

Optimization of resource use in the formation of a network interaction model

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Abstract. The article is based on the research materials of the network interaction of universities in the context of physical culture and sports activity. The research is based on the methodology of network theory and the resource approach in the strategic management of organizations. The results of the study show that the formation of a network model can significantly increase the coverage of the population with projects of physical culture and sports activity using already existing resources. The results obtained indicate the effectiveness of strategies for networking organizations.

1 Introduction

The formation of a network strategy for managing a university is a priority task at the present stage of development of the education system of the Russian Federation. Its use is based on resource, relational and network theories, the provisions of which are adapted for the university as an object of strategic management in the works of A.A. Gres'ko, M.S. Rakhmanov, K.S. Solodukhin [1], K.S. Eleneva, Yu.Ya. Yeleneva [2], V.N. Lupanov [3]. Network strategic management in general involves the use of various integrative forms in order to form and effectively use the infrastructural, intellectual and resource potential of network participants [4].

These multifaceted connections are explained within the framework of the concept of "network", which is a set of individual subjects of physical culture and sports activity and multidirectional connections between them. In the work of M. Castells [5] it is noted that in the context of the theory of networks, three key terms are used: network formation or networking, networks and network structures. Networking is a general term for activity, as a result of which connections are created between people and organizations through regular meetings, conferences, new communication technologies. Networks are formed when connections between organizations or individuals are formalized, i.e. become regular and subordinate to the principle of satisfying mutual interests. Network structures arise when the activity of separately acting network elements is no longer sufficient. Keast R. et al. [6] noted that network structures arise when the actors participating 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 members, when they take on complex tasks that are beyond the capacity of independently operating

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organizations, are transformed into a new whole. Moreover, as noted in W. Mastenbrook's 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.

At the same time, the subjects within the network organization of physical culture and sports activity in Russia have their own hierarchical characteristics [8]. So at the primary level, professional and amateur teams are distinguished at educational organizations and enterprises whose activities are related to physical culture and sports, amateur physical culture and sports teams, sports schools, sports clubs and sections.

The subjects of the primary level are the basis for the subjects of the second level of the hierarchy, whose activities are related to the issues of methodological, coordination and financial support of the primary level. The subjects of the second level of the hierarchy include sports associations, sports leagues and sports confederations.

On the basis of the subunits representing the primary public organizations of physical culture and sports in the Russian Federation, larger organizations are formed, designed to improve the efficiency, organizational and methodological or commercial leadership of the field of activity that unites these people. In the Russian Federation, such public organizations are: sports organizations, physical culture and sports societies, sports associations, sports federations, sports leagues, sports confederations, sports unions.

It is quite obvious that effective network strategies make it possible to resolve issues of coordination of activities, to overcome the resource constraints of individual universities through the formation of partnerships, unions, and associations. In turn, the theory of strategic management considers networks as a way of organizing the activities of relatively independent subjects, which in the framework of the subject of this study are institutions of higher education. Subjects remain independent while pooling resources and forming stable relationships with respect to objects of interaction. And for the physical culture and sports activities of the university, the objects are joint projects, including both educational activities and socially significant events with the participation of universities.

2 Methods

In the context of the research, the following conceptual model of the formation of a network strategy for the interaction of physical culture and sports activities of a university within the framework of the project approach is presented in Figure 1.

The implementation of the conceptual model essentially corresponds to the solution of a large-scale optimization task, where the target function is to maximize the number of participants included in the projects of physical culture and sports activity, and resource constraints provide for the analysis of the following:

- Sport facilities;
- Sport equipment;
- Financial resources;
- Staff.

According to the proposed model, it is necessary to analyze the totality of projects of physical culture and sports activities of the university, which are planned to be implemented in the coming period. The main factors of the analysis are determined by the needs for the resources involved for the implementation of these projects. At the same time, the possibilities of external counterparties - potential participants in network interaction are being studied, their characteristics and resource potential are determined, which can be used in the implementation of joint projects.

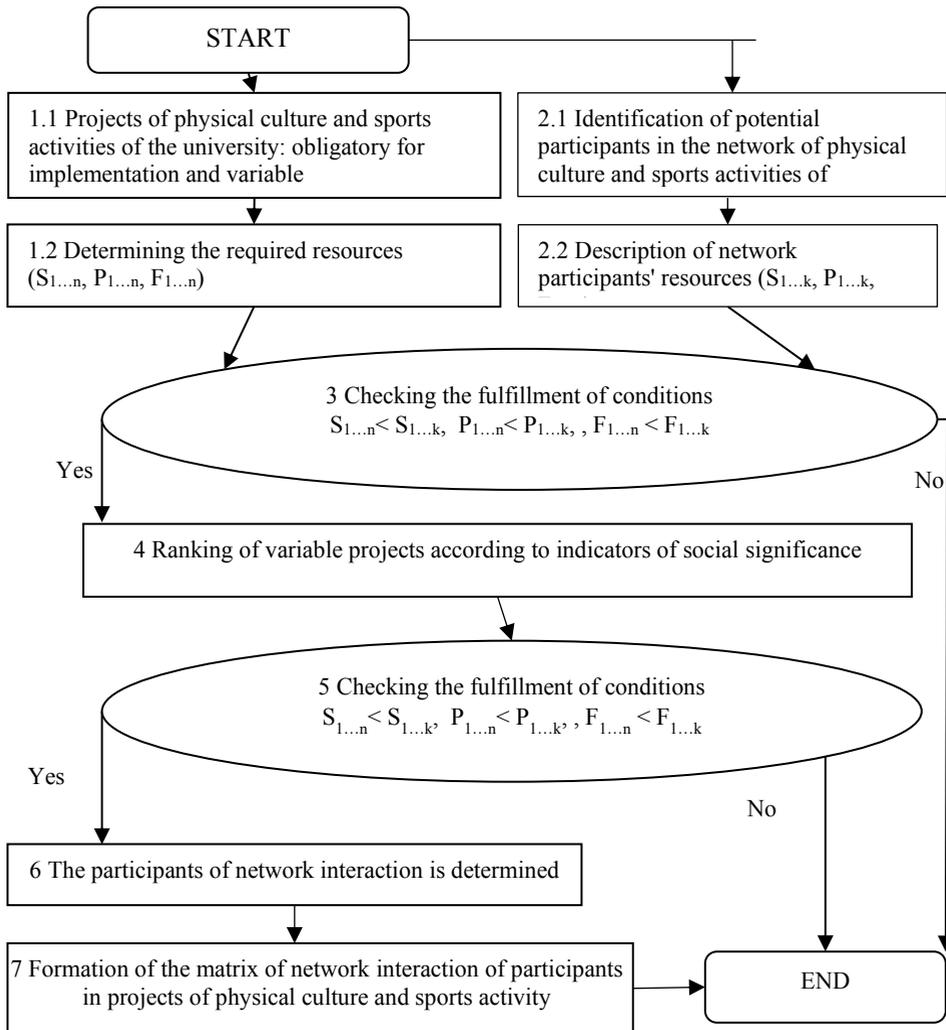


Fig. 1. Conceptual model of network management of physical culture and sports activities of the university within the framework of the project approach

Next, you should correlate the resources available to the university and the resources of partners. If it turns out that there are not enough resources, but at the same time there are network actors with these resources in a large (sufficient) volume, then you can proceed to the next step, which should assess the social significance of the projects planned for implementation. After ordering according to the degree of importance, it is possible to form a matrix of network interaction of the participants of the planned projects.

3 Results

On the basis of the proposed algorithm, a complex of projects of physical culture and sports activity of universities of the Sverdlovsk region was formed. Table 1 presents the characteristics of the projects obtained as a result of the implementation of stages 1.1 and 1.2 of the methodology.

Table 1. The list of projects of physical culture and sports activities implemented in the territory of the Sverdlovsk region and their resource requirements.

Name of projects of physical culture and sports activities of universities of the Sverdlovsk region			Resource requirements			
			Sports facilities	Sports equipment	Financial resources	Staff
Obligatory projects	Basic professional educational programs № 1-10	FSBEI HE "Ural State University of Economics"	4000	4000	4160	7644
	Basic professional educational programs № 1-3	ANO HE "Humanitarian University"	408	408	2104	2489
	Basic professional educational programs № 1-15	FSAEI HE "Russian State Vocational Pedagogical University"	1437	1437	7840	6578
	Basic professional educational programs № 1-45	FSAEI HE "Ural Federal University named after the first President of Russia B. N. Yeltsin"	18058	18058	30880	19133
	Basic professional educational program № 1	FSBEI HE "Yekaterinburg State Theater Institute"	71	71	1232	1213
	Basic professional educational program № 1	FSBEI HE "Ural State Conservatory named after M.P. Mussorgsky"	149	149	1760	1240
	Basic professional educational programs № 1-3	FSBEI HE "Ural State Medical University "Ministry of Health of the Russian Federation"	829	829	4160	4178
	Basic professional educational programs № 1-7	FSBEI HE "Ural State Pedagogical University"	2862	2862	5320	3867
	Basic professional educational programs № 1-5	FSBEI HE "Ural State Law University"	1878	1878	5440	4000
	Basic professional educational programs № 1-5	FSBEI HE "Ural State Agrarian University"	608	608	1840	1333
	Basic professional educational programs № 1-3	FSBEI HE "Ural State University of Architecture and Art"	106	106	1040	711
	Basic professional educational programs № 1-12	FSBEI HE "Ural State Mining University"	3713	3713	6800	6133
	Basic professional educational programs № 1-12	FSBEI HE "Ural State Forest Engineering University"	2983	2983	6800	5756
	Basic professional educational programs № 1-7	FSBEI HE "Ural State University of Railway Transport"	3249	3249	5320	5511

Continuation of Table 1. The list of projects of physical culture and sports activities implemented in the territory of the Sverdlovsk region and their resource requirements.

Variable projects	Military sports games among university students	26	26	52	39
	All-Russian race "Ski track of Russia"	12	12	24	18
	All-Russian sambo team tournament among students in memory of the USSR master of sports	28	28	56	42
	Nation Cross	12	12	24	18
	Open championship of the Sverdlovsk region in sambo wrestling among senior schoolchildren for the "Cup of the Rector of Ural State University of Economics"	8	8	16	12
	Open badminton tournament	24	24	48	36
	Ural State University of Economics open rock climbing tournament "LIGHTNING" among junior schoolchildren	12	12	24	18
	Championship of Yekaterinburg in rock climbing	20	20	40	30
	Championship of the Sverdlovsk region in rock climbing	12	12	24	18
	Volleyball Championship of the Ural Federal District (2nd stage of the All-Russian Universiade)	26	26	52	39
	Regional Championship of the Association of Student Sports Clubs (chess, table tennis)	20	20	40	30
	Competition in Yekaterinburg in shooting from pneumatic weapons "Ural State University of Economics Open Tournament"	12	12	24	18
	Competition in shooting from pneumatic weapons "Victory Day"	12	12	24	18
	Spartakiad of Leninsky district	12	12	24	18
	Student regatta	12	12	24	18
	Universiade of the Sverdlovsk region	54	54	108	81
	"Ready for Labor and Defense" festival among correctional schools	24	24	48	36
	Fitness congress	24	24	48	36
	Championship of the Russian Student Sports Union in climbing, speed	24	24	48	36
	Relay "For the prize of the newspaper Vecherniy Yekaterinburg"	8	8	16	12
Relay race of Leninsky district	24	24	48	36	

The next step is to characterize the resource capabilities of each university from the standpoint of potential network interaction in the context of projects of physical culture and sports activities in accordance with paragraphs 2.1 and 2.2 of the developed methodology. Information on resource capabilities is presented in table 2.

Table 2. Resource characteristics of participants in network interaction

University name	Uni.No.	Availability of time for the use of sports facilities, hour / year	Availability of time for the use of inventory, hour / year	Availability of financial resources, thousand rubles	Time available for staff participation, hour / year
FSBEI HE "Ural State University of Economics"	1	3620	3620	5200	8600
ANO HE "Humanitarian University"	2	1230	1230	2630	3200
FSAEI HE "Russian State Vocational Pedagogical University"	3	4456	4456	9800	7400
FSAEI HE "Ural Federal University named after the first President of Russia B. N. Yeltsin"	4	18660	18660	38600	24600
FSBEI HE "Yekaterinburg State Theater Institute"	5	860	860	1760	1560
FSBEI HE "Ural State Conservatory named after M.P. Mussorgsky"	6	900	900	2200	1860
FSBEI HE "Ural State Medical University "Ministry of Health of the Russian Federation"	7	2500	2500	5200	4700
FSBEI HE "Ural State Pedagogical University"	8	3700	3700	7600	5800
FSBEI HE "Ural State Law University"	9	3400	3400	6800	4500
FSBEI HE "Ural State Agrarian University"	10	1100	1100	2300	1500
FSBEI HE "Ural State University of Architecture and Art"	11	640	640	1300	800
FSBEI HE "Ural State Mining University"	12	5600	5600	8500	6900
FSBEI HE "Ural State Forest Engineering University"	13	4500	4500	8500	7400
FSBEI HE "Ural State University of Railway Transport"	14	4200	4200	7600	6200
Total		55366	55366	107990	85020

The analysis showed that the total time of possible use of sports infrastructure facilities and sports equipment of universities in the Sverdlovsk region is more than 55 thousand hours, the time of staff use is 85 thousand hours, and financial resources are estimated at more than 107 million rubles. Since these resources are unevenly distributed among universities, the optimization task, which is posed as part of the development of strategies for network interaction of universities, boils down to ensuring the most efficient use of resources, taking into account the preference of projects in terms of social indicators, as well as reaching the maximum possible number of participants. To solve this problem, we will consider the use of resources for the implementation, first of all, of projects of physical culture and sports activity that are obligatory for implementation in universities (point 3 of the developed methodology), table 3.

Table 3. The result of comparing the availability and use of resources of physical culture and sports activities of universities for obligatory projects

Obligatory project name	University No.	Sports facilities	Sports equipment	Financial resources	Staff
Basic professional educational programs № 1-10	1	-380	-380	1040	956
Basic professional educational programs № 1-3	2	822	822	526	711
Basic professional educational programs № 1-15	3	3019	3019	1960	822
Basic professional educational programs № 1-45	4	602	602	7720	5467
Basic professional educational program № 1	5	789	789	528	347
Basic professional educational program № 1	6	751	751	440	620
Basic professional educational programs № 1-3	7	1671	1671	1040	522
Basic professional educational programs № 1-7	8	838	838	2280	1933
Basic professional educational programs № 1-5	9	1522	1522	1360	500
Basic professional educational programs № 1-5	10	492	492	460	167
Basic professional educational programs № 1-3	11	534	534	260	89
Basic professional educational programs № 1-12	12	1887	1887	1700	767
Basic professional educational programs № 1-12	13	1517	1517	1700	1644
Basic professional educational programs № 1-7	14	951	951	2280	689

As can be seen from the table, for almost all participants in network interaction, there is no shortage of resources for the implementation of obligatory projects due to the fulfillment of the requirements of the main professional educational programs. At the same time, there is a shortage of space and inventory at FSBEI HE "Ural State University of Economics", so this university is forced to enter into network interaction with other universities in order to compensate for the emerging resource shortage of some of the sports facilities for the implementation of obligatory projects.

Next, we will perform the steps of stages 4 and 5 of the methodology and select participants for network interaction based on an optimization model, which includes the target function – maximizing the number of people participating in physical culture and sports activities, taking into account resource constraints: sports facilities, sports equipment, financial resources and staff. Let's consider the resource limitations of the formed matrix of the network model of physical culture and sports activity of universities of the Sverdlovsk region, table 4.

Table 4. Resource restrictions of the formed matrix of the network model of physical culture and sports activity of universities of the Sverdlovsk region

Resources	Indicator	University No.													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sports facilities	Allocated resources for networking projects	0	268	448	448	220	212	330	448	318	124	56	448	448	448
	Existing resources	-380	822	3019	602	789	751	1671	838	1522	492	534	1887	1517	951
	Resource allocation result	-380	554	2571	154	569	539	1341	390	1204	368	478	1439	1069	503
Sports equipment	Allocated resources for networking projects	0	268	422	422	220	212	330	422	318	124	56	422	422	422
	Existing resources	-380	822	3019	602	789	751	1671	838	1522	492	534	1887	1517	951
	Resource allocation result	-380	554	2597	180	569	539	1341	416	1204	368	478	1465	1095	529
Financial resources	Allocated resources for networking projects	0	520	828	828	424	408	644	828	620	248	112	828	828	828
	Existing resources	1040	526	1960	7720	528	440	1040	2280	1360	460	260	1700	1700	2280
	Resource allocation result	1040	6	1132	6892	104	32	396	1452	740	212	148	872	872	1452
Staff	Allocated resources for networking projects	0	414	645	645	342	330	507	645	489	186	84	645	645	645
	Existing resources	956	711	822	5467	347	620	522	1933	500	167	89	767	1644	689
	Resource allocation result	956	297	177	4822	5	290	15	1288	11	-19	5	122	999	44

As the analysis of the resources allocation of participants in network interaction shows (Table 4), the expansion of participation in projects of physical culture and sports activities of universities is mainly due to the provision of projects with the necessary additional personnel, and also, which turned out to be most typical for ANO HE "Humanitarian University" and FSBEI HE "Ural State Conservatory named after M.P. Mussorgsky", restrictions with financial support of projects were revealed.

The results obtained allow us to speak about the effectiveness of using the project approach in the strategy of network management of physical culture and sports activities of universities, since the number of participants involved can be significantly increased from 31 917 to 41 151 people with more effective use of existing resources. Further research can be aimed at a more detailed description of the project profiles of universities - participants in network interaction and analysis of the balance of the network strategy.

4 Conclusions

The results of the study allow us to confirm the provisions of the network theory and the resource approach in the strategic management of organizations regarding the achievement of higher indicators with the effective use of opportunities for the involvement and redistribution of resources within the network. The data obtained can be used within the framework of territorial locations to increase the effectiveness of the use of both sports infrastructure facilities and, in general, for social facilities.

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