Analysis of network interaction in the context of physical education and sports activities of universities

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Abstract. The realization of the various interests of students in the sports activities of universities requires educational institutions to have a diverse material and technical base: sports facilities of various specifics, qualified personnel, and methodological developments. At the same time, the capabilities of individual higher education institutions are limited. The solution to this problem is possible through the integrated use of the resource base of several educational institutions and municipal facilities for the organization of sports and athletic activities. An effective exchange of resources is based on network models of relationships, the management of which is based on the provisions of the theories of strategic and general management and a project approach. The purpose of this study was the formation of a network model of interaction in the processes of sports activities of universities in the Sverdlovsk region. The study was conducted by the Physical Education and Sports Department in conjunction with the Management and Entrepreneurship Department of the Ural State University of Economics in the period 2019-2020. The information ground of the study is formed based on the analysis of plans for sporting events, tender documentation, as well as the database of contracts concluded by participants in the strategic network. The research methodology is based on a network theory and involves the construction of a directed graph, where the nodes are university subjects, and objects of network interaction are placed on arcs. The results of the study show that the network model is of the concentric type, the main unifying projects in the framework of physical culture and sports activities are such sports events as “Nations Cross”, “Universiade of the Sverdlovsk Region” and “Ski Track of Russia”. There are no links in the network interaction scheme due to the need to implement on a contractual basis the training courses included in the Basic professional educational programs of higher educational institutions, the network is based only on participation in external events initiated by state and municipal authorities, the corporate sector, sports organizations and universities themselves.

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1 Introduction

As numerous studies show, the growing scientific interest to the formation of network interaction strategies, since they allow to successfully solve the issues of coordinating the activities of a significant number of participants, to overcome the resource limitations of individual universities through the formation of partnerships, unions, and associations. The theory of strategic management considers networks as a way of organizing activities of relatively independent entities, which are higher education organizations in the context of the subject of this study. Subjects maintain independence, but at the same time combine resources and form stable relationships with respect to objects of interaction. For sports activities of the university, joint projects, including both educational activities and socially significant events with the participation of universities, act as objects. The network strategy of sports activities of the university can provide coordination of the activities of network entities to achieve the following socially significant strategic goals:

- the formation of students' ability to adhere to ethical values and a healthy lifestyle;
- the formation of students' ability to use methods and means of physical education to ensure full social and professional activities.

It is the nature of the goals of sports activity that determines the features of objects of network interaction, connections, and ways of formalizing network relations. Relations may include communications of entities, joint activities, and the resources exchange. The formalization of relations can be voluntary or fixed in a set of agreements.

The methodological basis for the study is network theory, in which various relationships between subjects are explained in terms of the concept of “network” [1-5]. It was noted in work [5] that three key terms are used in the context of network theory: network formation, networks, and network structures. Networking is a general term for activity, which creates connections between people and organizations through regular meetings, conferences, and new communication technologies. Networks are formed when relations between organizations or individuals are formalized, become regular and subordinate to the principle of satisfying mutual interests. Network structures arise when the activity of separately acting network elements is already insufficient. An article of Keast [6] noted that network structures arise when the actors in the network realize that they are only “small fragments of the big picture”. Network structures may require independent actions of individual members, but at the same time, network participants, when they undertake the solution of complex tasks that are impossible for independently functioning organizations, are transformed into a new whole. Moreover, as noted in the book [7], people depend on each other and have, at the same time, their own interests ... in a certain sense, we could even talk about a coalition of divergent interests.

The complex nature of the university's sports activity management processes necessitates the development of a methodology that considers the dual goals of network interaction of subjects and resource limitations of the university's sports strategy. In modern science, developed common approaches to solving this problem.

The process methodological approach to the university's sports strategy assumes that the strategy development is proposed by the authors to the stages of its formation and implementation, for example, using the well-known SWOT analysis method. So, in the article [8], the necessity of using an assessment of the effectiveness of the strategy of physical culture and sports activity through a seven-point assessment corresponding to the use of a seven-stage order of strategy formation is noted. The work [9] focuses on the possibility of using official statistics forms in assessing the effectiveness of indicators.

The resource concept in the strategic management of various objects is represented quite widely. The article by Evseev & Volkov [10] examined the information resources of sports and athletic activities. The article by Neverkovich & Popov [11] shows the parameters of

resources from the position of economic regulators of sports activities. Also, in an article by Popov [12], it was noted that technological (or resource) efficiency is understood as the degree of intensity of the use of commercial resources of a physical culture and sports activities organization in terms of the ratio between the output of various types of products and the size of the expended resources.

2 Methods and types of the Earth’s remote sensing

Most authors emphasize the importance of the material and technical base and staffing for the sports and athletic activities of the university. We fully share this point of view while starting from the hypothesis of increasing the resource base for the implementation of physical culture and sports activities of universities through the use of a network interaction strategy with both higher education organizations and other organizations with the ability to provide sports infrastructure facilities [13-14].

In our proposed methodology, each parameter characterizing the projects of physical education and sports activities of the university corresponds to a group of indicators presented in table 1.

Table 1. Formalization of the project’s parameters of the universities’ physical education and sports activities

Physical education and sports project’s parameters	Indicator	Assessment method
The needs of the implementation of the Basic professional educational program	The number of class hours for the implementation of physical education disciplines in the curriculum	Summarizing class hours for physical education disciplines in the curriculum of the corresponding Basic professional educational program
	The number of students professionally engaged in various types of sports activities	Estimated by counting the number of students engaged in various types of sports activities on January 1 of the current year
	The number of students engaged in sports sections	Estimated by counting the number of students involved in sports sections on January 1 of the current year
	The number of physical education and sports events at the university	Estimated by counting the number of physical education and sports events for the current academic year
Social effects of the physical education and sports project	The value of physical culture and sports activities for students	Estimated by a student survey “How interesting are physical education classes for you at the university?” on a five-point scale
	The share of the population of the municipality systematically involved in physical education and sports	Estimated by using the data on the number of people engaged in physical education and sports aged 3-79 years according to form No. 1-FC "Information on Physical Culture and Sports" according to Federal State Statistics Service on January 1 of the reporting year
Human resources of the project	Compliance of numerical characteristics with the requirements of personnel support for the project	Estimated as the ratio of actual and standard number of employees
	Compliance of qualification characteristics with the requirements of the project staffing	Estimated as the share of workers who meet the required qualifications of the total

Table 1. Continued

Material and technical and financial resources of the project	Using of sports facilities in the project	The indicator is estimated with detailing by types of sports facilities as a share of the time it takes to fill this facility during the implementation of the project from the annual operating time fund
	Using of sports equipment in the project	The indicator is estimated with detailing by types of sports equipment as a share of the time of its use in the implementation of the project from the annual fund of operating time
	The amount of financial resources involved in the project	Estimated as the share of financial resources matching the total project costs

Thus, the presented list of indicators allows to analyze the university’s network interaction and form the basis for making managerial decisions regarding the formation of a pool of physical education and sports projects that will expand the resource base for student’s trainings.

3 Results

The results of the study of network interaction in accordance with the above methodology in relation to physical education and sports activities of the Ural State University of Economics are presented in table 2.

Table 2. Network strategy map of physical culture and sports activities of the Ural State University of Economics

Map Fields	Projects	Mandatory of implementation	The number of class hours for the implementation of physical education disciplines in the curriculum	The number of students professionally engaged in various sports	The number of students engaged in sports sections	The number of physical education and sports events at the university	The value of physical culture and sports activities for students	The share of the population of the municipality systematically involved in physical education and sports	Compliance of numerical characteristics with the requirements of personnel support for the project	Compliance of qualification characteristics with the requirements of project staffing	Using of sports facilities in the project	Using of sports equipment in the project	The amount of financial resources involved in the project
1	Basic professional educational programs 1-10	yes	4000	277	97	0	1,961	0,000	0,889	0,889	1,105	1,105	0,800
2	Nation Cross 2019	not	12	517	0	1	1,667	0,000	0,667	0,667	0,003	0,003	0,700
3	Relay race "For the prize of the newspaper Evening Ekaterinburg"	not	8	374	0	1	4,118	0,000	0,778	0,889	0,002	0,002	0,700

Table 2. Continued													
	Fitness Congress	not	24	130	0	1	4,216	0,000	0,778	0,778	0,007	0,007	0,700
	Spartakiad of the Leninsky district	not	12	21	0	1	3,725	0,000	0,667	0,667	0,003	0,003	0,700
	Competitions in Ekaterinburg city for shooting from pneumatic weapons "Open tournament of USUE"	not	12	18	0	1	2,843	0,000	0,889	0,889	0,003	0,003	0,700
	All-Russian team sambo tournament among students in memory of the USSR master of sports	not	28	22	0	1	3,039	0,000	0,778	0,889	0,008	0,008	0,700
	Badminton Open Tournament	not	24	52	0	1	1,176	0,000	0,778	0,667	0,007	0,007	0,800
	Climbing Championship of the Sverdlovsk Region	not	12	25	0	1	1,471	0,000	0,778	0,667	0,003	0,003	0,700
	Open championship of the Sverdlovsk region in the struggle of sambo among senior schoolchildren at the "Rector Cup of USUE"	not	8	351	0	1	4,902	0,000	0,667	0,889	0,002	0,002	0,800
	All-Russian race "Ski Track of Russia - 2019"	not	12	461	0	1	1,275	0,000	0,667	0,778	0,003	0,003	0,700
	Universiade of the Sverdlovsk region	not	54	48	0	1	4,216	0,000	0,778	0,778	0,015	0,015	0,700
	Badminton Open Tournament	not	20	75	0	1	3,725	0,000	0,778	0,667	0,006	0,006	0,800
3	The regional championship of the Association of student sports clubs (chess, table tennis)	not	20	25	0	1	1,569	0,000	0,778	0,889	0,006	0,006	0,800
	Climbing Championship of Ekaterinburg city	not	20	18	0	1	0,980	0,000	0,667	0,667	0,006	0,006	0,700
	Badminton Open Tournament	not	20	63	0	1	3,824	0,000	0,667	0,667	0,006	0,006	0,700
	Relay race of the Leninsky district	not	24	25	0	1	3,431	0,000	0,667	0,889	0,007	0,007	0,800
	Victory Day airgun competition	not	12	20	0	1	1,176	0,000	0,778	0,778	0,003	0,003	0,700
	USUE Climbing Open Tournament "LIGHTNING" among elementary school students	not	12	9	0	1	4,118	0,000	0,667	0,778	0,003	0,003	0,800

Table 2. Continued												
"Ready for work and defense" festival among special schools	not	24	24	0	1	3,725	0,000	0,778	0,778	0,007	0,007	0,700
Climbing Championship of the Russian Student Sports Union, speed	not	24	18	0	1	4,020	0,000	0,889	0,667	0,007	0,007	0,800
Championship of the Ural Federal District in Volleyball (2nd stage of the All-Russian Universiade)	not	26	18	0	1	1,275	0,000	0,889	0,778	0,007	0,007	0,700
Military sports games among university students	not	26	11	0	1	1,765	0,000	0,667	0,778	0,007	0,007	0,800
Student regatta	not	12	23	0	1	3,529	0,000	0,667	0,778	0,003	0,003	0,800
Total		4446	2625	97	23		0,002			1,228	1,228	

As can be seen from table 2, the Ural State University of Economics is characterized by overloading field 3 of the network strategy map for physical education and sports activities, which is due to restrictions on the venues for events, provision of equipment and personnel of the necessary qualifications. This situation allows us to predict a decrease in the presence of the university in network interaction and a focus on the implementation of the mandatory part of educational programs. Next, in Figure 1, we present a summary diagram of network interaction in the contexts of physical education and sports activities of universities of the Sverdlovsk region.

Fig. 1. Scheme of network interaction of physical culture and sports activities of universities of the Sverdlovsk region

The study allowed to identify projects with the greatest participation of students, which include:

- Universiade of the Sverdlovsk region, this project is carried out under the general supervision of the Ministry of Physical Culture and Sports of the Sverdlovsk Region represented by the State Autonomous Institution of the Sverdlovsk Region "Center for the Organization and Holding of Physical Culture and Sports Events" and the Student Sports Union of Sverdlovsk Region;
- The mass race “Nation Cross”, in which at least 20,000 university students, schoolchildren, students of secondary schools, and pupils of children and youth sports schools take part annually;
- “Ski Track of Russia”, participation in this event is annually attended by over 3,000 university students of the Sverdlovsk region.

The analysis showed that a large role in strengthening the physical training of students, the organization and holding of physical culture, health and sports events, the promotion of physical culture and sports is played by sports clubs of professional educational organizations and educational organizations of higher education. The leading positions in the organization of this direction are occupied by sports clubs of the Ural Federal University named after the First President of Russia B.N. Yeltsin (UrFU), the Federal State Budgetary Educational Institution of Higher Education "Ural State Mining University", and the Federal State Budget Educational Institution of Higher Education "Ural State Pedagogical University". UrFU Sports Club is one of the largest sports organizations in the Sverdlovsk Region. The club is actively developing sports such as athletics, rock climbing, basketball, various martial arts, handball, futsal. Students of the Federal University are part of the sports teams of the Russian Federation in 15 sports. In addition, the study revealed

that students of secondary professional educational organizations and educational institutions of higher education in the Sverdlovsk region who do not have their own sports facilities are engaged in city sections and sports facilities of industrial enterprises, and participate in regional and city competitions. The problems of the development of student sports are the poor provision of sports equipment and the absence of many educational organizations' own sports facilities.

4 Conclusions

An analysis of the interaction scheme of physical education and sports activities of the universities of the Sverdlovsk region allows us to conclude that the network model is of the concentric type, the main unifying projects in the framework of sports and sports activities are Nation Cross, Universiade of the Sverdlovsk Region and Ski Track of Russia. There are no connections in the network interaction scheme due to the need to implement on a contractual basis the training courses included in the main professional educational programs of higher educational institutions. The network is based only on participation in external events initiated by state and municipal authorities, the corporate sector, sports organizations and universities themselves.

The characteristic of the ratio of the number of objects to the number of network entities is approximately equal to unity, which indicates its low productivity, which once again indicates an insufficient number of interaction objects (projects). The characteristic of the orientation of the connections makes it possible to identify two universities that are most actively using the network strategy of physical culture and sports activities: Ural State University of Economics and Ural State University of Architecture and Art, while other network entities show low repeatability of connections. The characteristic of network connectivity allows us to identify the presence of a group of independent entities whose participation in network interaction projects is fragmented.

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