



¹ Dusan SABADKA

INNOVATION POTENTIAL METRICS

¹ TECHNICAL UNIVERSITY OF KOSICE, FACULTY OF MECHANICAL ENGINEERING, SLOVAKIA

ABSTRACT: The Innovation Potential Indicator looks at behaviors that affect how new ideas, processes and products are generated, developed and implemented. For organizations fuelled by new ideas and constant change, this assessment bridges the gap between what you know about someone in the present and their future potential for innovation and creativity.

KEYWORDS: competitiveness, innovation potential, management, innovation metrics

INTRODUCTION

Systematic innovation management is a key driver for competitiveness in small and medium sized companies. The successful realization of vision and innovation strategy in business practice is subject to conditions existence which is determining related innovation activity. The first place from among conditions is going to innovation potential. The capacity of innovation potential is created by subject capability to effective activity considering conditions and opportunities. In the case of enterprise innovation capacity is created by overall ability to performance. Fundamental prerequisite for enterprise, to receive better competitive position on the branch of business or to improve position on the market, is its potential to be highly innovative level and constitutes an essential element of effective pro-innovation business system.

THE ROLE OF METRICS IN INNOVATION MANAGEMENT

To evaluation and consequently to take actions to improve the innovative potential of enterprises appropriate metrics are needed. Metrics are used in different areas to assess the level of systems and processes defined by a set of quantitative and qualitative benchmarks. Definition of metrics is implemented through the measured or described indicator measurement procedure and its frequency and criteria enabling evaluation of its achieved or planned level (the limit value, best value, etc.). Method of innovation potential evaluation of enterprises using metrics is in practice effective for the following reasons:

- possibility to compare of evaluative criteria with other types of innovation metrics,
- flexibility for various conditions that means modification in the economic crisis, in change of the territory business, with new customer requirements,
- existence of models and evaluation of innovation in business analysis and statistics a similar profiling,
- activating effect of innovation metrics in the company evaluation of effectiveness, motivation, etc..

The role of metrics in business innovation processes [9]:

- create a strategic direction for innovative activities and the need for signal changes in priorities,
- identify critical points of innovation processes,
- regulate the allocation of resources for innovation projects,
- allow evaluation of the effectiveness of spending on innovation and the comparison result compared to objectives,
- promote the responsibility of business management for innovation,
- metrics allow to set objectives for the partial parameters of innovation and localize incentives to achieve the objectives,
- motivate employees to innovate through business incentives tied to metrics,
- quantify the level of the innovative potential and make a diagnosis problems but also opportunities to develop.

Metrics as innovation management tool include [8]:

1. **Planning:** participation of key stakeholders in the creation of metrics that support identification of sources of value creation and implementation of business strategy.
2. **Monitoring:** structured measurement and evaluation activity of innovation business parameters and comparison with targets. Allows you to define the necessary modifications of strategies and projects.
3. **Implementation and learning:** the continuous feedback evaluates progress and a new opportunity for innovations.

As a basis for the model of analyze and evaluation of business innovation potential have been examined of several authors and organizations approaches, [5] [6] [14] [15]. According to the authors Pitner, Švejda [12] the innovation potential represents overall capacity of the company (including its departments and units) to a successful, effective carrying out of vision. The level of quality and innovation potential of the business is important to company reached a high level of innovation in the following areas of business management:

- technical and technological level, including research and development
- sales and marketing level,
- the level of logistics
- human resources
- management

ANALYSIS OF INNOVATION POTENTIAL EVALUATION METHODS

Creating and managing effective creation and implementation of innovation requires define and communicate the appropriate metrics. It is a strategic approach that begins with business strategy for growth and competitiveness and feeds into the related innovative projects and business processes. There are many tools for measure the level of innovation potential, either from microeconomic or macroeconomic perspective.

The macroeconomic view of innovation potential at national level is the capacity to develop and advance further. The evaluation and measurement deals with competitive advantages of regions or states. This potential is proportional with the country's, or region's available intellectual assets including all public goods and intellectual properties. The number of patent applications reflects well a country's intentions to improve and develop. A country's innovation potential also depends on the material and financial resources provided for these purposes, which corresponds with the size of the GDP [1] [4] [17].

On the other side there is a microeconomic measurement of innovation potential on the firm's level. It can be measure through innovation potential indicators, which is relevant to firm's departments related to innovation or affects innovation performance. At the microeconomic level, innovation can be measured by the research and development, effectiveness of production process, customer satisfaction, innovation and technology transfer, and the motivation of employees. This level includes for example: revenues from the sale of new products, the cost of research and development, length of new product life cycle, the number of patents, or the introduction of new production and information technology.

Both perspectives is important for evaluation of innovation exploitation in relevant environment. It is possible to make a summary of some examples.

BALANCED SCORECARD

Among the most important methods for evaluating the complex business performance is method "The Balanced Scorecard performance" by authors Kaplan and Norton. The balanced scorecard suggests that we view the organization from four perspectives, and to develop metrics, collect data and analyze it relative to each of these perspectives: Learning and growth perspective, The business process perspective, The customer perspective, The financial perspective [5].As the concept of benchmarks the performance of R&D process are listed these examples [5]:

- the percentage of new products,
- the percentage of new products protected by patents,
- introduction of a new product to market in less time than its competitors,
- payback costs for R & D,
- operating profit rate of new products within a specified timeframe the cost of R & D.

APPLICATION METHODS OF CONSULTING FIRMS

A large group of methodologies dealing with the innovation level is application procedures for re-engineering consulting firms and innovative projects. As an example, can be present "a global comparative study of manufacturing firms - Deloitte & Touche." In this type of expert survey methodology, innovations are integrated into each processes of the supplier - customer chain:

- strategy, product innovation, new services, time to market, flexibility to customer requirements, e-technology, software systems,
- management, innovative information and forecasts, product changes, changes in production, innovative communication, research and development, design and engineering, lean production, kaizen, rapid technology changes and alterations, and others,
- benchmarks of performance, revenue growth, market share growth, return on capital and more.

The advantage of this type of methodology is being supported by an extensive base factual data, limiting is the generality of application.

EVALUATION DEVELOPED BY A COOPERATION OF UNIVERSITY - EU PROGRAMS

Department of Management Innovation and FEK projects under the Leonardo da Vinci "U-SME Innovation: Design of a model for joint University - SME Innovation"

develop a methodology for assessing the innovative potential of SMEs, training modules for increase the innovation performance of firms and the layouts of introducing a system procedure work with innovations in the company. The methodology maps several problem areas related to innovation potential of the company. These include:

1. Strategy and planning
2. Marketing
3. Technological process
4. Quality, environment
5. Logistics
6. Organization and human resources

The aim of questionnaire is to assess the innovation potential of the company on whose basis is then designed another program to introduce the work system with innovations in order to increase customer satisfaction and other stakeholders

THE METHODOLOGY OF PROCESSING OF INNOVATION CHARACTERISTICS BY THE OECD

In the publication "Oslo Manual: Guidelines for collecting and interpreting innovation data"[11] prepared by the OECD and the European Commission has established a set of instructions that can be used to create comparable indicators of the innovation process. Manual examines the problems of methodology and interpretation, which is possible to meet during use of indicators. Scope of the Manual:

- Manual covers innovation only in the business sector
- Deals with innovation at the firm level
- Focuses on technical and production process innovation, while providing optional guidelines for other forms of innovation such as. organizational change
- Covers the dissemination of information to the level of "new to firm"

MODEL OF INNOVATION POTENTIAL

Innovation potential of enterprise is an internal characteristic, and for its development is a needed objectified indicator capable of identifying critical areas and use a competitive advantage.

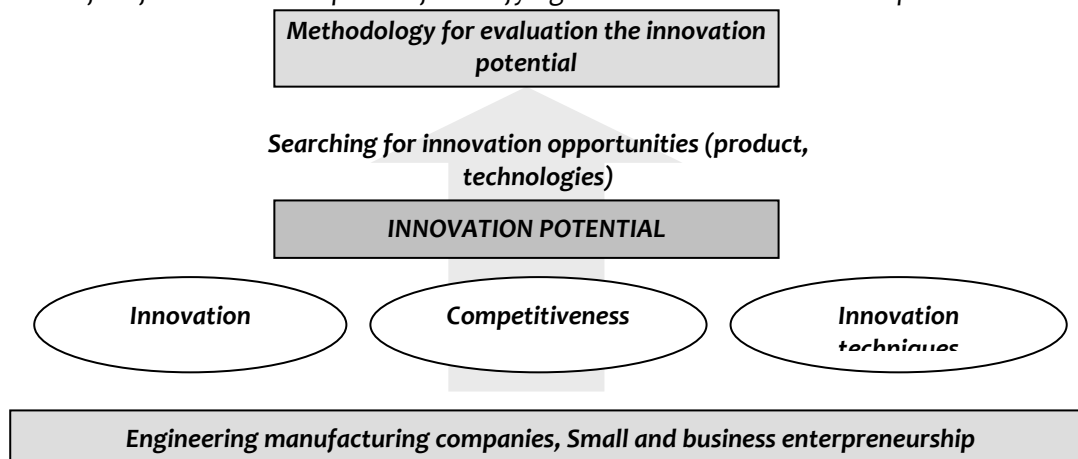


Fig. 1: Concept for evaluation of innovation potential. Source: Own processing

Evaluation of innovation potential of enterprise currently being addressed in two ways. The first focuses on an integrated level of performance the other is specializing in the evaluation of the components of corporate responsibility.

The target focuses of innovation potential evaluation:

1. Prepare of business strategy changes in terms of innovation
2. Finding new opportunities to improve the competitive position of its strengths.
3. Identification of critical points and the procedures for their elimination.
4. Identifying potential risks and the basis for elimination scenarios
5. The integration of innovation business activities, motivation of employees, receive partnerships for innovation projects

Based on the above approaches to the evaluation of performance and businesses innovation potential, it can be concluded that the innovation potential of business concerns all areas of business environment. The most important are:

- Products (services)
- Production (implementation) processes
- Supplier relationships
- Marketing, sales

- Organizing system, people management
- Financial Management
- Information Technology
- Cooperation and networks

At the Technical University of Košice, Faculty of Mechanical Engineering has been developed evaluation methodology of the innovation potential for engineering companies that maps some company areas directly to issues affecting innovation. The proposed model of innovation potential consists of ten modules that map individual business areas directly related to the issue of innovation. The model of innovation potential is shown in Fig. 2. Each area is associated with a number of evaluation indicators on which is fix the final level of innovation potential. The last step is to determine the position of the company in terms of its competitiveness and search capabilities to improve.

The choice of structuring the audit of 10 modules corresponding to the generally applicable approach to resultant organizational units. The modules are particularly accentuated to:

- significance of business management, organization and human resources,
- market position, taking into account potential risks and changes
- existence and significance of research and development base,
- modules products and technology with the flexibility of adaptation to new requirements
- the financing of innovation and allocation of resource utilization,
- importance of partnerships and alliances as part of globalization,
- application of innovative techniques such as knowledge orientation of the business.

The actual evaluation of innovation potential is realized by the innovation internal audit. The audit is based on the method of assessment of pre-selected criteria and indicators compiled by the structure of the model of innovation potential.

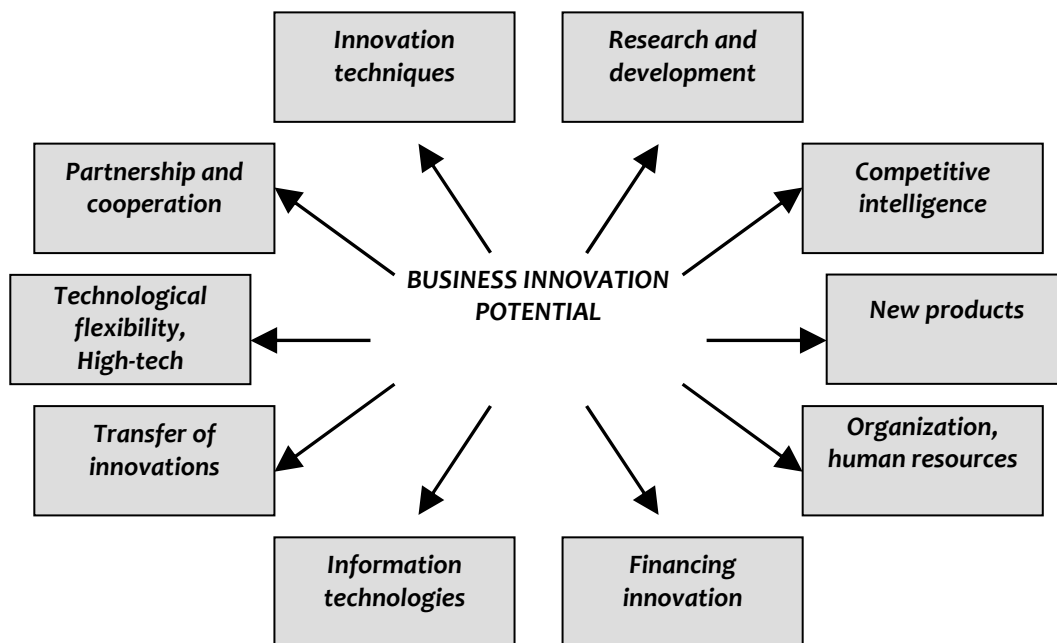


Fig. 2: Model of innovation potential. Source: Own processing

MODULES AND INDICATORS

This chapter provides a brief characteristics of each module, with an emphasis on innovation issues, and each module is associated with set of areas of evaluation (indicators).

Module 1: Research and development

The main task of business R&D is to bring innovation successfully to target market. In various stages of the innovation process ongoing in the company, staff of R & D units needs to participate in the creation of new product at the synergistic interdependence with other organizational units of competence (marketing, manufacturing, finance ...). The share of technical and technological information, generated by the corporate research employees, has controlling interests in deciding about next procedure of innovation especially in the early stages of development.

The areas of evaluation: the existence of its own R&D base, employees of research and development, R&D costs, product development cycles, implementation of R & D results in practice.

Module 2: New Products

The products are a key outcome of the production activity of the company and its core of competitiveness. The competitiveness of the products is influenced by several interrelated

factors. The dominant position of the product in business results from the fact that it is means of satisfying customer needs and through sales of products to achieve business income.

The areas of evaluation: the introduction of new and innovation products, economics of product innovation, level of quality and reliability, technological level of new product application of innovative techniques for reducing the cycle time of new product development, innovations of production processes, marketing aspect of innovative products.

Module 3: Technological flexibility, high-tech

The very nature of innovation and technological development shows that new ideas often come from unexpected areas which tend to be the intersection of two disciplines or technology sectors. Some very successful innovative practices are not the result of latest research, but the result of new applications of existing modern technology.

The general significance of technology level for business competitiveness based on the following factors:

- technological system binds a substantial part of business resources
- technology is the dominant factor determining the efficiency and effectiveness (productivity and quality)
- changes in technology in the world based on technology transfer, and high-tech system approaches

The areas of evaluation: current level of production technology, equipment manufacturing devices, applying new technologies in the industry, technology investments, factor of flexibility.

Module 4: Organization and Human Resources

Permanent changes reduce the need for precise definition of the classical requirement individual jobs and their respective work tasks. A typical feature is overcoming narrow specialization. They provide comprehensive, integrated work roles by expanded and enriched the content of work, strengthens the power of individuals and groups. For workers, this means better use of their potential, acquire new knowledge and experience, learning problems in multiple contexts.

The areas of evaluation: the level of organization and business management, implementation and management of innovation projects, increasing performance of processes and the level of benefits,, support from management, implementation of innovative policies and strategies, quality of labor and social environment, the area of personnel management, motivation and employee satisfaction, training and retraining.

Module 5: Information Technologies

Information technology has significantly changing the ability of firms to respond adequate for commercial opportunities and to emerging competitive threats. The use of information systems operated by means of information technology to strengthen the strategic capabilities organizations can be characterized increasing productivity, accelerating innovation and improving processes and building strategic information resources.

The areas of evaluation: the level of information technology use, computer aided systems design, purpose of information technology use, internet use, Internet communication.

Module 6: Financing Innovation

Innovative business faces the problem of increased need for funding and therefore drafting a business plan with realistic foundations is necessary assumption to success. Securing financial resources for innovation business means to find the money for production, marketing and sales, research and development.

The areas of evaluation: resource allocation for innovation, innovation projects financing, availability of resources for investment in the necessary extent.

Module 7: Transfer of innovations

Among the motive forces of transfer development are overcome the lack of own resources and reduce R&D costs, drastically reduce the time of innovation preparation and reduce the risk of innovation and globalization trends, shortening innovation cycles and increasing competition.

The areas of evaluation: the level of cooperation with research and development organization or university, subjects of transfer, the transfer application to business, the potential benefits of transfer, use transfer services.

Module 8: Partnerships and Cooperation

The existence of a high level of partnership is an important source of competitive advantage. The main objectives of the partnership include: integration of resources for new opportunities, cost reduction, shorter innovation cycles, and transfer of knowledge.

The areas of evaluation: business cooperation, participation in innovation networks, external funding.

Module 9: The innovation intelligence system

As an important innovation tool is applied the complex information systems type of Competitor Intelligence, which transforms disaggregated data about competitors and other entities to strategically useful knowledge for business management. In the analysis of the industry is generally preferred structuring of intelligence by the following groups:

- customers, suppliers, direct competitors,
- firms with substituting goods
- companies with the potential entry into the sector, global business conditions (macroeconomic, political, legislative, social and technical).

Areas of evaluation: application rate of the intelligence systems in the enterprise, the relevance of focus intelligence system, identify the drivers of innovation, the existence of new opportunities

Module 10: Innovative techniques

Innovative management techniques are based on a process approach, which basic principle is to continuously improve business processes. The basic mission of these techniques is a positive influence the method of management, which is systematically identifies the business processes and their attributes, creates the conditions for their effective process, coordination, measurement and continuous improvement. The result is good product integrating customer requirements and business strategy.

Areas of evaluation: application of innovative techniques and tools, level of selected innovative techniques utilization, the use of project management techniques, techniques for design and product development, methodological tools for preparation of innovation techniques and improvements.

CONCLUSIONS

To utilize of innovation potential can be used more or less complex management systems of the innovation process, which are very close to the knowledge management systems. But it is very important, that complexity of the system is corresponding with the level of the innovation potential and culture of business staff. The barriers of the development of innovation potential in Slovakia and its regions can be summarized in the following groups:

- deficit in physical infrastructure,
- lack of access to capital,
- weak structure of supporting institutions,
- regional isolation,
- lack of demand for R&D results by business sector and poor funding of research activities in the business sector,
- research and education sector does not provide sufficient incentives for business sector.
- fragmentation of innovation policy and low motivation for introduction of business innovations.

According to several surveys of the of the innovation potential evaluation of small and medium-sized enterprises [6] [10] [11], have been found the following deficiencies:

- Innovations are usually not a key process in the enterprise.
- Innovation process is based on technology transfer more than for its own research and development.
- There is a lack of interest and unwillingness of owners and top managers to undergo risk.
- Absence of a systematic methodology for the use of innovative potential. Innovation is often confused with the methods of developing new products without links to customer.
- Lack of innovative business culture.
- Lack of comprehensive marketing information systems modeling future markets, monitoring of customer needs, defining pricing strategies analysis of new opportunities for development and expansion.
- The lack of a comprehensive evaluation of the benefits of innovation. The assessment is based usually only on the basis of economic indicators. This method is dependent on determination of revenues resulting from innovation, which is very difficult, especially in primary stages of the process, which is not seen as a finished product will look like and who will target customers promising innovations, dominated focus on certainty.

The benefits of using the innovation potential:

- increase the competitiveness of the company;
- accelerated innovation of products and services offered;
- will bring a positive change in the culture of the company;
- minimize losses arising from non-use of existing innovative potential employees of the company;
- enable into the innovation process involve customers and business partners of company;
- improved relationships with business partners;

- increase the positive image of the company.

Perspectives of the innovation potential development of SMEs engineering focus can be summarized in the following conclusions:

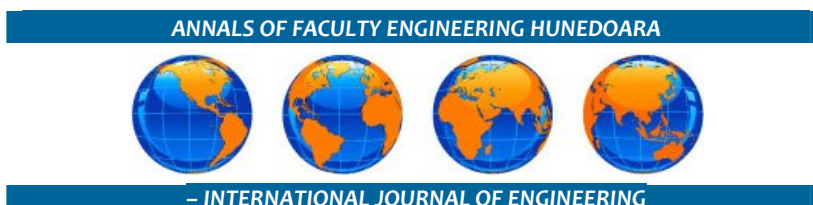
- The active implemented innovation process should be a key process ensuring a competitive advantage.
- The effective use and development of innovation potential has a positive impact on improving competitiveness and business performance.
- Innovative activities are devoted mainly medium and large enterprises that have sufficient resources.

ACKNOWLEDGEMENT

The contribution is part of a research project „Centre for Management Research technical, environmental and human risks for sustainable development of production and products in engineering" (ITMS: 26220120060) on the grounds of promoting operational research and development program financed by the European Regional Development Fund.

REFERENCES

- [1.] Blažek, L. a kol.: Metodická východiska zkoumání a řízení inovační výkonnosti podniku. 11/2005 Working Papers. Centra výzkumu konkurenční schopnosti české ekonomiky, Brno ISSN 1801-4496
- [2.] European Commission: Innovation Management and Knowledge – Driven Economy. Brussels – Luxembourg 2004. http://www.innovation.lv/ino2/publications/studies_innovation_management_final_report.pdf
- [3.] Eurostat: SMEs and entrepreneurship in the EU. 2006: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-NP-06-024/EN/KS-NP-06-024-EN.PDF
- [4.] Jáč, I.- Rydvalová, P.,-Žižka, M.: Inovace v malém a středním podnikání. Brno. Computer Press 2005. ISBN 80-251-0853-8
- [5.] Kaplan R., Norton D.: Balanced Scorecard: Strategický systém merania výkonnosti podniku. Management Press, Praha 2002. ISBN 80-7261-063-5
- [6.] Kaplan, S., Winby, S.: Innovation Metrics - Measuring Innovation to Drive Strategic Business Growth. InnovationPoint LLC. <http://www.innovation-point.com/Innovation%20Metrics.pdf>
- [7.] Kováč, M., Sabadka, D.: Model inovačného potenciálu podniku. In. Transfer inovácií č.7/2004. <http://www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/7-2004/pdf/3-6.pdf>
- [8.] Kováč, M., Sabadka, D.: Primárna úloha inovačného potenciálu v zvyšovaní produktivity firmy. In: Acta Mechanica Slovaca roč. 8, č. 2-b (2004), s. 231-236. ISSN 1335-2393
- [9.] Kováč, M.: Aplikácia metrík pre stimulovanie inovácií. In. Transfer inovácií č.16/2010. <http://www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/16-2010/pdf/008-011.pdf>
- [10.] NADSME: Výskum v prospech malých a stredných podnikov. Národná agentúra pre rozvoj malého a stredného podnikania Bratislava, marec 2007. www.nadsme.sk
- [11.] OECD: Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data. OECD publishing, 3rd edition 2005. ISBN 92-64-01308-3
- [12.] Pittner, M., Švejda, P.: Řízení inovací v podniku. 1.vyd. Praha. Asociace inovačního podnikání. 2004. ISBN 80-903153-2-1
- [13.] Sabadka D.: Audit inovačného potenciálu podniku. In. Transfer inovácií č. 7/2004. ISBN 80-7093-6
- [14.] Sabadka D.: Vybrané metódy a techniky pre zvyšovanie inovačného potenciálu výrobných podnikov. Doktorandská dizertačná práca. SJF TU Košice 2004.
- [15.] Švejda, P. a kol.: Inovační podnikání. Praha. Asociace inovačního podnikání. 2007. ISBN 978-80-903153-6-5



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