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# METHODOLOGICAL ASPECTS OF INNOVATION STATISTICS AND THE INNOVATIVENESS OF LATVIA

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**Abstract.** The target of this paper is to illustrate the statistical methodology used for collecting and presentating data that characterizes innovation processes in Latvia, and to show the main empirical results of innovativeness in Latvia. For this purpose, a literature review, as well as statistical analysis methods such as grouping, processing and comparison methods are used. The Central Statistical Bureau of Latvia (CSB) collects data on innovation activities within business enterprises in Latvia on a regular basis, using a methodology supplied by Eurostat. Measuring Innovation is a major step towards evidence-based innovation policy making. This paper presents the experience of the Central Statistical Bureau of Latvia when collecting and presenting data on innovativeness in Latvia and gives some proposals to improve co-operation between statisticians and respondents and to motivate enterprises to provide correct and accurate data on innovations. The empirical results of CIS 2010 presented in this paper are based on a sample of 1358 enterprises.

**Keywords:** linkages in the innovation process, Community Innovation Survey, innovative enterprises, statistics on patents, methodological recommendations.

## 1. The Community Innovation Survey 2010 Methodology

In today's rapidly changing business environment, innovation is a prerequisite for success and the maintenance of a competitive advantage. That is why innovation is now moving to the top of the agenda for organizations around the world. This means that solid strategic innovation policy planning is of crucial importance.

Measuring Innovation is a major step towards evidence-based innovation policy making. Innovation data may serve several purposes. Firstly, accurate, reliable, comparable statistical data on innovations helps to better understand innovation and its relation to the country's economic growth. Secondly, innovation statistics provide indicators for benchmarking national performance.

Innovation is a continuous process. Firms constantly make changes to products and processes and collect new knowledge, so measuring such a dynamic process as innovations is no straightforward operation. With the objective of capturing this process, the Oslo Manual presents guidelines for collecting data on the general process of innovation (for example, innovation activities, expenditures and linkages), the implementation of significant changes in the firm (i.e. innovations), the factors that influence innovation activities, and the outcomes of innovation [Par 22]. The Oslo Manual covers innovation in the business enterprise sector only. It deals with innovation at the level of the firm; it covers four types of innovations: product, process, organisational and marketing and covers diffusion up to 'new to the firm'.

Innovation activities include all scientific, technological, organisational, financial and commercial steps which actually lead, or are intended to lead, to the implementation of innovations. Some of these activities may be innovative in their own right, while others are not novel but are necessary for implementation [Par 40]. During a given period, a firm's innovation activities may be of three kinds:

- **Successful** in having resulted in the implementation of a new innovation (though not necessarily commercially successful).
- **Ongoing**, work in progress, which has not yet resulted in the implementation of an innovation.
- **Abandoned** before the implementation of an innovation [Par 42].

The Community Innovation Survey (CIS) is a survey conducted by EU Member states to monitor Europe's progress on innovation. The questionnaire covers the main themes listed in the Oslo Manual 3rd edition. Since 2000 the CIS has become a major source of data for the 'European Innovation Scoreboard'. According to the Oslo Manual [Par 55], the target population for innovation surveys concerns statistical units (innovators and non-innovators, R&D performers and non-R&D performers) in the business enterprise sector, including both the production and services

sectors. Innovative activities take place in small and medium-sized units as well as in large units. To capture innovation activities in these smaller units, the target population should include, at a minimum, all statistical units with at least ten employees.

The Community Innovation Survey 2010 (CIS 2010) collected information on enterprises' innovations and innovation activities during the three years 2008 to 2010 inclusive (the three-year period from 1st January 2008 to December 31st 2010; the reference period of the CIS 2010 is the year 2010). CIS 2010 was based on the NACE Rev. 2 classification of economic activities. The target population of the CIS 2010 was the total population of enterprises in NACE Rev. 2 sections A to N. [9]

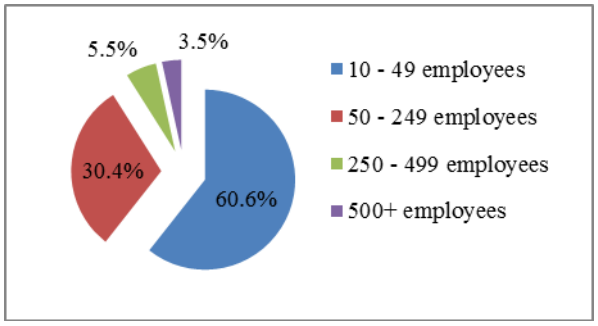
The CIS 2010 was carried out in order to achieve a certain level of precision for the total population concerning the following indicators: percentage of innovation-active enterprises; percentage of innovators that introduced new or improved products to the market; new or improved products, as a percentage of total turnover; percentage of innovation-active enterprises involved in innovation co-operation. These variables are listed in section 1 of the annex of the Commission Regulation No 1450/2004 on innovation statistics. In addition, the CIS 2010 was carried out to achieve a certain level of precision for the total population with regard to the following indicator: total turnover per employee.

## 2. Data collection 2011

The Central Statistical Bureau of Latvia (CSB) collects data on innovation activities within business enterprises in Latvia on a regular basis, using a methodology supplied by Eurostat. The target population of the innovation survey is economically active statistical units - merchants (individual merchants and commercial companies) carrying out economic activities in the following areas: NACE Rev.2 Sections B, C, D, E, H, K and NACE Rev.2 Divisions 46, 58, 61, 62, 63 and 71. The final sampling frame for 2010 consisted of 15815 enterprises and the sample of 1358 enterprises. The enterprises in the sampling frame were stratified by two main variables: by economic activity at the two-digit division level of NACE Rev.2; and by the number of employed persons, enterprises being distributed into six size-classes, namely over 500, 250-499, 50-249, 10-49, 1-9 and 0 employees. For international comparisons, combined size-classes are used: large (250+ employed persons), medium (50-249 employed persons) and small (10-49 employed persons) enterprises. According to the Community Innovation Survey 2010 Methodological recommendations, micro-enterprises (less than 10 employees) could be surveyed on a voluntary basis. In Latvia, filling out a survey questionnaire is an excessive burden for micro-enterprises, so micro-enterprises were excluded from the sample. Regional sampling as the third dimension could not be taken into consideration in Latvia when sampling as most strata had too small a number of enterprises in them. The regional analysis of Survey results for Latvia regions had to be limited to the estimates for the main indicators without going into further details.

Fig. 1 shows the proportions of sampled enterprises by size according to the number of employees. 60.6% of the surveyed enterprises are small (10-49 employed persons); 30.4% are medium (50-249 employed persons) and 9.0% are large enterprises (250+ employed persons).

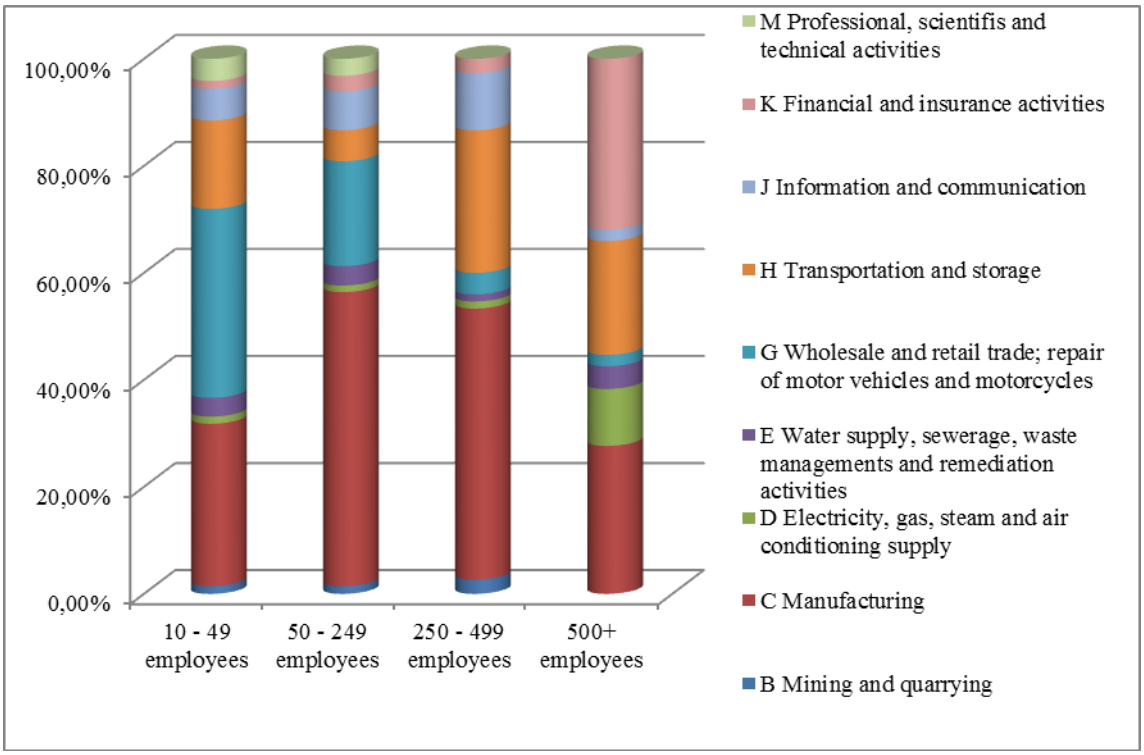
Fig. 2 shows the proportions of sampled enterprises by size and NACE Rev.2 Sections. Small sampled enterprises are mostly carrying out Manufacturing (C) and Wholesale and retail trade; repair of motor vehicles and motorcycles (G) activities; medium sampled enterprises are mostly involved in Manufacturing (C) activities; large sampling enterprises are mostly involved in Manufacturing (C), Transportation and storage (H) and Financial and insurance activities (K).




Source: Author's calculations based on unpublished CSB data.

**Fig. 1** Percentage of sampled enterprises for innovation survey 2010 by size according to the number of employees

The CIS 2010 was mainly an online survey; the main data transmitting media was available on the website of the Central Statistical Bureau of Latvia. Enterprises still had the possibility of printing out the survey questionnaire as a pdf-file and returning it after filling by post or by e-mail. Only 11.7% of respondents used the old-fashioned way, 88.3% of respondents preferred the online version. The response rate was high. In absolute figures, out of 1358 sampled enterprises 1205 or 88.7% responded. The main non-response reasons: 103 sampled enterprises or 67.3% of non-respondents refused to provide a survey questionnaire; 30 sample enterprises or 19.6% of non-respondents stopped their work for a fixed period of time; 19 of sampled enterprises or 12.4% of non-respondents were impossible to contact.




Source: Author's calculations based on unpublished CSB data.

**Fig. 2** Percentage of sampled enterprises for innovation survey 2010 by size and NACE Rev.2 Sections

Throughout the processing cycle, there was a systematic and sustained follow up with the responding enterprises to make sure that the data provided was of good quality and passed all edit checks. In cases of incorrect data, logical errors or item non-response the respondent was contacted by phone to clarify its information. There was also the need to contact enterprises in order to remind them to submit their survey questionnaire. In Latvia it would be useful to make interviews in person (instead of surveys by email or by post) and by trained staff, since they provide a positive impact on the response rate and on the quality of the results obtained. During an interview qualified staff could provide the respondent with immediate and relevant assistance in completing the questionnaire, thereby improving the quality of the results. Moreover, direct contact with the respondent helps to identify weaknesses in the Survey questionnaire which should be corrected. The Survey questionnaire contains specific questions about the innovation process, so questions relating to the firm's economic data should be provided by the finance division, whereas specific questions about innovative technologies may be completed by the product manager. Moreover, in order to successfully carry out the innovation survey, both statisticians and respondents should be able to distinguish four different types of innovations: product innovations, process innovations, marketing innovations and organisational innovations. A common understanding of the innovation process, and an extensive and comprehensible explanation of the types of innovations helps to get more accurate, reliable and comparable data on innovations, which are an integral part in the planning process of innovation policy.

### 3. Innovation Through Linkages

Enterprises promote innovation through frequent interactions and information flows. Recent empirical and theoretical contributions in the literature on innovation have highlighted the importance of external linkages to improve the innovation potential of enterprises [4]. In particular, these analyses have highlighted the presence of a positive relationship between the extent of reliance upon external linkages and the performance of an enterprise [15]. Interaction with external actors for innovation processes may occur formally (i.e. through a collaboration agreement) or informally (i.e. external actors acting as sources of knowledge).

Linkages may depend on the nature of the enterprise and on its market [6]. The enterprise may develop multiple linkages to obtain new information, knowledge, technologies, production practices and human and financial resources. In all cases, information on linkages shows how the enterprise responds to its business environment. The Oslo Manual [Par 278] recommends that data be collected on all three types of linkages, drawing on the list of sources above. For use in innovation surveys, these types of linkages can be defined as:

- **Open information sources:** openly available information that does not require the purchase of technology or intellectual property rights, or interaction with the source.
- **Acquisition of knowledge and technology:** purchases of external knowledge and/or knowledge and technology embodied in capital goods (machinery, equipment, software) and services, which do not involve interaction with the source.
- **Innovation co-operation:** active co-operation with other enterprises or public research institutions for innovation activities (which may include purchases of knowledge and technology).

The Community Innovation Survey 2010 (CIS 2010) asked questions on the developer of enterprises' product innovations (goods innovations and services innovations) and on the developer of enterprises' process innovations. CIS 2010 contained questions on the geographical markets where the enterprise sold goods and/or services. Also CIS 2010 contained the question block *No 6* on *Sources of innovations and co-operation for product and process innovation.* Enterprises were asked to identify information sources that provided information for new innovation projects or contributed to the completion of existing innovation projects: *Internal* (within the enterprise or enterprise group), *Market sources* (Suppliers of equipment, materials, components, or software; Clients or customers; Competitors or other enterprises in your sector; Consultants, commercial labs, or private R&D institutes), *Institutional sources* (Universities or other higher education institutions; Government or public research institutes); *Other sources* (Conferences, trade fairs, exhibitions; Scientific journals and trade/technical publications; Professional and industry associations) and to evaluate the degree of importance of the information obtained from a source; to identify if enterprise co-operated on any of its innovation activities with other enterprises or institutions; to indicate the type of innovation co-operation partner by location; to explain which type of co-operation partner did the enterprise find the most valuable for the enterprise's innovation activities. This information gathered through the innovation survey is sufficient criteria for future support of innovation performance and for enlarging the roles of knowledge producing organizations to implementation stages, including academic entrepreneurship.

Predominantly focused on the enterprise-level of analysis, the empirical literature has assessed the role of scientific connections, notably partnerships with university researchers, on enterprise performance [2]. Using university collaboration as a science link, several papers seem to support the hypothesis that links boost internal R&D investment [1], innovation productivity and sales [3]. While they provide little explanation about the process through which science affects private innovation. The studies relying on the "production function" have found that scientific involvement and ties with leading science academics lead to more technology [20]; more "important" patents: i.e. international patents [5], and a higher average of quality-adjusted patenting [20].

By providing a map of the research environment and current understanding of science, science helps enterprises avoid wasteful experimentation by focusing on the most promising research paths, thereby increasing the productivity of their internal research. Resent research suggests that the links to basic research by industrial enterprises have dramatically increased in the last decade and that enterprises nowadays manifest a diversity of links. There is evidence of rising university spin-offs [13], university-industry collaboration [20], mobility of university researchers [14], science-linkage in private patents and so forth.

In the context of linkages in the innovation process 'knowledge management' is of great importance as it involves activities relating to the capture, use and sharing of knowledge by the organisation. The CIS 2010 contained question

block *No 11* on *Creativity and skills* to gain information on knowledge management practices. One can conclude that the evaluation of existing managerial and knowledge capacity is extremely important as it helps to indicate the balance between commercial aims and knowledge missions.

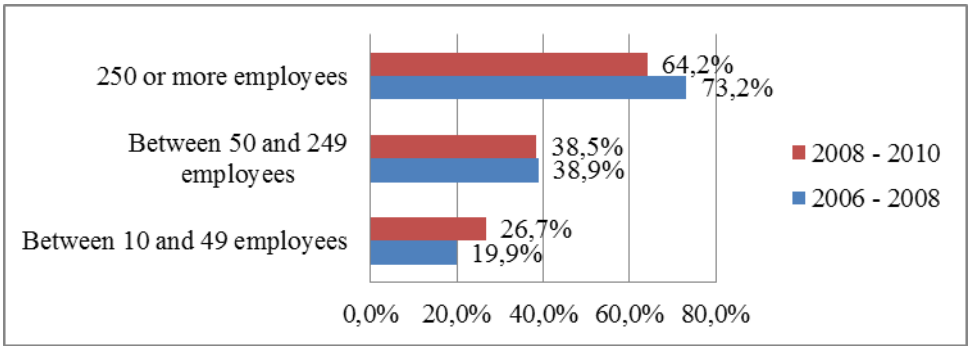
## 4. Innovation survey results

Eurostat provides methodological guidelines for the variables used in the calculation of the aggregated CIS 2010 results specified in an Excel document. Any questions which were not in the CIS 2010 questionnaire but were added by a National Statistical Institute should not be included in the microdata file. The data should be transmitted to Eurostat via electronic Data files Administration and Management Information System, in order to guarantee secure transmission. The document consists of 33 Excel sheets; the first sheet collects general information on the CIS 2010 data (country, reference year, currency, unit, response rate and deviations from the CIS 2010 methodological recommendations etc.) and it is followed by a sheet containing exchange rates and flagging variables and then the tables for the data. Each table has the same NACE Rev 2, enterprise size class and general classification structure (i.e. the rows). The columns are concerned with the variables to be collected for a particular table.

Some of the NACE sectors are part of the Core NACE population, while others are not. Where NACE sections or divisions are split into core and non-core elements, separate figures for "Core" NACE and "All" NACE (which is core and non-core NACE combined) will be requested. NACE Rev. 2 sections B, C, D, E, H and K, and NACE Rev. 2 divisions 46, 58, 61, 62, 63 and 71 constitute the **core** NACE population for CIS 2010. NACE Rev. 2 sections A, F, I, L and N and NACE divisions 45, 47, 59-60, 69-70, 72-75 are part of the **non-core** population. All tables request information for core NACE sections (i.e. NACE B, C, D, E, H and K) broken down by four enterprise size classes (Total, 10-49 employees, 50-249 employees, 250 or more employees) while the information for all NACE 2 digit (and non-core NACE sections) divisions are only at the Total level. [11]

According to the results of the CIS 2008 and CIS 2010 surveys in 2006-2008 innovative enterprises were estimated as 24.3% of the total number of enterprises in the population, but in 2008-2010 29.9% of the total number of enterprises were innovative. Innovation expenditures in 2010 for technological innovation in the industries surveyed are estimated as having reached 130367 thousand EURO. This is significantly less than for the previous period of 2008. In 2008-2010 technological innovation active enterprises were estimated as 16.7% of the total enterprise number (in 2006-2008 – 20.1%) and non-technological enterprises in 2008-2010 were 13.1% of the total enterprise number (in 2006-2008 – 4.2%). It can be concluded that in 2008-2010 in comparison with 2006-2008 the percentage of non-technological enterprises was much higher, so in 2008-2010 mainly due to the economic crisis innovative enterprises invested mostly in non-technological (marketing and organisational) innovation activities which are less expensive than technological. The most important objective of technological (product and process) innovations in 2010 in Latvia was the "Acquisition of machinery, equipment and software".

Fig. 3 shows the proportions of innovative enterprises by size according to the number of employees. When comparing the data of Latvia with the results of innovation surveys CIS2008 and CIS2010, one can conclude that an increase in the share on innovative enterprises was seen only among small ones.




Source: Author's calculations based on CIS 2010 results.

**Fig. 3** Innovative enterprises as a percentage of the total number of enterprises

The results of the analyses of the results of the innovation survey in Latvia support the idea that the economy of Latvia is just at the beginning of the process of moving into an innovation-based development stage and this process needs support from a well-functioning innovation system which should create the required innovative capacity in the wider society.

## 5. Statistics on Patents

Patents play a significant role in innovation and economic performance as they can have a positive impact on competition when they enhance market entry and firm creation. One of the major functions of the patent system is the dissemination of technical information.

The effect of patents on innovation and diffusion depends on the particular features of the *patent regime*. Patent subject matter (the domain of knowledge that can be patented, if the patenting criteria of novelty, non-obviousness and usefulness are also met), patenting requirements (the height of the inventive step required for a patent application to be granted) and patent breadth (the extent of protection granted to patent holders against imitators and follow-on inventors) are three basic tools for policy makers involved in the design of patent regimes that could be used to enhance both innovation and diffusion. [7] Statistics on Patents observed in this paper as Patent data can be considered as proxy measures of the output of R&D in the form of inventions.

A patent is a form of intellectual property. Fig.4 illustrates number and percentage of Granted and Rejected Invention Patents received by the Patent Office of the Republic of Latvia during 2004-2011. The diagram shows that the number of invention patent applications during 2004-2009 increased steadily; during these six years the number of invention patent applications more than doubled. Despite the fact that during 2010-2011 the number of invention patent applications decreased rapidly, one can see that the percentage of granted patents is very high, so most probably the quality of inventions increased significantly.

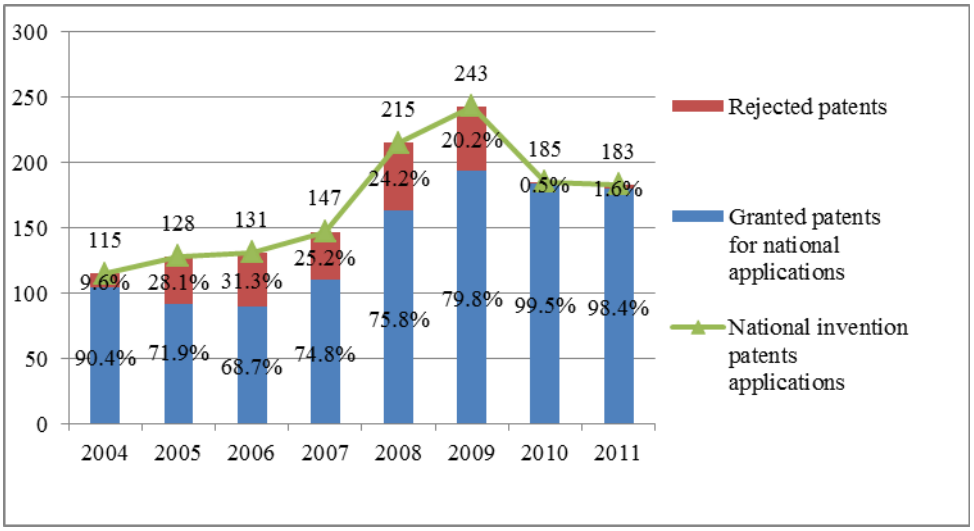



**Fig. 4** Number and percentage of Granted and Rejected Invention Patents per Year [17]

Each year, the European patent office (European Patent Office-EPO) collects and publishes detailed statistics on patent filings and grants. Data show (see Fig.5) that until 2007 the growth in the number of patent applications in the Baltic States was steady, but in 2010 a reduction in the number of patent applications was observed; in 2009 the EPO received a record number of patent applications. According to EPO Statistics data for 2010 for Latvia as the applicant's home state patents were granted in the following fields of technology: Chemistry (Organic fine chemistry; Biotechnology; Pharmaceuticals; Materials, metallurgy); Mechanical engineering (Machine tools; Textile and paper machines; Other special machines). [17] For 2010 for Estonia and Latvia as countries of residence of applicant nearly one in every four of European patent applications presented to the EPO were granted, for Lithuania nearly a tenth of the European patent applications presented to the EPO were granted. [8]

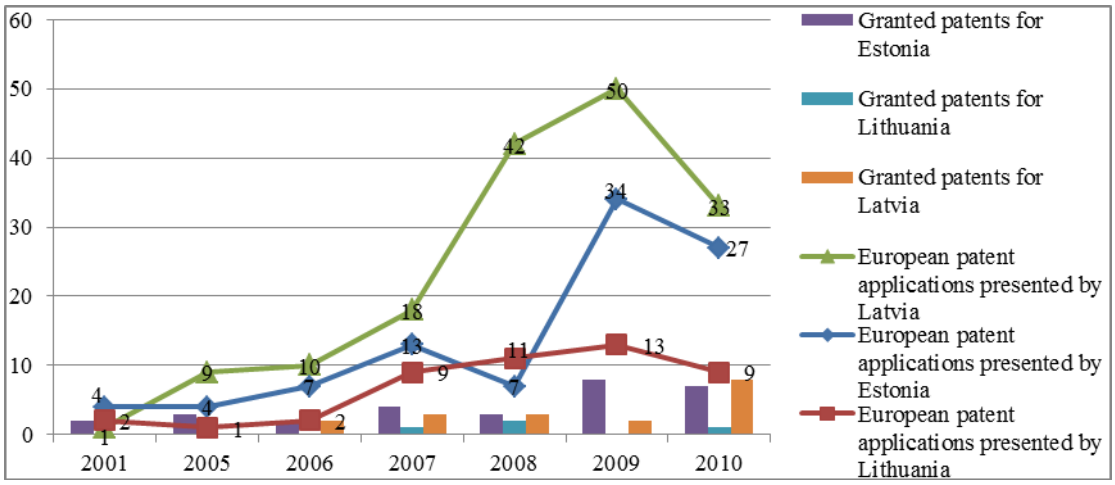



**Fig. 5** Number of European patent applications and Granted Patents per Year [8]

## 6. Data dissemination

The accessibility of innovation statistics should be identified as one of the key priorities. The Innovation Survey results are mainly published by the Central Statistical Bureau of Latvia (CSB) in the Statistical Data Collection 'Research and Development and Innovation Statistics'. Unfortunately, just a few tables on Innovations are available at the CSB Website. Constant growth in the development and use of the Web and associated technology has changed the way that users expect to gain access to official statistics and data. The use of Web and associated technologies should be improved in disseminating official innovation statistics and the need to help our users find official statistics more easily and in a form which they can then use for their wide variety of purposes should be stressed. So innovation statistics in the future mostly should be available at the CSB Website, not on paper. CSB is planning to expand the range of statistical information on innovations available at the CSB Website. One more way of disseminating and promoting statistics on innovations is to publish press releases at the CSB Website. The Press releases are short and concise statistical information sheets issued in accordance with the regular dynamics of the statistical survey schedule, while the Statistical Data Collection presents comprehensive results of surveys in the same field

In order to improve co-operation between statisticians and respondents and to motivate enterprises to provide correct and accurate data, booklets with the main indicators on innovation statistics from the last survey should be disseminated directly to respondents who filled-in the survey questionnaire, together with expressing thanks for their collaboration. Such information could be interesting to them.

It seems to us that there is not sufficient interest in statistics on innovation on the part of innovation policy-making government bodies. CSB makes an official delivery to data users, but the CSB staff do not know how the information is used. CSB rarely receives any additional requests for concrete information. Nevertheless, innovation activity is one of the sustainable development indicators for working out the national innovation support strategy for Latvia.

## Conclusions

1. Statistics on innovation are extremely important as creativity and innovation is a core competency for leaders and managers. Generating fresh solutions to problems, and the ability to create new products, processes or services for a changing market and new world are part of the intellectual capital that gives a company its competitive edge. Creativity is a crucial part of the innovation equation.

2. Recent innovation surveys indicated that only a small percentage of Latvian enterprises are innovative. According to the results of CIS 2008 and CIS 2010 surveys in 2006-2008 innovative enterprises were estimated as 24.3% of the total number of enterprises in the population, but in 2008-2010 29.9% of the total number of enterprises were innovative. When comparing the data of Latvia with the results of innovation surveys CIS2008 and CIS2010, one can conclude that an increase in share on innovative enterprises is only seen among small ones.

3. In 2008-2010 in comparison with 2006-2008 the percentage of non-technological enterprises was much higher, so in 2008-2010 mainly due to the economic crisis innovative enterprises invested mostly in non-technological (marketing and organisational) innovation activities which are less expensive than technological.

4. According to EPO Statistics data for 2010 for Latvia as the applicant's home state patents were granted in the following fields of technology: Chemistry (Organic fine chemistry; Biotechnology; Pharmaceuticals; Materials, metallurgy); Mechanical engineering (Machine tools; Textile and paper machines; Other special machines).

5. The widest possible dissemination and use of official innovation statistics and data is gained by better utilizing the Web and associated technologies and by adopting consistent data formats and standards, expanding the quantity of information available on the CSB portal.

6. One more way of disseminating and promoting statistics on innovations is to publish press releases on the CSB Website. The Press releases are short and concise statistical information sheets issued in accordance with the regular dynamics of the statistical survey schedule, while the Statistical Data Collection presents comprehensive results of surveys in the same field.

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## INOVACIJŲ STATISTIKOS METODOLOGINIAI ASPEKTAI IR LATVIJOS INOVATYVUMAS

**Svetlana Jesiļevska**

**Santrauka.** Straipsnio tikslas – aprašyti statistinius metodus, naudojamus renkant ir publikuojant inovacinius procesus Latvijoje apibūdinančius duomenis, bei pristatyti pagrindinius empirinius inovatyvumo tyrimo rezultatus. Tam pasitelkiama medžiagos apžvalga ir analizė bei statistinės analizės metodai – duomenų grupavimas, apdorojimas ir lyginimas. Latvijos centrinis statistikos biuras, naudodamas Eurostato metodiką, reguliariai renka duomenis apie Latvijos verslo įmonių inovacinę veiklą. Inovacinės veiklos vertinimas – didelis žingsnis faktais grindžiamos inovacijų politikos formavimo link. Straipsnyje apžvelgiama Latvijos centrinio statistikos biuro patirtis renkant ir teikiant duomenis apie inovatyvumą bei pateikiami siūlymai, kaip būtų galima tobulinti bendradarbiavimą tarp statistikos tarnybų ir respondentų bei motyvuoti įmones teikti teisingus ir tikslius duomenis apie inovacijas. Taip pat pristatomi 2010 metų Bendrijos inovacijų tyrimo rezultatai, gauti naudojant 1358 įmonių imtį.

**Reikšminiai žodžiai:** ryšiai inovacijų procese, Bendrijos inovacijų tyrimas, inovatyvios įmonės, patentų statistika, metodinės rekomendacijos.