Přístupy určení efektivity institucí v inovačním prostředí

Approaches to Evaluate the Effectiveness of the Institutions of Innovative Environment

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Abstract:

Purpose of the research: to study the problem of evaluating the effectiveness of innovative environment institutions, and to define the possible approaches to build a methodology for assessing the effectiveness.

Methods: Basing on the analysis of the basic purpose and usefulness of economic institutions, we identified three main components of the effectiveness of institutions: reduction of the uncertainty factor, gain in time, direct gain in money. The performance of an innovative project is proposed to be split into two groups: input, that is, showing during the development and the implementation of the project and output, that shows at the stage of making a profit. In addition, for the equal consideration of all the three components of the institutions effectiveness we suggest that the parameters of the transaction should be expressed in a three-dimensional coordinate system, where one axis u – is the uncertainty, the second axis t – the time and the third axis m – the cash flow.

Findings: The calculations revealed that for an implementation of an innovative project, a start-up firm requires either a long-term loan or a venture capital funding or a placement in a technopark. For large and medium-sized firms the project is more attractive to a medium-sized company, because on the background of its performance indicators the effect is not blurred, as against the profits of a large firm. This confirms the effect of short-sightedness of large firms.

Conclusions: Carrying out such a comparative assessment of the effectiveness helps to explain the seemingly strange unpopularity of certain innovative environment institutions in the Russian context. Also, on the basis of this method we can try to predict the demand for some kinds of institutions being imported from a foreign practice or implemented in a process of designing the institutes.

Keywords: innovative environment, the effectiveness of institutions, transaction costs, complex effect of the transaction, entropy, Prospect Theory

JEL Classification: O17, O43

Introduction

The competitiveness of any country depends large-ly on the ability to build a system of economic in-stitutions that would provide the necessary economic growth. The most important for economic growth in the current conditions are the institutions of the in-novative environment. However, the state's resources allocated for the formation of the necessary instituti-ons are limited. At the same time, the introduction or importation of new institutions do not always lead to desired results, as effectiveness of institutions may be lower than expected. In these circumstances, to the foreground comes the problem of objective evaluati-on of the effectiveness of institutions and comparing them inside this criterion to determine the ways to improve the national innovation system.

Evaluating the effectiveness of institutions is one of the poorly-developed areas of institutional econo-mics. There are relatively few studies on the mea-surement or assessment of the effectiveness of such institutions. Most researchers have limited themsel-ves to the classification of the institutions effective-ness (Litvintseva, 2003). Among such approaches are the following. North (North, 1990) divides the effectiveness of institutions according to the nature of the action into allocative and adaptive, according to the degree of exposure into positive, negative and zero efficiency, and also he separately identifies the marginal efficiency of institutions. O.S Sukharev (Sukharev, 2009) also adheres to the division of the efficiency into allocative and adaptive, but he dee-pens the classification, allocating subtypes within these.

If we consider the effectiveness of institutions in the innovation environment, in accordance with this classification it should be attributed to the adapti-ve efficiency, or, according to the classification of Sukharev, the effectiveness of innovation.

The technique, which, according to E. Balatsky (Balatsky, 2007) can be successfully used to analyze the functioning of institutions, is a well-established method for analyzing the effectiveness of govern-ment organizations with social objectives.

The general formula of quality (K) for functioning of institutions can be summarized as follows:

$$K = \sum_{i=1}^{n} \gamma_i A_i R_i E_i , \qquad (1)$$

where:
i — the index of objective,
A — coefficient of the adequacy of the institution,
R — coefficient of performance of the institution,
E — efficiency coefficient of the institution,
γ_i — parameter, which fixes the importance of the i-th objective (requirement) of the institution.

In this case it is assumed that the created instituti-on has several objectives and their respective needs. Moreover, the importance of these objectives and needs may be different, as reflected in the coeffici-ents γ_i (in many cases, it may be equal to 1). The coefficient of the adequacy of the institute is an ratio of the objectives (C), pursued by the established in-stitution, to the existing social needs (P): $A = C/P$. The coefficient of the institute performance is the ratio of the received result adequacy degree (X) to the afore-put objectives (C): $R = X/C$. And finally, the coefficient of the institute efficiency is such a traditional indicator of the efficiency as the ratio of the result (X) to the cost (Z): $E = X/Z$. The higher these ratios, the higher the quality of the institution.

However, this technique has several disadvanta-ges which make it unsuitable for use in management decision-making by the public authorities respon-sible for the formation of the institutional environ-ment. First, the coefficients of adequacy (A) and efficiency (R), as well as the parameter γ_i, retaining the importance of the i-th objective, are too abstract, and their definition is too subjective and often the ratio will depend on the purpose and point of view of the evaluator, and not on the real effectiveness of the institute. Second, this method is weakly consis-tent with the theory of transaction costs, which is the main explanation for the effectiveness of institutions at the present stage.

Sukharev O.S. in his article (Sukharev, 2007) out-lined the possibility of using methods of calculating rates of use-value in relation to assessing the qua-lity-efficiency of the newly introduced institutions when there is competition between the old structu-res and newcomers. The normal rate of use-value (NRU) is a measure that allows to give a generalized assessment of the quality of goods or an institution according to the consumer preferences.

$$NRU = \sum_{j=1}^{J} w_j \sum_{i=1}^{I} w_i^j \eta_i^j , \qquad (2)$$

where:
w_j, w_i^j — weights, respectively, of the groups and individual indicators of an institution (or goods') quality,
η_i^j — the correspondence of the individual indicators to the properties that the consumer prefers.

This methodological approach can be used in the evaluation of the newly introduced systems of rules into the economic space: the tax code, land, labor code, when the new regulations replace the old ones, as well as in evaluating any reform measures that lead to a change in the rules and patterns of economic behavior of specific agents. However, Sukharev O.S. recognizes that this approach is expert-analytical, but this fact makes both the weak and the strong side of it. Moreover, he argues that "any exact estimations (models) in this branch do not exist, and are hardly possible" (Sukharev, 2007). The purpose of this paper is to try to refute this thesis.

1. Methods

1.1 Components of the effectiveness of institutions

For an objective evaluation of the effectiveness of institutions it is necessary to refer to the cause for the appearance of institutions – the limited rationality of economic agents, their inability and even unwillingness to collect and process large volumes of information needed for decision making. That is, economic agents as social beings are more likely to agree on something everyone should do in this or that situation (and what would happen if the agreement is broken) than try to figure out all the options for their own and the others' behavior. Thus, the main purpose of the institutions is reducing the uncertainty of the transactions results. This property of the institutions is mentioned by many of the founders of institutional theory.

For example, North said directly that "Institutions reduce uncertainty by structuring daily life" (North, 1990) "We can easily make decisions, as our interaction with the environment is institutionalized so as to reduce uncertainty" (ibid. , p. 40). "Institutions form the basic structure upon which people throughout history have sought to create order and intended to reduce uncertainty in the process of exchange" (ibid., p. 151).

Hodgson mentioned that "in a world where uncertainty reigns, where possible probability calculus does not exist, there rules, norms and institutions play a functional role in the formation of a basis for expectations, beliefs and in decision-making" (Hodgson, 1988). That is, he also believes that a major function of norms and institutions is to overcome the uncertainties in the decision-making process.

The most striking example of an institution designed to reduce uncertainty is the institution of insurance reserves. Thus there is a diversion of additional resources of the society onto the formation, storage and maintenance of these reserves, but the overall uncertainty of the future is reduced. Another way is the transformation of the uncertainty into a risk. According to North, "Modern methods of insurance and diversifying of the securities portfolio ..." can be considered "... just as a way to transform uncertainty into risk, and thereby to reduce the transaction costs by reducing the set of probabilities" (North, 1990). Although, according to Coase (Coase, 1988), there is another way to reduce uncertainty, namely associating individuals into an organization, which in this case is referred to as an alternative to institutions. Coase generally believed that "it is highly unlikely for a company to appear absolutely outside any conditions of uncertainty" (Coase 1988).

At the same time, reducing the uncertainty of the transactions results is not the only benefit of the institutions. Another important merit of the institutions is reducing the loss of time as one of the types of transaction costs, which, however, begins to emerge only after having been adopted by the institution (learning effect). This relates the institution to the routines whose primary purpose is precisely to reduce the amount of time spent by an individual or a firm. An example of the institution, which allows to reduce the time spent on the implementation of transactions, is the institution of a public offer, through which the parties of a transaction save on costs of negotiating and making a contract.

The third component of the effect from using an economic institution is money, because economic institutions are primarily aimed at regulating the commodity-money transactions, the main purpose of which is to obtain monetary gain (profit). That is, the use of effective institutions brings benefits to economic agents, which is manifested not only in reducing the uncertainty of the result of the transaction, or a gain in time for its implementation, but also in a direct increase of the amounts of money. An example of such an institution is the institution of private property, which allows owners to maximize the benefit from the use of their property. Another more striking example of the institution aimed at increasing incomes, is the institution of bank deposits. In addition, the inclusion of money as a part of evaluating the effectiveness of the institute is due to the necessity of resources cost accounting as the main component of transaction costs.

Thus, we have identified the three basic components that must be considered when evaluating the effectiveness of institutions. It is these components in one form or another which are usually included into the composition of transaction costs. Generally, it is quite possible that there may be other compo-

nents of the effectiveness of institutions, but they are more or less likely to derive from the basic.

1.2 The complex effect of the transaction

The effectiveness of institutions is shown in their application by economic actors in transactions, so before you evaluate the effectiveness of the institutions of the innovative environment, you must use the previously allocated three components to determine the effect of the introduction of the innovative project as a kind of transaction. Due to the fact that transaction costs can be divided into two groups depending on the time of their display: ex ante and ex post, the indicators for the performance of an innovative project are also divided into two groups: input, that is, working during the development and the implementation of the project (stage investments) and output, that is, working at the stage of making a profit (payoff). It should be noted that due to the prevalence of the concept of transaction costs, the approach to the study of transactions has become one-sided, *i.e.*, the majority of researchers, following the founders, are studying just the cost of transactions, losing sight of the resulting benefits obtained as a result. The fundamental difference of the proposed method lies in the fact that we consider not only the costs associated with the implementation of transactions, but also the benefits as a result of their commission. This approach is consistent with the common methodology for assessing the effectiveness as such, based on the ratio of results to costs.

In addition, for the equal consideration of all the three components of the effectiveness of the institutions, we suggest to express the parameters of the transaction in a three-dimensional coordinate system where one axis u – is the uncertainty, the second axis of the t – time, and the third axis of the m – cash flow (Figure 1).
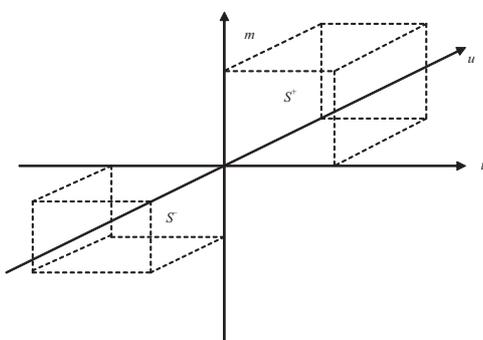

Figure 1. Graphic expression of a complex transaction efficiency. Source: Author's own study.

Thus, in the proposed coordinate system there are formed spaces S^+ and S^- – complex positive and negative effects from the estimated transaction (an innovation project). The amount of the space is the size of the effect. The space S^- is a generalized expression of transaction costs, and the space S^+ is a generalized expression of the expected benefits of the transaction. In order to correctly assess the effects it is necessary to standardize the units on all axes, that is, to express them in a range from 0 to 1. We use the following units: the axis of t is the ratio of duration of the project to the time-reserve (the lead time) of the innovator; the axis of u – the uncertainty of costs and income (the residual risks of exceeding the capital expenditure and the unsuccessful outcome of the project), the axis of m is the share of investment costs or profits from the innovation project in total annual earnings (net income) of the entity (economic agent) prior to the project.

Correlation of total values of investment costs and additional revenue with value of total annual earnings (net income) of the economic agent prior to the project is explained by the fact that perception of the risk by economic actors in virtue of the limited rationality considerably varies depending on receivable point of view and research objectives. As Stanislav Skapa and Martin Vemola (Skapa, Vermola, 2012) note, explanation to this fact can be given by the Prospect Theory of Kahneman and Tversky (Kahneman, Slovik, Tversky, 2005). Estimation of benefit of the loss and the win are made by the people in relation to some starting point (hypothesis of comparative utility). That means that utility can be comparative value (in relation to some starting point), as contrasted with classical additive functions of utility that underlie in the big part of "Neoclassical economics" and don't have this property. Guaranteed revenue or income prior transaction can serve to evaluate monetary component, the starting point for time component is "event horizon", in the capacity of which some time-reserve prior the project by the competitors can serve for innovator, or, at a pinch – time-reserve till the bankruptcy.

The difference between the spaces S^+ and S^- is a complex gain from the transaction (innovation project). That is:

$$\Delta S = S^+ - S^-, \qquad (3)$$

where:

$$S^- = \frac{T_1}{T} \cdot \frac{M_1}{M} \cdot (1 + U_1) \ , \qquad (4)$$

$$S^+ = \frac{T_2}{T} \cdot \frac{M_2}{M} \cdot (1 - U_2) \quad , \qquad (5)$$

where:

T_1 time needed for preparation and implementation of the transaction (innovation) years,

T time resource according to the predicted cash flow for the future and the obsolescence of existing products, years,

T_2 the time of gaining the effect of the transaction (innovation), years,

M_1 the annual cost of resources to carry out the transaction (capital expenditure on the innovation at its implementation stage), monetary units,

M an annual surplus of the cash flow (total income) of the entity (economic agent) prior to the transaction (innovation), monetary units,

M_2 an annual additional income as a result of the transaction (innovation), the monetary units,

U_1 assessment of uncertainty (residual risk) of the excess costs over the planned resources,

U_2 assessment of the uncertainty of obtaining additional revenue.

Under the conditions that:

$T_1 < T$ the time needed for preparation and implementation of the transaction does not exceed the time resource of the entity (economic agent),

$M_1 < M$ the cost of resources needed to implement the transactions do not exceed the annual surplus cash flow of the entity (economic agent) prior to the transaction. That is, it is assumed that innovations are financed from current revenue, without the use of borrowed funds.

If either condition is violated, the possibility of implementing the transaction (innovation) is being questioned, as for the purity of evaluating the effectiveness of institutions it is assumed that initially there are no institutions of innovation environment, and implementation of the innovation is determined by the net benefits of economic agents.

Actually, the technique itself allows us to compare innovation projects among themselves with equal consideration of the monetary and nonmonetary factors influencing the effectiveness of innovation, as

proposed by the author in the other works (Islamutdinov, 2010a, Islamutdinov, 2010b). In this article the application of the described method is extended for the purpose of evaluating the effectiveness of institutions of innovative environment.

2. Research results (findings)

2.1 The calculation of the efficiency of the institutions of innovative environment

The calculation of the efficiency of the innovative environment institutions held at the hypothetical example (Table 1).

As for the basic institutions required for the development of economic actors innovation activity, there can be named long-term loans available, the developed patent system, venture financing, technology parks, technology transfer centers. The initial data for the calculations are given in Tables 2 and 3.

The results of the calculation of the comparative effect for the use of innovative institutions are listed in Table 4.

As it can be seen from the table, for the implementation of innovative project, a start-up firm requires either a long-term loan or a venture capital funding or a placement in a technopark. Without these institutions, the activities of new innovative firms are virtually impossible, as evidenced by the impossibility to calculate the effect of the transaction due to the lack of lead time to implement it. What is more, the most effective is a venture capital financing, followed by a placement in a technology park, and a long-term loan is 3.5 times less attractive.

As for large and medium-sized firms, regardless of the innovative institutions, the project is more attractive to a medium-sized company, because it is not blurred on the background of a medium-sized firm's usual performance, as against the profits of a large firm. This confirms the effect of short-sightedness, when large firms simply cannot notice a promising innovation.

Patenting and venture financing increase the effectiveness of an innovative project for both the large and medium-sized firms. A long-term credit, a placement in a technopark and the use of technology transfer reduce the effectiveness of innovation for all firms, except for beginners. However, it should be noted that a placement in a technopark can overcome the short-sightedness characteristic of large firms. For this purpose it is essential for an innovative project to have financial independence, *i.e.* separate financial balance, or better to be isolated into a subsidiary company. For example, in our case, a large firm isolated an innovative project into a sepa-

Table 1. Baseline data on a hypothetical innovation project (firm's own R&D).

Project indicators	Values
The time of development and deployment, years	3
Expected time of receiving the effect, years	6
Additional annual investment costs, million monetary units	4
Additional annual profit, million monetary units	15
Estimation the uncertainty of excess costs	0.5
Estimation of profit uncertainty	0.7

Source: Author's own study.

Table 2. Indicators of the innovative environment institutions influence on the effectiveness of transactions (innovative projects).

Innovative environment institution	Influence on the project indicators
Long-term loan for 5 years at 5% per annum	Cash flow is converted so that additional annual investment cost is reduced to 3.063 million monetary units due to the stretch for 5 years'. As a result, the start-up firm's time-reserve increases to 5 years (the rest firms' remains unchanged).
Patenting	Due to the costs of the registration and maintenance of the project, the annual expenses are increased by 0.5 million monetary units, the profit is reduced by 0.3 million monetary units. The profit term is increased to 10 years.
Venture financing	The annual investment costs are almost set to zero (as funded by the venture capital fund), only operating costs of 0.5 million monetary units remain. Annual income is reduced by 2 times, because, under the terms of financing, 50% goes to the fund. The start-up firm's time-reserve increases to 4 years (the rest firms' remains unchanged).
Technopark placement	The annual investment costs are reduced by half (because there is no need to spend on office equipment, facilities, etc.). Annual income is reduced to 9.5 million monetary units, as, under the terms of the provision of facilities, 30% goes to technopark. The start-up firm's time-reserve increases to 3 years (the rest firms' remains unchanged).
Use of technology transfer	All figures are reduced by copying the others' technologies: – time of development and implementation to 1 year – expected time of receiving the effect to 3 years – additional annual capital expenditures to 2 million monetary units. – additional annual profit to 4 million monetary units. – assessment of costs exceeding uncertainty to 0.1 – assessment of the profit uncertainty to 0.2

Source: Author's own study.

Table 3. Indicators of the innovation firms.

Indicators of the firms	Major firm	Medium-sized firm	Start-up firm*
Time-reserve (the lead time), years	30	10	0.5
The average annual income before the introduction of innovations, million monetary units.	1500	50	1

*A startup company has no profit, but it has its own funds in the amount of 1 million monetary units., which will last for 6 months. Source: Author's own study.

Table 4. Comparative effects of the institutions of the innovative environment.

Indicators of implementation of the innovative project	Major firm	Medium-sized firm	Start-up firm*
without the use of innovative institutions	0.00020	0.01800	x*
with credit for 5 years at 5% per annum	0.00009	0.00805	0.80539
with patenting	0.00053	0.04770	x
with venture funding	0.00025	0.02250	2.81250
with technopark placement	0.00018	0.01620	2.70000
using technology transfer	0.00016	0.01480	x

* To calculate the effect on a start-up firm is not possible, because of insufficient time resource. Source: Author's own study.

rate unit with a balance of 5 million monetary units. a year. Then the comparative effect makes 0.54000, which makes it by 2700 times more attractive of the same project's rates without its isolation, and compares to the rates of a start-up firm.

2.2 Mathematical expression of institutes' measures

Thus, offered method allows comparing of different institutions on the base of complex measure, equally taking into account the three components, that influence the effectiveness of innovative projects taken as transactions: uncertainty, time and money. It is possible to improve this method by more exact mathematical expression of institutes' measures.

A certain initiative in this direction was made by the author in the article "Perfecting of a scaling of innovation project's efficiency" (Islamutdinov, 2009), it was suggested to improve existing method of evaluating effectiveness of innovative projects using the items of system's theory and thermodynamics. It was suggested to put in some corrections to economic consequences of production and denial of entropy for the period of innovative project's realization. Developing the entropy approach, we can suggest using measure of entropy for mathematical expression of three measures of institutes' effectiveness: uncertainty, time and money.

Uncertainty of the results of transaction is directly connected with the entropy. For example, there are two economic actors in the economic system, the both of them are described by probable behavioral reactions in the process of making the transactions. Let's suggest that in the process of making the transaction with equal probability ($p = 0.33$), each of them can make the following decisions:
1. To meet all conditions of transaction;
2. To meet the part of transaction's conditions, and to eliminate the rest of them;
3. Do not meet conditions of the transaction.

Thus, the entropy of each of participants of transaction can be computed using the following formula (Nicolis, Prigogine, 2003):

$$H(N) = -\sum_{i=1}^{N} 1/N \log_2 1/N = \log_2 N, \quad (6)$$

In our case it comes up to $\log_2 3 = 1.584963$. For example, some institution, that acts as referee. The probability of decisions of transaction's parties changes under the influence of this institution (moreover, not only ex post, but also ex ante). For example, probabilities have changed in the following way:

To meet all conditions of transaction ($p = 0.7$);
To meet the part of transaction's conditions, and to eliminate the rest of them ($p = 0.2$);
Do not meet conditions of the transaction ($p = 0.1$).

In this case, the entropy of each participant of the transaction amounts

$$H = - (0.7*\log_2 0.7 + 0.2*\log_2 0.2 + 0.1*\log_2 0.1) = 1.15678,$$

that means that entropic gain amounts 0.42818.

It is necessary to imagine that economic system consists of controllable and control subsystems to understand the impact of money on the entropy. The controllable system (the sum total of external and internal environment's factors) has 10 equally possible conditions, accordingly its entropy is $\log_2 10 = 3.321928$. For example, to simplify calculations let's concede that the system doesn't produce entropy (perfect system).

Accordingly, the common entropy of system is defined by (Nicolis, Prigogine, 2003):

$$H(B) + H_B(Y) - H(Y), \quad (7)$$

where:
$H(B)$	variety's entropy of external environment's influence,
$HB(Y)$	relative entropy of variety of managements Y underneath the condition of external environment B.
$H(Y)$	entropy (variety) of control system.

For example, to simplify let's concede that control system can accept 5 possible equally probable conditions (although it is impossible in practice, conditions of controllable system are not a priory equally probable), and relative entropy is equal the half of control system's entropy, then $H(Y) = \log_2 5 = 2.321928$, and $HB(Y) = ½ H(Y) = 1.160964$. The general system's entropy makes $H(O) = 3.321928 + 1.160964 – 2.321928 = 2.160964$.

For example, one controlling action cost about 100 units of money (although this dependence is nonlinear in practice and can define only empirically). Accordingly, minimally necessary income for saving status quo of the system is 500 units of money.

Let's concede that in economic system were invested 100 units of the cash (earnings or credit), that can be spent to raise the variety of control system's states. That means that the amount of states of control system increases to 6. The general entropy of system makes $\log_2 10 + ½ \log 26 – \log_2 6 = 2.029447$, that is decreases by 0.131517.

If the firm has additional costs for transaction in the amount of 100 units (and there is no possibility to incur debt), accordingly, costs for controlling action decrease, and the amount of states of control system also decrease from 5 to 4.

In this case, the general entropy of system makes $\log_2 10 + \frac{1}{2} \log_2 4 - \log_2 4 = 2.321928$, that is increase 0. 16096.

The money can influence the level of entropy in other way, through the acquisition of information. If we consider the same example, costs of additional 50 units of money allow to get information, according to which probability of one state of controllable system doubles (to 0.2), accordingly possibility of the rest states of system decrease (to 0.089). Accordingly, the entropy of controllable subsystem makes to $H = - (0.2 \cdot \log 2\ 0.2 + 9 \cdot 0.09 \cdot \log 2\ 0.09) = 3.259916$, that is the general entropy decrease by the amount 0.062012.

As for impact of time on the entropy, it is known that entropy is function of the time according to the second law of thermodynamics, moreover, the production of entropy slow down with time. But it is fairly only for closed systems. Economic systems have one more source of entropy – external, more important in terms of saving status quo, because on one hand, it works as a place for entropy's allocation, on the other hand, creates additional influx of entropy.

Allocation of entropy to external environment is made with the help of the money and paid by money controllable influences (v.s.). With time increase of entropy's influx from external environment is conditioned, from one hand, by increase of variety of possible external environment's states, the more time period, the more events can happen: on the other hand, by decrease of authenticity of the information about possible states of external environment, that is leveling of their probabilities.

Assume that currently external environment has 3 possible states with probability 0.2, 0.3 and 0.5. We consider the first case: appearance of 1 new state of external environment happens in each moment t with a probability 0.15, and probabilities of the rest states proportionally decrease (in our case by 0.05).The entropy of states of external environment changes from 1.485475 to 1.839491, that is increase by 23.8%. We consider the second case: leveling of probabilities of extreme condition by 0.05. In this case the entropy increase to 1.539491, that is by 3.6%. Major influx of entropy brings increase of the amount of external environment's states. In practice of innovative activity the first case corresponds to risk of appearance of new product or resource in the market in future, and the second case corresponds to simple increase of uncertainty with the increasing of time horizon of planning.

But, the time might have a positive effect on the entropy's level, and it connects with decrease of options when the time has expired, then the situation clears naturally. This aspect is used in method of real options. This property is based on the fact that new states of external environment appear as well as part of states lose its actuality, that is probability of these states become equal to zero (or equal zero by innovator consciously, because these variants are a priory unprofitable. It is possible in case of consideration only the local part of external environment that definitely influences innovative project. Decrease of the amount of states of system's local parts possible thanks to nonlinear properties of economic system, when their development might be chaotic, and limited by framework of some attractor. Then, if the system develops on the attractor, the other possible states become nonactual.

Continuing our example, assume that the waiting the period of time t has led to cancellation of the state with probability 0.3 (probability of two other events increase accordingly by 0.15). Then the entropy of external environment comes to 0,934068, that is decrease by 37.1%.

Thus, possibility of mathematical expression of components of institutions' efficiency with the help of entropy's measure may be considered proven.

3. Discussion

There are still some points that require a further study and discussion.

First, we cannot say with a reasonable certainty that the described three components of the effectiveness of institutions are exhaustive. As mentioned above, it is possible that further investigations will allow to allocate one or more components of the effectiveness of institutions. However, we believe that a common approach to the selection of these components is correctly chosen: it is a review of the institutions as instruments to control the transactions. It is possible that the number of components can as well decrease because some components will extend through the others, for example, the time required may well be expressed in terms of additional uncertainty is created via the general chaos of the economic development, and a sustainable cash flow or strong reserves of cash, on the contrary, reduce the uncertainty. This generally means that all the components in one way or another can be expressed in the terms of uncertainty.

Second, the technique of bringing the three components to one and the same scale in the three-dimensional model of efficiency is not final and may be refined and improved. In this, any criticism is welcome. It is probably necessary to correlate costs and profits with some grounds: additional costs prior to introduction of innovations, and additional profit with general earnings of firm, for accounting of subjectivity and difference in perception of risk in full accordance with a theory of perspectives.

Third, this method does not include the society costs for the functioning of the institutions themselves, but on the other hand, taking into account this component of the institutions efficiency was not included into the purpose of this article and represents a prerequisite for an individual study.

Conclusion

Thus, the proposed method of evaluating the effectiveness of innovative environment institutions allows you to compare different institutions on the basis of a comprehensive index, equally taking into account three components that influence the effectiveness of innovative projects taken as transactions: uncertainty, time and money. Carrying out such a comparative assessment of the effectiveness will explain the seemingly strange unpopularity or failure of certain institutions of the innovation environment in the Russian context. Also on the basis of this technique you can try to predict the success of the spread of a new institution in the process of its transplantation while being imported from the foreign practice, or while being implemented as a result of an institutional design.

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