

# DEVELOPMENT OF STRATEGIC INTERACTION OF AGENTS OF ENTREPRENEURSHIP INFRASTRUCTURE

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## Abstract

In today's economic environment, a transformation of relationships of key market participants occurs, which includes entrepreneurs, investors, government structures and infrastructure agents. In this case, the nature of relationship in the process of infrastructural provision should be determined by strategic direction of infrastructure agents actions.

The article considers the entrepreneurship infrastructure as a multi-agent system of networking interaction, within which a reduction in transaction costs of doing business takes place, which necessitates investment platforms within the association of investors in order to reduce investment risks for collective market participants. The subject study includes the main achievements and conclusions of neo-institutionalism theory, theory of social justice, as well as methodological tools of mathematical modeling and statements of game theory.

The article generates a new theoretical and methodological approach to development of entrepreneurship infrastructure and interaction of its agents. The ways of institutionalizing the cooperation of infrastructural support agents to achieve the best efficiency of entrepreneurship infrastructure are identified.

**Keywords:** entrepreneurship infrastructure, interaction strategy, multi-agent system, entrepreneurship.

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## 1. Introduction

In modern economy, the relationships of key market participants are transformed: entrepreneurs, investors, government agencies and infrastructure agents, which involves the search for and implementation of a new theoretical and methodical approach to the formation of infrastructure support system for entrepreneurship. In this case, the type of relationships in the process of infrastructure support should be determined by the strategic focus of the agents' actions.

In this aspect, the entrepreneurship infrastructure is considered as a multi-agent system of network interaction, within the framework of which the transaction costs of the entrepreneurship organization are reduced. The agent-oriented approach

to the formation of the entrepreneurship infrastructure is realized through the model of interaction of agents with the identification of synergy options: market, logistics, social, investment, innovation and that of labor resources. The interrelation of agents requires the identification of conditions for their interaction and strategic direction of their actions. Multiagent system as a priority issue suggests the identification of certain types of interaction strategies: socially-oriented behavior, implementation, innovation-oriented strategy and coalition strategy. The conditions and the order of interaction of agents for achieving efficiency in the infrastructure of entrepreneurship are determined.

## **2. Theory**

The networkization of economic space and the development of information and communication technologies are objective prerequisites for changing the subject composition of entrepreneurship infrastructure and the mechanism for realizing its functions. This is manifested in the fact that in conditions of increasing the level of uncertainty in the external environment and replacing the specialization of economic infrastructure agents with universal integrity (autonomy), the probability of developing a deterministic algorithm for making effective management decision is reduced, or the solution of the task is complicated by significant amount of transaction costs.

When constructing the enterprise infrastructure, it is important to take into account both external signs and features of the economic environment on which the degree of explicitness (openness) of interaction will depend, as well as internal signs of self-organization and implicit (hidden) properties of economic agents. For this, the introduction of agent-based approach contributes to the provision of adaptive management of entrepreneurship infrastructure, taking into account the uncertainty of environmental factors and dynamism of infrastructure formation.

It should be noted that, according to the report of the Government of the Russian Federation (RF), dynamics of entrepreneurship structures for the recent years has declined: the turnover of entrepreneurship entities fell to 32.4% in 2014, compared to 34.2% in 2013. Only 4.7% of working-age people (according to “

Global Entrepreneurship Monitoring 2014” project) are beginning entrepreneurs, while in the BRICS countries the indicator is higher (Brazil - 17.2%, China - 15.5%, India - 6 , 6%, South Africa - 7%), and in the US regions the indicator reaches 13.8%.

According to the data of the Central Bank of the Russian Federation, in 2015 the share of small and medium-sized enterprises (SMEs) in the total portfolio of legal entities and individual entrepreneurs was 16.9% with the world average of 23%. The share of SME products in total export according to the Federal Customs Service reached only 6% in 2015. Similar phenomena testify to ineffective policy in the field of support and stimulation of entrepreneurship.

According to the World Bank's "BusinessDoing-2016" report (profile of the country of the Russian Federation), the rating of domestic business environment as to 10 criteria among 189 countries reached the 51 place in 2015 (compared with 54 in 2014), and the total indicator "Easinessof business running” was 70.99% in 2015 (compared with 69.26% in 2014). Thus, the conditions for doing business in Russia still require the significant transformation.

Analysis of data on indicators of doing business in the country allows us to formulate the following conclusions.

#### Rating of business opportunities in the Russian Federation (according to the World Bank's BusinessDoing 2016)

Topics	DB 2016 Rating	DB 2015 Rating	Change in rating
Registration of enterprises	41	34	↓-7
DealingwithConstructionPermits	119	117	↓-2
Connection to the power supply system	29	53	↑24
Registration of property	8	8	No change
Getting loans	42	61	↑19
Protection of minority investors	66	64	↓-2
Taxation	47	50	↑3
International trade	170	169	↓-1
Enforcementofcontracts	5	5	No change
Resolving Insolvency	51	44	↓-7

Source: BusinessDoing 2016 favorablebusinessenvironmentrating (WorldBankGroupproject) [11]

Increase in the rating of business conditions is stipulated by solving the problems of access of entrepreneurship structures to energy resources and the

credit system, as well as by reforms in the field of credit policy. According to international experts, the most problematic areas of the business environment in the Russian economy are procedures for registration of enterprises, guarantees of minority investors and resolution of insolvency of enterprises, as well as implementation of international trade. Such conclusions allow us to judge the imperfection in the development of relations as agents of the market and business structures, as well as instability in the development of relations between investors and business owners.

One of the ways to improve the development of relations between market agents and entrepreneurship structures is the agency-oriented approach, which in world practice is widely used in the formation of transport, logistics, graphic, geoinformation systems, implementing management tasks in online trading [1], emergency response [2] and modeling the social structures [3].

As part of this approach, the entrepreneurial infrastructure is treated as a multi-agent system based on the distributed intelligence of agents with a set of implicit properties. This ensures their independence in the development of management decisions, adaptability to changes in environmental factors, the desire for interaction, activity and communication .[10]

When implementing relationships within the framework of business infrastructure provision, various types of interaction take place between entrepreneurial entities, infrastructural support and state bodies acting as a regulator, which facilitates the establishment of the order of interaction through the formation of the regulatory framework. As a result, the interaction of participants in the infrastructure support of entrepreneurship contributes to the achievement of the goals of social and economic development.

The effectiveness of interaction is achieved by taking into account factors that affect the development of entrepreneurship in the market infrastructure.

According to the results of the analysis, it is obvious:

1. The most favorable conditions for doing business: vocational education, commercial and physical infrastructure, as well as dynamics of markets.

2. Evaluation of social image is significant, which contributes to the possibility of acquiring a high social status of entrepreneurs.

3. Low indicators of evaluation are: the level of state regulation, the solution of problems of taxation and licensing (in particular, protection of intellectual property) [9].

The conditions that hamper the development of entrepreneurial potential are identified: the inadequacy of government funding sources and subsidizing the entrepreneurship.

The effectiveness of interaction of agents is achieved through the effective performance of functions of the participants performed in the formation of the infrastructure.

Functions of mutual influence of participants in the formation of the entrepreneurship infrastructure (author's approach)

managing managed	entrepreneurs	Agents of infrastructural provision	Managing subjects of infrastructure
Entrepreneurs	Development of entrepreneurship self-organizing	Option identification of use of infrastructure resources	Provision of infrastructure resources
Agents of infrastructure provision	Entrepreneurship efficiency gain due to infrastructure means	processing and execution of a request for the use of infrastructure resource	Providing data on the availability of resources at infrastructure facilities
Managing subjects of infrastructure	Providing the availability of available resources for the implementation of entrepreneurial decisions	Identification of infrastructure resources and reserve sources	Maintaining the stable state and development of infrastructure

To perform imputed functions, infrastructure agents are forced to coordinate their behavior using different types of integration (alliances, coalitions, teams, etc.). It should be noted that the functioning of the multi-agent system involves a number of problems: uncertainty of the external environment and growing competition on industry-specific risks; Limited information about the state of the environment. Variants of the integrated interaction are presented in Table.

Variants of interaction effects of participants arising in the formation of entrepreneurial infrastructure (author's approach)

Type of synergy effect within the	Content of emerging synergy effect	Consequence of effect appearance in entrepreneurship infrastructure	Infrastructure agent
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framework of interaction of participants			s and elements
.Market synergy	organization of market space for implementation of trade and intermediary operations on the basis of combining the interests of consumers, entrepreneurs, investors.	acceleration of turnover of entrepreneurship structures; - open market interaction (communication) of market entities; - reducing the costs of contracts when concluding agreements.	Forms of open market interaction, integrated distribution channels, agents of inter-industry interaction
Social synergy	development of socially responsible business and strengthening of the social effect of entrepreneurial activity	- reduction of general unemployment indicators of population; - Realization of social capital; solving the acute social problems by entrepreneurship	Forms of development of social entrepreneurship (Social and public sector).
Investment synergy	pooling of investment resources in implementation of joint investment programs into the projects of entrepreneurship structures	- increasing the efficiency of investments through capital turnover; - - formation of reserve resources of financing the entrepreneurial ideas	Specialized financial and credit institutions, CCI,, investment funds, entrepreneurship associations
Innovative synergy	formation of innovative nature of entrepreneurship activities development	- creation of open innovation networks of interaction; - technology transfer to entrepreneurship; - ensuring the sustainability of technological development of business; - Reduction of distribution costs..	Research institutes, scientific parks, technoparks, scientific and production associations, SEZes
Logistic synergy	Integration of commodity routes and infrastructure resources, concentration of resource at the "distribution points".	- - acceleration of production cycles - creation of additional added value; - reduction of the role of costs of scale; - delegating the logistic functions of entrepreneurs	«Points (centers) of resources distribution between infrastructural objects (logistic centers)
synergy of use of labor resources	strengthening of communications between entrepreneurial structure and labor resources of localized economic systems	- attraction of labor reserves to the organization of entrepreneurship; development of service sector; positive dynamics of quality of life of population and labor market; strengthening self-organization of entrepreneurship structures	Objects of social infrastructure, employment centers, coaching centers, covoriation facilities

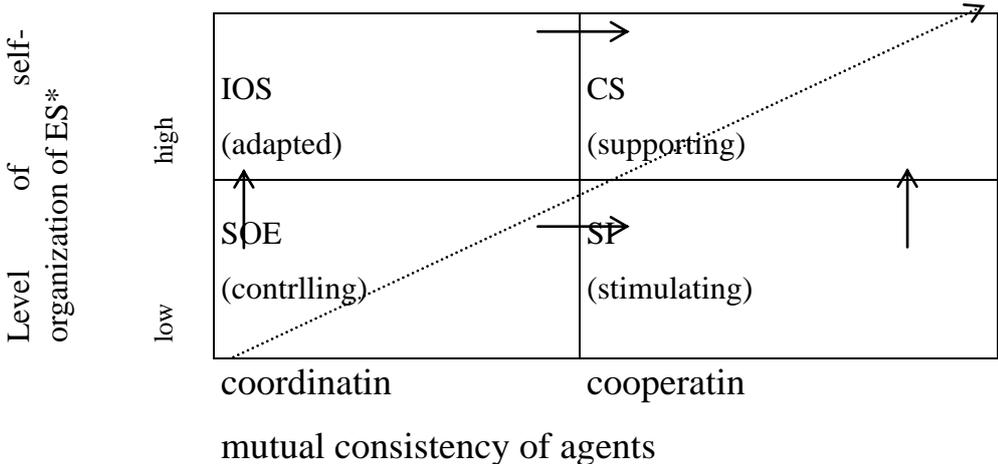
The integrative effect of interaction is manifested in decrease of transaction costs of entrepreneurship activities and in the additional benefits of entrepreneurship entities from sharing resources. The complexity of measuring the total interaction effect is determined by different types of synergy. In the activities

of network partnerships, public-private partnership, projects in the field of social entrepreneurship, clusters and special economic zones.[1]

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### 3. Results

The strategic focus of interaction is, on the one hand, the reduction of transaction costs, on the other - the organization of localized systems of different types. In the context of agent interests, strategic alternatives to effectiveness functioning of market infrastructure are highlighted. The proposed strategic infrastructure development map identifies four variational strategies: a socially-oriented, innovative-oriented, coalition and implementation strategy. The main parameters of the matrix are: level of self-organization and degree of mutual consistency of the action of agents (Pic. 1).



\*ES – entrepreneurial structure

Pic. 1. Strategies for behavior of entrepreneurship infrastructure agents  
(author's approach)

The strategy of socially-oriented behavior is aimed at creating a controlling influence of infrastructure agents in order to achieve social - value behavior and growth of social responsibility. The key areas are: formation of social attitudes of entrepreneurs, creation of conditions for development of entrepreneurship in order to meet social attitudes of social groups and the state. The development of

infrastructure in this strategy is due to social control and coordination in the agents' relations.

Innovation-oriented strategy envisages the preparation of entrepreneurial structures for introduction to the market, as well as strengthening of the relationship between agents with the aim of cooperation in technological development.

The implementation strategy means the development of self-organization with inclusion of educational, labor, advisory elements to stimulate entrepreneurship. The key priorities are: strengthening and maintaining relations within the company, as well as strengthening the intra-organizational ties.

Coalition strategy involves the development of cooperation between entrepreneurship entities by clustering and forming the network culture of business with the aim of achieving the effect of integration when using the infrastructure. The key attitudes should be considered the creation of favorable conditions for entrepreneurship cooperation, development of network interaction infrastructure.

The vectors of transitions between different strategies mean the managing actions on the relationships of agents with the aim of strengthening self-organization and cooperation. Thus, when managing the development of infrastructure, a single complex of relationships between entrepreneurship entities, managing bodies, commercial and public organizations is created. The key vector in this case is the desire to cooperate with respect for the interests of the parties. This conclusion is based on the provisions of theory of games that a strategy of cooperation contributes to changing the goals of individuals (players) and "supports the desire to avoid betrayal" [2, p. 86].

It should be noted that implementation of agent behavior strategies solves the tasks of interaction within the infrastructure, and, according to the inequality of the resulting effects from interaction, requires identification of the most important types of infrastructure synergy.

Formation of managing tasks within the framework of agent interaction  
strategies (author's approach)

Type of strategy for infrastructure agents	Type of managing impact	Particular infrastructure management tasks	Predominant synergies
Socially-oriented (SOE))	control, coordination	- formation of social attitudes; - development of public goods; - strengthening of social responsibility; - improving the quality of management. -	Social, labor, market
Innovative-oriented (IOS)	adaptation, development	- development of collective use; - strengthening the interconnection of enterprises and technological centers; - development of venture financing; - provision of technologies transfer, -	innovative, investment, market, logistic
Implementation (SI)	implementation, cooperation	- development of public and educational services; - introduction of training programs at enterprises; - development of public finance systems; - formation of open interaction of entrepreneurship, personnel and educational sector	labor, investment, market, social
Coalition (CS)	support, cooperation	- strengthening of logistic cooperation; - creation of investment funds for collective projects; - redistribution and localization of labor resources within networks; - development of entrepreneurship clustering.	Logistic, investment, labor

When implementing infrastructure provision, it is important to establish clear rules regarding the use of resources, as well as to implement a "transparent" system of sanctions for violating the rules in the use of public resources. The dilemma "The tragedy of the commons"<sup>1</sup> makes it possible to assess the infrastructure of entrepreneurship as the public good which is subjected to problems of rational consumption and conservation of public resources. The possibility of effective solution of the problem is emphasized through the use of information about local conditions and systems of rules. [2]

For this, it is noted that in order to overcome obstacles in the development of public resources, first of all, it is necessary "to create self-organization systems that will cope with this problem better than others." The conditions and the order of formation of infrastructure, taking into account the agent relationship strategies, are presented in Table.

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<sup>1</sup>Elionor Ostrom. Governing the Commons. Cambridge: Cambridge University Press, 1990, and «Coping with The Tragedy of the Commons», Annual Review of Political Science (2 June 1999): pp. 493-535.

Determination of conditions and order of formation of entrepreneurship  
infrastructure taking into account the strategies of agent relationships (author's  
approach)

Strategies for behavior of infrastructure agents	Key directions for establishing the conditions of infrastructure formation	Types of infrastructure institutions
Oriented	determination of areas of social responsibility of entrepreneurs; Social - formation of requirements to the quality of products and services; - Development of social value of entrepreneurship; - strengthening the role of social groups in development of entrepreneurship	Socio-public institutions, social associations
Innovation-oriented	- ensuring the implementation of innovations and developments; - simplification of implementation of scientific-research developments of entrepreneurship; - Establishment of patent and legal relations	Technological institutes, Research-scientific centers, legal institutes
Strategy of implementation	strengthening the competence of entrepreneurship entities and personnel; - distribution of public funds in entrepreneurial activities; - Development of co-creation in the activities of entrepreneurs.	Educational and labor institutions, public finance funds
Coalition	- establishment of interrelationships within networked entrepreneurial structures; - development of corporate culture; - strengthening the interaction of entrepreneurs of different industries.	- Collaboration and Clustering Institutes

Thus, the important strategic moment in the development of agent relationships is the achievement of institutional stability based on their self-organization.[6]

The estimation of infrastructure support parameters of entrepreneurial structures of the Republic of Tatarstan (RT) was used taking into account the classification of infrastructure parameters, in our study of the dependence of entrepreneurial activity on the level of infrastructure development.

To determine the normalized estimates of the indicators, the Harrington scale was used, which was also applied in the economic and mathematical model of assessing the infrastructure support of entrepreneurship in the regions of the Russian Federation. The results of the assessment for small enterprises of RT are given in Table.

Estimation of parameters of infrastructural support for small business of the  
Republic of Tatarstan (Using the Harrington scale)

Groupfeature	№ in order	Coefficient of ponderability $\gamma_{\alpha}$	Normed estimates (as to years)			
			2010	2011	2012	2013
Staffing, thousand people.	1	0,2660	0,3612	0,7589	0,7995	0,8805
Institutional update, thousand units	2	0,2963	0,3627	0,7872	0,9823	0,9949
Budget of regional programs of development of IB, bln rubles.	3	0,1711	0,4230	0,5744	0,3462	0,6656
State market supply with contracts for supply, , thousand units	4	0,0901	0,9873	0,3218	0,4775	0,0474
Financial and credit support of MF, bln. rub.	5	0,1765	0,1344	0,7385	0,9014	0,9957
FINAL ESTIMATIONS (taking into account the ponderability of the feature.)			0,3886	0,6927	0,7651	0,8229

The analysis of estimates as to the given parameters of infrastructural support for small business in the Republic of Tatarstan leads to the following conclusions. The lowest estimate of the level of infrastructure provision in 2011 is related, first of all, to the problem of financial and credit provision, i.e. the level of accessibility and the volume of financial and credit resources for development of entrepreneurial sector. However, the assessment of state provision by contracts for supply of goods (for municipal needs) is greatest in comparison with subsequent years.

Thus, the infrastructure support for entrepreneurship of the Republic of Tatarstan was based on increasing the competitiveness of small enterprises, to a greater extent, at the expense of their own efforts, than by attracting external sources of financing. Over the period 2010-2013, the situation was changed, and external financial and credit instruments have gained weight in the structure of infrastructure support. At the same time, the budget for implementing small business development programs has increased (a certain "failure" of budget financing is observed in 2012). The number of newly created entrepreneurial structures is also influencing the development of infrastructure in the region, which

in 2013 is almost absolute (within the regression model) value (0.9949) compared to previous years. As for the staffing of entrepreneurship within the framework of infrastructure, it can be noted that development of this parameter has a stable positive trend (with the exception of the assessment in 2010), and the maximum value of this parameter estimation was registered in 2013 (0.8805). [8]

In general, the factors investigated earlier influence the model of development of infrastructure support for entrepreneurship in RT by 72.23% in 2013 (based on the comparison of the actual level of entrepreneurial activity and calculations on the econometric model). Accordingly, the level of entrepreneurial activity is affected by 27.77% of the factors of infrastructure provision, not accounted for in regression dependence. Among them are the indicators of functioning of institutional-market elements of the small business infrastructure of the Republic of Tatarstan [3].

#### **4. Discussion**

It is established that when implementing the infrastructure support mechanism, it takes place the continuous process of forming institutions for development of entrepreneurship on the basis of infrastructure support mechanisms, regulation of entrepreneurial activity, ensuring interaction between entrepreneurs and managing subjects of the economy. At the same time, the need for infrastructure elements directly depends on the parameters of functioning of entrepreneurial entities, the most important of which is self-organization of entrepreneurial structures.

Considering the interaction of stakeholders in the process of infrastructural support, it can be concluded that the relations between entrepreneurial structures and entities that represent the institutions of infrastructure support should be compromised. This will make it possible to achieve efficiency for both sides: from the point of view of entrepreneurs, ensuring successful activity in the economic environment, and from the position of governing bodies - growth of the level of entrepreneurial activity and realization of entrepreneurial potential as the basis for economic development.

In general, the typology of agent behavior strategies is directed to the development of the infrastructure, but the use of pure behavior strategies can be limited by the state of economic attitudes of agents in development of localized systems. Therefore, when implementing infrastructure support for entrepreneurship within the framework of localized territorial systems, it is necessary to take into account the conditions for their economic development. In turn, the use of strategies for behavior of infrastructure agents allows the formation of further strategic ways (scenarios) for development of entrepreneurship infrastructure in localized systems.

## **5. Conclusions**

Typology of strategies of behavior of agents of the business infrastructure allows us to identify the directions in the development of infrastructure that are relevant for the appropriate level of development of self-organization in business structures. At the same time, the use of pure behavior strategies can be limited by the state of the economic attitudes of agents in the development of localized systems; therefore, when implementing the infrastructure support of entrepreneurship within localized territorial systems, it is necessary to take into account the conditions of their economic development AND THE Features of INTEREST IN THE ACHIEVEMENT OF STRATEGIC OBJECTIVES. In turn, the use of strategies for the behavior of infrastructural agents allows FORECASTING the results of interaction and to formulate further strategic ways (scenarios) for the development of the business infrastructure in localized systems.

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