

How to Measure Innovativeness at Company's Level?

Challenge for the Future or Return to the Past¹

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Abstract

An innovative firm can be defined as a business entity that has implemented at least one innovation during the period under review [1]. Taking into account that “innovation” is a concept that is evolving, adapting its definitions to the changes in the global environment, the innovativeness of companies should be analysed in a multifaceted and flexible way.

Fortunately, not every change can carry a proud name of “innovation”, although the scope of this concept is very wide. As a result, not all companies can call themselves innovative. It is very important to take into account the fact that a lot of research on innovation of companies has the form of a survey and the surveyed entities can express their subjective opinions about their own innovation activity or, what is worse, they very often do not understand what term “innovative” means.

Because of the above, the issue of the measurement of innovation in companies needs to be discussed. In order to get the results showing if the company has actually implemented innovations, the objective and unquestionable measurements should be used.

The aim of this paper is to discuss the problem how to measure innovativeness of firms. Should we multiply the number of indicators and accept the fact that the definition of “innovation” is being extended? Or should we go back to the past, and focus on some lesser, but stable, number of measurements, e.g. related solely to R&D activity? [2] Should we construct composite indicators or disaggregate them? And finally, should we try to find universal set of indicators which will measure innovativeness of every firm under every condition and irrespective of the objective of research? Or should we tailor innovation indicators individually to our informational needs?

The paper will also present the tools which can be used to measure innovation processes taking place in companies, from different points of view. The proposed indicators include the elements that determine the level of innovativeness of companies, including investment readiness and sources of innovation in firms such as R&D activity and consumers. The paper points out the fact, that we should use different indicators to measure one phenomenon when the objectives of the research differ. For example, venture capital fund will need different information on investment readiness of an entrepreneur than the entrepreneur about herself/himself.

Introduction

Innovativeness contributes to economic prosperity of countries and the ability of an economy to create and adopt innovation is one of the main factors affecting the performance and competitiveness of the economy [3]. Therefore the need to support innovative companies and an active policy in this area is stressed [4].

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It is also important to systemically monitor the level of innovation [5] not only at the national level but also in other disaggregated approaches [e.g. 6, 8]. This should be followed by the development of new dimensions of statistics and build new innovation indicators [e.g. 7, 8]. And because the market is stimulated by innovations developed by companies [8], the attempts should be made to measure the innovativeness of companies. This is extremely difficult due to the constraints facing statistics of innovation in this regard.

Statistics and measurement of innovation – the review of literature and research

Measuring innovativeness of enterprises - dilemmas and challenges

The indicators of the R&D activity were the precursors of the present measurement of innovation. They were created and developed in late 1960s and are still today used to measure the “input” in the innovation process, comprising both the human and financial resources [e.g. 3, 5]. The first innovation indicators were developed at the turn of the 1970s and 1980s [3]. Since then, statistics and measurement of innovation have gained significance and have been significantly broadened and deepened and are still a very fast developing field of science. Still, the measures which are developed are imperfect, because they:

- Do not reflect the relationship between the “input” and “output”,
- Do not demonstrate the impact and economic effects of innovations,
- They are to a large extent subjective [9].

In addition, too much emphasis is put on the R&D, which is indeed an important source of innovation, but not the only one and not the most important in every industry [e.g. 3, 8]. Omitting the innovations not resulting from the R&D will not reflect the full picture of innovation. In addition, it should be noted that innovation of companies is affected by elements which are difficult or even impossible to measure [10]. The subjectivity of owners / management in regard to the acceptable level of risk of innovation activity is an example of such a difficult to measure determinant. Similarly, omitting the hard-to-measure factors may provide an incorrect assessment of the innovation of the company.

It should also be noted that the commonly used methods for research of innovativeness are often in the form of questionnaires addressed to companies, as the main source of innovation. Enterprises are asked to express their opinion on their own innovation activity and answer a series of questions regarding:

- Barriers and drivers of innovation,
- Sources of funding on innovation activities and the level of expenditure on innovation,
- Sources of information for innovation activity,
- Diffusion of innovation,
- Effects of innovation,
- Types of the introduce innovation (product, process, organizational, marketing) [e.g. 11, 12].

This approach to data collection means that the results obtained are subject to a number of errors, resulting mainly from the high degree of subjectivity and a lack of understanding of what can and what cannot be regarded as innovation [e.g. 4, 8]. The problem is complicated by the very definition of the term “innovation”. The latest edition of the Oslo Manual recognizes the innovation as introduction of a new or significantly improved product / process, a new marketing method or new methods of organization [1]. The definition has changed several times over the years along with a change in approach to the importance of innovativeness for the development of economies and entities operating in these economies. In addition, it can be assumed that the term “innovation” will be further modified and updated. The notion will include ever more new areas in which it will be possible to

implement novelties and improvements, and the evolution of the term will result from the need to adapt this notion to the changes taking place over time.

Therefore, the ambiguity of the term „innovation” makes the innovation statistics refer to the unspecified phenomenon, making it difficult, or even impossible for the respondent companies to understand it [e.g. 8, 13, 14]. As a result, the data collected and the measurement of innovation based on the data are often subject to error because the respondents differently interpret concepts and can provide various data in terms of substantive value and quality as well as incomparable data.

Another difficulty in measuring innovation in companies is the nature of innovation. Namely, it is a continuous process which means that companies are systemically trying to introduce changes in products and processes and are continuously learning [4]. The continuity and dynamics of the process additionally hinder the measurement of innovation [1].

The imperfection of the measurement of innovation means that the cognitive value of the innovative indicators is marginalized or generalized through the use of composite indicators [e.g. 3, 15, 16]. There is a conviction that the importance of statistics and measurement of innovation may increase if, for example:

1. We harmonize the term „innovative” and the respondent companies understand the concept of „innovation”,
2. We expand the database for innovative statistics,
3. We measure innovation introduced in a group of companies separately from innovation of individual companies,
4. We measure innovation resulting from R&D separately from innovation not involving R&D,
5. We measure innovation in innovative companies separately from non-innovative companies,
6. The measurement will take into account various sources of innovation in enterprises [8].

These demands indicate the need to disaggregate data and eventually focus attention thoroughly examine a particular phenomenon and depart from the generalization of results in the form of composite indices. As it is pointed out by R. Barré and P. Papon, the single indicator covers only one aspect of the measured area and it is not wholly [10]. As a result the rates of human resources utilization in R&D activity will tell nothing about HR education, patent indicators do not inform about non-patent innovation etc. Therefore, one should discuss the question if we should accept the fact that definition of “innovation” is being extended and multiply the number of indicators and then aggregate them to one index. Or should we go back to the past, and focus on some lesser, but stable number of measurements, e.g. related solely with R&D activity [2]?

The measurement of innovativeness in Europe

The reports on innovation generally use composite indicators, although it is stressed that this is not a satisfactory solution. It is based on comparison within one index, by using the weights, a certain amount of indicators without common unit of measurement and incomparable. This leads to a considerable simplification of analyses and therefore often to incorrect assessment of the studied phenomenon. In addition, problematic is the selection of indicators and assignment of weights to these indicators. The issue becomes important when we omit the significant, but hard to measure determinants, in the composite index [e.g. 8, 17, 18].

In Europe, the most well-known Methodology for Measuring innovation is the Summary Innovation Index (SII), which is the basis for classifying European economies

based on the level of their innovativeness. SII is an example of an indicator which analyses over 20 measures in seven areas listed below [e.g. 19, 20, 21]:

1. Human resources,
2. Finance and support,
3. Firm investments,
4. Entrepreneurship,
5. Throughputs,
6. Innovators,
7. Economic effects.

The SII is an indicator aggregated from single measures, the number of which and counting formula change almost every year. For example, the EIS 2005 study was based on 26 indicators, the EIS 2006 and EIS 2007 on 25 while in the reports published in 2009 (EIS 2008) and in 2010 (EIS 2009) the SII was measured through aggregation of 29 indicators. In 2011, following the redefinition, the “Innovation Union Scoreboard (IUS) 2010: The Innovation Union’s Performance Scoreboard for Research and Innovation” report was published [21]. In this study the methodology for measuring innovation in the surveyed economies was changed. Instead of 29 indicators forming SII, 25 were introduced, out of which seven indicators had never been used before. In the IUS study published in 2012 again the number of measures included in the framework of SII was reduced [19].

The annual changes in the construction of the Summary Innovation Index, a composite indicator, clearly show the difficulties in the selection of single measures which together fully reflect the phenomenon under study. This confirms that composite indicators provide imperfect information. This may confirm the reduced role of the aggregated indicators in favour of measures which thoroughly examine the specific phenomenon.

It is worth noting that although companies are regarded as the main source of innovation, only a few indicators in the SII index refer to companies. In the latest study, published in 2012 these were:

- The share of SMEs introducing their own innovations in the total number of SMEs,
- The share of SMEs cooperating in innovation in the total number of SMEs,
- The companies introducing product and process innovations as per cent of the total number of SMEs,
- The companies introducing marketing and organization innovations as per cent of total number of SMEs,
- Sales of new to market and new to firm innovations as per cent of turnover [11].

Therefore, there is a discernible shortage of instruments which would help to determine the level of innovativeness at company level. Instruments which would examine the phenomenon in question with regard to determinants economic in nature (including financial), technical, as well as those difficult to assess, non-economic factors, such as intellectual capital, investment readiness and entrepreneurship. Indicators which will measure outlays on innovation activity as well as their results. Because it should be noted that innovation today is one of the basic processes in the company, equal with the core operational activity and management processes.

Indicators of innovation of enterprises - proposals

Proposed classification of indicators

As evidenced by the OECD, the measurement of innovation is gaining importance, but new indicators still focus exclusively on providing information to policy makers and analysts [1]. Therefore other important market players who often decide about the success of innovation, namely the providers of funds or the users of innovation solutions, are ignored.

Innovation activity is characterized by a high degree of uncertainty. Therefore, it is important for every potential investor to have objective information on the risk of engaging in the project, on possible losses and profits. This information may be provided by the innovation indicators.

Similarly, the users of innovative solutions are interested in the results of innovation activity. They want to know to what extent their suggestions or ready solutions have been implemented by the entrepreneur in order to implement the innovation. Increasingly often the growing importance of users in creating innovations is evidenced [22].

One should not forget that these are the firms, first of all that are interested in the level and the measurement of their own innovativeness. For rationally managed companies, focused on their own development and increase in value, it is essential to have objective information on:

- Outlays incurred on innovation,
- The effects of innovation,
- Relationship between input and effect of innovation,
- Sources of information for innovation activity,
- Sources of innovation, including the indication how much is the result of research and development and how much comes from without R&D,
- Structure of the implemented innovation,
- Structure of financing innovation activity and costs of capital,
- Opportunity costs,
- Sunk costs resulting from unsuccessful attempts to implement innovation,
- Determinant of innovations, including the factors hampering innovation.

Both the number of potential recipients of information about the companies' innovative activities and the kind of information such as statistics and measurement of innovation that should be delivered has not been fully exhausted above.

It should be noted, however, that all interested will expect information different from the results emerging from the measurement of innovativeness in companies because they all will put different objectives for measurement. Therefore, one should observe the indicators of innovation very flexibly. We should not focus exclusively on creating composite indicators which due to a high level of generalization or by ignoring important determinants may distort the picture of innovativeness [e.g. 3, 15, 16]. The measurement of company innovativeness should therefore be adjusted to objectives for which the study was undertaken and the innovation indicators should be constructed from this angle. This forces the need to disaggregate data, resulting in focusing attention and an in-depth examination of a specific phenomenon.

Selecting indicators for the objectives of research

As already mentioned, the selection of the object of research, and consequently the measurement and selection of innovation indicators will depend on the objective pursued. For example, a venture capital fund may be interested in the level of investment readiness of the provider of innovative idea because this knowledge will help him to determine the extent to which the entrepreneur is ready to start cooperation with the fund. In turn, it may be essential for an innovator to know if the measures undertaken for the development of investment readiness (e.g., financial outlays on trainings) have brought about the desired effect (raising equity capital). Therefore, a variety of approaches can be used to measure the same phenomenon, i.e., the investment readiness of an entrepreneur, resulting in the use of different indicators. But in both cases one should thoroughly analyse the phenomenon under study and apply multi-aspect approach. The selected examples of innovation indicators measuring

different aspects of company innovativeness, namely research and development, investment readiness and users as a source of information on innovation activity are presented below.

The measurement of research and development

Unquestionable effect of the research and development on the level of enterprise innovation means that this activity should be analysed as a priority and more comprehensively [2]. In the aforementioned study, IUS 2011 refers to three indicators referring to R&D in various approaches:

1. Expenditure on R&D in the public sector as per cent of GDP,
2. Expenditure on R&D in the enterprises as per cent of GDP,
3. Expenditure on non-R&D activity as per cent of turnover [11].

From the point of view of enterprises the latter two indicators are important. They inform about the expenditure on R&D (second indicator) and on non-R&D activities (third indicator) in enterprises. Both, however, have different units of measurement so they are incomparable. What's more, they do not fully meet information requirements on R&D activity in enterprises. In order to understand the process, importance and effects of the R&D sphere in enterprises and its effect on innovation activity, the phenomenon should be examined in much greater detail.

Let us consider the unmentioned above indicator showing the expenditure on R&D in enterprises as per cent of turnover. For a complete picture of the structure of these expenditures one could make it more specific by constructing three new indicators measuring comprehensively which part of their revenue earned from sales they appropriate for R&D. Each indicator will demonstrate the different aspect of the same phenomenon, namely:

- How much of company total R&D expenditure is spent on their own R&D work.
- How much of company total R&D expenditure is spent on in-sourcing,
- How much of company total R&D expenditure is spent on out-sourcing [2].

Another issue that requires attention is the choice of indicators for the purpose of the research, which will be different for particular recipients of information coming from the measurement of innovation. Let us consider the ratio of tax benefits resulting from conducting the R&D activity in an enterprise [e.g. 2, 23]. The way of measuring benefits (the amount of the tax exemption obtained + tax reductions) will depend on the purpose of the study. The company which wants to calculate how much it saves on tax exemptions and reductions will have other information expectations as to the indicator than the state which creates fiscal and innovation policy. The company conducting R&D could express the ratio as a share of tax benefits received in total expenditure incurred. On the other hand, the state will consider it important to compare e.g., the total amount of benefits which the firms received due to tax exemptions and reductions with future tax revenues from taxation of financial results of R&D activity in these enterprises.

The measurement of investment readiness

Investment readiness may be defined as the capacity of an SME or entrepreneur who looks for equity finance to understand the principles of operation and informational needs of an investor, who is presented with a project, by being able to respond to these needs, by providing professional presentation, with relevant information, by being credible and by creating confidence [24]. By taking part in training and information meetings entrepreneurs can build or improve their investment readiness [25].

The measurement of investment readiness is extremely difficult. The expenditure incurred by the company on programs to improve investment readiness is of course, an example of an indicator that could be used. But the indicator presented in such a way is of little informational value. One has to refer these outlays for example to the net profit, to sales

or to the amount of acquired equity. In each case the information coming from the calculated measure will have different meaning.

What's more, the indicator of outlays on programs to improve investment readiness could also be more specific by indicating the nature of support (seminars, workshops, forums). In addition, both of these two classifications can be overlapped, producing for example an indicator of outlays on participation in investment forums as per cent of turnover.

A measure indicating intensity of trainings on building investment readiness could be another example. The information value of such an indicator will depend on the method of measurement which is determined by the needs of the recipient. The enterprise may express the indicator as a ratio of participation in the programs for improvement of investment readiness, to all the trainings the enterprise is taking part. Such an approach will help to find out what percentage of trainings builds the investment readiness. The authorities, on the other hand, while interpreting the information content of the name of the indicator may apply the formula: the share of offers from the Business Environment Institutions (BEI) on building investment readiness to all offers of the BEI. This will help authorities to examine training needs on the said phenomenon and define the necessity of state help for the BEIs.

The measurement the impact of consumer

The importance of users as a source of information for company innovation activity was raised by von Hippel [e.g. 26, 27] back in the 1980s. Today, the concept is developed under the name of User-Driven Innovation. This is a process which allows consumers to contribute to the development of innovation in enterprises through the use of signals, information and even ready-made solutions coming from consumers [28].

The impact of a customer can be also measured by using an indicator of share of innovation implemented in an enterprise following implementation of consumers' ready-made solutions as per cent of all implemented innovations. The information value of this indicator will be even greater if we specify it to particular types of innovation: product, process, organizational and marketing.

It should be noted, however, that this indicator will be differently interpreted by enterprises and consumers. From the point of view of an enterprise this measure will show the importance of consumers as a source of information for innovation activity. In turn, it will show to consumers to what extent enterprises pay attention to their needs and expectations.

Conclusion

Measuring the level of innovativeness at a company's level faces a number of limitations involving both collection of statistical data and the design of appropriate indicators. This does not change the fact that the measurement of innovation provides relevant information about the determinants, processes and effects of innovation activities of enterprises, important for the respondents as well as for the policy makers, providers of funds and for the users of innovation. Therefore, it is important to use tools to measure and monitor the innovation of enterprises.

The choice of indicators and their construction should not, however, be coincidental. The measurement should take into account the purpose for which the measurement is made. Thus, in order to learn the structure of sources of innovation activity in an enterprise one should collect the relevant data and use structure indicators adopting the same reference point for each source. This will allow keeping comparability of data and facilitating interpretation.

It should also be remembered that there is no single universal set of indicators which when collected into one index would provide a complete picture of innovation activity of a firm because each enterprise has its own specificity and operates in a different environment which affects its innovativeness.

In order to get a complete picture of innovativeness activity of companies it would be best to examine in detail and separately all determinants of company innovation. In practice, however, this is not possible due to the complexity of the phenomenon, continuity and dynamics of the innovation process and the evolution of the concept of innovation.

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