



Economic and Social Council

Distr.: General
18 December 2012

Original: English

Statistical Commission

Forty-fourth session

26 February-1 March 2013

Item 4 (h) of the provisional agenda*

Items for information: statistics of science and technology

Institute for Statistics of the United Nations Educational, Scientific and Cultural Organization and the Directorate for Science, Technology and Industry of the Organization for Economic Cooperation and Development

Note by Secretary-General

In accordance with a request of the Statistical Commission at its forty-third session,** the Secretary-General has the honour to transmit the report of the Institute for Statistics of the United Nations Educational, Scientific and Cultural Organization and the Directorate for Science, Technology and Industry of the Organization for Economic Cooperation and Development describing their work on science, technology and innovation statistics. The report documents recent developments in the measurement of science, technology and innovation, with particular emphasis on efforts to revise guidelines on measuring research and development, support the implementation of the capitalization of research and development in National Accounts and applying the concepts and methods of the *Frascati Manual* on a truly global basis. Among other things, the report also highlights efforts to improve the comparability of innovation statistics based on business innovation surveys carried out worldwide. The Commission is invited to take note of the report.

* E/CN.3/2013/1.

** *Official Records of the Economic and Social Council, 2012, Supplement No. 4 (E/2012/24, chap. I.A).*



Report of the Institute for Statistics of the United Nations Educational, Scientific and Cultural Organization and the Directorate for Science, Technology and Industry of the Organization for Economic Cooperation and Development on statistics on science, technology and innovation

I. Introduction

1. The present report has been produced in response to the regular request of the United Nations Statistical Commission on the status of science, technology and innovation statistics. Previous reports were presented to the Commission in 2004 (E/CN.3/2004/15) and 2008 (E/CN.3/2008/21). This report outlines the current situation and highlights some challenges and selected future developments. It has been jointly prepared by the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics and the Organization for Economic Cooperation and Development (OECD) Directorate for Science, Technology and Industry, with inputs from Eurostat, the Ibero-American Network on Science and Technology Indicators and the African Union/New Partnership for the Development of Africa (NEPAD).

2. Science, technology and innovation are among the main drivers of economic growth and play a crucial role in poverty alleviation. Statistics on science, technology and innovation are fundamental to understanding the processes by which development has an impact on societies and their economies. Statistics on research and development efforts and outputs, innovation and human resources for science and technology are discussed in the report.

II. Modus operandi for work on science, technology and innovation statistics

A. UNESCO Institute for Statistics

3. The UNESCO Institute for Statistics is the lead agency in the United Nations system for science, technology and innovation data collection. The main lines of action of the UNESCO Institute for Statistics in science, technology and innovation statistics are: survey operation and data guardianship; training and capacity-building; standard-setting and methodological development; and analysis and publications. This work is carried out in the framework of extensive collaboration and partnerships with national, regional and international governmental and civil society organizations.

B. Organization for Economic Cooperation and Development

4. The work of OECD on science, technology and innovation statistics is principally conducted by the Committee for Science and Technology Policy's Working Party of National Experts on Science and Technology Indicators. The National Experts on Science and Technology Indicators group is led by a bureau that is elected every year and is currently chaired by Belgium and supported by

Vice-Chairs from Italy, Japan, Switzerland and the United States of America. Working with the OECD secretariat, the bureau formulates a biennial schedule of projects that are reviewed, debated and prioritized by the Committee, eventually becoming part of its overall programme of work. Statistical activities on science, technology and innovation have consistently ranked among the top priorities of the Committee for Science and Technology Policy, and science and technology methodologies, indicators and quantitative work have rated among the highest in terms of quality and impact across the whole organization. The National Experts group meets in a plenary session at least once a year, while task forces and expert workshops address, in a more focused way, particular issues on an ad hoc basis. Task forces or ad hoc groups of the National Experts on Science and Technology Indicators are currently working on reviewing several aspects of the research and development and innovation measurement framework, developing indicators of knowledge flows and constructing measures of public support for research and development and innovation. Delegates who attend the meeting of the National Experts represent the 34 OECD member countries, the European Commission, including the Directorate-General for Research and Innovation and the Directorate-General for Eurostat, as well as four observer countries (China, India, Russian Federation and South Africa), and there are also regular participants from the UNESCO Institute for Statistics, the Ibero-American Network on Science and Technology Indicators and the African Union/NEPAD.

5. As part of the OECD Innovation Strategy published in 2010, OECD released in 2010 a monograph on measuring innovation, closely mirroring the former's horizontal approach to innovation. The monograph presented new measures and new ways of looking at traditional indicators. Building on a half-century of OECD indicator development, it sought to reflect adequately and as comprehensively as possible the diversity of innovation actors and processes and the linkages among them. The monograph moved the 2007 OECD Blue Sky measurement agenda¹ on science, technology and innovation indicators forward and drew on measures of education, entrepreneurship, economic, environmental and social outcomes, and the framework conditions that support or inhibit innovation. In its declaration issued at the Group of Eight (G-8) meeting at the 2011 Deauville summit, the G-8 leaders invited "...OECD to develop in a fully inclusive, open and accountable way in cooperation with relevant international organizations' measurements of innovation performance, focusing on concrete impacts on growth and jobs rather than inputs and investigating the systemic relationship between indicators."

C. Other organizations

6. Eurostat carries out a joint research and development statistics collection with OECD four times a year. It also collects innovation statistics by means of the Community Innovation Survey from the European Union and European Economic Area member States and European Union and affiliate candidate countries. Through European Union statistical legislation most important elements of these data collections have been made mandatory for European Union member States. Eurostat also compiles and releases patent statistics for the European Union and its member States using sources directly obtained from the European Patent Office. The

¹ See E/CN.3/2008/21.

Eurostat working party on research and development and innovation statistics is also involved in methodological work in various science and technology domains. It has worked closely with OECD in the revision of the *Oslo Manual* and the *Frascati Manual* and other technical guidelines. The Community Innovation Surveys prepared and coordinated by Eurostat implement the Oslo measurement guidelines in a comparable way across European Union countries. This preparation in particular consists of agreeing on a harmonized survey questionnaire to guide each biennial survey wave. The most recent Community Innovation Survey data released are with reference years 2008 to 2010. The development of the next Community Innovation Survey started in November 2011, and field work will be launched in 2013 with the implementation recommendations drafted in 2012.

7. Some other regions of the world have in recent years significantly improved their capacity for the production of science and technology statistics. In Latin America, the Ibero-American Network on Science and Technology Indicators, with the participation of all American countries, Spain and Portugal, was created following a proposal made at the First Ibero-American Workshop on Science and Technology Indicators carried out in Argentina in 1994. The Network was adopted by the Ibero-American Science and Technology Programme for Development (Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo) as an Ibero-American network and by the Organization of American States as an inter-American network. It became effective in April 1995. The main support of the network currently is the Organization of Ibero-American States, through the Science, Technology and Society Observatory of the Center for Higher Education Studies. It also counts with the support of the Spanish Agency for International Development Cooperation.

8. The Ibero-American Network on Science and Technology Indicators collects and publishes research and development and innovation statistics from Latin American countries, and is also active in studies relating to methodological issues and training at the regional level.

9. In Africa, the African Ministerial Council on Science and Technology adopted in 2005 Africa's Science and Technology Consolidated Plan of Action, which is a framework for science, technology and innovation to respond to the socioeconomic challenges facing the continent. As a flagship programme within the Plan of Action, in 2005 the African Science, Technology and Innovation Indicators Initiative was launched, whose goal is to contribute to improving the quality of science, technology and innovation policies at the national, regional and continental levels by strengthening Africa's capacity to develop and use science, technology and innovation indicators. In 2009, the Initiative was established as one of the working frameworks between NEPAD and the African Union Commission.

10. Between 2007 and 2010, participating countries conducted research and development and innovation surveys. The outcomes of those surveys were captured in the 2010 inaugural edition of the African Innovation Outlook. The Outlook was the first in a series intended to provide information about science, technology and innovation activities and the state of science, technology and innovation in African countries. Phase 2 of the African Science, Technology and Innovation Indicators Initiative is currently under way, with the release of the second issue of African Innovation Outlook scheduled for mid-2013.

11. The Science and Technology Consolidated Plan of Action also stipulated the creation of the Observatory for Science, Technology and Innovation Policy in Africa, which eventually was established by the Assembly of the African Union by its decision 232 (XII) of February 2009. It will be a continental repository of science, technology and innovation statistics and a source of policy analysis. The African Science, Technology and Innovation Indicators Initiative will become an action line within the programme of work of the Observatory for Science, Technology and Innovation Policy in Africa.

D. Publications and databases

12. The UNESCO Institute for Statistics provides research and development statistics to the United Nations Statistical Division (for the *United Nations Statistical Yearbook*), the United Nations Development Programme (*Human Development Report*), the World Bank (*World Development Indicators*), the *UNESCO Science Report*, the *World Social Science Report* and other stakeholders. Its global research and development statistics database is available online,² and it has published thematic bulletins and fact sheets on topics such as the evolution of research and development personnel and expenditure in the world, and women in science and technology. In 2012, it released the UNESCO eAtlas of Research and Experimental Development,³ which allows the user to explore and adapt maps, charts and ranking tables for more than 75 indicators on the human and financial resources devoted to research and development.

13. The UNESCO Institute for Statistics is currently building a database for innovation statistics that will include global data and metadata, as well as an inventory of innovation surveys carried out worldwide.

14. The OECD Main Science and Technology Indicators edition is published on a biannual basis and provides the most timely available source of information on research and development and other key science, technology and innovation indicators for the OECD area.⁴ The Research and Development Statistics Database⁵ is based on a joint international data collection with Eurostat, comprising data on research and development expenditures and human resources. It is now a web-only publication available from the OECD statistics portal.⁶ Like Main Science and Technology Indicators data, it is now freely available to all users. The Research and Development Statistics Database is accompanied by the Sources and Methods Database, a metadata tool that provides detailed information on how research and development statistics are collected on a country and topic basis.⁷ The Analytical Business Enterprise Research and Development Database is produced by the OECD secretariat by adjusting research and development data by economic activity in the Research and Development Statistics Database, in order to align as well as possible with economic indicators in the OECD/STAN family of industry structural

² Available from <http://stats.uis.unesco.org>.

³ Available from www.uis.unesco.org/data/atlas-research-development/en.

⁴ Available from www.oecd.org/sti/msti.

⁵ Available from www.oecd.org/sti/rds.

⁶ Available from www.oecd-ilibrary.org/economics/data/oecd-stat_data-00285-en.

⁷ Available from http://webnet.oecd.org/rd_gbaord_metadata/default.aspx.

databases.⁸ Other publications in the science and technology include the Compendium of Patent Statistics, published by OECD in 2009, the OECD Biotechnology Statistics, published in 2009, and the Key Biotechnology Indicators.⁹ Patent statistics are available online.¹⁰

15. In addition to these standard publications, OECD produces science and technology indicators in a number of other publications such as *Science, Technology and Industry Scoreboard*, an OECD flagship publication that provides a comprehensive picture of countries' innovation and performance in the global economy.¹¹ *STI Scoreboard* is published every two years, alternating with its "sister", policy-focused publication, *STI Outlook*. The latest edition, published in 2011, included over 180 indicators illustrating trends and patterns in science, technology, innovation and industrial performance in OECD and major non-OECD countries (notably Brazil, India, Indonesia, the People's Republic of China, Russian Federation and South Africa), presenting indicators traditionally used to monitor developments in science, technology, innovation and industry, and complementing them with experimental indicators that provide new insights into areas of policy interest.

16. For new and emerging work of both a statistical and a methodological nature, OECD uses its working papers series as a dissemination tool. Recent reports include studies on modes of public funding of research and development, measures of investment in organizational capital, modes of innovation in business and the labour characteristics and international mobility of doctorate holders.¹²

17. Eurostat releases all its science, technology and innovation statistics for free on its website.¹³ Together with the data from European Union member States, these releases consist of data also for other European countries and other countries depending on the availability of reasonably harmonized data and needs for showing comparisons. Database release is supported by short web articles on the website Statistics Explained and compendium publications of Eurostat. Science, technology and innovation statistics data are further reported in a variety of standard publications of the European Commission, such as *Innovation Union Competitiveness Report* and *Innovation Union Scoreboard*. Data on research and development intensities (gross domestic expenditure on research and development as a percentage of GDP) belong to a set of Europe 2020 Strategy headline indicators whose development towards the target is closely monitored.

III. Current work and future challenges

18. There have been many significant changes in science, technology and innovation statistics since the last UNESCO Institute for Statistics/OECD report to the United Nations Statistics Commission. The present section provides a summary of the key developments by thematic area.

⁸ Available from www.oecd.org/sti/anberd.

⁹ Available from www.oecd.org/sti/keybiotechnologyindicators.htm.

¹⁰ Available from www.oecd.org/sti/innovationinsciencetechnologyandindustry/oecdpatentdatabases.htm.

¹¹ Available from www.oecd.org/sti/scoreboard.

¹² Available from www.oecd.org/sti/publicationsdocuments/workingpapers.

¹³ Available from <http://epp.eurostat.ec.europa.eu/>.

A. Methodological developments in measuring research and development

1. Forthcoming revision of the *Frascati Manual*

19. The *Frascati Manual* was originally written by and for the national experts in OECD member countries who collect and issue national research and development data (see *Frascati Manual*, chap. 1, para. 1). Over the years, it has become the standard of conduct for research and development surveys and data collection not only in OECD and the European Union, but also in other United Nations Member States; for example, through the science and technology surveys of the UNESCO Institute for Statistics. At their meeting in June 2012, the National Experts on Science and Technology Indicators celebrated the fiftieth anniversary of the first set of internationally agreed guidelines for measuring research and development and agreed to take forward their ongoing review of the research and development and innovation measurement framework by initiating the process that will lead to a further revision of the *Frascati Manual* on research and development. This revision process aims to address known challenges to the collection, the interpretation and the international comparability of research and development data, taking stock of best practices and proposing clearer and easier to implement guidelines that can be broadly applied by OECD and other countries. The revision of the manual has been incorporated into the programme of work and budget of the Committee for Science and Technology Policy for the biennium 2013-2014, drawing on recent work by task forces of the National Experts on Science and Technology Indicators dedicated to the study of business and higher education research and development, enabling technologies and working groups on direct and indirect public funding of research and development.

2. Measuring research and development in developing countries

20. The UNESCO Institute for Statistics encourages all countries to use the *Frascati Manual* international standard for research and development statistics. It disseminates the Frascati methodology throughout the world, including its main definitions in its research and development survey instruction manuals, and discusses the details of its application in workshops. Based on its data collection and these workshops, and in wide consultation with experts, regional networks and national authorities, the UNESCO Institute for Statistics produced the technical paper “Measuring research and development: Challenges Faced by Developing Countries”.¹⁴ This work provided the basis for a short guidance document, produced in partnership by the UNESCO Institute for Statistics and OECD and ultimately approved by the National Experts on Science and Technology Indicators, which maintains the standard definition of research and development and considers a number of issues of special relevance to emerging economies and developing countries. This document was adopted by the OECD member countries and published online as an annex to the *Frascati Manual*.¹⁵

21. The UNESCO Institute for Statistics is currently working on a guide to provide hands-on guidance to countries on how to carry out an research and development

¹⁴ Available from www.uis.unesco.org/Library/Documents/tech%205-eng.pdf.

¹⁵ Available from www.oecd.org/innovation/innovationinsciencetechnologyandindustry/49793555.pdf.

survey, which will include model questionnaires for all performance sectors. The guide will target in particular countries that are starting to carry out research and development surveys. The UNESCO Institute for Statistics is also in the process of revising the concept of scientific and technological activities, which was adopted by UNESCO in 1978.

3. Research and development capitalization

22. The previous report noted that the National Experts on Science and Technology Indicators had played a key role through its involvement in the Canberra II Group in the latest revision of the System of National Accounts (2008 SNA) and the decision to treat expenditures on research and development in the accounts as gross fixed capital formation. More recently, the National Experts have worked with the OECD Working Party of National Accounts to prepare the *Handbook on Deriving Capital Measures of Intellectual Property*, published by OECD in 2010, which includes a chapter on research and development and the implementation of the new System of National Accounts requirements. OECD has been following national efforts to implement the capitalization of research and development, disseminating the initial methods adopted and findings. In recognition of this important, new user community for research and development statistics, the forthcoming revision of the *Frascati Manual* will likely incorporate methodological guidelines to assist with the requirements of national accounts with regard to building a bridge with Frascati data.

4. Estimates of public support for research and development

23. In recent years, OECD has successfully introduced regular data collections on the design and financial cost to Governments of providing tax incentives for research and development. These experimental indicators have been very influential in policy debates in several countries. Based on these experiences, it may soon be possible to codify the key concepts and definitions so that they can be integrated into the research and development measurement framework, potentially alongside existing guidelines on measuring Government budget appropriations or outlays on research and development, given the similar administrative and budgetary nature of these data. In parallel to this work on improving the comparability of data on the cost of research and development tax incentives, an OECD project has been assessing the feasibility of producing policy-relevant breakdowns of available Government budget appropriations or outlays on research and development estimates beyond the traditional socioeconomic objectives, identifying, among other things, what prioritization mechanisms Governments use when allocating funds in support of research and development; for example, by entrusting arms-length institutions and third parties with decisions on which projects to fund, or allocating funds directly through programmes.

B. International research and development data collection activities

24. UNESCO has been collecting science and technology statistics from its member countries since the 1970s. After an absence in the 1990s, the UNESCO Institute for Statistics re-established a regular biennial global research and development survey in 2004. The fifth survey is currently being carried out. In order to avoid duplication in data collection, data sharing agreements have been

established with OECD, Eurostat and the Ibero-American Network on Science and Technology Indicators and are in negotiation with the African Union/NEPAD. The questionnaire can be downloaded from the UNESCO Institute for Statistics website and data can be submitted electronically using a dynamic pdf questionnaire. The survey addresses 215 countries and territories, and data are available for 147 countries. Most of the non-responding countries are small island developing States, or less developed countries, which often have less developed science and technology systems. The group of non-responding Arab States is also significant, although several of these are currently in the process of carrying out research and development surveys.

25. OECD has collected research and development statistics for nearly 50 years for its member countries, and since 1997 has collected research and development data for selected non-member economies. The non-member economies currently covered in the main science and technology indicators are Argentina, China, Romania, Russian Federation, Singapore, Slovenia, South Africa and Taiwan Province of China.

26. OECD and Eurostat have now put in place a protocol of cooperation to reduce the burden on national statistical authorities by organizing a joint data collection of the research and development variables, namely, the International Survey of the Resources devoted to research and development. A joint questionnaire is used to collect statistics. OECD and Eurostat collaborate in assessing the quality and the comparability of the data.

C. Innovation statistics and indicators

1. Methodology and worldwide usage

27. Innovation surveys were primarily developed to increase knowledge about innovation in firms with the dual purpose of improving the understanding of the processes and outcomes of innovation and developing effective innovation policies. The latest revision of the joint OECD/Eurostat publication *Oslo Manual* on measuring innovation was published in 2005. The concepts developed in the manual, including of marketing and organizational innovation, are now systematically implemented in innovation surveys across countries, including the Community Innovation Survey in Europe. Surveys comprising questions on innovation based on the *Oslo Manual* framework have been carried out in nearly 80 countries over more than 20 years, with the United States and China among the most recent adopters. The current edition of the *Oslo Manual* also includes the annex “Measuring innovation in developing countries”, which was developed by the UNESCO Institute for Statistics with the assistance of the Ibero-American Network on Science and Technology Indicators, in consultation with experts from developing countries that have carried out innovation surveys.

28. As part of its review of the measurement framework for innovation, OECD set up in 2010 a task force to review current business research and development and innovation surveys and provide suggestions for future improvements, with a view to identifying issues to be addressed in forthcoming revisions of the *Frascati Manual* and *Oslo Manual*. A key component of this work is the review and assessment of the quality and the comparability of innovation surveys in order to monitor how the revisions adopted in the 2005 edition of the *Oslo Manual* are being implemented. As

part of this review work, OECD has collected metadata information adapting the quality assessment model used by Eurostat for European Union member and associate States. This work is reviewing the extent to which different types of questions, survey instruments and methodological differences may be driving some of the observed differences across countries' rates of innovation. Work is also ongoing in testing how companies interpret the concepts and the definitions proposed in the *Oslo Manual*, and the potential impact of cultural differences.

29. In line with its medium-term strategy, the UNESCO Institute for Statistics started working on innovation statistics in 2010. The first activity undertaken was to make an inventory of innovation surveys carried out worldwide, initially focusing on countries outside OECD and the European Union. Survey instruments and information on the methodological procedures followed to carry out these surveys have been collected. The inventory contains the main variables and methodological information of all surveys collected. The inventory will be included on the UNESCO Institute for Statistics website in March 2013. At a later stage, information on surveys carried out in the OECD area and the European Union will be added.

2. Data collection

30. The most recent Community Innovation Survey data released are with the reference years 2008 to 2010. This adds up altogether to seven survey waves of the Community Innovation Survey, of which six have been released in tabular format. The development of the next Community Innovation Survey started in November 2011. A dedicated task force consisting of 11 countries prepared the survey questionnaire and other related documentation for Community Innovation Survey 2012 by the end of 2012. The field work will be launched in 2013, with the target of releasing the European Union data in the second half of 2014. Together with the tabular output, Eurostat has been offering Community Innovation Survey microdata for research use consisting of over 20 countries enterprise level data for last four survey waves. This dataset can be accessed at the Eurostat SAFE Centre in Luxembourg (or in a more anonymized form through CD-ROM release) against a signed research contract. Community Innovation Survey data were used at the Eurostat SAFE Centre every third working day in 2012.

31. To date, OECD has not undertaken a formal international collection of innovation indicators to incorporate into its Main Science and Technology Indicators, nor has it promoted their use for international benchmarking purposes. However, selected indicators based on Oslo surveys have been published in various editions of *STI Scoreboard* and other OECD publications.

32. In June 2013, the UNESCO Institute for Statistics will launch the first global data collection of innovation statistics, to be carried out every two years. As is the case for research and development statistics, the intention is to collaborate with other international and regional organizations to avoid a double burden on countries and a duplication of efforts. In preparation of this new activity, a pilot data collection was carried out in 2011, targeting 19 countries, with a response from 12 countries.¹⁶ Furthermore, a metadata collection has been carried out in 2012,

¹⁶ Available from www.uis.unesco.org/ScienceTechnology/Pages/sti-innovation-pilot-data-release.aspx.

which will feed into the inventory and will provide the necessary contact information for the 2013 data collection.

3. Exploitation of innovation microdata at an international scale

33. The monograph *Innovation in Firms: A Microeconomic Perspective*, published by OECD in 2009, was the main output of the first phase for the Innovation Microdata Project launched in 2006. The project was designed to examine a range of issues relating to innovation and business performance using a common methodology, making the most of innovation survey data collected by OECD countries and observer economies. The project demonstrated the potential for better understanding the diversity of innovation performance at the micro level, making use of information typically neglected when compiling traditional aggregate indicators.

34. Furthermore, the project enabled the detailed exploration of the link between innovation and productivity and the role of intellectual property rights in a consistent way, e.g., using a common set of control variables and an econometric behavioural model with which to test hypotheses. This in turn further highlighted the importance of promoting the development of a micro data infrastructure that reduces the burden on statistical offices and respondents, and supports data linking and empirical analysis, including policy evaluation. The coordinated analysis of micro data has continued as part of the recent analytical work of OECD on research and development and innovation in services, for which it has been possible to access and use the Eurostat SAFE Centre, a key infrastructure that facilitates access to innovation survey micro data for several European Union and associated countries for research purposes.

D. Patent data

35. Patent indicators are used to map aspects of the innovative performance and technological progress of countries, regions or certain specific domains and technology fields. The use of patent statistics for monitoring developments in the field of science and technology has been expanding rapidly over the recent past. Not only has the use of patent indicators increased, but the diversity and the relevance of these indicators have also progressed. OECD has developed new and more sophisticated indicators, notably on patent families and citations, and has been looking recently at the production of indicators of patent quality and linking to firm-level data.

36. The *OECD Patent Statistics Manual*, published in 2009, capitalized on new experience on patent statistics and promotes the harmonization of methodologies. It addresses issues regarding the complexity of patent data and provides statisticians and analysts with guidelines for building and analysing patent-related indicators.

37. A patent statistics task force has been created, involving representatives from OECD, Eurostat, the European Patent Office, the Japan Patent Office, the Korean Intellectual Property Office, the United States National Science Foundation, the United States Patent and Trademark Office and the World Intellectual Property Organization. Its objective is to promote the coordination of activities regarding the production of statistics on patents.

38. The annual Conference on Patent Statistics for Decision Makers has become a popular event for science, technology and innovation statisticians, practitioners and data users. Organized by OECD and the European Patent Office, in cooperation with Eurostat, the Japan Patent Office, the Korean Intellectual Property Office, the United States National Science Foundation, the United States Patent and Trademark Office and the World Intellectual Property Organization, it was last held in Paris in November 2012.¹⁷ Among other things, the conference paid specific attention to the production of statistics on the entire IP bundle, including trademarks and designs.

E. Human resources in science and technology

39. The mobility and labour market performance of highly skilled people has continued to be a major policy issue for all countries, in order to ensure that the most talented individuals have the greatest chance to make a contribution to the needs of all countries. In response to policy evidence needs, OECD, the UNESCO Institute for Statistics and Eurostat have developed a methodology to follow up on the careers of doctorate holders, the so-called careers of doctorate holders survey. This methodology is being widely applied in Europe and various OECD countries, as well as in some developing countries. After a pilot data collection in 2005, a first large-scale data collection was conducted in 2007 and 2008 involving around 25 countries and a second data collection was carried out in 2010, also covering 25 countries. In 2013, it is expected that a new data collection will be carried out for reference year 2012. Following methodological and analytical work, including micro data analysis, carried out in 2011/12, a full set of comparative results and updated methodological guidelines will be published by the end of 2012.

40. While education statistics at the UNESCO Institute for Statistics give priority to basic education and the Millennium Development Goals, some attention has been given to higher education. The 2009 Global Education Digest has a chapter devoted to exploring the changing patterns in global higher education. It contains an analysis of the rising demand for higher education, represented by an explosive growth in tertiary students worldwide since 1999, presenting a unique picture of the landscape of international student mobility.

F. Statistical capacity-building

41. Statistical capacity-building is part of the core mandate of the UNESCO Institute for Statistics. In order to improve the availability and the quality of science, technology and innovation statistics in various regions of the world, capacity-building and training are needed. The UNESCO Institute for Statistics has designed and delivered an extensive series of regional workshops since 2005, addressing science, technology and innovation statisticians in developing countries. These workshops were often carried out in partnership with UNESCO headquarters, its regional offices, regional networks such as the Ibero-American Network on Science and Technology Indicators and the African Union/NEPAD, funding agencies and other interested partners.

¹⁷ Available from www.oecd.org/site/stipatents/.

42. Workshops have taken place in all developing countries in all regions of the world. The goals were to increase the number of countries regularly producing quality science and technology indicators; to create local capacity for the production of such indicators; to promote evidence-based science and technology policymaking; to facilitate discussion between countries, addressing problems they may have encountered; to learn about the characteristics of science, technology and innovation statistics data collection and use in countries of the same region; and to identify examples of good practice to be shared with other countries. The workshops were targeted at the statisticians who do the data collection and analysis in each country, but have also included policy and decision makers from a variety of national authorities.

43. There is currently a strategic shift in direction, away from regional workshops to more targeted assistance at the national level. For example, countries as diverse as Viet Nam, Ethiopia and Qatar have carried out or are carrying out an research and development survey with the help of the UNESCO Institute for Statistics, while assistance activities on innovation surveys are under way with China, Ecuador and Viet Nam. More countries have requested UNESCO Institute for Statistics assistance.

IV. Conclusion

44. There has been considerable progress since the publication of the last report to the United Nations Statistical Commission (E/CN.3/2008/21), as demonstrated by the increasing importance of science, technology and innovation statistics to the global user community. There has been a significant convergence in the application of measurement standards developed by OECD and partner organizations, supported by an effective coordination of activities between the various global and regional organizations. Research and development statistics have been used to document the relative resilience to date of research and development investments in the face of the economic crisis, tracking the rapid emergence of several developing economics as global research and development powerhouses. Changes in the way that research and development takes place and is accounted for in business and other organizations are key factors driving the case for undertaking a revision of the *Frascati Manual*. Within one or two years, research and development statistics will be incorporated in revisions to headline economic indicators like GDP for a sizeable number of countries.

45. The increasing adoption of Oslo-based innovation surveys on a worldwide basis is particularly promising, highlighting to decision makers the wider range of innovation activities beyond research and development. While the international comparability of innovation indicators is still problematic, these data have been particularly attractive to the research community and provided several insights on the way innovation takes place within firms. This has led several users to ask for an extension of the framework outside the domain of market-based companies into public sector organizations, user innovation and related areas. Statistical agencies have been piloting approaches in recent years.

46. Following an expansion in recent years in the number of activities on science, technology and innovation statistics, many statistical agencies and bodies in charge of science, technology and innovation statistics are currently reporting financial

difficulties and the need to identify priorities and potential areas for savings. The potential integration of different statistical surveys is high on the agenda of several organizations as a possible mechanism for reducing survey burdens and increasing response rates. However, relatively little is known about the impact of integration on the quality of responses or the effective burden on respondents. Electronic data collection methods are also becoming more widespread in the domain of science, technology and innovation statistics.

47. Against this backdrop, the international organizations operating in this field have made a strong case for developing the evidence on the benefits and costs of alternative methods for collecting data and using administrative sources. Considerable emphasis has been placed on the importance of developing a global infrastructure for linking data and carrying out detailed microdata analysis in a safe and non-disclosive environment.

48. Cooperation between the main agencies active in this area (UNESCO Institute for Statistics, OECD and Eurostat) has been increasingly close, with excellent results. There is also a very good relation with regional agencies, such as the Ibero-American Network on Science and Technology Indicators and the African Union/NEPAD. This avoids burdening countries with multiple requests for the same data and the duplication of efforts at the level of the international and regional agencies. Cooperation between international agencies and national statistics organizations has also been good, with active participation in both OECD and UNESCO activities.

49. However, in developing countries, national statistics organizations are less involved in the area of science, technology and innovation statistics, with line ministries, such as the Ministries of Science and Technology, often taking the lead. National statistics organizations should be encouraged to get involved in order to improve data quality, since increasing policy emphasis on science and technology suggests a need for regular science and technology data collection in national statistical plans and strategies. In many countries, increased resources are needed for the collection of timely and relevant science, technology and innovation statistics of high quality, based, where applicable, on international methodologies.

50. The community of statisticians needs to continue to work together to make a better case for the importance and relevance of such data.

Annex

Methodological manuals and relevant documents

<i>Type of data</i>	<i>Title</i>
UNESCO	
	Recommendation concerning the International Standardization of Statistics on Science and Technology, UNESCO, Paris, 1978
	Manual for Statistics on Scientific and Technological Activities (ST-84/WS/12), UNESCO, Paris, 1984
	Measuring R&D: Challenges faced by Developing Countries: Technical Paper No. 5, UNESCO Institute for Statistics, Montreal, 2010
	UNESCO Institute for Statistics website: www.uis.unesco.org
OECD/Eurostat	
The Frascati family: <i>The Measurement of Scientific and Technological Activities Series</i>	
Research and development	<i>Frascati Manual 2002: Proposed Standard Practice for Surveys on Research and Experimental Development</i> (OECD, 2002) www.oecd.org/sti/frascaticmanual
Technology balance of payments	<i>Manual for the Measurement and Interpretation of Technology Balance of Payments Data — TBP Manual</i> (OECD, 1990)
Innovation	<i>Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd edition</i> (OECD/Eurostat, 2005)
Patents	<i>OECD Patent Statistics Manual, Paris: OECD, 2009</i>
Science and technology personnel	<i>The Measurement of Human Resources Devoted to Science and Technology — Canberra Manual</i> (OECD, 1995)
Biotechnology	<i>A Framework for Biotechnology Statistics</i> (OECD, 2005)
Other methodological frameworks for science and technology	
High technology	“Revision of High-technology Sector and Product Classification” (OECD, STI Working Paper 1997/2)
Bibliometrics	“Bibliometric Indicators and Analysis of Research Systems, Methods and Examples”, by Yoshiko Okubo (OECD, STI working paper 1997/1)
Globalization	<i>OECD Handbook on Economic Globalisation Indicators</i> (OECD, 2005)
Information society	<i>OECD Guide to Measuring the Information Society (2011)</i>
Education statistics	<i>OECD Handbook for Internationally Comparative Education Statistics</i> (OECD, 2004)
Doctorate holders	<i>Methodological guidelines</i> (www.oecd.org/sti/cdh)