Telecommunications Policy 38 (2014) 812–826

Contents lists available at ScienceDirect

Telecommunications Policy

URL: www.elsevier.com/locate/telpol

Characterizing and comparing the evolution of the major global economies in information and communication technologies ☆

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ARTICLE INFO

Available online 2 August 2014

Keywords:
ICT industry
R&D investment
Patenting
Employment
Digital Agenda for Europe

ABSTRACT

In this paper, we characterise and compare status and evolution of the ICT industry of the six major global economies in ICT: China, the EU, Japan, Korea, Taiwan and the USA. For this, we employ official data covering the period 2006–2009. Our analysis shows that although the EU is the largest economy of the world, it is the least ICT-specialised economy of all six major ICT economies. The USA is clearly the top global player in ICT in many respects. In both ICT Manufacturing and ICT Services it has the largest Value Added, BERD, BERD intensity and labour productivity. We further observe that China has, by far, the largest number of employees in both ICT Manufacturing and Services, while its level of ICT BERD remains low. China is however an emerging economy and economic indicators of its ICT sector have strongly grown from 2006 to 2009. Japan's ICT sector has a larger weight in the national economy than those of the USA, EU, and China. Moreover, it is the country from which the highest number of ICT patent applications originate. We also find that, of all six major global economies in ICT, Taiwan and Korea have the most ICT-specialised economies, with a strong orientation towards Manufacturing. Finally, we discuss selected results of our analysis and conclude the paper with tentative policy implications for the EU.

1. Introduction

In this paper, we characterise and compare, using most recent official macro-economic data, the evolution of the ICT industry of China, the European Union (EU), Japan, Korea, Taiwan and the USA, all major global players in this field. The Information and Communication Technologies (ICT) industry includes IT and telecom hardware manufacturers, telecom operators and software and computer service firms. It provides technologies and solutions necessary for the development of the digital economy and society. This analysis is particularly relevant for policy makers since the ICT industry and ICT-enabled innovation make an increasingly important contribution to economic growth.

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http://dx.doi.org/10.1016/j.telpol.2014.04.010

1.1. Policy background

Europe 2020, the EU strategy for growth launched in 2010, set five ambitious objectives on employment, innovation, education, social inclusion and climate/energy to be reached by 2020.[1] One of them is the target to invest 3% of the EU's GDP in R&D by 2020, an achievement that "could create 3.7 million jobs and increase annual GDP by €795 billion by 2025".[2] The *Digital Agenda for Europe*[3] (DAE) is one the seven "flagship initiatives" of *Europe 2020*. The DAE aims at a doubling of both public funding of ICT R&D and business expenditures in R&D by the ICT industry. At the EU level, the most important public instrument for funding R&D, including R&D in ICT, has been the series of framework programmes for research and technological development. The EU launched in 2014 the *Horizon 2020* programme for research and innovation which will cover the period until 2020 with a total budget of €70 billion.

1.2. Research context

Quantitative evidence is needed on a regular basis in order to monitor progress and impact of policies and their instruments; and in order to guide their future development. As part of its mission to provide robust, evidence-based policy support, the Information Society Unit of JRC-IPTS regularly analyses the state of the ICT industry and of ICT R&D activities in the EU, under the PREDICT project, "*Prospective insights on R&D in ICT*".[4] The fifth edition of the PREDICT report was published in 2012 (Stančík and Desruelle, 2012). The research presented in this paper builds on the analyses developed so far under PREDICT. The PREDICT analysis, although clearly focused on the EU, benchmarks the performance of the EU ICT industry with that of the US and of other developed and emerging economies. For example the 2012 analysis observed a growing gap between the EU and the US, in terms of the size of the respective ICT sectors and of their R&D.

International benchmarking – going beyond just comparing the EU and US – was developed in PREDICT by analysing non-official data on R&D expenditures by the top worldwide R&D-investing ICT companies, and also by analysing patenting data (De Prato, Nepelski, Szewczyk, & Turlea, 2011a; Nepelski & Stancik, 2011; Turlea et al., 2009, 2010, 2011). PREDICT also analysed in details the performance of the ICT industry in several of the BRICS countries, in particular in Brazil, China and India (Simon, 2011a, 2011b).

The research presented in this paper complements the analyses developed so far by comparing and analysing the performance of the ICT industry of the most important global players in ICT (China, the EU, Korea, Japan, Taiwan and the USA), using a consistent set of indicators based on most recent official macro-economic data.

In the next sections of the paper, we first identify the major global players in ICT by comparing the economic weight of their ICT industry and their volume of Business Expenditures in R&D (BERD). We then analyse the specialisation and strengths of these economies in ICT Manufacturing and Services, examine main trends, and discuss selected results. We finally conclude with a brief summary for each of the six major global players in ICT and tentative policy implications for the EU.

2. Approach and data

The data analysed in this research (Value Added, Employment and BERD) was collected from official sources including OECD, US Bureau of Economic Analysis, NSF, METI, EUROSTAT, National Bureau of Statistics of China, Statistics Korea, and National Statistics of Taiwan. For patents we use EPO PATSTAT data. Our analysis covers four years, from 2006 to 2009. 2009 was the most recent year for which official data was available at the time when we did our research.

We followed as far as feasible the most recent definition of the ICT sector – i.e., ISIC 4/NACE Rev. 2 – adopted by the OECD in 2007.[5] For reasons of data availability, we had to slightly adapt this definition. The definition of the ICT sector used in this paper is provided in Box 1. In order to obtain comparable data from 2006 to 2009, we elaborated a transition methodology from the previous to the current definition.[6] We also developed correspondence tables to account for different ICT sector definitions in the analysed countries.[7] Data collection and methodological work were conducted jointly with the *Valencian Institute of Economic Research* (Ivie). Our data sets, indication of data sources, and methodological reports and notes are publicly available on the JRC-IPTS web site.[8]

[1] http://ec.europa.eu/europe2020.

[2] http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=why.

[3] http://ec.europa.eu/digital-agenda/en.

[4] The Institute for Prospective Technological Studies (JRC-IPTS) is one of the seven scientific institutes of the European Commission's Joint Research centre (JRC). For more information on PREDICT and for its publications, see http://is.jrc.ec.europa.eu/pages/ISG/PREDICT.html.

[5] See *OECD Information Economy – Sector definitions based on the International Standard Industry Classification (ISIC 4)*, Annex 1, p. 15. Available at: http://www.oecd.org/science/scienceandtechnologypolicy/38217340.pdf.

[6] *ICT Sector Definition Transition from NACE Rev. 1.1 to NACE Rev. 2: A Methodological Note*. Authors: Matilde Mas, Juan Carlos Robledo, Juan Pérez. Editors: Juraj Stančík, Geomina Turlea, Paul Desruelle. JRC Technical Report, EUR Number: 25690, Jan. 2013. Available at: http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=5919.

[7] 2006–2009 NACE REV. 2 ICT datasets methodological notes, December 2012. Available at: http://is.jrc.ec.europa.eu/pages/ISG/PREDICT/2da/documents/20062009NACE2_METHOD.pdf.

[8] http://is.jrc.ec.europa.eu/pages/ISG/PREDICT/2da/data2.html.