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## Innovation Activity of Russian Business Entities and its Determinants

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**Abstract:**

*Market growth prospects of the entities during the innovation activity could not be sized up due to lack of systematized and shared view at factors defining the innovation activity of business entities.*

*The paper presents key factors of innovation activity along with its classification by levels (macro, meso, and micro). Authors suggested a specific innovation activity evaluation framework as well as multivariate regression model of assessing the structure and key-factors' effect on business activity is developed.*

**Keywords:** Innovation activity, modeling, factors, innovation

**JEL classification:** C15, O30

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## **1. Introduction**

Innovation activity of business entities is irregular in structure and dimensions and depends on development, goal setting priorities, and tools of innovation policy at the state in the Russian Federation (Morkovina *et al.*, 2015). Importance of providing the appropriate level of innovation activity of business entities is highlighted in the 2020 Strategy of Innovation Development of the Russian Federation (the 2020 Strategy) approved by Decree of Government in 2011 aimed at switching into innovation based development pattern including innovation based industrialization up to 40-50% by 2020 (2009 – 9,4%) and increasing of innovation output up to 25-35% by 2020 (2010 – 4,9%).

Thus, despite measures on innovation development promotion in 2015 nearly 9,3% entities in Russia were innovation-based and active i.e. make technological, organizational, and marketing innovations among others although, as per 2020 Strategy, the innovation-active entities' share by 2020 should reach 15% level. Current lag is magnified by insufficient return on innovation goods, works, and services' sales despite the growth trend in absolute terms (+7,4% for 2015). Commonly, the value of goods, works, and services' share in 2015 was at 8,4% level and decreased by 10% since 2013. For each 1 RUB of costs there were only 3,2 RUB of innovation goods, works, and services.

Internal funds are considered as the major funding source of innovation activity in Russia. By now, more than 51% of technological innovations' costs are funded by internal funds. Both federal and regional funds in total funds came to 24,5% level. Extrabudgetary funds amounted to 0,5%. Foreign investments made up much less (0,3%) (Bezrukova, 2014; Ivanova *et al.*, 2017; Sibirskaya *et al.*, 2016).

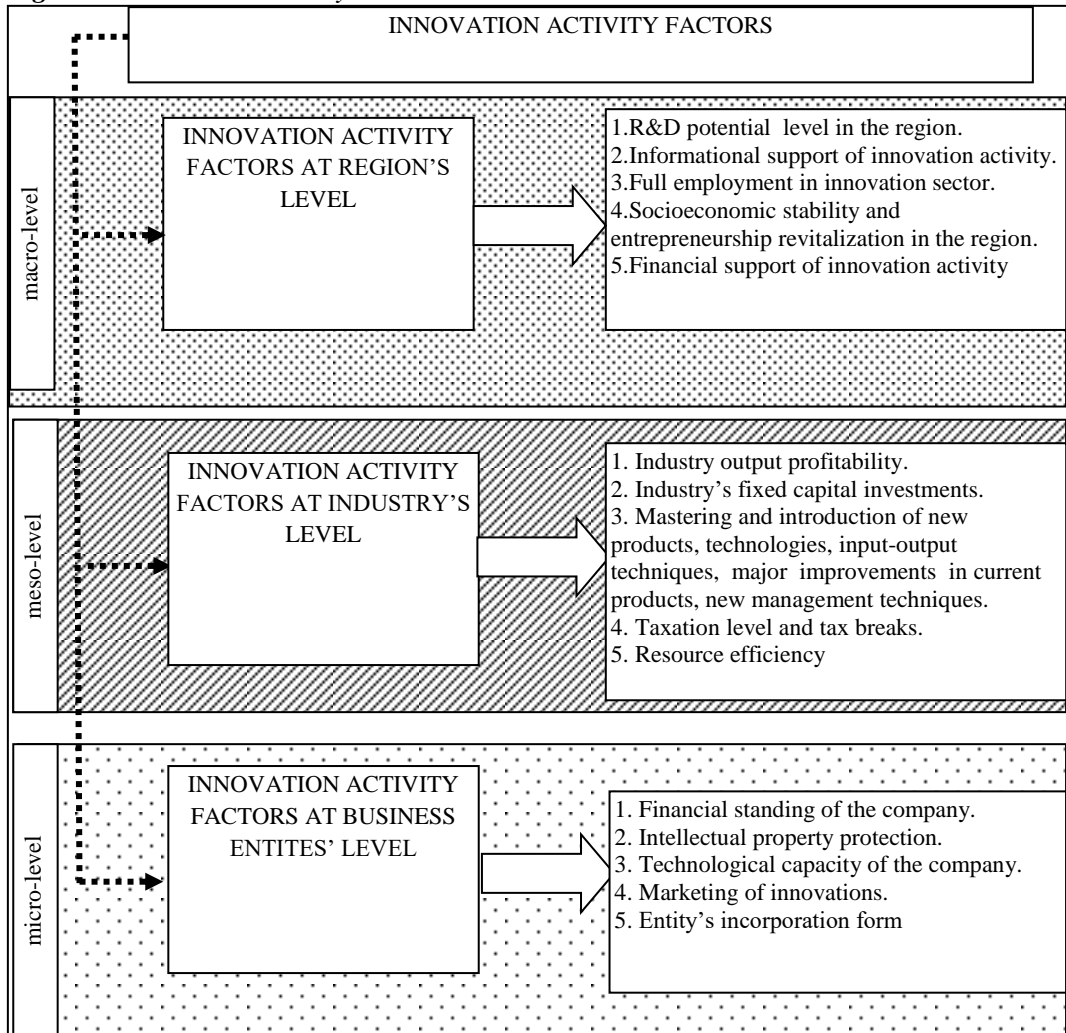
Thus, poor innovation activity results from not only lack of innovations but lack of skills and experience in the field of innovation activity management and absence of adaptive tools of innovation activity promotion.

## **2. Theoretical, Informational, Empirical, and Methodological Grounds of the Research**

Innovation activity turns to be a result of vibrant market developments as well as industrial policy, living standards, innovation activity' state and regional backings, socioeconomic stability, and entrepreneurship revitalization at all levels including regional macro-level (Drapalyuk *et al.*, 2014; Valma, 2014). Besides the lag of Russian business entities in innovation development there is a set of structural issues in organization of innovations management at industry and entities' level medium and micro-level. Study of factors affecting the innovation activity established the system-wide classification (Figure 1). Since the role of factors is unequal, to assess the impact it is suggested to apply weighing coefficients based on expert judgements (Panyavina, 2016; Kossova *et al.*, 2014; Tyaglov *et al.*, 2017; Theriou, 2015).

Authors utilized an expert method to justify innovation activity major factors. Experts with sufficient skills in innovations' making and commercialization were involved (Panyavina, 2016).

**Figure 1. Innovation Activity Factors in Russia**



To arrange factors and assess their significance authors applied triage method providing data on logical factors' analysis and their cross-effect scoring via MS Excel software. The method is based on expert evaluations and matrix records, providing evaluation and determination of major factors to be focused on.

The analysis sequence includes a number of stages:

1. Expert team in determining factors of innovation activity is identified:

X: (1 = 1, n).

Entrepreneurs that make innovations were involved on an expert basis. Expert group of 5 persons is rather specific. Experts do not score factors but compare them pair-wise for every group resulting in “more”, “less, or “equal”. Each expert’s data is obtained as pair-wise matrices.

$$\gamma_j = (\gamma_{ik,j}) \tag{1}$$

where  $i, k=1, \dots, n; j=1, \dots, m; \gamma_{ik,j}$  – result of j Expert’s pair-wise comparison of  $X_i$  and  $X_k$  factors. Could be expressed in 2 points at maximum if the weight of one factor exceeds another. 1 point could be given when both factors’ weight is equal. Zero points is given when the weight of one factor is less than another’s.

2. Determining the significance of factors. The worksheet is developed for innovation activity factors evaluation. Results could be filled in the table to develop average evaluations systems on their basis. The average score is obtained by dividing total score by number of experts.

3. Evaluation system data is used for developing square matrix  $C = C_{ik}$  where  $C_{ik}$  numerical value of superiority i over k factors. It is important to keep the condition of  $X_i > X_k, C_{ik} = 2$ ; for  $X_i < X_k, C_{ik} = 1$ ;  $X_i = X_k, C_{ik} = 0$  when conducting the analysis.

4. Further the relative weight of factors is calculated in a number of iterations further summarized in Table 1.

5. Factors with upper Pi2 value are considered major.

### 3. Results

Calculations resulted in square incidence matrices to evaluate major innovation activity factors at all levels:

- at regional level (macro);
- at industry’s level (medium);
- at business entities’ level (micro).

As a result, a set of major factors was picked from every group. Factors and their relative values are summarized in the Table 1.

**Table 1.** Major innovation activity factors at macro, medium, and micro-levels

| Factor  | Weight of factor |
|---|------------------|
| Macro-level   |                  |
| 1. R&D potential of the region                            | 0,177285         |
| 2. Informational support of innovation activity           | 0,099723         |
| 3. Full employment in innovation sector                   | 0,315174         |
| 4.Socioeconomic stability and innovation entrepreneurship | 0,148969         |

|   |          |
|---|----------|
| promotion in the region   |          |
| 5. Financial support of innovation activity   | 0,258849 |
| Meso-level  |          |
| 1. Profitability of industry's output   | 0,16274  |
| 2. Fixed capital investments  | 0,2273   |
| 3. Mastering and introduction of new products, technologies, input-output techniques, major improvements in current products, new management techniques | 0,32313  |
| 4. Taxation level and tax breaks.   | 0,10894  |
| 5. Resource efficiency  | 0,17787  |
| Micro-level   |          |
| 1. Financial standing of the company  | 0,26385  |
| 2. Intellectual property protection.  | 0,05746  |
| 3. Technological capacity of the company  | 0,35913  |
| 4. Marketing of innovations   | 0,10583  |
| 5. Entity's incorporation form  | 0,21372  |

In the course of research authors considered number of innovation activity factors that could be used for further patterns and interconnections' evaluation via multivariate regression model at macro, meso, and micro-levels. The factors are:

- at macro-level: full employment in innovation sector, financial support of innovation activity;
- at medium-level: resource efficiency, industry output profitability, mastering and introduction of new products, technologies, input-output techniques, major improvements in current products, new management techniques, industry's fixed capital investments;
- at micro-level: technological capacity, financial standing of the company.

To reveal the pattern and interconnections of major innovation activity factors authors formed resulting indicators. The innovation activity level is calculated as quotient of entities making innovations to the total number of companies, so the volume of shipped innovation goods, works, and services turns to be a resulting feature of innovation activity level at all levels (Vyaznikova and Bezrukova, 2015).

Further step is quantitative evaluation of resulting features and indicators at macro-level (Voronezh region), medium-level (forestry, wood-pulp, and paper industry), and micro-level (public company "Voronezh Orchard", a company with sufficient R&D in STEM) (Table 2).

**Table 2.** Evaluation of resulting features and indicators of innovation activity at micro, meso, and macro-levels

| Period | Resulting feature <sup>2</sup>      | Resulting indicators <sup>3</sup> |                               |                                |
|--------|-------------------------------------|-----------------------------------|-------------------------------|--------------------------------|
|        | Volume of shipped innovation goods, | Titles of protection              | Number of staff involved into | Technological innovation costs |

<sup>2</sup>2013-2015 data taken from Federal State Statistics Service;

<sup>3</sup>2013-2015 data taken from Federal State Statistics Service;

|               |  |  |  |  |
|---------------|--|--|--|--|
|               | works, and services ( <b>macro-level</b> ) (Y), mln. RUB                                     | granted for patents, utility models, and designs (X <sub>1</sub> ), ea | R&D (X <sub>2</sub> ), person.   | (product, process) (X <sub>3</sub> ), mln.RUB.                 |
| 2013          | 13520,8  | 473  | 10763  | 7564,3   |
| 2014          | 24742,4  | 679  | 10865  | 6769,7   |
| 2015          | 50120,6  | 705  | 10600  | 9905,2   |
|               | <b>Resulting feature</b><br>1  | <b>Resulting indicators</b> <sup>2</sup>                               |  |  |
| <b>Period</b> | Volume of shipped innovation goods, works, and services ( <b>meso-level</b> ) (Y), mln. RUB  | Volume of fixed capital investments (X <sub>1</sub> ), mln. RUB        | Innovation goods, works, and services, reintroduced or major variation exposed (X <sub>2</sub> ), mln. RUB | Number of frontier technologies utilized (X <sub>3</sub> ), ea |
| 2013 год      | 839392,1   | 130500   | 19451,1  | 5777   |
| 2014 год      | 898735,6   | 115800   | 22788,2  | 6265   |
| 2015 год      | 1075417,1  | 134000   | 45220,3  | 6824   |
|               | <b>Resulting feature</b><br>4  | <b>Resulting indicators</b> <sup>5</sup>                               |  |  |
| <b>Period</b> | Volume of shipped innovation goods, works, and services ( <b>micro-level</b> ) (Y), mln. RUB | Working capital availability (X <sub>1</sub> ), kRUB                   | Number of staff involved into R&D (X <sub>2</sub> ), person.   |  |
| 2014          | 2124   | 717  | 3  |  |
| 2015          | 9502   | 2199   | 3  |  |

Final sequence of analysis suggested innovation activity factors' structure and interconnections evaluation via multivariate regression model.

#### 4. Conclusions and recommendations

Innovation activity factors' analysis at micro, meso, and macro-level confirmed major interconnections as well as provided data for making a regression model:

$$y = -1011639,3 + 69,6x_1 + 82,3x_2 + 14,5x_3 \quad (2)$$

<sup>4</sup>2013-2015 data taken from public company "Voronezh Orchard" financials;

<sup>5</sup>2013-2015 data taken from public company "Voronezh Orchard" financials.

It is proved that innovation activity increases for 69,6 ea when titles of protection granted for patents, utility models, and designs indicator grows by 1 ea. under other fixed values. At macro-level, innovation activity increases by 82,3 ea when number of staff involved into R&D indicator grows by 1 ea under other fixed values. Innovation activity increases by 14,5 ea when technological innovation costs indicator grows by 1 ea under other fixed values.

At medium-level, multivariate regression model becomes to:

$$y = -143477,6 + 0,36x_1 + 0,12x_2 + 21,6x_3 \quad (3)$$

Coefficients show that innovation activity increases by 0,36 ea, by 0,12 ea, and by 21,6 ea when volume of fixed capital investments, innovation goods, works, and services, reintroduced or major variation exposed, and number of frontier technologies utilized indicators increase by 1 ea correspondingly under other fixed values.

At micro-level, innovation activity increases by 4,9 ea when financial standing indicator grows by 1 ea under fixed value of number of staff involved into R&D; innovation activity increases by 51,2 ea when number of staff involved into R&D indicator grows by 1 ea under fixed value of financial standing indicator:

$$y = -1523,1 + 4,9x_1 + 51,2x_2 \quad (4)$$

Current research suggests the conclusion that innovation activity of Russian business entities is affected by number of factors, which should be evaluated individually for micro, meso, and macro levels. Building the factors' system provides developing the multivariate regression model of innovation activity management to act rapidly on environment and innovation variations' trends.

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