



OECD Science, Technology and Industry Scoreboard 2013

INNOVATION FOR GROWTH



OECD Science, Technology and Industry Scoreboard 2013

This work is published on the responsibility of the Secretary-General of the OECD. The opinions expressed and arguments employed herein do not necessarily reflect the official views of the Organisation or of the governments of its member countries.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Please cite this publication as:

OECD (2013), *OECD Science, Technology and Industry Scoreboard 2013*, OECD Publishing.
http://dx.doi.org/10.1787/sti_scoreboard-2013-en

ISBN 978-92-64-20073-9 (print)
ISBN 978-92-64-20500-0 (PDF)
ISBN 978-92-64-203181 (HTML)

Biennial:
ISSN 1562-983X (print)
ISSN 2072-5345 (online)

1. Note by Turkey:

The information in this document with reference to “Cyprus” relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the “Cyprus issue”.

2. Note by all the European Union Member States of the OECD and the European Union:

The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities or third party. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Photo credits: Cover © Sergey Nivens/Shutterstock.com; © Redshinestudio/Shutterstock.com.

Corrigenda to OECD publications may be found on line at: www.oecd.org/publishing/corrigenda.

© OECD 2013

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgment of the source and copyright owner is given. All requests for public or commercial use and translation rights should be submitted to rights@oecd.org. Requests for permission to photocopy portions of this material for public or commercial use shall be addressed directly to the Copyright Clearance Center (CCC) at info@copyright.com or the Centre français d'exploitation du droit de copie (CFC) at contact@cfcopies.com.

Foreword

The OECD Science, Technology and Industry Scoreboard 2013 draws on the latest internationally comparable data to uncover the strengths of OECD and other leading economies and explore the continuing challenges to overcome the effects of the recent financial and economic crises. It features indicators traditionally used to monitor developments in science, technology, innovation and industry, and complements them with new and experimental indicators that provide new insights into areas of policy interest.

The STI Scoreboard is not about “ranking” countries or developing composite indicators. It is about giving policy makers and analysts the means of comparing economies with others of a similar size or with a similar structure and monitor progress towards desired national or supranational policy goals. It draws on the OECD’s efforts to build the data infrastructure needed to link actors, outcomes and impacts; it highlights the potential and the limits of certain metrics and points to directions for further work.

Indicators are pointers. They do not address causal relations. Moreover, the validity of a set of indicators depends on its use. The selected indicators have been developed with the following criteria in mind:

- Indicators should be based on high-quality statistics and robust analytical principles and be measurable internationally, over time and with prospects of improvement.
- Indicators should be relevant, particularly for decision makers.
- Experimental indicators that complement more established ones bring new perspectives and advance the measurement agenda. They help to stimulate continuing and new policy debates and uncover new dynamics.

The first chapter, Knowledge economies: trends and features, provides a broad perspective. It looks at innovation, firm dynamics, productivity and jobs against the backdrop of the economic crisis. It explores the new geography of growth through the lenses of global value chains, the changing landscape of innovation, the features of science today and the characteristics of innovation beyond formal research and development.

Six thematic chapters focus on areas of key policy interest:

- **Building knowledge** looks at the knowledge assets that many firms and governments view as their current and future sources of long-term sustainable growth. It focuses on indicators of knowledge-based capital and on the jobs and employment related to it, scientific skills and education, and investment in research. It also presents experimental indicators of public funding and new estimates of R&D tax incentives.
- **Connecting to knowledge** helps inform the policy debate with a set of metrics on the variety and nature of mechanisms for knowledge exchange. Among the indicators presented are the impact of scientific collaboration (based on patent citations) and science-industry linkages (based on citations of non-patent literature in patent documents). Also included are new indicators on

researcher mobility that track the careers of scientists who publish in scholarly journals and on the extent of firms' collaboration in innovation processes.

- **Targeting new growth areas** examines the direction of countries' scientific efforts and the technologies on which they build their comparative advantage. It presents R&D and innovation indicators in biotechnology and nanotechnology and in health, environmental and information and communication technologies, and looks at developments in smart ICT infrastructure. It also reveals how the development of technologies accelerates over time and how innovations emerge from the combination of different technologies.
- **Unleashing innovation in firms** is concerned with the dynamism of the business sector and shows the strong contribution of young firms to job creation using new microdata-based indicators. It looks at the main ways in which firms innovate and proposes a novel indicator on the intellectual property bundle to point to firms' joint use of patents, trademarks and industrial designs to protect their innovations. New data on registered designs provide information on how countries protect creativity. Other indicators address the extent to which governments create the conditions for young innovative firms to grow and the broader policy environment for innovation.
- **Competing in the knowledge economy** looks at how countries seek to build their competitive strengths and uses a wide range of more sophisticated indicators than those that are generally available. It considers industrial specialisation and diversification, R&D and trade specialisation, technological advantages and relative strengths, as well as the characteristics of innovative firms and their use of new technologies in business processes.
- **Participating in the global economy** draws out the implications of structural characteristics for economies' participation in global value chains. Indicators related to firms' size, survival and growth and to foreign affiliates accompany employment patterns in key industries and linkages between manufacturing and services. Novel indicators building on the OECD-WTO Trade in Value Added Database shed new light on economies' participation in global trade and value chains and the implications of this participation for jobs.

The main audience of the STI Scoreboard is policy analysts with a good understanding of the use of indicators and all those engaged in producing indicators for analytical or policy-making purposes. A few paragraphs introduce each indicator and offer some interpretation. They are accompanied by a box called "Definitions" for those less familiar with the methods used. A box titled "Measurability" summarises measurement challenges, gaps and recent initiatives.

All charts and underlying data can be downloaded via the Statlinks ([hyperlink to a webpage](#)). For the first time, additional data that expand the coverage of countries and time periods are available in the Statlinks. New tools to visualise indicators and help users develop thematic and country profiles based on their own interests will be available on the STI Scoreboard website.

Acknowledgments

This volume is the result of a collective effort by the Economic Analysis and Statistics Division (EAS) of the OECD Directorate for Science, Technology and Industry (DSTI), under the guidance of Alessandra Colecchia. Lead authors were Alessandra Colecchia, Andrea de Panizza, Fernando Galindo-Rueda, Vladimir Lopez-Bassols, Mariagrazia Squicciarini and Colin Webb with contributions from Silvia Appelt, Laudeline Auriol, Brigitte van Beuzekom, Catherine Bignon, Brunella Boselli, Agnès Cimper, H el ene Dernis, Chrystyna Harpluk, Pedro Herrera-Gimenez, Elif K oksal-Oudot, Guillaume Kpodar, Marie Le Mouel, Valentine Millot, Pierre Montagnier, Asako Okamura, Fabien Verger, Bo Werth and Norihiko Yamano.

The contributions of Mari Jibu (Japan Science and Technology Agency) and Roberto de Pinho (Ministry of Science, Technology and Innovation, Brazil) as visiting experts at EAS, on the analysis of scientist mobility and science-technology links, respectively, are greatly appreciated. The analysis of science and technology links relies on an algorithm developed by Thomson Reuters and Japan's Science and Technology Agency matching patent and scientific publication databases.

Brigitte van Beuzekom and Elif K oksal-Oudot coordinated the production process of this publication. Andrew Wyckoff and Dirk Pilat provided overall guidance and comments.

Others in DSTI and elsewhere in the OECD made available their respective areas of expertise: Nadim Ahmad, Fr ed eric Bourassa, Chiara Criscuolo, Koen de Backer, Rudolf Van Der Berg, Isabelle Desnoyers-James, Agust n D az-Pin es, Peter Gal, Corinne Heckmann, Joseph Loux, Mariarosa Lunati, Carlo Menon, Laurent Moussielt, Filipe Silva and Karen Wilson.

The SCImago Research Group (CSIC, Spain), www.scimago.es, led by F elix de Moya-Aneg on with contributions from Carmen L opez-Illescas, Zaida Chinchilla-Rodr guez and Elena Corera- lvarez, collaborated with the OECD in designing and preparing new indicators of scientific production, collaboration and impact using Elsevier's Scopus data.

EAS matched 16.2 million patents in the EPO's Worldwide Patent Statistical Database (PATSTAT) and 2.2 million OHIM and USPTO trademarks against 1.2 million companies in Bureau van Dijk's ORBIS  database thanks to the efficient matching software developed for the OECD by IDENER, Seville, www.idener.es/nosotros_en.html.

Several indicators are based on special data requests to national statistical offices or ministries. The time and help granted by the OECD National Experts for Science and Technology Indicators (NESTI), their colleagues and organisations have been instrumental to this publication.

Preliminary results from the DYNEMP project on firm-level dynamics, under the aegis of the OECD Working Party on Industry Analysis (WPIA), have kindly been made available by teams in 15 countries: Werner H olzl (Austria – WIFO); Hilde Spinnewyn, Chantal Kegels, Michel Dumont (Belgium – Federal Planning Bureau); Gabriel Lopes de Ulyseia, Carlos

Henrique Leite Corseuil, Fernanda de Negri (Brazil – IPEA); Mika Maliranta (Finland – ETLA and Statistics Finland); Lionel Nesta, Flora Bellone (France – GREDEG, CNSR and OFCE, Sciences Po); Adrienn Szep Szollosine, Erzsebet Eperjesi Lindnerne, Gabor Katay, Peter Harasztosi (Hungary – Central Bank of Hungary and Central Statistical Office of Hungary); Stefano Costa (Italy – ISTAT); Kyoji Fukao, Kenta Ikeuchi (Japan – Hitotsubashi University and National Institute of Science and Technology Policy); Leila Ben-Aoun, Anne Dubrocard, Michel Prombo (Luxembourg – STATEC); Michael Polder (Netherlands – CBS); Lynda Sanderson, Richard Fabling, Gerald Minnee, Hamish Hill (New Zealand – New Zealand Treasury, Statistics New Zealand, Motu Economic and Public Policy Research); Arvid Raknerud (Norway – Statistics Norway); Valentin Llorente Garcia, Luis Esteban Barbado Miguel, Jose Manuel Almendros Ulibarri, Javier Agustin Munoz Carabias (Spain – Ministry of Industry, Energy and Tourism and Spanish Statistical Office); Eva Hagsten, Jan Selen, Monica Nelsonedberg (Sweden – Statistics Sweden); Javier Miranda (Census Bureau of the United States).

Table of contents

Acknowledgments	5
Reader's Guide	10
Executive summary	13
1. Knowledge economies: Trends and features	17
Sources of growth and the crisis	18
The new geography of growth	40
The changing landscape of innovation	50
Science and innovation today	57
Notes	70
References	81
2. Building knowledge	85
1. Investment in knowledge	86
2. Human resources and knowledge-based capital	88
3. Learning for innovation	90
4. Skills for innovation	92
5. New doctorates	94
6. Doctorate holders	96
7. Researchers	98
8. R&D	100
9. Higher education and basic research	102
10. Business R&D	104
11. R&D tax incentives	106
12. International funding of R&D	108
Notes	110
References	118
3. Connecting to knowledge	121
1. R&D and knowledge flows	122
2. Open innovation	124
3. Collaboration on innovation	126
4. International collaboration	128
5. Skills mobility	130
6. Researchers on the move	132
7. Research excellence	134
8. Science for innovation	136
9. From knowledge to inventions	138

10. Inventions across borders	140
11. Technology flows and markets	142
Notes	144
References	149
4. Targeting new growth areas	151
1. R&D funding and specialisation	152
2. Green innovation	154
3. Health innovation	156
4. Biotechnology R&D	158
5. Nanotechnology R&D	160
6. ICT innovation	162
7. Broadband price and quality	164
8. Fixed and wireless broadband	166
9. Internet users	168
10. Emerging technologies	170
Notes	172
References	177
5. Unleashing innovation in firms	179
1. Mixed modes of innovation	180
2. Broader innovation	182
3. Public support to innovation	184
4. The IP “bundle”	186
5. Trademarks	188
6. Knowledge-asset-related trademarks	190
7. Registered designs	192
8. Trademarks and patents	194
9. Entry, exit and survival	196
10. Firm employment dynamics	198
11. Access to capital	200
12. Policy environment	202
Notes	204
References	211
6. Competing in the knowledge economy	213
1. Industry specialisation	214
2. ICT industry specialisation	216
3. Export structures	218
4. R&D specialisation	220
5. Technological advantage	222
6. Trade competitiveness	224
7. E-business uptake	226
8. Young innovative firms	228
9. Technological strengths	230
Notes	232
References	237