BARRIERS TO INNOVATION ACTIVITY – THE IDENTIFICATION BASED ON STATISTICAL APPROACH

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Abstract

The data regarding barriers to innovation activity are collected in accordance with the Eurostat and OECD methodology (Oslo Manual 2005) on the basis of forms developed by the national statistics offices of the European Union countries and Norway. These forms (reports on innovations in industry and service sector – PNT-02) do not seem to meet the expectations of public statistics users. Their fundamental weaknesses are the occurring defects in the construction of formulated questions and answers about barriers to innovation activity. In particular, an incomplete, shorter than in the case of the Oslo Manual and changing list of the observed factors impeding innovation activity deserves criticism, as well as the discontinuous (changing) terminology used for some barriers to innovation. These shortcomings are deepened by the applied "modified" and subjective scale of the significance assessment regarding the potential barriers. A critical analysis of the respective solutions (the first purpose of the article) was considered a sufficient premise for the proposal to modify the reports on innovations in industry and service sector in the part concerning the data on barriers to innovations (the second goal of the article). The suggested changes allow full identification of barriers to innovation activity by eliminating the defects of Oslo Manual and PNT-02, as well as objectify value judgments about the significance of the existing barriers to innovations (antonym of the subjective assessment scale in PNT-02).

Key words: barriers to innovation activity, statistical reporting, survey studies

JEL Code: C18, L26, O31

Introduction

The identification of barriers (obstacles) to innovation activity is carried out using classical survey studies. Questions regarding this issue are formulated in statistical reports on innovations in industry and service sector. Their analysis should be focused on verifying the correctness of the questions asked, along with a range of possible answers, classifying the

potential barriers to innovation activity and determining their significance. The assessment of the adopted solutions in this area (Community Innovation Survey – a report on innovations in industry /PNT-02/[1]) along with the proposal for their possible modification were defined as the purposes of the below presented discussion.

1. Identification of barriers to innovation activity in statistical reports

The research on enterprise innovations, including barriers to these processes, is conducted as part of the Community Innovation Survey (CIS) on the basis of model forms developed by the national statistics offices of the European Union countries and Norway. These reports use both Eurostat and OECD methodology described in the Oslo Manual (CSO, 2017; Duarte *et. al.*, 2017; Głuszczuk, Raszkowski, 2018).

Innovation activity carried out by enterprises can be limited by numerous barriers (Thongsri, Chang, 2019). The Oslo Manual (OM) systematizes them, distinguishing cost, market, institutional, knowledge-related and other reasons responsible for failures in carrying out innovation activities (Tab. 1) (OECD/European Communities, 2005; Ruiz-Jiménez, Fuentes-Fuentes, 2013). This classification did not always provide the basis for grouping factors constituting barriers to innovation activity in the reports (PNT-02) [2] about enterprise innovation, however, more criticism should be addressed to the problem of differences between OM recommendations and PNT-02 reports in terms of the observed factors as barriers to innovation activity (Tab. 1).

The scope of collected information within the framework of PNT-02 reports is in many respects poorer than in the case of the Oslo Manual. In these forms:

- institutional factors are excluded from barriers to innovation company processes (absence of infrastructure, weakness of property rights and legislation, legal regulations, standards and taxation),
- the types of obstacle which may occur in a certain group of factors, as barriers to innovation activity, are often limited (e.g. knowledge-related factors do not cover: internal organizational fossilization of an enterprise, insufficient innovation oriented potential, lack of IT, problems with the availability of external services, etc.),

[1] The analysis covers the reports on innovations in industry (PNT-02). Reports on innovations in the service sector (PNT-02/u) replicate the solutions adopted in PNT-02.

[2] The data on barriers to innovation activity are collected once every four years and cover three-year observation periods. In the reports on innovations in industry (PNT-02), the questions regarding barriers to innovation appeared in the forms from 2007, 2011, 2015 and 2019 and referred to the years 2004-2006, 2008-2010, 2012-2014 and 2016-2018 respectively.

Tab. 1: Barriers to innovation activity – Oslo Manual guidelines vs. PNT-02 and PNT-02/u reports

	Oslo Manual 2005	PNT-02 for the years 2004-2006 and 2008-2010		PNT-02 for the years 2012-2014		PNT-02 for the years 2016-2018
Economic factors	Perceived risk is too high	---	Innovation barriers	---	Factors hampering innovation activity	---
	Costs are too high	Costs are too high		---		Costs of innovation activity are too high
	No financial resources in an enterprise	No financial resources in an enterprise or in a group of enterprises		No possibility to finance innovation from internal sources of an enterprise		No possibility to finance innovation from internal sources
	No external financial resources:	No external financial resources		No possibility to finance innovation from external sources – credits or means within private equity funding (including venture capital)		No possibility to finance innovation from external sources – credits or means within private equity funding (including venture capital)
	venture capital	---				
	public funding sources	---		Difficulties in obtaining public grants or subsidies for innovations		Difficulties in obtaining grants or public subsidies
Knowledge-related factors	Insufficient innovation potential (R+D, project work, etc.)	---		---		---
	No qualified personnel:	---		---		---
	in an enterprise	No qualified personnel		No personnel presenting appropriates skills in an enterprise		Insufficiency of personnel presenting appropriates skills
	on labour market	---		---		---
	---	No information about technology		---		---
	No IT	---		---		---
	No information about markets	No information about markets		---		---
	Problems with the availability of external services	---		---		---
	Problems in finding cooperation partners in the following areas:	Problems in finding cooperation partners in the field of innovation activity		No cooperation partners		No cooperation partners
	development of products and processes	---		---		---
	marketing partnerships	---		---		---
	Internal organizational fossilization of an enterprise:	---		---		---

	Oslo Manual 2005	PNT-02 for the years 2004-2006 and 2008-2010		PNT-02 for the years 2012-2014		PNT-02 for the years 2016-2018
	personnel attitude to changes	---		---		---
	management staff attitude to changes	---		---		---
	enterprise management structure	---		---		---
	Inability to delegate employees to perform innovation activities due to production requirements	---		---		---
	---	---		---		Brak dostępu do wiedzy zewnętrznej
Market factors	Unstable demand for innovative products or services	Unstable demand for innovative (new and/or significantly improved) products		Unstable market demand for innovative ideas		Unstable demand for new ideas
	The existing enterprises dominate the potential market	The market is filled by the dominant enterprises		Too much competition on the market		Too much competition on the market
Institutional factors	No infrastructure	---		---		---
	Weakness of property rights	---		---		---
	Legislation, legal regulations, standards, taxation	---		---		---
Other factors	No need to carry out innovation activity due to the previously launched innovations	No need to carry out innovation activity due to the innovations launched in previous years	Reasons for the absence of innovations	No need to implement innovations due to the previously launched innovations		---
	No need due to the absence of demand for innovations	No demand for innovations		Low demand for innovations on the market		---
	---	---		No need to implement innovations due to small competition on the market		---
	---	---		Absence of good ideas for innovations		---
						Divergent priorities in an enterprise

Source: authors' compilation based on (OECD/European Communities 2005; Statistics Poland 2007, Statistics Poland 2011, Statistics Poland 2015, Statistics Poland 2019)

- Oslo Manual items are aggregated (e.g. no external financial resources without identifying barriers related to the availability of venture capital, difficulties in finding cooperation partners without indicating the scope of such cooperation – the development of products or processes, marketing).

In addition, when comparing the subsequent editions of reports about innovations in enterprises the following changes should be noted:

- the terminology of some barriers, which may result in interpretation doubts and in extreme cases undermine the comparability of collected data – e.g. too high costs of innovations (in the years years 2004-2006, 2008-2010) were changed into too high costs of innovation activity (in the years years 2016-2018), no financial resources in an enterprise or in a group of enterprises (in the years years 2004-2006, 2008-2010) was replaced by no possibility to finance innovation from internal sources of an enterprise (in the years years 2012-2014, 2016-2018),
- the list of observed factors (inconsistent observation of some barriers – e.g. too high costs of innovations/innovation activity were included in the research covering the years 2004-2006, 2008-2010 and 2016-2018, however, left out in the edition concerning the period 2012-2014; adding new barriers, the observation of which is suggested in the Oslo Manual – e.g. difficulties in obtaining subventions/grants or public subsidies were not introduced into the forms until the years 2012-2014, 2016-2018); abandoning the observation of some barriers – e.g. no information about technology, no information about the markets was included in the research for 2004-2006 and 2008-2010 and left out in the subsequent editions of the discussed reports; adding new barriers, outside the Oslo Manual guidelines – e.g. no access to external knowledge and divergent priorities in an enterprise observed starting from the identification of barriers for the period 2016-2018).

Changes in the terminology of barriers to innovation processes, similarly to more extensive flexibility of the list including the observed factors, acting as barriers to this activity, make more problematic and sometimes even impossible to compare the research results of subsequent editions. This deficiency is aggravated by the applied, unstable and subjective scale of significance assessments referring to particular innovation barriers.

The factors being an impediment to innovative processes have different impacts. Their importance (significance) has to be determined in the course of statistical surveys, to recognize correctly not only the set, but also the scale of pro-innovation problems encountered by enterprises. An open issue related to this suggestion is the method for determining the rank of individual barriers (OECD / European Communities, 2005). In the

reports on innovations in industry, valuation judgments about barriers to innovation activity are based on ordinal features. However, in the studies covering the observation period 2004-2006, 2008-2010 and 2012-2014, a four-grade scale of assessment was used to determine the degree of significance related to particular barriers as 1 – high, 2 – medium, 3 – low, 4 – insignificant, and in the subsequent edition of forms, referring to the years 2016-2018, the weight gradation of the identified obstacles was changed (degree of significance: 1 – very important, 2 – important, 3 – of minor importance, 4 - unimportant). Consequently, the results of recent studies remain incomparable to their previous editions. Moreover, it is worth highlighting that the new rating scale did not eliminate the key disadvantage. In each of the aforementioned solutions, the prepared set of answers is imprecise and leads to highly subjective assessments. The same situation may result in various observations of the entities covered by the study, i.e. in the same circumstances one of the respondents may consider a given barrier very important, whereas the other important or even of minor importance, depending on individual feelings.

2. The proposal of statistical approach to barriers of innovation activity

The identification of barriers to innovation has to feature a pragmatic dimension, which results in taking into account the needs of public statistics users. In their perspective, full identification of the most important obstacles to innovation, along with determining their significance properly, seems to be of utmost importance. These issues, considering the questionnaire oriented nature of the research, are connected with the appropriate selection of the type of questions asked as well as the right set of possible answers.

Survey questions are divided into closed (determining the type and number of possible answers), open (allowing for any answers and are usually recorded in the way the respondent has formulated them) and semi-open (including several prepared answers and the position "other options") (Hill, Alexander 2003). Their selection is the responsibility of the person preparing the questionnaire, however, it should be remembered that the closed questions can be used only when there is an opportunity to compile a comprehensive list of potential answers. This condition is not possible in the case of identifying barriers to innovation activity. Their diversity makes the attempts to capture all factors acting as impediments to innovation processes doomed to failure, which always involves the risk of not taking into account the significant innovation barriers in the carried out research. For this reason, the sphere of researcher's interest should include open or semi-open questions. The first of them

result in a relatively full recognition of the problem, however, they are burdened by two essential shortcomings (difficulty in analysing the collected research results – grouping the received responses, potential risk of clarifying the answer by the analyst) (Hague *et al.*, 2005; Lysek, 2019). These shortcomings are, to some extent, resolved by semi-open questions, which seem to be the proper compromise in the course of identifying innovation barriers. Within their framework the Oslo Manual guidelines regarding the systematics of barriers to innovation activity can at least be partly reflected, however, with a simultaneous reservation of the need to open the list of potential innovation obstacles. The introduction of "other barriers, what kind?" may result in the identification of significant barriers, not included in the conducted surveys, which should be taken into account in the subsequent editions of the research.

The correct identification of barriers to innovation activity should – as already indicated – lead to the recognition not only of the set, but also of the scale of pro-innovation problems encountered by enterprises.

The value judgments expressing attitudes, views and/or observations of the respondents may be based on different assessment scales, but their choice is frequently combined with the subject of the carried out research (Mangione, 1999). When observing barriers to innovation activity, it seems reasonable to apply the following scale (Głuszczuk, Raszkowski, 2017):

- numerical-verbal, combining the meaning of a given factor (numerical approach) with the consequences of its occurrence (verbal approach),
- unipolar (the list of answers grading the importance of a given barrier from "unimportant" to very "important"),
- objective, i.e. resulting in the same value judgments in the identical circumstances.

The above mentioned recommendations are taken into account in the proposal of the statistical presentation of innovation activity barriers (Tab. 2).

The proposed presentation of barriers to innovation activity reflects, to a great extent, the Oslo Manual guidelines, however, it has been significantly supplemented. This solution clarifies the assessment scale of the impact exerted by particular barriers on innovation processes, as well as opens the list of potential factors which can impede the innovation oriented activity. Opening the list of barriers seems to be of particular importance as it facilitates the identification of unknown innovation barriers (not included in PNT-02 reports), as well as emphasizes these factors which have been aggregated.

Tab. 2: Barriers to innovation activity – the proposal of presentation in statistical reporting

Please specify the degree of importance of the listed barriers to innovation activity in the years (three-year observation period, e.g. 2016-2018), using the evaluation scale from 1 to 4, where individual numbers indicate that the given factor is: 1 unimportant, without any impact on innovation activity either continued or completed with implementing the innovation, 2 of minor importance, without much impact on the innovation process (innovation activity is difficult, however continued or completed with implementing the innovation), 3 important, significantly affecting the innovation process (innovation activity is interrupted, but with the possibility of its resumption), 4 very important, significantly impeding the innovation processes (innovation activity is abandoned before its initiation or interrupted without the possibility of its resumption).				
Economic factors				
No possibility to finance innovation from internal sources	1	2	3	4
No possibility to finance innovation from external sources	1	2	3	4
Knowledge-related factors				
No personnel presenting appropriates skills in an enterprise	1	2	3	4
Problems with the availability of external services (external knowledge)	1	2	3	4
Problems in finding cooperation partners	1	2	3	4
Internal organizational fossilization of an enterprise (personnel or management staff attitude to changes, organizational structure)	1	2	3	4
Market factors				
Unstable demand for innovation products or services	1	2	3	4
The existing enterprises dominate the potential market	1	2	3	4
Institutional factors				
No infrastructure	1	2	3	4
Weaknesses of property rights	1	2	3	4
Legal regulations including taxation	1	2	3	4
Other factors, what kind? Please name max. 3 barriers at 3 or 4 significance level				
			3	4
			3	4
			3	4

Source: authors' compilation

For example, the respondent by ticking off "no possibility to finance innovation from external sources", can supplement his/her answer by entering "Other factors, what kind?" – no access to bank loans or public funding.

Conclusion

The purpose of the article was to present critical analysis of the applied solutions (CIS, PNT-02) in terms of collecting data on barriers to innovation activity and to recommend possible changes in this respect.

Critical analysis of the applied solutions allowed noticing that in the reports on enterprise innovations (PNT-02):

- an incomplete, closed list of barriers to innovation activity is used, which is much shorter than the one suggested in the Oslo Manual,
- incorrect, subjective scale assessing the significance of factors impeding innovation activity is used,
- the terminology of some barriers as well as the list of barriers observed in subsequent research editions are left changed.

These imperfections can be overcome by the proposed modification of the scope of data collected on innovative activity barriers. The suggested changes will allow for an overall identification of barriers to innovative activity by opening the list of potential obstacles and objectifying value judgments about the significance of the existing innovation barriers, combining the importance of a given factor (numerical approach) with the consequences of its occurrence (verbal approach).

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