INDICATORS OF INNOVATION POTENTIAL

Kateřina Jiřinová – Hana Scholleová

Abstract

Innovation activities in companies are an essential prerequisite for a competitive advantage and long-term existence of the company. Competitive advantage of the whole economy certainly depends on the competitiveness of companies. The importance of innovation as an important tool for companies is rapidly increasingly to maintain long-term competitive advantage. Therefore, discussions about sutability of possible instruments for measuring innovation potential are intensifying. Consensus on what data are required to assess the best innovation performance has not yet been reached. This article discusses common goals and and indicator characteristics on a transnational, national, sectoral and corporate levels. Generally, both the input index (assumptions) and output index (results) are used in the evaluations. The aim of this article is to focus on discovering potential scales, which could be directly applicapbeland for all participants in the innovation process. This article also aims to analyze the relationship between the evaluation of innovative potential of enterprise using a variety of innovative indices.

Key words: innovation potential, measure of innovation, competitiveness, SAII

JEL Code: M21, O31

Introduction

In today's economic world only competitive companies will succeed. The basic driving force for building a competitive advantage is continuous improvement - through continuous and large technological or process related steps. Successful company management determines its success in an international comparisons and layout means for redistribution (creation and GDP growth). Very important factors are primary social impacts (creation of jobs, wealth of residents, the possibility of selfrealization, social satisfaction). For all these reasons, the states are naturally interested in monitoring, measuring and influencing innovative behavior in society.

Measurements are carried out at different levels according to which measured characteristics and formed scales are selected. The article shows common objectives and characteristics of the benchmarks monitored on a transnational level, in the state and corporate environment. In the past, innovations were supported throughout various projects, with not always entirely positive effects. This article aims to define such weaknesses, where the support of business units in order to achieve higher output effectivity could be targeted.

1 Metrices of innovation evaluation and their goals

To measure innovation, scales on transnational, national, sectoral and corporate levels can be employed. When looking into global and national scale, it is possible to see a fundamental trend: a shift from objectivity to the necessary information capability with a focus on further decisions. Global scales mostly consist of general assumptions idocators or outcomes of innovative behavior, which are recent, precise and objectively measurable. Research conducted by statistical offices authorities on a national level has already measured both hard indicators (% of revenue share from innovative products sales etc.), and soft indicators, although these might be mislead by subjective distortion.

1.1 Transnational measurement

Amongst the most known regularly and systematically conducted investigations on the transnational level belong GII ranking (Cornell University, INSEAD, and WIPO, 2015) or SII ranking (European Innovation Scoreboard, 2016). The scales are based on collection of hard well measurable data that provide a logical framework. The Global Innovation Index (GII) 2015 covers 141 country economies around the world and uses 79 indicators across a range of themes. Indicators are tracked in two main categories - inputs and outputs. On the basis of inputs, these indicators cope with human and capital resources, business environment and infrastructure of all these mentioned parts. In terms of outputs, technological knowledge and creative outputs are monitored. For several years United Kingdom, Switzerland and Sweden have been the three leadind countries in the ranking. The first three positions of inputs have been occupied by Switzerland, Singapore and Finland, although in terms of outputs Singapore is at 20th position and Finland is on 10th, which can only indicate two alternatives. First of all, that monitored premises do not automatically imply sufficient quality results, or second, that the observed outputs are not a relevant indicator of long-term innovation activity. (On the

contrary Czech Republic is with its premises on 27th place, with outputs is has reached 17th place, thus according to GII it shows significantly better results under given the conditions.)

GII's problem is monitoring and reporting of results on a nationa level, whereas in globalized world it has become a quite complex process to determine whether the success of one country is affected by any preconditions in other countries. Similar characteristics and problems are associated with SII (European Innovation Scoreboard, 2016).

The SII distinguishes between 3 main types of indicators - activation, firm activities and outputs - capturing in total 25 indicators. The SII is primarily monitored for EU countries, where the first three places are regularly occupied by Sweden, Finland and Denmark. Czech Republic is a moderate innovator. The weakest link of Czech Repulblic's innovation environment is generally Venture Capital Investments and patenting. The question is whether these facts are a cause or a consequence of the fundamental innovative behavior of Czech companies being held in the ICT (information and communication activities) sector (Nečadová, 2013), which is particularly demanding in terms of human resources and their knowledge and in which patentability is often difficult.

At the national level, innovative corporate behavior is monitored mainly by regular statistical surveys. These statistical surveys are ordered by national statistical organizations in developed countries and within Europe there is an effort to unify both the indicators monitored and their evaluation methodology (Czech Statistical Organization, 2016). Results include: detection of innovation barriers, shift in the innovation behavior of companies and ability to adjust the system of state support to reach the most effective impact.

The last survey at 2012-2014 (Czech Statistical Organization, 2016) shows that in the Czech Republic, there are 42% companies implementing innovation, while there was a decline since the period of 2010-2012, therefore we can expect a relative decline in international comparison, where even before the year 2012 the Czech Republic was within the EU average. According to this metric the most successful innovators were Germany, Luxembourg and Ireland, where the amount innovating businesses reached over 66%. Technical innovations are considered as the primary innovation activities. When it comes to implementing of technical innovation, the Czech Republic's position is slightly better than in the field of overall innovation activities. Most technical innovations within the EU28 were engaged throughout businesses in Germany (55%), Luxembourg (48.5%) and Belgium (46.5%). Interesting is also the relatively low share of technology innovating businesses in the United Kingdom, with only 34% share. Among the most common barriers to innovation, businesses traditionally

mention lack of financial resources, both internal and external (inability to raise funds outside the company).

These and other types of barriers, differ significantly depending on the monitored sectors - while in the pharmaceutical industry 18% of non-innovators mentioned this barrier, whereas for example in the manufacture of electrical equipment indicated a problem with a lack of resources only 4% of non-innovating businesses. As a second barrier businesses mention lack of qualified employees – even here we can see significant differences between various sectors - while in the transportation sector this lack is relevant for only 0.2% of cases, in the section of information and communication activities such problem was reported by 3.1% of cases. All this above mentioned indicates that it is not possible while influencing the development of innovative potential to act uniformly in all sectors and companies because their needs and barriers differ in each sector. Whilst the needs of some companies could be solved by a direct financial support, other companies need to be provided with a more secure infrastructure or a better quality education system applicable on a long range.

1.2 National metrices

As a response to the need for better data orientation and data linking, to ensure strategic information on the status and development of the innovative capacity of the Czech Republic, project INKA was introduced (Csank et al, 2016).

The main objective of the project was to design and verify methodology for regular evaluation of the innovative capacity in the Czech Republic. Unlike other methodologies it is not focused very much on the assumptions of the environment, barriers, inputs and outputs, but directly on companies. It is a comprehensive evaluation of innovative processes in companies and their systematic approach to innovation. Primary data from the companies must pursue notably the work of companies with a future and their market position, a kind of entrepreneurial aspirations. This result suggests, to generate measures of innovations, wchich should later continue to serve as their evaluation and for further management, it is not possible to work only with statistically based objective hard data, but also focus on processes evaluation, infrastructure and internal characteristics of firms.

Only very few organizations have an effective system for measuring their overall innovation performance (Bartoš, 2013).

In recent years, several methods have been introduced to directly serve business units to assess their innovation capabilities. They work with both hard and soft data, and certainly do

not serve for mutual comparison of enterprises, but should be a tool to improve their activities.

One such index was compiled by Vacek (2010), and is focused on six groups of soft factors (Strategy and Planning, Marketing, Product and Technology, Quality and Environment, Logistics, Organization and Human Resources).

In each of these areas 6 questions were posed- together to evaluate 36 aspects on a scale from 1 to 4. This evaluation does not sum up the results, while each area of the data was evaluated separately. Selected financial data for the last 6 years were also collected and been evaluated. The disadvantage of such evaluation is ita compilation, it serves only to a single firm for a possible shift in time by creating a motivational factor.

A little later is compiled the so-called Self-Assessment Innovation Index - SAII (Špaček, 2015), which evaluates not only the groups but evaluates the company as a whole, ie. the percentage of sets in which the company uses its possible innovative potential. SAII methodology consists of 40 questions, classified into four thematic groups (conceptual activities, management infrastructure, resources, operational management of the innovation process, financial and nonfinancial indicators), while the maximum number of points that can be obtained each questions is five.

The value of SAII:

$$SAII = \text{obtained point} / \text{the maximum possible points}, \quad (1)$$

where the maximum achievable amount is 200.

A more detailed description of the rage of SAII methodology (Špaček et al, 2016) is in the table 1, which among other things shows minority representation of the traditional measures of inputs and outputs, whose importance has been overrated as stated above.

Resources as an input indicator have a maximum effect of 18% and measurable output indicators may be 15%. The key importance for the innovation potential of a company is the method of its management set up with an emphasis on long-term stability (conceptual activities, infrastructure and processes).

Each company is classified into one of the categories listed below according to the achieved score. Companies can also monitor their success in the sub-sections or individual key issues.

If SAII is between 80 – 100%, it means it is an excellently innovative company, a well innovative company has a score of 60 - 79 %, an above-average innovative company has 40 - 59 % score, a company with a score between 20-39% is a below-average innovative company and up to 20 % we can say, that it is a non-innovative company.

Tab. 1: SAII - criterion

Group	Question about	% of SAII
Conceptual activities	Conceptual materials	13%
	Cooperation with external entities	
	Innovative techniques	
	Strategic value tools	
	Project management	
Resources	Finance	18%
	Human resources	
	Technique	
	Grants	
	Information	
	Sharing in knowledge	
	Learning Organization	
Management infrastructure	The system metrics and responsibility	23%
	System implementation and commercialization of information	
	Formalization of working with ideas	
	Innovative role	
	Leadership	
	The system of rewarding innovators	
	Development innovators	
	Working with the "mistake"	
	Organizational structure	
Operational management of the innovation process	Activities of the innovation process	33%
	Ex. award letter	
	Pre-project documentation	
	Opposition procedure	
	Prototype testing	
	Validation	
	Risk analysis	
	Intellectual Property Protection	
	The principles of change management	
	Postaudit	
	Evaluation of postaudits	
	Archiving materials of innovation projects	
	Presentation of innovation projects	
Indicators	The share of sales of innovation	15%
	The average payback period of innovation in the industry / sector	
	Return coefficient	
	The change in labor productivity	
	Intellectual Property Protection	
	External recognition	

Source: own processing by (Špaček et al, 2016)

The SAII methodology does not serve for an external disqualifying evaluation, however it is a tool of self-reflection for companies and also their guideline for evaluating their own performance using an innovative combination of hard (especially financial) and soft (behavioral) metrics.

Pilot survey index SAII

The first pilot survey of SAII took place in January and was edited afterwards. In September 2015 the pilot survey was held by a software solution, but only 19 companies have submitted complete data. Respondents were allowed to anonymity, but is is known that it was Czech business executives who manage medium-sized businesses, technical production, and who participate in innovations. SAII is set very strong, tab. 2 shows the overall results.

Tab. 2: Results SAII - pilot survey

SAII (%)	Rating	Position	% of companies in survey
80 – 100	A	An excellently innovative company	0%
60 - 79	B	A well innovative company	32%
40 - 59	C	An above-average innovative company	47%
20 -39	D	A below-averageinnovative company	16%
<20	E	Non- innovative company	5%

Source: own processing

The question is which criteria were evaluated in the most companies as insufficiently monitored. Relative point profits for all reporting companies, to maximize profit potential and monitored execution rate ER (C) in a pilot survey group (19 subjects for 5 points = 95 points), were taken for this evaluation, ie.

$$ER(C_i) = \Sigma C_{ij}/95 \qquad (2)$$

where

ER(C) is excution rate for criterion i,

C_{ij} - points that subject j) gave to criterion i)

In Table 3 are listed criterions with below average values ER (C), here considered <40% and above average in the group, here considered ER (C)> 60%.

Table. 3 divides the classification criterions into groups - in criteria with low-performance dominate those which can be broadly defined as indicators of assumptions and results or inputs and outputs of innovation, these are criteria currently measurable, but otherwise not corresponding to a total long-term disposition of the company and its potential for innovative behaviour.

Tab. 3: Criteria with bellow – average score as a whole

Criterion with ER(C) < 40 %	**ER(C)**	**Group of criterions**
The average payback period of innovation	6%	Indicators
Return coefficient	20%	Indicators
External recognition	23%	Indicators
Project management	35%	Conceptual activities
Grants	35%	Resources
Learning Organization	35%	Resources
Presentation of innovation projects	38%	Management infrastructure
Criterion with ER(C) > 60 %		
Finance	61%	Resources
Development innovators	62%	Management infrastructure
The share of sales of innovation	62%	Indicators
Cooperation with external entities	63%	Conceptual activities
Human resource	63%	Resources
Leadership	63%	Management infrastructure
Archiving materials of innovation projects	66%	Operational management ...
Activities of the innovation process	67%	Operational management ...
The change in labor productivity	73%	Indicators

Source: own processing

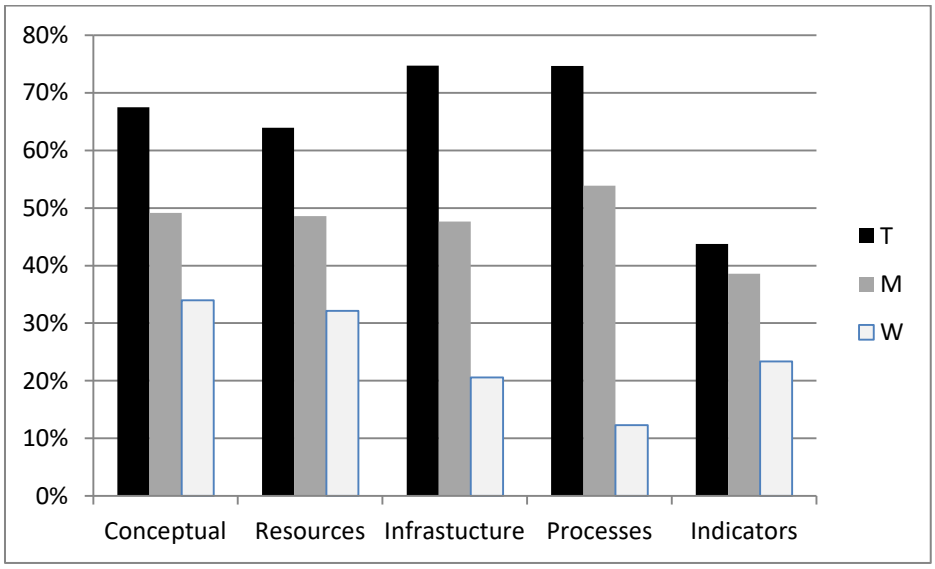
In contrast, in the remaining criteria (i.e. those that can not be seen in Tab. 3 but can be seen in comparison with Tab. 1) with average values, not even one of the criteria of Resources or Indicators.

If we focus on tracking the success of each group of criteria in the distribution of monitored groups by success in the SAII rating (see Fig 1), we can see the differences between successful and less successful businesses. The group of top innovators (T) consists of entities

belonging to the upper score quartile, the group of middle innovators (M) consists of the second quartile and the remaining businesses are due to their low evaluation classified as weak innovators (W).

The graph in Fig 1 shows that the deficit of weak innovators in conceptual activities, resources and indicators is directly proportional to their position, but the significant deficit originates in managerial infrastructure, and in operational management of the innovation process.

Fig. 1: Group distributin according to their criterions



Source: own processing

Conclusion

The results of the pilot research, show the importance of innovation indicators which are not measured by most rankings. For the actual innovation performance and long-term competitiveness of companies are not only important inputs and outputs measurable via hard scales, but especially the internal settings of each business unit comprising activities, conceptual, managerial infrastructure and operational processes, all in a well interconnected unit. In general terms they are objectively worse measurable indicators, therefore we generally remain at assumptions and outputs. It would seem that the outputs are a good indicator of success. This applies only in cases where outputs are monitored on a long term. Innovation „Better“ of higher order does not generate real effects on a short term. The reallocation of resources from various funds supports them while, however monitoring output scales in short term is key when reallocating resources from various support funds. This leads

to situations where support is often directed where it does not bring substantial effects in terms of development (Scholleová, 2014). But results of research in dairy industry show that innovations, and public support of innovations, enabled dairies to stabilise their profits, and to increase their competiveness, during the period of economic crisis. (Špička et al, 2015). This suggests that the innovative potential should be measured also with regard to the industry in which the business is located. At the moment, we can expect a new challenge to support innovation, currently listed criteria are still vague, but it is already clear that once again there will be two less important and controversial areas of inputs and outputs (the amount of grant will be based on the size of the company and the key evaluation criteria will be - high potential of application of developed products on the market, innovative product ranges, degree of manufactured products novelty, quality of the project budget, experience and competence of the applicant). It is to discuss for a long-term research, whether the redistributed resources can bring an adequate effect.

References

Bartoš, V., Žižlavský, O. (2013). Inovační Scorecard jako prostředek měření inovační výkonnosti u MSP. Trendy Ekonomiky a managementu. Vol. IV, no 7. p. 90-103. ISSN 1802-8527.

Cornell University, INSEAD, and WIPO (2015): The Global Innovation Index 2015: Effective Innovation Policies for Development. Fontainebleau, Ithaca, and Geneva. ISSN 2263-3693.

Csank, P., Jovanovič, P., Vozáb, J. (2016). Innovation capacity of the Czech Republic: The main conclusions of the verification analyses. Technology Agency of the Czech Republic, Prague 2016. ISBN 978-80-88169-05-5.

Czech Statistical Organization: Inovacni aktivity podniku v CR 2012– 2014 (2016). Data of survey available online at 1. 5. 2016 on https://www.czso.cz/csu/czso/inovacni-aktivity-podniku-v-cr-2012-az-2014

European Innovation Scoreboard 2016. (2016). Available online at 1.5. 2016 on http://ec.europa.eu/DocsRoom/documents/17822

Nečadová, M. (2013) : Vliv ekonomické krize na inovační aktivitu v regionech a v high-tech průmyslu. In: JEDLIČKA, Pavel (ed.). Hradecké ekonomické dny 2013, Ekonomický rozvoj a management regionů. Hradec Králové, 19.02.2013 – 20.02.2013. Hradec Králové : Gaudeamus, 2013, s. 31–36. ISBN 978-80-7435-250-8.

Scholleová, H., Hájek, J. (2014) : Effectiveness of innovation support from EU funds program. In: 19th International Scientific Conference; Economics and Management 2014, ICEM 2014 [online]. Riga, 23.04.2014 – 25.04.2014. Amsterdam : Elsevier, 2014, s. 529–532. Procedia – Social and Behavioral Sciences 156. ISSN 1877-0428.

Špaček, M., (2015). Measurement and evaluation of innovation. In: Loster, T., Pavelka, T. (ed.). The 9th International Days of Statistics and Economics Conference Proceedings [online]. Praha, 10.09. – 12.09.2015. Slaný : Melandrium, p. 1558–1569. ISBN 978-80-87990-06-3. Available online at 21. 4. 2016 on http://msed.vse.cz/msed_2015/article/115-Spacek-Miroslav-paper.pdf.

Špaček, M., Srpová, J., Riedlbauch, V., Patočka, J., Jiřinová, K., Hájek, J., Veber, J., Scholleová, H. (2016). Metodika hodnocení inovací pomocí indexu SAII. Praha.

Špička, J., Smutka, L., Selby, R. (2015). Recent areas of innovation activities in the Czech dairy industry. Agricultural Economics.Vol. 61, No. 6, p. 249–264. ISSN 0139-570X.

Vacek, J. (2010). 'Hodnocení inovačního potenciálu firmy (manuál),' ZČU Plzeň, available online 25. 4. 2016 on www.kip.zcu.cz/USME/dotaznik.pdf.

Contact

Kateřina Jiřinová
University of Economics Prague
W. Churchill sq. 4
Prague 3
Czech Republic
katerina.jirinova@vse.cz

Hana Scholleová
Czech Technical University Prague
Masaryk Institute of Advanced Studies
Kolejní 2a
Prague 6
Czech Republic
hana.scholleova@cvut.cz