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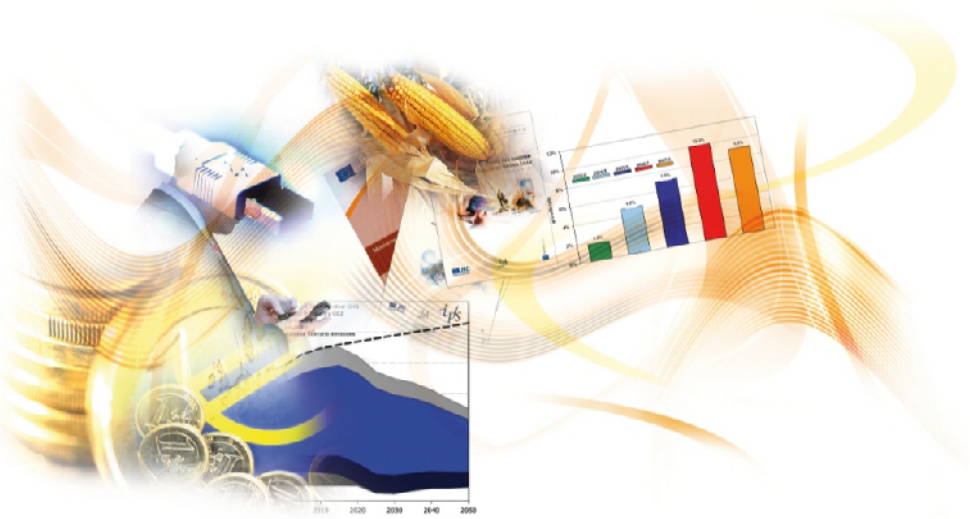

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PREFACE

R&D activity in the Information and Communication Technologies (ICT) industrial sectors is an important factor in boosting the competitiveness of the European economy. The ICT industry and ICT-enabled innovation in non-ICT industries and services is making an increasingly important contribution to economic growth in advanced economies. The ICT sector was highlighted in the EU Lisbon Objectives, and has retained its prominence in the recently proposed **Europe 2020 Strategy**.

The Information Society Unit at IPTS[1] is carrying out a research project on Prospective Insights on R&D in ICT (PREDICT)[2] and has produced a series of annual reports.[3] PREDICT combines, in a unique way, three complementary perspectives: national statistics (covering both private and public R&D expenditures), company data, and technology-based indicators. PREDICT relies on the latest available official statistics delivered by Member States, Eurostat and the OECD.

The first part of each annual PREDICT report gathers the most recent quantitative information on ICT R&D investments in the EU and worldwide. It presents the data by countries, sub-sectors and companies. The second part of each report is dedicated to a specific thematic analysis. In 2009, the thematic analysis focused on patents data analysis. In 2010, it focuses on internationalisation of ICT R&D.

As an extension of these existing research efforts, IPTS launched a tender for research focused on R&D in ICT sectors in India, China and Taiwan, in order to gain a better understanding of major ICT R&D capabilities in those parts of the world. The 2011 PREDICT report offers a country-level approach to ICT R&D internationalisation by analysing the ICT industry in China and India, the two largest emerging economies. It then provides a first synthesis of the research.[4]

This research exercise led to three further reports on China, India and Taiwan, each one including a dataset and a technical annex. The proceeding of the conference organised as part of this on-going research and as a working tool for a report on ICT in BRIC countries is an additional output.

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1 IPTS (the Institute for Prospective Technological Studies) is one of the 7 research institutes of the European Commission's Joint Research Centre.

2 PREDICT is co-financed by JRC-IPTS and the Information Society & Media Directorate General of the European Commission.

3 Available on our website under the link http://is.jrc.es/pages/ISG/PREDICT.html

4 Also based on these country reports and further research, IPTS is preparing a report on ICT in BRIC countries. For more, see under Simon J-P (2011) (forthcoming).

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INTRODUCTION

The Information Society Unit of the JRC-IPTS has been investigating the Information and Communication Technologies (ICT) sector and its R&D in Asia for several years[5] as an extension of its research efforts for the PREDICT[6] project. The forthcoming 2011 PREDICT report offers a country-level approach to ICT R&D internationalisation by analysing the ICT industry in China and India, the two largest emerging economies. The conference was organised as part of this on-going research and as a working tool for a report on ICT in BRIC countries.

The conference[7] aimed to gather the most recent information on the Asian ICT scene, to raise questions rather than find answers, to reflect on the EU position and policies toward Asia as a whole, and toward India and China more specifically.[8] The following questions were proposed for discussion and supported by experts' presentations:[9]

- How is the ICT industry, and its R&D activities developing in selected Asian countries?
- What are the prospects for the future?
- Regional ICT production and trade: what are the main ICT-related relationships between the countries? Is there a regional dynamic?
- What are the existing or potential strategies for EU and US ICT companies? How willing are these companies to collaborate with Asian partners? What are the most visible signs of success… and failure? What are the future hopes, threats and opportunities?
- What are the existing or potential policies at national or European level that could offer support to ICT companies?

5 IPTS launched in 2005, and again in 2008, several tenders for research focused on R&D in ICT sectors in Asia, particularly in India, China and Taiwan, in order to gain a better understanding of major ICT R&D capabilities in those parts of the world.

6 The PREDICT project combines, in a unique way, three complementary perspectives: national statistics (covering both private and public R&D expenditures), company data, and technology-based indicators. Available at: http://is.jrc.ec.europa.eu/pages/ISG/PREDICT.html

7 http://is.jrc.ec.europa.eu/pages/ISG/PREDICT/AsiaICT.html

8 Japan was deliberately left out of the Conference programme for reasons of timing.

9 22 experts from academia, research institutes, industry and administration were invited, 13 of whom work and/or have operations in Asia.

WORKSHOP SESSIONS

Session 1: Asian ICT developments - where are the challenges?

Welcome Speech

Mr. David Broster, *Head of Information Society Unit, Institute for Prospective Technological Studies (IPTS), Joint Research Centre (JRC), European Commission.*

Session 1 set the scene for the conference. It was opened by Mr. Broster who introduced the reasons why the JRC-IPTS and the EC are interested in researching the role of Asia in the developments in ICT R&D. He stressed three key words: globalisation/ specialisation/ cooperation.

Key Note Speech 1: International cooperation in ICT RTD – a luxury or a necessity?

Dr. Stephan Pascall, *Adviser International Cooperation, Information Society and Media Directorate General (INFSO), European Commission.*

Mr. Pascall addressed the importance of ICT R&D collaboration. According to him, international cooperation is a need, considering the current developments in both developing and developed countries, including Europe. He reinforced this point by the growing R&D capabilities in ICT of Asian countries, particularly South Korea and Taiwan, where private companies are increasing their ICT R&D spending. China 'produces' a huge number of engineers whereas the EU does not.

Mr. Pascall also addressed the barriers to the development of R&D collaboration. The most important challenges include protection of IPR, reciprocity, language barriers and technology transfer difficulties. He concluded that we could benefit more from each other's competences.

Key Note Speech 2: Globalization of science and technology - the Asian drama

Prof. Aqueil Ahmad, Walden University School of Management (USA).

Mr. Ahmad started his key note speech by emphasising the interconnectedness of six dimensions of globalisation and by stressing the fact that the globalisation of science and technology is one element of the globalisation process. Then he focused on the changing dynamics of knowledge production and flows and the increasingly important role of Southern and Eastern countries in this process. He described these countries' transition from borrowing and imitation to adaptation and invention, in line with Mr. Pascall's views on the increasing role and independence of Asian countries as regards ICT R&D.

Another issue mentioned by Mr. Ahmad were the differences in the innovation policy approaches taken by various countries. For example, whereas China has adopted a 'technology first, science later' policy, India has reversed these priorities and has focused first on science. Furthermore, he mentioned the role of the Chinese vision of 'learning from the others' in the process of policy making.

Lastly, Mr. Ahmad discussed the differences in social values between western and eastern countries and how they influence personal decisions concerning career choices and their long term-impact on a country's technological performance. He also concluded that one should learn from others, and added that most of the fears about Asia were unfounded – in fact, there are opportunities to be found in a globalized world.

Globalisation of R&D: Opportunities and Challenges from Asia

Mr. Vincenzo Spiezia, *Head of ICT Indicators Unit, Directorate for Science, Technology and Industry, OECD (France).*

Mr. Spiezia started by reviewing recent statistics on innovation capabilities in Asia. China is closing the gap with the EU and India is lagging behind in R&D. Korea, Taiwan and Singapore are faring better than the OECD average for R&D gross expenditure (% GDP). Though the innovation capabilities of these countries are growing fast, a gap remains nevertheless. He continued by asking whether the rising prowess of Asia in R&D is 'good or bad news'. In his view, as innovation is not a rival good, countries should promote international cooperation in R&D, in order to benefit from emerging new actors.

He argued that the increase in Asian R&D may lead to higher growth for the world economy, help to meet global challenges if R&D spillovers spread among economies and that international cooperation in research is key. The last point, however, remains quite challenging as the levels of cooperation between Asia and the EU remain very low as EU firms cooperate mainly with EU and OECD countries. The same is true for patents: EU firms tend to co-invent with other EU firms whereas China and India co-invent more with the US.

As possible ways of addressing this issue, he reviews the major elements of the OECD innovation strategy which aims to improve international collaboration by, among others, fostering innovation beyond S&T towards intangible assets; supporting education and training to empower people to be creative and engage in innovation; favouring the creation and growth of new firms; fostering the diffusion of knowledge through well-functioning networks and markets and developing international co-operation in S&T to address global challenges.

He concluded by stating that the overall model of innovation is moving towards openness and away from 'closed' innovation.

Recent observations on Asian ICT R&D

Mr. Paul Desruelle, *Senior Scientific Officer, Institute for Prospective Technological Studies (IPTS), Joint Research Centre (JRC), European Commission.*

Mr. Desruelle compared the ICT sectors in selected world regions: input and output to ICT R&D; and the internationalisation of ICT R&D. His observations and comments reinforced the view that the role of Asian countries in ICT R&D is growing.

In addition, he listed a number of issues concerning the challenges resulting from the rise of Asia. Those demanding most attention include: the increasing specialisation of specific countries and regions; the emergence of new players; the relocation of activities; the increasing international cooperation; and the implications of all of these for the EU.

Session 2: ICT industry and its R&D in India

Setting the scene

Mr. Jean-Paul Simon, Senior Researcher, Institute for Prospective Technological Studies (IPTS), Joint Research Centre (JRC), European Commission.

Mr. Simon reviewed the most important indicators for the Indian economy, and the ICT sector and its R&D activity. He stressed that since the introduction of market-based economic reforms in 1991, India has become one of the fastest growing major economies in the world. The Indian economy is the world's eleventh largest economy by nominal GDP and the fourth largest by purchasing power parity with an impressive growth rate for the last two decades.

The Indian ICT sector is growing in all domains, but is predominantly driven by software services. India is the second-largest (after China) and one of the fastest growing mobile markets in the world and offers an interesting case study of innovation with the budget telecom model or 'bottom of the pyramid' (BOP) model.

Trends in the ICT industry and ICT R&D in India.

Prof. Payal Malik, Delhi University (Delhi, India).

Ms. Malik first reviewed the key facts on the Indian ICT sector. In this context, she emphasised the strong 'imbalance' in the composition of the Indian ICT industry towards the service (software) sector. In addition, concerning the spatial distribution of the ICT economic activity, she mentioned that the software export from Indian states is very skewed. Only six top ICT regions account for 97% of the total revenues. All these regions also show a strong presence of foreign firms. A similar picture emerges when looking at company level data, where there is a strong concentration of revenues among the top 3 firms, i.e. Tata Consulting, Wipro and Infosys.

In the second part of her presentation, Ms. Malik discussed the issue of ICT R&D performed in India. According to her, two sets of players in India perform ICT R&D, i.e. either large domestic forms or subsidiaries of multinationals. Large domestic players undertake internal and external inventive activities. Officially, only 4.3% of all listed software firms in India have lab or R&D equipment expenses. The propensity to patent is low.

However, this official data is not very accurate for several reasons. For example, internal inventive activities help to improve the service delivery process and are consumed by the firms themselves. Second, activities performed for external clients who outsource their product development activities are listed as high-end work, but not as R&D. Lastly, measuring R&D in the service sector, which dominates Indian ICT activity, is a difficult task. All these factors prevent us from getting a proper view of the Indian R&D activities.

To conclude, Ms. Malik argued that the model of Indian innovation is quite unique, as many useful innovations arise outside establishments where expenditure on 'R&D' the scientific and industrial is measured. Moreover, this model requires that India undertakes more 'frugal innovation', producing more 'frugal cost' products and services which are affordable by people with low income levels (BOP model).

India - A Future ICT Powerhouse?

Mr. Christer Hammarlund, International Relations Officer - Relations with China and India, Information Society and Media Directorate General (INFSO), European Commission.

Mr. Hammerlund argued that ICT manufacturing is moving to lower-cost locations in OECD and Asian countries and that the OECD-area ICT sector has shifted to computer and related services and other ICT services. In this context, India has a lot of potential and, in time, will become a global player in ICT, even if the R&D investment remains small.

ICT Innovations in South Asia: An Assessment.

Prof. Rohan Samarajiva, *Founding Chair and CEO, LIRNEAsia (Sri Lanka).*

Mr. Samajiva argued in favour of finding new ways of capturing and assessing innovation in service-centric economies, such as India's. Growth is driven by a 'service revolution' with unusual innovations and also by the spread of decentralized innovation. This last challenges conventional measures designed for manufacturing activities (i.e. measuring outputs: patents are very 'old style' mostly useful in industry). A service-driven economy needs other indicators.

Session 3: The view from the industry (I)

Telefónica's strategic alliance in China

Mr. Pablo Pfost Minguez, *Director Regulatory Strategy, Telefónica Group (Spain).*

Mr. Pfost Minguez presented the activities of Telefónica, Spain and its joint activity with China Unicom, that covers over 10% of world population (a combined customer base of 590 million, 60 million net additions per semester, more than the entire population of Spain). The cooperation with Unicom concerns, among others, the use of network, roaming and procurement. However, Telefónica withdrew from undertaking joint research activities with Chinese companies and, instead, focuses on more tangible operations.

Infosys Research and Innovation

Dr. Jai Ganesh, Principal Research Scientist, Future Web Research Lab, SETLabs, Infosys Technologies Ltd. (India).

According to Mr. Ganesh, Infosys is a truly global company. Infosys' R&D process is, to a large extent, based on software engineering and technology labs (SETLabs), which are centres for applied technology research in software engineering and enterprise technology. It has created a global delivery model based on the co-creation of products with customers. The activities of these SETLabs go beyond industrial R&D and include output such as peer-reviewed articles. Collaboration with leading universities and patenting inventions worldwide are also important elements of their operations.

Asia – epicentre of the ICT revolution.

Mr. Rajiv Bawa, Executive Vice President of Corporate Affairs, Uninor/ Telenor (India)

Telenor serves 200 million subscribers, half of them in Asia and has been present in this region for over 15 years. According to Mr. Bawa, one of the results of Asian countries entering the global economy is a change in company business models. In general, companies are shifting their attention from the 600 million consumers in rich countries to the 6 billion in developing countries. The core characteristics of these markets are, however, very challenging. For example, consumer behaviour that is expressed in cash-based transactions or pre-paid logic (95%) forces companies to innovate. Companies' responses to these challenges include: sharing infrastructure, outsourcing services, and looking for additional revenue sources. This strategy is summarised as adopting low cost thinking and doing it smarter. Telenor opted not to have high-end R&D is such markets.

Session 4: - ICT R&D in China

Setting the scene

Jean-Paul Simon, IPTS, European Commission.

Mr. Simon introduced the main indicators. China's GDP has achieved more rapid growth than most other countries in the world. On a purchasing power parity basis, China is the second largest economy in the world after the US, being about 41.56% of total EU27 (World Bank, 2009).

China has become the largest producer of ICT products (exports of ICT were multiplied by 4 between 2004 and 2008 even though much of these exports are re-exports from other Asian countries). Manufacturing dominates China's ICT industry. China is the world's largest mobile market and hit 853 million subscribers in January 2011[10].

Trends in the ICT industry and ICT R&D in China

Prof. Shiguo Liu, Institute of World Economics and Politics (IWEP), Chinese Academy of Social Sciences (CASS), China.

According to Prof. Liu, ICT has become a pillar industry of China's economy. ICT services[11] is growing quicker and catching up with manufacturing. In 2006, value added reached 4.46% for manufacturing (1.37% in 1997) and 3.9% for services (0.85% in 1997). China's ICT activities are clustered in a few provinces such as Guangdong, Jiangsu and Shanghai.

He explained that research is a priority in China (most R&D labs are for ICT) and has been supported by the Government since mid 1980s. In 2008, it was selected as one the 10 sectors to be revitalised (R&D Programme 863: 20% for ICT). The 12th 5 Year Plan (2011-2015) is focusing on ICT to support industry and urbanisation. ICT shows a much higher R&D intensity than non-ICT industries. By the same token, ICT's R&D inputs and outputs increase at higher speeds than non-ICT industries. However it is still more focused on D (75%) than R; with only 5% fundamental research. Therefore, in spite of the important investments in R&D, China still lags behind in innovation.

Prof Liu summed up the role of Chinese firms in overseas R&D. Chinese ICT firms overseas are infants compared to their foreign partners, but they grow quickly. Some Chinese ICT firms, such as Lenovo, Huawei, ZTE and Haier, operate small-scale R&D units abroad, which focus on technology monitoring and other non-indigenous research activities. Though the leading firms have a high R&D intensity, the others lag far behind foreign firms in innovation ability.

Managing foreign R&D in China: some lessons

Prof. Dr. Max von Zedtwitz, H Professor & Director GLORAD Center for Global R&D Management, Tongi University, China.

Prof. Max von Zedtwitz focused on the evolution of R&D in China. China-based R&D is increasingly value-adding, not just cost-oriented. More than 1 200 foreign R&D centres had been set up in China by 2009 with early entrants in ICT, telecoms, and software. ICT accounts

[10] And 900 million in April, MIIT, "Operation of China's Telecommunication industry", May 24, 2011, see http://www.miit.gov.cn/n11293472/n11293832/n11293907/n11368223/13767994.html

[11] ICT Services are composed of the followings: telecommunications and other information transmission services, computers services, and software.

for half of these, with a strong presence in Beijing. China's R&D expenditure as a percentage of GDP is growing: 0.7% in 1985, 1.4% in 2008, 2.5% in 2020 (planned). If China's R&D expenditure continues to grow at the same rate (21% per year) as it has for the past twenty years, it will overtake the US level of 2010 ($ 390 billion) in 2020 ($ 454 billion).

He emphasized the importance of China's focus on education, with students specialising in science and engineering: there are 30 million students (vs. 5 million in 1998) in China (36% in engineering); 17 million in the EU, 16 million in the US. Many students go abroad and want to 'rebuild China'.

China will become more important as a source of technology. The global R&D footprint increasingly includes China and India, which means that each R&D centre will play a role in a global network. Hence, R&D in China is not just for tactical advantage.

The dynamics of ICT R&D: a case study

Dr. Stephane Grumbach, INRIA, France.

Dr. Stephane Grumbach opened his presentation with an account of China's historical background, emphasizing China's desire to recover its glorious past.

ICT services are growing in mobile telecom (800 million mobiles: 300 million mobile surfers), Internet applications (450 million people online) and services outsourcing. Four Chinese web sites are among the top 16 worldwide. Tencent, Aidu and Alibaba.com now rank 4, 6, 12 among the top global fifteen publicly traded internet companies (by market value, as of 2010). Chinese is the 2nd language on the net with Spanish coming 3rd. China leads in web 2.0 application usage penetration.

China has managed to set up new ICT giants with strong export capacity such as Lenovo, ZTE and Huawei. China has ranked n°1 for ICT exports since 2004, high-tech exports are mostly under foreign brands.

He confirmed that ICT was a research priority. This impressive growth is translated into R&D expenditures and output. China's inventive output[12] overtook both the EU and the US, and covered more than 44% of all Asian patent applications in 2007. He also confirmed that fundamental research was weak, although he added later that there is a strong belief in science (as shown in the number of students).

He stressed that few Chinese corporations are among the main investors for R&D (scarcely a dozen Chinese corporations are among the top 1 000 worldwide). Among these 1 000 top corporations, Chinese and Indian firms account for 1% of R&D expenditures (EU firms for 32%, North America for 40%).

He concluded that China was learning a lot from abroad and wondered if we could learn from China.

Science and Technology: EU/ China cooperation

Frank Greco, First Counselor, Information Society and Media, Delegation of the European Union to China and Mongolia, RELEX, Information Society and Media Directorate-General (INFSO), European Commission.

Mr Frank Greco outlined the key ICT research programmes (863 high-tech applied programmes, 973 basic research programmes, major S&T Special Projects ('Mega Projects'), most of which are not open (de facto or de jure) to foreign enterprises.

[12] Measured by ICT patent applications. See: IPTS, Predict 2011 (forthcoming).

He then introduced the EU ICT priorities vis-à-vis China:

- promote EU ICT policies and principles (digital agenda, regulatory framework, space policies, environment/climate change),
- address effectively ICT market access issues for EU companies in China (non-discriminatory PRC standards e.g. for mobile, export credits quoting the strong support of state-owned banks for instance providing Huawei and ZTE with a € 26 billion credit line, IT security certification),
- develop a stronger, equitable and fruitful R&D relationship. The latter prequires a level playing field based on reciprocity.
- He nevertheless gave some examples of the China-EU ICT research dialogue and cooperation.

He concluded that although approaches may be different, policy objectives can often be similar; developing synergies between EU and China in ICT activities could be very productive but is challenging in practice.

Assessing the IT policies

Dr. Marc Laperrouza, École polytechnique fédérale de Lausanne (EPFL-CDM-MIR), Switzerland.

Dr. Marc Laperrouza highlighted the tremendous efforts devoted to putting China into league of countries doing significant ICT R&D. However, there is still long march ahead and the success stories may be misleading. Nevertheless, we find strong political signals backed up by financial means (e.g. research programmes plus credit lines). Some firms ('national champions') have emerged as serious contenders in the market and increasingly in the labs. There is a shift from domestic to international patenting. Chinese firms are going global.

He also noted that China has become the 3rd largest patent office in the world by annual invention patent applications. Some of the firms (national champions) take R&D very seriously:

- Huawei has 17 R&D centres globally (Alcatel has 50…); 43% of the entire workforce is engaged in R&D; in 2010 this company was ranked 5th most innovative company in the world by Fast Company.
- ZTE employs 25 000 researchers around the world; more than 30 000 issued and pending patents.

The top 100 Chinese ICT companies invested RMB 40 billion in R&D in 2008 (3.5% of total revenue), but he questioned the correlation between the amount spent on R&D and success in the markets. Chinese firms still suffer from weak industrial innovation capacities. Macro and micro issues need to be addressed.

As a contrast, he reminded the audience that targeted policies of the US government created the US lead in radio technology, telecommunication, microelectronics and the Internet. US government 'never' picked winners in the form of national champions but consistently earmarked support for particular sectors deemed to define the future.

To conclude, he questioned whether China was still simply an assembler or already an innovator. He asked if China's institutional framework was ripe to support sustainable R&D in ICT, as size alone only matters if accompanied by the spread of innovative capacity. This last involves the application of new ideas and methods through a wide range of applications and supportive institutions.

Challenges of R&D transformation to China

Dr. Joerg Siewerth, Network Systems, Head of Productivity Management, Nokia Siemens Network, Germany.

7 000 employees (10% of Nokia Siemens Networks' global workforce) are working in China for Nokia Siemens Networks, of whom 50% are employed in R&D. Nokia Siemens Networks is also involved in:

- Product Management, Manufacturing, Sales and Services,
- A factory in Suzhou, which manufactures for both global and local customers,
- Continuous investment in 6 R&D centres in China.

Together with China Mobile, Nokia Siemens Network with their Chinese labs has created one standard for the next mobile generation (TD-LTE: TD-SCDMA): a standard reaching potentially 30% of the world market. This acknowledges the fact that China will become more important as a source of technology.

Session 5 - ICT Industry R&D in South East Asian countries

Trends in the ICT industry and ICT R&D in South Korea

Dr. Sangwon Ko, Korea Information Society Development Institute, Kyunggi-Do, South Korea.

Dr. Sangwon Ko gave an overall picture of ICT in Korea: the ICT industry accounted for 8.5% of GDP in 2010 (Q2), but has now entered the mature stage. For hardware, the growth potential is on the wane for major devices. It remains weak (a mere 1.8% of the world market) for software, despite continued government support. It is strong, however, in online games (23% world market share –sales, as of 2010). The hardware-focused business model, its weak software/supplementary industry, and the insufficient growth base which holds back the country's ICT advancement are all issues for the Korean ICT industry. Additionally, IT utilization in Korea lags behind other countries and productivity in the service sector is low despite greater production and employment. The government is willing to use IT to drive up productivity.

Domestic R&D investment increased from KRW 1.6 trillion[13] on average in the 80s, to KRW 8.2 trillion in the 90s, and KRW 22.9 trillion in the 2000s. R&D investment in 2009 reached KRW 37.9 trillion, raising the ratio of R&D to GDP to 3.57% (government: KRW 5.6 trillion (14.7%), universities KRW 4.2 trillion (11.1%), and the business KRW 28.1 trillion (74.3%), as of 2009. IT R&D represented 33% (KRW 12.4 trillion) of all R&D expenditure (KRW 37.9 trillion) in 2009, and government investment in R&D was highest for IT. The business sector investment is focused on development while universities invest more on basic research, however the business community is also stepping up basic research investment. ICT manufacturing is responsible for 45.5% of R&D budget in the corporate sector (2009), an increase of 12.4% per annum from 2000 to 2009. Expenditure for basic research is growing the fastest under the government's plan to expand basic research investment to support the rise of the IT industry, and upgrade the overall R&D system by developing original technology and enhancing demand-oriented R&D.

Researchers in the ICT manufacturing industry represent 36% of all researchers. The ICT sector provides greater per capita R&D budget than non-IT manufacturing and service industries. The number of ICT-related patents grew considerably. Patent applications from the ICT industry comprised 44.8% (73 000) of all applications (163 000) in 2009. The main drivers are Samsung, LG Electronics and the public research institute ETRI.

Trends in the ICT industry and ICT R&D in Taiwan

Dr. Shin-Horng Chen, *International Division, Chung-Hua Institution for Economic Research, Taiwan.*

Taiwan is highly specialised in the ICT sector, in terms of manufacturing GDP (value added), exports, and more importantly R&D expenditures. Its industrial structure is characterised by vertical disintegration. The global production network plays an important role in Taiwan's ICT industry, which shows strong commitment to R&D, and domestic production focuses on 'intermediate goods'. A number of Taiwanese-made products enjoy a significant global market share. The GDP share of Taiwan's ICT manufacturing is relatively high, compared to many other countries, 7.06% in 2006, set against 23.0% for the manufacturing sector as a whole. Out of this percentage, 5.13% is attributed to the segment 3210 (manufacture of electronic valves and tubes and other electronic components),

[13] 100 KRW= € 0.06 trillion (US): 10^{12}

associated mainly with the IC and LCD sectors. Both are also known in Taiwan's 'Two Trillion Industries' and are actively promoted by the government.

Taiwan's ICT exports are highly concentrated in ICT intermediate goods (around 70% of Taiwan's total manufacturing exports are related to these goods), rather than ICT end products. Taiwan shows an interesting shift from end-product manufacture (computers and related equipment) to component manufacture and now forms an ICT hub in the global value chain. The iPhone is a good example of this, and shows how Taiwan has become a facilitator for Chinese manufacturing. This model is very different from the vertically integrated model to be found in South Korea, Japan and China.

The role of Taiwan's iCT industry is based on the fact that its firms form part of the global production and innovation networks, which shape Taiwan's ICT R&D and R&D internationalization (both inward and outward). Taiwan's R&D has a strong tendency to collaboration with global leading players, especially brand marketers, accompanied by a delinking of R&D and production/commercialisation in terms of location.

The Taiwanese ICT industry as a whole is moving from a focus on foreign technology to indigenous innovation. Taiwan's R&D intensity (R&D/GDP) increased from 2.08% in 2001 to 2.62% in 2007. About 67% of the national R&D expenditure can be attributed to the ICT industry. In terms of US patenting, Taiwan has been ranking fourth for nine years in a row (1999-2007). However, in sharp contrast, Taiwan faces a huge and increasing deficit in technological trade. Taiwan's achievement in international patenting is not proportional to its trade balances in technology, a phenomenon described as 'innovation paradox'.

Session 6 - The view from the industry (II)

EU/Asia collaboration along the semiconductor equipment and materials supply chain

Mr. Carlos Lee, SEMI Europe, Director General, Brussels Office, Belgium.

Mr. Carlos Lee first gave an overview of the characteristics of the semiconductor industry: an enabling and pervasive technology, the most R&D intensive, a global industry of which 85% is made up of SMEs with global revenues of € 176 billion for the semiconductor industry per se (100 000 employed in the EU), € 29 billion for the semiconductor equipment and € 28 billion for materials (a combined 105 000 employees in the EU).

He stressed that remaining close to the customers (device manufacturers) is of strategic importance for European companies. Some European equipment suppliers make 90% of their revenue in Asia. He then described the various types of collaboration between the EU and Asia:

- European supplier and Asian customer,
- European supplier and Asian R&D institute/university,
- European manufacturer with competing manufacturer in Asia,
- European R&D institute with Asian companies,
- Regional workshops.

However there are some European issues to be addressed such as 'the knowledge drain', intellectual property and market access. He concluded that partnership needs to benefit both parties in both the short-term and long-term, Europe needs a long-term strategy which means more commitment to manufacturing.

Microsoft Research in Asia: Tapping into great potential

Dr. Fabrizio Gagliardi, *EMEA Director, External research, Microsoft, Switzerland.*

Dr. Fabrizio Gagliardi told the audience that Microsoft Research has been involved in Asia since 1998 (the Beijing lab was founded in November 1998). Research is focusing on five main areas: data-intensive computing, multimedia, natural user interface, search and on-line ads and customer service fundamentals. He explained the potential that academic collaboration could have as a bridge to build long-term and mutually beneficial partnerships between Microsoft Research and academia in Asia Pacific.

He concluded that Asia has become, over the last few years, a very fast developing economic region with considerable investments in R&D. Therefore, it is important for all IT players to tap into the enormous potential of this region with local investments and international collaboration. Europe can mutually benefit from this collaboration.

Concluding Session - Questions and challenges for European policy

A European policy view point

Eddy Hartog, Head of the International Relations Unit, Information Society and Media Directorate-General (INFSO), European Commission.

Mr. Eddy Hartog stressed the unique opportunities opening up, the synergies and cooperation worldwide. A key word for the way look at these various forms was co-opetition. Some developments introduced into the relation with Russia and China (joint calls, for instance) could be introduced with Asia. In its relationships with Asia, the EU is following four objectives: competitiveness, market access, tackling global issues such as digital divide; environment and the maintenance of cultural diversity.

The Commission wishes to widen its digital agenda to international issues and this agenda must be translated into action. Furthermore, the EU has to build much better intelligence of what is happening in the world.

CONCLUSIONS

Asia is ever more present in the ICT R&D global landscape. There was consensus among speakers about the rise of innovative capabilities in Asia and about its strong dynamics in terms of catching up. However, the speakers also agreed that a gap still remains and that there are local differences. These countries are still in the early stages. China is closing the gap with the EU27 quicker, but India is lagging behind. Korea, Taiwan and Singapore are above the OECD average for R&D gross expenditure (% GDP).

The economic rise of India and China creates possibilities for both domestic and foreign companies, but challenges their business models and their ways of delivering new products. One of the major issues that companies need to focus on is how to deliver fully-functional products to low-budget and numerous customers. Some of the strategies to address this challenge include, for example, sharing capital-intensive investments with other companies; collaborating with other firms on research and development and competing in the final product market; delivering new products developed and designed for the needs of local markets.

In general, most agreed that countries such the economies of India and China and the way companies in these countries do business, are different from those in the developed countries. Big numbers require big solutions according to the speakers: hi-tech / low-cost. Hence, any measures related to economic, inventive or political activities there need to be custom-tailored and to account for this distinctiveness.

The rise of Asian countries creates a challenge for developed countries and their policies for science, R&D, education, industry and international affairs. Although to some extent, the importance of these issues has been recognised, it was argued that there is still a lot of work to be done on both sides to improve the conditions for fruitful collaboration. There was nevertheless agreement on the need to learn from others, to find new forms of ‘co-opetition’ and to create a level playing field. However from an EU standpoint, barriers still need to be addressed.

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Abstract

The Information Society Unit of the JRC-IPTS has been investigating the Information and Communication Technologies (ICT) sector and its R&D in Asia for several years as an extension of its research efforts for the PREDICT project. The conference was organised as part of this on-going research to gather the most recent information on the Asian ICT scene.

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