Methodology of Innovation Surveys

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The needs for data on innovation increased together with the recognition of the importance of innovation activities. The article gives an overview of the history of innovation statistics focused on methodological developments in the EU countries and in Hungary. The methodological guidelines for innovation surveys, the Oslo Manual was published by the OECD the third time in 2005. Internationally comparable data on innovation have been available for the past ten years, and non technological – marketing and organizational – innovation have only been measured in most countries since 2006. EU legislation on innovation statistics came into force in 2004 and harmonised the surveys – named CIS – in this field.
Lots of results have been achieved but some problems are to be solved. More information on innovation is required, for example on co-operation and skills needed for innovation. Micro data and connected data sources should be used for deeper analyses. The creation of more composite indicators could give a wider picture of different connections in the field of innovation. Knowledge of innovation at enterprise level has to be improved and closer cooperation between data users and data producers would help the development of innovation statistics.

Keywords: innovation statistics, Oslo Manual, CIS

1. Introduction

Lately, the importance of innovation statistics has significantly increased. Today, innovation[2] is undoubtedly a major driver of the economy. Consequently, it is of high priority to acquire all related information. To understand the data on innovation, it is very important to know what kind of methodology is behind them. To meet the growing information needs, it is essential to develop a detailed methodological background. Significant improvements have been made in this area, but still there are many problems to be solved. This article describes the progress, outlines the shortcomings and formulates proposals for their elimination.

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[2] The present definition of innovation by the Oslo Manual: An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method or a new organizational method in business practices, workplace organization or external relations. (Oslo Manual, 3rd Edition page 46)

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2.   The history of innovation statistics

The main drivers of development of innovation statistics are the OECD and EUROSTAT. The work in this field is led and partly financed by these two organisations. Data collections specifically focusing on innovation, providing internationally comparable data do not have a long history.

Until the end of the 1970's, quantitative information on innovation were derived from R&D statistics and were only referred to technological development. The reason for this approach was that the technology push model (Schumpeter 1980) of innovation was widely accepted. It means that all innovation activities were based on R&D. Nowadays, it is obvious that most innovations have other, sometimes more important sources than R&D, for example acquisition of machinery, equipment and software, or external knowledge, training.

In 1980, the OECD organized a conference on innovation measurement, and in 1986 established a working committee with the task of identifying metrics for innovation. Seven countries (the United Kingdom, Canada, Germany, the United States, France, the Netherlands and Italy) developed the method based on their experience for a survey to be carried out in the Nordic countries. Based on the results of this survey a proposal for NESTI (National Experts of Science and Technology Indicators) was developed in 1989. The working group of NESTI – with the active participation of a Hungarian delegate, Annamária Inzelt, in collaboration with the OECD Secretariat, prepared the methodological guidelines for innovation surveys known as the Oslo Manual. Its first edition was published in 1992. The Oslo Manual provides a harmonized framework for measuring innovation and it is used in all the OECD countries and is also a model for other countries.

The first edition of the Oslo Manual placed emphasis on technological innovation and mainly dealt with manufacturing. It was not suitable for measuring innovation in the service sector and non-technological innovation, although their importance had increased. It was the main reason for the revision of the Oslo Manual. The second version of the Manual came out in 1997, but its weaknesses revealed in a short time. Not only product[3] and process innovation[4] must be measured but the other forms of innovation, like marketing[5] and organizational[6] innovation too.

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[3] A product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics. (Oslo Manual, 3rd Edition, page 48)

[4] A process innovation is the implementation of a new or significantly improved production or delivery method. This includes significant changes is techniques, equipment and/or software. (Oslo Manual, 3rd Edition page 49)

[5] A marketing innovation is the implementation of a new marketing method involving significant changes is product design or packaging, product placement, product promotion or pricing. (Oslo Manual, 3rd Edition page 49)

The results of surveys and the needs for detailed information on innovation drew attention to other contexts of the issue. The revised Oslo Manual came out in 2005. The main changes are that this publication includes the measurement methods for non-technological innovation forms, – like marketing and organizational innovation – and not only technological improvements have been accepted as product or process innovation (OECD 2005, Katona 2006). If the methodology is changed, it is very important to take the aspects of comparability into account.

The first CIS (Community Innovation Survey) type survey (CIS1) was carried out – based on the Oslo Manual – in 1993. The original purpose of the survey was to obtain data on innovation outputs, in addition to a range of innovation inputs and activities that were not based in formal R&D. It was a pilot survey aiming to test the methodology. Internationally comparable data were only provided by CIS2 in 1997-98. After CIS2, CIS was organised every second year, namely CIS3 in 2000, which was the first fully harmonized at EU level.

The year 2004 was extremely significant, because the Commission Regulation (EC) No 1450/2004 on innovation statistics came into force (Európai Közösségek Bizottsága 2007). This regulation orders not only what kind of data should be compiled and what kind of variables need to be reported to the EUROSTAT, but it determines the methodology for data collection too. It means that the main characteristics of innovation surveys are the same in all the EU countries:

-    Target population: all enterprises with more than 10 employees in selected NACE categories (agriculture, construction and some service industry are not covered

-    A harmonized questionnaire is used (the core questionnaire is exactly the same)

-    The survey is repeated regularly every other year.

The "Blu Sky II" conference entitled "What Indicators for Science, Technology and Innovation Policies in the 21st Century" was organized by the OECD in 2006. This forum focused on the measurement of innovation and it outlined how to construct policy-relevant indicators to respond to the changing needs.

In 2008 CIS2006 was carried out. The questionnaire of this survey – according to the 3rd Oslo Manual – included two new modules: one for measuring organisational innovation and the other for marketing innovation. First of all the policy-makers were interested in environmental innovation. To get information on this topic, CIS2008 has a separate part for it.

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[6] An organisational innovation is the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations. (Oslo Manual, 3rd Edition page 51)

3. Innovation statistics in Hungary

The first innovation survey was carried out in Hungary out in 1994 in the frame of Innovation Research Institute led by Annamária Inzelt. It was a pilot survey aiming to test the methodology recommended by the Oslo Manual (Inzelt 1995). In 1999, another pilot survey was organized by the Innovation Research Institute focusing on knowledge intensive service sectors (Inzelt 2001). The goal of this survey was also to improve methodology.

The first innovation survey at national level was carried out by the Hungarian Central Statistical Office (HCSO) in 2000, in order to measure innovation activities in manufacturing (KSH 2001). The primary aim was to test the questionnaire and to adapt the methodology. The method used was based on the Oslo Manual. The definitions were new and sometimes unknown for the data providers. The new questionnaire was long and it was to respond on a voluntary basis, which resulted in a very low response rate (under 20%).

The second innovation survey at national level, CIS3 was fully harmonized with the OECD's and EUROSTAT's recommendations and its data were more reliable than from the previous one (KSH 2003). "CIS light" with fewer questions was implemented in 2003.

In accordance with EU legislation Hungary has been carrying out CIS every other year since 2004. CIS4 was organized by HCSO in 2005. CIS4 was the first obligatory one to respond, and its response rate was higher than 70%. Hungarian surveys cover more than 19,000 enterprises, their sample size is app. 6,000 and include all enterprises over 100 employees and the smaller ones by the sample selection (KSH 2006).

Besides the HCSO's innovation surveys, there are others organized by different research institutes which are in most cases focused on special areas like industrial parks or microenterprises.

4. The strengths of present innovation statistics

There is a separate survey especially for the collection of data concerning innovation.
According to theoretically supported methodological guidelines this CIS type survey measures technological and non technological innovation.

The standardized methodology and the harmonized core questionnaire are used in every EU countries. The core questionnaire includes the following parts:
- General information about the enterprise
- Product (good or service) innovation and its developers, share of turnover of new products
- Process innovation and its developers

- Ongoing or abandoned innovation activities for product and process innovations
- Innovation activities and expenditures for product and process innovation
- Sources of information and co-operation for innovation activities
- Innovation objectives
- Organisational innovation
- Marketing innovation
- Basic economic information on enterprise
- EU countries are to report the set of indicators to EUROSTAT on a mandatory basis. (Until 2004, the implementation of surveys was based on "gentlemen's agreement".)

The quality of data on innovation is controlled, based on a quality report system prescribed by EUROSTAT and it is obligatorily used by the EU countries. The data from CIS are mostly internationally comparable. The regional innovation data are available in most countries, first of all to help policymakers to define innovation strategy.

A Safe Centre was established by EUROSTAT, where the microdata sets from innovation surveys are available for researchers for deeper analyses.

The method of measurement is continuously developing; from time to time the experts of this area discuss the problems and necessary improvements which are based on the increasing needs of data users. There is a difficult task to supply more and more data without increasing the burden of data providers and data producers. One of the solutions of this problem is that the structure of the questionnaire is modular. In addition to the core questions, every survey has a module, dealing with different topics. (For example the module for environmental innovation in CIS2008, carried out in 2009-2010.)

The description of strengths may seem short, but the content behind them is momentous and very important. It has been achieved by means of enormous efforts.

5. The weaknesses of innovation statistics

One of the basic problems is the definition of innovation itself. The definition is not very strictly defined, a bit "light". It is difficult to identify what is new or significantly improved. In general, it is rather the smaller companies that are faced with the problem. They often think that innovation could only be used by bigger enterprises. The other problem is that the definition is not as widely known as it should be. Sometimes the term of R&D and innovation are used synonymously.

There are some problems connected with the usefulness of indicators. The most widely used indicator in innovation statistics is the average ratio of innovative enterprises. It is not enough correctly useable for two reasons. One of them is that this indicator does not show how innovative the firms were, e.g. when the enterprise

introduced one single product with a share of cca.1% of the turnover, it is counted equal with another firm introducing more products with higher share and in addition having process innovation. The average ratio is not fully appropriate for comparisons because the structure of economy (by NACE categories and by size of enterprises) affects its size. The countries could be very different in this respect. The use of standardization method would be preferable.

The other group of problems is related to the lack of information. Only little information is collected on the impacts of innovation. It would be very important to know more exactly how innovation affects productivity and the profit of companies. Other data sources than CIS should also be used for analysing this. It is a fact that the possibility of connecting different databases is very limited. The rules of data protection are strict in most countries. Generally National Statistical Offices are only allowed to connect data and analyze them at enterprise level. OECD had a micro data project. Its results were published and give a good example of use of CIS data for econometric analysis (OECD 2009).

EUROSTAT provides access to anonymised micro data for scientific purposes but this is not a proper solution for the above mentioned problem because the anonymisation method could cause the loss of important information and the EU countries micro data are sent to EUROSTAT only on a voluntarily basis, it means that some of the national datasets are not available at the Safe Centre.

It is known that co-operation plays a very important role in innovation but the related information is insufficient. CIS collects information only on type of partners and not on type, frequency and content of co-operation.

Human resources are key elements of innovation. There are no questions in CIS about this topic. Innovation scoreboard only includes data on the number of people graduated at ISCED 5 and 6 levels and the number of participants in lifelong learning. These data are not detailed and are not in direct connection with innovation activities of enterprises. CVTS[7] could provide valuable information. CVTS are carried out every five year in the EU counties, based on harmonized methodology providing internationally comparable data. There is a possibility to use data from this survey and CIS together. The reference periods of the two surveys are not the same, but the relatively slow changes in these fields would not cause significant disturbing effects in the analyses. EUROSTAT plans to introduce a new module in CIS questionnaire on skills needed for innovation but it has not yet been worked out in details.

It is evident that different types of innovation have effects on each other but only a little information is available on that. Most product innovations go hand in hand with process innovations, and technological innovations very often need non-

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[7] CVTS is Continuing Vocational Training Survey carried out every five years in EU countries with harmonized methodology

technological innovations. The connection between different types is bidirectional. Deeper analyses are needed to discover links between several innovation activities.

It is known that innovation could have lot of sources. It is to be regretted that there is no information on the importance of different sources. The CIS questionnaire only includes a list of the sources without their order. Data on innovation expenditure are collected and have some usefulness in this respect but these are not reliable enough because enterprises in general do not have separate files on their investments, costs by different purposes and cannot show appropriately the weights of separate sources. R&D expenditures are the most solid data but it is not too simple to divide them by correlation to innovation.

An overall problem in innovation statistics is the weak co-operation between data producers and data users, namely the determining group, the policymakers. The data needs are sometimes not defined properly or come out very late to take into consideration for surveys. The period between the emergence of needs and their satisfying is long, because of the necessary methodological preparation work.

For satisfying the needs the length of questionnaire and the burden of respondents must be taken into account too.

These days the efficiency of functioning of organizations in the government and higher educational sector is a key question. There is no information on innovation activities in the public sector. A special approach is needed for measuring innovation in this area. The OECD's and EUROSTAT's expert groups have begun the methodological preparation work but only pilot surveys have been carried out in a few countries until now.

Last but not least, the problem of used indicators has to be mentioned. Most of them are simple and not composite (OECD 2008). (A composite indicator means the combination of answers to several questions in creation of an indicator, like dual – product and process – innovators.) Composite indicators can provide a deeper picture of innovation.

6. Conclusions

The needed improvements follow from the weaknesses. Some of them were mentioned above. The main message of these problems is that more information should be used. It does not mean that CIS needs to be enlarged. The use of different connected data sources could be one of the solutions. Separated surveys on smaller samples could be the answer to the question concerning co-operation.

The knowledge of innovation also needs to be diffused at enterprise level. It is not a statistical task, it needs a contribution of governor institutions.
It is clear that innovation activities are more important than their measurement itself, but without measurement it is impossible to evaluate results and define the strategy

which helps to become more innovative with economically and socially beneficial results.

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