Center for Global Development

— CONSULTATION DRAFT —

Europe Beyond Aid: Evaluating Europe's Contribution to the Transfer of Technology and Knowledge to Developing Nations

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Abstract

Technology is an essential factor in economic and human development. The technology component of the Commitment to Development Index (CDI) assesses the contributions of donor countries to global economic development through the creation and spread of new and existing technologies. The purpose of this study is to review the underlying data and trends, to understand the drivers of the decline in Europe's technological commitments and contributions, and to make policy recommendations for raising Europe's role in global technological development.

Accessing knowledge is one way in which poor countries catch up to wealthy, more industrialised ones, and donor countries can contribute to technological development and diffusion by publicly funding research and development activities. The paper concludes that the commitment of European countries to technological development in developing economies has declined and lags behind the commitment and effort of other developed countries. The study proposes to increase public research and development in technology areas that most benefit developing nations; relax the stringent intellectual property laws impeding the diffusion of technologies; and take a more active lead in the process of transferring substantive technologies to the developing world.

Europe Beyond Aid Consultation Report Series

Europe Beyond Aid uses the Commitment to Development Index (CDI) to examine European countries' collective commitment to development on seven cross-border issues: aid, trade, finance, migration, environment, security, and technology.

We calculate a consolidated score for the 21 European countries included in the CDI to track their pursuit of development-friendly policies. In 2014 the Center for Global Development is launching a series of discussion papers for public consultation. Our goal is to press for a broader and more informed discussion about how European policies can improve. By the end of the year, we will synthesize the expert consensus on the seven themes of the CDI into a comprehensive and specific policy agenda for European countries setting out practical, evidence-based conclusions on how they can improve their policies which affect development and global poverty.

Please, share your comments, suggestions and ideas by email to pkrylova@cgdev.org. We will be looking forward to hearing from you.

1. Introduction

The Center for Global Development's (CGD) Commitment to Development Index (CDI) draws attention to the many different ways in which wealthy nations affect global poverty. It is divided into seven dimensions: aid, trade, finance, security, environment, migration and technology. It is the last of these which is the subject of this paper.

Technology is an essential factor in economic and human development. Producers and consumers in developing economies benefit from advances in medicines, agriculture, energy, industry, digital and telecommunication technologies, among other innovations. In addition to increasing productivity and facilitating industrialisation, technology makes substantial contributions to improvements in the quality of life. However, for many developing and least developed countries, the source of technologies is the developed countries. The developed countries conduct most of the world's research and development (R&D) and are the main suppliers of new technologies, such as medicines and information technology, among others. Although the capacity for innovation is emerging in some developing economies, the technological needs of the South are often filled by innovations developed in the North. This is one way in which developing countries can 'catch up' on industrialised economies. For this reason, technology transfers from the developed world, and access to global knowledge, are critical to enhancing economic development and reducing poverty in the developing world.

The technology component of the CDI assesses the contributions of donor countries to global economic development through the creation and spread of new and existing technologies. (In this context, the term 'technology' refers to knowledge, ideas and processes in general, as well as to technological goods embodying new knowledge). Accessing knowledge is one way in which poor countries catch up to wealthy, more industrialised countries.

Donor countries can contribute to technological development and diffusion by publicly funding R&D activities. Such nationally financed research can often explore fields of science and technology that private firms have limited incentives to invest in or that poorer countries do not have the resources to research. Nationally financed R&D is also, in general, openly accessible for use by private firms and non-profit institutions alike in their respective technology endeavours.
Much R&D is also conducted by the private sector. It is this activity which intellectual property rights (IPRs) can influence, by providing incentives for innovation as well as the diffusion of innovations. IPR policies and regulations will therefore also have an impact on technology creation and global technology transfer. However, the interplay between IPRs and innovation and diffusion is somewhat more complex. In some cases, intellectual property protection that is too long or too broad may stimulate innovation at the expense of reducing diffusion by raising the price of technology goods, or it may even reduce innovation effort by raising the costs of accessing and utilizing new knowledge in follow-on research and development. In the design of IPR policies and regulations, "more" is therefore not always "better" for innovation and technology transfer.[1] A balance needs to be struck between the interests of rights holders and those of the users of IPRs. Furthermore, for the interests of developing countries, IPR policies in the developed world should be conducive to the transfer of technologies to the developing world.

[1] See Park (2013).

To assess the commitment of countries to global technological development, the CDI's technology component measures two key areas:

- Government support for research and development (including tax incentives for private sector R&D), and
- An intellectual property rights system that helps, or does not impede, the flow of new knowledge and technologies to the developing world or access thereto.

The CDI shows that European donor countries have fallen down the world league table of their contribution to technological development in the developing world. The purpose of this paper is to review the underlying data and trends, to understand the drivers of the decline in Europe's technological commitments and contributions, and to make policy recommendations for raising Europe's role in global technological development.

1.1 Europe's Technology Policy: Why It Matters

This evaluation of Europe's technology policies is not an abstract exercise. Technological activities in Europe have worldwide implications. First, European countries, along with the US and Japan, are the leading suppliers of technologies in the world. Europe – which for the purposes of this paper include the 21 countries in Europe which are included in the Commitment to Development Index[2] – conducts most of the world's R&D and owns most of the world's intellectual property rights to innovations. Developing economies, particularly the least developed economies, have weaker innovative capacities, fewer resources, and smaller innovation markets. They thus conduct much less R&D and innovation, even for technologies that are especially critical for local needs, such as treating diseases, malnutrition, and climate change. Hence, they depend to a large degree on the R&D and innovation conducted in developed regions, like Europe. Furthermore, the technological needs of developing economies are in areas, such as health and the environment, in which commercial enterprises tend to have weaker incentives to conduct innovation. As a result, the governments of developed economies play a leading role in either funding projects or providing incentives for private firms to pursue targeted research projects. And with a GDP and total population close to those of the United States, Europe's commitment to and contributions towards innovation is crucial to the creation and dissemination of technologies.

Second, Europe's role in the technological development of the developing world is an international obligation. Technology developers and owners in Europe, along with their counterparts in Japan and the US, are key beneficiaries of the *Trade Related Intellectual Property Rights* (TRIPS) Agreement of the World Trade Organization (WTO) that came into effect in 1995. This far-reaching, multilateral agreement established minimum standards for intellectual property rights across countries. In developing economies, this meant significantly raising the strength of intellectual property protection and enforcement in their markets, which benefit the technology producers, who predominantly come from the 'North'. In exchange, TRIPS should also benefit the users, particularly users in the 'South'. The agreement contains an important principle: that intellectual property rights (henceforth IPRs) should contribute to innovation and the transfer of technology. Article 7 of the Agreement lays out the fundamental objectives of TRIPS:[3]

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[2] Austria, Belgium, Czech Republic, Denmark, Hungary, Italy, Ireland, Finland, France, Germany, Greece, Ireland, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, and the UK.

[3] "Agreement on Trade-Related Aspects of Intellectual Property Rights," World Trade Organization, accessed June 27, 2012, http://www.wto.org/english/tratop_e/trips_e/t_agm0_e.htm

> "The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations."

Moreover, Article 66.2 of the agreement requires developed country members to participate in ensuring that technologies spread to the developing world:

> "Developed country Members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members in order to enable them to create a sound and viable technological base."

In the Doha rounds of 2001, concerns were expressed that this technology transfer requirement needed to be made more effective; that is, to "put in place a mechanism for ensuring the monitoring and full implementation of the obligations." Thus, in 2003, a *TRIPS Council* decision mandated that developed country members submit reports annually describing how they are complying with Article 66.2 of TRIPS.

This means that Europe has an existing international commitment (in exchange for enjoying stronger worldwide IPRs) to help spread technologies to the developing world and thereby contribute to the latter's technological development.

The transfer of technology is an important mechanism for poor countries to close the gap with rich countries, and prevent widening inequality between countries. Yet Europe's performance to date, according to the data which underpin the CDI, suggests that its efforts to help developing economies build a 'sound and viable technological base' fall below those of other developed countries, like the US, Japan, Australia, and Canada. Europe's public support for R&D appears below potential and Europe's increased stringency of IPRs seems to impede the flow of technologies to the South and reduce the latter's access to new knowledge.

The next section will begin by reviewing the trends in the technology component of the CDI in order to isolate the sources of the decline in Europe's technology commitment scores. Section 3 will take a deeper look at some recent European technological developments and policies that affect Europe's global development efforts and contributions to technological development in poorer countries. Section 4 will provide policy recommendations for improving Europe's efforts and contributions. Necessarily, this paper is not intended to be a comprehensive and in-depth study of European technology policies and intellectual property regimes. It is intended rather as a think-piece on the lessons for Europe of the CDI technology component and on particular policy developments in Europe that merit further debate.

2. Trends in the CDI Technology Component Measure

The technology component of the *Commitment to Development Index* gives 2/3 weight to government support for R&D and 1/3 weight to intellectual property rights.[4] Government R&D support in turn consists of government outlays for R&D in various socio-economic categories and of fiscal subsidies for business enterprise R&D (both of which are expressed as percentages of GDP, to adjust for the country's capacity to make such investments). The score for intellectual property rights rewards countries that do not institute IPR regulations that can restrict the flow of technologies to developing countries (once innovations are created). The following is an overview of the technology component and its sub-components, which is explained in greater depth following this summary:

Overall Technology Component score (a weighted average of 1 and 2)
Calculation of the overall score of the technology component is standardized so that in the reference year (2012), 5 equals the average. The overall technology score is a weighted average of the following two subcomponents:

1. Government R&D Support:
    - a. Government Expenditures as a percentage of GDP in:
        - Agriculture (discounted 25%)
        - Environment
        - Defence (discounted 50%)
        - Exploration and Exploitation of Earth and Space
        - General Advancement of Knowledge
        - Industrial Production and Technology
        - Energy
        - Health
        - Education
        - Culture, Political, and Social Systems
    - b. Business R&D expenditures subsidized by the government as a percentage of GDP

2. Intellectual Property Rights:
    - a. Non-Patentability of Plant and Animal Species and Software
    - b. Lack of Limitations on Patent Rights, such as
        - Compulsory Licensing
        - Patent revocation for discontinued working (or exploitation) of patent
        - Patent opposition system
        - Research Exemptions for Patent Infringement
    - c. IPR Extensions, such as
        - TRIPS-plus provisions in free trade agreements
        - Anti-circumvention laws
        - Protection for Databases

[4] For details of the Index, see the technical paper: David Roodman, "The Commitment to Development Index: 2012 Edition," October 2012, available at http://www.cgdev.org/doc/CDI%202012/Index%20technical%20paper%202012.pdf.

The starting point for the assessment of government policy regarding generation is OECD data on **direct government R&D**, whether performed by public agencies or by private parties on contract.[5] To this is added an estimate of the subsidy value of **tax incentives for private R&D**. Not all R&D is treated equally in the Index, as certain kinds of developed country R&D – namely agriculture, energy and industrial development – is regarded as having less value for poor countries, resulting in a discount of 25%. This is so because some R&D programmes are aimed at improving knowledge of direct use in commercial applications. This knowledge surely can be useful for improving production technologies in developing countries, but is more likely to be mediated through private channels that may be protected by intellectual property or other restrictions on use. Similarly, military R&D is discounted by half because while some of it does have potential use for developing countries (including the Internet), much does more to improve the destructive capacity of rich countries than the productive capacity of poor ones.

The intellectual property rights sub-component recognises that certain policies and regulations of a country can impair the ability of developing countries to gain access to its knowledge or technologies. For example, the **patenting of plant and animal varieties** affects biotechnological innovations, agriculture and food production, and medicines. Patents create market power so that the firm possessing the rights will supply goods monopolistically and charge prices higher than under free competition. Both the reduced supply and higher prices affect access to the goods. Likewise the **patenting of software** affects the availability of digital technologies, computers, and telecommunication products that can enable developing economies to catch up to developed economies that are well-equipped with these technologies.

Compulsory licensing refers to the situation in which a government compels a patent or copyright holder to license the invention or work to a third party. This a useful option for a government that wishes to respond to a lack of suppliers (or unwilling suppliers) for serving a specific market need, such as vaccines. Typically, developing economies lack the manufacturing capacity to fulfil domestic demand. In that case, it is important to be able to import the good, typically from a supplier in a *developed country*, assuming the latter can sufficiently supply the good. If not, the developed country government could require the patent holder to license the technology to other firms so that more of the good can be produced and exported to the developing countries in need of the good. TRIPS Article 31f requires that compulsory licensing be issued primarily for domestic supply, not export. But this requirement has since been moderated by TRIPS Council decisions so that a developed country government could issue a compulsory license for purposes of exporting a product.[6]

Other safeguards that exist are for governments to **revoke a patent** if the holder is not exploiting it or has never exploited it, but is simply hoarding the right. Or for governments to allow a **patent opposition system** in which third parties can challenge the validity of a patent grant (within a given time limit); this helps ensure that invalid patents are not issued, which could otherwise tie up the supply of a good or innovation. Research exemptions allow firms to 'infringe' a **patent for**

[5] Alicia Bannon and David Roodman "Technology and the Commitment to Development Index," April 2004 prepared for the Center for Global Development, available at http://www.cgdev.org/doc/CDI/technology_2004.pdf.

[6] Article 31f of TRIPS can be waived if both the "eligible" importing country and exporting country provide notification to the TRIPS Council, along with details about the compulsory licensing arrangement and the product in question. Only the amount of the product needed in the eligible importing country is allowed to be produced under the license and all goods produced under that license must be exported only to that county.

research and experimental purposes, and help prevent patent rights from inhibiting follow-on innovations.[7]

The IPR policies of developed economies can also potentially harm developing country interests. For example, developed countries have entered into **bilateral and regional free trade agreements** with developing country partners that contain IPR provisions that go beyond TRIPS (i.e., so-called TRIPS-plus measures). Adoption of these measures by developing economies may result in the institution in developing countries of an IPR system that is stronger than one that is appropriate for them at their stage of economic development. The stronger IPR system (resulting from TRIPS-plus) may not be conducive to the needs of local innovators that rely on imitation and adaption of existing innovations. Furthermore, the stronger IPR system there may marginally attract more foreign direct investment and licensing from the 'North'. That is, the enhanced market power effects of TRIPS-plus could reduce or slow down the rate of technology transfers, due to limited competitive pressures.

The **anti-circumvention rules** against tampering with technology protection measures protect IPR owners against piracy; but it is important that the rules and penalties should not be so harsh that they inappropriately interfere with learning and imitation. Anti-circumvention rules can prevent reverse engineering and opportunities for learning by doing. For example, the rules may reduce the ability of governments, firms, and other organisations, to improve the design of their computer and security systems. Lastly, some developing economies, such as in Europe, have granted patent-like protection to compilers of databases, even if the data were already in the public domain or created with public funds. Strong **database protections** reduce the flow of useful, public knowledge to developing economies.

Table 1A shows the overall rankings for the 2013 CDI technology component scores, encompassing individual scores for R&D and IPR, as well as a weighted average of the two to provide an overall total score for each country:

[7] In the case of pharmaceutical innovation, the exemptions allow producers of generic drugs to exploit existing patented innovations for purposes of obtaining government approval of their drugs so that these drugs can be ready and marketed upon the expiration of the patent right covering the original drug.

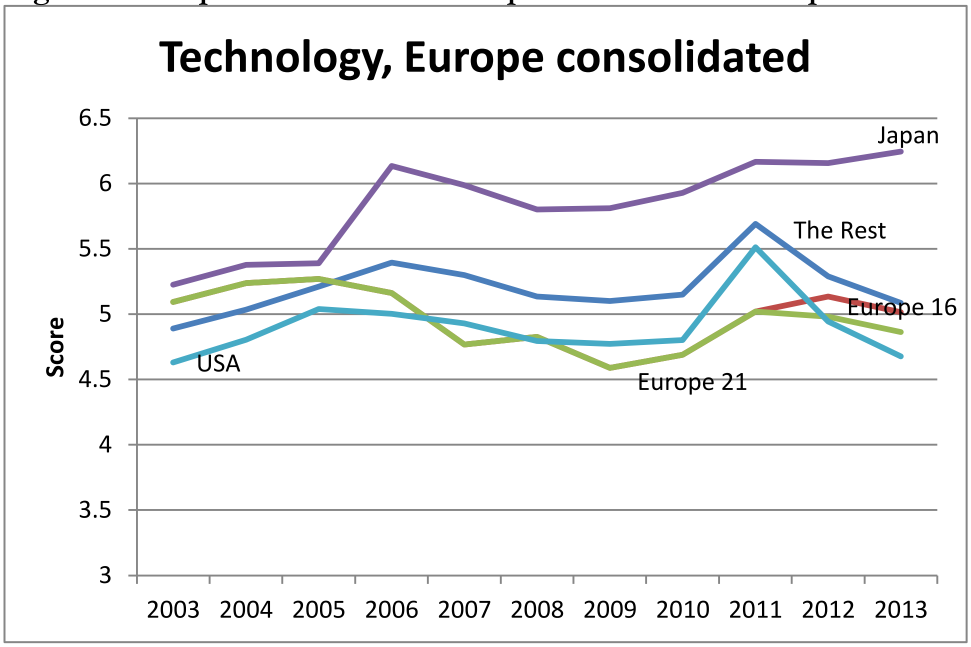
Table 1A.2013 Technology Component

Country	Government R&D	IPRs	Overall score
South Korea	7.8	4.8	6.8
Denmark	7.8	4.2	6.6
France	7.5	4.6	6.6
Portugal	6.8	5.6	6.4
Japan	6.7	5.4	6.2
Norway	6.0	5.2	5.7
Finland	6.1	4.7	5.7
Austria	5.9	5.1	5.6
Spain	5.4	5.5	5.4
Czech Republic	5.7	4.8	5.4
Canada	4.5	6.9	5.3
Netherlands	5.6	4.3	5.2
The Rest (incl. South Korea)	5.4	4.7	5.2
Germany	5.5	4.2	5.1
Europe 16	5.3	4.4	5.0
Switzerland	4.8	5.0	4.9
Europe 21	5.1	4.5	4.9
United States	5.0	4.1	4.7
Australia	3.7	6.7	4.7
Sweden	4.8	3.9	4.5
Belgium	4.3	4.7	4.4
New Zealand	3.1	7.0	4.4
United Kingdom	4.3	4.0	4.2
Luxembourg	4.0	4.4	4.1
Italy	3.7	4.4	3.9
Ireland	3.6	4.0	3.8
Hungary	2.5	4.7	3.2
Greece	1.8	4.6	2.7
Slovakia	1.6	4.7	2.6
Poland	1.6	4.5	2.5

Source: CDI 2013, authors' calculations

Nordic countries tend to lead the ranks in the CDI. Europe's performance on the technology component is different from the other six dimensions of the Index (aid, trade, environment, finance, migration, security) in that the leaders in technology are not only Nordic countries, but also Mediterranean countries such as Portugal, France and Spain. Europe performs at the global average (5.0) on technology, where they are significantly outperformed by Japan and South Korea and roughly on par with New Zealand and the United States. When assessing the original CDI European countries (Europe 16[8]), we can see that their consolidated score is slightly higher than that of all European countries currently included in the Index. This is mainly because of low government expenditures on R&D in the Visegrad[9] countries, which take the last places on the technology component (with the exception of the Czech Republic). The consolidated score for the Rest[10] (non-European countries in the Index) is above average and above the European score.

Figure 1. Europe's Performance Compared to Other Developed Countries



Source: CDI 2013, authors' calculations

Figure 1 shows the overall score for the technology component for Europe 16 consolidated measured against the remaining six countries in the CDI for the period 2003 - 2013. As the graph shows, Europe's overall score on technology has remained relatively stable and around average since 2003, and Europe's slight downward trend from 2006-2010 means that it is now outperformed by most of the other CDI countries. Within Europe, there is considerable variation. In 2013, European countries hold the bottom ten spots in the ranking (with the exception of New Zealand), including large countries such as the UK, Italy and Poland, all of which perform well below the median (ranks 20, 22 and 27, respectively). But at the same time, Denmark, France and Portugal do quite well, leading with ranks 2, 3 and 4respectively. Greece, Slovakia and Poland, in particular, perform rather abysmally – significantly weighing down the European average – because of Greece's strict, patent-like proprietary rights on data compilations, Poland's support of extending intellectual property rights in bilateral treaties, and Slovakia's extremely low government expenditure on R&D, which is also the case of Poland and Greece.

[8] Europe 16, for these averages, is treated as: Austria, Belgium, Denmark, Italy, Ireland, Finland, France, Germany, Greece, Ireland, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the UK. Europe 21 includes the 2012 addition of Czech Republic, Hungary, Luxembourg, Poland, and Slovakia in the CDI, but we do not have historical data for those five countries.
[9] Visegrad group includes the Czech Republic, Hungary, Poland and Slovakia.
[10] Australia, Canada, Japan, New Zealand, United States. South Korea was added to the Index in 2008, and is not included in this group, unless explicitly stated.

Tables 1B and 1C break down the overall score into its subcomponents: the score for government R&D support and the score for intellectual property rights. In the case of government support for R&D, Europe scores slightly above or at the median in 2003-2011, with a more significant increase in 2012 and 2013. While its score for government support has been rising since 2009, Europe has not been keeping pace with other developed countries' public support for R&D. Given the recent economic downturn in Europe and calls for budgetary cuts, public support for research and development is not likely to improve much over the horizon.

Table 1B. Technology Component, Government R&D Sub-Score

Government R&D	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
Australia[3]	**3.7**	4.1	3.9	3.4	3.6	3.9	3.8	3.9	4.3	4.2	4.3
Austria[1,2]	**5.9**	6.0	5.7	4.9	5.0	4.9	4.7	4.7	4.9	5.1	5.0
Belgium[1,2]	**4.3**	4.5	4.5	4.4	4.2	4.2	3.6	3.6	3.8	3.7	3.5
Canada[3]	**4.5**	4.6	4.7	4.7	4.4	4.8	5.2	5.1	5.1	4.9	5.1
Czech Republic[2]	5.7	5.4									
Denmark[1,2]	7.8	7.7	7.4	6.1	6.0	5.7	5.9	6.1	4.4	4.4	4.5
Finland[1,2]	6.1	6.5	6.4	5.2	5.3	5.4	5.8	6.0	6.0	6.0	5.9
France[1,2]	7.5	7.6	6.8	6.4	6.2	6.8	6.8	6.8	6.4	6.4	6.3
Germany[1,2]	5.5	5.6	5.2	4.4	4.1	4.5	4.4	4.5	4.6	4.5	4.4
Greece[1,2]	1.8	2.0	1.8	1.8	1.9	2.3	1.8	1.8	1.9	1.8	1.9
Hungary[2]	2.5	2.8									
Ireland[1,2]	3.6	3.8	4.1	3.6	3.1	3.1	2.6	2.5	1.8	1.6	1.8
Italy[1,2]	3.7	4.0	4.3	3.9	3.1	3.6	4.8	4.8	4.8	4.8	4.8
Japan[3]	6.7	6.5	6.4	6.0	5.9	5.8	6.1	6.1	5.0	5.0	4.8
Luxembourg[2]	4.0	4.1									
Netherlands[1,2]	5.6	6.1	5.5	4.9	5.0	5.4	4.9	5.0	5.2	5.1	5.2
New Zealand[3]	3.1	3.3	3.4	3.3	2.9	2.0	3.2	3.2	3.2	3.2	3.2
Norway[1,2]	6.0	6.0	6.3	5.1	5.1	6.0	5.3	5.8	5.1	5.0	4.6
Poland[2]	1.6	1.7									
Portugal[1,2]	6.8	7.7	6.9	6.9	4.3	4.6	4.4	4.4	4.4	4.7	4.3
Slovakia[2]	1.6	1.5									
South Korea	7.8	8.1	7.3	6.9	5.8	6.4					
Spain[1,2]	5.4	6.1	6.0	6.6	7.1	6.8	5.5	5.6	5.5	5.2	4.5
Sweden[1,2]	4.8	5.1	5.3	4.3	4.3	4.7	5.1	5.3	5.7	5.2	5.1
Switzerland[1,2]	**4.8**	4.5	4.7	1.5	3.7	4.4	4.6	4.8	4.6	4.6	4.4
United Kingdom[1,2]	**4.3**	4.5	4.9	4.5	4.3	4.6	4.3	4.5	5.1	5.1	4.5

United States[3]	**5.0**	5.4	6.3	5.3	5.3	5.3	5.5	5.6	5.7	5.3	5.1
Europe 16[1]	5.3	5.5	5.4	4.9	4.7	5.0	4.9	5.0	5.0	5.0	4.7
The Rest[3]	**5.3**	5.6	6.2	5.4	5.3	5.4	5.6	5.7	5.4	5.2	4.9
Europe 21[2]	5.1	5.3									
The Rest (inc. Korea)	**5.4**	5.7	6.2	5.5	5.3	5.4					
Median	4.8	5.1	5.4	4.8	4.4	4.8	4.8	4.8	4.9	4.9	4.5

Source: CDI 2013, authors' calculations

In the case of intellectual property rights, European IPR policies have become stronger in recent years, instituting changes that are not likely to be development-friendly. Thus, the score for intellectual property rights has declined among European countries over the period 2003 - 2013. Here, Europe – as a whole – scores at or below the median.

Table 1C. Technology Component, Intellectual Property Rights sub-score

IPRs	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
Australia[3]	6.7	7.3	7.6	7.6	7.5	7.5	7.5	6.7	6.7	6.7	6.7
Austria[1,2]	5.1	5.1	4.7	4.7	4.7	4.8	4.8	4.6	4.8	4.8	4.8
Belgium[1,2]	4.7	4.7	4.7	4.7	4.8	5.0	5.0	6.5	6.8	6.8	6.8
Canada[3]	6.9	7.5	7.2	7.2	7.5	7.5	7.5	8.3	8.3	8.3	8.3
Czech Republic[2]	4.8	4.8									
Denmark[1,2]	4.2	4.2	3.8	3.8	3.9	4.0	4.0	4.6	4.8	4.8	4.8
Finland[1,2]	4.7	4.7	4.7	4.7	4.8	5.0	5.0	6.5	6.8	6.8	6.8
France[1,2]	4.6	4.6	4.3	4.3	4.4	4.6	4.6	6.5	6.8	6.8	6.8
Germany[1,2]	4.2	3.8	3.8	3.8	3.9	4.0	4.0	4.6	4.8	4.8	4.8
Greece[1,2]	4.6	4.6	4.6	4.6	4.7	4.8	4.8	6.2	6.4	6.4	6.4
Hungary[2]	4.7	4.7									
Ireland[1,2]	4.0	4.0	4.0	4.0	4.0	4.1	4.1	5.0	5.3	5.3	5.3
Italy[1,2]	4.4	4.6	4.7	4.7	4.7	4.8	4.8	5.8	6.1	6.1	6.1
Japan[3]	5.4	5.4	5.7	5.7	5.7	5.7	5.7	6.1	6.1	6.1	6.1
Luxembourg[2]	4.4	4.4									
Netherlands[1,2]	4.3	4.3	4.3	4.3	4.4	4.6	4.6	5.7	6.0	6.0	6.0
New Zealand[3]	7.0	7.5	7.3	7.3	7.3	7.3	7.3	7.9	7.9	7.9	7.9
Norway[1,2]	5.2	5.2	4.8	4.8	4.8	4.8	4.8	5.9	6.1	6.1	6.1
Poland[2]	4.5	4.6									
Portugal[1,2]	5.6	6.7	6.6	6.6	5.2	5.4	5.4	6.5	6.8	6.8	6.8
Slovakia[2]	4.7	4.7									

South Korea	4.8	4.8	5.5	5.5	7.0	7.0					
Spain[1,2]	5.5	5.5	5.5	5.5	5.6	5.8	5.8	6.5	6.8	6.8	6.8
Sweden[1,2]	3.9	3.9	3.9	3.9	4.0	4.3	4.3	5.7	6.0	6.0	6.0
Switzerland[1,2]	5.0	5.0	5.0	5.0	5.4	5.4	5.4	5.7	6.0	6.0	6.0
United Kingdom[1,2]	4.0	4.0	4.0	4.0	4.0	4.1	4.1	5.0	5.3	5.3	5.3
United States[3]	4.1	4.1	3.9	3.9	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Europe 16[1]	4.4	4.4	4.3	4.3	4.4	4.5	4.5	5.5	5.8	5.8	5.8
The Rest[3]	4.7	4.7	4.7	4.7	4.6	4.6	4.6	4.8	4.8	4.8	4.8
Europe 21[2]	4.5	4.4									
The Rest (inc. Korea)	**4.7**	4.7	4.7	4.7	4.7	4.7					
Median	4.7	4.7	4.7	4.7	4.7	4.8	4.8	5.9	6.1	6.1	6.1

Source: CDI 2013, authors' calculations

The IPR policies and regulations of European countries follow both European Union-wide directives and regulations as well as national laws and regulations (see Seville, 2009).[11]

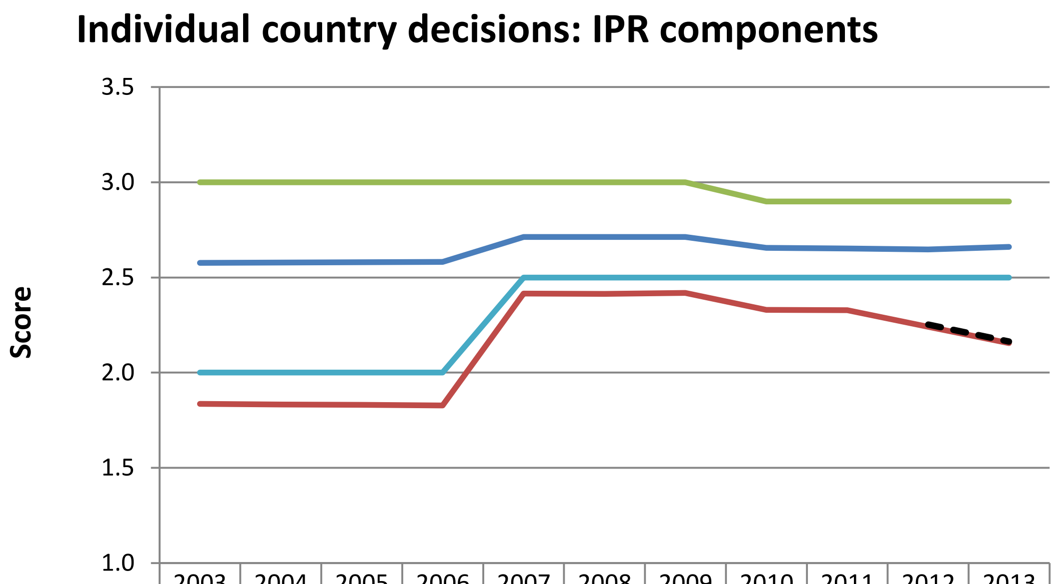
In recent years, European Union member states have pursued increased harmonisation of IPR regulations in order to facilitate intra-EU trade. Both substantive laws regulating the coverage and enforcement of IPRs and procedural laws governing the acquisition and maintenance of intellectual property rights have been harmonised (see Cook, 2010). National systems do retain some independent legal provisions and practices. The question arises: is Europe's poor performance and gradual deterioration the consequence mainly of sub-components that are driven by EU directives and other EU-wide decision-making, or is it the result of choices made in national systems?

We can answer this by dividing the sub-components into those which are mainly decided at EU level, and those which are decided mainly at national level. EU regulations account for most of the variation in the component scores for databases, the patentability of software and plants and animals, TRIPS-plus free trade agreements, patent opposition procedures, and research exemptions. National regulations and practices account for the most of the variation in the scores on compulsory licensing, patent revocation, and anti-circumvention laws. In what follows, separate IPR scores were computed for those due to EU regulations and those due to national.

Figures 2A and 2B simply show the raw (unweighted) counts of the existence of IPR regulations that are not development-friendly. The scoring is done in a way that countries are penalized for restrictive IPR regulations (0 – no penalty, 1 – full penalty). For example, a country that does not allow for compulsory licensing is scored a zero, whereas a country that utilizes it to promote technological access scores a one. Figure 2A focuses on nationally-driven regulations and 2B on EU-driven regulations.

[11] The European Union (EU) encompasses the European Commission (EC) and the member-states of the EU.

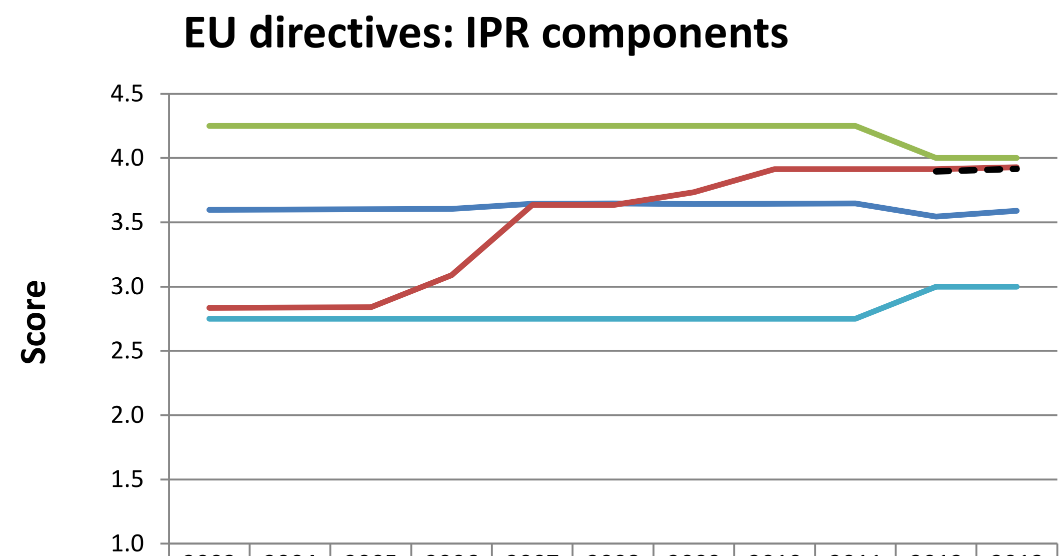
Figure 2A. Raw count of IPR Components Relating to Individual EU Country Decisions (i.e., compulsory licensing, anti-circumventions, and non-revocation, max. penalty = 3)



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
The Rest	2.6	2.6	2.6	2.6	2.7	2.7	2.7	2.7	2.7	2.6	2.7
Europe 16	1.8	1.8	1.8	1.8	2.4	2.4	2.4	2.3	2.3	2.2	2.2
United States	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.9	2.9
Europe 21										2.3	2.2
Japan	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5

Source: CDI 2013, authors' calculations

Figure 2B. Raw Count of IPR Components Relating to EU Directives (i.e., coverage, patent opposition, experimental exemptions, database, TRIPS+, max. penalty = 6)



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
The Rest	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.5	3.6
EU14	2.8	2.8	2.8	3.1	3.6	3.6	3.7	3.9	3.9	3.9	3.9
United States	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.0
EU19										3.9	3.9
Japan	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	3.0	3.0

Source: CDI 2013, authors' calculations

Assuming these regulations are representative, Figures 2A and 2B suggest that it is the EU regulations that are making the IPR regimes of European countries more stringent. Figure 2A suggests that the national regulations the European countries are becoming less stringent over the period 2009 - 2012. But Figure 2B suggests that EU regulations have dramatically raised the strength of IPRs in European member states and implemented a regime that is not conducive to technological development in the developing world.

To recap, the CDI finds that the commitment or effort of European countries to technological development in developing economies has declined since 2003 and lags behind the commitment and effort of other developed countries. The problems appear to be the consequence primarily of decisions made at EU level. The next section will discuss in more detail some of the changes in government R&D and IPRs in Europe that are behind these trends.

3. Analysis of Technology Policy and Developments in Europe

This section seeks to explain the policies and developments underlying the European trends discussed in section 2 and to assess their impacts on global technological development. First, the public R&D expenditures of European countries are discussed. Second, the intellectual property regulations are reviewed. Third, the technology transfer activities of the public and private sectors in Europe are examined.

3.1 Government R&D

Tables 2A and 2B examine government budgetary outlays for the kinds of R&D spending that may especially benefit developing and least developed nations, such as health and environment (most beneficial for development) and agriculture and energy (still beneficial, although less so due to commercial focus of the R&D and therefore a higher chance of IPR protection). The data are from 2013 CDI edition, which was released in November 2013, and were used to derive the technology component scores for the 2013 CDI (although source years for individual countries may vary). The purpose of the table is to give a sense of how Europe (21 European CDI countries consolidated) compares to Japan and the US. The tables show the absolute levels of spending, [12] spending per capita, and spending per GDP, to show where countries stand.

Table 2A. Public Sector R&D relevant for Developing Nations, 2013 Raw Scores, millions of US current dollars

Country/region	(1) Agriculture	(2) Environment	(3) Energy	(4) Health	(5) Total Govt's R&D less defence	Share of (1)-(4) in (5)
Japan	1,014	715	4,057	1,652	34,279.4	**21.70%**
United States	2,395	570	2,398	33,642	63,056.0	**61.86%**
The Rest	4,403	1,952	7,273	37,578	110,190.3	**46.47%**
Europe 16	3,885	2,895	4,597	9,743	105,318.1	**20.05%**
Europe 21	4,042	3,030	4,729	10,034	110,479.5	**19.76%**

Source: CDI 2013, authors' calculations

Table 2B. Public Sector R&D Relevant for Developing Nations, Per Capita and Percent GDP

Country/region	(1) Agriculture	(2) Environment	(3) Energy	(4) Health	(5) Total govt's R&D less defence
Japan: per-capita	8.0	5.6	31.8	13.0	268.9
United States: per-capita	7.7	1.8	7.7	108.2	202.7
The Rest: per-capita	8.8	3.9	14.6	75.4	221.0
Europe 16: per-capita	9.5	7.0	11.2	23.7	256.4
Europe 21: per-capita	8.5	6.4	9.9	21.1	232.4
Japan: percentage GDP	0.024%	0.017%	0.094%	0.038%	0.797%
United States: percentage GDP	0.016%	0.004%	0.016%	0.224%	0.421%
The Rest: percentage GDP	0.020%	0.009%	0.033%	0.173%	0.506%
Europe 16: percentage GDP	0.026%	0.019%	0.031%	0.065%	0.702%
Europe 21: percentage GDP	0.025%	0.018%	0.029%	0.061%	0.670%

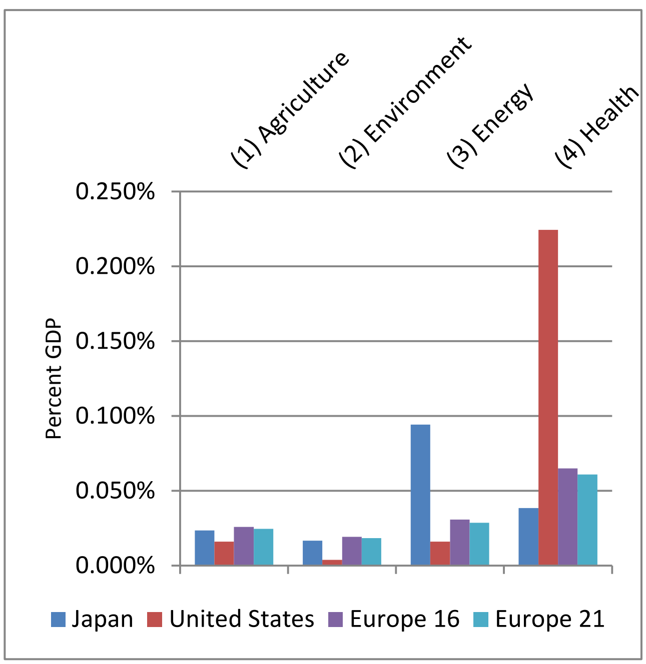
Source: CDI 2013, authors' calculations

[12] Agriculture and Energy scores in this chart have not been discounted by 25%

South Korea and Denmark finish at the top of the technology component in 2013, thanks to government expenditure on R&D worth around 1 percent of their GDPs. Speaking generally, Europe's commitment to research and development is rather weak; Europe overall performs well below the median for tax subsidies for R&D, government expenditures on R&D and total government support for R&D. Spain has the second highest tax subsidy rate for business R&D, but spends less overall on R&D as a share of GDP. Greece, Hungary, Poland, and Slovakia spend less than 0.3 percent of GDP on R&D, they devote a significant portion of this to defence. France, Germany and the United Kingdom all spend a large share of government R&D expenditure on defence, which, as the three largest countries in Europe, drags down Europe's performance significantly. Additionally, Sweden, despite its overall strong performance in the CDI, ranks third to last with the lowest tax subsidy rate to businesses for R&D, which hinders the creation of technological advances.

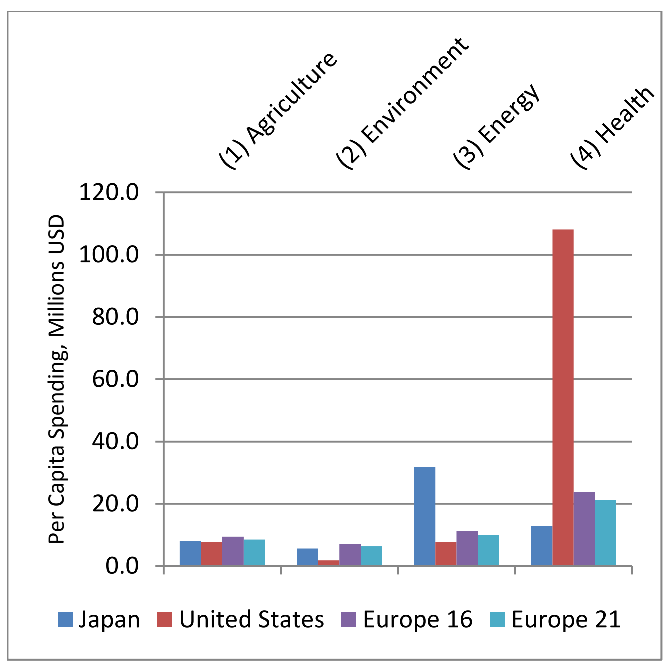
Agriculture is clearly relevant to the developing world (despite its 25% discount), which employs a large, if not the largest, share of the population. Europe provides the most public sector agricultural R&D, followed by the US and Japan. However, per European country, member states perform the least among the developed countries listed (as well as South Korea, Canada and Australia, which spent USD 997, 502.5 and 353 million, respectively, on agriculture R&D in 2013 CDI). Per person or as a ratio to GDP, individual European nations tend to contribute about the same amount to public sector agricultural R&D as Japan and the US (see Figures 3 and 4).

Figure 3. Public Sector R&D Expenditure, Per Capita Expenditure, Percent GDP



Source: CDI 2013, authors' calculations

Figure 4. Public Sector R&D



Source: CDI 2013, authors' calculations

Energy and the environment are also important for developing economies that seek to adapt to climate change and deal with their energy needs. Much of the innovations that pertain to climate change, conservation, and alternative energy sources are researched and developed in the 'North.' Southern R&D in these fields is often conducted in collaboration with Northern public and/or private organisations. Europe, overall, funds the most public sector environmental R&D, but Japan – as a stand-alone country – is just behind the total of all of the 21 CDI European countries combined. Furthermore, public sector R&D investment in the environment is a small share of the Europe's public sector research budget. It is the fourth lowest public R&D spending item, next to exploration of the Earth, culture, and education.

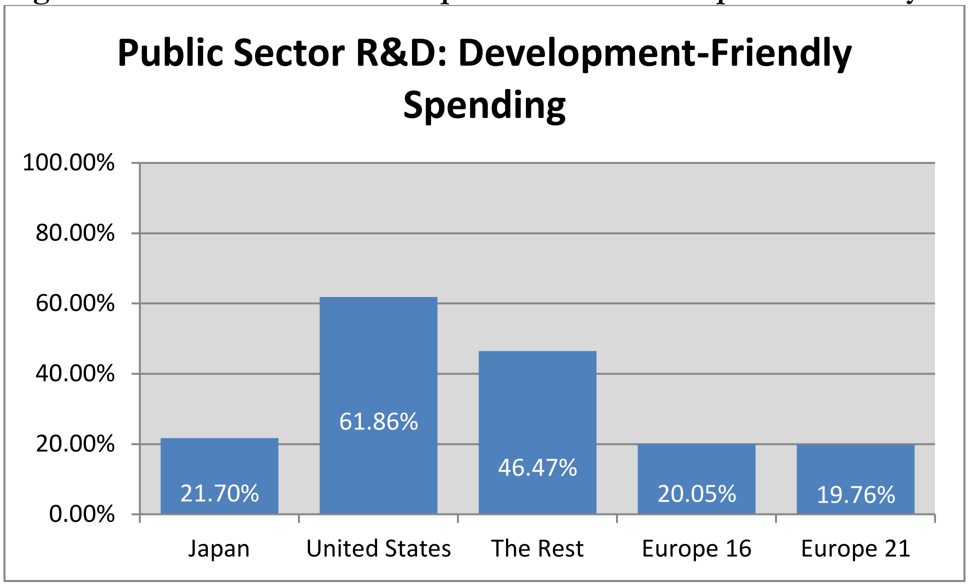
The public sector R&D investments of European countries in energy are (on average) similarly relatively low compared to the amounts spent in Japan and the US, as well as South Korea and Canada. Collectively, the Europe spends about as much on public sector energy R&D as the Japanese government alone spends.

Health care R&D is also critical to poor countries for developing drugs, medicines, treatments, surgical and diagnostic techniques, and equipment. Here, a much wider gap exists between public sector R&D in Europe and that in the United States and Japan. The US government spends at least three times more on health care R&D than does all of Europe combined. On a per-capita basis, Europe collectively spends twice as much on public sector health care R&D as the Japanese government.

Clearly, there is room for expansion in public sector health care R&D in Europe. What these aggregate expenditure figures do not show are the specific kinds of health care projects that governments fund, such as expenditures for tropical diseases or other diseases afflicting developing nations. European R&D expenditures here are especially disconcerting. According to a report by *Médecins Sans Frontières* (2008), the European Community in 2007 spent 18.7 million euros for Tuberculosis (TB) research, 17.1 million euros for Malaria and nothing for neglected tropical diseases. This sum pales in comparison to total EU GDP of 11.4 trillion euros or to total EU public sector R&D of 88 billion Euros that year. *Oxfam* (2008) reports on more recent activities of the European Commission to spend 420 million euros on R&D for HIV and AIDS, TB, and malaria, but just a tenth of that amount for all other neglected diseases. Individual European countries have not shown more commitment than that. Germany spent just 0.12% of its research budget on neglected diseases. Thus, Europe needs to not only raise its public sector R&D in health care, but allocate a larger share towards diseases targeting the poor in developing countries.

Lastly, Table 2A, last column and Figure 5 show the share of all four of these R&D areas important to developing countries (i.e., the sum of agriculture, environment, energy, and health public sector R&D) in the total public sector R&D budget, net of defence expenditures. As can be seen below in Figure 4, U.S. expenditures on these kinds of R&D account for slightly more than three-fifths of the net-of-defence public sector R&D budget. In Japan, they account for more than one-fifth. But in Europe and the European Union overall, these expenditures account for less than one-fifth of the public sector R&D budget. This suggests, at least on the basis of these figures, that the bulk of Europe's public sector R&D is mostly for developed country needs, with less benefit for developing countries. Hence, Europe's commitment to global technological development will be weak unless significant changes are made to both the level and composition of European government R&D.

Figure 5. Public Sector R&D Expenditure on Development Country Areas



Source: CDI 2013, authors' calculations

3.2 Intellectual Property Rights

First, IPR developments relating to information incorporated in the CDI are discussed; then developments in IPR regulations that are not explicitly covered in the CDI are discussed.

In the CDI's technology component, the four types of IPR features that exhibit the most variation over time and/or across countries are **coverage** (the patentability of software and plant and animal varieties), **compulsory licensing**, **anti-circumvention laws**, and **TRIPS-plus provisions** inserted into free trade agreements.[13] Changes in these IPR features are most responsible for the shifts over time in the technology component score of European countries. The discussion below will focus on these four areas.

3.2.1 Coverage

Through the Biotechnology Directive 98/44/EC and Article 52(2) of the European Patent Convention, the European Union has harmonised standards for the legal protection of plant and animal varieties and computer software among member states. Best practices tend to vary by country; technology policies that are best for one nation need not be suitable for another. Harmonisation for its own sake is not necessarily an efficient growth policy, as it reduces the flexibilities of national governments to adapt their IPR laws to national circumstances.

These intellectual property rights apply within the European Union. So, how do these laws affect developing countries? On the one hand, stronger protection should create incentives for innovation and commercialisation, which could ultimately benefit people in developing economies. However,

[13] Not as much data variation exists over time in the laws governing revocation of patent rights, opposition to patent grants, database protection, and exemptions for experimental research. For database protection, the main variation is between countries; that is, between the European countries which provide such protection (due to the 1996 EU Database Directive 96/9) and the other developed countries which do not.

private firms in Europe that get to enjoy the stronger IPRs may not target their innovations specifically to meet the needs of poor countries. he firms are more likely to focus their R&D on products or processes for which there is a large market – that is, for the developed world. Even then, increased R&D and innovation cannot be guaranteed if the stronger IPRs result in excessive market power. Firms would innovate less and introduce new technologies to the market more slowly if IPRs eliminate or reduce business rivalry. Competition helps spur innovation as firms vie for consumers with new and better products (see Aghion et al., 2005). In the absence of competitive pressures, firms may reduce their innovation efforts.

The patenting of software and biotechnology in the EU and member-states could harm developing nations in other ways.

- First, these technological fields cover a lot of developing country needs, such as access to digital technologies, educational materials, nutrition, and medicines.
- Second, monopolistic provision of these goods due to patent protection results in, ceteris paribus, a lower quantity of supply and higher prices, both of which ultimately reduce access and technology diffusion, particularly to the poor. The severity of the reduction in supply or increase in prices depends on the availability of substitutes. If few alternative technologies are available, patent protection imposes high costs.
- Third, strong protection for software and biotechnology in the EU could block exports from developing countries. As Shin et al. (2012) argue, the products originating from developing economies are not high value added products or high in technological content. They tend to be goods that are adaptations or imitations of 'Northern' products, and are likely to be viewed as infringing the IPRs of EU products and hence prevented from entering the EU market. This would be unfortunate since developing economies could enhance their economic development and increase jobs and growth by increasing their exports to industrialised nations.

3.2.2 Compulsory Licensing

As discussed above, compulsory licensing can be conducive to global technological development if such licenses can be issued for exporting essential goods to countries in dire need. Netherlands has a 'Policy Rule' for issuing such compulsory licenses under section 57 of its Patents Act. The European Community in 2006 followed with Regulation 816/2006 to allow "compulsory licensing for manufacturing pharmaceutical products for export to countries with public health problems." However, some criticisms can be levelled at this regulation.

- First, this option has been under-used. A WIPO (2011) survey suggests that few European countries have issued compulsory licenses for this purpose (e.g., Finland, Czech Republic, and Hungary). European countries have not taken a world lead in implementing this regulation. Indeed, Canada in 2007 was the first developed country to issue a compulsory license for exporting generic drugs.
- Second, the regulation merely gives legal sanction to compulsory licensing for purposes of exporting. It does not constitute a policy action plan. The law works passively and not proactively. A more committed effort to assist less developed economies would have been for the European Union and its member governments to coordinate a drive to supply essential goods for export to developing countries in need, or at least to facilitate negotiations among IP owners, exporters, and importers.
- Third, the regulation imposes conditions for the granting of a compulsory license, one of which is that the goods produced under the license can only be sold to the country or

countries listed in the compulsory licensing application. By restricting the licensee's market, the regulation limits the ability of the licensee to achieve economies of scale and gives few incentives for licensees to make long term investments in productive capacity.

3.2.3 Anti-Circumvention Laws

Next, on anti-circumvention laws, the European Union introduced Directive 2001/29/EC "on the Harmonization of Certain Aspects of Copyright and Related Rights in the Information Society" (or the "EUCD"). Article 6 of the EUCD deals with the legal protection against the circumvention of copy protection measures. Member states have incorporated the general legal framework on circumvention prohibitions and exceptions, but differences in the application of the EUCD in national laws exist (Gasser and Urnst, 2006). These laws could also constrain the technological development of less developed economies. First, it is important to distinguish between copyright infringement and circumvention. The latter activity may be for personal use or for educational use – to instruct and learn by reverse engineering, making a copy, and constructing and reconstructing a technological device or programme. Anti-circumvention rules combined with, or enforced in, technology transfer agreements between 'North' and 'South' may make it difficult to convey the underlying 'know how' or tacit knowledge to the recipients of technology in developing economies. Such rules could inhibit learning by doing, which is an important mechanism for technological catch up in the developing world, or make adapting the new technology to local environments more difficult. The reason for the latter is that technologies need to be interoperable with other technologies or products in the economy or in an organisation, but that may not be possible if certain encrypted devices or programmes cannot be circumvented. As Lohmann (2010) argues, anti-circumvention rules jeopardize fair use, adversely affect scientific research, and block competition. Knowledge Ecology International (2008, Appendix A) also makes a plausible case that anti-circumvention laws could effectively prolong the term of intellectual property protection, since follow-on inventors or creators cannot access the underlying innovation or build upon it and make competing technologies. Thus, such laws can be a hindrance to global technology diffusion. None of the European countries that implemented them have created any exceptions for technology transfers to poor countries.

3.2.4 TRIPS-plus Provisions

Turning to TRIPS-plus issues, the actions of the European Union to insert TRIPS-Plus provisions in their free-trade agreements (FTAs) with developing economies further affect the technological development of developing nations adversely.[14] Because trade is a community competence, these are decisions taken at EU rather than member state level.

It is important to distinguish between 'optimal IPRs' and 'strong IPRs', or between TRIPS-compliance and TRIPS-Plus. It is not the case that "more is better" when it comes to the level of strength of IPRs for promoting innovation and economic development.[15] Nor does "one size fit

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[14] Examples of such free trade agreements include CARIFORUM-EC (Caribbean countries), EU-India, EU-Colombia-Peru, EU-Mercusor, and EU Economic Partnership Agreements with Africa. See Fink and Reichenmiller (2005) for further analyses.

[15] IPRs that are too weak provide inadequate incentives for innovation; IPRs that are too strong reduce market rivalry and do not stimulate innovation. Park (2008) provides a survey of the economics literature.

all". The level of IPR strength that is optimal for economic growth and social well-being varies between developed countries and developing, being generally lower for the latter. Thus, the TRIPS-plus FTA provisions create the potential risk of pushing Southern IPRs into IPRS that are stronger than is appropriate for their stage of economic development. TRIPS-plus also affects the 'flexibilities' that the original TRIPS agreement conferred upon developing economies so as to facilitate their access to important technologies for their public health and economic development needs.

Among these flexibilities is their ability to use **compulsory licensing**. Normally, compulsory licensing reduces the strength of IPRs and may discourage innovation or discourage creators from seeking IP protection. On the other hand, compulsory licensing may protect the broader interests of society. The patent or copyright holder may inadequately exploit the invention or work to society's detriment. Or the patent and copyright holder may be behaving anti-competitively, using its IPR to prevent the entry of other producers into the market or to hoard intellectual assets for some strategic purpose. Third parties may approach the owner of the intellectual property to seek a license, but the owner of the IP may refuse to license on reasonable grounds. In an IPR system which provides for compulsory licensing, the government may exercise this option to increase the supply of a needed good, especially if national emergencies exist, or to allow more competition.

Another flexibility that TRIPS-plus FTAs may reduce is a developing country's option to permit **parallel imports**. Parallel importation allows international arbitrage: a good that is available more cheaply in one region can be bought and then sold in a region where the good is available more expensively, thus enabling a convergence in prices. A more formal definition of parallel importation is that it is the importation of a patent-protected product (or a product protected by a copyright or trademark) from another country where the product was legitimately placed, either by the patent holder or someone else authorised to do so, but where the *importation* was not authorised by the rights holder. These parallel imports are genuine products; they are not counterfeits or pirated products. The main issue is that their transfer from one market to another was not authorised by the rights holder. Intellectual property laws are quite specific about the reach of IP rights holders. In some systems, say a *national exhaustion* regime, the rights holder has the most control. Once the product is marketed, others can resell the product, but only within the nation, not outside it. Under this system, no parallel imports are therefore permitted. Under a *regional exhaustion* system, the product can be freely resold within the region (say the European Union) but not outside it. This system therefore partially allows parallel imports, namely among countries within the region but not from outside. Under an *international exhaustion* regime, the product can be resold anywhere in the world, so that this system fully allows parallel importation. Clearly, the patent holder would most prefer a national exhaustion system so that it can practice price discrimination (i.e., charge different prices for the same good in different nations, depending on the sensitivities of market demand and purchasing power levels, so as to maximise profits). The users and consumers in high price countries would most prefer an international exhaustion regime so that parallel imports can bring prices down; but those in low price countries, under that regime, might regret seeing their cheaply available goods exported abroad.

The TRIPS agreement does not make any requirement of countries to adopt any particular exhaustion regime. The agreement leaves countries free to determine their own policy on this matter (Article 6). Thus, parallel importing is permitted if a member country deems it to be in its national interest. For developing economies, parallel imports can be a useful check against abusive price discrimination or price collusion among producers and distributors who are given exclusive territorial rights due to IPRs. Parallel imports can also be useful if they enable developing economies to access the same good at cheaper cost. On the other hand, price discrimination can be a useful mechanism to increase access to goods in poor countries to which firms would otherwise be unwilling to export. Thus, free trade agreements of the EU which aim to deprive developing country partners the option to use parallel imports or compulsory licensing may adversely affect their partners' ability to access essential technologies on better terms.

Another key provision of TRIPS-plus agreements that could affect developing countries significantly is **test data exclusivity**. As background, pharmaceutical companies undertake tests to determine the safety and efficacy of their drugs or treatments. This is done in order to obtain regulatory and marketing approval. When a pharmaceutical patent expires, companies producing generic drugs can then enter the market and produce the same drug. However, generic companies also need to submit test data and obtain marketing approval. Rather than repeat the tests that were originally conducted, it would save costs and time if the generic companies were able to access and use those test data. However, those data are protected for a temporary period of time. Their use is the exclusive right of the original pharmaceutical company or patent holder. Depending upon their stringency, the laws protecting test data exclusivity could significantly delay the generic companies' access to the data and thereby delay generic competition. Even if its patent on the drug expires, the original drug company can enjoy a longer period of monopoly due to the generic firms' inability to obtain marketing approval in a timely manner. Alternatively, the generic companies can repeat the test, but that can be very costly and has little or no public benefit. The need to redo the test could also postpone the entry of generic companies into the marketplace if it takes much time to redo the tests. Furthermore, the increased cost of developing the generic drug – due to repeating the test – would be reflected in an unnecessarily higher price of generic drugs.[16]

The EU has strong protection for test data – potentially up to 11 years. The base period of test data exclusivity in the European Union is 8 years and a further 2 years can be added for market exclusivity and another year if there are one or more *new therapeutic uses* of the drug. This issue of test data exclusivity challenges the EU's commitment to technological development in the developing world. Its strong laws on data exclusivity may restrict access to knowledge by firms in the developing world, and contribute to a delay in the adoption and diffusion of important medicines and other health care technologies to the developing and least developed world, as the following case study suggests:

> India has been called the "pharmacy of the developing world" because it produces a large number of high-quality, affordable generic copies of costly medicines. Thanks in large part to competition stemming from Indian generics, the price of first-line antiretroviral drugs (ARVs) dropped from more than US$10,000 per person per year in 2000 to around $150 per person per year today. This significant price decrease has helped to facilitate the massive expansion of HIV treatment worldwide: more than 80 percent of the HIV medicines used to treat 6.6 million people in developing countries come from Indian producers. But an ongoing free trade agreement (FTA) negotiation between the European Union (EU) and India and its pending data exclusivity clauses could greatly restrict the ability of Indian generic manufacturers to continue producing high-quality, affordable medicines that millions of people with HIV/AIDS and other diseases and conditions in poor countries rely on to stay alive.

[16] Ethical issues exist as well, such as conducting medical tests on subjects knowing full well, from previous experiments, that certain treatments work and some do not.

The EU's policy on patents for new therapeutic uses may also be problematic, as it could also impede technological access and diffusion in developing countries. To see how, consider the case where there is a patent on a drug. Under some IPR regimes, another patent can be granted for new, therapeutic uses of the drug. This legal right may create incentives for innovators to come up with new ways to apply a given technology; for example, to find that a drug that previously treated one medical condition can now be used to treat another.[17] Suppose the drug company obtains a new patent for the new use. Effectively, though, this also delays the entry of generic competition. Generic companies may not sell drugs to treat the first condition because the original patent holder now continues to hold the exclusive rights to the drug which treats both conditions. The original drug company could potentially have patent protection for twice the length of time for its one invention. Thus, though it may seem appealing to create incentives for firms to come up with new uses of an existing technology, it is deceptive because firms may use its R&D strategically to retain its monopoly advantage; that is, to innovate in order to pre-empt entry and competition. In the end, the new use that is discovered may be quite marginally valuable from society's perspective, insufficient to outweigh the cost of additional protection. This may also give manufacturers perverse incentives not to use medicines for all the conditions against which they are effective from the outset, so that they can artificially extend the life of the patent by introducing some of those uses later on.

IPR not picked up by the Commitment to Development Index

The description above of IPR developments in Europe pertains to those aspects of IPR that the CDI measures. The analysis that follows shows that the index is reflecting a broader trend of changes in European intellectual property rights which consistently increase the stringency of IP protection in Europe, potentially at the expense of international development, particularly in the area of intellectual property rights *enforcement*.

To combat counterfeiting and piracy, the European Commission issued Directive 2004/48 to strengthen and harmonise measures relating to the enforcement of IPRs within the European Union, using the best practices of at least one member-state (Tritton, 2008, p. 1132). The Directive requires all member states to provide sanctions and remedies against counterfeiting. Judicial authorities are to order infringers to pay damages and/or allow injured parties to recover lost profits. The Directive can be far-reaching; for example, if the alleged infringement is on a commercial scale, the accused can be ordered to disclose banking statements and other financial and commercial documents.

To further combat counterfeiting and piracy, the EC adopted Council Regulation 1383/2003 *"concerning customs actions against goods suspected of infringing certain intellectual property rights …"* The rationale is that it is difficult to contain the distribution of counterfeit and infringing goods once they enter a border, or to bring proceedings against all persons involved in unlawful trade. Hence it is more efficient to prevent entry at the border at the earliest possible opportunity (Tritton, 2008, p. 1140). Thus, Regulation 1383 enables IP rights holders to request customs authorities of member-states to monitor goods entering the EU, seize, or prohibit the entry of counterfeits, pirated goods, and other IP infringing imports. The regulation also prohibits the export, or re-export, from the EU of these goods. If an importer disputes the charges that its goods are infringing or counterfeit, then

[17] An example of this is the drug AZT which originally treated cancer and was later discovered to treat AIDS.

a proceeding may then take place in the court of a member-state. Member-states, such as the U.K., have put in supplementary regulations setting out further details on the rules and procedures.

Regulation 1383 is a quite powerful tool, akin to the Section 337 investigations of the US International Trade Commission which can also order customs to stop the entry of imports that may infringe intellectual property rights. Between 2008 and 2010, member-states of the EU have detained more than 400 million articles or goods (see European Community (2010)). German and British customs accounted for 60% of these detentions. Italian customs was a distant third, accounting for 5%. About 76% of these goods were destroyed and 16% were dealt with in the court system. Only 7% or so of the goods were released because either they were not infringing or the rights holder did not follow through.

Unfortunately for a number of developing economies, Regulation 1383 has obstructed their access to certain important technologies. According to Oxfam (2011), at least 20 documented cases exist where goods in transit, such as medicines, were seized by customs agents in Europe. For example, generic drugs from India on route to South America (Brazil, Colombia, Peru, and Venezuela) were confiscated in countries like the Netherlands. The drugs were under patent protection in the EU but not in India or in the South American countries to which the drugs were destined. **These detentions by European customs have had a deleterious impact on global public health.** Some of these drugs were treatments for AIDS purchased by the Clinton foundation for delivery in Nigeria. In some cases, the goods should not have been seized; for example, in 2009, German customs agents impounded the shipment of a generic version of Amoxicillin, an antibiotic drug, en route from India to Vanuatu. The agents confused the product with an existing trademarked drug. The IP owner of the trademarked drug, *GlaxoSmithKline*, later clarified that the drug was not infringing its trademark.

Seizures of goods at the European border could only increase as the European Union and its member states expand their intellectual property rights – whether in the form of increased coverage of protection or stricter laws against anti-circumvention, and so forth – as that creates more situations where goods in transit could step on the IP rights of existing holders.

Stronger enforcement of IPRs seems to be part of a growing trend within Europe. In 2009, France passed a 'three strikes law' to combat internet file sharing. After being warned a third time for engaging in this activity, an internet user's access is to be disconnected. The U.K. government has also passed a similar 'three strikes' law in its *Digital Economy Act* of 2010, which was implemented in June 2012, that require ISPs to notify suspected pirates via "copyright infringement reports." Once an Internet user has been placed on the copyright infringement list and has been notified three times in a year of violations, copyright owners will be able to seek a court order to uncover the user's personal details in order to begin legal action against them.

3.3. Technology Transfer

First, some government efforts at technology transfer will be described and then some actual private flows of technologies will be discussed.

Recall that governments of developed countries have an obligation, under Article 66.2 of TRIPS, to provide "incentives" for enterprises and institutions within their territories to engage in technology transfers to least developed countries. Furthermore, a TRIPS Council decision mandates these governments to submit reports to demonstrate that they are in compliance with this obligation. The governments are to provide full reports every three years (beginning with 2003) and updates in the intervening years; in other words, to report annually on their technology transfer activities. Though there is much debate about the usefulness of these reports in providing information about the technology policies of developed country governments (see Maskus 2005 and Moon 2008), there should be little doubt that these reports are an important indicator – or signal – of whether developed country governments take their obligations seriously. The TRIPS agreement struck an important bargain between the developing world and the developed: that the less developed economies were to benefit from technology transfers in exchange for more strongly protecting the IPRs of developed countries. Thus the timeliness, frequency, content, and depth of these reports should be revealing.

A number of problems exist, though, with comparing the reports submitted by different developed countries. Different countries do not submit reports in a uniform way, with a standardised format or outline. Different governments adopt different definitions of technology transfers. Nonetheless, these reports provide additional perspectives on, say, Europe's commitment and efforts to help improve the technological development of developing economies.

As a background, Article 66.2 does not mandate that the government itself perform the technology transfers. Rather it simply requires governments to provide incentives for firms and other organisations within its jurisdiction to engage in technology transfer activities in less developed countries (LDCs). Furthermore, it does not specify what kinds of incentives to provide. Should they be fiscal incentives or involve government programmes? Since the manner by which governments are to create these incentives is left rather vague, concern arises that even policies that are remotely relevant to technology transfer activities may count as being compliant. Another issue is whether Article 66.2 meant that governments must provide incentives in "addition" to those already in existence. For instance, if the European Union already had in place incentives prior to TRIPS that stimulated companies to invest in the LDCs, would the EU be in compliance or would it still need to augment its policies?

Given this 'flexibility' in determining what actions governments must take, the European Union provides the following guidelines in its latest extensive report submitted to the TRIPS Council (Feb. 2012, p. 2):[18]

"[T]he EU considers that relevant incentives can be identified as those that:

- Objective 1: Promote projects such as direct investment, licensing, franchising, sub-contracting, etc.
- Objective 2: Improve access to available techniques and industrial processes.
- Objective 3: Support joint research projects.
- Objective 4: Provide training in technology management and production methods.
- Objective 5: More indirectly, improve the absorption capacity of LDCs (capacity building).
- Objective 6: Encourage trade in technological goods."

[18] Note that the EU's report includes summaries on behalf of all its member states as well.

Moreover, the European Union provides the following (rather broad) working definition of technology transfer:

> "Technology transfer refers here to the ways and means through which companies and organisations acquire technology from foreign sources. There are several types of technologies as well as several channels of transmission. Indeed, the acquisition by least developed countries (LDCs) of a sound and viable technological base does not depend solely on the provision of physical objects or equipment, but also on the acquisition of know-how, on management and production skills, on improved access to knowledge sources as well as on adaptation to local economic, social and cultural conditions." (p. 1)

Thus, according to this definition, technology transfer is satisfied not just through increased trade, foreign direct investment (FDI), joint ventures, or licensing, but also through increased training and capacity building, which seem to characterise a lot of the programmes and activities described in its 2012 report (despite the unpromising evidence from evaluations of the effectiveness of such capacity building programmes) .

Independent analysis by Moon (2011) suggests that a minority of reported activities actually qualify as incentives for technology transfer if a narrower definition of *qualifying* incentives is used, such as financing the purchase of technologies, incentives for FDI in technologically-oriented fields, providing venture capital, and so forth. In addition, Moon (2011) finds that less than half of the reported activities target the least developed WTO countries. Indeed, the European Union report (Feb. 2012) acknowledges that it does not have a specific policy per se for technology transfer to the LDCs:

> "Finally, it should be borne in mind that no technology transfer programme is specifically dedicated to least developed countries as such. EU initiatives are usually specific to countries/groups of countries/regions, since the EU strongly supports regional integration, which fosters better understanding and political and economic links between neighbouring countries." (p. 2)

Table 4A. Developed Country Submission of Reports on Technology Transfer Activities (per Article 66.2 TRIPS)

Countries	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013 ***
Australia	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
New Zealand	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Norway	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Switzerland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Canada	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Japan	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
US	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
European Union	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Austria	Yes				Yes	Yes	Yes	Yes	Yes	Yes	
Belgium					Yes	Yes	Yes	Yes	Yes		Yes
Czech Republic	Yes		Yes	Yes	Yes	Yes	Yes				
Hungary											
Denmark	Yes		Yes		Yes	Yes	Yes	Yes		Yes	
Finland	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
France		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Germany	Yes	Yes	Yes	Yes	Yes	Yes**	Yes	Yes	Yes		
Greece											
Ireland		Yes	Yes			Yes				Yes	Yes
Italy			Yes								
Luxembourg											
Netherlands	Yes		Yes								
Poland											
Portugal											
Slovakia			Yes	Yes					Yes	Yes	Yes
Spain	Yes	Yes	Yes		Yes	Yes	Yes	Yes		Yes	
Sweden	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
United Kingdom	Yes				Yes		Yes	Yes	Yes	Yes	Yes

* As of the time of this writing
** No narration; just a table of programmes submitted.
YES -- indicates that a report was submitted

Source: World Trade Organization (2003- 2014)

The main contention here is that the EU reports seem to display significant underperformance on the part of European countries to fulfil their Article 66.2 obligations, consistent with what the CDI finds for their technology component scores. Table 4A provides a list of the CDI countries and indicates whether they have submitted a report in each year since 2003.[19] As the table indicates, gaps exist in the reporting by EU member states. In some years, member states do not submit a report. Some countries, like Greece and Portugal, have never provided a report. Others like Italy submitted only once and the Netherlands twice. In 2008, Germany provided a mere two pages of a table, with no narrative.

[19] Only those countries listed in Table 4A and Lithuania have ever submitted a report to the WTO on their technology transfer activities.

Table 4B. Selected Examples of Technology Transfer Activities reported in the Article 66.2 Submissions, 2011-2012

Authority	Programme
European Union	Supply of small and medium farm machinery to N. Korea, 2 million euros Support for Energy and Environment to Africa Regional, 28.2 million euros Private Sector Development in Ethiopia, 11 million euros Support to Innovative Enterprises in Ukraine, 2.5 million Euros
Denmark	Cotton Production in Uganda
Finland	Business partnership support in Official Development Assistance (ODA)-countries, 4.3 million Euros
Ireland	Capacity Building in African countries
Sweden	Risk capital to companies investing energy/environment in less developed countries (LDCs)
United Kingdom	Event for Mobile Phone Banking, 30,000 British pounds Teaching English in Bangladesh Funding for Higher Institutions in Africa and Asia, 3 million Euros
United States	Clean Technology Fund for Developing Economies Partnerships between US Government agencies (USAID, EPA, CDC) and developing countries Licensing of Health Care Technologies (Vaccines), Funding of R&D on Infectious Diseases by the NIH OPIC Provision of Risk Insurance and support for US investment in emerging markets, $800 million African Growth and Opportunity Act, providing duty free access to goods from sub-Saharan Africa US Department of State and Department of Commerce Workshops and Agreements on Sci & Tech Trade Capacity Building Assistance to less developed countries (LDCs), $771 million Millennium Challenge Corporation investments in developing world, $8 billion as of Aug. 2011 US Department of Agriculture Technology Transfer: distribution of plant germplasms to LDCs USPTO training and technical assistance to less developed countries (LDCs)

Notes:
Amounts spent on programmes are not specified if there was inadequate information
USAID denotes US Agency for International Development, NIH National Institutes for Health,
EPA Environmental Protection Agency, CDC Center for Disease Control, NSF National Science Foundation
OPIC Overseas Private Investment Corporation, USPTO US Patent and Trademark Office

Source: World Trade Organization (2003-2014)

Moreover, the technology transfer programmes summarised in the EU and member-states' reports show considerable room for improvement. Table 4B provides a sample of programmes and activities reported by the EU, its member states, Japan, and the US that affect less developed countries. Some countries, such as Austria and France, report programmes that do not target the less developed economies, and thus are not listed in the table above. First, the programs often involve relatively paltry sums (under €30 million). The language used to describe the programmes is quite general, focusing on the mission and the outline of the intended goals. The descriptions lack details on how the programmes were carried out, who the participants were, and the criteria for measuring success. Inadequate information is conveyed for an observer to read the reports and replicate the design of a project (not that this kind of detail was mandated or asked for, but sufficient information is needed to assess whether developed countries are in compliance with their obligations, or otherwise 'every country gets a passing grade'). Second, as pointed out above, the programmes vary in quality and relevance to technology transfer. Some of the Swedish projects are quite substantive, involving the transfer of clean technologies, wind power, electrical distribution systems, and plant breeding techniques to African countries. However, some of the UK projects have no immediate impact on private sector technology transfers, such as its programme to teach English in Bangladesh, to assist with voter registration in Sierra Leone, or to hold an event showcasing mobile phone banking in Africa.

In contrast, the reports submitted by the US government in 2011-2012 contain much more detail and seems to indicate more substantive programmes and policies for international technology transfer. A wide range of government agencies participate in generating incentives for US firms and institutions, including universities, to engage in technology transfers to less developed countries. Larger sums of money are appropriated for these programmes than they are in the EU and its member states. Actual technologies are also transferred; for example, the National Institutes of Health (NIH) has licensed medical treatments and drugs to less developed countries and the Department of Agriculture (USDA) has distributed plant germplasm to various poor countries for use in food production. Funds are established, such as the *Clean Technology Fund*, to help developing economies purchase or invest in low carbon technologies. Nonetheless, while the US report provides a lot of detail on the missions and scope of its projects, it also lacks specifics on the design and implementation of the programmes. A number of the programmes seem self-serving; that is, to help US firms gain entry into foreign markets and help reform policies and institutions within those markets up to US standards, such as strengthening intellectual property rights, and then as a by-product, help developing countries gain technology and develop economically.

In summary, the reports that European countries have submitted to the TRIPS Council as required under their technology transfer obligations do not reflect well on their commitment to technology development in the developing world. At worst, the technology transfer is insufficient. At best, the reports are incomplete, suggesting that European countries are not taking seriously compliance with Article 66.2 and its monitoring arrangements.

Finally, we look briefly at some measures of actual technology transfers. If governments provide significant incentives for private enterprises to engage in technology transfers to the developing world, these enterprises should be observed to increase their *exports* to and *foreign direct investment* in that part of the world. Thus far, however, no formal empirical studies have yet been conducted on the extent to which government incentives created in response to Article 66.2 of TRIPS have stimulated technology transfer, controlling for other variables that affect such transfer. The following therefore is an informal look at the trends in European, US, and Japanese technology transfer.

Table 5A reports the exports of high tech goods of Japan, the US, and European Union. Manufactures of high skill and technology intensity are used as a proxy for high technology goods. The table breaks down these exports by destination and by period (2003 and 2012). When compared to Japan and the United States, European exports to the developing world are largest, although combined exports of Australia, Canada, New Zealand, United States and Japan are larger than the combined European exports to developing countries. But individual member states export less to the developing world than do Japan and the US. Unlike Japan and the US, the European countries export more high tech goods to other developed countries than to the developing and least developed countries. In other words, European high tech trade is concentrated in the developed world. There should be potential, via public policies and incentives, to shift or expand their high tech trade with developing and least developed economies. However, in 2012, compared to 2003, the volume of European exports to developing countries almost doubled, whereas in the case of Japan and the United States the increase was much smaller (31% and 42% respectively).

Table 5A: Exports of high tech goods

Country/region	Year	Exports to Developed economies	Exports to Developing economies excluding LDCs	Exports to Least developed countries
Japan	2003	73,354,183	100,629,713	122,089
		(1.66%)	(2.28%)	(0.003%)
	2012	54,427,852	131,636,800	211,891
		(1.159%)	(2.80%)	(0.005%)
United States	2003	171,765,386	143,750,456	828,518
		(1.36%)	(1.14%)	(0.007%)
	2012	182,287,089	204,631,190	1,515,359
		(1.58%)	(1.77%)	(0.013%)
Europe 21	2003	820,840,472	138,001,594	3,259,448
		(5.69%)	(0.96%)	(0.024%)
	2012	1,099,975,376	266,787,169	6,565,520
		(8.58%)	(2.08%)	(0.051%)
Europe 16	2003	786,498,786	135,352,072	3,429,126
		(5.69%)	(0.98%)	(0.025%)
	2012	1,015,164,098	256,766,662	6,418,622
		(8.35%)	(2.11%)	(0.053%)
The Rest	2003	291,082,762	251,368,201	1,092,335
		(1.60%)	(1.38%)	(0.01%)
	2012	291,389,492	352,892,807	2,229,328
		(1.41%)	(1.71%)	(0.01%)

Source: UNCTAD 2014, World Development Indicators (2013)

Table 5B examines the stock of Japanese, US, and European Union FDI in the developed and developing world. Again the pattern is quite consistent with that of high tech exports. The EU's overall stock of FDI is larger in both regions, but there are more countries within the EU. Hence, per individual country, the stock of FDI is smaller than that of Japan or the US. Again, the EU's FDI is concentrated in the developed world. The ratio of FDI stock in the developing world to the FDI stock in the developed world is lower in the EU than in Japan or the US. Again, there is potential for growth in EU foreign direct investments in the developing and least developed countries, given appropriate incentives.

Table 5B. Stock of Outward Foreign Direct Investment

Source Country:	year	FDI Stock in Developed economies	FDI Stock in Developing economies
Japan	2003	235062	77937
		(5.23%)	(1.73%)
Japan	2010	461002	288957
		(9.37%)	(5.88%)
USA	2003	1241169	407087
		(10.54%)	(3.46%)
USA	2010	2664498	856328
		(20.28%)	(6.52%)
EU14	2003	3971430	548493
		(34.67%)	(4.79%)
EU14	2010	6294956	1288896
		(46.76%)	(9.57%)
EU-Big3 (Ger, Fra, UK)	2003	2218921	286827
		(34.38%)	(4.44%)
EU-Big3 (Ger, Fra, UK)	2010	3474909	663318
		(47.61%)	(9.09%)

Notes:

The FDI figures are in millions of real 2005 US dollars

Figures in parentheses are the FDI figures as a percentage of GDP

Source: Eurostat 2012

4. Policy Recommendations

The discussion above suggests action for European governments and the European Union which will:

1. increase public R&D in technology areas that most benefit developing nations;
2. relax the stringent intellectual property laws that impede the diffusion of technologies to developing nations; and
3. take a more active lead in the process of transferring substantive technologies to the developing world.

In particular:

- **Public sector support for research and development needs to increase in real terms, particularly in the areas of Health Care, Energy, Environment, and Agriculture.** The support can be either direct public funding or tax-subsidy incentives to private enterprises and other institutions. Expanded effort is especially needed from France, Germany, and the United Kingdom – the three leading R&D nations in Europe. Similarly, Sweden should look to increase its tax subsidy rate to businesses for R&D in order to promote the creation of new technology.
- **The governments of the European Union member states need to focus their R&D more on innovations or sectors that pertain to the developing world**, such as medicines for neglected diseases, food and nutrition, technologies for dealing with climate change, infrastructure (water and sewer systems), broadband access to global knowledge, and education. The non-European CDI countries spend – on average – approximately one-third of their total government R&D on these development-friendly sectors. In order for Europe to catch up to that mark, they would collectively need to spend approximately 1.4 billion USD additional funding on development-focused R&D each year.
- **The European Union and its member states need to scale back on measures that increase the stringency of their system of intellectual property rights.** The emphasis needs to be more on technology diffusion than on creation, particularly since excessively stringent IPRs do not promote technological creation. European governments need to further develop policies that facilitate competition as a means of encouraging and 'incentivizing' innovation in recognition of the role that competition plays in spurring innovation.
- **The source of the increased stringency of IPRs is the EU directives and regulations that seek to harmonise IPR standards within the EU. Harmonisation need not occur at high IPR standards, nor does harmonisation actually need to be pursued.** Harmonisation measures should be limited to those aspects of IPR law and practice that promote clarity, transparency, and non-discrimination. Harmonisation should not be used as part of a strategy to increase European innovation and productivity, since even amongst EU member countries 'one size' technology policies do not fit all. Harmonisation for its own sake cannot be an efficient growth policy. Thus, the EU needs to reconsider its pursuit of harmonisation and scale back its drive to establish high, uniform standards of IPRs among member states.
- **Among the IPR policies that should be relaxed are: laws prohibiting the anti-circumvention of technology measures and the patenting of animal and plant**

varieties and software programmes. Regulation 1383, allowing customs seizures of suspected IP infringing goods, needs to be repealed.

- **Development impact studies should be conducted prior to pursuing further EU bilateral and regional free trade agreements (FTAs) with developing nations, particularly agreements that will strengthen IPRs among member states (above TRIPS-levels).** The EU is recommended to create a task force to study whether any TRIPS-plus provisions will have a significant, negative impact on developing country members before pursuing FTA negotiations with developing economies, similar in nature to environmental impact studies are that are often conducted prior to approving energy-related projects.
- **Test data exclusivity periods should be shortened.** Barriers to competition from generic companies should be eliminated. In particular, the use of patent term extensions and other practices to strategically delay the entry of generic competitors upon expiry of a patent right should be avoided and be potentially considered abuse of a 'dominant position' by incumbent rights holders.
- **European governments should use their option to issue compulsory licenses for purposes of exporting essential goods to developing economies that have insufficient manufacturing capacity to produce them.** A more proactive, leading role needs to be taken to marshal supplies to the developing world, including identifying gaps and problem areas, and providing stronger incentives for technology transfers
- **The EU and member-states should do more to fulfil their TRIPS Article 66.2 obligations** and to submit more detailed and transparent reports that clearly indicate how they are complying with their obligations. The EU and member states should submit reports annually that follow a pre-determined common format that provide comprehensive overview of all relevant activity.
- **Regarding their international technology transfer obligations, European governments need to provide more substantive incentives, such as tax incentives or subsidies for transferring technologies or investing abroad.** Governments could also provide better risk insurance and credit to firms and institutions that engage in technology transfer activities abroad. The French, German, and U.K. governments ought to significantly allocate more funding for technology transfer projects and focus on projects that involve concrete technical transfers, including know-how, expertise, and capital.
- **The Greek, Portuguese, Italian, and Dutch governments need to participate more in the Article 66.2-related activities** and/or make their activities known or visible via detailed submissions of reports on their activities.
- **The technology transfer incentives and projects should especially target the least developed economies**, not just the large and fast growing, higher-income developing economies, like China, Brazil, India, or Singapore.
- **Member states should establish an *official* international technology transfer office** whose task will be to oversee and implement their technology transfer obligations.
- **European policymakers should foster a culture that gives more encouragement and support for open innovation, technology sharing, and dissemination.** These models of innovation are quite advantageous for innovators in developing economies, as they provide lower cost access to technologies and opportunities for learning and human capital accumulation (see Isaac and Park, 2010). Open innovation has worked well, alongside traditional proprietary IP regimes, in the software and biotechnology sectors, and has potential in other industrial sectors. A culture of open innovation would eschew efforts to impulsively assert property rights over knowledge, as done under the EC's Database

directive, or protect the secrecy of knowledge, as seems to be the objective under anti-circumvention laws, test data exclusivity rules, or laws affecting internet freedom, and instead would seek to expand the stock of knowledge in the public domain, preferably global public domain.

- **Developing economies also have obligations with respect to intellectual property rights.** For example, IP rights holders may engage in price discrimination, charging relatively lower prices in markets with less sensitive (elastic) demands. Price discrimination enables the rights holder to maximize global profits, while enabling consumers in poor countries to get more affordable access to technologies. This arrangement will not work if "resale" cannot be prevented; for example, where a parallel trader, say, can purchase the good cheaply in the developing country market and sell it in a developed country market. Resale will likely reduce the rights holders' profits and raise the price of goods to consumers in poorer countries, as the good becomes scarcer there. Developing and least developed country governments should help prevent such resale, and work with IP holders to seek not only the lowest possible wholesale price, but retail price as well.
- **Developing country governments should also cooperate to help reduce piracy, counterfeiting, and the wilful infringement of intellectual property rights within their borders.** While IPRs in the developing world should not be at the same high standards prevailing in the developed world, this does not imply that IPRs should not be respected in the developing world. Innovators and businesses should have their intellectual properties adequately protected so as to encourage investments in the local economy, creativity, risk-taking, job creation, and economic growth. Illicit trade is counterproductive. It focuses on wealth redistribution and not wealth creation, and is often associated with corruption and organized crime.
- **Make an Affirmative Declaration on Technology Transfer.** Maskus (2012) proposes and discusses this idea more fully. Policymakers must expressly indicate that technology transfer for purposes of economic development is a global priority. An international declaration should help formalize developed country commitments to global economic development, and could include specific policy provisions, such as patent buyouts, differentiated patent life spans according to local circumstances, public funding programs, public-private research collaboration, special licensing terms for academia and research laboratories, and flexibilities and limitations on copyrights for purposes of education and scientific research. This declaration should also include the participation of higher income developing countries that have the capacity and resources to help transfer technologies to the lower income and least developed countries.

In the meantime, IPR reform continues to be a source of tension between developed nations and poor countries. On March 5-6, 2013, the TRIPS council met to discuss a proposal from the least developed countries for their transition period (to fully comply with TRIPS) to continue until each of them develops enough economically to be lifted out of the UN-defined least developed category. The group argues that its members still lack the financial and technological capacity to protect intellectual property. WTO members, at the March 2013 meeting, accepted that the deadline for least developed countries to protect intellectual property generally could be extended beyond the current July 1, 2013 date. During the discussion, the EU noted its willingness to consider an extension of the LDC transition period; however, it did not support the mechanism for extension framed in the LDC Group submission of November 5, 2012, which sought a decision that would permit an LDC member not to apply the provisions of the TRIPS Agreement, other than Articles 3, 4 and 5, until they ceased to be an LDC. In the EU's view, its most important concern with the LDC request was that it felt that the request lacked "both a clear and predictable perspective and it remain[ed] silent on how IP and the TRIPS Agreement could specifically help LDCs in building a viable technological base."

The European countries have lagged behind other developed countries in supporting the dissemination of technologies to the developing world. This is unfortunate since Europe is a leading source of innovations. Given its collective wealth, endowments, productive capacity, and strong institutions and governance, Europe has the potential to contribute more to global technological development.

Attending to these activities should enhance Europe's role in global economic development and its rank in the CDI's commitment to the technological development of developing economies. It is expected, though, that Europe's increased efforts and commitment be ultimately translated into an actual rise in technology trade with developing economies, foreign direct investment that results in establishing research laboratories and innovation centres in the 'South', licensing contracts and joint ventures with firms and organisations there, and reliable supply and access to technologies in the developing world. This would benefit European firms and citizens, as well as those in the developing world.

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