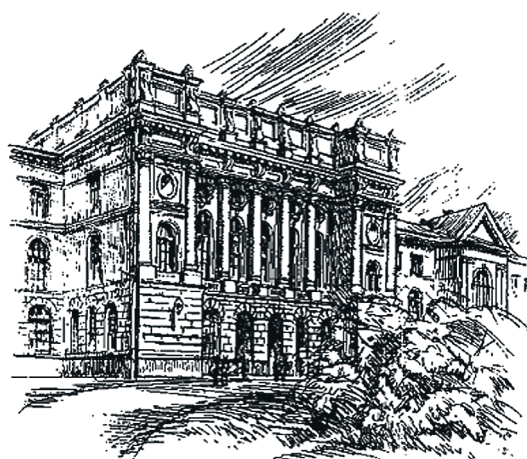


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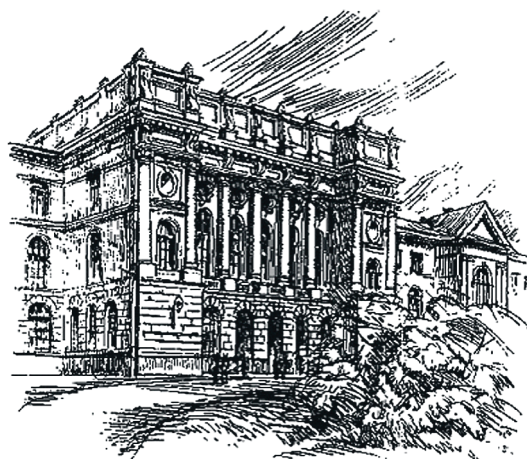
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МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ



НАУЧНО-ТЕХНИЧЕСКИЕ ВЕДОМОСТИ

САНКТ-ПЕТЕРБУРГСКОГО ГОСУДАРСТВЕННОГО
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НАУЧНО-ТЕХНИЧЕСКИЕ ВЕДОМОСТИ САНКТ-ПЕТЕРБУРГСКОГО ГОСУДАРСТВЕННОГО ПОЛИТЕХНИЧЕСКОГО УНИВЕРСИТЕТА

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Adarsh Anand, Richie Aggarwal, Ompal Singh, Deepti Aggrawal

UNDERSTANDING DIFFUSION PROCESS IN THE CONTEXT OF PRODUCT DIS-ADOPTION

Адарш Ананд, Ричи Аггарвал, Омпал Сингх, Дипти Аггарвал

ПОНИМАНИЕ ПРОЦЕССА ДИФФУЗИИ В РАМКАХ ОТКАЗА ОТ ПРОДУКТА

Diffusion theory is a well-accepted marketing concept that involves regular intervention of customers. But dealing with customers is a staggering task for managers and the challenge becomes stiffer in a dynamic market. It has been seen in the past how (by observing the adoption pattern of individuals) the aforesaid process has helped firms in dealing with innovation adoption. In the present article, we have emphasized the other part of the dichotomy of the adoption process, the dis-adoption, and have thereby formulated a diffusion process incorporating dis-adoption behavior of customers. Moreover, the dependency of imitators on the adoption behavior of innovators regarding the product/service provided by the firm has been highlighted. The proposed sets of models have been categorized on the basis of varying market structure using the exponential and linear market growth functions. Models have been validated and empirically analyzed on two real life sales data sets. Furthermore, a graphical presentation has been shown using ternary plot to see the relationship between the rate of adoption, the rate of dis-adoption and the rate at which new adopters are increasing the market. Our results indicate that the probability of potential discontinuers can be calculated explicitly; we have also discussed the role of previous adopters in contributing to the firm's growth.

DIFFUSION; DIS-ADOPTION; DYNAMIC MARKET; INNOVATION; TERNARY PLOT.

Диффузионная теория является общепринятой в маркетинге, при этом предполагается регулярное вмешательство клиентов в ее рамках. Взаимодействие с клиентами – сложная задача для менеджеров компаний, работающих на динамично развивающемся рынке. Наблюдение за закономерностями, в соответствии с которыми отдельные потребители осваивают инновации, показало роль данного процесса в инновационной деятельности компаний. В данной статье рассмотрена другая сторона процесса освоения – отказ от инноваций и описан диффузионный процесс с учетом поведения потребителей, отказывающихся от использования продукта. Также описано влияние имитаторов на поведение новаторов, осваивающих предоставляемые компанией продукты или услуги. Предложена классификация моделей на основе различной рыночной структуры с использованием экспоненциальной и линейной функций роста рынка. Апробированы и эмпирически проанализированы модели, основанные на двух реальных наборах данных о продажах. Кроме того, построен тернарный график зависимости между скоростью освоения продукта, скоростью отказа от продукта и скоростью, с которой новые потребители, начинающие использовать продукт, увеличивают долю рынка компании. Полученные результаты указывают на то, что вероятность отказа потребителей от использования продукта может быть вычислена в явном виде; описано влияние потребителей, которые уже начали использовать продукт, на экономический рост компании.

ДИФФУЗИЯ; ОТКАЗ ОТ ПРОДУКТА; ДИНАМИЧНО РАЗВИВАЮЩИЙСЯ РЫНОК; ИННОВАЦИЯ; ТЕРНАРНЫЙ ГРАФИК.

1. Introduction. The breadth of the study lies in investigating and understanding the diffusion process of a new product/service. Conde [7]

described the diffusion process in a very accurate and lucid manner and stated: Diffusion has to be considered as the propagation of messages

related to new ideas that lead to subsequent innovations (products, processes, technology, etc.), with an expectation of change in receptor behavior, which will be evident in adoption or rejection of the innovation. In the early stage of the diffusion process, a small group of population called innovators are initiated to buy the product but later on, the imitators come into existence into the market, which are influenced by the innovators' word of mouth or by other communication channels. A time-lag exists between different consumers of a social system during the adoption period. The social interaction between adopting pioneers and potential adopters explains the phase of rapid market expansion. The satisfied buyers will influence others to make the purchase of the product and also repurchase the product that leads to the expansion of market frequently.

In 1995, Rogers [30] defined the innovation decision as a five-stage process: *knowledge* in which individuals become aware of innovation, *persuasion* which forms the favorable or unfavorable attitude towards innovation, *decision* to accept or reject it, *implementation* to put the innovation in use and at last, *confirmation* to reinforce or reverse their former adoption decision. Out of these five stages, the decision is the most crucial stage where the happening of the sales is dependent upon customers' perception. By drawing attention towards this stage, we have tried to describe the impact of adopters and dis-adopters on the growth of the product/service. Firms know that the success and failure of their new product will shape their future. Therefore, managers are concerned with understanding the sales growth of innovations introduced in the market as well as the factors that shape it. However, there are several aspects that affect the adoption process and that have been examined, including advertising [9, 16, 34], consumer behavior [4, 20, 35], product warranties [1, 19], product price [1, 6, 29], and word of mouth and social influence [13, 21]. The biggest challenge in marketing research is to study the customers' behavior in all these aspects. Sometimes firms need to change their practice according to the individuals' need and their behavior.

Daron and Joshua [8] investigate the effect of changes in potential market size on entry of new drugs and pharmaceutical innovation, by focusing on exogenous changes driven by

demographic pressures. In literature, Romer [31], Grossman and Helpman [14], Aghion and Howitt [2], discussed the role of profit incentives and market size in innovation for the pace of aggregate endogenous technological progress. Lehmann [24] describes the dis-adoption as the process of cessation or substantial reduction in the use of a previously valued behavior or possession. Companies seek to increase their revenue by introducing innovation in dynamic markets. Successful introductions of innovation into the market are beneficial not only from the current customers' perspective but also attract other customers in achieving higher revenues [28]. The reverse case is also true for the real market scenario. If the innovation is not liked by the customers in the market, it would lead to dis-adoption that will ultimately results into lower revenues which in turn slow down the growth of the firm [12, 27]. Parthasarathy & Bhattacharjee [26] examined the service that is perceived as being more useful, easy to use and compatible is more likely to gain wider acceptance among the potential adopters.

Duck [10] described dis-adoption as a process of ending a relationship as separation, termination, dissolution, withdrawal, disengagement, divorce, break-up, discontinuity, decline, exit, and rejection in which each phenomenology is worthy of investigation in its own right. Dis-adoption behavior incurs for the firm losses in the quantitative form (e. g. monetary loss of company) as well as in the qualitative form (e. g. goodwill). In this paper, we have categorized the dis-adopters into two different groups: firstly, the adopters who are not satisfied with the product or have the better option may discontinue using the product. Secondly, the potential adopters who were keenly interested to buy a product, but didn't buy it due to some reason or other, this type of behavior is called balking behavior of the adopters, e. g., a potential adopter of Nokia gets influenced by the salesman to purchase Samsung instead of Nokia. Further, two different categories of the product, tangible and intangible are studied. Tangible products are those which we can see, touch and hear like clothing, whereas the intangible ones are those which cannot be seen and touched like service provided by insurance companies. Some of the researchers [1, 8] had worked by considering tangible product only and some [10, 25] focused on intangible



products. We intend to study both types of product.

Dis-adoption holistically is an integral part of the innovation and diffusion process, not a separate process. Moreover, this social process involves not only the individual but rather the whole society. Parthasarathy and Bhattacharjee [26] point out the effective means of customer retention strategies to maintain the market share and revenues of online service firms. They have also analyzed that the negative interpersonal influences generated by disenchanted discontinuers are more persuasive than positive interpersonal influence and lead to overall losses for firms. Some approaches treat adoption as the relationship of marriage between the consumer and the brand and dissolution is visualized as divorce [11]. Dis-adoption has an adverse effect on the firm and may lead it into retrogression. For instance, we can consider the market effects of social networking websites. Since 1994, social networking sites existed in the market, but didn't get much advancement due to limited knowledge available to users. In 2004, a software engineer Orkut Büyükkökten started Orkut [17] as a social networking website with a large number of users, and also in the same year, Mark Zuckerberg, founded Facebook [18] for social networking but with a limited number of users. In later years, the information regarding user-friendly and advanced features of Facebook spread out into the market, which made the users stop using Orkut and start using Facebook, which lead to an increase in the market share of Facebook rapidly. This means that the market penetration is very much dependent upon adopters and their behaviour, as they become the brand ambassador for the innovations.

In this paper, we examine how the market structure affects the whole diffusion process. Market structure as we defined it, refers to the variation in the adoption of product in different state of affairs. The general factors that expressed the detailed knowledge of market structure are: first, product durability and product utility, as more utilization with less durable product/service escorts the exponential growth model (EGM) of market, while the moderate durability and utility leads linear growth model (LGM) of market and more utilization with least durability tends the repeat purchases growth model (RPGM) of marketing. Second, in reality peer pressure

occurs in marketing, the adopters which are not potential buyers in actual will buy the product when many of the neighbors/relatives bought the product. Third, variation between the product quality and buyers expectation impinge the market structure, and so on. Hogan et al. [15] shows the impact of a lost customer on the profitability of the firm and also found that the early dis-adopter costs more than the loss of a later adopter. Libai et al. [25] evaluated the influence of dis-adoption on growth in service markets. They presented an approach where they measure the customer equity that takes into account inter-firm dynamics in a growing market and also calculate the customer equity when firms are strongly affected by customer switching to other competitors and dis-adoption of the category.

We use a simple and more powerful technique to define diffusion models where a product is first purchased, after that the information is transferred, and then the changes come in their current market status. Aiming to give models a more direct marketing application, we have leveraged the above impactful dis-adoption in three different market scenarios that may help to improve the accuracy of adoption and dis-adoption predictions. The aim of our research is to contribute to the methodological and substantive evolution of diffusion models towards a better understanding of their application potential. In particular, we consolidate the convenience of using diffusion models to understand the diffusion process of any innovation (consumer products, services, etc.), and extend diffusion models to accommodate effects (such as repeat purchases or dis-adopters) that are not present in many of the existing models.

The objective of our study is to investigate the dis-adoption behavior in different market situations. Our approach is more comprehensive than many studies because we have integrated innovation diffusion modeling with various market structures and have also calculated the dis-adoption rate of users explicitly in each case. We have tested our models on sales data set of two differently used consumers product and services. Their result show that the formulated models gives the better explanatory result of diffusion models and also are two-step ahead forecasts than the basic Bass model [5]. Bass model [5] didn't calculate the dis-adoption rate

explicitly and considered the constant market size. Here, in this paper, we have overcome these two limitations of the Bass model.

The rest of the paper has been categorized as follows: the mathematical model formulation has been provided in subsequent section 2. In section 3, verification of the models has been done by analyzing the data. Section 4 comprises the managerial implication and is followed by conclusion in section 5.

2. Model formulation. It will be interesting to note that the spread of diffusion works in the same pattern as an epidemic. In the contagionist paradigm, diffusion comes through personal contact between previous adopters and potential adopters of innovation. It can be termed as the epidemiological model. We can clearly observe that the diffusion model is a rational process as the greater the number of previous adopters, the more information there will be in the market about the characteristics, advantages and previous adopters' experience of the innovation, which reduces the risk aversion of potential adopters and favors the decision to adopt; i. e., the rate of adoption increases with an increase in the number of adopters in the social system. Although there is also the possibility of negative interaction between adopters about the innovation which may lead to loss of the firm, the majority of authors lean towards consideration of positive interpersonal interaction between the population of potential adopters [25]. We outline a simple framework of the diffusion process to structure our research by considering different market structures incorporating dis-adoption among them.

2.1 Proposed modeling framework. In 2009, Libai et al. [25] gave a formulation to estimate the growth of services by considering the dis-adoption rate. They discussed two options to introduce dis-adoption attrition in diffusion models where in the first it defines the lost-for-good dis-adopter who will never rejoin the firm at a later date and in the second category the dis-adopter may rejoin the firm. It depends upon customers' personal experience rather than facts and research whether they rejoin the service or not. To formulate a consistent model Libai et al. [25] assume that dis-adopting customers can rejoin by taking into account the fact that the customer's return is subject to the diffusion process. They also assume that word-of-mouth is

exchanged between the users and nonusers. The mathematical model given by Libai et al. [25] to define diffusion pattern with the impact of dis-adopters is as follows:

$$\frac{dN(t)}{dt} = p[m - N(t)] + \frac{q(1 - \delta)N(t)}{m}[m - N(t)] - \delta N(t), \quad (1)$$

where $N(t) = \int_0^t n(t)dt$ represents the cumulative number of adopters by time t , $n(t)$ is the number of adopters at time t , m defines the expected number of potential adopters, p and q represent the coefficients of innovations and imitations, respectively, and δ is the rate of dis-adoption. In the above-described equation, the first term implies the remaining number of buyers who are influenced by external influence, the second term, $[q(1 - \delta)N(t)] / m$, represents the impact of effective word-of-mouth promotion by retained customers, which results in the reduction of imitators by the rate of dis-adoption δ from $[qN(t)] / m$ to $[q(1 - \delta)N(t)] / m$ and the third term indicates a decrease in the adopters at a particular point of time, i. e., the group of people who have adopted the product by time ' t ' who wish to discontinue the product. The impact of the third term can be seen in the second term that represents the effective word of mouth promotion by retained customers. After solving equation (1) with the initial condition $N(0) = 0$, we get the following equation:

$$N(t) = \frac{\bar{m}(1 - e^{-(\bar{p} + \bar{q})t})}{1 + (\bar{q} / \bar{p})e^{-(\bar{p} + \bar{q})t}}, \quad (2)$$

$$\eta \equiv q(1 - \delta) - p - \delta \quad \text{and} \quad (3)$$

$$\Delta \equiv \sqrt{\eta^2 + 4q(1 - \delta)p}$$

The parameter $\bar{m} \equiv m \frac{\Delta + \eta}{2q(1 - \delta)}$ represents the number of potential adopters incorporating dis-adopters. From equation (3), we can justify that η and Δ have an inverse relation with δ , i. e., the values of η and Δ decrease as δ increases. In variables, $\bar{p} \equiv \frac{\Delta - \eta}{2}$ and $\bar{q} \equiv \frac{\Delta + \eta}{2}$ are constants representing the coefficient of

internal and external influence considering dis-adoption attrition respectively. From equation (2), it is clear that the structure of the model is flexible in nature. For different values of \bar{p} and \bar{q} , equation (2) can give either exponential curve or S-shaped curve. If the value of $\bar{q} = 0$, then the equation (2) transforms into an exponential growth model. In general, exponential models have been used in case of uniform growth, whereas S-shaped curves have been developed when the growth is non-uniform [21]. The model proposed by Libai et al. [25] was based on the S-shaped growth curve as the innovators and imitators cannot be distinguished due to lack of information, using the similar set of assumptions to incorporate the case of both services and product in the determination of eventual adoptions. In this paper, we propose an alternative way of approaching the model of Libai et al. [25]. In the following sub-section, we assume the rate of adoption to be logistic in nature to define the behavior through which individuals receive information and purchase the product.

2.2 Alternative formulation of the diffusion process incorporating dis-adoption attrition. This methodical approach is based on all the assumptions and situations mentioned above. We have also assumed that adoption by innovators plays an important role as imitators will adopt the product only if innovators purchase it. We propose an alternative methodology for determining the diffusion process. As per the modeling framework provided by Kapur et al. [21] based on the S-shaped curves to derive an alternative formulation of Bass model [5] to incorporate that for a product one can be an innovator or can be an imitator, with the same directions we formulate a model incorporating dis-adoption attrition to define the diffusion pattern. Therefore, the differential equation of the proposed model to calculate the cumulative number of adopters at time 't' is given as:

$$\frac{dN(t)}{dt} = \bar{b}(t)[\bar{m} - N(t)], \quad (4)$$

where $N(t)$ is the cumulative number of adopters at time t incorporating dis-adoption; $\bar{b}(t)$ is the rate of adoption considering the impact of dis-adoption.

On considering rate of adoption to follow logistic function., *i. e.*,

$$\bar{b}(t) = \frac{\Delta}{1 + \bar{\beta}e^{-\Delta t}}. \quad (5)$$

Consequently, equation (4) takes the form:

$$\frac{dN(t)}{dt} = \frac{\Delta}{1 + \bar{\beta}e^{-\Delta t}}[\bar{m} - N(t)], \quad (6)$$

here the adoption rate incorporating dis-adoption attrition is defined as Δ ; consist of rate of innovators and imitators influenced by dis-adopters in an additive form, *i. e.* rate of adoption (Δ) = rate of innovators (\bar{p}) + rate of imitators (\bar{q}). The variable $\bar{\beta}$ represents the learning parameter that defines the shape of the adoption curve taking dis-adoption factor into account. The cumulative sales follow the S-shaped adoption curve $\bar{b}(t)$.

After solving the equation (6) with initial condition $N(0) = 0$, we get

$$N(t) = \bar{m} \left(\frac{1 - e^{-\Delta t}}{1 + \bar{\beta}e^{-\Delta t}} \right). \quad (7)$$

On considering $\bar{\beta} = \frac{\bar{q}}{\bar{p}}$ and $\Delta = \bar{p} + \bar{q}$, we observe the equations (7) and (2) are identical, which implies that the differential equation (6) is equivalent to differential equation given in Eq. (1) which is an expression to determine the overall sales in the presence of the dis-adoption factor. Here we can see that equation (7) is in same direction as the Bass model [5] but with different parameters (taking into account the rejection/dis-adoption).

2.3 Diffusion patterns with dynamic potential adopter. As discussed earlier, the famous Bass model [5] was based on a certain set of assumptions. The market being fixed in size was one of the prominent assumptions. Many researchers have provided an extension of this perspective [20, 33, 34]. In this approach, fetching the ideas from Kapur et al. [21] and Libai et al. [25] we propose a framework for dynamic potential adopter inculcating the dis-adoption process. And so, the following differential equation has been utilized for the proposal:

$$\frac{dN(t)}{dt} = \frac{\Delta}{1 + \bar{\beta}e^{-\Delta t}}[\bar{m}(t) - N(t)] \quad (8)$$

This equation gives the expansion of the above-mentioned diffusion pattern defined by equation (6) by incorporating dynamic market potential adopters $\bar{m}(t)$, instead of \bar{m} . There are several factors effective on the social system, which confirms that the population of potential adopters in equation (8) is more pragmatic. The factors like price and quality of the service, promotional efforts made by firms, the socio-economic factors, governments rules and regulations, customer expectations and so on affect the market size on the whole. The important features of equation (8) are: it highlights the market size effect in diffusion process and it determines the probability of dis-adoption of potential buyers. Various modeling approaches have been justified to define the varying pattern of diffusion patterns. One approach has been varying the market size $\bar{m}(t)$ with time that can be linear or exponential. Other approach has been to represent $\bar{m}(t)$ as a function of the number of previous adopters. To study the diffusion pattern we follow the three possible basic changes in the population of potential adopters $\bar{m}(t)$. In Tab. 1 (given in the appendix), we have defined the dynamic potential adopter diffusion models that incorporate the effect of dis-adopters which can be assumed to be the modified form of Kapur et al. [21].

Table 1

Dynamic Potential Adopters Diffusion Models
(Modified form Kapur et al. [21])

Models	$\bar{m}(t)$	$N(t)$
LGM	$\bar{m}(1 + \alpha t)$	$\frac{\bar{m}}{1 + \bar{\beta}e^{-\Delta t}} \left[\left(\frac{\Delta - \alpha}{\Delta} \right) (1 - e^{-\Delta t}) + \alpha t \right]$
EGM	$\bar{m}e^{\alpha t}$	$\frac{\bar{m}\Delta e^{\alpha t}}{(\alpha + \Delta)} \left[\frac{1 - e^{-(\alpha + \Delta)t}}{1 + \bar{\beta}e^{-\Delta t}} \right]$
RPGM	$\bar{m} + \alpha \bar{N}(t)$	$\frac{\bar{m}}{1 - \alpha} \left[1 - \left(\frac{(1 + \bar{\beta})e^{-\Delta t}}{1 + \bar{\beta}e^{-\Delta t}} \right)^{(1-\alpha)} \right]$

According to the nature of escalation of the product, different forms of $\bar{m}(t)$ have been used. The three general approaches of market size fluctuation for the formulation of diffusion models by incorporating dis-adoption factor are taken into consideration as shown in Tab. 1. By using these $\bar{m}(t)$ in equation (8) we found the closed form of solution of $N(t)$ using the initial

condition $\bar{N}(0) = 0$ implying that initially no adoptions take place. In LGM the rate α is the linear rate of increment in potential buyers with respect to time. While in EGM the rate α is an exponential rate of adoption with time.

Similarly, in RPGM the rate α is the increment of potential buyers with respect to previous buyers, i. e., in this case, the adoption process is dependent upon previous buyers. If the value of δ tends to zero, then the proposed model converges towards the LGM, EGM and RPGM defined by Kapur et al. [21]. Also at the same time the above equations are similar to equation (6), when the rate α at which the market size changes is zero. By considering the value of δ to be non-zero, the value of $\bar{m} < m$, $\bar{p} > p$ and $\bar{q} < q$, also all other parameters will act positively.

3. Data analysis. In order to illustrate the estimation procedure and for generality of diffusion models, we have analyzed Kapur et al. [21] and proposed a model on real sales data-set of two different products/service. DS-I represents the sales data of Nokia cell phones obtained from Anand et al. [3] and DS-II represents the sales data of Ultrasound machines (Jordi.com [37]). The parameters and comparison criteria of the proposed model were estimated using simultaneously NLLS [36] by the SAS software package [32].

3.1 Parameter estimation. The estimates of coefficients of the proposed models and the models given by Kapur et al. [21] for cumulative sales data are given in Tab. 2 and Tab. 3 (refer appendix).

Tab. 2 displays the results of empirical analysis and suggests that the Nokia Cell Phone loses from 7 % to 40 % of their potential customers due to attrition whereas it can be seen from Tab. 3 that the population of potential adopters of Ultrasound Machines decreases by around 20–30 %. The rate of dis-adoption also varies for each service category DS-I and DS-II. In DS-I, the value of δ varies from 0.005 to 0.1 and for DS-II, the dis-adoption rate lies between 0.12 and 0.16.

Therefore, it is important for firms to study the behavior of customers to make some effective investment in reducing dis-adoption as p is influenced by the external factors of the firms but q is influenced by the word-of-mouth of the actual adopters. The value of q is reduced to \bar{q} because we assume that the only satisfied adopters will spread the positive word-of-mouth.

Table 2

Parameter estimation of DS-I

Parameters	Kapur et al. [21]			Parameters	Proposed Models		
	LGM	EGM	RPGM		LGM	EGM	RPGM
m	517359	409366	456325	\bar{m}	366872	347655	278368
p	0.021	0.027	0.019	\bar{p}	0.029	0.032	0.029
q	0.044	0.052	0.114	\bar{q}	0.032	0.053	0.143
α	0.032	0.028	0.179	α	0.058	0.033	0.5
β	2.088	1.937	5.756	$\bar{\beta}$	1.079	1.679	4.921
δ	–	–	–	δ	0.0046	0.012	0.101
b	0.065	0.079	0.134	Δ	0.061	0.085	0.172

Table 3

Parameter estimation of DS-II

Parameters	Kapur et al. [21]			Parameters	Proposed Models		
	LGM	EGM	RPGM		LGM	EGM	RPGM
m	99.493	100	100.03	\bar{m}	97.9704	96.347	99.9013
p	0.003	0.0028	0.0013	\bar{p}	0.004	0.004	0.001
q	0.495	0.499	0.594	\bar{q}	0.477	0.473	0.621
α	0.001	0.002	0.002	α	0.002	0.003	0.001
β	165.17	180.665	465.937	$\bar{\beta}$	134.36	125.005	621.396
δ	–	–	–	δ	0.1227	0.1759	0.1641
b	0.498	0.501	0.599	Δ	0.481	0.476	0.622

The ternary plot given in Fig. 1 and Fig. 2 (refer to the appendix) showcases a graphical presentation of three-dimensional parameters in two-dimensional plane. In Fig. 1 and Fig. 2, the x-axis represents the rate of adopters, the y-axis represents the rate of dis-adopters and the z-axis shows the additional adopters of the market potential. By using the ternary plot, we have tried to classify the relation between the rate of adoption (Δ), dis-adoption rate (δ) and the rate at which additional adopters increase the market potential (α) for different market scenarios, by normalizing the parameters to 1. From the ternary graph through Fig. 1, it is discernible that the rate of dis-adoption is always less than 0.2, i. e., we get the upper bound of it in DS-I, on the other hand, in case of DS-II the rate of dis-adoption is bounded between 0.2 and 0.3, which implies that both products are surrounded by a good number of dis-adopters. The other two rates of DS-I show the antipathy relation with each other in order to balance all the three models of DS-I and the parameter α of DS-II

influences the market negligibly. So we can conclude that the probability of dis-adoption and adoption affects the whole market of DS-II effectively where rate of adoption is quite high.

3.2 Model comparison. The performance of our proposed models is compared with diffusion models given by Kapur et al. [21]. We have considered the coefficient of correlation R^2 and Sum of Squared Errors (SSE) as goodness of fit measures. R^2 is the square of the correlation coefficient which measures the percentage of the total variation about the mean accounted for the fitted curve. For a larger value of R^2 , the model provides the better explanation of the variation in the data [23]. Similarly, SSE defines the sum of the squared differences between the actual value and the predicted value of each observation. The smaller the value of SSE, the better the model fits in the data. The summary statistics of goodness of fit measures for both the models on DS-I and DS-II are shown in Tab. 4 (given in the appendix). The values of R^2 and SSE give the better fit of our proposed models.

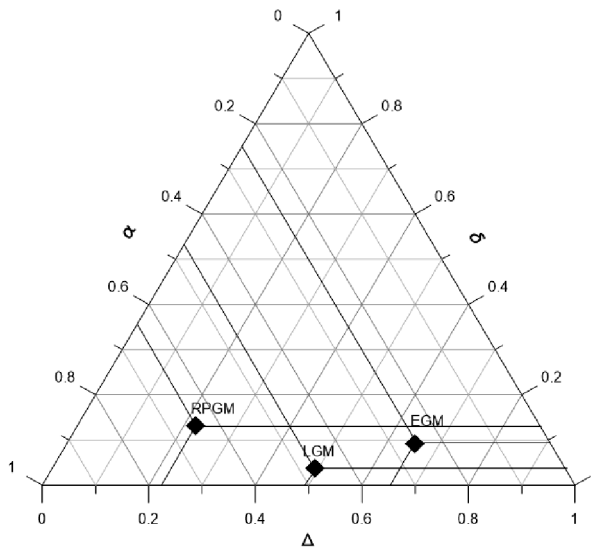


Fig. 1. Relation between α , δ and Δ of DS-I

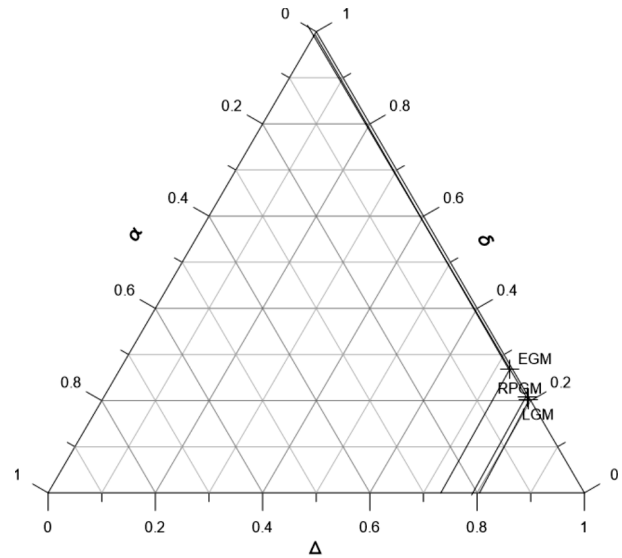


Fig. 2. Relation between α , δ and Δ of DS-II

Table 4

Goodness of Fit measures

Models		Kapur et al. [21]		Proposed	
		R^2	SSE	R^2	SSE
DS-I	LGM	0.997	8.05E+08	0.997	8.11E+08
	EGM	0.997	8.12E+08	0.997	8.21E+08
	RPGM	0.993	1.68E+09	0.991	2.37E+09
DS-II	LGM	0.996	167.1	0.994	242.7
	EGM	0.993	281.9	0.995	212
	RPGM	0.999	5.998	0.999	0.000053

In Fig. 3 and Fig. 4 (refer to the appendix), the actual and the predicted values for both data sets have been illustrated for models proposed by Kapur et al. [21] and for proposed models by using a line graph. All the values of the models are overlapping each other; this means that the proposed models give a good result in all cases.

4. Managerial implications. The presence of so many products and their advertisement has made it convenient for consumers but very difficult for firms. Consumers are directly or indirectly affected by word-of-mouth. And so there is always a lot in the wood that despite being potential buyers, the consumers never make a purchase if they heard anything wrong about the

offering. Therefore, we generally judge the success rate of any firm with those of who actually adopt the product. In this work, we have taken care of this fact and provided a mathematical approach for managers by which they can easily determine the number of people adopting/rejecting their product and can hence make a decision to cover up the same. The study is a helping hand to managers in another sense that it simultaneously also takes care of the changing market size scenario, i. e., it provides a good insight into the dynamic aspect of the market.

By knowing the requisites, the firm will be able to understand the endogenous and exogenous factors for dis-adoption and so they can work more intensely to not lose their potential adopters.

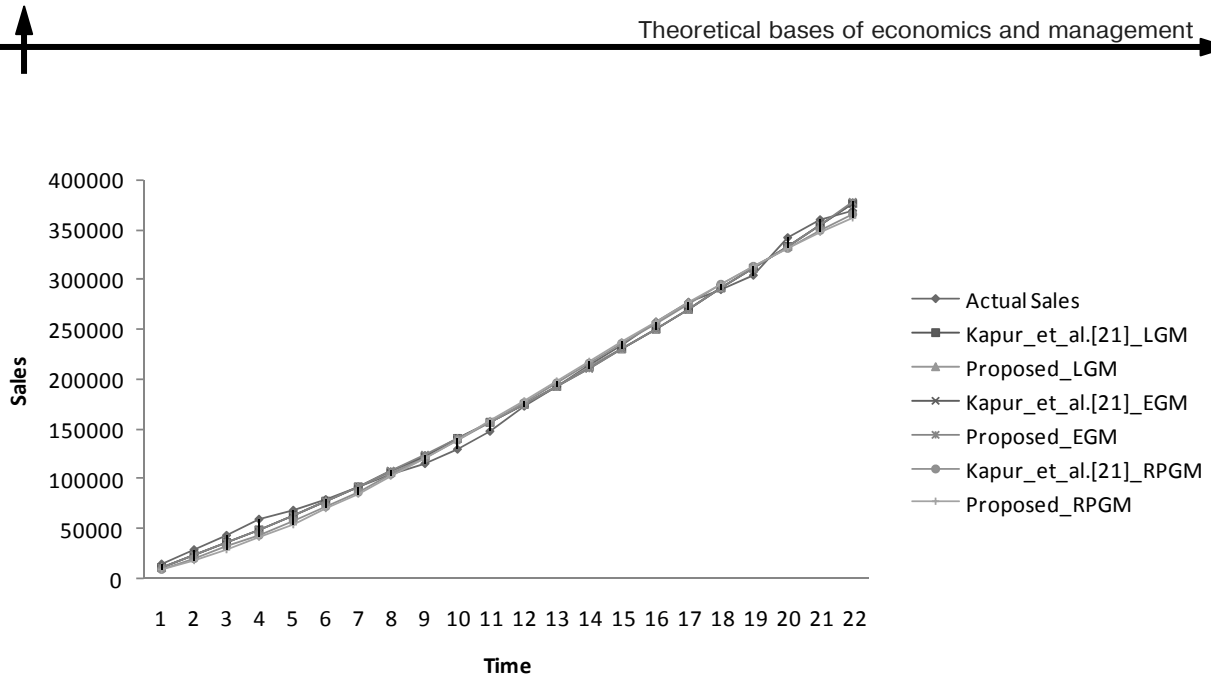


Fig. 3. Actual and Predicted sales for DS-I

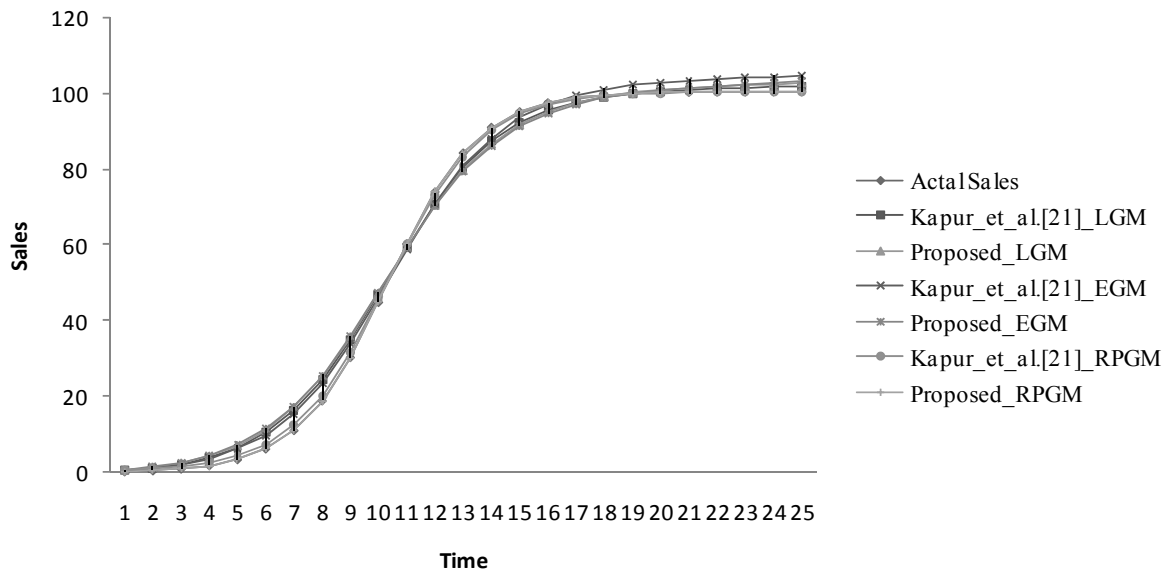


Fig. 4. Actual and Predicted sales for DS-II

5. Conclusions. The proposed work provides an approach to alternatively determining the actual number of adopters when market expansion and dis-adoption are happening simultaneously. The study investigates the diffusion process when the behavior of early innovators affects the entire adoption process; as their positive and negative word-of-mouth influence the imitators to a very good extent. Here, taking the idea from an established model by Kapur et al. [21], we have proposed three different approaches for market expansion.

All the parameters affected by the dis-adopters and the rate of dis-adopters have been calculated separately. Three different dynamic market potentials have been considered to give a better explanation of the unstable market size. Our study investigates the rate of entry and exit of the adopters into the market by taking different market scenarios, for example, in case of DS I, the proposed exponential growth model with a 3 % exponential increment in the potential adopters with time will lead to an approximately 1 % dis-adoption among the adopters.

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ANAND Adarsh – University of Delhi, PhD.
Department of Operational Research, University of Delhi, Delhi-110007, India. E-mail: adarsh.anand86@gmail.com

АНАНД Адарш – Университет Дели, PhD.
E-mail: adarsh.anand86@gmail.com

AGGARWAL Richie – Department of Operational Research, University of Delhi, MSc.
Room no. 207, II floor, Department of Operational Research, University of Delhi, Delhi-110007. E-mail: richie_aggarwal@yahoo.com

АГГАРВАЛ Ричи – Университет Дели.
E-mail: richie_aggarwal@yahoo.com

SINGH Ompal – Department of Operational Research, University of Delhi, PhD.
Room no. 207, Department of Operational Research, University of Delhi, Delhi-110007. E-mail: drompalsingh1@gmail.com

СИНГХ Омпал – Университет Дели, PhD.
E-mail: drompalsingh1@gmail.com

AGGRAWAL Deepthi – Amity School of Business, PhD.
Amity School of Business, Amity University, Noida UP, India. E-mail: deepthi.aggrawal@gmail.com

АГГАРВАЛ Дипти – Университет Дели, PhD.
E-mail: deepthi.aggrawal@gmail.com



S.Y. Ushakova, E.N. Zharova, Y.V. Fetisov

THE ANALYSIS OF INTERNATIONAL AND DOMESTIC EXPERIENCE OF THE REGULATION OF THE NATIONAL INTELLECTUAL CAPITAL

С.Е. Ушакова, Е.Н. Жарова, Ю.В. Фетисов

АНАЛИЗ ЗАРУБЕЖНОГО И ОТЕЧЕСТВЕННОГО ОПЫТА РЕГУЛИРОВАНИЯ НАЦИОНАЛЬНОГО ИНТЕЛЛЕКТУАЛЬНОГО КАПИТАЛА

The article describes different approaches to the definition of «intellectual capital» and examines its components, i. e. human capital and intellectual property. A comparative analysis of the various systems of state regulation of the intellectual capital management and the use of intellectual activity in the USA, Great Britain, China, Russia and other countries is conducted. * The study was sponsored by RFH in the framework of the Research project «Development of proposals to improve the efficiency of using the intellectual capital of Russia» (Project no. 15-02-00632). Special attention is paid to the analysis of universities as an important element of the national system of intellectual capital. In particular, brief characteristics of foreign and domestic systems of remuneration of the teaching staff are considered, which provoke the world discussions on the legality of the use of quantitative and expert assessments in the formation of this system, given the current trend towards the use of quantitative performance indicators. The data is given that now most countries prefer a decentralized system of higher education as more flexible and responsive (in spite of the fact that the process of decentralization brings both positive and negative effects). The most urgent problems of the domestic system of state management of human capital and RIA are stated such as geographical remoteness of the regions from the center, horizontal inequality in wages, low salary of researchers, lack in demand for the intellectual property, etc. A pictorial diagram of different kinds of taxation that promote the use of intellectual capital operating in different countries is based on the accumulated experience. The data on tax benefits, stimulating the domestic system of research and development at the federal and regional levels is classified. The analysis of the national system of tax benefits in the use of intellectual capital, the results of which confirm the gap between the scientific and industrial sectors has been carried out. The directions for the improvement of the national intellectual capital management system are outlined.

INTELLECTUAL CAPITAL; HUMAN CAPITAL; INTELLECTUAL PROPERTY; GOVERNMENT REGULATION; ACADEMIC AND TEACHING PERSONNEL.

В статье раскрываются различные подходы к определению понятия «интеллектуальный капитал», рассмотрены его составляющие – человеческий капитал и результаты интеллектуальной деятельности. Проведен сравнительный анализ различных систем государственного регулирования управления интеллектуальным капиталом и использования результатов интеллектуальной деятельности – американской, британской, китайской, российской и др. *Исследование выполнено при финансовой поддержке РФНФ в рамках Научно-исследовательского проекта «Разработка предложений по повышению эффективности использования интеллектуального капитала России» (Проект № 15-02-00632). Особое внимание в статье уделено анализу вузов как важнейшему элементу национальной системы интеллектуального капитала. В частности, дана краткая характеристика зарубежных и отечественной систем оплаты труда научно-педагогических кадров, согласно которой в мире до сих пор идут дискуссии о правомерности использования количественной или экспертной оценок при формировании данной системы, при существующем тренде к использованию количественных показателей результативности. Приведены данные о том, что в настоящее время, несмотря на традиционные различия в подходах к этому вопросу, большинство стран отдают предпочтение децентрализованной системе высшего образования как более гибкой и оперативной (при этом отмечается, что процесс децентрализации несет в себе как позитивные, так и негативные эффекты). Перечислены наиболее актуальные проблемы отечественной системы государственного управления человеческим капиталом и РИД: географическая удаленность регионов от центра, горизонтальное неравенство в оплате труда, низкие размеры базовых окладов научных работников, невостребованность многих объектов интеллектуальной собственности и пр. На основе обобщенного опыта представлена наглядная схема различных видов налогового стимулирования использования интеллектуального капитала, действующих в разных странах. Систематизированы данные по налоговым льготам, стимулирующим отечественную систему исследований и разработок на федеральном и региональном уровнях. Проведен ана-

лиз отечественной системы налоговых льгот в сфере использования интеллектуального капитала, результаты которого подтверждают разрыв между научным и производственным секторами. Намечены направления по совершенствованию отечественной системы управления интеллектуальным капиталом.

ИНТЕЛЛЕКТУАЛЬНЫЙ КАПИТАЛ; ЧЕЛОВЕЧЕСКИЙ КАПИТАЛ; РЕЗУЛЬТАТЫ ИНТЕЛЛЕКТУАЛЬНОЙ ДЕЯТЕЛЬНОСТИ; ГОСУДАРСТВЕННОЕ РЕГУЛИРОВАНИЕ; НАУЧНО-ПЕДАГОГИЧЕСКИЕ КАДРЫ.

Introduction. Currently, great attention is paid to the concept of intellectual capital. This subject has been brought up by the researchers engaged in the study of the development and use of intellectual capital, such as G. Becker, J. Ben Poret, J. Mintzer, L. Thurow, T. Schultz, L. Edvinsson, M. Malone, N. Bontis and others, whose works show that knowledge and skills have socio-economic value. They, in turn, relied on the classical works of political economists, such as D. Ricardo, W. Petty, A. Smith, who analyzed the nature of the labor force and considered the creative abilities of people and their development as the main source of the country's wealth. In particular, L. Edvinsson and M. Malone noted that the intellectual capital generated by human knowledge is the latent source of the value of the company [1]. T. Stewart [2] defined intellectual capital as an intellectual material that includes knowledge, experience, information, intellectual property, and is vital for the creation of values.

The objective of this article is to analyze foreign and domestic experience of state regulation of country's intellectual capital usage. For this purpose, at the macro level, this category is defined as: (1) *human capital, that is, people with their abilities, skills, knowledge and qualification that make up the human resource of the national economy, one of the factors of the economic growth;* (2) *the results of intellectual activity (hereinafter – RIA) or, in other words, the intellectual product of human capital.* As noted by S.E. Ushakov and S.S. Aushkap [3], «there are many areas of implementation of the intellectual product. The intellectual product is used in the economic activities of the enterprises, in the system of education, as well as the source of the accumulation of basic knowledge that can be demanded in the future».

1. The analysis of the experience in the state regulation of the development, use and accumulation of human capital

1.1 The analysis of the international experience in the state regulation of the development, use and accumulation of human capital. The authors aim to analyze the existing

world experience in the given area with the view to use it in the Russian context. In many technologically developed countries one of the key roles in the development and application of the scientific knowledge belongs to higher educational institutions that are focused on fundamental and applied research. The quality of state regulation of the higher education sector influences directly the efficiency of the use of human capital. The effectiveness of its use depends on academic staff remuneration, certification and reward system, quality control of educational programs, systems of professional standards and training, etc.

Today, there are various models of the control system of higher education management, with varying degrees of centralization. The centralized model of management education is typical for **France**, where the state fully controls the entire educational system. Moreover, education in France is funded mainly by the state. Public expenditures on national education in France make up approximately 23 % of the state budget [4].

In the **United States** there is a three-tier system of educational management, with no single federal body of higher education management, and many of the issues of financial security as well as accreditation of educational institutions are solved at the regional and federal level [5]. Public funding of higher education in the US is carried out in three main areas – research funding, financial support to universities and financial assistance to students. Funding is provided through the federal budget, the budgets of state and local budgets [6]. A similar system operates in Canada, where state regulation of educational activities is carried out at the level of provinces and territories, and there is no federal Ministry of Education. Thus, Canada's universities have the status of autonomous institutions with independent educational systems, which report to the regional ministries of education. The structure of public funding of higher education institutions in Canada is made up of the federal budget, funds administration and the provinces of the municipal budget. Today, programs of targeted financing of research universities are

increasingly popular in Canada. Such programs are implemented by the source of the federal budget specially created by the National Fund for the promotion of innovation (Canada Foundation for Innovation), aimed at the promotion of the university research and development [7].

For the **UK** it is typical to have many specialized intermediary agencies to communicate between the central education authorities (Department of Education and Training) and local authorities [8]. This demonstrates quite a high degree of decentralization of the British education system. Financing higher education in the **UK** requires the allocation of funds according to indicators of student admission, labor input and resources for their training. It should be noted that in the **US**, as well as in **Canada** and in the **UK**, private funding of higher education accounts for more than 40 % [9].

In **Germany**, the system of education is managed by the Ministry of Education which develops the concept of educational policy, determines the national legal framework for the functioning of the education system, provides funds for the expansion of higher education institutions and the development of the modern infrastructure for their effective functioning. Current management of education is the responsibility of the state governments and is regulated by the relevant laws on higher education, based on the federal framework law. On the state level, educational process is managed by the ministries in terms of, primarily, financial, administrative and personnel matters. Most of the financial costs of the universities is covered by the communities. Annual budgets of universities are part of the community budgets, which are adopted by the land parliaments. This suggests that the educational system in **Germany** is to a certain extent decentralized to the regional level.

Summarizing the international experience of state regulation in the higher education system, it should be noted that currently, many countries prefer a decentralized system of higher education system, which allows to make quick decisions in the organization of the educational process, thereby certainly improving the efficiency of the educational system. However, there are still prospects for the development of a clearly defined multi-level public sector management

structure of higher education. A full or partial rejection of the state system of regulation of the educational sphere stimulates strengthening the market mechanisms in the educational environment, which does not always lead to positive results in terms of the quality of educational services. In this regard, we can conclude that state control of educational services is important.

Effective use of human capital as part of the intellectual capital of the nation is also stimulated by a competent state policy on the formation of a remuneration system of scientists and university professors. In the world, the financial reward of academic and research staff is one of the most pressing issues in the regulation of the human capital use. The academic community in the world is becoming less homogenous and more subject to diversification. In this respect, in many technologically developed countries, the material incentives for highly qualified personnel, in addition to the basic salary, include bonuses, allowances and subsidies, and their share depends on the country and university traditions, and other factors. In most countries, salary depends to a greater extent on the position, work experience, scientific degree, and the field of knowledge of the researcher. Such areas of knowledge as economic, engineering and natural sciences are usually valued higher than humanities. The average income level of the professor tends to reach the general level of the middle class, although it can be lower in some countries [11].

Universities in most countries are divided into public and private that coexist in different proportions. The former, as a general rule, are funded centrally from the state budget or public funds, or charge a tuition fee or exist at the expense of special private or public funds. For example, in **Australia**, almost all universities are state. Reduced funding in **Australia** in recent years has led to a reduction in the number of teachers and their differentiation. The level of wages is regulated by the trade union.

UK is among those countries where wages in the academic sector are high in comparison with the salaries of the specialists from other areas of the economy and allow academics to reach the top layer of the middle class. British universities often promote the additional employment of the teachers, and counseling can be carried out by

the teachers, both independently and as part of the university. However, salaries of the academic staff in the UK are still lower than those in other English-speaking countries such as the United States and Canada.

In some countries with lower living standards and paternalistic relations with the state system, an essential part of academic earnings is made up by the additional payments, allowances and subsidies, which increases the basic salary by several times. For example, in **China**, additional payments for meals, travel expenses, books and magazines, housing, insurance premiums in case of unemployment, etc., are quite common in addition to bonuses for the position and overload. However, the question of the legitimacy of paying such subsidies is decided by the university, its departments or faculties (depending on the performance), but they are not guaranteed by the central government [12].

In **Japan** it is common to motivate the research staff in higher education institutions by paying extra for experience and innovation. The experience of Japan is unique for the thoroughly built human resource management system, which includes not only world-known lifetime employment, but also the system of personnel rotation and training them in the workplace [13]. Japanese companies, including research institutions, are characterized by regular insignificant increase, motivating employees, and their transfer to other departments, sectors and branches. Professional career in science under Japanese law must be over at the age of 60, and before that no researcher having a permanent position can be fired. Every year there is a certification of researchers, during which their performance is assessed on the basis of such performance as indicators of scientific activity, the number of publications and links to them, the number of invitations to the conferences, the number of patents, etc. In case of successful certification the employee is promoted to the next level of payment [14].

Currently, there is a tendency in the world towards the development of scientific and teaching personnel pay system that is mainly based on quantitative indicators of performance in research and teaching activities, although this form of evaluation is subject to legitimate criticism from the scientific community. According to M. Yurevich, some countries, such

as Britain and France, prefer to use an expert job evaluation system of scientists and lecturers. Such countries as the Netherlands, Germany, Australia use a combined system of evaluation, i. e., quantitative indicators in conjunction with the expert assessment [15]. The question of whether to use a quantitative or expert assessment of the effectiveness of scientific and teaching staff performance in the formation of the remuneration system is still debatable.

1.2. Analysis of the domestic experience of state regulation in the development, use and accumulation of human capital. In Russia, there is a three-tier system of higher education management: at the federal, regional and local level. In recent years, as part of the administrative reform, there have been some changes in the system of state regulation of the higher education sector. Currently, higher education management at the federal level is carried out by the Ministry of Education and Science of the Russian Federation and the Federal Service for Supervision in the Sphere of Education and Science affiliated with it. At the regional and local level, the educational system is administered by the appropriate federation bodies and local governments of city districts. As a result of the reforms there was a change in the organizational structure of the management system of higher education, but it has led to a more complicated process of decision-making and duplication of the functions of the bodies involved in the management of the higher education system [16]. Focusing on the result in the management of the higher education system came as a positive outcome of the reforms. In this context, attempts are made to develop public funding of higher education, depending on the universities performance, proved by such indicators as the number of undergraduate and graduate students, the number of teachers with advanced degrees, publication activity of the teachers, the number of available educational programs of the university, and so on.

The entire system of higher education in Russia is to a large extent influenced by the geographical remoteness of the Far Eastern and Siberian regions from the central part, which leads to some decentralization in the public administration system. V.M. Novikova says [17]: «This situation has both negative and positive



consequences. The former are due to the difficulties in coordination and harmonization of the standards at different levels. The latter are caused by the opportunities to introduce the best features of European, Asian and American educational system into the Russian educational system». Geographical aspect leads to a shortage of highly qualified scientific and teaching staff in the regions. Current programs aimed to attract scientists and teachers in the regions do not give the desired effect. Research personnel is mainly concentrated in the capital region and in the traditional research centers (e. g., Novosibirsk). Other regions of the country do not attract qualified researchers. This is due, inter alia, to the socio-economic situation in Russia as a whole. The lack of high-tech production results in the low demand for highly qualified specialists and, as a consequence, highly qualified teaching staff. Therefore, there is no need for the state regulation of relocation of scientific and teaching staff. Thus, it is necessary, first of all, to solve the problem of employment of future graduates in high-tech industries to cope with the problem of uneven distribution of highly qualified personnel in the country.

In recent years, plans to support federal and national research universities are implemented in Russia. According to I.B. Nazarova [18], one of the main objectives of federal and national universities is «... to strengthen the ties between higher educational institutions and economic and social spheres and to develop innovative services and products». In general, the implementation of these plans contributes to independence of the universities which have the status of federal and national ones and it is consistent with the process of decentralization of the Russian higher educational system. It should be noted that the decentralization process brings both positive and negative features. On the one hand, a significant part of the authorities is delegated to universities, which facilitates the decision-making process, but, on the other hand, gives rise to certain isolation of the bodies of the higher education system of the country, its inconsistency and unevenness of their development. In this connection, given the scale of the country, the relevant experience of Germany could be useful in Russia. It should be noted that in Germany there is a federal center of higher education management system, yet

most authorities are delegated to regional management structures, i. e., the Land Ministries of Education.

Speaking about the remuneration of academic staff, it still remains one of the main issues in Russia. A number of new regulations in the system of remuneration of scientific workers and teachers has not been approved yet and is still under discussion. The documents that are in force now include the Decree no. 38n of 25.11.2014 adopted by the Federal Agency of Science and Education «About the system of payment of the federal state budgetary institutions employees in the sphere of research and development», and the Decree no. 10 «On the approval of the Model remuneration system of employees of the federal state budgetary educational institutions, subordinate to the federal agency of scientific organizations» as well as the Decrees of the Ministry of education and science and the Ministry of Healthcare of the Russian Federation which suggest schemes for the remuneration of scientists and university professors. However, new schemes have not yet been put into action. As is known, according to the legal documents defining the strategic guidelines of the development of scientific, technical and educational spheres, salaries of researchers and university professors should be several times higher than the average salary in the region. However, in the first half of 2015 the average salary of the researcher was 32 566 rubles, which amounted to 115.9 % of the average wage [19]. The solution to this problem has not been found yet.

Now in Russia there is a system of allowances and bonuses for academic and teaching staff. Extra charge for an academic degree and position, a higher salary for the rank of full members and corresponding members of the state academies of sciences are the most widespread [20]. Innovative Development Strategy of the Russian Federation for the period up to 2020 provides for the introduction of additional allowances to the salaries of the university lecturers engaged in efficient research activities. Since December 2009 there has been an increase in the average salary of researchers up to 25 thousand rubles, but there are significant differences in the wage level of employees in scientific and educational spheres behind the average figures.

Such reforms have resulted in a new system of wages in scientific and educational spheres, but, unfortunately, have not solved all problems, and even spawned new ones. Thus, E.A. Volodarskaya and V.V. Kiselev [21] consider horizontal inequality in pay, i. e., significant differences in wage levels of the groups of the same qualification working in different departments, regions, scientific fields, etc., one of the main problems. This inequality impedes the development of the scientific potential of the country. According to the study, increasing regional inequality is not caused by the objective reasons, such as the results of research, the implementation of priorities and so on, but is due to the regional differentiation, the competitive position of the firms, the formation of monopoly groups of scientists working for the corporate interests and other subjective factors. As a result, those scientists who managed to earn «relational» capital, which in its turn forms the administrative rent, are in a more privileged position, while inefficient redistribution of resources based on lobbying only reinforces the existing imbalances. For example, highest wages are paid to scientists working in the areas related to mining, economics and law and those working in the most affluent and successful regions.

According to E.A. Volodarskaya, V.V. Kiseleva [21] and D.A. Bocharnikov [20], a large gap between the wages of managers and employees (also, the dependence of the employees wage level on the managers decisions can be a means of influence on the former), a large gap between the wages of experienced scientists and young ones, low basic salary and an insignificant bonuses that do not motivate employees to improve their skills, as well as the high proportion of alternative employment of scientists are other important issues in the regulation of salaries of researchers. Thus, analyzing the current situation, we can conclude that the problem of work stimulation of scientists and university professors, who constitute of the main components of human capital, has not yet been solved in Russia.

2. The analysis of experience of state regulation in using RIA

2.1. The analysis of international experience of state regulation in using RIA. Now, let us consider the international experience of state regulation in the use of another component of the country's intellectual capital, i. e., intellectual property. Reification of RIA occurs through the

introduction of intellectual work results such as patents, licenses, models, copyrights, know-how, software, etc., into practice. In practice, intellectual capital is used in the process of commercialization (or introduction into economic circulation) of RIA, for instance, manufacturing high-tech products and services based on the use of RIA, or sale of patents and licenses for their use.

International experience shows that management of intellectual property is one of the priorities of state policy both in the higher educational sector and in the sectors of science and high-tech production. The development and implementation of the regulatory acts for creating and maintaining favorable conditions for the implementation of the measures to stimulate the efficiency of using intellectual capital is one of the forms of state regulation.

The experience of legal regulation of intellectual property rights in countries such as Britain and the US is quite unique, since the legislation of these countries has a rich history. In the UK, a specific role in the law system is given to judicial precedents. On the whole, the UK legislation contains more than two hundred legal documents, rules, regulations and international treaties relating to regulatory issues of legal relations in the field of intellectual property [22]. The main legislative acts regulating relations in the sphere of intellectual property in the UK are the following: the Law «On copyright, industrial designs and patents» (1988), the Law «On Trademarks» (1994), the Law «On copyright and related rights, as well as on trademarks (crime and liability)»(2002), the Law «On patents» (2004). These regulations govern patenting of industrial property, introduce the criteria of novelty and industrial application of these objects, define possibilities of the copyright owner for the use and alienation of these rights, determine the means of legal protection of industrial property, the order of their registration, etc. [23].

In the **United States** the scope of intellectual property is regulated by more than 150 regulatory documents, regulations and contracts. The main laws are the following: the Law «On intellectual property and the priorities of the Organization» (2008), the Law on Patents (Industrial Designs) and the Code of Federal Regulations Patents (1996). An important legal document in terms of stimulating the creation of intellectual property is the law of Bay-Dole Act (1980), under which US universities are defined as not only higher



education institutions but also centers of research and development, and are instructed to patent the results of intellectual activity with the view to subsequently commercializing them. Thus, intellectual property rights, according to this law, belong to its creator, the commercial organization. This trend can be found in other technologically advanced countries. L.V. Levchenko [24] wrote in his book [24]: «The main trend in the legislation of the last two decades observed in technologically advanced countries is the dominance of the idea of securing exclusive rights for intellectual property to the organizations, as they are most likely to launch these results into economy basing on the interests for all parties: the authors and other right holders as well as customers and performers».

China's legislation in the field of intellectual property can be called relatively «young» in comparison with the legislation of the United Kingdom and the United States. These issues have been under close consideration only since the mid 1980s, when the development of science and technology became a priority in the country. The main normative acts in this sphere are the Law «On Copyright» (2010) and the Law «On Patents» (2008). All in all, China has 22 laws and 100 regulations and rules relating to intellectual property [22]. However, the violation of intellectual property rights remains a challenge for modern China and its legislation needs further improvement. It should also be noted, that, according to E.A. Salitskaya [25], «an important step in China's policy in the field of scientific research and rights on intellectual property was the permission (under the American Bayh–Dole Act) to commercialize intellectual property created in the framework of research projects funded by the state».

2.1.1. Taxes as a means of management and use of intellectual capital. The study of foreign experience has shown that there are various types of tax incentives used as a tool to improve the efficiency of its use. These incentives include: reduction of tax rates (income tax, value added tax, other taxes); tax breaks and exemptions from taxes of the companies engaged in research and development within the framework of special programs or areas; write-off of the expenses on research and development with the multiplying factor; investment tax credit; tax breaks to pay taxes on the profit from ongoing investment projects; special depreciation regimes;

income tax benefits on salaries of researchers and their contributions to social funds.

Figure below shows tax incentives, their mechanism and the countries using them:

The analysis of the dynamics of the main indicators in the field of creation and use of intellectual capital in the countries using tax incentives has shown that these measures do not always lead to an increase in the share of research and development expenditures in the enterprise structure. For instance, the analysis of statistical data of the Organization for Economic Cooperation and Development (hereinafter – OECD) showed that in 2010–2011 such countries as Spain and Canada have provided significant support to the business sector by indirect methods to stimulate research and development and the use of RIA. However, in terms of the activity of the business sector in carrying out their own research and development, the positions these countries have taken were far from leading (27 and 22 respectively, of the 36 countries included in the sample). Moreover, Canada observed a decrease in the activity of the business sector in financing the companies' own research and development, compared with the data of 2001. In this context, countries periodically review a set of tax measures to stimulate the R&D sphere, through continuous monitoring of their effectiveness.

2.2. Analysis of the state regulation experience in the use of intellectual activity in Russia. In Russia, the use of the results of intellectual activity is controlled by about 80 normative documents, regulations and contracts. The main legal acts are the Civil Code of the Russian Federation, the Federal Law no. 364-FZ «On the Amendments to the Federal Law «On Information, Information Technologies and Protection of Information» of November 24, 2014, the Civil Procedure Code of the Russian Federation» and a number of other regulatory documents. The regulatory framework governing the creation and use of intellectual property is provided by the international legal acts adopted under the World Intellectual Property Organization and its agencies (hereinafter – WIPO), agreements between individual states, acts of the International Organization for Standardization (hereinafter – ISO), international financial reporting standards (hereinafter – IFRS) accounting intellectual property in the financial statements of the entities in accordance with the federal legislation.

Reduced rates of income tax	Taxation of the income from the use of a qualified intellectual property object, at the effective income tax rate, which depends on the mode share of income that is not subject to taxation	Belgium, France, Hungary, Luxembourg, the Netherlands, Spain, United Kingdom
Reduced tax rate on the sale revenue of technology stocks	Cancellation or introduction of preferential tax rate on the sale revenue of high-tech innovative companies	Belgium, USA
Exemption on value added tax	Reduced tax rates, or application of differentiated rates for high-tech goods	United Kingdom, Germany, Spain, Sweden
Write-off of the expenses on research and development with a multiplying factor	The size of the tax credit is calculated from the amount of R&D expenditure, or from the increase in R&D expenditure	Australia, Austria, Belgium, Britain, Denmark, Hungary, the Czech Republic
Investment tax credit	Payment of the accrued income tax to companies engaged in research and development. The amount of the tax reimbursement is calculated as a percentage of R&D spending	Australia, Austria, Belgium, United Kingdom, Hungary, Denmark, Canada, USA
Tax breaks to pay tax on profit from ongoing investment projects	Permitted delay of paying the profit tax for the companies doing research and development	China, India
Special modes of depreciation	Accelerated depreciation of fixed assets used in R&D	Belgium, Brazil, United Kingdom, Denmark, Canada, China, Mexico, France, Poland
Exemptions from income tax on the salaries of researchers and their contributions to social funds	The exemption of the income tax on the salaries of researchers with a PhD or master degree, as well as salaries of engineers or other employees of the companies with the status of «fledgling innovative company»	Hungary, the Netherlands, Turkey, France

Tax incentives for the creation and use of RIA, their mechanisms and the list of countries using them [26]

The Government Resolution no. 233 «On the approval of the rules of the state management of the RF rights on the results of intellectual activity carried out for the civil, military, special and dual purposes» of March 22, 2012 is the document regulating the process of rights management of intellectual property created at the expense of public funds. The aim of this Regulation is to streamline the rights management process on the results of intellectual activity, created by order of the state.

The inventory showed that the balance of the state has accumulated a huge amount of intellectual

property created by the state order and unclaimed in the actual production. An important step towards enhancing circulation and use of RIA, established by the state in economic activity of enterprises, was the legislating process of donating rights to enterprises which are manufacturers of products, works and services on the basis of the free use of intellectual property. This step, of course, contributes to the process of commercialization of intellectual property, and, therefore, leads to the more efficient use of intellectual capital.

As for the fiscal aspect of state regulation in the field of RIA use, there is a whole set of tax



incentives for the sphere of scientific research and development in Russia, that is, the creation and use of intellectual capital at the federal and regional levels [26].

The analysis of the system of tax benefits in the use of the country's intellectual capital in Russia showed that such benefits are mainly focused on encouraging the work of the scientific research sector. In the field of production involving the use of intellectual products (innovations), there are fewer tax benefits. The study based on the data of the Institute of Statistical Studies and Economics of Knowledge of HSE showed low demand for the tax exemption for the implementation in Russia of the exclusive rights on inventions, utility models, industrial designs and other RIA as well as the use of rights on RIA on the basis of a license agreement. The survey conducted by the experts of the Higher School of Economics found that in 2011 the advantage of this benefit was taken by 24.3 % of research institutes, 23.1 % universities and only 0.3 % of industrial enterprises [27]. This data suggests a low turnover of RIA in the Russian market and the low demand for it from the manufacturing sector of the economy. These statistics suggest that there is a problem of the gap between research and the productive sector of the economy that can be attributed to the systematic macroeconomic problem of the Russian economy that needs to be solved. Intelligent product created in the science sector, is not fully commercialized. This is also proved by the "Unified state information system for recording the results of research and development and technological works of civil purpose" database (rosrid.ru) [28], which accumulates information on a large number of RIA created with public funds, but not applied in the real economy. Thus, the gap between research and productive sectors in economy makes the complex of existing tax incentives ineffective and calls for its restructurization.

Conclusions

1. To develop proposals for a more efficient use of the country's intellectual capital, which consists of two components, the human capital and the intellectual property, it is necessary to use the experience of the countries where the administration system in scientific and technical spheres is well-established, stable and flexible to the new realities, and the system of commercialization

and legal protection of the intellectual product is well-developed.

2. The analysis of foreign experience in the state regulation of the creation, use, and accumulation of human capital has shown that many countries prefer a decentralized higher education system, which results in a more efficient decision-making process in the educational organization, thereby improving the efficiency of the educational system. However, at the same time, the development of a clearly defined multi-level public sector management structure of higher education should not cease altogether. Given the scale of the country, the experience of Germany, where there is a single federal management center of higher education, but a significant number of competences is delegated to the regional management structures, could be useful for Russia.

3. One of the most important instruments to promote the efficient use of human capital as part of the national intellectual capital is the remuneration system of scientific and teaching staff. Currently in the world, the remuneration system tends to be based on the quantitative performance indicators of research and teaching activities. Russia has also embarked on a similar pay system. However, there is no consensus about the quality of the system in terms of the efficient use of human capital in Russia and in other countries.

4. Most important forms of government regulation in RIA use are the legislating activities. In Russia, there is an on-going process of improving the legal framework for managing the use of RIA. In particular, a big step in this direction was the legal registration process of the donation of rights on RIA funded by the state to the companies that are potential producers of products on the basis of RIA.

5. The analysis of the international experience in the formation of the tax incentives complex in the field of RIA use showed that in technologically advanced countries, the efficiency of the mechanism for promoting the creation and use of intellectual capital requires constant monitoring and updating. However, the tools to stimulate the effective use of RIA are applied in the world and are yielding results. The analysis of the fiscal aspects of state regulation in RIA use showed that in Russia a set of tax incentives for the nation's intellectual capital is currently

inefficient and needs to be revised. The inefficiency of fiscal instruments is largely due to the low demand for tax incentives in the manufacturing sector, reflecting the need to address systemic macroeconomic problems in the Russian economy.

The direction of future research includes specification of the results obtained in the course of the study and their development to the level of practical use by various structures and institutions.

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USHAKOVA Svetlana Y. – The Russian Institute for Economics, Policy and Law in Science and Technology.

105064. Zemlyanoy val str. 50A. Bil. 6. Moscow. Russia. E-mail: altaxaris@yandex.ru

УШАКОВА Светлана Евгеньевна – начальник отдела Российского научно-исследовательского института экономики, политики и права в научно-технической сфере, кандидат экономических наук.

105064, ул. Земляной Вал, д. 50А, стр. 6, г. Москва, Россия. E-mail: altaxaris@yandex.ru

ZHAROVA Elena N. – The Russian Institute for Economics, Policy and Law in Science and Technology.

105064. Zemlyanoy val str. 50A. Bil. 6. Moscow. Russia. E-mail: zharovaen@rambler.ru

ЖАРОВА Елена Николаевна – старший научный сотрудник, Российский научно-исследовательский институт экономики, политики и права в научно-технической сфере, канд. экон. наук.

105064, ул. Земляной Вал, д. 50А, стр. 6, г. Москва, Россия. E-mail: zharovaen@rambler.ru

FETISOV, Yuriy V. – The Russian Institute for Economics, Policy and Law in Science and Technology.

105064. Zemlyanoy val str. 50A. Bil. 6. Moscow. Russia. E-mail: altaxaris@yandex.ru

ФЕТИСОВ Юрий Владимирович – старший научный сотрудник Российского научно-исследовательского института экономики, политики и права в научно-технической сфере.

105064, ул. Земляной Вал, д. 50А, стр. 6, г. Москва, Россия. E-mail: altaxaris@yandex.ru



A.N. Tsatsulin, N.I. Babkina

**CAN AN UNSTEADY BANKING SYSTEM INCREASE
THE STABILITY OF THE RUSSIAN ECONOMY
DURING A PROTRACTED CRISIS?**

А.Н. Цацулин, Н.И. Бабкина

**МОЖЕТ ЛИ НЕУСТОЙЧИВАЯ БАНКОВСКАЯ СИСТЕМА
ПОВЫСИТЬ СТАБИЛЬНОСТЬ РОССИЙСКОЙ ЭКОНОМИКИ
В УСЛОВИЯХ ЗАТЯЖНОГО КРИЗИСА?**

The article deals with the stability of the domestic economy in the context of the main problems of the Russian banking system which developed in the period of transition to a market economy and after the 2008 economic crisis. The authors paid particular attention to the readjustment procedure for the authorized commercial banks in the mode of recovery of economic subjects of the market of banking products and services. This is because of the extraordinary role that the banking system under the control of a mega-regulator plays in the functioning of the institutional economy. The banking system, however, is currently demonstrating its own compression at an alarming rate. The authors are trying to obtain an understanding of the problems that are common to the withdrawal of the Russian industry from the recession and in particular to the recovery of the Russian banking system.

As a result of their analysis, the authors also consider it necessary to preserve the competitive environment of banking products and services in the country. Law-abiding commercial banks experiencing temporary difficulties but operating in the market without serious violations should undergo a rehabilitation procedure without having their licenses revoked.

STABILITY OF ECONOMIC INSTITUTIONS; BANKING SYSTEM; AUTHORIZED COMMERCIAL BANK; RE-ADJUSTMENT; MONETARY AGGREGATES; CREDIT RATE; RESISTANCE; WITHDRAWAL OF THE LICENSE; DISCOUNT; OBJECT OF PROPERTY.

В статье рассматриваются вопросы стабильности отечественной экономики в контексте главных проблем российской банковской системы, которые складывались как в период перехода к рыночным отношениям, так и после экономического кризиса 2008 года. Особое внимание авторы статьи уделили процедуре санации коммерческих уполномоченных банков в режиме оздоровления экономических субъектов рынка банковских продуктов и услуг. Это объясняется той чрезвычайной ролью, которую играет банковская система под контролем мегарегулятора в функционировании институциональной экономики. Но сама банковская система в настоящее время демонстрирует собственное сжатие угрожающими темпами. Авторы стараются разобраться в тех проблемах, которые являются общими для вывода национальной экономики из состояния рецессии и для оздоровления непосредственно банковской системы России.

Также авторы статьи, в результате проведённого ими анализа, считают необходимым сохранение конкурентной среды банковских продуктов и услуг в стране. А испытывающие временные трудности, но законопослушные коммерческие банки, работающие на рынке без серьёзных нарушений, подвергать процедуре оздоровления без лишения их лицензии на профессиональную деятельность.

СТАБИЛЬНОСТЬ ЭКОНОМИЧЕСКИХ ИНСТИТУТОВ; БАНКОВСКАЯ СИСТЕМА; УПОЛНОМОЧЕННЫЙ КОММЕРЧЕСКИЙ БАНК; САНАЦИЯ; ДЕНЕЖНАЯ МАССА; КРЕДИТНАЯ СТАВКА; УСТОЙЧИВОСТЬ; ОТЗЫВ ЛИЦЕНЗИИ; ДИСКОНТ; ОБЪЕКТ НЕДВИЖИМОСТИ.

*In fact, God is on the side
of the biggest bank accounts.*

Adam Smith

Introduction. On November 17, 2015, Sberbank head German O. Gref told reporters, «What we are seeing now – it is a large-scale

banking crisis. We see zero profit of the banking sector, a huge formation of reserves, the Central Bank has to clean the banking sector from banks that are not, in fact, banks. In general, the situation is very severe in the banking sector, but controlled» [37]. The severity of the situation is obvious, but is it controlled?

The specifics of this period, which is defined by certain prominent economists [16] as the change of yet another technological paradigm, when a post-industrial economy has to be immediately replaced, allegedly, by an innovative economy, is in *the failure of the market mechanisms* predicted by none of the theorists. Since the trends of global instability and poorly predictable price and exchange rate volatility also affect the national economy, the market becomes, so to speak, temporarily short-sighted.

Accordingly, since the balancing equation must be satisfied, the role of the state and paternalistic attitudes dramatically increases in this situation that is no longer quite market. It is the state that now carries the main burden in initiating the widely discussed and planned the large-scale restructuring of the national economy, or the new industrialization or re-industrialization, etc.¹ in Russia, and, while the country was recently recognized as a superpower, it is currently classified by the world's three leading rating agencies (Fitch Ratings, Moody's Investors Service, Standard & Poor's) in a group of countries bashfully called *developing*.

These circumstances determine the urgency of the questions touched upon in this article and widely discussed in the scientific community, including by the professionals listed in the bibliographic list of used literature [7, 10, 12, 16, 26, 29, 33–35], and also in the works of other famous authors not included in our review.

1. Is the State a «night watchman» of the national economy or the visible «hand of the market»? How to interpret such an involuntary increase of the state's role in market realities? World experience of previous similar financial crises shows that a *window of opportunities* indeed opens for the developing countries wanting to profit from a new wave of economic growth. However, to 'open' this window, it is necessary to have the rate of accumulation not at 20–23 %, as is the situation in Russia, but to strive to attain a 35–40 % savings rate to Gross Domestic Product (GDP). Since the market itself cannot generate such a huge momentum, direct state intervention into the mechanics of the inevitable capital growth is necessary.

Taking into account the direct intervention of state institutions in the process of restructuring,

¹ These terms are now widely discussed and commented upon in the scientific community.

the banking sector should play a special role in implementing the future structural changes. Indeed, if we consider the potential sources of financing, those presented by the fiscal mechanisms are not great, but there are enormous opportunities presented by the monetary mechanism. However, there are no workable mechanisms for financing economic growth through a system of the Russian Central Bank (CBR) because they are not clearly described in the founding documents. The mechanisms of the lending schemes of structural changes and the long-term target programs and projects were also not set [15].

Federal Law on the Central Bank, of course, should be improved further, as the main Russian regulator (megaregulator) is not responsible for the economic performance of the country as opposed to, say, the Federal Reserve System (FRS) of the USA², whose regulatory documents explicitly describe this dynamics. The provision is especially well detailed as a doctrine in the statutes of the 12 regional offices of the authorized banks of the Federal Reserve as maintaining a balance between the interests of commercial banks (CBs) and key national interests.

But the role of Russian banks as a driving force of the economic development of the country, aside from the above-said, is significantly complicated by the quality of the financial services rendered to the clientele and to consumers in the broadest sense. The discussions at the World Economic Forum in Davos in 2013 ranked this quality around the 60th place in the world, between Colombia and Venezuela, and actually after Ukraine [14].

These circumstances are directly related to the specifics of the monetary policy which has been carried out in the last 17 years in our country. Money supply is issued primarily for the purchase of foreign currency (in Central Bank of RF currency interventions mode), so all serious bank loans are either state-owned bank products (more precisely, of the banks with state participation), or foreign loans which are digested by the Russian non-state (authorized) commercial banks.

However, since the early 2000s, we observed the opposite process of a multifold growth of

² The Federal Reserve System, or FED, was created on December 23, 1913 as an independent federal agency to carry out the functions of the Central Bank of the United States, and implement centralized control over the commercial banking system of America [19]



Russian direct investment flows abroad credited by the domestic banking system and having exceeded \$70 billion [18,105] in 2012. Already in 2014, as reported in the Deposit Insurance Agency (DIA) report [30.3], Russians took 1.3 trillion rubles away from the banks. However, during the same year, household deposits in banks increased by 9.4 % to 18.55 trillion rubles, but this increase was achieved entirely due to currency revaluation.

In fairness, we should remember that in the midst of the financial liquidity crisis in December 2008, the State Duma introduced a bill to amend Art. 76 no. 86-FZ [15] to confer additional powers on special representatives of the Central Bank to oversee all banks receiving anti-crisis support in the form of subordinated loans of Vnesheconombank, unsecured loans of the Central Bank, and federal budget funds placed in bank deposits. Special supervisors need to track the distribution of public funds: the representatives of the Central Bank are entitled to attend the meetings of the bank's management bodies, to participate (without voting rights) in decisions on lending and liability management, and request the information necessary to verify the activities of the bank. The Bank requires the consent of the curator to perform a number of transactions and operations, for example, carrying out large payments.

On the other hand, in accordance with the established procedure, the legislators provided for the participation of authorized banks, accompanied by long-term production contracts (a minimum of three years), as well as contracts within the so-called life cycle, which include economic actors, both on the open market, and the public-private partnership mode. These innovations can with the support of the bank create more favorable conditions for businesses experiencing serious difficulties, since businesses should thus be able to confidently predict their financial condition at the expiration date stipulated in the contract.

2. The interest rate – the price of credit.

While Russian banks' profits for the same period grew continuously, as analysts, we cannot precisely congratulate the domestic bankers on their success, as these record results were obtained mainly due to the inflation of credit rates (congruent with a *key rate* of the Central Bank), driving the rest of the economy into depression. But the development of relatively new (and at the

same time relatively old) credit facilities is not a cure-all for the economic development of the country; here the positive experiences of Germany, America, and China should be noted, with banking using project financing, rather than the universal principles of lending, as the driving force practically everywhere.

According to mass media and respectable economic journals, \$ 600 billion is needed for modernization, reconstruction or new industrialization of the national economy. However, as \$ 500 billion were already taken abroad by Russian borrowers, the question arises whether our money economy and the monetary authorities could generate the same amount of credit supply, which is now actually transferred to foreign sources of credit, as Prof. O.G. Dmitrieva³ [12] constantly writes and speaks convincingly.

An extremely important issue for the entire Russian economy is the assessment of its prospects for sustainable development, including its most important sector, the banking system. The stability of the banking sector and the possibility of improving the banking system as a whole depend on the solution of this problem. Terminologically speaking, compared with stability and reliability, sustainability is a broader concept and involves a complex of conditions and measures through which a financial and credit organization performs its functions and fulfills its obligations to other entities with which it interacts in the marketplace and in the financial markets.

Ways to improve the effectiveness and efficiency of the banking system in the aftermath of the international financial crisis can be found through the detailed study of global trends and patterns of development of the banking business, their sound projection onto the Russian economic reality and skillful adaptation of trend effects to the constantly changing conditions of the banking environment and the inflation that has become very noticeable in 2015. Characteristics of the last components are reflected in Fig. 1, and the combined indicator is rapidly approaching the parameters of the inflationary dynamics of Belarus and Ukraine (see Fig. 2).

³ A trustworthy author proves that the escalation of Russian debt, along with the replenishment of the Reserve Fund and National Welfare Fund, leads to the imposition of the negative effects of surplus / deficit budget, i. e., artificial deceleration of economic growth accompanied by a dramatic increase in government debt and its servicing costs.

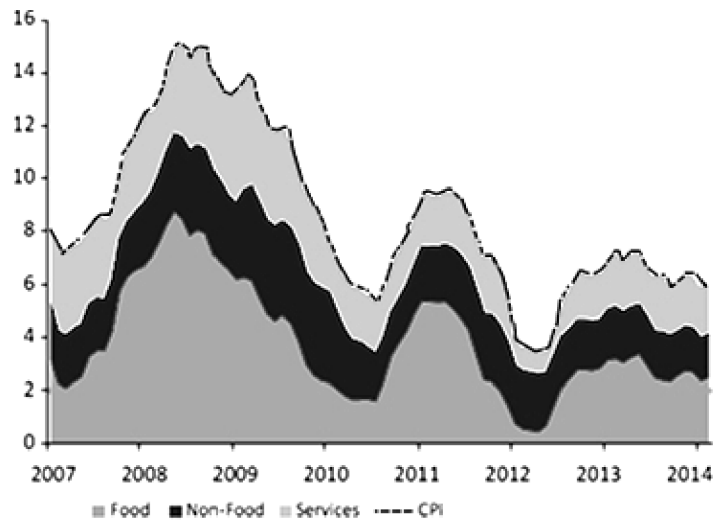


Fig. 1. The dynamics of the inflationary component in RF for the period 2007–2014, %: the dark gray area is the food component; black is the non-food products; light grey is the services; the upper dotted outline of the light-gray area (dark dotted line) is the monitoring of the Laspeyres price index (CPI) for the period.

Data source: estimates by Rosstat (<http://www.gks.ru/>) and experts from World Bank. URL: <http://data.worldbank.org/> as of 01.03.2015

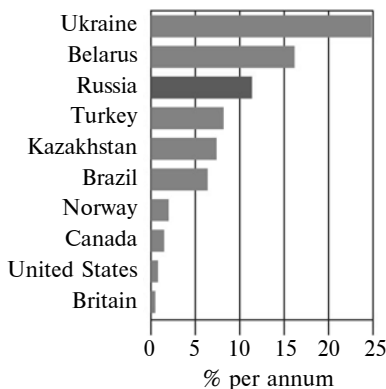


Fig. 2. The distribution of individual countries in the growth of the CPI in December 2014, %.

Data Source: Rosstat. URL: <http://www.gks.ru/>

The following global trends in the banking sector can be highlighted as an illustration of what is happening: basing all activities on the most modern IT-technologies; non-stop improvement of the traditional and the introduction of new techniques and methods of interaction with customers and providing them with the entire spectrum of banking services (expansion of supermarket chains, banks, installation of multimedia kiosks, machines, the use of the global Internet, and so on); as well as the intensification of banking activities in the markets of securities, precious metals and real estate.

Most banking institutions are constantly developing their own unique business models. Banking products are not changed for decades: a

savings account is the same savings account, a mortgage is a mortgage, so the banks are focusing not on the development of various products satisfying some needs, but on how to make banking products more affordable and easy to use. In Spain, for example, there is the possibility of algorithmic verification of credit scoring systems which can automatically evaluate the profile of the borrower's small business compared with similar companies to determine reliability, even without personal contact with customers.

For example, in Germany the ING Bank Group (Netherlands) recently received permission from the regulator to use technologies that allow customers to open an account via the Internet by using facial recognition technology [33]. In 2014, as the opportunity to identify customers by fingerprints through smartphones emerged, some banks immediately incorporated this capability into their services and banking deals in the major markets.

In 2014, the Russian financial market participants have argued that the current composition of Internet banking is the pinnacle of its evolution, and nothing fundamentally new can emerge [38]. However, some Russian banks are trying to create innovative products within each of the three components of the functional remote channels.

The first component are the functionality payments and transfers; the second the Internet banking services related to the classical banking products (health insurance, real estate, job loss,



loss of solvency and so forth). The insurance segment is attractive to their significant commissions, and it is a risk-free business, i. e., the risks are assumed by the insurance company and the bank acts as a sales channel. The third component is in improving the financial literacy of the population and the financial health of the bank client, and in improving the financial planning of individuals and entities. The current financial planning system has certain shortcomings because it was created for the sake of ratings, rather than the convenience of the consumer.

One of the key Russian trends for 2014, as claimed by the chief economist and well-known strategist of Deutsche Bank J. Lissovlick, was the consolidation of the banking sector, reorganization and revocation of licences from unscrupulous commercial banks (CBs) [9]. Another important trend last year was an attempt to cool the Central Bank of RF rate of retail lending in the country, which took place against the background of the continuing growth in the volume of «bad» (also known as «toxic», also known as «poisonous») debt⁴. In our opinion, in 2016, the same as in the previous year, the Central Bank will continue to actively and consistently withdraw licenses from banks but will far less regularly send them to reorganize.

Meanwhile, the situation in the credit market continues to worsen. At the beginning of February 2015, the citizens of the Russian Federation owe a total debt of more than 11 trillion rubles, 730 billion of them in overdue payments, while 89 % of all debt are consumer loans, the shortest, most unsecured, with the highest percentages. The rest are mortgage and housing loans; debts to banks exceeded the level of the 2009 crisis [31.33].

By the beginning of May 2015, the share of overdue bank loans rose to a record 7.22 %, reaching 780.6 billion rubles, despite the slowdown in lending. Since the beginning of 2015, overdue debts increased by 17.0 %; in a year (from the end of April, 2014 to the end of April, 2015) they grew by 1.5 times, as indicated in the review published by the largest collection agency *Sequoia credit consolidation* [32]: «In 2009, the share of overdue debt did not exceed 7.0 %» that generally corresponds to the values in Fig. 3.

⁴ Currently the idea of creating in Russia a special bank for bad debts on the basis of Vnesheconombank [23.8] is discussed, using debt repurchasing in South Korea after the crisis of 2008–2009 as an example, as well the situation in post-crisis Ireland. Thus, VEB could turn into a kind of mega-collector.

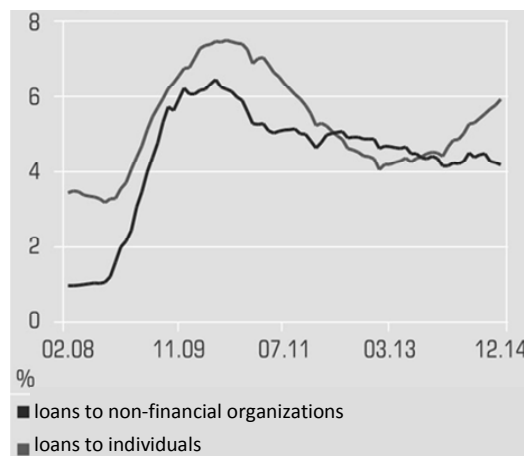


Fig. 3. The share of overdue loans to non-financial organizations and individuals for 2008–2014.

Data Source: Central Bank of RF [25]

Financial pyramids may continue to grow on the banking market by the REPO scheme (from repurchase agreement, or repurchasing operations); the sizes of these are already at record levels⁵. It is estimated that the share of the Central Bank of RF in liabilities of the banking sector exceeded 11 % at the beginning of 2015. Fig. 4 shows fragments of how the events developed using the direct REPO financial instrument up to this point.

⁵ REPO is the form of the transaction in which securities are sold, and at the same time an agreement to repurchase them is concluded at a pre-stipulated price and time, i. e., repos are an instrument of liquidity of the banking sector, against securities. Reverse repurchase agreements (reverse repo) are the purchase of securities with an obligation to resell. Thus, the repurchase agreement is a transaction of two types: an operation with cash securities today, plus a forward contract for the same assets in the future. At the beginning of the trading day on 01/04/2014, the total debt to credit institutions to the Central Bank repo transactions amounted to 1 trillion 936 billion 301.8 million rubles [20].

Repos are carried out on an ongoing basis by the Central Bank every working day at fixed interest rates. Repo auctions with a minimum rate are held by the approved schedule.

A year later, the total debt on direct repo transactions to the Central Bank at the beginning of the trading day on 01/04/2015, respectively, increased to 2 017 793 400 000 rubles at the beginning of the previous operating date, which follows from the CB RF information. CB RF requirements for credit organizations on separate agreements to repurchase at a specified date officially are: Operations on an auction basis – 1 910 803 600 000 rubles; operations with fixed rate – 106 989 800 000 rubles [24].

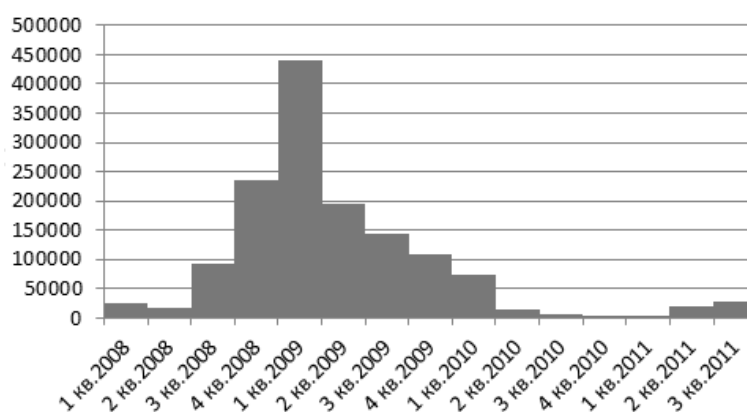


Fig. 4. Debt on repo transactions to the CB RF, on a quarterly basis for the 2008–2011 period, mln rub.

Data source: Central Bank of RF [25]

In September 2015, the mega-regulator upheld the size of the key rate at 11 %, although a slight decline by 1 or 2 steps (a step is 0.25 pp.) was predicted. As a rule, the discount rate of over 10 % indicates a rigid monetary policy of the regulator, but we should remember that at the beginning of 2014 the rate was 5.5 %. It is also important to pay attention to two aspects of this problem. On the one hand, the megaregulator was, metaphorically speaking, caught between the *Scylla* and the *Charybdis* of the macroeconomic outcome.

With a commensurate rate reduction the already worrisome risks of inflation increase sharply; when the rates grow, or at least retain their current levels, the economy, which is far removed from the «warmed up» state as it is, is severely cooled down. Since the exchange rate of the ruble, which is influenced by the external political situation (the sanctions, the unstable situation in the global emerging markets), makes as a very significant contribution to inflation, higher rates are intended, among other things, to protect the national currency from weakening.

On the other hand, it is well known that the problems of the national economy are structural in nature, and that reducing the rates is not enough to ensure sustainable growth. As the economy is descending into a recession, the era of low interest rates begins, i. e., low rate should not be the sole purpose and is not self-sufficient in any part of the monetary policy. A complex of structural reforms is required, which has been only pointed out by Kudrin.

3. Reducing the number of credit institutions in the banking market is a customary, forced trend that is nevertheless gaining momentum. The banking community expected to lose 33–35 licenses in

2015, as voiced by the corresponding member of the Russian Academy of Sciences, President of the Association of Russian Banks, G.A. Tosunyan (in his speech on April 4, 2015 in St. Petersburg at the 6th International Scientific and Practical Conference «The architecture of finance: geopolitical imbalances and the potential for development of national financial systems», in which one of the authors of this article participated), although as of November 11, 2015 there were 82 lost.

In 2013, 44 licenses were revoked from credit institutions, and 95 in 2014, which is the highest number since 1999 [27], so it is clear that this process is accelerating, and «harmonization» of the banking system and the new market restructuring inevitably lead to a further transfer of contributions of individuals to the accounts of major banks. These banking institutions are the beneficiaries of all sorts of gains from the difficulties of the current economic situation, while medium and small-sized organizations are forced to consolidate their activities in various ways to stay in the market. There was a total of 11 recorded rehabilitations of commercial banks in 2014, which is very little [28]. The overall dynamics of this process in the banking market is shown in Fig. 5.

The main cause of the events is the particular current state of the national economy, which is exhibiting signs of a recession, i. e., a special pattern of the decrease of growth rates of macroeconomic indicators. In connection with the withdrawal of licenses from many CBs, the inflow of deposits in «almost» state-owned banks and banks with state participation has increased significantly, as, respectively, has the area of banking credit and financial operations.

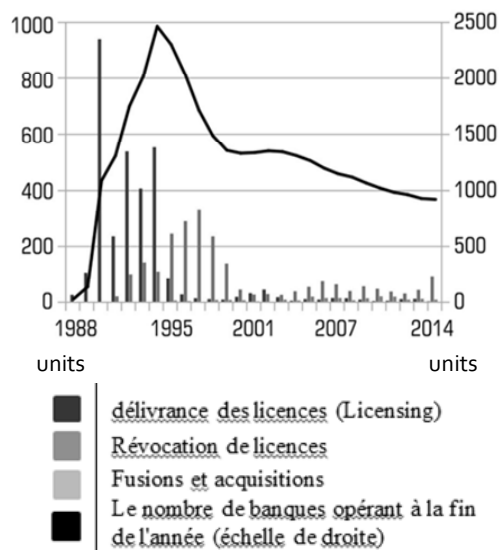


Fig. 5. The movement of credit institutions in the banking market of the Russian Federation for the 1988–2014 period.

Data Sources: CBR; Calculations AC «Expert Ural». URL: <http://www.expert-ural.com/analytics/>, 2015

However, the DIA cash resources are rapidly dwindling due to massive withdrawal of licenses for banking activity, while the size of the maximum compensation for individuals owning deposits was raised to 1.4 million rubles. Of course, the DIA has the right to apply for borrowing to the mega-regulator to replenish the insurance fund. However, legal entities whose ruble and foreign currency accounts were kept in the «fallen» the banks are denied the right to compensation for losses from the fund, and the market prospects of the majority of business entities and individual entrepreneurs who simultaneously lost their assets are rather vague. The consequence of these processes is the gradually increasing level of unemployment in the country.

According to the data of the Labor Agency for the beginning of November 2015, the unemployment rate in Russia rose by 15 % in 10 months, including due to a lower demand for workers. Currently, there is a tendency to reduce the number of vacancies from employers, and the sheer number of jobs that are in the database of the Russian labor market data are halved in comparison with January. This dramatically increased the level of staff in part-time, i. e., by 40 % [36].

4. The practice of appraisal activities of banking institutions in their liquidation, mergers and acquisitions. Consolidation is an important tool in managing the transformation of the banking

sector, and the frequency of use regulator of the instrument is the main indicator of the state of the sector. Such a tool has traditionally turned into an instrument of the monetary authorities at a concentration of banking capital. Most experts, both domestic and foreign, is associated the concept of «consolidation» is a mergers and acquisitions.

As a result, taking into account and coordinating the existing positions of various experts regarding the economic substance of consolidation, it is possible to reach an intermediate conclusion that consolidation is a process in which the merging and consolidation of the banking businesses occurs through acquisitions and the merging schemes of independent banking institutions [10]. However, it seems to us that these processes require close supervision by the government and content analysis conducted by the scientific community.

The need for market assessment of the banking business, assets and liabilities of financial institutions arises in cases where they become potential or real objects of market processes and transactions, i. e., purchase, sale, liquidation, privatization, corporatization, transfer in trust, etc. Specifically, business assessment of an individual CB is necessary for selecting the options justifying its restructuring, for improving the efficiency of its asset management and for maximizing its total value and the usefulness of a particular banking institution for the financial market.

The peculiarity of the market valuation of the CB is that it is carried out at the junction between the theory and practice of credit and banking and assessment of banking institutions. In this regard, one of the theoretical issues becomes identifying the essence, content and forms of expression of such economic categories as the *market value* of the economic entity in relation to the traditional banking structure. While there is some accumulated experience of calculating cash flows, forecasting income and expenditure, determining the discount rate to evaluate the CB as an integrated business, assessing its tangible assets and certain types of intangible assets, analog selection, etc., the acceptable methods of assessing the cost of the specific bank assets are still in need of further theoretical and practical development [6].

Consolidation of economic entities of the banking sector can be seen as the process of unification and enlargement of the credit institution's capital, as a certain stage of

development of the latter when the development of bank strategy is caused by diverse factors taken into account in the analysis. These factors can be internal, such as the achievement of *synergies* and external factors of different risk levels, for example, *political*. Other external factors may include economy- and industry-scale factors, as well as legislative initiatives.

Thus, to counteract the activities of unscrupulous banks, on November 23, 2014, the President of the Russian Federation signed amendments to the Federal Law «On Mortgage (Pledge of property)» no. 102-FZ of 16.07.1998. These amendments provide for the repayment of a recording made on the basis of the statement of the pledgee, in the case of the sale of collateral through foreclosure in court. That is to say, the 2014 version of the «On Mortgage (Pledge of property)» law emphasizes that if the borrower refused, for any reason, to pay the mortgage, then, upon application of the lending bank, the mortgaged property can be put up for sale. Moreover, if the parties mutually agree, the property mortgaged through the imposition of a penalty may be put up for sale at a price less than the one indicated in the contract of mortgage lending.

According to banking experts, this form of auction contributes to greater economic results in selling mortgaged property in the time of crisis. In addition, it increases the interest of the mortgagee to the use the market mechanism for selling the property, which has a positive impact on the development of mortgage finance [13]. In other words, the amendments to the federal law established and included in the legal framework as a norm for the convenience of both lenders and borrowers. When property prices fall, selling residential premises even by the residual credit value, i. e., subtracting the sum that the borrower has already paid, still exceeds its market value during the crisis.

In addition, changes in national legislation clarify the features of the mortgage of buildings and other non-residential premises. By law, real property is transferred as collateral only if the property right of the person concerned has already been registered. However, the explanatory note to the regulatory document does not ensure the full protection of the legitimate interests of the creditor with simultaneous registration of title with encumbrance in the form of collateral,

even though such a procedure is provided in relation to housing mortgage. In particular, the objects of housing stock and land, acquired at the expense of the bank, are pledged from the date of registration of property rights. In this case, the interests of creditors are protected under the Act.

From the point of view of public law, the differences in the legal status of residential, non-residential facilities, infrastructure and real estate land plots are absent, since all of these properties can be pledged in equal measure. The implementation of these amendments in the Civil Code will enhance the ability of entrepreneurs to obtain loans secured by non-residential premises, and so on. In addition, the rules are improved regarding mortgage registration affecting civilized relations between lenders and entrepreneurs.

But it is necessary to also pay special attention to the factors of endogenous nature that significantly affect the process of this consolidation. These factors include the financial and economic condition of the CB and the state of a potential bank-acquirer, because the bank starting a friendly takeover of another organization takes over not only the financial and other risks, but also the commitments of the organization which it acquires.

It is assumed that the absorption or merger of banks can pursue a number of tactical and strategic objectives. The latter objectives include strengthening of positions in the banking market and increasing their own competitiveness and that of the business environment. The social objectives include such processes as the needs of diverse banking clientele. The economic objectives mean the achievement of the synergetic effect caused by the *complementarity* of the specific assets of merged banks.

Acquisition of new customers and, very importantly, the preservation of the existing ones is of particular importance for banks, due to the echoes of the international financial crisis. According to the calculations of Western analysts of the banking sector, preservation of existing customers is only 30 % of the purchase price of the new. According to surveys, 70 % of customers stop using banking services mainly because of poor prices, tariffs and poor quality of services offered. Western credit institutions offer banking products in the *Online Mode* using a variety of technical devices and telecommunication links,



enabling them to maintain their image and popularity [13].

Based on the global trends, the current state of the Russian banking system, the policy of the Russian Government and the Central Bank of the Russian Federation regarding its reform, as well as taking into account the strategic objectives and performance indicators of the largest domestic banks, it is possible to form and offer to implement a variety of projects not only improving the efficiency of its activities in the aftermath of the international financial crisis, but also establishing a set of measures to enhance the stability of the entire banking system.

A CB is financially stable if it covers its expenses invested in assets (fixed assets, intangible assets, working capital) through its own funds, does not allow undue receivables and payables, and pays on time for its obligations, as well as any economic subject. The key financial activities are the correct organization and the use of working capital. Therefore, in the analysis of the financial condition of the rational use of working capital, the bank's assets are the focus.

5. Will the market prefer resolution or liquidation of CBs? Or is it actually state business? One of the most important functions of managing the economic entity is the financial analysis revealing abnormalities in the development of the subject under study that in some cases requires its resolution instead of elimination.

In Russian, the term for bank resolution, *sanatsia*, comes from the Latin for 'resolution', *sanare*, meaning recovery, recuperation. The Great Dictionary of Economics interprets this concept as a system of measures implemented to prevent bankruptcy of industrial, commercial, banking monopolies, specifying that the reorganization can occur through the merger of the borderline-bankrupt enterprise with a strong company; issue of new shares or bonds to raise money capital; an increase in bank loans and the provision of government subsidies; converting short-term debt into long-term; full or partial purchase of the shares of the enterprise which is on the border of bankruptcy by the state.

Preventing bankruptcy does not mean an overall recovery for the CB or it overcoming the crisis. The above list of activities is incomplete and does not disclose sufficiently the fundamental methodological approaches to choosing the forms of rehabilitation. Some of the local

authors define resolution as merely measures for the financial recovery of the CB which are implemented with the help of foreign legal entities or individuals, and are aimed at preventing the debtor CB from being declared bankrupt and its subsequent elimination [11].

From the given spectrum of definitions about the nature of the concept of reorganization, a single definition can be synthesized, which will absorb the rational kernel of each of the given options. Resolution is the system of financial and economic, industrial, technical, organizational, legal and social measures designed to achieve or restore solvency, liquidity of assets, profitability of the debtor CB in the long-term period at least exceeding 5 years [26].

In other words, resolution is the set of all possible events that can lead to the financial recovery of the CB. The present definition embodies a comprehensive approach to the notion, is versatile and fully illuminates the economic substance of the reorganization of enterprises. For a more complete disclosure of rehabilitation the types of events that take place within the boundaries of financial recovery should be specified.

Measures of financial and economic nature take a special place in the process of resolution; these measures describe the relationships that often arise in the process of mobilization and use of domestic and external financial sources for the recovery of the CB. Sources of financing for resolution procedures can be the means attracted by both the conditions of a loan and/or property rights, on both a *turnaround* or a *non-returnable* basis [15].

The aim is to cover the financial rehabilitation of the current losses and to eliminate their causes, renewing or maintaining the face-liquidity and solvency of the CB, reducing all types of debt, improving working capital structure and forming financial resource funds. Resolution plays an important role in the system of stabilization measures aimed at leading the CB out of the financial crisis. From a legal and a technical standpoint, resolution is a system of measures for the financial rehabilitation of the CB, implemented with the help of individual or legal third parties, and aimed at preventing the CB from being declared bankrupt and from elimination [7]. Today, every sixth CB is a candidate for resolution due to their insurmountable unprofitability and/or chronically low profitability, which is illustrated in Fig. 6.



Fig. 6. Mass of the rate of profit in the banking system of the Russian Federation for the 2004–2014 period. Data Source: calculations of the Central Bank [25]

In a market economy, CB resolution has a significant economic potential, is an important tool for regulation of structural changes and is included in the most effective mechanisms for the financial stabilization of CBs. Resolution of the financial and credit organizations is carried out in three main ways: a) before the creditors of the institution start bankruptcy proceedings if the CB resorts to external assistance on its own initiative in an attempt to get out of the crisis; b) if the CB refers to the arbitration court for bankruptcy, while formulating its resolution conditions; and finally, c) if the arbitral tribunal makes the decision on carrying out resolution based on the proposals from creditors who want to satisfy their claims against the debtor and to repay its obligations to the budget.

In cases b) and c) the resolution activities are allowed for in conjunction with starting a court case for the CB's bankruptcy in case a consensus of a meeting of creditors is reached with respect to both the deadlines for fulfilling each of the requirements, and the transfer of debts to the established legal entities.

The widest range of forms of resolution and opportunities is legislatively established in option a) when the CB in a state of crisis initiates the resolution process itself, caught up in a state of crisis, but until bankruptcy proceedings are started. In such a situation the best conditions of crisis management of the CB form that best meet the interests and goals of the functioning of the CB, allowing to use fairly sophisticated techniques and a rather painful operation of financial improvement, increasing economic

stability at all stages of such management, and serving as a certain preventive measure.

At this initial control stage, based on the results of diagnosing bankruptcy and monitoring the implementation of measures to stabilize the internal financial conditions of the CB, a fundamental decision is made to perform resolution. The feasibility of the resolution is caused by the fact that the use of internal mechanisms of the CB's financial stability do not always reach their goals, and the CB's critical financial condition continues to deepen. Indeed, as noted by Sberbank's experts, in the short-term forecast period, the amount of toxic debts in the segment of ruble corporate loans will reach its peak by the middle of 2016, and the projected level of the delay will be even higher than in the previous crisis of 2008, as shown by dashed lines in Fig. 7.

The feasibility of resolution is determined by the actual prospects of exiting the crisis and the financial condition of successful development of the CB in providing it substantial external support in the recovery stage. If, as a result of serious analysis, such a prospect is established, the resolution initiated by the CB should in a specific case obtain authentic (genuine and effective) support from the Central Bank of the Russian Federation and the Association of Russian Banks, and it is only through this turn of events that the resolution of a particular CB has a chance of success.

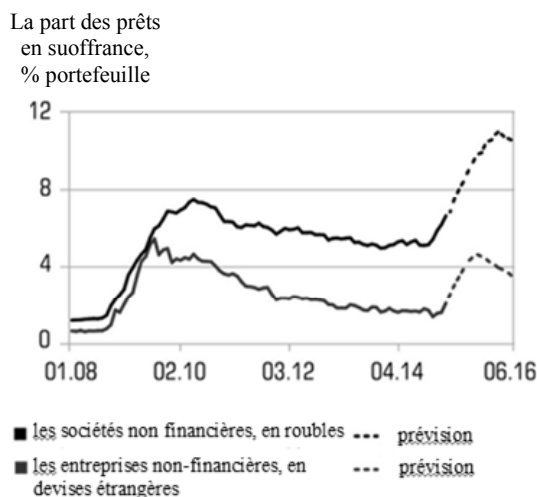


Fig. 7. Analysis and forecast of «bad debts» in the segment of ruble-denominated corporate loans over the 2008–2016 period.

Source: calculations and forecast of M. Matovnikoff (Savings Bank of Russia), according to the Central Bank of the Russian Federation [25]

This concept reflects the ideology of implementing the proposed resolution, determining its subsequent directions and forms. Depending on the approach, there are the offensive and the defensive concepts for resolution. The *defensive concept* of resolution is aimed at reducing the volume of the operating and investment activities of the CB, providing a balance of cash flows at a lower volumetric level than their volumetric one. This concept implies the involvement of external financial assistance for the restructuring of the relevant size.

The *offensive concept* of resolution is aimed at diversifying the operating and investing activities of the CB, providing an increase in the size of the net cash flow in the coming period due to the increase of efficiency of banking operations. In this case, the external financial assistance and other reorganization measures implemented in the course of resolution are used in order to enter other regional markets and to rapidly complete the actual investment projects started.

The offensive resolution concept does not contradict the basic principles of a common economic development strategy of the CB. Depending on the scale of the crisis state of the CB identified in the process of diagnosing the depth of the bankruptcy and on the adopted resolution concept, there can be varying main directions of its implementation. The mechanism by which the main objectives of the recovery of the banking structure are achieved is characterized directly by the resolution form. Its specific forms are defined under the resolution direction chosen by the CB, taking into account the peculiarities of the banking activity of the subject, the results of crisis diagnostics and the recommended techniques of crisis management.

Conclusions

1) A mechanism for achieving the main objectives of the resolution is characterized directly by its form chosen from the recommended broad spectrum. This form can be adjusted in a specific direction of the resolution elected by the CB. For example, resolution aimed at refinancing the debt of the CB can take these forms: state concessional lending; target bank loans; transfer of debt to another entity.

2) If the power structures really have the intention to create a workable funding mechanism of progressive structural changes in the Russian economy, it is necessary, first of all, to pay

attention to the improvement of public credit facilities and refinancing of CBs, as well as to introduce a flexible system of money supply with the regulating role of the interest rate, i. e., the loan rate [29]. The most important role should be played by real development institutions that have clear plans and accountability mechanisms for achieving these plans. Therefore, it is necessary to improve the legislative and regulatory practices regarding the economic relations in the Russian marketplace.

3) In this sense, the legislative initiative of the Ministry of Finance of the Russian Federation making a number of amendments to the Federal Law «On Banks and Banking Activity» at the end of June 2014 is noteworthy. The amendments state that the state-owned companies and public corporations, many private institutions and retail chains are allowed to open accounts and deposits⁶ only in the state bank and in VEB, as well as in Russian private banks (alimited number of CBs) with a net worth of not less than 16.5 billion rubles, which is clearly paternalistic in nature, aimed at protecting the funds of the Russian strategic companies, preserving business in the real sector of economy, and at protection against possible sanctions [21.8].

4) Furthermore, the efforts in increasing the integrity of the state funds in Russian banks, initially started with the intention of clearing the banking sector from unfair participants, will be completed by 2017. As of January 1, 2016, there were 733 credit institutions in Russia; in a year, their number dropped to 101. For comparison, in 2007 the country had more than a thousand CBs.

Summary. In view of searching for ways of improving the Russian banking system as a whole, increasing the stability of individual CBs and leading the national economy out of recession, there are several promising areas for further research, such as the formation of the concept of effective CB with a scalable business model, the development of banking in the digital environment, analysis of the prospects for the

⁶ In 2013, the state-owned companies placed 720 billion rubles in bank deposits [22.8]. In late 2013, the megaregulator acted as a driver for tightening the criteria for the selection of credit institutions for placement of state company funds, due to the fact that the Housing and Utility Reform Foundation, a state corporation, lost as much as 1.5 billion rubles in the seemingly stable Investbank.

interaction of CBs with Asian markets, the study of the investment banking capabilities.

These studies should concern such aspects of functioning of the banking system as the corporate and social responsibility of bankers and analysts of the domestic financial sector. As for the classical banking, then regardless of our preferences, it will wither away, and, accordingly, greater attention should be paid to developing of the electronic sphere with its rapidly evolving innovative filling.

But above all, it is necessary to solve the conceptual and methodological issues of whether to ensure resolution of all questionable financial market players, or to justify the creation of the system with 10–15 largest national banks in Russia with an extensive branch network and regulatory capital adequacy. The potential candidates for this narrow circle are, without a doubt, Sberbank, VTB, Alfa-Bank, Rosselkhozbank, VEB, and the whole range of the Gazprom financial structures, etc.

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TSATSULIN Alexander N. – St. Petersburg, North-West Institute of Administration of the Russian Presidential Academy of National Economy and Public Administration, Professor of the Chair of Financial Management, Doctor of Science (Economy), Professor.

199178, Sredniy pr. VO. 57/43. St. Petersburg. Russia. E-mail: vash_64@mail.ru

ЦАЦУЛИН Александр Николаевич – профессор кафедры финансового менеджмента Северо-Западного института (филиал, Санкт-Петербург) Российской академии народного хозяйства и государственной службы при Президенте Российской Федерации, доктор экономических наук, профессор.

199178, Средний пр. В.О., д. 57/43, Санкт-Петербург, Россия. Тел. (812)714-35-85. E-mail: vash_64@mail.ru

BAVKINA Nina I. – Associate Professor of Economics and Management in Machine Building St. Petersburg Polytechnic University Peter the Great, Candidate of Economic Sciences, Associate Professor.

195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. Тел. (812)534-74-36. E-mail: babkina-nina@mail.ru

БАБКИНА Нина Ивановна – доцент кафедры Экономики и менеджмента в машиностроении СПб политехнического университета им. Петра Великого, кандидат экономических наук, доцент.

195251. Politechnicheskaya str. 29. St. Petersburg. Russia. E-mail: babkina-nina@mail.ru

E.R. Schislyeva, N.V. Yuireva

THE ECONOMIC BEHAVIOR OF AN ENTREPRENEUR

Е.Р. Счисляева, Н.В. Юрьева

ЭКОНОМИЧЕСКОЕ ПОВЕДЕНИЕ ПРЕДПРИНИМАТЕЛЯ

The paper deals with economical, social and cultural context of business in present-day society. The economical aspect of business activity includes organizational and production innovations, as well as economical freedom. The personal aspect involves steady individual features which are manifested irrespective of specific production activities (intuition, aggressiveness, charisma). The paper examines the peculiarities of business functioning in Russia, identifies various pitfalls in the economical behavior typical for the national business culture and analyzes the key features of its entrepreneurship. Russian post-transformation economics fell into a trap of systemic crisis as previous institutes of social regulation had been destroyed. Cultural and moral values characterizing the former business relations lost their importance. Meanwhile the society spontaneously developed institutions that were using the interaction models previously regarded as unsuitable. Economic agents transformed into the business elite which has its own sources of power in present-day society, getting the opportunity to use some kind of independence within the political institutes nowadays. However, the methods it uses to support its social status reflect the systemic crisis that has struck the entire society and, in particular, its economic behavior. New economic agents have been able to succeed in an uncertain and aggressive business environment. Their achievements have nothing to do with professional competitiveness, but rather with the effective adaptation to an unfavorable social and economic situation. They have not adapted to the current market, but begun to work closely with the situation using «the time of troubles» for getting non-competitive advantages: compensating the lack of special skills with the activities bringing quick returns, indifferent to norms of law and ethics. The paper defines conditions required for the transition to the civilized ways of business activities, the rationally motivated choice of ethical code of conduct and the establishment of social mechanisms to correct the influence of market subjects' subconscious motivation on the economical activity.

BUSINESS SPIRIT; ORGANISATIONAL AND PRODUCTION INNOVATION; INTUITION STRATEGY; IMPLICIT KNOWLEDG; SOCIAL PSYCH-ANALYSIS; SPECIFICITY; PARTICULARISM; DIFFUSENESS.

Статья анализирует социально-экономическое поведение предпринимателя в современном хозяйственном контексте. Экономический аспект его деятельности включает в себя организационно-хозяйственное новаторство и экономическую свободу. Личностный аспект предполагает устойчивые индивидуальные характеристики, которые проявляются независимо от конкретных хозяйственных ситуаций (интуитивность, агрессивность, харизматичность). В статье выявлено проблемное поле экономического поведения в национальной бизнес-модели; в концептуальном плане исследована специфика российской предпринимательской деятельности. В постсоветской России разрушились сформированные ранее механизмы регуляции экономического поведения. Прежняя система ценностей утратила свое значение. Одновременно возникли институты, поощрявшие хозяйственную активность, которая ранее считалась неприемлемой. На волне общественных изменений появился хозяйствующий субъект, организовавшийся в бизнес-элиу, который получил относительную независимость в новой системе распределения властных полномочий. Однако его методы закрепления собственного статуса отразили системный кризис, поразивший общество в целом и экономические отношения в частности. Социальная аномия предоставила больше шансов на выживание тем, кто мало чувствителен к неблагоприятным условиям внешней среды. Они не только адаптировались к рынку, такому как есть, но и сумели использовать «смутное время» для получения «внерыночных» преимуществ: компенсировать дефицит профессиональных умений деятельностью, обеспечивающей быстрый доход; сочетать высокие амбиции с релятивизмом или безразличием к правовым или моральным нормам. В статье определены необходимые условия перехода к цивилизованным стандартам ведения бизнеса – рационально обоснованный выбор предпринимателя в пользу этического поведения и создание социальных механизмов, корректирующих влияние подсознательной мотивации на хозяйственную деятельность рыночных субъектов.

ДУХ ПРЕДПРИНИМАТЕЛЬСТВА; ОРГАНИЗАЦИОННО-ХОЗЯЙСТВЕННОЕ НОВАТОРСТВО; ИНТУИТИВНАЯ СТРАТЕГИЯ; НЕЯВНОЕ ЗНАНИЕ; СОЦИАЛЬНЫЙ ПСИХОАНАЛИЗ; СПЕЦИФИЧНОСТЬ; ПАРТИКУЛЯРИЗМ; ДИФФУЗНОСТЬ.

Entrepreneurship is as old as the economic system itself. There was no such word in the books of ancient scientists. Thus business activity was not discussed in the preindustrial period. First scientific business theories formulated only in the 18th century (A. Turgot, A. Smith, D. Say) were rather primitive. The modern attitude to the problem is polysemous, as it combines multiple ideas, some of which are mutually contradicting. The meaning of «entrepreneurship» ranges from «an idle class» (T. Veblen) [1] to «the basic phenomenon of economic development» (Shumpeter) [2]. The theoretical paradigm suggested by Shumpeter and Hayek is based on the interdisciplinary approach [3]. It considers business activity as a functional, economical, social and cultural phenomenon.

The economic aspect of business includes two interrelated elements: organizational and managerial innovations and economic freedom. The long list of other elements (risk-taking, decision making, resource ownership, leadership, profitmaking, interaction with the authorities and suppliers, clients, etc.) is either optional or complementary. The unpredictable development of a new business and the responsibility imposed by economic freedom can ensure new risks. Decision making is an integral characteristic of business and management. Investment freedom, as well as the right to capitalize income, springs from economic freedom. The motivation to make profit has its roots in the very nature of economic activity, it also represents the goal of organizational innovation.

Business reveals itself through different forms, such as the establishment of a new enterprise or reorganization of an old one, maintaining the new modification of old connection, but it is always linked with a combination of productive factors. Shumpeter defined its function as the creation of possibilities for the output of new goods, discovery of raw materials, sale markets, restructure of production. This activity implies «making new combinations of productive factors» or various innovations [4]. Business is connected with other types of entrepreneurship, such as management, scientific research, marketing, each of them being capable to change previous production combinations. The business function has been performed by experts during the evolution of economic relations.

The state of social and economic environment is very important. It predetermines

not only the ways of «new combinations», but also the motivation of business activity. Businesspersons as economic players hold social positions according to their class interest and form the living standards and a system of moral and aesthetic values.

Hayek's concept is based on personal freedom as one of the greatest values, limited by the laws of the civil society. Individual independence enables to use economic potential in a productive way. Economic freedom gives an active agent a number of rights guaranteeing independent choice of type, form and sphere of economic behavior as well as the method for implementing and using its product and profit. Freedom is limited by a number of circumstances. But the autonomy of decision making seems to be the main condition of business, without which a new productive combination is impossible in terms of economics, organization and psychology. Productive forces in general are influenced by either freedom or its antipode, dictatorship. For example, economic freedom provides the implementation of scientific discoveries aimed at the manufacturing modernization. In case there is no such freedom, scientific achievements have to be introduced.

Personal freedom together with the influence of «the invisible market hand» [5] and competition provides the high intensity of search activities, effectiveness of resource distribution and realization of personal abilities. Despite the fact that business function is dispersed, a special class of people, «ready to try out new possibilities» [6], is distinguished among economic agents. Different countries have the same number of entrepreneurs. The lack of «business spirit» [7] is not linked to the human nature, but it is the result of limitations imposed by the existing customs and institutions.

Hayek's theory of «concealed knowledge» implies that an economic possesses a unique knowledge which helps to make independent decisions. The best possibilities for using informational advantages are created by the market. The pricing mechanism informs everybody of demand and supply. The sector of maximum market uncertainty prepares a «breakthrough into the future». It is boosted by competition and determines the search for changes in customer preferences and the methods of satisfying them. Such a context gives businesspersons the chance to effectively combine their unique knowledge and the market



situation. This combination strengthens their competitiveness and provides the highest possible income.

The development of the institutes does not always highlight its social and economic nature. Functions and features are mixed in more primitive institutional forms, which make them harder to discern. For example, it is hard to distinguish one element of business activity from another in a feudal's actions. The modern businessperson is not only a capitalist-owner, but also a manager, an engineer and a technical instructor. Even now he or she acts as a purchasing and sales agent, personnel manager, etc. The new combinations of activities are predetermined by the personality of a businessperson, rather than by his or her occupation. Every economic agent whose behavior differs by its search style is a potential entrepreneur. This behavior implies certain underlying personality traits. It is intuitive thinking related to the will and ability to focus on essential things in the situation, rather than directly to intelligence. Professional skills, broad-mindedness and analytical abilities are not a guarantee of business success. The great importance of instinct and intuition are decreased by keen understanding and complicated rationalization. Secondly, an entrepreneur has the ability to obtain the determined goal despite uncertainty and environmental resistance. The third quality is the authority based on charisma, which facilitates target searching for likeminded people.

Personologists partly agree with sociologists, though their conclusions are more radical. According to psychoanalysis, a businessperson is a deviant psychological type with success-oriented behavior. He or she has low tolerance to psychological strain and frustration, limited scope of attention, which induces the tendency to make a decision according to the first impression and intuition. Investigation and analytical research of problems are limited due to the fact that cognitive process does not fulfill the integration function. Such a mentality lacks logic concentration, self-critical reflection and active research processes.

Impulsive behavior is typical for a business actor. Short-term operative planning focused on satisfaction of immediate profit, rapidity of psychic reactions, immediateness of emotional

expression are their distinctive features. In this respect, financial well-being can be considered an indicator of prestigious social status. Such a person lacks bright individuality, he or she rarely has brilliant intellect and talents in other activities, rather than business. From the social point of view, it is a typical upstart, who has poorly resolved motivation concerning traditional culture values. Their behavior repertoire is notably short of something we call the «relationship culture». Bad manners and lack of «respectability» especially irritate those who «do not have to earn their place in the sun» through their efforts.

Unconscious obstacles of the entrepreneurial mental type can be overcome with the help of psychological defense mechanisms formed in the childhood. According to this model, the father is considered to be a very strict person which for a child is synonymous to being rejected, while the mother is usually strict too, but is the one who approves. The parents' images are gradually integrated. The perception of control and rejection becomes a dominating pattern of behavior. This situation has caused aggressive reactions and psychological tension, which are transferred to business actors themselves or to others. Personal traits are linked with a compensatory reactions, which results in basic feelings of imperfection and develop into self-independence, absolute control and domination in any activities. The individual works out the opposite type of reaction: hyper-activity and impulsiveness are opposed to difference and submission; non-conformist resistance is opposed to fear of authorities; ambition is opposed to the sense of inferiority and helplessness; optimism and recoverability are opposed to depression and anxiety. In these activities a business person tries to shape the organization where they could have the leading position. The firm is considered to be the symbol of their success and it is much more important than the method of money-making. It is the realization of his ability to create a new reality.

The situation of social crisis has given an impulse to develop a business class from the people who were called «negative passionaries» [8] by L.N. Gumilev. The market reforms have brought about economic agents who have been able to succeed in an uncertain and aggressive business environment. Their achievements have

nothing to do with professional competitiveness, but effective adaptation to unfavorable social and economic situation. They not only accept the conditions, but interact with the situation using «the times of troubles» for getting non-competitive advantages [9].

Russian business activity differs in the variety of internal organization, which explains contradictory personal features of its agents [10]. On the one hand, cognitive mechanisms of general estimation are heavily involved. On the other hand, there is a striking working efficiency, linked with simultaneous inclusion into the working process of several psychical structures. Such psychological adaptation provides a high level of motivation into the working activity despite the conditions of strong uncertainty. A businessperson's self-esteem does not depend on social approval or disapproval because of their internal energy. Finally, goal-setting is characterized by proceduralism, maximization and paradoxicality of behavioral choice. The competitive environment maintains the businessperson's unconscious desire to avoiding stereotypes, rivalry amplifies their abilities to think outside the box in any problematic situation. Domination of intuitive mental strategies shapes creative patterns of business behavior with various unknown outcomes. Dominance of the intuitive way of thinking over the rational one results in psychological exhaustion. If an individual has a relatively high positive self-esteem, it would be possible to adequately assess the failures, not to use violence for correcting them, not to compete against rivals in an unethical manner. However, a high positive self-esteem is quite a random occurrence. For this reason, a mature market has worked out a variety of means (cultural, law, power) for setting a limit to (restraining, restricting) deviant business behavior.

Russian post-transformation economics has fallen into a trap of the system crisis when previous institutes of social regulation have been destroyed but new ones have not been built yet. Cultural and moral values which characterized the former business relations have lost importance. Meanwhile, the society has spontaneously developed institutions which use interaction models that have been considered unsuitable just a while ago [11]. Economic agents, having come into focus of weakly regulated business processes, transformed into

the business elite, which has its own sources of power in the modern society, getting the opportunity to use some kind of independence within the political institutes nowadays [12]. However, the methods it uses to strengthen its social status and prestige reflect the systemic crisis that has stricken both the entire society and bodies of government, in particular.

Investigation results of the Russian Independent Institute of Social and National Problems have confirmed that influence of macro-environmental factors (government economic policy, legal coverage of business activity, actions of regional and local government institutes) on the business stability is much lower compared to microeconomic and personal indices [13]. The decline in the subjective significance of macro-conditions is connected with the peculiar adaptation of a Russian business agent.

The anomy of the Russian society resulted in the loss of cultural values, which entailed the emergence of low-level models of economic behavior. The fledgling market awoke primitive instincts of egoistic, acquisitive and ethnocentric behavior hidden in the «collective unconscious». Getting away from the conventional social control they provoked a higher crime rate in the country.

The behavioral pattern of the entrepreneur can be defined using Parsons' incentive-cultural dilemmas («affectivity – diffuseness – particularism – quality – performance – self-orientation» [14]). They reflect the rational content of business behavior in society [15]. Though T. Parsons did not make ethical judgment using his dilemmas, they reveal an explicit biased nature of the Russian entrepreneur [16]. In particular, they are characterized by self-centered orientation, pursuing their own interest.

There are basic qualitative characteristics of business people providing their adaptation to social conditions: moral, law and occupation (all of them are the indicators of civilized market relations). Consequently, classification of business types is based on various variables: law abidance, competence, and moral and ethical aspects. According to such definitions, two ideal types can be distinguished:

- «cultural business person» – business activity demands professional education, law obedience, scrupulous ways of reaching the goal;
- «wild businessman» – just the opposite features; the behavior, is dominated by the unconscious



motivation under the influence of passionarity, attractiveness, ego-complexes, etc. [17].

The type is widely spread among the representatives of Russian business. They take on anything that did not require special knowledge and are oriented on obtaining fast income, ignoring laws or using culturally rejected means of goal achievement. According to the report of the Russian Union of Manufactures and Businesspeople Expert Institute, 40 % of businessmen have earlier been prosecuted, and every third of them has a connection with criminal world (for representatives of large businesses this figure is even higher) [18].

The antisocial character of Russian business is in strong opposition to everything which reduces income and support of any activity which increases it. The entrepreneur accepts success only on the basis of material wealth sacrificing other social connections and links for such sake. The entrepreneurs who have a chance to succeed are those who have no need to reinvent themselves, are not prone to reflection, and whose ambitions are combined with relativism or indifference to

laws and moral principles. The moral legitimacy of Russian business is doubtful, which makes its relationship with society very complicated. Weakness of the legal conscience, collapse of morality, and media advertising of individualism, quick success, richness and outsized consumption values facilitate the development of the deviant form of business activity. The social responsibility of business cannot be separated from the general level of public moral. It does not exist by itself, isolated from common cultural environment. If the ideas of duty and responsibility are devaluated and altruistic values are repudiated, the activity for the social welfare will not be considered as the respectable form of behavior [19].

Nowadays the main efforts of businesspeople are aimed at personal enrichment by any means. On the other hand, they are concerned about their business publicity through commercial media. Creating a social and cultural environment stimulating a businessperson to activities approved by the majority of the population becomes a very important task.

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SCHISLYAEVA Elena R. – doctor of science in economics, professor, director of International Graduate School of Management, Institute of Industrial Economics and Management, Peter the Great St. Petersburg Polytechnic University.

СЧИСЛЯЕВА Елена Ростиславовна – директор школы «Международная высшая школа управления» Инженерно-экономического института Санкт-Петербургского политехнического университета Петра Великого, доктор экономических наук, профессор.

195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. Тел.: (812)329-47-94. E-mail: dean@igms.info

YUIREVA Natalia V. – Senior Lecturer in International Graduate School of Management, Institute of Industrial Economics and Management, Peter the Great St. Petersburg Polytechnic University.

195251. Politechnicheskaya str. 29. St. Petersburg. Russia. Tel.: (812)329-47-96. E-mail: natalia_yreva@mail.ru

ЮРЬЕВА Наталья Владимировна – ст. преподаватель школы «Международная высшая школа управления» Инженерно-экономического института Санкт-Петербургского политехнического университета Петра Великого.

195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. Тел.: (812)329-47-96. E-mail: natalia_yreva@mail.ru

195251. Politechnicheskaya str. 29. St. Petersburg. Russia. Tel.: (812)329-47-94. E-mail: dean@igms.info



I.V. Skvortsova, Y.R. Nurulin

**ON DEVELOPING TERRITORIAL CLUSTERS
WITHIN INNOVATION SYSTEMS**

И.В. Скворцова, Ю.Р. Нурулин

**К ВОПРОСАМ РАЗВИТИЯ ТЕРРИТОРИАЛЬНЫХ КЛАСТЕРОВ
В РАМКАХ ИННОВАЦИОННЫХ СИСТЕМ**

The article presents a combined analysis of national, regional and corporate innovation systems and innovation clusters. The evolution of these concepts and the main characteristics of modern national innovation systems have been analyzed. An innovation cluster is considered as an element of the regional innovation system which provides scientific, technical, organizational, financial, and personnel support for all stages of the innovation cycle. The experience of the St. Petersburg Cluster of Clean Technologies for the Urban Environment, which is a part of the regional innovation system of St. Petersburg, has been analyzed. The requirements for the properties of a corporate innovation system of organization that acts as an initiator of cluster creation have been formulated. The conclusion that the innovation cluster is a special element of the regional innovation system with clearly defined properties is substantiated. These properties include: functional completeness in relation to all stages of the life cycle of complex high technology projects; the proximity of geographical location of the main participants in the cluster, combined with close informal relations of persons which make decisions of various levels during implementation of cluster projects; intrinsic motivation (readiness) of cluster members to use non-economic principles of business development in the implementation of cluster projects; intrinsic motivation (readiness) cluster members to modernize their own CIS meet the requirements of cluster projects.

INNOVATION CLUSTER; INNOVATION SYSTEM; CLEAN TECHNOLOGIES; CLUSTER'S PROJECT; INNOVATION PROJECT LIFE CYCLE.

Анализируются инновационные кластеры и национальные, системы различных уровней. Рассмотрена эволюция данных понятий и проанализированы основные черты современных национальных систем. Доказано, что эффективная инновационная система должна обеспечивать как виртуальное (информационное), так и физическое взаимодействие субъектов инновационной деятельности. При анализе инновационной деятельности выделены следующие типы инновационных систем: национальные инновационные системы (НИС); региональная инновационная система (РИС); корпоративная инновационная система (КИС). Доказано, что инновационная деятельность реализуется уже не только внутри отдельной организации, а все шире опирается на широкое межкорпоративное взаимодействие и, как следствие, запускается процесс конвергенции технологий. Инновационный кластер рассматривается как элемент региональной инновационной системы, обеспечивающий научно-техническое, организационно-финансовое и кадровое сопровождение всех этапов инновационного цикла. Проанализирован опыт развития Санкт-Петербургского кластера чистых технологий для городской среды как элемента региональной инновационной системы Санкт-Петербурга. Сформулированы требования к свойствам корпоративной инновационной системы организации, которая выступает инициатором создания кластера. Обоснован вывод о том, что инновационный кластер можно рассматривать как особый элемент региональной инновационной системы, который обладает ярко выраженными свойствами: функциональной полнотой по отношению ко всем этапам жизненного цикла комплексного наукоемкого проекта; близостью географического расположения основных участников кластера в сочетании с тесными неформальными связями лиц, принимающих решения различного уровня при реализации кластерных проектов; внутренней мотивацией (готовностью) участников кластера к использованию неэкономических принципов развития бизнеса в ходе реализации кластерных проектов; внутренней мотивацией (готовностью) участников кластера к модернизации собственной КИС с учетом требований кластерных проектов.

ИННОВАЦИОННЫЙ КЛАСТЕР; ИННОВАЦИОННАЯ СИСТЕМА; ЧИСТЫЕ ТЕХНОЛОГИИ; КЛАСТЕРНЫЙ ПРОЕКТ; ЖИЗНЕННЫЙ ЦИКЛ ИННОВАЦИОННОГО ПРОЕКТА.

Introduction. Since the 1990s, we can observe in the scientific literature a lively discussion about the importance of innovation for

enterprises, regions, countries and societies in general. It is intuitively obvious that innovation is a complex concept which takes into account a

variety of aspects of the process of obtaining new products and services on the basis of scientific achievements. It concerns the matters of using scientific and technological equipment, special principles of financing, special organizational forms of work of participants of the process, etc. The term «innovation system», which is used in the literature, reflects this complexity and comprehensiveness. The term was proposed by Freeman for comparing the levels of technological development of different countries [1]. Currently, this term is widely used in the scientific literature in the analysis of patterns of occurrence and distribution of innovations [2-6]. Recognizing the complex and multifactorial nature of innovation, researchers are exploring innovative systems, identifying them as complex of agents who share common policies and institutions that ensure the implementation of new technologies, products and services.

Following Freeman, the researchers of the innovation process pay significant attention to its regional aspects, considering geographic clustering as one of the most important qualities of innovation systems. The idea of geographic clustering was proposed by Alfred Marshall in 1921, but it has gained particular importance in recent years. The reason for this is as follows.

The implicit (hidden) knowledge, which is based on individual or corporate experience, plays an important role in the innovation process. At present, this knowledge cannot be distributed by means of ICT, since there are no methods and technologies of its formal representation (coding). Implicit knowledge requires for its transmission spatial proximity of the carriers of knowledge and innovation agents and organizing their direct interaction.

Both the innovative high-tech industry and the traditional industry, which strive for innovation, often lack a clear understanding of the market needs due to the high dynamics of changes in the knowledge-based economy. Due to the lack of specific knowledge of the future needs, the strategy (and often tactics) of behavior in the market is based on the general idea on the trends of technologies development and future demand for their applications. This common vision must be formed only on the basis of regular, frequent informal contacts between the participants of the innovation process.

The maximal effect can be achieved in the case when the innovation activities subjects which have similar mentality are interacting within the innovation system. This helps develop a common culture of innovation and enhance mutual trust.

Thus, one of the important features of the innovation system is its ability of using implicit knowledge, informal connections, and interacting subjects' common system of values. A necessary condition for the development of this feature is the geographical proximity of innovation activities subjects. As a result, territorial innovation clusters are forming, i. e., groups of organizations concentrated in a limited area, which are complementing each other within creating value chains in developing innovative products and services.

Rather a lot of attention is paid to the matter of researching innovation clusters in contemporary scientific literature. Traditionally, the following features of clusters are distinguished [7]:

- the geographical proximity of the cluster's participants;
- the affinity of technologies used in creating value chains;
- the commonness of subjects which are about to change in the process of creating the value chains;
- the presence of an innovative component;
- the presence of a mechanism for cooperation of cluster participants and coordination of their activities;
- the presence of a synergistic effect from the interaction between participants of the cluster.

There is also a unity of two opposite features of the cluster: mutual competition of its members, and their close cooperation in the formation of the unique competences of the cluster. [8].

Innovation clusters are an effective tool for the development of regions of Russia [9]. For their support, organizational and financial instruments are used, which including:

- providing grants for the implementation of development programs for regional innovative clusters in the regions of the Russian Federation;
- implementation of measures for the development of regional innovative clusters within the federal target programs of the Russian Federation;
- involving development institutions to implement programs of territorial innovative cluster development;

- encouraging the participation of big companies in the activities of regional innovative clusters;
- dissemination of experience in the use of tax allowances to stimulate innovative activities of the participants of innovative territorial clusters.

Problem definition. A number of works note a close relationship between regional innovative clusters and regional innovation systems and the elements of the innovation infrastructure [10–12]. Even though the terms «innovation system» and «innovation cluster» are widespread, it should be noted that there is a problem of identifying the scope of application for these terms. The urgency of this problem stems from the fact that a number of researchers are using these terms without a clear explanation of what exactly is meant by innovation system or cluster, what are their functions, composition and structure and how these concepts are related. By analogy with the term «innovation» [13, 14] there is a broader interpretation of the terms «innovation system» and «innovation cluster», when these words mean everything that is directly or indirectly related to the development of production.

An analysis of the typology of innovation systems is required, comparing them with the basic functions of regional innovative clusters and allowing to substantiate the relationship of these concepts and understand the perspectives of their development.

Innovation systems typology

- The key components of the innovation systems are the following [5]:
 - innovation-active firms, investing in research and implementation of new technologies to increase profits and meet consumer demand;
 - specialized public institutions which support or conduct research and promote the dissemination of new technologies;
 - institutions of higher education (universities) that combine research activities and personnel training;
 - specialized state programs (sets of measures) aimed at the development of science and the spread of new technologies;
 - industry legislation that regulates intellectual property rights, features of the interaction of various institutions, etc.

In general, the following resources are required for developing an innovation system [15]:

- Financial Capital (available «seeding» venture and investment capital).

- Physical infrastructure (transport, communications, water and electricity, etc.).
- Business infrastructure (institutions such as industry associations, chambers of commerce, development agencies).
 - High-quality living conditions and anticipated benefits from the placement of businesses in this location.
 - Administrative regulation of low cost of infrastructure and / or loans for business start-ups.
 - A diversified economic base consisting of product suppliers and distribution networks, as well as suppliers of specialized services.
 - Proximity to markets.
 - Proximity to sources of knowledge, such as universities or research centers which perform fundamental and applied research.

The last point is particularly important for contributing to the continuous updating of the knowledge base within the innovation system. This applies in particular to the science-intensive and high-tech industries. Universities and research institutes promote the development of innovation clusters and provide a steady stream of creation and transfer of new knowledge as a source of innovation. This transfer includes not only the processes of explicit and implicit knowledge transfer in the process of cooperation, but also the physical movement and communication between people.

Thus, an effective innovation system should provide both virtual (informational) and physical interaction of the subjects of innovation activity.

The following types of innovation systems are traditionally selected in analysis of innovation activity:

- National Innovation System (NIS);
- Regional Innovation System (RIS);
- Corporate Innovation System (CIS).

Many authors emphasize the inextricable link between NIS, RIS and CIS, carrying out a comparative analysis [16,17]. Summarizing the results of studies of Russian and foreign scientists dedicated to the problems of the development of innovative systems, we distinguish the following elements of the innovation system.

{Ci} – a set of subjects of innovative activity (research organizations that are engaged in the implementation of its research results into production, or solve the problem formulated by production; small innovation companies created by the authors of scientific achievements for their commercialization; innovators which are at

the pre-incubation stage of the development of innovative ideas; specialized divisions of large industrial corporations and universities).

{Ei} – a set of objects of the innovation infrastructure (business incubators, innovation and technology centers and other organizations that provide specialized services to subjects of innovation activity).

{Ni} – a set of normative legal documents regulating various aspects of innovation (laws, regulations and directives of government authorities, forming a favorable innovation climate).

{Ui} – a set of financial and other support mechanisms available to subjects of innovation activity. The mechanism in this case means a set of rules and procedures aimed at a certain limited number of participants and at achieving some kind of goal. Support mechanisms within innovative systems include:

- measures to promote the demand of government authorities of various levels for innovative products;
- procedures providing tax concession and loans for the subjects of innovation activity
- procedures providing direct subsidies for the subjects of innovative activities to compensate for the costs of certain types of activities;
- procedures providing indirect subsidies and guarantees to subjects of innovation activity;
- procedures for organizing special congresses, exhibitions and other informational and marketing activities with the use of administrative resources of public authorities to promote innovative products both in the Russian and foreign markets;
- procedures providing a system of consulting and outsourcing services to the subjects of innovation activity on a preferential basis;
- procedures of targeted training and retraining of personnel for subjects of innovation activity.

{Pi} – a set of priorities of innovation activity (international and national priorities of development of science and technology and critical technologies; regional priorities of innovative development; the priority areas of innovation activity of certain corporations and enterprises; the area of highest-level competences of certain innovators).

By the innovative system we mean a coherent set of its elements, corresponding to the known attributes of systematicity.

$$Si = \langle Pi Ci Ei Ni Ui \rangle$$

The innovative system has a hierarchical nested structure: an innovative system of the

lower level is an element of an innovation system of a higher level $S_{cor} \subset S_{reg} \subset S_{nat} \subset S_{int}$

Each of the levels of the innovation system hierarchy possesses its own set of elements [18].

National innovation system and its effectiveness evaluation. The NIS concept was proposed by Freeman (1987), and later it was developed by Porter (1990), Lundvall (1992), Nelson et al. (1993) and by other researchers. The main idea of the NIS concept is that the innovation process in the country should be coordinated and supported by both private and public institutions.

Lundvall defines NIS as a set of elements and their relationships, which are used for production, dissemination and use of new and economically useful knowledge and interact within national boundaries [19].

OECD defines NIS as a set of technologies and information belonging to people, companies or organizations that play a key role in development of innovation, competitiveness and economic efficiency at the national level [6]. In fact, this concept confirms the statement that effectiveness and competitiveness of the economy depends not only on individual innovation subjects (innovators, innovative companies, science and technology organizations, universities, etc.), but also on the degree of development of their interaction as elements of a unified system using knowledge in the real sector of the economy, taking into account categories such as the priorities and values, norms and law.

Currently the NIS conception is widely used in the scientific literature worldwide, forming the basis for estimating the global competitiveness of countries [20-22].

A typical feature of the present stage of development of NIS is that innovation activity happens not only within particular organization, but increasingly relies on a wider inter-company collaboration. Large corporations are acting as initiators of creating knowledge networks, involving in these networks other institutions, such as universities, independent laboratories, government research institutions, etc. There are forming ecosystems of open innovation aimed at creating new business opportunities by sharing complementary knowledge and skills of different partners, including not only suppliers, customers, research organizations, but sometimes even competitors.



Another typical characteristic of the current stage of NIS development is the convergence of technologies. The most perspective areas of technological convergence are computer, nano- and biotechnologies, as is reflected in the approved list of crucial technologies of the Russian Federation [23].

Much of today's research on NIS is devoted to the models and methods of evaluating of NIS effectiveness and efficiency [24-26]. At the core of these studies is the idea of allocating a set of indicators that characterize the degree of development of one or another component of the NIS. Each of these indicators is assessed on the basis of statistical data and expert estimates. In the future, the obtained values can be used in making management decisions for the development of NIS, or its particular elements using a multi-criteria optimization methods.

The idea of transition to one-criterion evaluation of the effectiveness of NIS is realized in the formation of the Global Innovation Index (Global Innovation Index – GII) [27]. The final GII index forms as the arithmetic average of two indicators: the input intermediate Innovation Index (Innovation Input Sub-Index) and the output intermediate Innovation Index (Innovation Output Sub-Index). Each of these indicators reflects the key attributes of NIS. The input intermediate index reflects the properties of NIS elements: the quality of the institutional component, human capital and research, infrastructure development, market development level and the level of business development. The output intermediate index reflects the effectiveness of NIS: the level of knowledge and technological results and the level of creativity results. Depending on the research objectives, the GII is used to analyze the influence of the human factor on the national level of innovation, the local dynamics of innovation or the impact of innovation on the global economic growth.

Regional innovation systems and clusters. For the first time the RIS concept was formulated by Braczyk, Cooke and Heidenreich in 1996 [20]. Later it was developed in the works of a number of Russian and foreign scientists [21–24]. The key elements of RIS are the innovative companies, which are the subjects of innovation interacting with the external environment that is formed by competitors, suppliers, customers, governments and other external organizations on the basis of regional policy, territorial, social and cultural and

other features of the business environment in the region.

Important role in the RIS belongs to universities and other scientific organizations, which form the knowledge that is the basis for the innovation process, as well as for a network of structures ensuring the spread of innovation. The traditional focus of research is the issue of benchmarking and performance measurement RIS [25–29].

Among the above-mentioned properties of innovation systems, the geographical location of its main elements is essential. This thesis is confirmed by the increasing frequency of the use of the term «innovation cluster» in the analysis of innovation systems.

According to the definition proposed by Porter (Porter 1998), clusters are defined as «a geographically connected group of interacting organizations: specialized manufacturers, service providers, industry and related organizations (e. g., universities, agencies, standardization and trade associations), who specialize in a certain subject area, being both competitors and partners» [30]. Recognizing the importance of regional innovation clusters and the benefits of synergies from the agglomeration of innovative agents, many regional governments in Russia and abroad have been implementing programs for development of regional innovation systems with certain different clusters as their elements. The following strategy for the development of these systems could be selected depending on degree of the authorities participation [31].

- Negligible involvement of public authorities in the formation of innovation clusters.
- Indirect involvement of public authorities in the RIS formation is limited to the role of a catalyst of the process.
- Direct involvement of the authorities in the RIS creation by investing in infrastructure and education, including programs of additional vocational training.
- Direct support of the authorities of changing the economic structure of the region through the implementation of the cluster's programs.
- The strategy of direct intervention, coupled with the practice of making major management decisions based on more political than purely economic goals. Typical tools of this strategy are the subsidies and other targeted tax preferences, regulatory and legal framework of protection and control, as well as government ownership and control.

Corporate innovation systems and their role in clusters formation. Recognizing the leading role of innovative companies in ensuring the RIS effectiveness, a number of authors consider the company as a special enterprise-level innovation system (CIS) [32, 33].

Many authors emphasize the inextricable link between NIS, RIS and CIS and conduct their comparative analysis [26, 33]. However, the main focus of research traditionally done on analysis of the processes of creation and dissemination of knowledge within the NIS, RIS or KIS while the structure and functions of NIS, RIS and CIS, as well as their interactions studied enough. There are also no studies that reflect the relationship of the CIS parameters and innovation clusters. In this regard, it is important to analyze the stages of development of existing clusters and their relationship with innovation systems at various levels. For this analysis, we consider the stages of development of St. Petersburg Cluster of Clean Technologies for the Urban Environment [34]. This cluster was created in 2014 under the management of the Center for Cluster Development of St. Petersburg as part of the St. Petersburg RIS [35].

At the time of the survey (January 2016), 26 companies were members of the cluster. These companies are designed to support all stages of the innovation cycle of introduction of resource-saving technologies in housing in St. Petersburg.

One of the special features of this cluster is the dynamics of development of its geographical constituents.

The cluster founders were organizations, compactly located within the restricted area (St. Petersburg). The systems approach to solving complex problems of resource conservation in housing showed the need for innovative organizational and technological solutions that have already been tried and worked outside the geographical scope of the cluster (in Norway and Finland). In addition, the problems for which the cluster is created, are relevant not only for St. Petersburg, but are typical for the regions of Russia. In this regard, the cluster included representatives of the Kurgan Region and the Republic of Tatarstan. As a result, the geographic scope of the cluster have been extended beyond one region and reached the national and international levels. The dynamics of the St. Petersburg Cluster of Clean Technologies for the Urban Environment

reflects the general principle of development of the complex innovative project life cycle:

1. *Identification and systematic analysis of the problem at the site of its occurrence.* A necessary condition for effective implementation of this step is to have an organization that is involved in the problem-solving process, and knows its nature, characteristics and solutions. For St. Petersburg Cluster of Clean Technologies for the Urban Environment such organization was the Non-Profit Partnership «The urban homeowners association» [36] which has initiated a project to improve the energy efficiency of typical apartment buildings in St. Petersburg.

2. *Search for the best organizational and technical solutions to the identified problems.* The advanced Russian and foreign technical solutions and organizational and financial arrangements were used in this project. These include an effective model for attracting investment, the introduction of technology and innovation in housing, which is based on experience in public and private companies in Norway, as well as organizational and technical solutions of Finnish companies that have been studied during the project «Efficient Energy Management» EFEM Neighbourhood Programme and Cooperation Southeast Finland and Russia ENI [37]. Referred organizational and financial mechanisms are part of the RIS of St. Petersburg, which confirms the thesis of the structural and functional relationships of the cluster and RIS.

3. *Formation of the development team providing solutions for scientific, technical, organizational, personnel and other tasks in frame of the solving problems.* The objectives of this phase are completely adequate for the formation of an innovation system. A necessary additional condition for formation of a cluster is the typical character of the problem being addressed. For the problem under consideration this condition is satisfied, as efficiency improvement in housing in relation to the old buildings is typical for St. Petersburg and other regions of Russia.

4. *Treatment received organizational and technical decisions as part of a pilot project.* With regard to the analyzed problem, this stage was implemented in the course of the project «Increasing Energy Efficiency of Apartment Houses of Mass 137 Series», which won the regional stage of the Second All-Russian competition of completed projects in the field of energy conservation, energy efficiency



and energy ENES-2015 in the nomination «Best energy-efficient apartment building».

5. *Replication of the pilot project results.* For implementation of this phase, the Kurgan State University and the Agropolis «ALKIAGROBIOPROM» (Republic of Tatarstan) joined to the cluster. Thus, access at NIS level for the cluster was provided.

This example of cluster development shows the extremely important role of the company which is the cluster initiator. It can be regarded as the center of crystallization, without which the crystallization process does not start. In this connection, it is necessary to formulate requirements for initiators of cluster creation. First of all, these requirements relate to the mission and strategy of the company, which in general terms can be summarized as follows:

- The priority of social orientation of the company's focus on business results;
- The priority of the strategy of developing cooperation above the strategy of combatting competition;
- The priority of the open innovation principles above the principles of the intellectual property protection;

– The use of the social networks formation principles for the interaction of participants of the implemented cluster projects.

All of these principles should be implemented in the CIS of the initiator of a cluster creation.

Results. The above-described observations suggest that the innovation cluster can be regarded as a special element of the regional innovative system which has the following pronounced properties:

- Functional completeness in relation to all stages of the life cycle of complex high technology projects;
- The proximity of the geographical location of the main participants in the cluster, combined with close informal relations of decision makers at various levels within the framework of implementing cluster projects;
- Intrinsic motivation (readiness) of cluster members to use non-economic principles of business development in implementing cluster projects;
- Intrinsic motivation (readiness) of cluster members to modernize their own CIS to meet the requirements of cluster projects.

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SKVORTSOVA Inga S. – Peter the Great St. Petersburg Polytechnic University.
195251. Politechnicheskaya str. 29. St. Petersburg. Russia. E-mail: ingaskvor@list.ru

СКВОРЦОВА Инга Викторовна – доцент Санкт-Петербургского политехнического университета Петра Великого, кандидат экономических наук.

195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. E-mail: ingaskvor@list.ru

NURULIN Yuriy R. – Peter the Great St. Petersburg Polytechnic University.
195251. Politechnicheskaya str. 29. St. Petersburg. Russia. E-mail: yury.nurulin@gmail.com

НУРУЛИН Юрий Рифкатович – профессор Санкт-Петербургского политехнического университета Петра Великого, доктор технических наук.

195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. E-mail: yury.nurulin@gmail.com

I.V. Ilyin, A.B. Teslya

**STRATEGIC BUSINESS AREAS
AS A MECHANISM FOR COORDINATING STAKEHOLDER INTERESTS
WHEN MANAGING A COMPANY'S PROJECT PORTFOLIO**

И.В. Ильин, А.Б. Тесля

**СТРАТЕГИЧЕСКИЕ ЗОНЫ ХОЗЯЙСТВОВАНИЯ
КАК МЕХАНИЗМ СОГЛАСОВАНИЯ ИНТЕРЕСОВ
ЗАИНТЕРЕСОВАННЫХ СТОРОН
ПРИ УПРАВЛЕНИИ ПОРТФЕЛЕМ ПРОЕКТОВ КОМПАНИИ**

In modern conditions of high uncertainty of the external environment, companies face the task of having to develop different behavioral strategies for different market segments. The efficiency of the company's performance in these conditions is largely determined by its effective interaction with stakeholders. In this connection, the tools for identifying the stakeholders play a major role in implementing projects. The organization of the company must be taken into account while developing a strategy and selecting ways of interacting with the stakeholders. Modern companies are becoming more project-oriented, so the problem of managing a project portfolio gains importance; a portfolio should ensure that the goals of the company are achieved throughout the implementation of the strategy in the selected strategic business areas. This paper proposes an approach to coordinating stakeholder interests while managing the company's portfolio. It is demonstrated that in the modern conditions, the successful implementation of projects is largely determined by the effective interaction with the stakeholders of the company. Using strategic business areas is offered as an economic tool for identifying and classifying stakeholders. The concept of strategic business areas (SBAs) has been clarified in the paper. The projects adopted by the companies while implemented the selected strategies can serve as a tool for coordinating the interests of stakeholders in each of the SBAs. Including social investment projects into the portfolio as substantiated by the authors as one of the tools for coordinating stakeholders' interests within the SBA.

STAKEHOLDERS; STRATEGIC AREAS OF MANAGEMENT; DESIGN-ORIENTED COMPANY; PROJECT; SOCIAL INVESTMENT; COORDINATION OF INTERESTS.

В современных условиях высокой неопределенности внешней среды перед компаниями встала задача необходимости разработки различных стратегий поведения для отдельных сегментов рынка. Результативность деятельности компании в этих условиях во многом определяется ее эффективным взаимодействием со стейкхолдерами. В связи с этим инструменты выявления стейкхолдеров играют одну из важных ролей в процессе реализации проектов. Разрабатывая стратегию и выбирая способы взаимодействия компании с заинтересованными сторонами необходимо учитывать организацию деятельности компании. Современные компании становятся все более проектно-ориентированными, поэтому для них важной становится задача управления портфелем проектов, обеспечивающим достижение поставленных целей компании при реализации стратегии в выбранных стратегических зонах хозяйствования. В статье предложен подход к согласованию интересов заинтересованных сторон при реализации портфеля проектов компании. Показано, что успешная реализация проектов в современных условиях во многом определяется эффективным взаимодействием компании со стейкхолдерами. В качестве экономического инструмента выделения и классификации стейкхолдеров компании предложено использование стратегических зон хозяйствования. В статье уточнено понятие стратегических зон хозяйствования (СЗХ). Проекты, принимаемые к исполнению компаниями при реализации выбранных стратегий, могут вы-



ступать инструментом согласования интересов стейкхолдеров в каждой из СЗХ. В качестве одного из инструментов согласования интересов стейкхолдеров в рамках СЗХ при формировании портфеля проектов авторами обосновывается включение в состав портфеля проектов социального инвестирования.

СТЕЙКХОЛДЕРЫ; СТРАТЕГИЧЕСКИЕ ЗОНЫ ХОЗЯЙСТВОВАНИЯ; ПРОЕКТНО-ОРИЕНТИРОВАННАЯ КОМПАНИЯ; ПРОЕКТ; СОЦИАЛЬНЫЕ ИНВЕСТИЦИИ; СОГЛАСОВАНИЕ ИНТЕРЕСОВ.

Stakeholder theory is currently well-developed and popular among researchers. The influence of stakeholders on the activities of the company has been discussed in a number of works, among which are the works of Freeman [17], Donaldson and Preston [18], as well as the work of Post, Preston and Sachs [20] emphasizing the importance of a long-term relationship between a corporation and its stakeholders. The strategies of controlling the interaction with stakeholders were also investigated [21].

Noteworthy Russian studies include the works by Ivashkovskaya, Popov, and others [3–10, 12, 13, 15, 19]. The need to coordinate the interests of stakeholders in the process of strategic management of the company is due to the fact that the efficiency of the company's performance is largely determined by the combined effect from the influence of individual stakeholder groups.

Another theory widely used in strategic management of diversified companies is the theory of strategic business areas (SBAs). We should mention here the works of Ansoff, Gradov, and others. In recent years, the corporate standard of project management is regarded as organizing the company's strategy. Successfully solving business problems in strategic business areas is determined, in particular, by the interaction with the company's stakeholders. Consequently, there is a need to create an economic tool for identifying and classifying stakeholders. In our opinion, strategic business areas are one of the most important tools, allowing to coordinate the interests of stakeholders through forming and managing a portfolio of projects. In this connection, it is necessary to analyze the stakeholders of projects taking into account the specifics of SBAs.

Diversifying entrepreneurial activity, i. e., increasing the number of business areas, has become an urgent problem as companies need to promptly respond to the changes in the environment due to the emergence of such factors as a slowdown in economic growth, a sharp reduction in the life cycles of technologies and projects, the increasing influence of governments

and special interest groups on the economy, increased competition, and others. In these conditions, companies needed to move on to decentralized management allowing a flexible and rapid response to the changes in the external environment. This led to the need to develop the appropriate behavioral strategies for different market segments, the need to identify strategic business areas as a unit of strategic management. The meaning of the concept of strategic business areas (SBAs) in management terms is that it allows the diversified companies to rationalize organizing heterogeneous management areas, and reduce the complexity of preparing the corporate strategy.

Igor Ansoff who originally authored this concept [1] defines an SBA as '...a separate segment of the environment, which the company has entered or wants to enter', pointing out that '...the SBA is characterized both by a certain type of demand (needs) and by a specific technology'. Later [2], Ansoff regards the SBA as a method of segmenting the business environment, based on allocating the areas in which the strengths and the weaknesses of the company and the potential of the SBA will be analyzed.

In general, there are several approaches to identifying and defining the SBA concept. The approach proposed by Ansoff et al. [1, 2] is based on allocating a fixed number of real general criteria characterizing the external environment of the company (the demand for products manufactured by a particular technology, or having the same customers, or a common geographical area, or partly coinciding competitors, or relatively close strategic objectives, or the possibility of unified strategic planning, or the common key success factors, etc.). Identifying the SBA by this principle does not clearly link it with the strategy implemented by the company.

Another approach [14] defined the SBA as an area of relative financial independence of the company (including independence in decision-making) having external competitors and operating on a foreign market. The main difference is that Han et al. propose to identify the SBA based on the criteria directly controlled by the company

(the given profit margin, the presence of its own planning system, etc.), while Ansoff et al. identify the SBA based on external factors not depending directly on the company's parameters, such as the demand or a group of consumers. The advantage of this approach is it is thus possible to link the criteria for identifying the SBA with the strategic goals of the company (winning over the competition, receiving a predetermined amount of profit).

The approach used by Gradov [16] regards the SBA as part of the external environment within which the potential magnitude of the effect of preventing the insolvency (bankruptcy) of the company is ensured in the long term to exceed the costs related to adapting the company's strategic potential to the variety of the demand for goods and services that the SBA has to satisfy.

Using the advantages of each approach, let us note that in the modern conditions, assessing the influence of the external environment of the company in terms of individual trends, threats, as well as developing the company's strategy is not possible without taking into account interest groups, i. e., stakeholders, whose interests are directly connected to the activity of the company in one of the SBA. Shareholders, employees (including managers who are the decision makers), investors providing financial resources, the local community and non-profit organizations are the company's stakeholders.

Based on the above and taking into account [15], let us define the company's strategic business area as part of an external environment that:

1. forms the demand for goods and services required for creating a particular structure of the company's strategic potential;
2. has boundaries allowing to maximize the ratio between the effect of preventing bankruptcy and the costs related to adapting the strategic potential of the company to the demand for goods and services that the SBA has to satisfy;
3. is characterized by the parameters of the business climate enabling the company to achieve its planned financial goals;
4. provides stable positive dynamics of the cash flows arising in the course of its maintenance by the company.
5. requires interaction with a specific group of stakeholders whose interests in the SBA are interconnected with the company's interests.

By this definition, a strategic business area can serve as a tool for identifying the stakeholders

of the company and for coordinating their interests. Let us examine the situation in more detail.

According to [17], the term 'stakeholder' implies a certain group of people or an individual who affect the achievement of the company's goals, or depend on its activities. Since the performance of the company is largely determined by the combined effect of the influence of individual stakeholder groups, it is necessary to take their interests into account when developing the strategy of the company in order to enhance the positive effects and avoid the negative.

The process of the interaction between the company and the stakeholders should be based on completeness (the possibility of identifying the entire spectrum of consequences for the company), significance (the assessment of the effect of the problems with the stakeholders on the performance of the company), and the ability of the stakeholders to respond to the activities of the company (the possibility of the stakeholders providing adequate feedback to the company's activities). There are the following groups of stakeholders of the company:

- internal (company owners and company managers who are the decision makers, other employees, trade unions);
- market (suppliers, customers, competitors);
- external (governments, financial structures, special interest groups).

Ref. [19] highlights the following types of stakeholders, using two parameters as criteria – the threat potential and the co-operation potential:

- Stakeholders who have a high potential for threats and for co-operation, the interaction with whom is extremely attractive to the corporation.
- Unsupportive stakeholders who have a high potential for threats and low for co-operation, the corporation needs to develop a protection system against them.
- Supportive stakeholders approve of the objectives and actions of the company.
- Secondary stakeholders who have a low potential for threat and cooperation.

The relationship of the stakeholders with the company is based on both the contract defining their rights and responsibilities, and the direct and implied obligations of the company. The variety and contradiction of the interests of the stakeholders of the company, a different assessment of the tolerable risk and the desired level of profitability stipulate the conditions for a

conflict of interest emerging. The conflict of interest means the structural imbalances in the distribution of economic effects between stakeholders reducing the company's financial stability and threatening the collapse of the existing economic relations.

The conflict of interest arises from the incompleteness of the list of stakeholders, the lack of coordination of their interests, different time horizons of planning, the desire of the stakeholders to maximize the individual benefits in a period. Therefore, the company's task is to identify the most influential, key groups of stakeholders and further coordinate their interests.

For a diversified company a list of stakeholders can be quite wide, and the interests conflicting and connected in many respects with the specific activities of the company, i. e., the specific strategic business areas. Thus, each SBA can have its own set of stakeholders.

The analysis of the stakeholders of a diversified company should include identifying and systematizing the key stakeholders and identifying the SBA which is most closely connected to their interests, assessing the goals in each SBA, and developing the strategies of

interaction with the stakeholders in the process of taking into account the specifics of a particular strategic business area, and the goals of corporate management.

Generally, the following groups of stakeholders of a diversified company can be named (see Tab. 1):

Systematizing stakeholder groups in the SBA allows to more fully take into account and coordinate their interests by obtaining a more complete list of stakeholders, building various strategies of the interactions of the company and the stakeholders in each SBA.

Involving stakeholders into the interaction with the company requires additional resources, the volume of which it is quite difficult to predict. Within a certain period of time the economic effect resulting from the interaction with the stakeholders in the SBA must compensate for the potential losses from the conflict of interest. Managing the stakeholders in each SBA involves negotiating, building relationships with the stakeholders in view of their specific interests in each management area, motivating their behavior in order to ensure a positive balance of the net financial flows of the SBA and achieve growth in the value of the company as a whole.

Table 1

Groups of stakeholders of a diversified company

Attribute		Company	SBA
Interests		stakeholders, whose interests are connected to the activities of the company as a whole, including:	stakeholders, whose interests are connected to the activities of some SBA, including:
Stakeholder groups	internal	shareholders, upper management	employees, whose interests are connected to the activities of some SBA
	market		suppliers and contractors, consumers in some SBA
	external	creditors, government structures	regional and municipal authorities, local communities
Degree of influence		stakeholders who can actively influence the company's strategic objectives (major creditors and shareholders)	stakeholders who can intensively influence the company's strategic objectives in an individual SBA
Stakeholder groups	internal	major shareholders, the company's management	SBA management
	market		suppliers and contractors, competitors in the SBA
	external	major creditors, government structures	regional and municipal governments, special interest groups stakeholders who experience the greatest positive or negative influence as a result of the company's activities in the SBA, including the recipients of positive or negative externalities (product consumers, local communities)

Table 2

Forming a profile of project characteristics or project program

Parameters	Parameter options			
Scope	projects related to the activities of the company as a whole	projects related directly to the activity of the company in several SBAs		projects related directly to the activity of the company in an SBA
Independence	separate project		program	
Set of tasks covered	reorganization (internal projects)		projects that meet specific business objectives (external projects)	
Obtained result	commercial, aimed primarily at obtaining a profit or some other economic effect		social investment projects implying receiving the mandatory non-economic and economic effects for the company	
Source of financing	net capital	debt capital	client's funds	mixed funds
Conflict of stakeholder interests	insignificant, interests can be easily coordinated	significant, high costs of coordinating the interests		it is impossible to coordinate the interests
Number of key stakeholders	options depending on the specifics of the company			
Externalities, the presence of stakeholders impacted through the implementation of the project	positive externalities, mainly positive effect	negative externalities, mainly negative effect	oppositely directed effects	insignificant externalities
Scale of the project	options for combining the value and the duration of the project for the company			
Complexity of the project	options for combining industrial, technological, organizational, and other parameters of the project			

The condition for achieving a positive effect of interacting with stakeholders is the possibility of obtaining a sufficiently complete and reliable information on the problems and interests of the stakeholders in each SBA, a clear understanding of what needs to be taken into account while developing the approaches to stakeholder interaction, and how it will affect the financial and business performance indicators in each SBA and how it will increase the value of the company as a whole.

While managing a set of strategic business areas, the company will face the necessity to revise the set of stakeholders, as each SBA can be characterized by its own set of stakeholders. At the same time, revising the company's set of SBAs is only possible within a long-term period, so in the short term we shall assume the SBA set to be constant.

In developing the principles and methods of interacting with stakeholders the organization of the company should be taken into account. Companies are becoming more project-oriented. The key task for them is thus managing the project portfolio that ensures the achievement of the objectives of the company when implementing the strategy in the selected strategic business areas. It is companies with a strong project orientation that should perform stakeholder analysis.

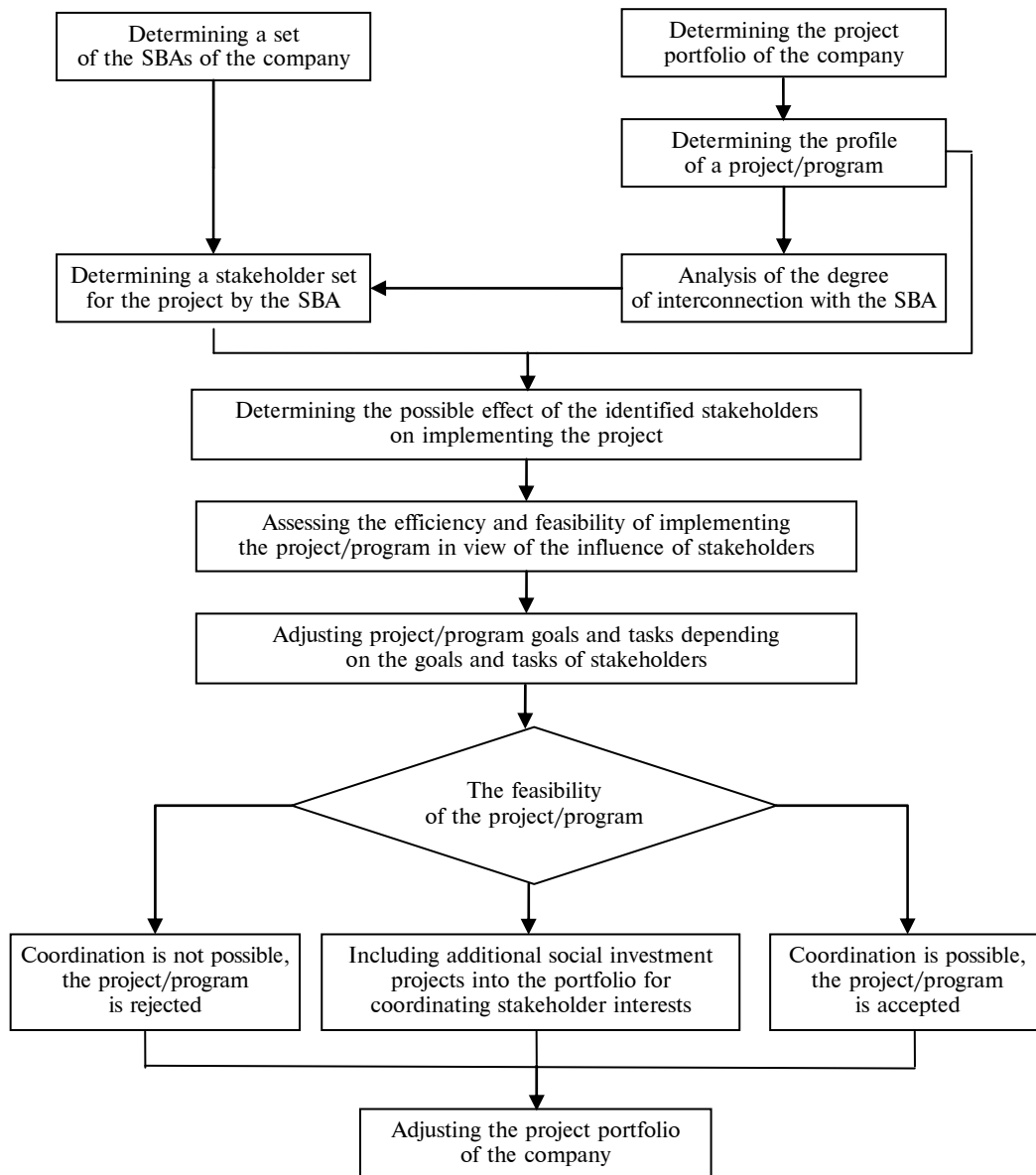
By a project we are going to mean a temporary organization for delivering one or

more business products according to an agreed business case. Projects accepted for execution by the company when implementing the chosen strategy serve as a tool for coordinating the interests of stakeholders in each SBA.

Projects implemented by a diversified company can be classified according to various criteria (see Tab. 2) presenting a systematic description of the projects implemented by the company and allowing classify stakeholders.

In view of the classification of projects in Tab. 2, it is possible to form a profile of a project or a program taking into account the types of stakeholders in each SBA. On the basis of the profile, we propose a procedure for managing the company's portfolio shown in Figure.

A project-oriented company forms a portfolio of projects within each SBA based on its own development goals and taking into account the interconnected interests of stakeholders in each business area. In our opinion, in the modern conditions, the successful implementation of projects is directly related to interacting with stakeholders. The company's mission is identifying the key stakeholder groups, forming and managing a portfolio of projects with a view to minimizing the losses from the conflict of interest. At the same time, the possibility of fully coordinating the interests of stakeholders (in the Pareto sense) seems to be quite problematic.



Managing the company's portfolio

In our opinion, social investments enabling the company to meet the needs, including the intangible ones, of various stakeholder groups whose interests are related to the SBA can be one of the tools for coordinating the interests of stakeholders. Determining the possible effect of the identified stakeholders on implementing the project

By social investments we are going to mean the material, technological, managerial, financial and other resources aimed at implementing social programs tailored to the interests of the major internal and external stakeholders as a result of which the company plans to gain both social and economic effects in the long term.

There are the following types of social investments: internal (investment in personnel training, healthcare and workplace safety investment) and external (sound business practices when dealing with both consumers and business partners, environmental compliance and resource saving, investing into the development of local communities).

Interests of stakeholders in each SBA can be coordinated by including social investment projects into the portfolio. The economic effect obtained by companies directly from implementing social investment projects will be, as a rule, delayed in time, and its magnitude will be

difficult to measure. However, implementing such projects may be expedient if they allow coordinating the interests of the company's stakeholders.

The traditional cost-benefit analysis of investment projects assumes that a project is feasible if:

- the project's rate of return exceeds the weighted average cost of capital (WACC);
- a positive value of the net present value (NPV) is maintained

Social investment projects, if assessed in terms of the traditional investment attractiveness indicators, can be found to be ineffective, as they can have:

- a negative net present value;
- a rate of return lower than the weighted average cost of capital (WACC);
- a low internal rate of return (IRR);
- a value of the profitability index close to 1 with a positive NPV value.

However, the projects related to social investment are deemed to be generally 'ineffective', as their goal is to form or maintain a company's competitive advantages, as well as serve as a tool for coordinating the interests of stakeholders.

The company's system of priorities when determining the main directions of social investment may be different in each SBA and depend, among other things, on the strength of the influence of different groups of external stakeholders in some SBA (local or regional authorities, civil institutions, non-profit organizations).

Taking into account the interests of stakeholder groups experiencing the greatest positive or negative effects as a result of the company's activities in the SBA should allow the company to achieve its strategic goals without violating the rights of stakeholders. This approach is fully consistent with the concept of social responsibility and necessitates implementing social investment projects.

Of course, including social investment projects into the company's portfolio is not the only tool for coordinating stakeholder interests in the SBA. However, it seems appropriate to stress the importance of this new tool, as it is relevant in the modern conditions, considering the growing social orientation of business development.

The impact of social investment on the results of financial and economic activities both in an individual SBA and the increase in the value of the company as a whole is not quite

clear, which engenders the need for a careful and balanced approach of the company when deciding to include these projects in the portfolio. Let us note the following factors which can provide a positive economic effect from social investment:

- the formation of a long-term social investment strategy taking into account the SBA specifics and its agreement with the overall strategy of the company;
- the formation of positive feedback to the implementation of social investment programs from the stakeholders;
- the manifestation of the results in the long-term period.

Since the precise impact of social investment is not clear, the following tasks become particularly urgent: assessing of the economic feasibility of the consequences of social investment over a certain period of time for the SBA, defining the tolerable (critical) volumes of funds allocated for financing social investment projects in any given moment within the SBA, forming of a set of indicators allowing to assess the economic consequences of social investment both for SBAs and companies.

To summarize, let us once again note that in modern conditions more and more companies choose the project-oriented approach to management. The successful implementation of projects is in the modern conditions largely determined by the effective interaction between the company and its stakeholders, which makes it necessary to select an economic tool for identifying and classifying the stakeholders of the company.

Strategic business areas of the company are the areas where the specifics of the company's activity can be observed most distinctly.

Combined analysis of the strategic business areas in view of the classification of stakeholders will allow the company to accurately determine the stakeholders of projects and programs, whose interests should be connected to a certain SBA.

A portfolio of projects and programs should be formed for each SBA using the identified interests, and a portfolio of projects for each SBA programs; this portfolio should include social investment projects allowing to coordinate the interests of stakeholders. Tailoring a mechanism for coordinating stakeholder interests in individual SBAs in view of the project-oriented structure of the company seem to present an interesting problem.

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ИЛЬИН Игорь Васильевич – заведующий кафедрой «Информационные системы в экономике и менеджменте» Санкт-Петербургского политехнического университета Петра Великого, доктор экономических наук.

195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. E-mail: ivi2475@gmail.com

ILYIN Igor' V. – Peter the Great St. Petersburg Polytechnic University.

195251. Politechnicheskaya str. 29. St. Petersburg. Russia. E-mail: ivi2475@gmail.com

ТЕСЛЯ Анна Борисовна – доцент кафедры мировой экономики и промышленной политики регионов Инженерно-экономического института Санкт-Петербургского политехнического университета Петра Великого, доктор экономических наук.

195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. E-mail: antes@list.ru

TESLYA Anna B. – World and Regional Economy, Institute of Industrial Economics and Management, Peter the Great St. Petersburg Polytechnic University.

195251. Politechnicheskaya str. 29. St. Petersburg. Russia. E-mail: Antes@list.ru



A.F. Tikhomirov, A.D. Goriushkina

**EVALUATION OF THE INTELLECTUAL CAPITAL
OF AN INTERNATIONAL COMPANY**

А.Ф. Тихомиров, А.Д. Горюшкина

**ОЦЕНКА ИНТЕЛЛЕКТУАЛЬНОГО КАПИТАЛА
МЕЖДУНАРОДНОЙ КОМПАНИИ**

The subject of the study are the assets of the company that are not recognized under the traditional accounting statement (intellectual capital, IC), including those related to the company using the results of research (R&D) which make a significant contribution to its value. The aim of this paper is to analyze the contribution of intangible assets in the performance and value of the company. The object of the study is an international company in the sector of e-commerce. The company's intellectual capital was estimated using Tobin's q ratio, VAIC and the cost capitalization method. Tobin's q of the company was higher than one (3.59), which indicates the presence of a significant intellectual capital. Research with the VAIC method showed that the largest contribution to the overall index is made by the component associated with human capital (HCE). The growth rate of HCE showed that each year the company gets an almost two-fold return on investment in such capital. Using the method of capitalization of R & D expenditures, we performed a recalculation of the key performance indicators, taking into account the impact on them of intangible assets, such as return on equity and total capital profitability of activity, asset turnover. Capitalisation of research has a positive effect on the basic parameters, although only slightly. It was found that current accounting standards do not identify many of the key components of IC. There is a large percentage of those costs in the structure of the intellectual capital of the company, which make up a large share of the company's investments, but cannot be capitalized in connection with the requirements of the existing accounting standards. This complicates the task of managing these assets, and of adequately assessing the company for investors.

INTELLECTUAL CAPITAL; INTAGIBLE ASSETS; MARKET CAPITALIZATION; TOBIN'S Q; COMPANY PERFORMANCE; COSTS CAPITALIZATION.

Предметом исследования являются не признаваемые в учете активы (интеллектуальный капитал) компании, в том числе связанные с использованием компанией результатов научных исследований (НИОКР), вносящие существенный вклад в ее стоимость. Целью работы является исследование вклада ценности нематериальных активов компании в показатели деятельности и стоимость компании. Объектом исследования является международная компания из отрасли электронной коммерции. Проведена оценка интеллектуального капитала компании методами коэффициента q Тобина, VAIC, метода капитализации затрат. Коэффициент Тобина исследованной компании оказался выше единицы (3,59), что указывает на наличие значительного интеллектуального капитала. Исследования методом VAIC показали, что наибольший вклад в суммарный показатель вносит компонента, связанная с человеческим капиталом (HCE). Темпы роста HCE показали, что год от года компания получает практически двукратную отдачу от инвестиций в такой капитал. С использованием метода капитализации затрат на НИОКР проведен перерасчет ключевых показателей деятельности с учетом влияния на них нематериальных активов – таких, как рентабельность собственного и совокупного капитала, рентабельность деятельности, оборачиваемость активов. Капитализация затрат на исследования положительно влияет на основные показатели, хотя и незначительно. Установлено, что современные стандарты бухгалтерской отчетности не идентифицируют многие важнейшие компоненты ИК. В структуре интеллектуального капитала предприятия существует большой процент тех затрат, которые составляют большую долю инвестиций предприятия, но не могут быть капитализированы в связи с требованиями существующих стандартов учета. Это затрудняет задачу менеджменту по управлению этими активами, а инвесторам – адекватной оценке компании.

ИНТЕЛЛЕКТУАЛЬНЫЙ КАПИТАЛ; НЕМАТЕРИАЛЬНЫЕ АКТИВЫ; РЫНОЧНАЯ КАПИТАЛИЗАЦИЯ; Q ТОБИНА; ПОКАЗАТЕЛИ ДЕЯТЕЛЬНОСТИ КОМПАНИИ; КАПИТАЛИЗАЦИЯ ЗАТРАТ.

Material, tangible resources which made the largest contribution in forming the value of an organization in the last century cannot provide the company with the necessary competitive advantages nowadays [1, 2]. Business in the 21st century comprises data, IT technologies, the Internet, e-commerce, brands, etc., which is to say, the features directly or indirectly connected with knowledge. The new features of the modern economy require new rules, new resources and aims for doing business, new strategies and new measures for achieving these strategies. Intellectual Capital, intangible resources and Intangible Assets are becoming the key drivers of operational success for modern companies, while material resources become factors that do not form a competitive advantage anymore.

Evaluation and measurement of these new business assets, such as elements of Intellectual Capital, is currently a problem for both company managers interested in internal and external assessment, and for investors monitoring markets and companies for allocating their capital. Such an assessment can be significantly different from the assessment of traditional financial performance indicators, which is performed in accordance with local and international financial and accounting standards. This makes it necessary to take into account some specific features of modern resources and assets, and the company might need to evaluate and reflect this in its reports.

The objective of this paper is to examine the effect that Intellectual Capital has on Key Performance Indicators of the modern company. The object of this study is the international e-commerce company, Zalando SE.

The subjects of the paper are the assets not recognized under traditional accounting standards and represented by Intellectual Capital connected with the company's implementation of R&D which make up a big share of the modern company investments and, in our opinion, create the value for the organization in the future.

1. The concept of Intangible assets and Intellectual Capital. One of the major limitations in the measurement of IC within the organization is the uncertainty of its concept as well as the uncertainty in the relationship between Intellectual Capital, Intangible Assets and Intellectual property: can they be considered equal? And if not, what is the nature of the interaction between them?

B. Lev points out in his book dedicated to Intangible Assets that these assets and IC are essentially interchangeable concepts with the only difference in the field of application: IAs are used by accounting specialists in a balance sheet, while IC is a concept that takes place in the calculation of financial indicators by the financial management of the company [3]. In their book «Weightless Wealth: Find Your Real Value in a Future», Andriessen and Tissen understand IAs as not only a balance sheet term, but an overall measure of intangible wealth creating the value for an organization [4]. In this regard, we should also distinguish the IAs as assets within accounting from those IAs which are unidentifiable under the balance sheet, sometimes called the Intangibles. Within the framework of this study we are going to accept that IC and IAs are equivalent concepts, assuming, however, that IA is somewhat broader than an accounting term, and identify them as Intangibles (here we talk about a broad understanding of IAs as the summation of «identifiable and unidentifiable IAs»). As for Intellectual Property, we argue that nowadays this term is far more narrow and is used mostly in legal practice. Taking into consideration the definition of IAs as a broad measure of intangible wealth of the company, we also agree that not all components of this wealth are legally a part of the organizational property. That allows us to state that Intellectual Property cannot be equated to the above definitions but represents only a part of the IAs of the organization.

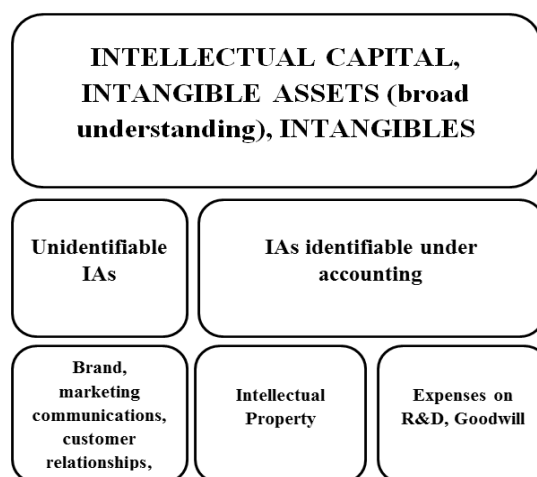


Fig. 1. Classification of the basic concepts covered in the study

Now, when we agreed on the basic concepts and definitions, we will examine the structure and the evaluation of the IC, which currently presents the main problem in discussions concerning the intellectual capital.

2. The structure of Intangible Assets (IC).

The structure of IC is particularly important in terms of measuring its value. This is due to the fact that the structure displays information on where and in which way the intellectual assets are located within the company. In today's practice it is very common to use the IC model of Hubert Saint-Onge [4], which divides all the elements of Intellectual Capital into three groups: human, structural and client capital. This approach is also in accordance with the IC classification of the International Federation of Accountants [5].

Human capital is connected with knowledge, skills and experience of employees, as well as with the organizational capabilities to monetize these knowledge, skills and experience.

Structural (or organizational) capital represents everything that is always a part of the company, even if employees with their knowledge and expertise left it. This is the most diversified element of IC, which includes Intellectual Property rights, IT resources, guidance for working processes, unique organizational structure and more of the unique techniques that might be economically sufficient for the company.

Client (or relationship) capital consists of the external relations of the organization with its clients, suppliers, partners, investors and other stakeholders and the capability of the company to monetize these relations in an efficient way. This might include trademarks; reputation of the company among its stakeholders; insiders of the company within partner or supplier organizations or among clients; repetitive purchases; long-term relationships with key partners and so on [6].

3. The value of IAs and its measurement.

Kendrick states [7], that in today's economy the proportion of material resources to immaterial, intangible ones is 30:70 percent, while in the beginning of the 20th century, this proportion was 63:37 percent. At the same time, a number of researchers from the MMU University (Malaysia) argue that the market value of some organizations is almost 6 times greater than their book value [8]. Thus, we suppose that traditional

accounting methods are able to display around 15 % of total value of the overall intangible assets. Therefore, a lot of attention nowadays is paid to the problem of correctly reflecting the new resources in the knowledge economy. Simultaneously, the main aim of every business, i. e., increasing the company's profit, still remains the same as it used to a century ago. This creates a dissonance in how the value of the organization is formally measured by current accounting standards and what its measure is in terms of knowledge economy.

This is particularly visible in high-tech industries, where the highest share of intangible assets among all the industries is concentrated. This creates the need in more adequate assessment of such assets in these organizations by restructuring and improving the traditional methods of IC measurement and recognition.

Currently there is a great number of methods for measuring IC. These methods are different by their nature and, therefore, all of them might be divided into four groups [9]:

1) Direct Intellectual Capital methods (DIC) require quantitative assessment of different components of Intellectual Capital after their identification.

2) Market Capitalization Methods (MCM), an approach, based on market capitalization evaluation. Such methods presuppose calculating the difference between the company's market value and the equity of its shareholders, with the obtained values then considered to be the IC.

3) Return on Assets Methods (ROA), which show the intellectual resource potential of an organization, a measure distinguishing this approach from MCM approach significantly. This is possible due to the ability to compare measurement results with the industry's average. The comparable values are defined as the proportion between average pre-tax earnings numbers and the average material assets numbers.

4) Scorecard Methods (SC) approach can be considered as quantitative as it does not imply dollar evaluation. These methods are comparable with the DIC methods, but the defined IC components are assorted then by scorecards or graphs.

Apparently, not every method can be used by every organization. For instance, MCM methods, which require the stock market data, can be very problematic to calculate for small

and medium enterprises (SME). Nevertheless, the existence of more than 30 methods [9] in the current IC measurement practice allows each company to choose which set of different approaches to apply while trying to measure the organizational value unidentifiable by traditional assessment.

Thus, the complex and profound examination of organizational Intellectual Capital might be provided through different combinations of the available traditional and alternative methods, which can be implemented in several steps (Tab. 1). In our opinion, the set of such methods is individual for every company and should be defined according to the nature of the company's business processes.

Table 1

The process of complex IC measurement in the international organization

Step	Purpose	Method
IC Identification	Can we prove the existence of the IC in the company?	Initial assessment: The ratio between booking and market value; «Tobin's q»
IC Diagnosis	What are the elements of the IC and where are they located in the company?	Navigators of Intellectual Capital
Quantitative or qualitative measurement	Is qualitative measurement possible? How to optimize the usage of the IC?	DIC, MCM, ROA and SC methods
IAs accounting	Which IC can we recognize within the traditional accounting standards?	Accounting standards application
Recognition of unidentifiable IC	Which unidentifiable IC do we consider important to disclose?	Alternative additional reporting methods

The market value of the company is one of the most indicative criteria determining the role of intangibles in the international organization. The amounts of enterprises where intangible assets create a high value steadily grow nowadays [1, 10]. However, intangible resources create some peculiarities, which should be taken into account while implementing the diagnosis and assessment of organizational IC.

For instance, the intangibles disclosed in accounting balance sheets and methods of profit calculation, capital expenses and assets are more relevant for traditional manufacturing corporations, where IC is not creating such a significant value as it is in, for example, high-tech enterprises. On the other hand, applying these standard methods to traditional accounting leads to undervaluing their financial indicators [11, 12].

4. Assessment of Immaterial Assets of Zalando SE

4.1. Company's profile. Zalando SE was chosen as an object of this study as an international fastly growing company of the e-commerce sector [13, 14].

The object of study was selected due to the fact that e-commerce is a fast-growing segment of the economy, including in Russia. A comprehensive study of the experience of the leaders of this industry is overdue and is of interest both from scientific and practical points of view. Our study was aimed primarily at educating the management of Russian companies operating in sectors with a high proportion of intangible assets in the management of their intellectual capital. During this study, mainly open sources and public company information were taken into consideration. Nonetheless, authors express their deep gratitude to Zalando management for support and enhancement of this study.

A relatively young business founded in 2008 in Germany, Zalando nevertheless shows strong financial results today. In 2014 the company announced an IPO with the intention to list on the Frankfurt Stock Exchange and gained revenue of 2.2 billion euro, which was a 26 % increase compared to the last year. Share price dynamics is shown in Fig.2, where «N»-quotes represent the announcement dates of the annual and quarterly results and changes in the company's strategic moves.

As shown on the graph (Fig. 2), despite being volatile, the share price had been increasing significantly for the period up to May 2015 when this study took place. We can assume that today the company remains attractive for investors and effective for the key stakeholders, which comes partly from growing opportunities of the e-commerce industry, and partly from an outstanding business strategy undertaken by Zalando management.



Fig. 2. Zalando share price dynamics for the period from October 20, 2014 to May 12, 2015, Euro

Source: corporate.zalando.com

The effectiveness of the company's business activities, from our point of view, is also enhanced by heavy investments into intellectual assets, such as marketing activities (13.6 % of profit in 2014); R&D activities; personnel recruiting and development; logistic activities (23.4 % of profit in 2014). These investments ought to add further value to the business in the near future.

Talking about the company's development so far, it is necessary to mention Zalando's history. Started as a German shoe online retailer in 2008, Zalando rather quickly extended its business to Austria (2009), Netherlands and France (2010). Today the company is represented in 15 European countries, where Zalando diversified its business from shoe retail to brand apparel retail. DACH region countries, i. e., Germany, Austria and Switzerland, remain among the key directions that Zalando operates in, having brought 56 % of all revenues generated by the company in 2014.

While the 2008–2014 period can be considered the time of Zalando's geographical expansion, the diversification of the company started from 2014. In 2014, the company launched an online fashion recommendation project aimed at strengthening the core company's business, i. e., apparel retail.

4.2. Aggregated IC assessment – Tobin's q.

First of all, it is necessary to detect whether the IC exists within a company to be able to then compare its effect with the effect among other industry players. Afterwards we will be able to outline the opportunities of its internal and external assessment.

To make it possible, we would use the Tobin's q method, which involves market capitalization calculation, thus being a part of the MCM group of methods discussed earlier in this study. Tobin's q is a ratio between the market value of the invested capital to the replacement cost of capital and can be also interpreted with the following formulas:

$$\begin{aligned}
 q &= \frac{\text{Market value of installed capital}}{\text{Replacement cost of capital}} = \\
 &= \frac{\text{Market value of the company}}{\text{Replacement cost of capital}} = \\
 &= (\text{Cap} + D) / (\text{Equity} + D).
 \end{aligned}$$

As we can see from the formulas above, the market value of the company can be calculated as a sum of the company's capitalization (Cap) and the total of the company's liabilities (D).

The price of Zalando's shares by the end of 2014 was €25.50, the number of basic shares totaled 226.5 million. Thus, Zalando capitalization

is: $Cap = EUR\ 25.5 \cdot 226.5\ million = EUR\ 5775.75\ million$. As shown in the company annual report, the amount of total liabilities was EUR 627.9 million [13].

To calculate the replacement cost of capital, we need to summarize the amount of total equity and the company's liabilities. After calculations we get EUR 1785.5 million as the replacement cost of capital, which allows us to calculate Tobin's q:

$$q = \frac{(5775.75 + 627.9)\text{million}}{1785.5\text{million}} \approx 3.59.$$

As the value of q is greater than 1, we can assume the existence of unidentifiable assets or Intellectual Capital within Zalando. At the same time we cannot state that the difference between the company's market value and thereplacement cost of the capital, i. e., EUR 4618.15 million, is itself the value of the Intellectual Capital. A lot of other effects influence the share price dynamics. Nevertheless, we still can estimate the influence that the IC can have by benchmarking the company's q against that of its biggest competitors. The results are shown in Tab. 2.

Table 2

Tobin's q of the biggest ecommerce players

Company name	q
Asos Plc	9.58
Amazon	2.65
Boohoo Plc	6.55
Yoox Group	3.13
Zalando SE	3.59
q avg	5.05

Source: companies' annual reports 2014.

As Tab. 2 shows, Zalando's q is above average, which might be caused by several reasons, such as having newly entered the stock market, market sentiment at the end of day, or other external and internal circumstances. Simultaneously, we can assume that competitors with a higher q own a higher amount of intellectual resources which accelerate the companies' growth. Here we can see the opportunity for Zalando to own such resources in the future.

4.3. Differentiated IC assessment – VAIC method. To estimate which components of the organizational IC accelerate more growth of Zalando's market capitalization, it is useful to calculate the so called Value Added Intellectual Coefficient (VAIC) [8]. This method is based on the assessment of two main components of IC (Fig. 3):

$$VAIC = CEE + HCE + SCE,$$

where CEE is the Capital Employed Efficiency;

HCE or the Human Capital Efficiency calculated as the value added divided by the personnel expenses;

SCE or the Structural Capital Efficiency calculated as the value added share in the difference between human capital and value added.

The VAIC method helps the company to identify how much contribution material and intellectual assets make into the company's value added. The higher VAIC is, the more effectively the company utilizes its physical assets, which is happening due to a greater amount of intellectual capital.

When calculating VAIC, we are going to interpret the sum of HCE and SCE as the contribution of IC into the value added, while CEE characterizes the material side of creating the value added.

Numbers from financial reports for the last three years will be needed to calculate the Value Added Intellectual Coefficient. All such information is freely available for Zalando SE. Using annual reports, we calculate the Value Added, VA, which is represented by the difference between the company's revenue and personnel expenses (which we further consider as Human Capital, HC). The Capital Employed, CE, will be calculated as the difference between the balance sheet total and the accounts payable. The results are shown in Tab. 3. For drawing up the forecast values of the coefficients, we used the Excel prediction function.

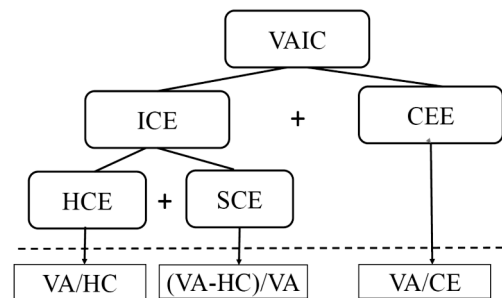


Fig. 3. VAIC coefficient structure

Source: <http://www.hse.ru/>

Table 3

VAIC and its components with forecast (*)

VAIC components	2012	2013	2014	2015*	2016*
CEE	0.095	0.197	0.284	0.381	0.4755
HCE	0.383	0.525	1.323	1.6837	2.1537
SCE	-1.609	-0.903	0.244	1.0973	2.024
ICE	-1.226	-0.378	1.567	2.7807	4.1772
VAIC	-1.131	-0.181	1.851	3.1617	4.6527

Source: Annual reports of Zalando SE, 2012–2014.

CEE, HCE, SCE in the Tab. 3 represent the effectiveness of respectively the capital employed, the human capital and the structural capital, and ICE the effectiveness of the aggregated IC.

It can be seen from analyzing the results obtained that the effectiveness of the Capital Employed increased rapidly in 2013 compared to the previous year. This increase continued a year later, i. e., while the value added totaled EUR 197 for every EUR 1000 of capital invested in 2013, it became then EUR 284 for every EUR 1000 invested in 2014. SCE improved in 2014, when it started to bring positive contribution by yielding EUR 244 for every EUR 1000 invested.

The most interesting in terms of interpretation is HCE, whose growth rate shows that Zalando receives an almost double contribution from the Human Capital into the value added each year. It allows forecasting almost a four times greater return on investments into personnel in 2016.

A retrospective change in all VAIC components is shown in Fig. 4.

4.4. Interpreting the assessment data.

Normally, VAIC coefficient values lie in the 1.5–15 range and the greater the value is, the higher the effectiveness of IC utilization. Zalando's VAIC is still minimal, which might be a result of low IC usage within the company, as other factors are still driving its growth. Nevertheless, the share of the IC creating the value added is increasing almost twice each year and is forecasted to reach the average among the industry players by 2016.

Thus, the IC is easily identified within Zalando SE by the significant difference between the company's market value and the booking value of its assets ($q > 1$). This difference is represented by more than EUR 3990 million, an amount which might be partly interpreted as the unidentifiable assets hidden within Zalando.

For the company, it is necessary to identify which part of the intangible assets lies within the framework of accounting standards.

Currently, Zalando SE manages its Intellectual Capital by capitalizing expenses that occur due to IC emergence. This is made in accordance with the IFRS-38 (International Finance Reporting Standards) standard, which in fact allows recognizing only the expenses incurred during the R&D process after the implementation of the development phase. Due to this peculiarity, e-commerce companies applying the standard disclose primarily these expenses appearing after acquisition or development of IT technologies as their greatest intellectual assets. For Zalando, expenses on IT development totaled EUR 29 million in 2014, which represented an increase by 26.6 % compared to the previous year.

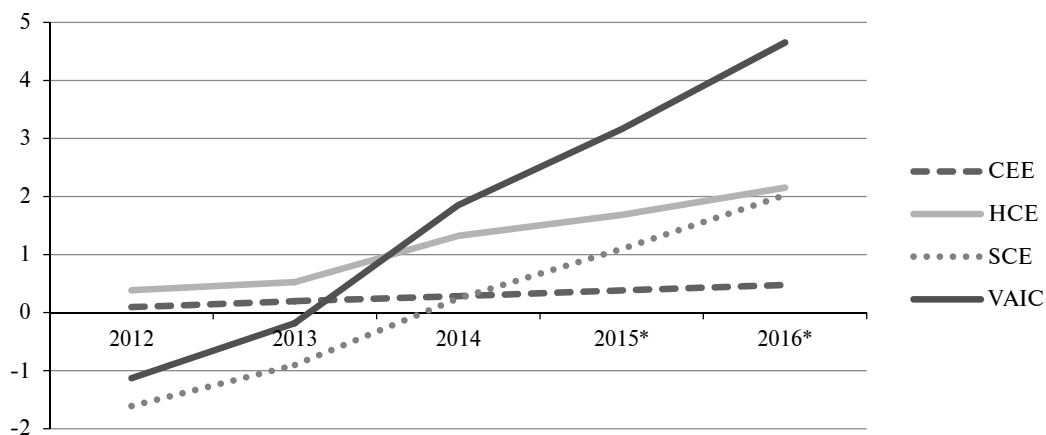


Fig. 4. VAIC components development, 2012–2016 (with forecast, *)

Therefore, we assume that the share of all intellectual assets of Zalando disclosed by accounting balance sheets now totals: $(29/3990) 100 \% = 0.73 \%$. Thus, less than 1 % (!) of the overall IC is measured. The remaining undisclosed capital lies in goodwill, human knowledge, client's potential and external relations of the organization, and therefore cannot be assessed by traditional methods.

To make this assessment more adequate for companies with a greater share of IC, it is necessary to improve traditional capitalization and accounting methods to then reevaluate fundamental financial indicators.

4.5. Assessment of the R&D effect on financial performance indicators by R&D expenses capitalization. For adequate examination of the company where intangible resources have a great impact on the whole business, it is necessary to rearrange accounts of capital and current expenditures to be able then to correct financial information, e. g., Financial Position Statement and Income Statement/Profit and Loss Statement. This might be done by capitalizing expenses, a method broadly used while assessing the intangible assets unidentifiable under accounting terms [11, 15].

The main difficulty here lies in identifying the capital expenses, which are those bringing the long-term value into the organizational performance and ensuring the company's growth in the future: advertising, training [12], etc. In case of R&D, for instance, research expenses are sometimes hard to measure in money terms, which is why all R&D expenses are, as a rule, deducted as current expenses. As a result, the

assets created by R&D are not reflected in the balance sheet as assets of the organization, which affects the company's cost of capital and profits. However, R&D expenses, however undefined they may seem, should within this approach be regarded as capital ones. Let us demonstrate how such a redistribution affect R&D expenses capitalization might have on Zalando SE financial performance indicators.

Information on the financial performance indicators, calculated using the data from Zalando's annual reports, is shown in Tab. 4.

To measure the assets that might appear from the research phase in the company's R&D process by applying the IFRS-38 standard, we firstly need to define the amortization period of these assets. At Zalando it is common to depreciate intangible assets in the 3 years after their acquisition. We assume that the same time passes from the beginning of the research to the moment when the results of the study can yield long-term results.

The next step is to collect the data about expenses that arise during the whole period of amortization. These numbers are displayed in Tab. 5 [16].

The linear method is commonly used to calculate amortization in German companies, which is also described by the IFRS-38 standard. With this method the amortization sum is equally distributed throughout the whole period and equal amounts of assets are depreciated every single period. For Zalando the current research amortization totals EUR 1649.31 thousand. If we then calculate unamortized costs amounts, we will get EUR 4335330, as shown in Tab. 5.

Table 4

Zalando SE Financial Performance Indicators

Indicator		2012	2013	2014
Return on Assets (ROA)	$ROA = P/A$	-0.101	-0.106	0.036
Return on Equity (ROE)	$ROE = NI/E$	-0.186	-0.213	0.041
Profitability index	$Pi = P/C$	-0.134	-0.109	0.029
Asset Turnover Ratio	$ATR = Q/A$	1.404	1.644	1.267
Costs Turnover Ratio	$CTR = Q/C$	1.857	1.685	1.029

Source: corporate.zalando.de.

Note. P – the profit; A – the assets; NI – the net income; E – the equity; C – the expenses; Q – the production volume.

Table 5

Zalando SE Research expenses amortization

Year	Research expenses,	Unamortized costs		Current year amortization,
	€, thousands	%	€, thousands	€, thousands
Current	2460	100	2460	
2014	2000	66.7	1333.33	666.66
2013	1626.02	33.4	542.00	542.00
2012	1321.96	0	0	440.65
Σ			4335.33	1649.31

Source: Zalando SE internal data.

Now let us adjust the carrying value of the assets by adding the obtained value of the research capital:

$$\begin{aligned} \text{Adjusted value of CA} &= \\ &= \text{Initial value of CA} + \text{Research capital} = \\ &= \text{EUR } 1126700 \text{ K} + \text{EUR } 4335 \text{ K} = \text{EUR } 1131035 \text{ K}, \end{aligned}$$

where *K – thousands.

Key financial indicators also need to be adjusted to include the capitalization of research costs:

$$\begin{aligned} \text{Adjusted operating profit} &= \\ &= \text{Operating profit} + \text{Research costs} - \text{Amortization} = \\ &= \text{EUR } 62100 \text{ K} + \text{EUR } 2460 \text{ K} - \text{EUR } 1649 \text{ K} = \\ &= \text{EUR } 62911 \text{ K}; \end{aligned}$$

$$\begin{aligned} \text{Adjusted Net Profit} &= \\ &= \text{Net Profit} + \text{Research costs} - \text{Amortization} = \\ &= \text{EUR } 47100 \text{ K} + \text{EUR } 2460 \text{ K} - \text{EUR } 1649 \text{ K} = \\ &= \text{EUR } 47911 \text{ K}. \end{aligned}$$

The key performance indicators from Tab. 4 might be recalculated using the new adjusted financial data. For that purpose, let us adjust in a similar way the data necessary for the calculations; the new data is listed in Tab. 6.

Table 6

Zalando SE adjusted Financial Performance Indicators

Indicator	2014	Adjusted numbers
ROA	0.0355	0.0359
ROE	0.0410	0.0424
Profitability index	0.0289	0.0293
Asset Turnover Ratio	1.267	1.263
Costs Turnover Ratio	1.029	1.031

Source: corporate.zalando.de.

It is evident that the capitalization of the research expenses has a positive effect on performance indicators, even though this effect is not significant. At the same time, since large amounts of unidentifiable assets are hidden and cannot be recognized under the balance sheet, we can assume that the effect of capitalization of expenses they cause might be much more perceptible. This includes expenses on marketing, personnel development [12], strategic development and others.

Conclusions. Thus, the proposed course of action provides a comprehensive assessment of the company's intellectual capital (see Tab. 1). In the initial stages it is necessary to establish the presence of IC and its localization using the methods of calculating Tobin's coefficient, VAIC and other. The method of capitalization of costs is proposed for a more accurate assessment of the individual components of IC. This method yields a monetary estimate of, for example, the IR related to scientific research, human capital, etc.

The novelty of the results is that the use of capitalization of costs allows to obtain a new, real value and performance indicators of a modern enterprise with a significant share of intangible assets unidentifiable in accounting records. This will enable investors and creditors to gain a better understanding of the structure of the assets of the company and make more informed decisions. For managers of the firm the comparison of the traditional and the proposed method allows to draw conclusions about the effectiveness of certain expenses in accordance with their capitalization and more soundly shape the budgets of both investment projects and operating costs.

In view of the above-described problems that arise during the process of IC evaluation, the need of revaluation of traditional accounting standards or development of additional IC reporting becomes, in our view, crucial. The new measures must provide an adequate assessment of the real value of a modern company.

The method for estimating IR by capitalization of costs proposed in this paper with a specific example (Section 4.5) is recommended primarily to Russian companies doing business in the field of e-commerce and other industries widely using the results of research and development in their activities.

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ТИХОМИРОВ Anton F. – Peter the Great St. Petersburg Polytechnic University.
195251. Politechnicheskaya str. 29. St. Petersburg. Russia. E-mail: antontikh@mail.ru

ТИХОМИРОВ Антон Федорович – профессор Санкт-Петербургского политехнического университета Петра Великого, кандидат технических наук.

195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. E-mail: antontikh@mail.ru

GORIUSHKINA Aleksandra D. – Peter the Great St. Petersburg Polytechnic University.
195251. Politechnicheskaya str. 29. St. Petersburg. Russia. E-mail: sasha.goryushkina@gmail.com

ГОРЮШКИНА Александра Дмитриевна – студент магистратуры Санкт-Петербургского политехнического университета Петра Великого.

195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. E-mail: sasha.goryushkina@gmail.com

S.V. Zdolnikova, A.V. Babkin

**INTEGRATED INDUSTRIAL STRUCTURES AS A TOOL
FOR IMPLEMENTING THE SYNERGETIC APPROACH
TO FORMING THE INDUSTRIAL POLICY**

С.В. Здольникова, А.В. Бабкин

**ИНТЕГРИРОВАННЫЕ ПРОМЫШЛЕННЫЕ СТРУКТУРЫ
КАК ИНСТРУМЕНТ РЕАЛИЗАЦИИ СИНЕРГЕТИЧЕСКОГО ПОДХОДА
ПРИ ФОРМИРОВАНИИ ПРОМЫШЛЕННОЙ ПОЛИТИКИ**

In modern market conditions the creation of an effective national economy largely is provided by the system stimulating innovation and technological development of the industry, while the government is one of the most effective factors shaping the conditions of existence and the practical application of innovation in production and other spheres of society. This paper considers the integration of economic entities as a means of forming state industrial policy. The purpose of the study is to show the interconnection of integrated industrial structures (IIS) and implementation of the synergetic approach in shaping industrial policy: to substantiate the effects of industrial policy on the growing trend of the formation of IIS, on the one hand, and the impact of synergies from the creation of the IIS on the development of Russian industry, on the other hand. The authors used statistical methods to assess the impact of IIS activities on the level of innovative development of the national economy, as well as applied basic concepts of marginal analysis to identify the conditions of appearance of synergetic effect in the IIS. The study found that the use of the synergetic concept in the formation of industrial policy is justified and necessary at this stage of development of the national economy, and the IIS can be considered as a tool for the realization of the synergetic approach in shaping the industrial policy. In the future, detailed elaboration of the methodology for assessing the synergetic effect of the IIS will be required, as well as development of organizational-economic mechanism of management of innovative potential of IPS as an integral part of the innovative potential of Russian industry as a whole.

INTEGRATED INDUSTRIAL STRUCTURE; INDUSTRIAL POLICY; SYNERGISTIC APPROACH TO MANAGEMENT; SYNERGIES; INNOVATION DEVELOPMENT.

В современных рыночных условиях создание эффективной национальной экономики в значительной степени обеспечивается за счет системного стимулирования инноваций и технологического развития промышленности, при этом государство является одним из действенных факторов, формирующих условия существования и практического применения инноваций в производстве и других сферах жизни общества. Данная статья посвящена рассмотрению интеграции хозяйствующих субъектов как одного из инструментов формирования государственной промышленной политики. Цель исследования – показать взаимосвязь деятельности интегрированных промышленных структур (ИПС) и реализации синергетического подхода при формировании промышленной политики: обосновать воздействие промышленной политики на усиление тенденции к образованию ИПС, с одной стороны, и воздействие синергетического эффекта от создания ИПС на развитие российской промышленности, с другой стороны. Авторами были использованы статистические методы для оценки влияния деятельности ИПС на уровень инновационного развития национальной экономики, а также применены основные положения концепции маржинального анализа для выявления условий появления синергетического эффекта в ИПС. В результате исследования было установлено, что применение синергетической концепции при формировании промышленной политики является оправданным и необходимым на данном этапе развития национальной экономики, а ИПС, могут быть рассмотрены в качестве инструмента реализации синергетического подхода при формированию промышленной политики. В дальнейшем потребуется детальная проработка методики оценки синергетического эффекта ИПС, а также разработка организационно-экономического механизма управления инновационным потенциалом ИПС как составной части инновационного потенциала российской промышленности в целом.

ИНТЕГРИРОВАННЫЕ ПРОМЫШЛЕННЫЕ СТРУКТУРЫ; ПРОМЫШЛЕННАЯ ПОЛИТИКА; СИНЕРГЕТИЧЕСКИЙ ПОДХОД К УПРАВЛЕНИЮ; СИНЕРГЕТИЧЕСКИЙ ЭФФЕКТ; ИННОВАЦИОННОЕ РАЗВИТИЕ.

The relevance of the research. The beginning of the 21st century has been marked by the advent of technological, marketing, organizational and other innovations. On the one hand, it contributed to the development of science-intensive industries, on the other hand, it made the business environment unsteady and unpredictable. Changes in market conditions lead to changes in industrial policy currently aimed at creating high-tech, competitive industry, ensuring the transition of government economics from the primary goods-exporting to the innovative type of growth.

However, industrial policy legislation at the federal level does not contain the exact programs and measures capable of contributing to this goal realization [1, 2]. Regional mechanisms of industrial policy formation and development often are not systematic and cannot be regarded as the basis for the elaboration of the country's industrial development general plan. That is why the determination of the means of forming and developing the industrial policy at the federal level is considered to be an urgent research problem.

In our opinion, the most appropriate means of forming the industrial policy is applying the synergetic approach. According to this approach, market entities are regarded as self-organizing systems which not only interact with the environment and allow to conform to it, but also influence the environment by overcoming the uncertainty and taking into consideration the priority of non-linear innovations.

Aims and tasks. The present article is focused on examining the synergetic approach to forming the industrial policy as well as on integrated industrial structures (IIS) as one of the possible means. In order to achieve this aim, the following tasks are put forward:

- 1) to analyze the industrial policy influence on the intensification of the integration processes in economics;
- 2) to examine the essence of the synergetic approach in relation to managing economic systems;
- 3) to justify the positive economic effect arising from the integration contributing to the Russian industry development from the perspective of the synergetic approach.

Industrial policy and integration processes in economics. Industrial policy is a system of relationships among government bodies, business

entities, scientific and social organizations regarding the formation of structurally balanced, competitive industry whose intellectual core is represented by the latest technological paradigm [3, 4] and received its legislative recognition in 2014 due to the adoption of the Federal Law no. 488-FZ «On industrial policy in the Russian Federation» of 31.12.2014.

Government industrial policy is aimed at ensuring the economic growth not only due to the quantitative expansion of production output, but also by increasing the part of high-tech and science intensive production, introducing various innovations into industrial processes, capable of creating a higher value added [5]. However, the Russian industry is now experiencing difficulties. According to Rosstat (Federal State Statistics Service), there is a considerable decrease in profits and production output of many branches in 2015 in comparison with 2014. Foreign sanctions, ruble exchange rate, investment activity decline have significantly decreased the development pace of industries and worsened their competitive position in the world market.

All this raises the problem of searching for possible means of increasing the effectiveness along with creating additional competitive advantages such as innovative products and services. Business entities integration, in particular, organizing integrated industrial structures (IIS) is regarded as one of these means.

IIS creation realizes one of the basic industrial policy principles: integration of science, education and industry. By joining efforts, participants can reduce costs of manufacturing the innovative products, increase the effectiveness of various innovations elaboration and augment input intensity.

Business entities integration is one of the most important tendencies of the economic transformations in Russia. The results of IIS work in the real sector of economy indicate the raising level of innovation activity, the increasing competitive ability of all branches of the Russian industry. For example, in 2013 the innovation activity of enterprises with more than 5000 personnel reached 73.9 %, while that of the enterprises with less than 100 personnel was just 5 %. What is more, the intensity of expenditures on various innovations in the enterprises are twice as big as this figure in small and medium businesses (Fig. 1).

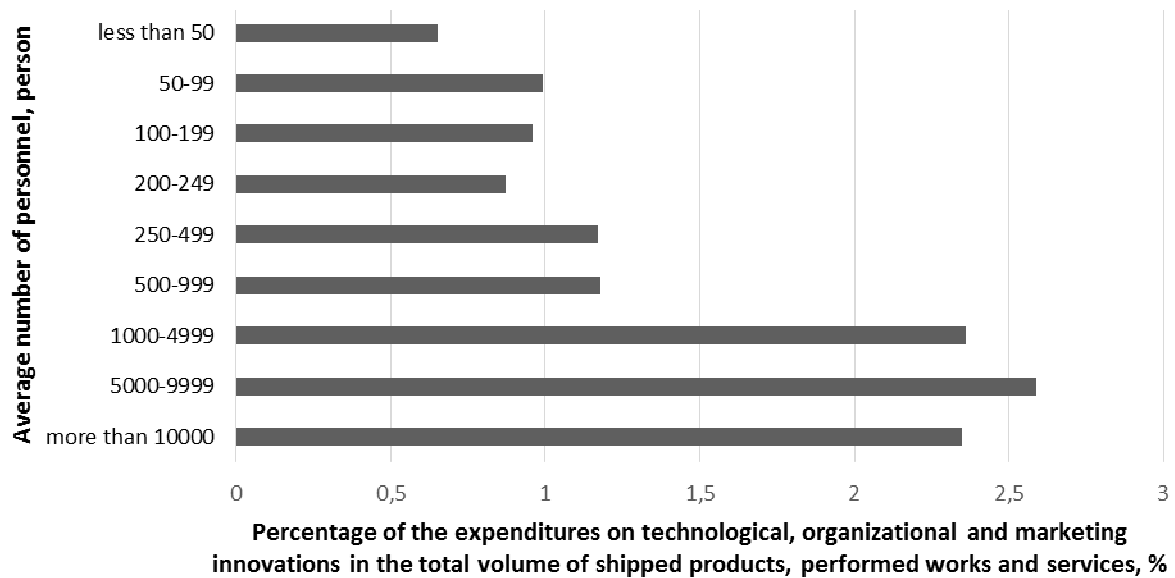


Fig. 1. The intensity of the expenditures on technological, organizational and marketing innovations ranging in accordance with enterprises size in 2007-2013

Prepared by the author on the basis of the statistics collection «Innovation activity indicators: 2015» [6]

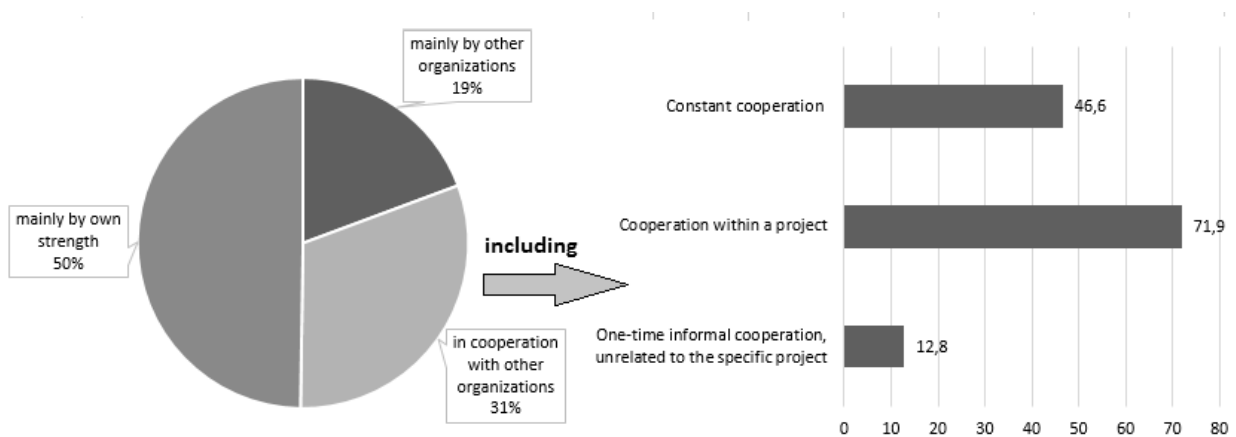


Fig. 2. Organizations distribution, participated in common projects, according to cooperation ties in percentage terms on average over a period of 2007–2013

Prepared by the author on the basis of the statistics collection «Innovation activity indicators: 2015»

In accordance with the statistics of 2007–2013, a third of all industrial enterprises cooperated with other organizations for the technological innovations elaboration. Regarding such high-tech branches of industry as computer engineering and aircraft production, including spaceship production, in 2013 these figures were 40 % and 44.6 % correspondingly. What is more, 46 % of all enterprises participating in common projects acted within constant cooperation (Fig. 2).

Corporate integration advantages are defined by the effects of combining resources, possibility

of obtaining credits on favorable terms from incorporated financial structures, research and development economies of scale, new products and technological processes launching, common marketing strategy realization. By joining efforts, integrated enterprises achieve the synergetic effect, which arises from the expansion and intensification of industrial-engineering communications such as, for example, joint use of raw materials, energy and other resources, material and technical basis, the consolidation of capital and other.

The synergetic approach implementing to economic systems management. Russian economists examining the nature of integration processes turn more often to the synergetic conception, which in contrast to the cybernetic approach (main management paradigm of the end of the 20th century) focuses on proactive system development, instead of the management depending on deviations or current tasks. Using the synergetics statements researchers managed to propose the thesis of the synergetic effect representing the result of the economic system transformation.

The term «synergetics» as an interdisciplinary branch of science investigating general rules of phenomena and processes in complex non-equilibrium systems on the basis of their characteristic principals of self-organization was introduced for the first time by German Haken in 1977 in his book «Synergetics» [7]. Synergy (after the Greek word «synergeia» – collaboration, commonwealth) is the summarizing effect of the interaction of two or more elements so that their joint operation exceeds significantly the effect of each separate element in their sum. Such Russian scientists as V.I. Arshinov, E.N. Knyazeva, S.P. Kurdyumov, V.A. Belavin, V.G. Budanov, Yu.A. Danilov, I.S. Dobronravova, I.A. Evin, G.G. Malinetskiy and others have been engaged in the research of synergetic effects. Nevertheless, the issue of the origin and the assessment of synergetic effects in economics remains insufficiently explored.

Integration processes strengthening, in particular, the formation of various integrated structures, clusters, interfirm partnership and others causes the interest in the research of the synergetic effect in economic systems. According to L.A. Musaev, the integration is mainly aimed at obtaining the synergetic effect, i. e., «the increase of the integrated companies' value which doesn't occur because of simple summarizing of their costs but due to a new cost addition» [8]. By cooperating, enterprises compensate their demerits and strengthen their merits in order to get the additional competitive advantage at the market.

O.V. Nesmachnykh and V.V. Litovchenko specify the following main integration advantages obtained due to the synergetic effect: innovations absorption acceleration, broad market coverage, cost saving and the increase in the efficiency of goods and services production, organizations flexibility improving [9]. As per R.Kh. Khasanov, the synergetic effect allows to reduce transactions

expenses, external and internal risks, as well as to increase research and development costs of the integrated structure, to enhance the profitability and attract investments [10].

According to S.G. Avdonina, the synergetic effect arises from the fact that the ties among the integrated structure participants are being normalized and developed to become closer and more productive. In this case, the synergetic effect makes for such integration advantages as faster exchange of material and information resources, as well as establishing stronger connections with the enterprises within the integrated structure which allows carrying out joint projects, strengthening the market position and entering new markets [11].

Thus, the synergetic approach to managing economic systems, including IIS, provides proactive system development, instead of the management depending on deviations or current tasks. In accordance with this approach, a market entity shall have the following qualities: flexibility, immediate reaction to the changes of customer demand, external conditions adaptation, which is true for IIS, as the majority of IIS are diversified structures, hence steady to risks and the external environment ambiguity.

In our opinion, applying the synergetic concept to forming the industrial policy is justified and essential at this stage of development. Integrated structures, in which the synergetic effect occurs, serve as the foundation of the developed countries' economics. These structures function successfully for more than fifty years, thus, they may be regarded as a means of implementing the synergetic approach for forming the industrial policy.

Integration as a means of the synergetic conception implementing. Let us examine the mechanism of the synergetic effect appearing in IIS with the help of the main marginal analysis theses. In accordance with this concept, the behavior of industrial enterprises of a certain manufacturing industry in the market will be similar to that of a monopolistic competitor, which is true if a region or the whole country are regarded as a market.

Let us suppose that there are two enterprises of a certain manufacturing industry, functioning in the market of monopolistic competition. Demand functions and total costs functions of the production have been determined for each of the two enterprises (see Tab. 1).

Table 1

Given data	Enterprise #1	Enterprise #2
Demand function	$D_1 = A_1 - B_1Q$, where A_1 и B_1 are the constants, measurable within the range of $(0, \infty)$	$D_2 = A_2 - B_2Q$ where A_2 и B_2 are the constants, measurable within the range of $(0, \infty)$
Total costs function	$TC_1 = a_1Q^2 + b_1Q + c_1$ where a_1, b_1, c_1 are the constants, measurable within the range of $(0, \infty)$ The expression $a_1Q^2 + b_1Q$ describes variable costs VC_1 , constants c_1 are the fixed costs FC_1 .	$TC_2 = a_2Q^2 + b_2Q + c_2$ where a_2, b_2, c_2 are the constants, measurable within the range of $(0, \infty)$ The expression $a_2Q^2 + b_2Q$ describes variable costs VC_2 , constants c_2 are the fixed costs FC_2 .

Table 2

Indices	Common for the enterprises # 1 and # 2	For IIS with respect to the synergetic effect
Demand	$D = A_1 - B_1Q + A_2 - B_2Q$	
Marginal yield	$MR = 0,5(A_1 - B_1Q + A_2 - B_2Q)$	
Variable costs	$VC_{comm} = a_1Q^2 + b_1Q + a_2Q^2 + b_2Q$	$VC_{IIS}^S = (1 - \alpha)(a_1Q^2 + b_1Q + a_2Q^2 + b_2Q)$ where α is the relative reduction of IIS variable costs compared with the sum of the enterprises variable costs before the integration
Fixed costs	$FC_{comm} = c_1 + c_2$	$FC_{IIS}^S = (1 - \beta)(c_1 + c_2)$ where β is the relative reduction of IIS fixed costs compared with the sum of the enterprises fixed costs before the integration
Total costs	$TC_{comm} = VC_{comm} + FC_{comm}$	$TC_{IIS}^S = VC_{IIS}^S + FC_{IIS}^S$
Marginal costs	$MC_{comm} = 2a_1 + b_1 + 2a_2 + b_2$	$MC_{IIS}^S = MC_{comm} - \alpha MC_{comm}$
Equilibrium quantity	$Q_{eq} = \frac{A_1 + A_2 - 2b_1 - 2b_2}{4a_1 + 4a_2 + B_1 + B_2}$	$Q_{eq}^S = \frac{A_1 + A_2 - 2b_1 - 2b_2 + 2\alpha b_1 + 2\alpha b_2}{4a_1 + 4a_2 - 4\alpha a_1 - 4\alpha a_2 + B_1 + B_2}$
The synergetic effect	$SE^* = TC_{comm} - TC_{IIS}^S = \alpha VC_{comm} + \beta FC_{comm}$ $SE^{**} = D_{comm}Q_{eq} - TC_{comm} - D_{IIS}^S Q_{eq}^S + TC_{IIS}^S$	

* calculated at $Q = Q_{eq}$

** where D_{comm} and TC_{comm} are calculated at $Q = Q_{eq}$, D_{IIS}^S and TC_{IIS}^S is calculated at $Q = Q_{eq}^S$

Supposing that these enterprises have merged, their demand functions and total costs functions will be summed up, if the production output remains the same. However, in practice the enterprises gain the benefit from the integration which could be in the form of reducing both fixed (rent, insurance payments, etc.) and variable costs (expenditures on raw and other materials, transport expenditures etc.) (see Tab. 2).

The synergetic effect in this context is represented in value units as the economy in IIS total costs. What is more, it is worth emphasizing that the economy arises not only due to the economy of scale, but also due to the more effective use of intellectual, scientific and technical potential of the integrated enterprises.

In the first variant, the synergetic effect is obtained in case the IIS production output does not increase relative to the production output of the enterprises before the integration (see Fig. 3).

The situation shown in Fig. 3 is not optimal for IIS, since a short-term equilibrium at the market, $MR = MC_{IIS}^S$, is not obtained. Fig. 4 represents the case when by increasing the output from Q_{eq} to Q_{eq}^S and decreasing the price from P_{eq} to P_{eq}^S , the IIS moves into an equilibrium state and receives the economic profit of the size $DQ_{eq}^S - TC_{IIS}^S$. In this case, the synergetic effect will be equal to the difference between IIS economic profit and the consolidated economic profit of the enterprises # 1 and # 2 (see Tab. 2).

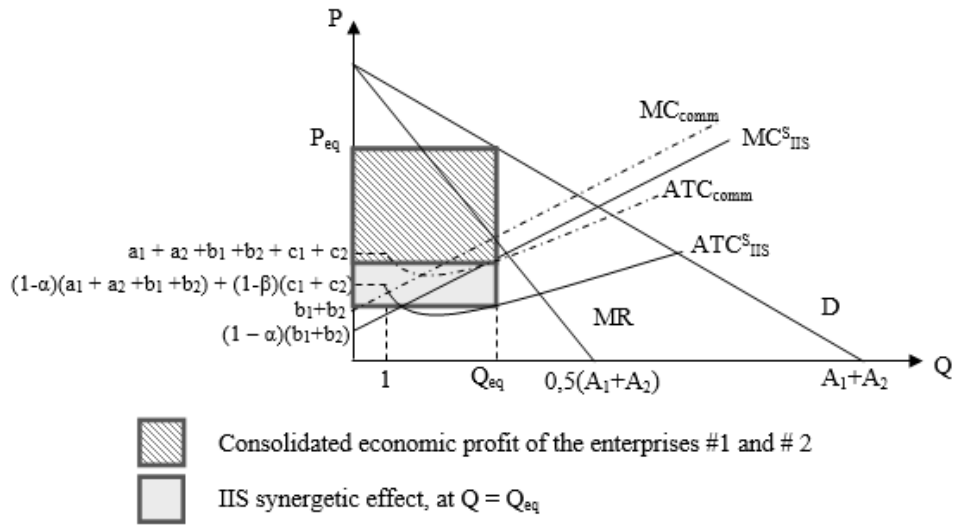


Fig. 3. IIS synergetic effect at $Q = Q_{eq}$

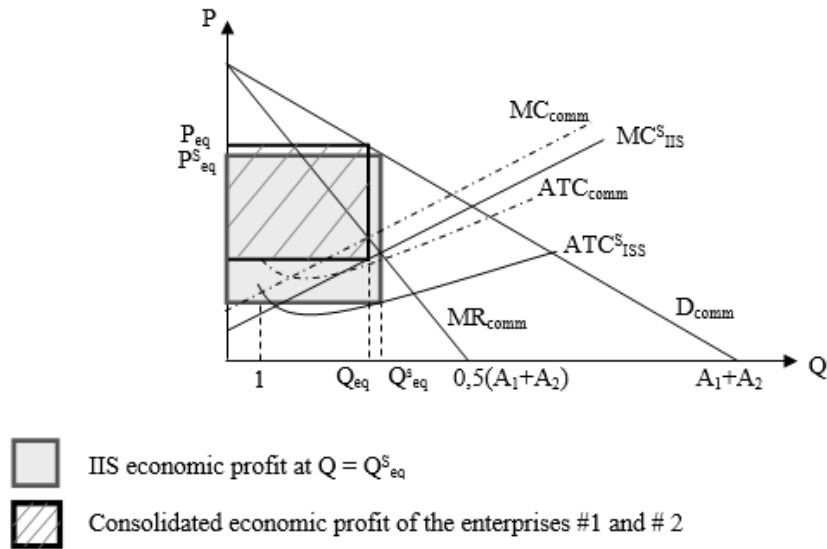


Fig. 4. IIS synergetic effect at $Q = Q_{eq}^s$

The above-described cases are true only for a short-term period of IIS functioning. Over a long-term period the obtained economy $(1 - \alpha)VC_{comm}$ и $(1 - \beta)FC_{comm}$ is lost due to inflation processes, technologies and equipment aging, management errors, competitive ability decrease and other reasons; along with this economy reduction the synergetic effect is lost.

The article authors propose to use marginal costs as the synergetic effect indicator for a long-term period, since they reveal the trend of both variable and fixed costs changing in the whole. Over a short-term period the difference between MC_{comm} and MC_{IIS}^s will make $\alpha(b_1 - b_2)$ value units, however, in course of time with the fixed

Q marginal costs will start to increase, and the synergetic effect will decrease (see Fig. 5).

We propose to consider the presented synergetic effect as the second-order power function:

$$SE = nt^2 + mt + \beta(c_1 + c_2),$$

$$\text{if } \begin{cases} n < 0, n = \text{const}, \\ m > 0, m = \text{const}, \\ MC_{comm} - MC_{IIS}^s = \alpha(b_1 + b_2), C \in [0, t^*], \\ MC_{comm} - MC_{IIS}^s < \alpha(b_1 + b_2), C \in [t^*, \infty], \\ Q = \text{const}. \end{cases}$$

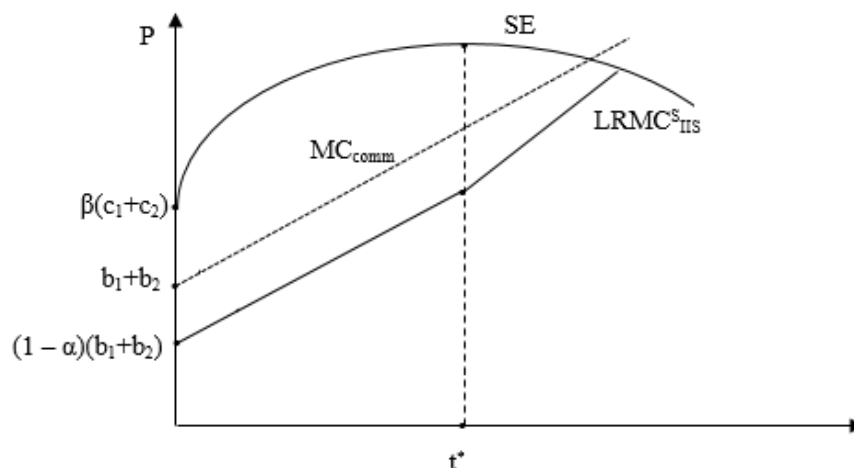


Fig. 5. The change of the IIS synergetic effect change at $Q = \text{const}$

Thus, the synergetic effect occurs in IIS at the moment of the integration, but in the course of time it disappears, if there are no efforts to increase the IIS activities efficiency: entering new markets, new technologies development, production diversification and others [12, 13]. However, the experience shows that IIS as a self-organizing system is capable of responding flexibly to external actions by some internal environment transformation, consequently, it is possible to suppose that at some period of time $t_i \in [0; t^*]$ a new synergetic effect SE_{ti} appears in IIS after a management decision d.

Along with that in order to increase the efficiency of the market entities activities, including IIS, it is required to take appropriate supportive measures, which is one of the main goals of the industrial policy [14]. In our opinion, forming the industrial policy shall be carried out on the feedback principle: on the one hand, the government creates the means for developing the industry, comprising the ones for IIS appearance, and on the other hand, responds to the problems arising during their implementation. For example, in case of IIS it is required to develop measures for stimulating innovation development, breaking into new markets, but at the same time for restricting them in case monopoly power tends to appear.

Findings. Thus, determining the methods for forming the industrial policy and developing it at the federal level is an important research problem, since the efficiency of these methods has a direct impact on the economic and innovation development of the branches of the Russian industry. The synergetic approach to forming the industrial policy serves not only as

the quantitative component of the effectiveness increase of market entities functioning, but also as its qualitative component, which is the essential condition of effective innovation development of the economics as a whole.

During the research, the following results have been obtained:

- 1) the influence of the industrial policy on integration processes strengthening in economics has been analyzed, statistics data have been examined, which permit to draw conclusion on IIS activities influence on the increasing of the innovation development level of the Russian industry;
- 2) the notion *synergetic effect* has been revealed, the essence of the synergetic approach to the economic systems management has been examined;
- 3) the principle of the synergetic effect appearance in IIS on the basis of the marginal analysis has been examined, the positive economic effect appeared from the integration contributing to the Russian industry development from the perspective of the synergetic approach has been justified.

Directions for further research. Promising directions for further research seem to be connected with developing a procedure for assessing the IIS synergetic effect, as well as with elaborating the business mechanism for managing the IIS innovation potential.

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ZDOLNIKOVA Svetlana V. – Peter the Great St. Petersburg Polytechnic University.
195251. Politechnicheskaya str. 29. St. Petersburg. Russia. E-mail: s.v.muraveva@yandex.ru

ЗДОЛЬНИКОВА Светлана Вячеславовна – инженер Научно-образовательного центра «Инновационная экономика промышленности» Санкт-Петербургского политехнического университета Петра Великого.

195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. E-mail: s.v.muraveva@yandex.ru

BABKIN Aleksandr V. – Peter the Great St. Petersburg Polytechnic University.
195251. Politechnicheskaya str. 29. St. Petersburg. Russia. E-mail: babkin@spbstu.ru

БАБКИН Александр Васильевич – профессор кафедры «Экономика и менеджмент в машиностроении» Санкт-Петербургского политехнического университета Петра Великого, доктор экономических наук, профессор.

195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. E-mail: babkin@spbstu.ru

A.N. Shichkov, N.A. Kremlyova, A.A. Borisov**DESIGNING THE OPERATION CYCLE
OF A MANUFACTURING AND TECHNOLOGICAL SYSTEM****А.Н. Шичков, Н.А. Кремлёва, А.А. Борисов****ПРОЕКТИРОВАНИЕ ОПЕРАЦИОННОГО ЦИКЛА
ПРОИЗВОДСТВЕННО-ТЕХНОЛОГИЧЕСКОЙ СИСТЕМЫ**

In order to manage innovating projects, the paper offers a method for estimating the degree by which a manufacturing and technological system (ECO – system) has been converted during the operation cycle into an economic system. The operation cycle of a manufacturing and technological system is seen as a circular integrated set of vectors of cash or cash equivalent flows arising as a result of converting technological processes into products in the form of technological stages or end products with market cost. The operation cycle consists of two contours formed by five vectors of cash equivalent flows. The first contour is a right-angled triangle of vectors that is formed by: the vector of direct technological operation costs, the vector of tangible and intangible assets and their summation being the vector of manufacturing capital. The second contour is also a right-angled triangle of vectors formed by: the vector of direct technological operation costs, the vector of net income and their summation being the vector of sales value. The modules and directions of all vectors are variables. The level of converting technological processes into money equivalent flows has been offered to estimate by the conversion coefficients. The ideal manufacturing and technological system has some upper limits of the conversion coefficients of the operation cycle. Namely, the vector of sales value divided by the vector of a manufacturing capital and the vector of tangible and intangible assets divided by the net income vector are equal to one. The graphical interpretation of an ideal operation cycle is an equilateral triangle. In the operation cycle of a real manufacturing and technological system the conversion coefficients are less than one. Every criterion in this integrated set may change simultaneously when any innovation is implemented in a manufacturing and technological system.

IDEAL (REAL) OPERATION CYCLE; VECTOR FIELD OF ECONOMIC POTENTIAL (LIABILITIES; ASSETS); CONVERSION OF TECHNOLOGICAL PROCESSES; MANUFACTURING AND TECHNOLOGICAL SYSTEM; VECTORS OF CASH EQUIVALENT FLOWS.

Для управления инновационными проектами предложен способ оценки уровня конверсии в операционном цикле производственно – технологической системы (ECO – systems) в экономическую систему. Операционный цикл производственно – технологической системы рассматривается как замкнутый интегрированный комплекс векторов денежных или их эквивалентов потоков, возникших как результат конвертации технологических процессов в продукты в форме технологических переделов или конечных продуктов, имеющих рыночную стоимость. Операционный цикл состоит из двух контуров, сформированных векторами потоков денежных эквивалентов. Первый контур является прямоугольным треугольником векторов, сформированным: вектором прямых технологических операционных затрат, вектором материальных и нематериальных активов и их суммой, являющейся вектором производственного капитала. Второй контур является также прямоугольным треугольником векторов, сформированным: вектором прямых технологических операционных затрат, вектором чистого дохода и их суммой, являющейся вектором объема продаж. Модули и направления всех векторов являются переменными величинами. Уровень конвертации технологических процессов в потоки денежных эквивалентов предложено оценивать коэффициентами конверсии. Идеальная производственно – технологическая система имеет верхний предел коэффициентов конверсии операционного цикла. А именно, вектор объема продаж, деленный на вектор производственного капитала и вектор материальных и нематериальных активов деленный на вектор чистого дохода равны единице. Графической интерпретацией идеального операционного

цикла является равносторонний треугольник. В операционном цикле реальной производственно – технологической системы коэффициенты конверсии меньше единицы. Каждый критерий интегрированно-го комплекса изменяется когда (если) осваивается любая инновация.

ИДЕАЛЬНЫЙ (РЕАЛЬНЫЙ) ОПЕРАЦИОННЫЙ ЦИКЛ; ВЕКТОРНОЕ ПОЛЕ ЭКОНОМИЧЕСКИХ ПОТЕНЦИАЛОВ (ПАССИВЫ; АКТИВЫ); КОНВЕРСИЯ ТЕХНОЛОГИЧЕСКИХ ПРОЦЕССОВ; ПРОИЗВОДСТВЕННО-ТЕХНОЛОГИЧЕСКАЯ СИСТЕМА; ВЕКТОРЫ ПОТОКОВ ДЕНЕЖНЫХ ЭКВИВАЛЕНТОВ.

Vector field of an economy ECO-system

In an innovation market economy all needs of people are bought and sold and, therefore, these needs have a market cost in cash or cash equivalent. Thus, from a physical and mathematical point of view, the economy is the field of economic potentials (Liabilities L and Assets A) where the «buy-sell» process (difference of potentials) is a dual process of forming cash flows with magnitude and direction. It is known that mathematical functions with magnitude and direction are vectors [1–3]. The gradient of potentials, i. e., Liabilities and Assets, forms the vector of cash or cash-equivalent flows. The engineering business is seen as an engine working on the basis of the gradient of potentials (Liabilities and Assets). In this case, liabilities and assets fulfill the functions of potentials of economic fields: «buy-sell» or «resources-results». For example, the results of business such as the assets of technological stages and taxes become liabilities in the subsequent technological stages (zones of financial responsibility) of enterprises and in the municipality budget. Therefore, the terms «liabilities and assets» determine the function of potentials.

In this context, we understand by **production management** [4] an economic system the infrastructure of which realizes the function of an engineering change order (ECO) [5] on the basis of the balance of supply and demand of products and services using different markets (fields of potentials).

An **operation cycle** is a circular integrated set of engineering and technological processes on the basis of mechanical, electrical, chemical, thermodynamical, optical and any other physical systems arising during the accounting period in the course of the ordinary activities of a manufacturing and technological system and as a result of the synergetic effect [6–8] are converted to an economic system in the form of cash-equivalent flows of sold products. In other words, an operation cycle is an integrated set of continuous processes ensuring the conversion of

technological systems into economic systems. In this sense, manufacturing and technological systems (ECO-systems) are the tools for the processes of conversion. It means that the manufacturing and technological system should be estimated in relation to the parameters of economic benefits. The main economic results of the conversion operation cycle are:

«**Net income** is an increase in the economic benefits emerging during the accounting period in the form of inflows or enhancements of assets or some decreases of liabilities that result in increases in equity, other than those related to contributions from equity participants» [9–11].

«**Revenue** is a gross inflow of economic benefits emerging during the accounting period in the course of ordinary activities of the entity. These inflows result in an increase in the equity of the shareholders, with investments calculated on the basis of the direct share in the equity» [9–11].

«**Profit** is the residual amount that remains after expenses (including capital maintenance adjustments, where appropriate) have been deducted from income. Any amount over and above that is required to maintain the capital at the beginning of the period is profit» [9, 10, 11]. Net profit is the property of owners, members and participants of equity. It consists of two parts. Net profit is the amount required to pay for non-operating expenses and to pay dividends on the basis of shareholders' meeting decision. Therefore, managers of an enterprise try to reduce the need in a net profit. Maintenance adjustments capital is the main tool to manage the taxable base of operating profit. As a rule, innovative enterprises do not have a taxable base of operating profit.

The main function of **operation management** is to organize the production ensuring the manufacturing of products with the required structure of direct technological costs in an operation cycle and consumer properties having competitive advantages and, consequently, having market cost.

The priority structure of direct technological costs G_0W_0 of the operation cycle:

According to Chapter 25 of the Tax Code of the Russian Federation, tax accounting should substantiate the planned net profit.

As for management accounting, it has to implement an operation cycle with a required coefficient of capitalization λ :

$$\lambda = \frac{V_{sv}}{G_0W_0}, \quad (1)$$

where V_{sv} is sales value of the operation cycle, G_0 is the designed production volume and W_0 is the designed unit costs.

If direct operating costs C_{oc} of the operation cycle are equal to 100 %, then material costs C_{mc} should be equal to 30 %; additional costs C_{ac} should be equal to 20 %; labor payment costs C_{lp} should be equal to 25 % and finally, depreciation of tangible costs C_{dc} should be equal to 15 %.

The balance equation of costs in the operation cycle has the form:

$$100 \% = C_{mc} / C_{oc} + C_{ac} / C_{oc} + C_{lp} / C_{oc} + C_{dt} / C_{oc} \approx 30 \% + 20 \% + 35 \% + 15 \%$$

If additional costs C_{ad} are 20 %, then the amortization of intangible assets C_{ai} is equal to 10 % and the summation of tax fixed assets N_{fa} , tax of land N_L and other costs are approximately equal to 10 % too.

Namely,

$$C_{ac} / C_{oc} \approx 20 \% = C_{ai} / C_{ac} + (...N_{fa} + N_L + ...) / C_{ac} \approx 10 \% + 10 \%$$

The net income D_0 , including net profit P_0 and capital maintenance adjustments C_{ma} is the summation of depreciation of tangible assets C_{dt} and amortization of intangible assets C_{ai} . Herewith, the fund formed from C_{dt} should be used only for simple reproduction, while the fund formed from C_{ai} is the resource for funding the extended reproduction of fixed assets.

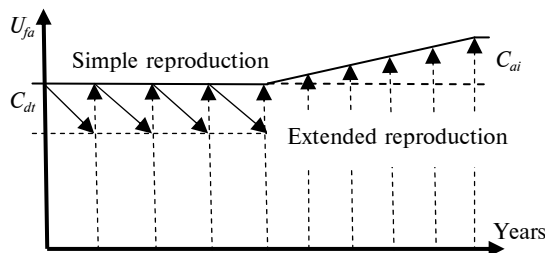


Fig. 1. Simple and extended reproduction of fixed assets U_{fa} of a manufacturing and technological system

Management accounting tends to increase the parameters of the operation cycle on which a coefficient of capitalization depends. It means that labor payment in the structure of assets in the operation cycle increases up to 35 %. In this case, an innovative enterprise will have competitive advantages on a labor market in a municipality. Besides, tax payments to all levels of budgets are prioritized for innovative enterprises of the municipality. Therefore, there is a tendency to try to achieve tax payments of 20 % in the structure of assets in management accounting.

Operating profit tax is the exception from the general rule. The fact is that the amortization of intangible assets decreases the taxable base of operating profit taxes; therefore, innovative enterprises with intangible assets do not pay the tax of operating profit. However, if enterprises have intangible assets, such enterprises pay more land taxes than enterprises without intangible assets.

The system of equations for an ideal operation cycle of ideal manufacturing and technological system

The equation for the cost of manufacturing and technological capital (balance cost of a manufacturing and technological system) consists of the summation U of tangible U_{fa} and intangible assets U_{ia} and direct technological operation costs G_0W_0 :

$$Q = U + G_0W_0. \quad (2)$$

The equation of manufacturing and economic capital (economic system) consists of the sales value V_{sv} of products and services equal to the summation of direct technological operation costs G_0W_0 and net income D_0 :

$$V_{sv} = G_0W_0 + D_0, \quad (3)$$

where any technological equipment, any manufacturing and technological system and any production enterprise have their characteristic GW in the form of parabola:

$$W = aG^2 + bG + c. \quad (4)$$

Project parameters of the manufacturing and technological system:

$$G_0 = -b / 2a; \quad W_0 = (4ac - b^2) / 4a.$$

Vector of direct technological operation costs G_0W_0

The designed parameters of business are:

G_0 is the production volume in physical units (unit/year);

W_0 is the unit costs (rub/unit).

If ΔG and ΔW are the limits of change of parameters in business, then coefficients a, b, c of equation (4) are found in three points from the range of change of production volume G and unit costs W .

Table 1

Example of the dependence of unit costs W on production volume G for a furniture enterprise [12]

Parameters of the manufacturing and technological system	First year	Second year	Third year
Production volume, G , thousand m^3 /year	22.4	26.4	26.2
Unit costs of production, W , thousand rub./ m^3	10.5	10.7	10.4

Based on Tab. 1, the system of equations is formed in order to find the numerical value for a, b, c (4):

$$501.8a + 22.4b + c = 10.5;$$

$$697.0a + 26.4b + c = 10.7;$$

$$686.4a + 26.2b + c = 10.4;$$

then $W = 0.29G^2 - 13.90G + 176.30$.

$$G_0 = 13.90/2 \cdot 0.29 = 24.31 \text{ thousand } m^3/\text{year};$$

$$W_0 = (4 \cdot 0.29 \cdot 176.30 - 13.90) / 4 \cdot 0.29 = 7.47 \text{ thousand rub./}m^3.$$

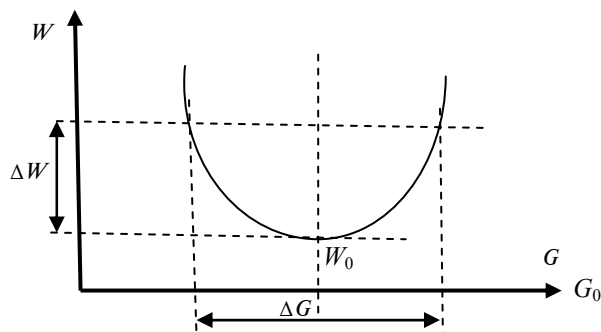


Fig. 2. Characteristic GW of any manufacturing and technological system

Productivity balance of technological and economic systems of the operation cycle

It is necessary to design an MTS that ensures the equality of the productivity of the wear of fixed assets and the productivity of operating costs. In this case the balance cost of fixed assets U_{fa} should be estimated by costs approach. The balance equation of productivity has the form:

$$T_{U_{fa}} \Rightarrow T_{G_0W_0} = \frac{U_{fa}}{R_G} = \frac{G_0W_0}{R_0}, \quad (5)$$

where R_G is the business constant determining annual resources of the useful life of fixed assets in hour/year; R_0 is business constant determining the annual resources of work time in hour/year. The equation (5) can be written in the form:

$$k = \frac{R_0}{R_G} = \frac{G_0W_0}{U_{fa}}, \quad (6)$$

where k is business constant determining its industry and which can be determined by industry. For example, a business relating to the metallurgical industry has $k = 0.5$, an engineering enterprise has $k = 1.0$, enterprises related to the «Gasprom» business have a numerical value of the constant k equaling 0.27. The business constant of forest industry enterprises has the value of 0.8.

Constant of business k for an enterprise as an integrated set of manufacturing and technological systems

Balance cost of fixed assets of an enterprise is equal to the summation of balance cost of each technological stage (MTSs):

$$U_{fa} = U_1 + U_2 + \dots + U_i. \quad (7)$$

Operating costs of all technological stages are equal to the summation of operating costs of each technological stage (MTSs):

$$C_{oc} = C_1 + C_2 + \dots + C_i. \quad (8)$$

These equations may be presented in the form:

$$\begin{aligned} \frac{C_{oc}}{U_{fa}} U_{fa} &= \frac{C_1}{U_1} U_1 + \frac{C_2}{U_2} U_2 + \dots + \frac{C_i}{U_i} U_i; \\ k_{mts} U_{fa} &= k_1 U_1 + k_2 U_2 + \dots + k_i U_i; \\ k_{mts} U_{fa} &= k_i (U_1 + U_2 + \dots + U_i). \end{aligned} \quad (9)$$

$$k_{mts} = k_i, \text{ where } k_i = \frac{C_i}{U_i}.$$

Constant of business k of each technological stage is equal to the constant of businesses k of each MTS of the enterprise.

Five vectors of cash equivalent flows which implement the conversion of manufacturing and technological processes are the following:

\bar{V}_{sv} , *rub/year*, is the *sales value* including taxes to budgets of all levels.

$\bar{G}_0\bar{W}_0$ is the *direct technological costs* including

- operating direct technological costs: the construction materials; energy resources; spare parts; repair and technological tools;
- labor payment including taxes and payments.

\bar{D}_0 is the *net income for simple and extended reproduction of business* including

- the capital maintenance adjustments consisting of the depreciation of tangible assets and the amortization of intangible assets;
- net profit to support joint stock capital in the form of dividends.

\bar{Q} is the *manufacturing capital* including

- the direct operating technological costs $\bar{G}_0\bar{W}_0$ and the fixed assets and intangible assets \bar{U} .

The mathematical model of the operation cycle in an ideal manufacturing and technological system

Eqs. (2) and (3) can be written in the form:

$$\frac{V_{sv}}{G_0W_0 + D_0} = 1, \quad (10)$$

$$\frac{Q}{U + G_0W_0} = 1. \quad (11)$$

Consequently, Eqs. (10) and (11) may be equated:

$$\frac{Q}{U + G_0W_0} = \frac{V_{sv}}{G_0W_0 + D_0}. \quad (12)$$

Eq. (12) in a dimensionless form is the following:

$$\begin{aligned} \frac{V_{sv}}{Q} &= \frac{G_0W_0 + D_0}{U_{fa} + U_{ia} + G_0W_0} = \\ &= \frac{\frac{G_0W_0}{U_{fa}} + \frac{P_0}{U_{fa}} + \alpha + \beta \frac{U_{ia}}{U_{fa}}}{1 + \frac{U_{ia}}{U_{fa}} + \frac{G_0W_0}{U_{fa}}} = \frac{k + \alpha + \beta \frac{U_{ia}}{U_{fa}} + \frac{P_0}{U_{fa}}}{1 + k + \frac{U_{ia}}{U_{fa}}}. \end{aligned} \quad (13)$$

If $V_{sv}/Q = v$ is the conversion coefficient, $k = G_0W_0/U_{fa}$ is the characteristic of business, $D_0/U_{fa} = m$ is the coefficient of capital maintenance adjustments, then the parametric equation (13) of the operation cycle of the ideal manufacturing and technological system has the form:

$$v = \frac{k + m}{1 + k + \frac{U_{ia}}{U_{fa}}}, \quad (14)$$

where $m = \frac{P_0}{U_{fa}} + \alpha + \beta \frac{U_{ia}}{U_{fa}}$. (15)

Analysis of parametric dependence (14) for the ideal manufacturing and technological system

If the limit of the coefficient of capital maintenance and fixed assets adjustments m tends to one, then the limit of the conversion coefficient in a technological system will also tend to one. In this case dependence (13) can be written in the form:

$$\begin{aligned} k + \alpha + \beta \frac{U_{ia}}{U_{fa}} + \frac{P_0}{U_{fa}} &= 1 + k + \frac{U_{ia}}{U_{fa}}, \\ \alpha + (\beta - 1) \frac{U_{ia}}{U_{fa}} + \frac{P_0}{U_{fa}} &= 1, \quad (16) \\ D_0 = U_{ia} + U_{fa} &= U, \end{aligned}$$

where α is the depreciation rate of tangible assets (fixed assets); β is the amortization rate of intangible assets; U_{ia} is the balance cost of intangible assets in the MTS equal to its balance cost estimated by the income approach U_{mia} minus the cost of the MTS estimated by the costs approach U_{fa} .

The upper limit of the conversion coefficient of the ideal manufacturing and technological system is equal to one:

$$\lim_{m \rightarrow 1} v = \lim_{m \rightarrow 1} \frac{k + m}{1 + k + \frac{U_{ia}}{U_{fa}}} = 1. \quad (17)$$

An integrated set of systems the parameters of which are described by equation (17) is the following:

The **technological machine (TM)** is the technological equipment which presents an integrated set of tangible and intangible assets, consisting of mechanical, electrical and/or chemical

engineering solutions, tools for manufacturing the elements of technological (operation) stages or whole technological (operating) stages having a market cost.

The manufacturing and technological system (MTS) is an integrated set of technological machines (tangible and intangible assets) providing the manufacturing of technological stages and/or end products with a market cost. The results of this operation cycle are net income and sales value.

The enterprise is an integrated set of manufacturing and technological systems; the results of the operation cycle are net revenue, sales value and tax payment to budgets of all levels.

Municipality is an integrated set of a system of industrial enterprises, the results of operation cycles of which are the budgets necessary and sufficient for ensuring the life activity of people in the municipality.

The subjects of the Russian Federation.

Parameters of an operation cycle of real manufacturing and technological systems

Operation cycle of metallurgical enterprises

Three metallurgical enterprises, JSC «Severstal», JSC «Magnitogorsk metallurgical company» and JSC «Novolipetsky metallurgical company», are similar in their technological and economic parameters.

The technological similarity of enterprises is determined by similar manufacturing and technological systems that produce steel sheets of practically equal volume and equal sales value.

Economical similarity of enterprises is confirmed by the equal numerical value of business characteristics and net income.

Geometrical interpretation of the operation cycle in the form of a vector triangle allows to combine two approaches to estimate technological and economic similarities of enterprises.

The main criteria of technological and economic similarities of enterprises are parametric equations.

Parameters determining the economic ECO-system of a manufacturing and technological system of an enterprise:

– operating profit, $P = V_{sv}/r$, where V_{sv} is the sales value with a value added tax (+18 % if products are sold on domestic market), r is the return on sales (40–15 %);

– operating profit tax, $Np = (P - N_{fa})\psi_p$ (ψ_p is the tax rate on operating profit: 20 % in budgets of two levels is equal to 2 % + 18 %) [14];

Table 2

The initial economic parameters of three similar metallurgical enterprises that manufacture steel sheets [13]

Parameters in mln \$ USA	JSC «MMC»	JSC «NLMC»	JSC «Severstal»
Cost of equity capital, A in 2006 (19.04.2006) in 2002	7892.94 725 10.9 (10.1)	13964.22 1575 8.9 (9.8)	7452.80 1214 6.1 (11.3)
Sales value, V_{sv} , \$/year	5380.00 1707 3.2	4468.73 1322 3.4	5055.17 1747 2.9
Return on sales, $r = P/V \cdot 100 \%$	24.6 % 15.7 % 1.6	41.6 % 23.9 % 1.7	35.2 % 17.7 % 2.0
Net profit, P_0	947.00 179.2 5.3	1385.34 207.3 4.7	1212.00 190.9 6.4

– fixed assets tax, $N_{fa} = \psi_{fa}U_{fa}$ (ψ_{fa} is the tax rate on fixed assets: 0–2.2 %) [14];

– planned net profit, $P_0 = (P - N_{fa})(1 - \psi_p)$;

– operating costs, $C_{oc} = V_{sv} - P$;

– balance cost of fixed assets, $U_{fa} = C_{oc}/k$ (k is the business characteristic, for metallurgical enterprises $k = 0.5$);

– depreciation of tangible assets, $C_{dt} = \alpha U_{fa}$ (α is the depreciation rate of tangible assets: for $\alpha > \psi_{fa}$, α should be greater than ψ_{fa});

– amortization of intangible assets, $C_{ai} = \beta U_{ia}$ (β is the amortization rate of intangible assets: as rule $\beta U_{ia} = (P - P_0)$, then $\beta = (P - P_0)/U_{ia}$);

– balance cost of intangible assets, U_{ia} ($U_{ia} = U_{fa(ia)} - U_{fa}$, where $U_{fa(ia)}$ is the fixed assets estimated by income approach);

– net income, $D_0 = P_0 + C_{dt} + C_{ai}$.

Graphical interpretation of parametric equation (14) developed on the basis of the Pythagorean Theorem [15, 16].

Eqs. (10) and (11) will be written in the form:

$$\frac{V_{sv}^2}{(G_0W_0)^2 + D_0^2} = 1, \tag{17}$$

$$\frac{Q^2}{U_{fa}^2 + (G_0W_0)^2} = 1. \tag{18}$$

Consequently, Eqs. (17) and (18) may be equated:

$$\frac{Q^2}{U_{fa}^2 + (G_0W_0)^2} = \frac{V_{sv}^2}{(G_0W_0)^2 + D_0^2}. \tag{19}$$

Table 3

The analysis of the parameters of the enterprise on the basis of Eq. [14]

Cost of equity capital on stock market, mln \$	JSC «MMC»		JSC «NLMC»		JSC «Severstal»	
	2002	2006	2002	2006	2002	2006
	725	7892.94	1575	7892.94	1214	7452.80
Sales value, V_{sv}	1707	5380.00	1322	4468.73	1747	5055.17
$Q = U_{fa} + G_0 W_0$	4296.33	11884.57	3090.4	6853.52	4274.1	9597.87
$v = V_{sv}/Q$	0.40	0.45	0.43	0.65	0.41	0.53
$G_0 W_0$	1334.33	3771.43	990.40	2411.85	1334.10	3046.45
Balance cost, U_{fa}	2962	8113.14	2160	5519.42	2940	6551.42
$k = G_0 W_0/U_{fa}$	0.45	0.47	0.46	0.44	0.45	0.47
Net income, D_0	242.2	1154.15	285.1	1578.52	293.8	1441.31
$\lambda = V_{sv}/G_0 W_0$	1.28	1.43	1.42	1.85	1.31	1.66
$\gamma = (G_0 W_0 + D_0)/V_{sv}$	0.92	0.92	0.92	0.89	0.93	0.89
$\mu = D_0/G_0 W_0$	0.18	0.30	0.30	0.65	0.22	0.47
$m = D_0/U_{fa}$	0.08	0.14	0.13	0.29	0.10	0.22
$v_p = (k + m)/(k + 1)$	0.38	0.42	0.42	0.53	0.40	0.48
Unit costs, W , \$/τ	143.8		122.7		151.3	
Constant of business						
$k = G_0 W_0/U_{fa}$	0.49		0.47		0.49	
$v = V_{sv}/Q$	0.42		0.43		0.37	
$m = D_0/U_{fa}$	0.10		0.13		0.10	

Eq. (19) in a dimensionless form is the following:

$$\frac{V_{sv}^2}{Q^2} = \frac{(G_0 W_0)^2 + D_0^2}{U_{fa}^2 + (G_0 W_0)^2} \quad (20)$$

If $V_{sv}/Q = v$ is the conversion coefficient, $k = G_0 W_0/U_{fa}$ is the characteristic of business, $D_0/U_{fa} = m$ is the coefficient fixed assets maintenance, then the equation (24) will have the form:

$$\begin{aligned} [V_{asv}(Q)]^2 &= (G_0 W_0)^2 + [D_0(U)]^2 \\ \text{if } (G_0 W_0)^2 &= [D_0(U)]^2 \\ \text{then } 2[D_0(U)]^2 &= [V_{sv}(Q)]. \end{aligned} \quad (25)$$

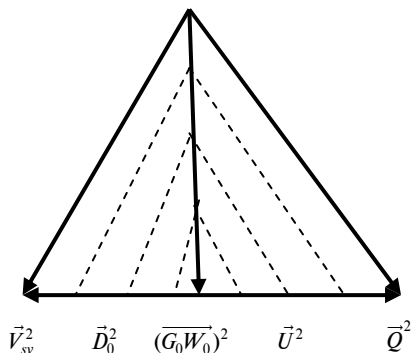


Fig. 3. Graphical interpretation of the operation cycle of the ideal manufacturing and technological system

Conclusion. Parametric analysis of the operation cycle of the ideal manufacturing and technological system allowed to formulate an integrated set of criteria for innovative tasks of an engineering business.

The integrated set of similarity criteria has the form:

1. $\vartheta = V_{sv} / Q \leq 1$ is the **conversion criterion** of the operation cycle in the ideal manufacturing and technological system equal to the ratio between the sales value of products and services sold and the cost of manufacturing capital. The conversion criterion of a real operation cycle is less than 45 %.

2. $\lambda = \frac{V_{sv}}{G_0 W_0} \leq 2$ is the **criterion of capitalization** of the operation cycle equal to the ratio between the sales value of products and services sold and the direct technological costs. Its numerical value cannot be more than 2 in an ideal operation cycle. The criterion of capitalization of a real operation cycle reaches only 1.5.

3. $M = D_0 / U \leq 1$ is the **criterion of capital maintenance adjustments** equal to the ratio between the net income and the balance cost of the summation of tangible and intangible assets. The numerical value of this criterion for the operation cycle in an ideal manufacturing and technological system equals one. As a rule, intangible assets do not exist in the structure of manufacturing capital or their amount is very small; therefore $M \ll 1$.

4. $\mu = \frac{D_0}{G_0 W_0} \leq 1$ is the **criterion of net income**

equal to the ratio between the net income and the direct technological costs. The criterion cannot be more than one for a real operation

cycle in a manufacturing and technological system.

Every criterion in this integrated set may change simultaneously when any innovation is implemented in the manufacturing and technological system.

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SHICHKOV Aleksandr N. – Vologda State University.
160000. Lenina str. 15. Vologda. Russia. E-mail: shichkov-an@yandex.ru

ШИЧКОВ Александр Николаевич – заведующий кафедрой Вологодского государственного университета, доктор экономических наук.
160000, ул. Ленина, д. 15, г. Вологда, Россия. E-mail: shichkov-an@yandex.ru

KREMLYOVA Nataliia A. – Vologda State University.
160000. Lenina str. 15. Vologda. Russia. E-mail: kremleva-n@yandex.ru

КРЕМЛЁВА Наталия Анатольевна – доцент Вологодского государственного университета, кандидат экономических наук.
160000, ул. Ленина, д. 15, г. Вологда, Россия. E-mail: kremleva-n@yandex.ru

BORISOV Aleksandr A. – Vologda State University.
160000. Lenina str. 15. Vologda. Russia.

БОРИСОВ Александр Алексеевич – доцент кафедры управления инновациями и организации производства Вологодского государственного университета.
160000, ул. Ленина, д. 15, г. Вологда, Россия.

T.A. Belova, R.Kh. Bahitova, I.A. Lackman

**DYNAMIC MODEL OF DIAGNOSIS AND FORECASTING
OF ECONOMY IN THE CITY OF UFA**

Т.А. Белова, Р.Х. Бахитова, И.А. Лакман

**ДИНАМИЧЕСКАЯ МОДЕЛЬ ДИАГНОСТИКИ И ПРОГНОЗИРОВАНИЯ
ЭКОНОМИКИ ГОРОДА УФЫ**

The paper presents the results of building a model for diagnosing and forecasting the economic activities in the city of Ufa. This study was performed as the analytical support for creating an economic development strategy in a metropolitan city. The novelty of the approach is in the detailed analysis of the city-level indicators of the development of economic activity. This allows to identify the problems in the development of the social and economic spheres. A vector autoregression model which takes into account the correlations between the main macroeconomic indicators was chosen as a tool for diagnosing the economy. . A preliminary statistical data analysis was done and cause-effect relations were determined in the article. Vector autoregression models were made for the following branches of the city economy: industrial production, construction, wholesale and retail trade, transport and communication. The represented types of economic activities hold the main economic potential of the metropolitan city. The modeling period covers the period from the 1st quarter of 2009 till the 3rd quarter of 2014. As a result of this study we managed to determine the competitive advantages and specific problems of the economic system in the metropolitan city, analyze the basic factors and actions for overcoming adverse trends in the future. The obtained information could be useful for public authorities to solve problems connected with enhancing the welfare of the population, improving the living standards of citizens, developing the infrastructure, contributing to the effective prosperity of the social and economic spheres of the city, developing a competitive economy, expanding the external economic relations.

ECONOMETRIC MODELING; TIME SERIES ANALYSIS; VECTOR AUTOREGRESSION MODEL; FORECASTING; ECONOMIC SECTORS.

Представлены результаты разработки модели диагностики и прогнозирования видов экономической деятельности города Уфы. Данное исследование представляет собой аналитическую поддержку создания стратегии экономического развития столицы Башкортостана. Новизна данного подхода заключается в детализированном анализе индикаторов развития видов экономической деятельности на уровне города, что позволит выявить проблемы развития социально-экономической сферы. В качестве инструмента диагностики экономики выбрана векторная авторегрессионная модель, которая позволяет учесть взаимосвязи между основными макроэкономическими показателями. Проведен предварительный статистический анализ данных и выявлены причинно-следственные связи. Построены векторные авторегрессионные модели для отраслей экономики города: промышленное производство, строительство, оптовая, розничная торговля; транспорт и связь. Представленные виды экономической деятельности составляют основной экономический потенциал мегаполиса. При этом период моделирования составлял с I квартала 2009 г. по III квартал 2014 г. На основе полученных адекватных моделей выполнено краткосрочное прогнозирование макроэкономических показателей, которое подтвердило значимость моделирования. Выявлены конкурентные преимущества и специфические проблемы функционирования экономической системы мегаполиса, проанализированы основные причины, факторы и действия для преодоления неблагоприятных тенденций в будущей перспективе. Полученная информация может быть полезна для органов государственной власти в решении вопросов, связанных с ростом благосостояния населения, повышением и улучшением уровня и качества жизни горожан, развитием инфраструктуры, эффективным процветанием социально-экономической сферы города, развитием конкурентоспособной экономики, расширением внешних связей.

ЭКОНОМЕТРИЧЕСКОЕ МОДЕЛИРОВАНИЕ; АНАЛИЗ ВРЕМЕННЫХ РЯДОВ; МОДЕЛЬ ВЕКТОРНОЙ АВТОРЕГРЕССИИ; ПРОГНОЗ; ОТРАСЛИ ЭКОНОМИКИ.

Introduction. At the present stage of development, one of the significant issues that many of the world's countries face is creating an efficient socio-economic urban development management mechanism that can coordinate the current processes to ensure all areas of life with the future long-term prospects. This problem is highly important in Russia, as the proportion of the urban population is 73.7 % according to the data gathered in 2010, also all factors forming the economic potential of the country are concentrated in the cities. Many urban districts of the Russian Federation analyze the current situation in the socio-economic sphere. Ufa, the capital of the Republic of Bashkortostan, is among the metropolitan cities [1]. The city is a center of culture, science and education, as well as the growth hub of the regional economy. About 200 large and medium-sized industrial enterprises are located in Ufa, with about 40 % of the republic's industrial potential concentrated there. The city is prospering and it is important to study the main types of its economic activity and to carry out comprehensive programs of social and economic development.

The results of creating an adequate dynamic diagnostic and forecasting model for Ufa's economy based on econometric modeling are presented in the article.

The novelty is that comprehensive research of economy of the city of Ufa as a separate territorial entity in view of the branches and taking into account the long-term response of investment and industrial components was carried out for the first time. The result was obtained by using vector autoregression models. This approach allowed diagnosing the main types of economic activities, making forecasts on the future prospects of the key macroeconomic indicators, detecting competitive advantages and problems of the functioning of a metropolitan economic system.

1. Research methodology and preliminary analysis of data. The econometric approach was chosen as a main method for diagnosing the economic activities, with a vector autoregression model (VAR-model) created, which is an efficient forecasting instrument capable of finding short-term forecasts and taking into consideration the influence of lagged values and factors on the dynamics of the main economy indicators [3, pp. 1590–1595; 4].

Modeling was carried out with the data for the period from the 1st quarter of 2009 till the 3rd quarter of 2014. The following industries: industrial production, construction, wholesale and retail trade, transport and communication were chosen for the analysis. These economic activities for Ufa are important in terms of contribution into the metropolitan economy. Indicators and their descriptions used in the study are shown in Tab. 1. The choice of factors was based on works by Sukhanova and Shirnaeva [3, pp. 1590–1595], and Deryugina and Ponomarenko [4], consultations with the city administration were held as well. Data from the territorial authority of the Bashkortostan Federal State Statistics Service [2] and the Central Bank of the Russian Federation [5] formed the information base. Since all of the considered time series followed the lognormal distribution occurring due to the smaller effect of additional units on the result, logarithms were found for all data sets before the analysis.

A preliminary data analysis was carried out at the beginning of the study:

1) with the help of the augmented Dickey–Fuller test (ADF-test) [6, pp. 427–431, 7] it was defined that all processes were static as conversion from initial data into growth rate was done (Tab. 2);

2) with the help of Granger causality test [8, pp. 424–438, 9, pp. 167–173] it was revealed that endogenous variables are logarithms of growth rate of shipped products and logarithms of growth rate of the volume of investment into the fixed capital aimed at all economic activities. The rest of the indicators are exogenous.

Thus, four vector autoregression models based on preliminary data analysis were created. They allowed estimating Ufa's economy efficiency by branch.

2. Vector autoregression models of Ufa's economy. The developed vector autoregression models of Ufa's economic activities were checked for adequacy and reliability of their indicators (Tab. 3). High t-statistics values of model parameters proved the statistical significance of the coefficients of the developed models, high F-test values of the models for each equation showed the connection of macroeconomic indicators, the values of determination coefficients close to unity showed the appropriate fit quality of the models.

Table 1

Initial data for the economy analysis of Ufa based on vector autoregressions

Designation	Description
lnVInd	Logarithm of the growth rate of the shipped industrial products (%)
lnNInd	Logarithm of the growth rate of the average number of industrial workers (%)
lnInvInd	Logarithm of the growth rate of the investment volume into the fixed capital aimed at the development of industrial production (%)
lnVCons	Logarithm of the growth rate of volume of the shipped construction production (%)
lnNCons	Logarithm of the growth rate of average number of construction workers (%)
lnInvCons	Logarithm of the growth rate of the investment volume into the fixed capital aimed at the development of construction (%)
lnVTr	Logarithm of the growth rate of the volume of products shipped in wholesale and retail trade (%)
lnNTr	Logarithm of the growth rate of the average number of wholesale and retail trade workers (%)
lnInvTr	Logarithm of the growth rate of the investment volume into the fixed capital aimed at the development of wholesale and retail trade (%)
lnVTC	Logarithm of the growth rate of the volume of shipped transport and communications goods (%)
lnNTC	Logarithm of the growth rate of the average number of transport and communications workers (%)
lnInvTC	Logarithm of the growth rate of the investment volume into the fixed capital aimed at the development of transport and communications (%)
lnOil	Logarithm of the growth rate of Brent oil price (%)
lnRer	Logarithm of the rate of growth of the real exchange rate, USD. / RUB (%)

Table 2

Dickey–Fuller test

Designation	Model type	Calculated value	Critical values	Series type	Integration order
lnVInd	with constant	-3.35	-3	DS	0
lnInvInd	with constant	-5.10	-3	DS	0
lnNInd	with constant	-5.39	-3	DS	0
lnVCons	with constant	-3.71	-3	DS	0
lnNCons	with constant	-3.56	-3	DS	0
lnInvCons	with constant	-4.44	-3	DS	0
lnVTr	with constant	-4.76	-3	DS	0
lnNTr	with constant	-6.03	-3	DS	0
lnInvTr	with constant	-5.66	-3	DS	0
lnVTC	with constant	-3.17	-3	DS	0
lnNTC	with constant	-5.93	-3	DS	0
lnInvTC	with constant	-5.64	-3	DS	0
lnOil	with constant	-3.36	-3	DS	0
lnRer	with constant	-4.66	-3	DS	0

Table 3

Statistical characteristics for each equation of the VAR-model

Statistical characteristics	Industry	Building	Wholesale and retail trade	Transport and communications
F-st.	6.15; 8.771	8.216; 20.412	4.345; 7.157	9.134; 16.504
R ²	0.672; 0.745	0.606; 0.793	0.626; 0.734	0.682; 0.795

Additionally, residuals of each model equation were analyzed. The analysis showed that the mathematical expectation of the residuals equaled zero, that the dispersion was constant based on an augmented White test for equation systems [11, pp. 817–838, 12, pp. 325–333], that there was no autocorrelation between the residuals, based on the Box–Pierce/Ljung–Box Q-statistics [13], and that the residuals were distributed normally based on the Jarque–Bera test [10, pp. 96–129].

Thus, the obtained diagnostic models of Ufa’s economic activities had acceptable statistical qualities.

The developed diagnostics models of Ufa’s economy are the following (Student’s t-statistics are in brackets in formulas (1)–(4)):

1) diagnostics model of the city industry:

$$\left\{ \begin{aligned} \ln VInd_t &= 0.516 \ln VInd_{t-1} - \\ &\quad [-2.38] \\ &- 0.648 \ln InvInd_{t-1} + 0.885 \ln NInd_t + \\ &\quad [-3.104] \quad [4.74] \\ &+ 0.565 \ln Oil_t - 0.314 \ln InvInd_{t-6} + \varepsilon_{1t}; \\ &\quad [3.786] \quad [-2.234] \\ \ln InvInd_t &= 0.813 \ln VInd_{t-1} - \\ &\quad [4.122] \\ &- 0.474 \ln InvInd_{t-1} + 0.437 \ln NInd_t + \\ &\quad [-2.498] \quad [2.576] \\ &+ 0.478 \ln Oil_t - 0.257 \ln InvInd_{t-6} + \varepsilon_{2t}, \\ &\quad [3.527] \quad [-2.01] \end{aligned} \right. \quad (1)$$

where $\ln VInd$ is the logarithm of the growth rate of the shipped industrial products; $\ln InvInd$ is the logarithm of the growth rate of the investment volume into the fixed capital aimed at the development of industrial production; $\ln NInd$ is the logarithm of the growth rate of the average number of industrial workers; $\ln Oil$ is the logarithm of the growth rate of brent oil price.

2) Ufa’s construction diagnostics model:

$$\left\{ \begin{aligned} \ln VCons_t &= 0.485 \ln VCons_{t-3} - \\ &\quad [2.123] \\ &- 0.814 \ln InvCons_{t-3} + 0.596 \ln NCons_t - \\ &\quad [-2.512] \quad [5.214] \\ &- 0.417 \ln Re r_t + \varepsilon_{3t}; \\ &\quad [-2.619] \\ \ln InvCons_t &= 0.626 \ln VCons_{t-3} - \\ &\quad [6.712] \\ &- 0.467 \ln InvCons_{t-3} + 0.289 \ln NCons_t - \\ &\quad [-3.532] \quad [7.998] \\ &- 0.446 \ln Re r_t + \varepsilon_{4t}, \\ &\quad [-2.468] \end{aligned} \right. \quad (2)$$

where $\ln VCons$ is the logarithm of the growth rate of volume of the shipped construction production; $\ln InvCons$ is the logarithm of the growth rate of the investment volume into the fixed capital aimed at the development of construction; $\ln NCons$ is the logarithm of the growth rate of average number of construction workers; $\ln Re r$ is the logarithm of the rate of growth of the real exchange rate, USD / RUB.

3) Ufa’s wholesale and retail trade diagnostics model:

$$\left\{ \begin{aligned} \ln VTr_t &= 0.577 \ln VTr_{t-2} + 0.526 \ln VTr_{t-4} - \\ &\quad [2.875] \quad [3.282] \\ &- 0.703 \ln InvTr_{t-2} - 0.396 \ln InvTr_{t-4} + \\ &\quad [-3.18] \quad [-2.12] \\ &+ 0.859 \ln NTr_t + 0.141 \ln Re r_{t-1} + \varepsilon_{5t}; \\ &\quad [4.107] \quad [2.547] \\ \ln InvTr_t &= 0.603 \ln VTr_{t-2} + 0.376 \ln VTr_{t-4} - \\ &\quad [3.378] \quad [2.642] \\ &- 0.799 \ln InvTr_{t-2} - 0.378 \ln InvTr_{t-4} + \\ &\quad [-4.066] \quad [-2.275] \\ &+ 0.657 \ln NTr_t + 0.542 \ln Re r_{t-1} + \varepsilon_{6t}, \\ &\quad [3.534] \quad [2.365] \end{aligned} \right. \quad (3)$$

where $\ln VTr$ is the logarithm of the growth rate of the volume of products shipped in wholesale and retail trade; $\ln InvTr$ is the logarithm of the growth rate of the investment volume into the fixed capital aimed at the development of wholesale and retail trade; $\ln NTr$ is the logarithm of the growth rate of the average number of wholesale and retail trade workers; $\ln Re r$ is the logarithm of the rate of growth of the real exchange rate, USD / RUB.

4) Ufa’s transport and communications diagnostics model:

$$\left\{ \begin{aligned} \ln VTC_t &= 0.774 \ln VTC_{t-1} - \\ &\quad [4.746] \\ &- 0.632 \ln InvTC_{t-1} + 0.643 \ln NTC_t + \\ &\quad [-3.91] \quad [2.236] \\ &+ 0.396 \ln Oil_t + 0.535 \ln Re r_{t-1} + \varepsilon_{7t}; \\ &\quad [2.44] \quad [2.011] \\ \ln InvTC_t &= 0.581 \ln VTC_{t-1} - \\ &\quad [4.292] \\ &- 0.629 \ln InvTC_{t-1} + 0.493 \ln NTC_t + \\ &\quad [-4.69] \quad [3.708] \\ &+ 0.516 \ln Oil_t - 0.653 \ln Re r_{t-1} + \varepsilon_{8t}, \\ &\quad [3.836] \quad [-2.956] \end{aligned} \right. \quad (4)$$

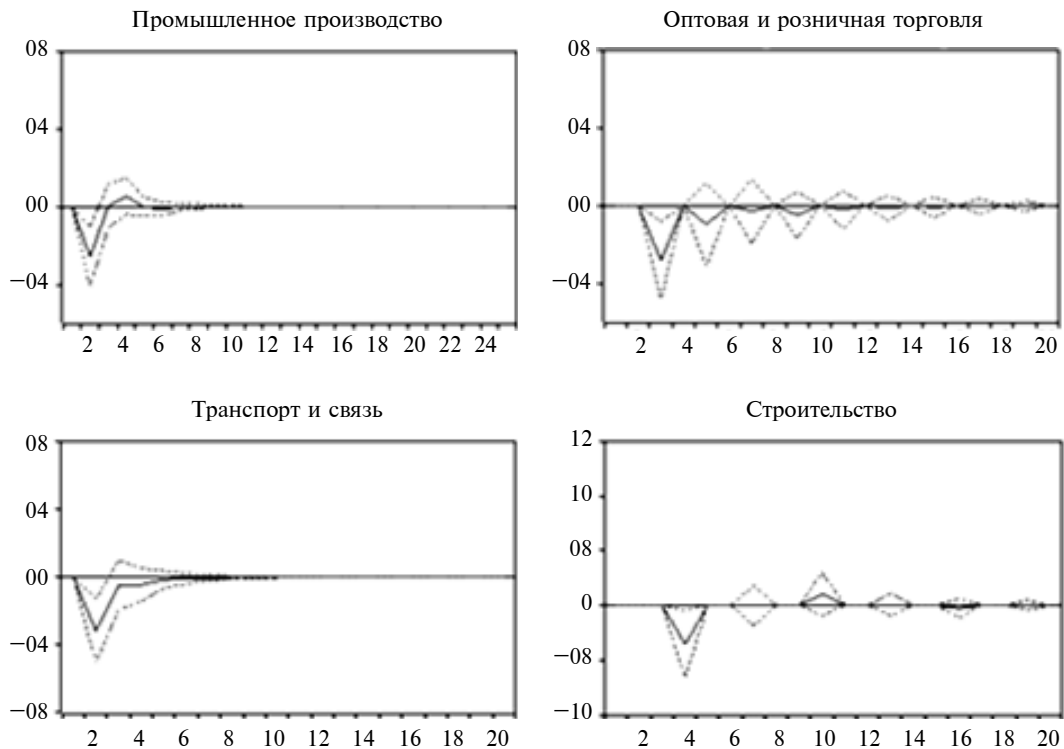
where $\ln VTC$ is the logarithm of the growth rate of the volume of shipped transport and

communications goods; $\ln InvTC$ is the logarithm of the growth rate of the investment volume into the fixed capital aimed at the development of transport and communications; $\ln NTC$ is the logarithm of the growth rate of the average number of transport and communications workers; $\ln Rer$ is the logarithm of the rate of growth of the real exchange rate, USD / RUB; $\ln Oil$ is the logarithm of the growth rate of Brent oil price.

Thus, comparing these diagnostics models of Ufa's economic activities, we can conclude the following: first, lagged values of present variables influence the growth rate of the volume of investment and growth rate of volume of the shipped production at present. The growth rate of the shipped production volume of past periods has positive interrelation with endogenous variables, because output expansion and service spheres development take place with the increasing of this indicator. Additional capital investment with an effective economic growth is required to provide all branches of economy with modern equipment and new technologies, which allows reducing costs of production and improving

the goods and services quality. Lagged values of the investment volume growth rates have a negative influence on endogenous variables. Less current investments are required provided that the past level of financing was high enough. However, investment must be carried out in effective forms. Investments into outdated means of production should not be made, otherwise inefficient capital utilization leads to resources restriction. It is obvious from the above that the reduction of shipped production volumes takes place. Diagnostics results of certain economic activities show that the effect of the depreciation of fixed assets surpasses that of innovative investments.

Functions of impulse responses, which describe the time it takes for the endogenous variable to return to the equilibrium curve at unit response of the exogenous variable, can be analyzed to confirm the adequacy of variable interrelation in the models [10, pp. 96–129; 14]. Figure shows the response of the logarithmic growth rate curves for the shipped production volume by type of economic activity to the 'shock' of the investment growth rate logarithm.



Response of the logarithmic growth rate of shipped products to the 'shock' of the investment growth rate logarithm



The curves presented in Fig. 1 indicate the negative response of the growth rate logarithm of shipped products to an increase in the investment volume growth rate logarithm for all types of economic activity. The effect from the change in the investing activities vanishes in 6–8 quarters of industrial production, transport and communication branches, but for the wholesale and retail trade and construction it can be seen for several years.

Secondly, the growth rate of the average number of workers affects the endogenous variables dynamics in all branches while the relationship is direct. It can be explained by the fact that additional funding for salaries and other deductions is necessary with an increase in the number of skilled and unskilled workers; the work force increasing assures the employment in the economy and expansion of the production. This factor has the greatest impact on the shipped products volume in the industrial branch ($\ln VInd$), as the branch is one of the most perspective, and highly skilled specialists are involved in it. The factor has influence on the shipped products volume of wholesale and retail trade ($\ln VTr$), related to the expansion of distributing facilities and creating workplaces.

Thirdly, the dependence of metropolitan economy on external factors is traced, that is, on the growth rate of oil price ($\ln Oil$) and the growth rate of exchange rate ($\ln Rer$). The growth rate of oil price has a positive influence on the development of industrial and transport and communication branches. It is the result of the influx of export petrodollars into the economy. The growth rate of exchange rate has a positive impact on the dynamics of wholesale and retail trade indicators ($\ln VTr$ and $\ln InvTr$).

Export goods bring a profit with the weakening of the national currency and support of domestic producers takes place as well. The growth rate of exchange rate has a negative impact on the construction variables ($\ln VCons$ and $\ln InvCons$). It can be explained by the strong dependence of construction branch on the costs of import construction technologies and materials.

Internal and external factors affect the development of main economic activities in the capital of the Republic of Bashkortostan. The examined indicators with scientifically substantiated signs are present in the models.

Conclusion. Thus, a comprehensive study was carried out for all branches of Ufa's economy taking into account the long-term response of investment and industrial components with the help of vector autoregression models. We have drawn the following conclusions based on dynamic diagnostics models and made a forecast for Ufa's economic situation:

a) the problem of depreciation of fixed assets, which have a negative effect on economic growth, is peculiar for the city of Ufa;

b) the examined types of economic activities need structural and technological modernization, expansion of interactions with scientific and educational institutions, sources of additional investment.

In the current economic climate, it is necessary to develop an effective investment policy directed at modernizing and supporting all types of economic activities in Ufa and further improve them. Dynamic diagnostic and forecasting models of the city's economy allowed to obtain a qualitative assessment of the current economic situation of the metropolitan system.

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BELOVA Tat'iana A. – Department of mathematical methods in Economics, Institute of Economics, Finance and business, Bashkir State University, postgraduate.

450074. Zaki Validi str. 3. Ufa. Russia. E-mail: k.t.a.1991.1991@mail.ru

БЕЛОВА Татьяна Александровна – аспирант кафедры математические методы в экономике, институт экономики, финансов и бизнеса, Башкирский государственный университет.

450074, ул. Заки Валиди, д. 32, г. Уфа, Россия. Тел.: (987)101-91-97. E-mail: k.t.a.1991.1991@mail.ru

BAKHITOVA Railia Kh. – Bashkir State University, Head of the Department «Mathematical Methods in Economics».

450074. Zaki Validi str. 3. Ufa. Russia. E-mail: bakhitovarih@mail.ru

БАХИТОВА Раиля Хурматовна – Башкирский государственный университет, заведующая кафедрой «Математические методы в экономике», д-р экон. наук.

450074, ул. Заки Валиди, д. 32, г. Уфа, Россия. Тел.: (927)351-11-88. E-mail: bakhitovarih@mail.ru

LACKMAN Irina A. – Ufa State Aviation Technical University, assistant professor of the department of «Computational Mathematics and Cybernetics».

450000. K. Marx str. 12. Ufa. Russia. E-mail: lackmania@mail.ru

ЛАКМАН Ирина Александровна – Уфимский государственный авиационный технический университет, доцент кафедры «Вычислительная математика и кикбернетика», кандидат технических наук.

450000, ул. К. Маркса, д. 12, г. Уфа, Россия. Тел.: (927)965-56-55. E-mail: lackmania@mail.ru

E.G. Naidenysheva

**THE IMPROVEMENT OF THE PRIVATE COMPANIES' SELECTION
PROCEDURE FOR CREATION A PUBLIC-PRIVATE PARTNERSHIPS**

Е.Г. Найденышева

**УСОВЕРШЕНСТВОВАНИЕ ПРОЦЕДУРЫ ОТБОРА
ЧАСТНЫХ КОМПАНИЙ
ДЛЯ СОЗДАНИЯ ГОСУДАРСТВЕННО-ЧАСТНОГО ПАРТНЁРСТВА**

As a result of studying the selection procedures (request for valuation, request for proposals, auction, tender) of private companies for creating public-private partnerships, some shortcomings of their work were identified. Firstly, only one company becomes a winner as a result of the selection, and the other applicants are excluded from participation in the partnership. Secondly, only financial characteristics of the companies that are potential participants are analyzed, some important factors of the legal and professional nature are not considered. The purpose of the article is to offer a procedure for preliminary and main selection (improve the existing procedure). It should be noted that we examine the development projects of social infrastructure, so the selection of companies is specific for the field assets: land, buildings, money. The pre-selection procedure is based on the analysis of legal and professional factors. The main selection procedure is based on the quantitative data of the assets of the company and forms partnerships of the companies whose assets are complementary to each other (the arguments of such sets of assets of the companies are listed in the first part of the work). In contrast with the existing selection procedure, the public-private partnership with the participation of several private companies can be identified as a result of improved selection procedure. This procedure can also create several public-private partnerships. The construction procedure of public-private partnerships is described using graph theory – coloring of vertices and edges of a graph according to certain rules. At the end of the article, there is a remark that the proposed procedure produces a result that is no less and in some cases even more effective than the current ones.

PUBLIC-PRIVATE PARTNERSHIP; ALLIANCE; SELECTION ALGORITHM; SELECTION PROCEDURE; GRAPH THEORY.

В результате исследования процедур отбора (запрос цен, запрос предложений, аукцион, конкурс) частных компаний для создания государственно-частного партнерства были выявлены некоторые недостатки их работы. Во-первых, в результате отбора победителем становится только одна компания, а другие, подавшие заявки отстраняются от участия в партнерстве. Во-вторых, анализируются только финансовые характеристики компаний – потенциальных участников, не учитываются важные факторы правового и профессионального характера. Целью статьи является предложить процедуру предварительного и основного отбора (усовершенствовав существующую). Следует отметить, что рассматриваются проекты развития социальной инфраструктуры, поэтому отбор компаний строится с учетом специфических для этой сферы активов: земельных участков, зданий и сооружений, денежных средств. Процедура предварительного отбора основана на анализе правовых и профессиональных факторов. Процедура основного отбора опирается на количественные данные об активах компании и составляет партнерства из компаний, активы которых дополняют друг друга (рассуждения о таких наборах активов компаний приведены в первой части работы). В отличие от существующей процедуры отбора, в результате работы усовершенствованной процедуры отбора может быть выделено государственно-частное партнерство с участием нескольких частных компаний. Данная процедура позволяет также сформировать несколько государственно-частных партнерств. Процедура построения государственно-частных партнерств описана с использованием теории графов и раскраски вершин и ребер графа по определенным правилам. В конце статьи приводится замечание о том, что предлагаемая процедура даёт результат не менее эффективный, чем существующая, а в некоторых случаях, даже лучший.

ГОСУДАРСТВЕННО-ЧАСТНОЕ ПАРТНЕРСТВО; АЛЬЯНС; АЛГОРИТМ ОТБОРА; ПРОЦЕДУРА ОТБОРА; ТЕОРИЯ ГРАФОВ.

Introduction. The formation of public-private partnerships implements the idea of mutually beneficial cooperation on the basis of the interests and goals of the participants (different sectors of the economy). On the one hand, the public sector gains the opportunity for more competent management of state property, increasing the quality and quantity of services provided to the society; on the other hand, companies that are business representatives improve business reputation and receive additional funding [2]. The more public-private partnerships are created, the more socially important projects can be implemented [12, 14]. The urgent task of providing a favorable social environment focuses our attention on the projects of social infrastructure development. [4].

Electronic business platforms are one of the tools for organizing the selection of private companies for PPP creation. The city administration places a request for selecting the candidates for private-company partners in a particular project on an Internet portal. A significant drawback of the method is that only one company can become the winner as the result of the selection procedure; all other companies who applied will not take part in the partnership.

Research Methodology. The main objective of the study is to offer such a selection procedure for private companies which allows to form several sustainable public-private partnerships for the development of social infrastructure projects. This object is achieved in several steps: the first is analyzing the possible government and business coalitions by taking into account the assets of potential participants; the potential participants are then divided into two parts, those that definitely will not be able to implement the project (and are excluded from consideration), and those who can implement it; after that a basic selection procedure is offered. It is shown that the result obtained by this procedure is no less effective (the number of PPPs will be no less than under the current procedure, and they will be more stable) than by the current selection procedure.

Creating public-private partnerships in view of the assets of potential participants. A lack of resources is a prerequisite to creating a public-private partnership [3, 10, 13]. In this case, private companies or city administration initiate the search for potential partners with the necessary (missing) resource. The analysis of the development of social infrastructure projects implemented through public-private partnerships reveals that

potential assets of the participants (as well as of the city administration as a representative of the state, and of private companies) can be divided into three groups: land; buildings and constructions; cash. It is convenient to use a language of binary relations to view the possible combinations of assets of private companies and the state, as well as to evaluate the possibility of establishing a PPP on their basis. [8]. If a private company has the land, but has neither money, nor buildings and structures, then it is denoted as «100», in other words, «1» means that the relevant asset is available, and «0» indicates the absence of the asset. So a set of state and business resources of the alliance can be written as a chain of six digits, where the first three show the assets of the city administration, and the last three the assets of the private company. After considering all possible chain combinations, it can be concluded which alliances will lead to the creation of PPPs, and which will not.

The number of all possible combinations is equal to the number of permutations with the repetition of 2 (two possible values: zero or one) by 6 digits in the chain, i. e., 64. However, some of the chains hold no interest for the investigation. Tab. 1 explains why these chains have been removed from the analysis.

Companies owning the asset sets described by the chains in the first four rows of the table will not be able to form PPPs. Let us determine the number of combinations excluded from consideration. The first row of the table consists of eight 6-digit chains: from «000000» to «111000», which will no longer be taken into account. The second row contains the chains from «000000» to «000111», but a chain of «000000» has been included in the first row, so it is not listed in the second row of the table which has seven new combinations. Seven and six combinations are excluded from consideration in the third and fourth rows, respectively. As a result, 36 combinations of different sets of assets needed for creating state and business alliances are identified (there are some examples of sets of assets that allow to create PPPs in Table 1; an interaction scenario is proposed in the last five rows, but this is only a fragment of the full table). Thus, we have identified the cases where government and business interests can be reconciled on the basis of the resources that each of these entities are lacking for implementing social projects. The third part of the work will offer a basic procedure for selecting the participants for creating public-private partnerships based on the selected sets of assets.

Table 1

Combinations of asset sets in the PPP

City administration assets			Private company assets			Scenario of development for the alliance
Land	Buildings and constructions	Cash	Land	Buildings and constructions	Cash	
000...111			0	0	0	It is impossible to create a PPP. The private company does not make any contribution to the Partnership, as it does not have any of the necessary assets (8 combinations)
0	0	0	000...111			It is impossible to create a PPP. The city administration does not make any contribution to the Partnership, as it does not have any of the necessary assets (7 combinations)
000...111			1	1	1	There is no need to create the PPP (the private company has all the necessary assets)
1	1	1	000...111			There is no need to create the PPP (the city administration has all the necessary assets)
1	0	0	0	0	1	Private company buys or rents land
1	0	1	0	1	0	Selling or leasing a building or construction to the city
1	0	0	0	1	1	Private company repairs (if necessary) the building and transfers it to the city as payment for land
1	0	0	1	0	0	Land is pledged to a credit institution by the private company to borrow funds
0	1	0	0	0	1	Private company repairs the building owned by the city administration and gets profits from using it together with the city administration after the building has been put into operation

Preliminary procedure for selecting participants. One of the four procedures can be currently used for selecting the participants by means of electronic business platforms: request for quotations, request for proposal, auction or tender. Regardless of the selection procedure chosen, one company that implements one project will be the winner. All other companies who do not win will be excluded from participation in PPPs. This is the first drawback of this selection: it does not account for the fact that alliances of the «private company-state» or «two private companies-state» types can be created among the companies that do not win to implement other social infrastructure projects. The second major selection drawback is that none of these four procedures take into account important factors of a qualitative nature (experience of the company, its business reputation, etc.), the selection is based solely on the quantitative characteristics related to the company's assets [6]. Subsequently, a situation

can occur when the winning company is not able to implement the project, for example, because of past trials (as these factors are not taken into account in the current selection procedure) [5]. In other words, it is impossible to analyze the stability of the company and the potential sustainability of the partnership. To avoid such situations, we propose to introduce a preliminary procedure for selecting participants that includes the parameters reflecting the quality indicators in quantitative terms. The parameters can be divided into legal and professional groups. These groups form the criteria designed to prevent outsiders (i. e., the companies which will be definitely unable to complete the project) from participating. The parameters of the first group may include having violated the rules of using urban areas and other real estate (buildings and structures) during the previous investment projects, the company's proven involvement in criminal activities in the economic sector, etc. The parameters of the second group are the

number of successfully implemented projects in the construction sector, the implementation of construction projects outside the Russian Federation, the presence of deviations from the planned timing for the previously implemented projects [7].

After the companies which are definitely not going to complete the project have been excluded, there remain several companies that are potential participants of the public-private partnership. The assets of the city administration and private companies should be analyzed by how they complement each other in order to identify one or more of the PPP companies that passed the preliminary selection procedure. [11, 15].

The main selection procedure. The basic selection procedure focuses on the assets of private companies and the city administration. We offer to use the language of graph theory to simulate the process of forming public-private partnerships of companies that have passed the pre-selection procedure. Let us construct an undirected graph $G = \langle V, E \rangle$, where V is the set of vertices and E is the set of arcs. If n companies pass the pre-selection procedure than V will consist of $2n$ vertices. Each node is either a private company or a city administration. The maximum number of PPPs formed of n private companies is n , therefore n vertices will correspond to the city administration (as the city administration should participate in every PPP, so the appointment of one peak to the city administration is not enough). Let us use a classical technique of graph theory and apply edge coloring [1]: the red edge will mean that the participants characterized by the connected peaks enter the PPP, the black edge will mean that the participants do not form the PPP. Graph G will be a complete bipartite graph, so the set of nodes can be divided into two disjoint sets A and B , while the edges connect the vertices only if one of them belongs to the set A , and the other to set B , each vertex of the set A is associated with each vertex of the set B [8]. A is the set of vertices corresponding to the public sector of the economy, B is the set of vertices corresponding to the private sector of the economy. This is done for two reasons. Firstly, it is to exclude from consideration the «private company – private company» type of alliances since they are beyond the scope of our analysis

and «city administration – city administration» unions formally possible with a full graph that is not bipartite. As a result, there will be only the coalitions reflecting the essence of the PPP, i. e., «private company – city administration,» or «private company – city administration – private company». Secondly, it is to consider all possible combinations of the interactions between private companies and the city administration.

Each selected participant and the city administration has one or more assets, which belong to one of the groups: land; buildings and structures; cash. For taking these assets into account in the formation of a PPP, each vertex of the graph corresponds to an information structure presented in Tab. 2. For example, if the city administration owns 10,000 square meters of land, «10000» is written in the field «available assets» at the vertices of the set A . If a private company needs 4000 square meters for the construction project, then «4000» will be recorded in the «Requirements» of the corresponding vertex of the set B . It is important to note that all vertices of A have the same information structures, as they show the assets of one city administration.

Table 2

Example of the information structure

	Available assets	Requirements
Land	0	4000
Buildings and constructions	0	0
Cash	1000000	0

The main selection procedure is based on the breadth-first search algorithm of graph traversal. Checks specific for the creation of the PPP are added during the traversal. The bipartite graph is built by the beginning of the main procedure, and each of its vertices is provided with an information structure with six number fields.

Following the classical breadth-first search algorithm of graph traversal, the vertices of the graph are colored by white, gray or black for keeping track of the main procedure. Initially, all the vertices are white; when a vertex is opened (discovered) during the search process, it is colored gray or black [9]. Gray means that the company corresponding to the vertex was

regarded as a candidate for participating in the PPP but did not pass the selection because its asset set is insufficient. The company with a set of assets that allows it to implement the project on the basis of the PPP has a black vertex.

The main selection procedure works as follows:

1) The vertex of the set A is chosen.

2) The «Available assets» field of its information structure is considered.

3) The chains with the set of assets corresponding to the «Available assets» field are selected from the available options. For example, if the vertex of the set A is represented by the information structure in Table 2, the chains with the first three digits «001» will be selected (the city administration has the money). At the same time the city administration does not have the land for the project (see «Requirements»), therefore, the last three digits in the chain will be «100», «101» or «110» (private companies entering into the PPP must own land lots). Consequently, after analyzing the information structure of the vertices, the chains of asset sets of the city administration and private companies which guarantee that the created PPP will be stable (i. e., the interests of the state and the business can be reconciled on the basis of the assets that each of them are lacking) can be selected.

4) We pass all the vertices connected to the vertex of the step 1, until we find the vertex of the set B corresponding to the desired set of assets (comparing the selected chains from step 3 to the information structures of vertices in B).

4a) If the vertex of the set B is not found, the main selection process ends.

4b) If the vertex of the set B is found, then the numerical values of the fields of the information structure are compared. If the assets are sufficient for the project, then the vertex of the set B and the vertex of the set A are colored black, the edge connecting them turns red, proceed to step 5. If the assets are not enough, then the vertex of the set B turns gray, proceed to step 4.

5) All the information fields of the vertices of A are edited: assets are adjusted (reduced by the amount used in the newly formed PPP).

6) Proceed to step 1.

After all of the «state – private company» couples have been considered, the possibility of creating the «private company – the state –

private company» alliances should be checked. In order to check the remaining gray vertices (companies not involved in any PPP), the original graph is rebuilt: the vertices of B are combined by two (the values of the information structure for the assets of the new vertices of B are calculated as the sum of the values of the fields of initial vertices), vertices of the set A do not change. The algorithm is repeated again for a new graph.

At the end of the algorithm the number of formed public-private partnerships will be equal to the number of vertices in the set A connected with at least one edge.

We claim that the described basic procedure offering the option of forming public-private partnerships is no less effective than the existing selection procedure; it is effective in the sense that the number of PPPs formed with the help of our proposed procedure will be at least not less than the number of PPPs formed with the help of the existing selection procedure. At the same time, the PPPs will be more stable due to the use of the pre-selection procedure analyzing the legal and professional aspects of the companies willing to participate in PPPs.

Proof. Let us consider two cases when the existing selection procedure did not reveal the winner (the assets of any company are not sufficient for implementing the project), and when one winner was selected.

In the first case, the result of the existing procedure will be 0 public-private partnerships. The proposed procedure tests the graph for the presence of the «state – private company» partnerships (and does not find any alliances as the assets of any company are not enough for implementing the project). However, then the original graph will be rebuilt and the search for the «private company – state – private company» alliances will be continued. Perhaps there will be companies among the new vertices that will be able to implement the project together with the city administration. In other words, the main result of the selection procedure will not be worse than the current.

If the current selection procedure identifies a winner, the main selection procedure will also reveal it (by analysis of the assets of private companies using the information structures). In addition, a few PPP can be found while searching



for the «state – private company» pairs. Additional partnerships may appear after searching for a PPP with three participants. Thus, the proposed selection procedure will be no less efficient than the present, and an additional pre-selection procedure allows to avoid the situations described in the second part of the study, so the partnerships formed will be more resistant.

Results and conclusions of the study. The analysis of the existing selection procedure for forming public-private partnerships has revealed some of its weaknesses. The study proposed to eliminate them by improving the selection procedure. The mechanism allowing to form a more stable partnership between the state and

the business with the help of two procedures of preliminary and basic selection is described. The first of them takes into account factors of legal and professional nature which are not taken into account in the current selection procedure. The second, based on the analysis of the assets of private companies and the city administration, selects alliances in which the participants can reconcile their interests by taking into account the missing assets and form a stable PPP.

We see a promising direction of future research in testing these procedures on specific examples of social infrastructure development projects, gathering the statistics about their stability, feasibility and the amount of formed partnerships.

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NAIDENYSHEVA Ekaterina G. – Institute of Industrial Economics and Management, Peter the Great St. Petersburg Polytechnic University.
195251. Politechnicheskaya str. 29. St. Petersburg. Russia. E-mail: kate.naiden@gmail.com

НАЙДЕНЫШЕВА Екатерина Григорьевна – ассистент кафедры «Информационные системы в экономике и менеджменте» Инженерно-экономического института Санкт-Петербургского политехнического университета Петра Великого.
195251, ул. Политехническая, д. 29, Санкт-Петербург, Россия. Тел.: (965)0219207. E-mail: kate.naiden@gmail.com

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