Bench shooting	0,58	1	Bench shooting	0,70	1
Table tennis	0,55	1	Biathlon	0,69	1
Handball	0,54	1	Basketball	0,49	0
Basketball	0,50	1	Kickboxing	0,46	0
Equestrian sports	0,48	0	Mountain biking	0,45	1
Cross-country skiing	0,46	1	Cross-country skiing	0,43	1

professionalization. And P3 factor refers to the sport popularity and management/ coordination difficulty as provided by the expert survey. Table 2 hereunder gives the weight matrix for 2018-2021.

Table 3 shows the structure of factors close to the prior period, with the exception of P2 factor indicative of the athletes' successes i.e. qualifications for the national teams highly correlated with the top places won in the national and international events. Skipping a detailed description of the model, we would note the following: although the sport priority index is not included in the most informative factors for the both periods, it may be fairly well modeled using by a set of indices. Moreover, the logistics model secures a complete matching of the formally approved and forecast basic sports due to the greater flexibility of the model. We used a simple linear model for calculations as it gives a reasonable range of basic sports options for consideration for the next period rather than secures a full match. Table 4 hereunder gives summarized results of the model.

The above Table data (with the M values descending to $M > 0.4$) shows the following errors in the formal basic sports qualifications: figure skating in 2014-17; and handball and boxing in 2018-21; whilst the model gives priority to equestrian sports, basketball and kickboxing. It should be noted that when the bottom threshold of the model is raised (for example, to $M > 0.5$), the erroneous formal basic sports numbers would change significantly.

Conclusion. The study demonstrated benefits of the new regional basic sports qualification method

that takes into account the actual progress indices of every sport discipline for the prior periods.

References

1. Ayvazyan S.A., Mkhitarian B.C. Applied statistics and basics of econometrics. Moscow: UNITY publ., 1998.
2. Zaryadov I.S. Introduction to R statistical package: variable types, data structures, reading and writing information, graphics. Moscow: Peoples' Friendship University of Russia publ., 2010. 207 p.
3. Litvin A.V., Shulikovskaya V.V., Arkalov D.P. Methodology for distribution of budgetary funding by sports in the region: case study of Udmurt Republic. *Finansovaya ekonomika*. 2018. No. 5. pp. 74-79.
4. On amendments to the federal law "On physical education and sports in the Russian Federation, 25.12. 2012, No. 257-FL.
5. Order of the Ministry of Sports of the Russian Federation of 25.04.2018 No. 592 "On approval of the list of basic sports for 2018-2022".
6. Order of the Federal State Statistics Service of 23.10.2014 No. 626 "On the approval of statistical tools for organization by the Ministry of Sports of Russia of federal statistical monitoring of performance of physical education and sports institutions".
7. Soshnikova L.A., Tamashevich V.N., Uebe G., Shefer M. Multivariate statistical analysis in economics. Academic study guide. Moscow: UNITY-DANA publ., 1999. 598 p.