

THEORETICAL INSIGHTS OF SUMMARY INNOVATION INDEX AND RELATED FACTORS

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Annotation

When Lithuania has been a part of the European Union, it has one of the most important objectives of the EU - to invest in the growth of the scientific potential to promote sustainable economic growth, social welfare and the realization of new markets in the global environment. Promoting innovation and deployment in the country, it is focused on the rapid and potentially broader technological modernization, ensuring high productivity and growth of all economic units of production quality improvement rates. For these reasons, the innovation index and its determinants assessment is essential to effective management decisions of state and business.

It is important for global markets realized innovation and deployment strategy to balance and maintain the government, business and higher education sectors. Related factors of innovations that contribute to sustainable economic growth and technological potential in different fields and sectors, there is a necessity to identify the related factors of innovations and evaluate its the impact for the application and development of innovation. This analysis can identify the economic and technological progress of incentives.

The purpose of this paper is analyze the related factors of Summary Innovation Index. This paper provides the theoretical insights of innovation conception, innovation influencing factors and related economic indicators which have impact for Summary Innovation index. Also it is reviewed Global Innovation Index, Innovation Capacity Index, Technology Achievement Index and Knowledge Economy Index. Achieving this purpose it is used a literature review and synthesis to conceptualize the field of innovations.

Key words: *innovation, summary innovation index, economic indicators.*

1. The conception of innovations

In order to properly investigate the significance of innovation and impact on economic development, it is necessary to identify the innovation definition, overview of academic research and to carry out the synthesis. To review the methods evaluated innovation development, to assess the positive and problematic aspects. Analyze what the macro and micro-economic indicators have a direct and indirect impact on the development of innovation and implementation. Defining correlation and linear regression models analysis methodology and problematic aspects.

The essential characteristics of innovation. According to Schumpeter (1996) innovation is related with the changes which create new products, production resources, markets and the emergence of circulation. Also innovation associated with industrial forms of implementation and economic development. Schumpeter define this concept by five phenomena that are important for the economic development (Figure 1).

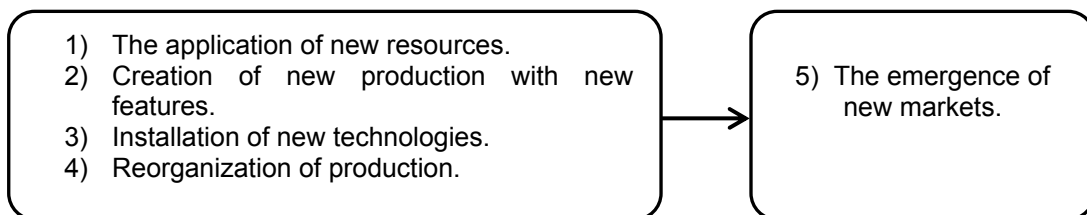


Fig. 1. Five phenomena that are important for the economic development.

Note: adapted by the author according to Schumpeter (1996) and Rogers (1998).

Schumpeter (1996) highlighted the emergence of new markets in the process, arguing that innovation has a greater impact than price competition based by economic development theory. Despite the market skepticism of the innovation, the successful development and application of innovation, market regulation mechanism is activated and eliminates the organizations that use the old technologies (Fig. 1). This provision has denied Neoclassicism theory which formed the view that the value is dependent on supply and demand. Neoclassicism treated the importance of mechanisms, which promoted the rapid development of production and led to the lowest price in the market (Čiegis, 2006). It is obvious that J. A. Schumpeter polemics statements was revolutionary for the production and economic evolution

levels, as emphasized innovation, knowledge and technological progress influence for the competitiveness of enterprises. The analysis of conception of innovation showed that it is identified quite differently. According to Filipescu et al. (2013), Anišic et al. (2013), Perdomo-Ortiz et al. (2009), Godin (2008), Melnik et al. (2000), scientific insights of innovation, all characterized it as an effective commercial application of new technologies, ideas and methods which related with developing new products or improving long egzisting resources or processes in the market. Often innovation compared to inventions that are interpreted as a new idea of a product or a process development and practical implementation, but these concepts are not identical. It is considered that innovation can be interpreted in two ways. However, Swan (2009) innovation linked to the invention of commercial introduction in the market and separated the concepts of innovation and invention. Such a provision gives a polemic view by Drucker (2004) that innovation given the ability to notice the change and use it effectively in the process of business and that it does not require generation of new ideas or special talent. Jakubavičius et al. (2003) emphasized entrepreneurial origins of innovation, that it can only be defined as an improvement. The analysis of the scientific literature shown that innovation is an effective innovation project that creates a new service, product, or process of the monitoring. On the other hand, the result of the project can be an existing idea, service or product improvement, given by the rapid technology deployment and project resulted into the commercial applications, which would be linked to the profits, productivity and increase of a competitiveness. It is necessary to respond quickly to market changes and adapt, innovation management processes in a globalized economy with rapid technological progress.

Theoretical classification of innovation in the scientific literature is analyzed by innovation content. Jakubavičius et al. (2003), Staskevicius (2004) argued that innovation occurred as the existing service or product improvements, it would be appropriate to classify the innovation in scientific and economic fields as well as efficiency. Ališauskas et al. (2005) distinguished between two types of innovative processes: modified and radical innovations. The authors believed that the radical innovation due to the fundamental changes in organizations and modified innovation related with an effective improvement of existing products and services. Valentinavičius (2006) analyzed the innovation grading methods and the fact that the priority of this methodology the author has chosen the Oslo Manual (Eng. Oslo Manual), the classification for targeted scientific and methodological innovation activities and evaluation. Using statistical indicators of innovation, innovation differentiated according to three indicators: production, education and services.

The Oslo Manual (1997) methodology and the importance are focused on the application of technological innovations in a production field (Fig. 2). Product innovations can be related to an external and an internal product improvements or changes in the properties.

Innovation schematic classification of the Organization for Economic Cooperation and Development (hereinafter - OECD) methodology analyzed the processes focusing not only on products and processes, but also focusing on innovation activities for better understanding the essence of business activities and operations (Fig. 2).

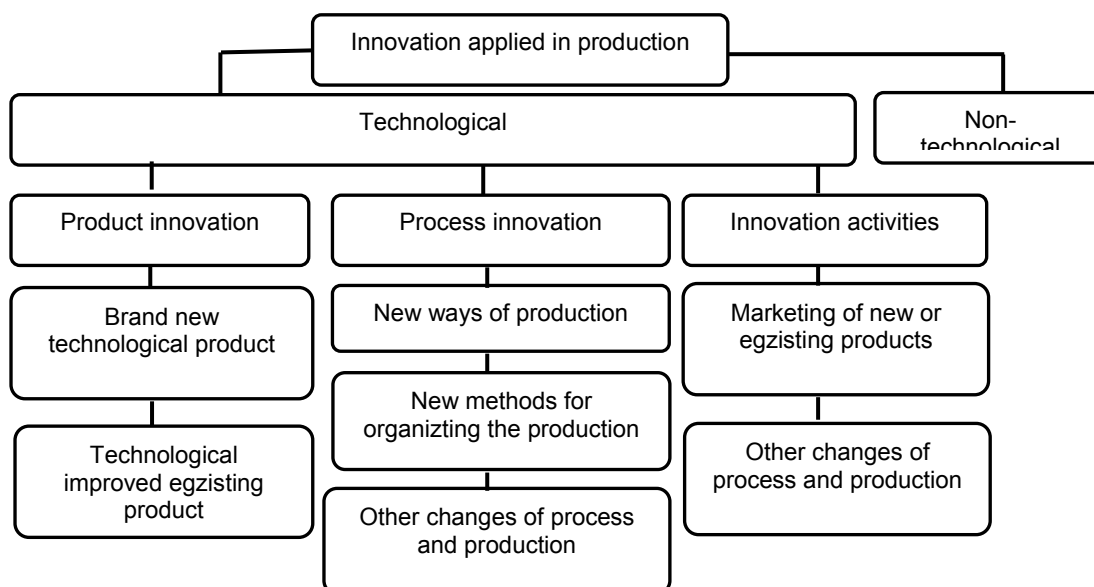


Fig. 2. Classification of innovation applied in production by EBPO methodology
Source: „Oslo Manual“ (1997).

Valentinavičius (2006) considered that this methodology is most often applied in the developed countries of the OECD innovation activities in the economic analysis. According to Jakubavičius et al. (2003), innovation is characterized by complexity, which helps to identify the target of innovative activities and to identify business niches content. The professor of Nottingham University in England, Swan (2009) scientific publications provided a linear model of innovation process involving such components like research, invention, design, innovation and market. It was described the direct fundamental and applied research and creative impact of the innovation process. Efficient use of inventions and designs or audiovisual work of professionals, it is possible to create a viable commercial innovation to realize the objectives. These innovations are first tested practically in the working environment and are potentially sold as a new or improved existing product with more attractive price, creating additional value not only for developers but also for companies and the society (broader analyzed by Kuklytė and Vveinhardt, 2016). Swan (2009) highlighted that innovation and inventions are a very important in the process of ideas generation. Inventions are generated new ideas for the processes of research and creativity and when the ideas reach the market, its turn into the innovation. It can be assumed that the inventions become an innovation only in the realization of the finished product or service reaching the market.

The scientific literature review shown that different types of innovations in business going to be targeted for specific reasons: reduction in production costs, increasing the market share, growth of output and productivity. Innovation classification forms given new approach to innovation as a system that has a composite nature. This suggests that innovation is complex phenomenon because it includes innovation in the creation, distribution and sales processes and integrates scientific work to entrepreneurship and other areas.

2. The influencing factors of innovation

Innovation development, rapid scientific and technological progress are main aspects creating economic stability in many countries'. It is important to identify what factors have an impact on innovation because innovation influence may be one of the major state policies and pillars. Lithuania has acceded to the European Union, the Alliance of trying to encourage innovation, but there is a limited support for reasearch and development (R & D) and innovation centers (Keršys, 2008). According to Glor (2003), Europe has the advantage in creation of research and innovation, but innovative projects are not realized effectively or there is a lack on the continuity like the complicated mechanism of innovative activities administration; imperfect funding mechanism; political interference environment and undeveloped innovation level of protection. Thus, Europe does not benefit from the accumulated knowledge and innovation, competition for the external environment interference. Assuming the facts, it is necessary to identify the factors that may influence innovations. The scientific literature analysis, factors having a direct or indirect impact on innovation activities. Innovation is influenced by internal and external factors, the effects of which related to the innovation life purpose. External environmental factors include economic, political, legal and social environment and the internal environment – macro-economic indicators and the business sphere related factors.

Melnikas et al. (2000) argued that innovation life cycles are different. The main innovation in the life-cycle phases: rapid growth, maturity stage, market saturation and finish. Promoting innovation in the development and application of business, attention should be paid to the innovation life cycle, macroeconomic indicators, the laws that govern the development of innovation strategy. It is appropriate to carry out an environmental review which analyzes selected countries in order to identify innovation and deployment scale and its related factors.

To identify the economic environment, it is necessary to analyze the macroeconomic indicators – gross domestic product (hereinafter - GDP), unemployment, inflation and indicators related to the functioning of organizations which can be defined as (Snieška et al., 2005): natural resources belonging to the geographical environment; intellectual capital, which is based on employees and their experience of adaptation; capital resources to assist in the production sphere creating a good quality of services and goods. The ability to effectively use the available natural resources, the development and innovation, has the impact on country's competitive advantage creating sustainable development. Strategy 2020 of European Commission give the priority for ecological innovation because it should replace obsolete or current processes and activities. Eco-innovation is important for social responsibility and environmental development of new markets for overcome the technological challenges reaching the sustainable design.

One of the most important economic factor is the intellectual capital, in the scientific literature often identified as human resources and is interpreted as the human physical and psychological characteristics which are associated with the qualification, education and socio-cultural level. According to Saner et al. (2009), human resources has a direct impact on the development and innovation in organizations, because working people acquire certain

knowledge and skills. Hence, the proper management of intellectual capital can gain a competitive advantage at an organizational level. Effective human resource management is human brainpower and expertise for the purpose of organizational goals (Išoraitė, 2011). According to foreign academics Bohlander and Snell (2007), Kotler and Keller (2007), Jewell (2002), human resources management identified as an ability to promote the company's innovative activities and gain increasing competitiveness through workers' knowledge and scientific potential. Swan (2009) emphasized potential of scientific innovation as opportunities and conditions as the state of being complete, which promotes scientific innovation activities – creating innovative products and adapting it to commercialization for using existing scientific performance changes or improvements. Melnikas et al. (2000) identified the scientific potential of innovation as a multi-level system of which cornerstone is the foundation of human resources. Summarizing the author claims, intellectual capital is directly related to innovative activities. In this case, it is appropriate to invest in human resources, since formed an organizational advantage and greater receptivity to innovation.

Capital resources are essential for creating the innovations. Constantly changing environment of human resources to adapt to technological progress and to be able to use the equipment to effectively pursued by the organizational objectives and the development of high value added. The intellectual capital and technical resources has a direct impact on the development of innovative activities, because the company has a lot of capital resources to invest in scientific potential. Innovative activities and development funding sources are associated with high risk, resulting in credit problems without sufficient capital. Organizations need to look for other sources of funding: Access to public assistance or the European Union structural funds and seek informal or corporate investors who are named "business angels" – people who have a lot of capital resources, generating high income and are able to take high risks. Indirect investors financing risky activities realize the experience and seeks direct control, which may become the company's shareholders. In 2007, European Investment Fund initiated the establishment of the Business Angels' Fund, which provides financial resources for the continuity of operations until 2015. Business angels fund allow for companies to obtain external sources of funding from the European Union structural funds, thus promoting small and medium enterprises. Lithuania focused on businesses with an annual turnover of 4 344 300 EUR. This fund could cover part of the investment, but it is necessary to have an organization of investment (for example, a shareholder or manager). The investment in the company's capital is no more than 45% of the general fund and invests at least 55% of private investment, of which at least 5% must invest the intermediary itself, while the rest of the "business angel". The maximum size of the investment in the company is 400 thousand. Euro statistical average business angel investment 5 - 57 thousands EUR (Business Lithuania, 2015). Other external financing alternative is to venture capital funds that focus on high-yield transactions with a turnover in excess of 72 thousands euros. In addition to proportionality of the funding depends on many factors: the innovative project development stage, innovative organization size, the necessary funding sources and the amount of capital held. Innovative organizations projects attract wealthy investors focus on the development of high value added and perspectives to generate a large profit in a long term period.

The rapid progress of science and technology has a direct impact on the development of innovation. According to Valentinavičius (2006), a geometric progression increasing information flows effectively evaluate new technological factors as slow response to technological change processes which may have a negative impact on organizational structures. This means that the technological changes mainly influenced by the company in connection with the production, operation and productivity. The research achievements and technological innovation is one of the most important conditions that ensure a competitive edge in the global environment. Each part funded R & D in order to create a favorable business environment for the development of innovative ideas and applications, as well as attract more foreign direct investments (hereinafter - FDI). Business climate depends on internal and external organizations, factors that contribute to the achievement of the objectives and the promotion of innovative activities. Melnikas et al. (2000) stated that each company must provide courses of action realization of innovative ideas: innovation friendly environment – adapting to the legal and administrative environment, innovation financing mechanism for adaptation; promoting a culture of innovation – an advanced business management and organization methods and the improvement for promotion of innovation in the public sector; science-oriented innovation – the research and application of modern strategies in public institutions (high schools, business incubators) and innovative business cooperation for the development of small and medium business which promote investment in new technologies (Raipa, Giedraitytė, 2014). Detailed company's internal and external assessment of the factors important in decision-making, in order to effectively carry out innovative activities. Increased business competitiveness achieved by encouraging the

application of innovation. In this process, participating in the basic organizational structure – innovation suppliers, companies and educational institutions. Taking a consideration of innovation related factors can be identified innovative project risks and performance, it is appropriate to measure innovation performance.

Innovative performance measured macroeconomic and microeconomic indicators. In practice, the innovation counted evaluating indices which are calculated differently depending on scientific and technological progress in various aspects and indicators. It carried out a number of studies aimed at identifying the macro-economic and micro-economic factors on the development of innovative activities. Nissan, Niroomand (2012), Keršys (2008) emphasized the micro-economic indicators measuring problematic that it is not always possible to measure the impact of innovation factors, using Likert cumulative assessment scale from 1 to 5. In order to optimally assess microeconomic factors surveys involving corporate executives and employees. However, for employees of optimism and incorrect answers, the results can be distorted and inadequate. Innovation index calculation evaluates the level of innovation in different countries to match it.

Summary Innovation Index (hereinafter - SII) – most commonly used in the European Union (hereinafter - EU) countries to assess the level of innovation in qualitative and quantitative terms. This started to run in 2000, the publication of the European Innovation Scoreboard. The period 2000-2015 index is calculated on the basis of 25 indicators, which are divided by the entrance to the innovation market indicators and indicators directly related to innovative performance. The main factors used to calculate the index: the role of business in early patent applications per 1000 population and scientific and technological achievements of results, which are measured on the basis of a qualified labor force and the knowledge economy's approach. From 2006 to the present Summary Innovation Index is calculated using 29 indicators. According to Archibugio et al. (2009), by the year 2008, SII was calculated with Japan and the United States of America statistics, however, that the calculation methodology is no longer applicable. The European Commission published data, the main factors affecting the index of total innovation: innovation factors – a lifelong learning process, the use of interactive applications; innovation and business integration - IT costs, costs of innovation development; intellectual property; knowledge of the future: the costs of R & D. Summary innovation index results in Europe ranges from 0 to 1 in value at a rate closer to 0 - the country has the lowest degree of innovation, if the index is close to 1 - achieved the highest innovation and application level.

The Global Innovation Index (hereinafter - GII) was used for analysis and published in 2007. GII aims to capture the multi-dimensional facets of innovation and provide the tools that can assist in tailoring policies to promote long-term output growth, improved productivity, and job growth. The GII helps to create an environment in which innovation factors are continually evaluated. It provides a key tool and a rich database of detailed metrics for economies from 15 indicators (McCann, Ortega-Agiles, 2012). It evaluated five input pillars capture elements of the national economy that enable innovative activities: Institutions, human capital and research, infrastructure, market sophistication, and business sophistication. Two output pillars capture actual evidence of innovation outputs: knowledge and technology outputs and creative outputs. GII gathers data from more than 30 sources, covering a large spectrum of innovation drivers and results; privileging hard data over qualitative assessments

Innovation Capacity Index (hereinafter - ICI) created to identify how the economic, political and institutional actions create a favorable environment for economic growth and encourage the development of new technologies. Index started using for evaluation in 131 countries in 2009. The reliability of the index is not high because of the different countries submitted and based by inaccurate data of statistics departments. ICI is calculated on the basis of 60 indicators that affect innovation. Index based on 5 factors (Lopez-Claros, Mata, 2010): institutional environment, human resources, legal and business framework, research and experimental development, information and communication.

Technology Achievement Index (hereinafter - TAI) evaluate the technological progress of the countries and the possibility of creating technological alliances. TAI was first published in Harvard University Competitiveness Report, in 2000. Index created for identification of existing technological achievements. Lopez-Claros and Mata (2010) highlighted that it is impossible to investigate expected technological advances or the measures to achieve the causal relations between the variables which are not accurately identified.

Knowledge Economy Index (hereinafter - KEI) assess the overall level of development in the country, according to the knowledge economy weighted criteria. According to Morkvėnas (2010), it identifying how the environment allows the effective use of knowledge. It is often confused KEI with the Knowledge Index (hereinafter - KI). While these indices are calculated on the basis of similar characteristics, but only the KEI evaluate the economic incentive and

institutional regime. Since 2001, knowledge of the index data published in the World Bank's statistical database.

The calculation of the different innovation indices are based on a variety of scientific and technological progress in aspects of microeconomic and macroeconomic indicators. The examination of the significance of innovation is necessary to evaluate the different aspects – innovation influencing factors and their assessment. Correct identification of the determinants of innovation enable to choose the appropriate methods for more precise calculation of the results. One of the most accurate and globally recognized indices are Summary Innovation Index and Global Innovation Index.

Conclusions

1. J. A. Schumpeter was the first who first formulated innovation concept in Economic theory, highlighting the importance of related events and differences: *innovation* – new ideas for an effective commercial realization, *innovation* – a new phenomenon, the method, *the invention* - the generation of new ideas. The study of innovation interpreted as a process of creating a new product or service or discovered improvement of already existing product or service and adapted to the market needs. The innovation theory of fusion analysis found that innovation is one of the most important factors to ensure international competitiveness and new markets and product realization in them.

2. In order to investigate the significance of innovation, identify innovation influencing factors which was divided into external and internal, directly or indirectly affecting the country's innovation development. The main factors – political, economic, social and general innovation factors (technological progress, foreign direct investment, information and communication infrastructure, business, generating innovation and deployment, market processes).

3. The macroeconomic and microeconomic indicators which affecting the development of innovation and application are used for the innovation quantification. The most reliable and best innovation reflective indices – Summary Innovation Index and Global Innovation Index.

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Received: 31 August 2016

Accepted: 11 October 2017