ASSESSMENT TECHNIQUE OF INNOVATIVE PRODUCTION COMPETITIVENESS

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Abstract

In the paper the assessment technique of innovative production competitiveness at various stages of life cycle taking into account an assessment of its technological level, an assessment of expenses chain and competitive advantages on each stage of life cycle of innovations is offered.

The assessment model of a technological level of innovative production based on creation of the integrated indicator considering the offered set of technical and economic parameters is offered.

Modeling of expenses chain on stages of life cycle of innovations allows to calculate the specific level of competitiveness in economic parameters and to carry out on this basis of comparison of costs of development and operation of an innovative product with similar expenses at competitors.

The analysis of competitive advantages at different stages of life cycle is based on research internal and environment of an economic entity, success factors of innovation commercialization are as a result systematized, the algorithm of innovation commercialization on the market is formed.

The complex of models offered in work allows to receive an objective assessment of innovative production competitiveness and to create effective algorithm of innovation commercialization on the market.

Keywords: competitiveness of innovative production, chain of expenses, life cycle of production, technological level of production

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Introduction

In the conditions of the growing intensity of world economy globalization paradoxically tension in the world markets increases. It is followed by toughening of competitive fight, and loss of competitive positions becomes more dangerous as modern macroeconomic dynamics leaves few chances for their return (Park et al., 2013). Especially the problem of increase of competitiveness of national economy is particularly acute for Russia which considerably lost the advantages (Dudin et al., 2014).

In Russia the current stage of market transformations is characterized by that management of difficult economic complexes and processes is significantly aggravated with problems of management in the conditions of market transformation.

For ensuring competitiveness the industrial organizations are compelled to update or improve constantly made production and to develop new technical solutions (Schumpeter, 1996). Today possibility of the organization to survive in the market is defined by its ability quickly to react to changes and the continuous innovative activity determined by its innovative potential (Sekerin & Gorokhova, 2013).

The assessment of competitiveness of an innovative industrial production should be carried out in four stages:

- assessment of a technological level of an innovative industrial production,
- an assessment of expenses chain (cumulative expenses) for life cycle of an industrial innovation,
- an assessment of competitive advantages at advance of innovative industrial production on the market,
- to definition of key success factors of an innovation commercialization.

1 Assessment of a technological level of an innovative industrial production

For an assessment of a technological level of an innovative industrial output it is accepted to form the generalizing (integrated) indicator on which value draw a conclusion about perfection of object of an assessment on the basis of its private characteristics.

For the solution of this task use various approaches and the methods based on them. In practice it is possible or to develop a method of calculation of the integrated indicator considering dynamics of change of various components of a technological level, and also level of their importance or to use a graphic method – a polygon of a technological level.

But it is difficultly to use the first approach as the importance of a technological level components can change over time that will demand processing of a method of calculation of an integrated indicator in connection with new value of scales of components.

In the second case this problem isn't necessary as the technique not rigidly fixes the importance of components, it is defined by experts.

The list of the most important characteristics (indicators) comprehensively characterizing products establish and form the massif of values of these characteristics.

It is very important to be defined, what values of indicators (big or smaller) characterize the considered objects from the best party. For example, the big mass of a product most often negatively characterizes a product (it very material-intensive), but for separate products it can serve as the positive characteristic.

For creation of a polygon of a technological level it is necessary to draw a circle of any diameter and from the center of a circle to carry out so many equidistant beams, how many characteristics are used for an assessment of perfection of a product. Each of beams intends for display of one of private estimated properties of production. On each beam scales of the indicators reflecting estimated properties randomly are under construction.

The greatest and smallest divisions of scales have to cover extreme values of the indicators which are found in the created massif of values. Provisions of the greatest and smallest divisions on each scale it is indifferent. The best values of scales are postponed from a circle.

It is necessary to carry out an expert assessment of the allocated characteristics forming a technological level of a product, for example, on a ten-mark scale. The number of points exposed by experts will influence result. Therefore by means of them it is possible to consider also the different importance of the analyzed characteristics. Than more significant characteristic, expert estimates have to be that in the bigger range of points. So the best value of an indicator can be estimated by experts and at 10 points, and at 5. The expert assessment of the same characteristics has to be less, than at the best sample.

Serially on each beam values of the indicators characterizing a separate product are postponed. The caused values connect the line forming generally a "rope" polygon. The area of the figure limited to a polygon generally reflects advantages (technological level) of a separate product. The it is more, the technological level of a product is higher.

Definition of an integrated indicator of a technological level is reduced to determination of the area of the represented polygons.

Information reflected in a polygon of a technological level allows to show a product, "ideal" for the reached level of technical development. It is characterized by a "rope" polygon, to the corresponding best values of indicators on each beam of the chart (a polygon of a technological level).

Measurement of the areas according to the constructed chart and correlation of the areas corresponding to each product with an area of a "ideal" product, allows to estimate actually technological level of each product reached at the corresponding stage of social and technical development. Thus use a formula

Kj=Sj:Su

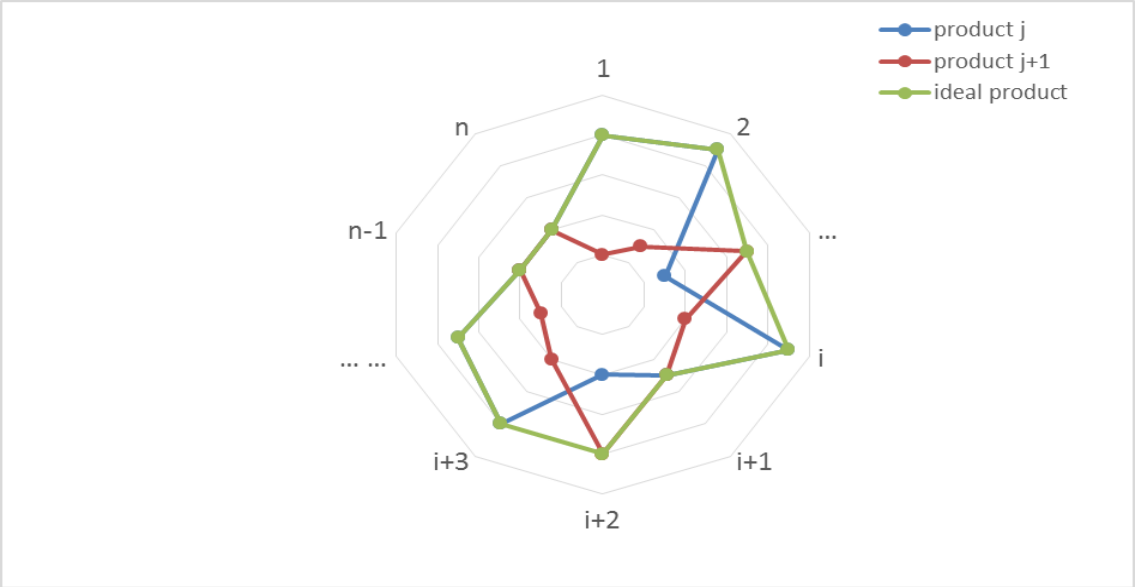
where

Kj — value of a technological level of j product, unit share;

Sj - the area of a polygon corresponding to j product, units of area

Su — the same, a "ideal" product, unit of area (see figure 1).

Fig. 1: Polygon of a technological level of an innovative industrial output



Each two next parameters, characterizing a technological level, form a triangle, one of which tops is the center of a circle, and two others are values of the corresponding parameters. Therefore, the area of this triangle can be calculated on a formula

$$S = \frac{1}{2} \times r_i \times r_{i+1} \times \sin \frac{360°}{n}$$

where

S – the area of the triangle formed by two next parameters,

n – number of parameters,

360˚- a cycle,

r_i and r_{i+1} are i and (i+1) values parameter.

Then the total area of i "rope" polygon can be calculated on a formula

$$S_j = \frac{1}{2} \times \sin\frac{360°}{n} \times \left(\sum_{i=1}^{n-1} r_i \times r_{(i+1)} + r_n \times r_1 \right)$$

The area of a "ideal" product can be calculated on a formula

$$S_u = \frac{1}{2} \times \sin\frac{360°}{n} \times \left(\sum_{i=1}^{n-1} r_i^{max} \times r_{(i+1)}^{max} + r_n^{max} \times r_1^{max} \right)$$

where

Su – the area of "ideal" product,

r_i^{max} and r_{i+1}^{max} are the maximum i and (i+1) values parameter.

Then, the technological level of j-go of a product can be calculated on a formula

$$K_j = \frac{\sum_{i=1}^{n-1} r_i \times r_{(i+1)} + r_n \times r_1}{\sum_{i=1}^{n-1} r_i^{max} \times r_{(i+1)}^{max} + r_n^{max} \times r_1^{max}}$$

It is expedient to range the analyzed objects as reduction of values of a technological level product and to reflect results of ranging in the form of the column chart.

Use of a polygon of a technological level allows to unite the quantitative and qualitative characteristics forming a technological level of production in a uniform dimensionless integrated indicator.

2 Assessment of expenses chain (cumulative expenses) for life cycle of an industrial innovation

It is advisable to practical use the following order of carrying out an assessment of a chain of cumulative expenses (sometimes "chains of expenses") for life cycle of an industrial innovation.

The calculation of competitiveness indicator for economic parameters determined by the relation of cumulative expenses for all life cycle of an industrial innovation and the competing sample is the cornerstone. Thus cumulative expenses for all life cycle are subdivided on single and current.

For calculation of level of competitiveness for economic parameters of an industrial innovation and the competing sample the formula is used

$$K_{econ\,comp} = \frac{Z^1_{total}}{Z^2_{total}} = \frac{Z^1_{\text{one-time}} + T_1 \times \sum_{i=1}^{n} Z^1_{oper\,i}}{Z^2_{\text{one-time}} + T_2 \times \sum_{k=1}^{m} Z^2_{oper\,k}}$$

where

$K_{econ\ comp}$ – competitiveness level in economic parameters of an industrial innovation and the competing sample,

Z^1_{total}, 3^2_{total} - cumulative expenses for life cycle of industrial goods according to the competing and new sample,

$Z^1_{\text{one-time}}$, $Z^2_{\text{one-time}}$ - one-time costs on competing and new developed to samples; include costs of research works and developmental development, of carrying out market researches, of production organizational technical training, of creation and introduction of the new and competing samples in structure of one-time costs,

T_1, T_2 – service life of the competing and new samples of an industrial output (according to m and n of years),

Z^1_{oper}, Z^2_{oper} - the average total current expenses consisting of costs of operation, repair and maintenance, given by one year of service according to the competing and estimated sample.

For the account in the analysis of various productivity of the developed and competing samples it is necessary to count the specific level of competitiveness in economic parameters of an industrial innovation and the competing sample:

$$K_{econ\,comp} = \frac{Z^1_{total}/q_1}{Z^2_{total}/q_2} = \frac{(Z^1_{\text{one-time}} + T_1 \times \sum_{i=1}^{n} Z^1_{oper\,i})/q_1}{(Z^2_{\text{one-time}} + T_2 \times \sum_{k=1}^{m} Z^2_{oper\,k})/q_2}$$

where

q_1 and q_2 is the productivity of the competing sample and industrial innovation respectively.

For the comparative analysis of cumulative expenses for life cycle of industrial goods according to the competing and new samples it is possible to use the following indicators: one-time costs (costs of research works, costs of developmental development, costs of market researches, costs of organizational technical training of production, costs of creation and introduction of a prototype) and current expenses (operational expenses and costs of repair and maintenance).

3 Assessment of competitive advantages at advance of innovative industrial production on the market

For an assessment of competitive advantages (the producer and/or the developer) at advance of new industrial goods on the market SWOT is expedient to apply – the analysis, thus is made an assessment of the internal environment of the industrial enterprise and environment of its activity (Mahajan, Wind, 1985). Below questions on which it is necessary to estimate position of the industrial enterprise are reflected.

Potential internal strengths of the industrial enterprise: absolute competence of all activity key aspects; sufficiency of financial resources; high quality of functional strategy; loyalty of buyers; possibility of economy from production scales; significant market share; effective management; existence of own technology; productive advertizing campaigns; ability to neutralize or reduce pressure from competitors; existence of competitive advantage on expenses; experience of innovative goods development; other (Carayannies & Grigoroudis, 2014).

Potential internal weaknesses of the industrial enterprise: lack of strategy; low profitability owing to an inefficient control system; outdated material base; insufficient administrative talents or abilities at the personnel of the enterprise; inefficient strategy of the enterprise; narrowness of the product range; lag in the sphere of research and development; internal production and technological problems; undeveloped image in the market; undeveloped marketing network; inefficient marketing activity; lack of necessary volume of money for financing of the demanded changes in strategy of the enterprise; higher product cost in comparison with the main competitors; other.

Potential external opportunities of the industrial enterprise: the direction of increasing the product range for increase in degree of satisfaction there are more than needs of clients; opportunities to make service of additional clients groups or an entry into the new markets or new market segments; existence of unique skills and/or technological know-how in production of new production or in new models already products; reduction of trade barriers in the attractive foreign markets; generation and introduction of new technologies; potential for implementation of vertical integration; weakening of market positions of the rival enterprises; other.

Potential external threats for the industrial enterprise: expansion on the market of the foreign rival enterprises, at which lower production expenses; increase in sales of goods substitutes; adverse dynamics of a trade policy of foreign countries or rates of foreign

currencies; existence of high legislative barriers and requirements; delay of growth of the market; change of tastes and needs of consumers; increase in insistence of suppliers and buyers; negative demographic dynamics; other.

4 Definition of key success factors of an innovation commercialization

During SWOT – the analysis it is necessary to define key success factors of the industrial enterprise. They should pay special attention when planning activity of the industrial enterprise as they form success (or a failure) the enterprises in the market, its competitive advantages and opportunities having direct impact on its profitability (Porter, 1980).

It is expedient to classify key success factors of the industrial enterprise for functional areas as follows: technology, sales of products, marketing, qualification of the personnel, organization of management, other (Drucker, 2007).

The maintenance of success key factors is given below:

technology – a high quality level of the realized scientific researches; possibility of production introduction of innovations; existence of technological advantages (Zhang & Yang, 2013); availability of the qualified labor; achievement of high efficiency; opportunity to organize production according to the requirement and parameters of consumers orders (Sun, 2015);

sales of products – the developed and effective network of wholesale dealers / distributors; width of access / presence at points of retail trade; low level of expenses on realization; accessory of points of retail trade to the industrial enterprise; delivery speed;

marketing – high level qualification of service marketing staff of the industrial enterprise; variety of nomenclature, range, existence of various models and/or types of production; availability of technical assistance system to clients at acquisition and use of production; accuracy of execution of consumers orders; art of sales; existence of guarantees upon purchase; appeal of design / packing;

qualification of the personnel – purposeful, talented workers; possession of a know-how in the sphere of production quality control (Kucharčíková, 2014); mastering level of workers concrete technologies; experience of development and carrying out effective advertizing campaigns (Šikýř, 2011);

the organization of management – high extent of information systems development; high speed of reaction to changes of a market situation; existence of wide practical experience, various know-how in the field of management of the economic subject;

the other – positive image / reputation of the company; low expenses; advantage of a territorial arrangement (Freeman, 2005); development of business communications at workers, their goodwill to buyers; existence at the company of access to the financial markets; existence at the industrial company of patents and licenses.

Conclusion

In article the technique of an assessment of competitiveness of an innovative industrial product including four stages is proved: an assessment of a technological level of an innovative industrial output, an assessment of a expenses chain for life cycle of an industrial innovation, an assessment of competitive advantages at advance of innovative industrial goods on the market, definition of success key factors of innovation commercialization. Its practical use allows to receive an objective assessment of level of competitiveness of an innovative industrial output and to create effective algorithm of its removal on the market.

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