

Principal issues of innovation activity development at machine building companies

Oleg Blinkov^{1,*}

¹Ural Federal University named after the first President of Russia B. N. Yeltsin, Russia

Abstract. The article is dedicated to the principal issues of innovation activity development at machine building companies. It considers a method to create a portfolio of innovative solutions, whose implementation would allow the company to solve the issues and increase competitiveness of the company's products.

Scientific management development of foreign and national researchers convincingly proves that the improvement of any object, development of any types of measures to improve the situation should begin with clarification, identification and assessment of the actual state of this object – in other words with the diagnostic process [1-3]. Given that in the current economic conditions one of the main factors of competitiveness between machine building companies is innovation activity, in our opinion “making a diagnosis” for any enterprise actually means to determine its growth directions and to develop appropriate organizational adjustment ensuring the effectiveness of implementation thereof.

Therefore, the first stage of diagnostics is to analyze the current state of the enterprise, identify its main problems and their effect upon competitiveness of the enterprise (internal diagnostics).

The main industrial problems that most commonly arise in the machine building activity are as follows:

- low organizational level of production and labor, including the growing problems associated with the imperfection of organizational management structure;
- low level of cooperation of production;
- low applicability of modern information technology, both in production and in organizational and management processes;
- large proportion of business units not contributing to obtaining economic results through the company's activity in general, in other words operating costs that exceed the results and accordingly are not profitable;
- disorder of management personnel structure determined by the nonconformity of the number of business units to the established regulatory requirements of the enterprise, may be caused by the company's growing pains;
- unjustified distension of management personnel or overburdened managers.

* Corresponding author: blinkovog@gmail.com

The main social and environmental challenges that most commonly arise in the company's activity may be identified as follows:

- ✓ poor quality of its output products and as a consequence its lack of competitiveness and low sales;
 - ✓ low-skilled employees that cause both inconsistencies in production and increased probability of getting injured;
 - ✓ poor ergonomics and therefore occupational safety violation, high occupational morbidity, and fatal injuries;
 - ✓ considerable volume of production waste and emissions of harmful components into the atmosphere, water and soil;
 - ✓ fines for violation of environmental law.
- The main market and economic challenges may be identified as follows:
- ✓ overexposure to import of spare parts and accessories;
 - ✓ high cost of borrowed sources of financing in the liquidity shortage of the financial markets;
 - ✓ low sales caused by low share of research and development carried out on the basis of marketing research;
 - ✓ high production costs;
 - ✓ products fail to meet the global quality standards;
 - ✓ overpricing of products of low quality.

Therefore, identification and systematization of the existing problems of the enterprise allows identifying the specific objectives for implementation of innovation processes and development of innovation activity of the enterprise as a whole, in other words determining the purposive approach to construction of portfolio of innovative solutions [4-6]. They may be:

Q – output product quality improvement/product quality improvement up to the international standards;

P – product price reduction while maintaining its previous characteristics and properties;

R – reduction of output production costs through R&D development, application of new technologies, development of import substitution and introduction of new methods of labor management;

V – increase in production program and sales volume through equipment upgrades and introduction of new methods of marketing research;

M – development of new markets for old/new products.

Thereafter, it is necessary to set combinations of objectives which in the current challenging market conditions are required for the enterprise to be implemented, taking into account the previously identified problem areas of its operation. Therefore, the second stage of diagnostics should be to analyze the market situation as a whole, including consumer requirements, industrial novelty, level of competition, development of market innovation, life cycle of output products and the company in general (external diagnosis). All of these factors contribute to a certain combination of objectives that the company needs to achieve to ensure its survival and competitiveness.

Traditional combinations that are most often used by businesses in the current economic conditions are shown in Table 1. Index 1 in the “Combination of objectives” column in Table 1 indicates that no change is made; Index 2 indicates the necessity for improvement of the defined direction of the company's activity.

For example, the first three combinations of objectives do not require any of innovations, their achievement is possible through rationalization of use of domestic resources, quality control strengthening, observance of shop-floor discipline, reduction in staff performing substandard work or provoking conflicts between colleagues – this is a conservative strategy.

The combinations of objectives as shown in lines 4 to 8 in Table 1 are typically implemented by innovators or simulants. They are more risky, but at the same time more progressive strategies with a longer positive effect from their implementation.

Table 1. Production growth directions.

No	Combination of objectives	Production growth direction
1	$Q_1P_1R_1V_1M_1$	Common production
2	$Q_2P_1R_1V_1M_1$	Premium output
3	$Q_1P_2R_1V_1M_1$	Output at reduced price for implementation thereof
4	$Q_1P_1R_2V_1M_1$	Output with the use of resource saving technology
5	$Q_2P_1R_1V_2M_2$	Expanded production for old and new markets
6	$Q_1P_2R_2V_2M_1$	Manufacture of old products using new technology
7	$Q_1P_1R_2V_2M_2$	Manufacture of old products for old and new markets
8	$Q_2P_2R_2V_2M_2$	Expanded production of new products using new technology for old and new markets

Besides, it should be noted that the market determines the directions of innovation activity by predefining the following:

- necessity for new and innovative solutions;
- alternatives when choosing a particular innovation process;
- timing of the innovation process and novelties in the market;
- procedure of placing novelty on the market;
- scope of innovation distribution;
- terms of innovation use and its replacement with a new one.

Therefore, it is necessary to further determine which innovations will ensure the achievement of the desired combination of objectives. Matrix that establishes a conditional dependence of achievement of the company’s strategic goals on implementation of specific types of innovation is presented as an example (Table 2).

However, there may be a great number of types of implementation of the selected combination of objectives. For example, Table 1 shows that the quality is affected by all types of innovation; however, their impact is different. It is also necessary to know the compatibility of some innovations with others, how they may be simultaneously implemented on the shop floor and how they may complement each other.

For example, the introduction of modern integrated management systems such as SAP ERP, Baan, BPCS, Oracle, etc., allow online taking of the most important solutions through the integration of different micro-processes, (Table 3).

Table 2. Types of innovation required to implement the strategy.

Types of innovation	Q	P	R	V	M
1. Development of invention and products based thereon	+		+		+
2. Research and development of new resource-saving technology and creating products based thereon			+		
3. Acquisition of new technology and creating products based thereon	+	+	+		
4. Acquisition of machinery and equipment	+		+	+	
5. Improvement of production engineering based on know-how	+			+	
6. Introduction of new or improvement of existing quality management system	+		+	+	+
7. Introduction of new methods of training	+			+	
8. Introduction of new methods of marketing research	+			+	+
9. Introduction of information technology			+	+	

These systems are based on quick decision simulation depending on market, scientific and manufacturing situation and the access to databases of such decisions ensures maximum involvement of employees in the process. Then we see that the implementation of an integrated system of such complexity does not only affect the whole system of management, but also entails innovations in labor management, having impact on changes in technology and production processes, enabling them to optimize their basic components, which in turn leads to a long-term implementation (subject to installation and arrangement of new operational environment by experts, the term is defined as 12 months; subject to self-tuning and improvement of the activity, the term may be increased up to 1-3 years). Accordingly, the implementation of medium and large integrated systems may be defined as the corporate innovation process of average complexity, and installation and start-up of local systems – as a simple innovation process, as it involves only one functional area of activity, and about a week is required for implementation; staff adaptation to this system is connected with training, therefore the total time does not exceed one month.

Table 3. Integrated management system.

Parameters	Local systems	Small integrated systems	Medium integrated systems	Large integrated systems
System name	1C, BEST, IPOTEK, Super Manager etc.	Concord XAL, Exact, Parus, Galaktika, Etalon etc.	JD Edwards, MFG-Pro, SyteLine etc.	SAP ERP, Baan, BPCS, Oracle etc.
Functionality	Activity-specific accounting systems	Integrated function management	Integrated management	Integrated management
Implementation time	1 to 5 days	More than 4 months	More than 6 to 9 months	More than 12 months

Therefore, a portfolio of innovative solutions that constitutes a justified market-based list of innovation processes of various complexity, the implementation of which is necessary for the company’s survival or its efficient operation in the difficult macroeconomic conditions inherent to the current Russian economy, is being formed [7,8].

References

1. S.N. Yashin, E.V. Koshelev, S.A. Makarov, *Analysis of the effectiveness of innovative activity*, BHV: Sankt-Petersburg, (2012)
2. P. Druker, *Innovation and Entrepreneurship: Translated from English*, (Williams: Kiev, 2007)
3. M.N. Mescon, M. Albert, F. Khedouri, *Management: Translated from English*, (Delo: Moscow, 1992)
4. A.E. Gerasimov, Problems of Innovative Activity Efficiency Improvement. *Innovatsii*, **12(9)**, (2001)
5. K.K Prakhalad, M.S. Krishnan, *The space business innovation. Creating value together with the consumer*, (Alpina publisher: Moscow, 2012)
6. Knowledge Management in the Learning Society. – Paris: OECD (Organization for Economic Cooperation and Development), (2000)
7. Ural Branch of the Russian Academy of Sciences. The Institute of Economics, 29, Moskovskaya str., Ekaterinburg, Russia, <http://www.uiec.ru/>.
8. A.A. Chulok, *Analysis of Innovation Efficiency Indicators at Micro and Macro Levels*. *Innovatsii*, **12(5)**, (2004)