Development of Dynamic and Comparative Functions of Estimation of Innovative Potential

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SUMMARY

Questions of the rate fixing of different indexes of work of industrial enterprises are considered in the article. Special attention is paid to indexes which form the separate constituents of the innovative potential of machine manufacturing enterprises. The author offers two different approaches to the setting of norms for indexes of work in enterprises, the use of which will have a considerable economic effect in practice.

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The innovative activity of creative subsections of industrial enterprises is an extraordinarily important subject of the market for innovations in our country. Leaning on scientific and technical resources, information, and skilled personnel, they assist the effective development of enterprise. The result of such co-operation must be new products and technologies, increases in the competitiveness of Ukrainian wares, and the creation of new workplaces. As will be shown below, under the term innovative potential of enterprise we understand the maximal possibility of enterprise in the use of all innovative possibilities which can be estimated in a type of system index characterising the level of efficiency of scientific innovation to the complex achievement of innovative aims. The innovative potential of enterprise is reproduced by the possibility of structural subdivisions into perspective development due to internal possibilities. The increase of innovative potential of enterprise is foreseen by providing:

- developments of new types of products that meet the newest demands of users;
- products with a competitive edge in the market that are produced by this enterprise;
- creation of the proper use of progressive technologies and equipment for the production of goods;
- necessary market performance in the target market of enterprise;
- sufficient level of profitability of production and commercial activity of subsections of enterprise;
- effective development of skilled potential and basis of scientific research;
- improvement of the administrative structures of the enterprise;
- development of corporate culture.

The method of estimation offered for assessing the level of innovative potential in an industrial enterprise includes dependences between the different stages.

The laying out of innovative potential is based on separate constituents. For implementation of this procedure it is recommended to use the principle of functional decoupling, which allows in a sufficient measure the structured presentation of innovative potential in the type of a hierarchical structure of separate elements, which enables us to conduct a more detailed analysis in the future.

The structurally innovative potential of industrial enterprise can be examined from different points of view depending on the tasks put before the researcher, by submitting the potential as a sum of different sort of subsystems, elements, and other component parts of the complex multilevel system. In our research we took a sectoral cut of this system which traditionally exists in our theory and practice. At the sectoral level the structure of innovative potential can contain different families into which the elements are classified, as a rule, by resource principle.

The conventional approach to the decision of the chosen task [4, 1, 2] assumes in the structure of innovative potential of industrial enterprises the ability to select

skilled, production-technological, financial and economic, information-based, material and technical, and organizationally administrative potentials. In our view, such an approach needs certain adjustments and clarifications. First, the presentation of innovative potential as the sum of the above-mentioned potentials is somewhat debatable. As was well-proven by us in the first sections of this paper, independent presentation has innovative potential and in a great deal differs from the approach by the value concepts of material and technical potential, skills, and other scientific and technical potentials. In our view, for the determination of the level of innovative potential of an enterprise, and especially during its realisation, a complete value is not needed for scientific and technical, skilled, material and technical or other potentials, since only a part of them is used for this purpose. For example, the skilled (labour, intellectual) potential of firm or enterprise includes all present labour resources and prospects of their development. At the same time, for the realization of innovative plans only labour resources needed for the making (by the use) of concrete innovation are required. In this connection, we suggest that a composition of innovative potential include not potentials of the proper directions, but constituents, for this allows separate directions, which in our view more exactly reproduce requirements for innovative potential, more focused in order to determine its level. In general cases, the relationship between the proper potentials (as prompted by the majority of researchers) and proper constituents (as prompted by the author) takes the following form:

$$I_{ni} \geq I_{ci},$$

where I_{ni} is the innovative potential of the proper ("i") direction (scientific and technical, resource, skilled and other potentials), and I_{ci} is the proper ("i") constituent of innovative potential.

The resulting inequality shows that innovative potential of i-ro direction, as a rule, is less than that of the proper constituent innovative potential. In this connection, the use of recommendations given in [4, 1, 2] more frequently brings everything over to the overpriced values of innovative potential, that then results in the overvaluation of innovative possibilities of an enterprise or firm. This can lead to errors in the innovative planning and result in negative consequences not only for the production-enterprise activities of separate enterprises or firms but also for the economy of the entire country.

The general approach is to estimate the level of innovative potential of an industrial or scientific enterprise, as developed by us and presented in the scientific literature [3, 5, 6]. This enables us to determine the level of innovative potential at this point in time, leaning on today's indexes of innovative development in enterprises. Such an approach is most widespread in scientific research, but it does not allow us to determine the dynamics of innovative changes within an enterprise, and in addition, it does not allow to make an objective comparative estimation of achievements of separate enterprises as compared to other enterprises, if there is the necessity for such. In this connection it becomes necessary for improving methods for the purposeful searching for possibilities of their use in dynamic comparative calculations of the level of innovative potential.

The most common failing of a great number of differently scaled indexes for the description of innovative potential is the absence of the unique approach to setting norms of the indexes analysed, as authors of similar research justly specify [4]. For comparison of indexes of innovative potential it is suggested to use one of the possible rationing functions [4], which, in our view, is a measure more suitable for setting norms of indexes of innovative potential:

$$P_{ні} = A^{-\frac{P_{em}}{P_i}} \quad (1)$$

where $P_{ні}$ is the index of innovative potential, the estimation of which is conducted, after setting of norms; A is the index of rationing function, which reproduces the set tasks put before research (permanent number); P_i is the proper «i» index of innovative potential at the moment of estimation; P_{em} is the standard value of «i» index of innovative potential, which is accepted for a comparative or dynamic estimation.

For gaining an end by estimation of the level of innovative potential of industrial enterprise, in our view, for the most acceptable quality the index of rationing function A is followed to accept the number 2, so that $A = 2$. Taking into account this suggestion, Equation (1) will assume the following form:

$$P_{ні} = 2^{-\frac{P_{em}}{P_i}} \quad (2)$$

Equation (2) has importance for the aims of this research property: its value is always certain to be in the interval from «0» to «1». If the value of $P_{ні}$ obtained in Equation (1) will be evened to 0.5 ($P_i = 0.5$), then it testifies to the middle level of index (at a comparative estimation) or an absence of change in an enterprise in the area of this index (at the dynamic estimation of $P_{em} = P_i$). An analysis shows that dependence is between P_i and relation of P_{em}/P_i , that $P_i = F(P_{em}/P_i)$ has a nonlinear character which makes it more difficult to dissociate outsiders from leaders or give grounds for the determination of certain fines for a reduction in innovative activity. For example, if the proper index of Ri will be increased by three times, then the value of Rni will be increased from 0.5 to 0.794 (an increase of 60%), and at diminishing of the same index by three times, the value of Rni will fall from 0.5 to 0.125 (a reduction of four times).

The use of Equation (2) allows us to drive to the unidimensional plane all indexes of innovative potential (on each of its constituents) with the purpose of carrying out certain actions for bringing them over to the complex summarising index. Without such an approach summarising indexes which are offered by different

researchers for the estimation of level of innovative potential do not have the adequate content. Moreover, often there are cases where it is simply improper to report separate indexes to the unique base.

The subsequent operation for the estimation of innovative potential of enterprise depends on the set purpose. In our view, all actions of researchers can lead to two possible scenarios of research:

- estimation of changes which happen in innovative potential of enterprise for a certain period of time (from now on we will name this the action of researchers or analysts' research of the dynamic function of the innovative potential of enterprise);
- the location of this enterprise in the hierarchy of innovative achievements of similar (or not quite similar) enterprises (we will name this the action of researchers or analysts by research into the comparative function of the innovative potential of enterprise).

Taking into account what is expounded above will set two possible scenarios for calculation of the level of innovative potential of an enterprise.

SCENARIO № 1

The aim of this scenario is to determine the degree of innovative development as a dynamic constituent of innovative potential of a particular industrial or scientific enterprise. For practical realization of this scenario statistical information is needed about all constituents of innovative potential for two periods which are compared against each other. More frequently thes are is the current and the previous year, but if it is necessary to watch the dynamics of change of innovative potential for a more protracted interval of time, it is recommended also to conduct a comparison of the base year with all following years, including with the current year. For calculation of values of each of the characteristic coefficients it is recommended to conduct a help dependence (2), the values of the proper constituents of which are interpreted as follows:

$P_i = P_{it}$ - value of «*i*» index of innovative potential in a current «t» year;

$P_{em} = P_{i(t-1)}$ - value of «*i*» index of innovative potential in «t-1» year which is chosen for comparison with the current year.

Taking into account these parcels, dependence (2) will be expressed as:

$$P_{ні} = 2^{-\frac{P_{i(t-1)}}{P_{it}}} \quad (3)$$

Many of the factors which form the level of innovative potential have a dimension of monetary items. In time such indexes can change value even with the stable (unchanging) terms of work of the enterprise. The researchers of innovative potential [4] justly point out the necessity of accounting for inflationary processes when researching the dynamics of separate indexes of this category. In this connection, in our view, dependence (3) will be more precise and its results more reliable when it is amended to include inflation. The indicated parcels are shown in dependence (4):

$$P_{ні} = 2^{-\frac{P_{i(t-1)}}{P_{it}}(1+\gamma_t)} \quad (4)$$

where $\gamma_t = \frac{Ц_t - Ц_{t-1}}{Ц_{t-1}}$ is the average annual inflation rate; $Ц_t$ is the price level in a current «t» year; and $Ц_{t-1}$ is the price level in the previous «t-1» year which is chosen for comparison with the current year.

SCENARIO № 2

The focus of this scenario for the location of actual enterprise is on the criterion of innovative development among the group of family enterprises, united in sectorial, territorial, pattern of ownership or some other factor, for the determination of comparative constituents of innovative potential. For the practical realization of this scenario statistical information is needed about the constituents of innovative potential of all enterprises examined for the period of time investigated (statistical model of comparison). For this purpose all calculation coefficients for every enterprise are determined in comparison of basic parameters of enterprise, which are then examined with the proper parameters on all group of enterprises. A base for comparison can be formed in one of two possible directions:

a) from all values, the proper parameter act as a base for comparison when setting norms for the proper parameters by a general model (1), which then takes the following form:

$$P_{ні} = 2^{-\frac{P_i^{кр}}{P_i}} \quad (5)$$

where $P_i^{кр}$ is the best value of «i» parameter among all enterprises which are examined;

b) all calculation coefficients for each enterprise are determined in comparing basic parameters of this enterprise to the proper parameters, which are determined as on the median of the group of enterprises which is examined. A rationing function for practical realization of this variant of calculations is as follows:

$$P_{ні} = 2^{-\frac{P_i^{ср}}{P_i}} \quad (6)$$

where $P_i^{ср} = \frac{1}{n}\sum_{j=1}^{n} P_{ij}$ is the middle value of the i-ro parameter among all enterprises *n* which are examined; P_{ij} is a value of i-ro parameter for a enterprise «*j*» in this period of time.

The use of the variant of calculation of «a» or «b» depends on the purpose of the research being conducted. For example, if a comparison of the innovative potential of a certain group of enterprises is made regularly from year to year, then a calculation on the variant of «b» will be more appropriate. In this case annual calculations will more objectively reproduce not only the current rating of enterprises on the index of innovative potential but also reproduce the dynamics of change of this rating and progressive (regressive) changes for a particular enterprise. If the comparative function of innovative potential is used validly for one occasion for a random group of enterprises, which with large probability will not be repeated in the near future, then it would be more appropriate to use the variant of calculation of «a». It should be noted that calculations on the variant of «a» are simpler, as they eliminate the calculation of median values of the proper indexes. In order to discuss the exactness of calculations with the use of variants «a» and «b», then, in our view, calculations on the variant of «a» will be much more precise, so as to reproduce the appearance of ideal innovative development in a virtual (with the set of the best indexes) enterprise. The estimated innovative potential of actual enterprises will have indexes that are not the best, while a virtual enterprise and, accordingly, the relative rating of enterprises which are examined, will be in a range from «0» to «1». The change of the best indexes (on every their name) annually can be observed at different enterprises, which will not allow us to conduct the permanent monitoring dynamics of innovative potential on a separate enterprise. If there is a necessity to conduct monitoring and comparative and dynamic constituents of innovative potential, then the calculations introduced here can be used to decide on the use of proposed variant of «b».

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