



Business, Eco-innovation and Globalisation

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Introduction

New products and services are being developed at an increasing rate in the technology-driven global economy. But how can we ensure that environmental considerations are taken into account throughout the life cycle of these new products, from production to disposal?

Technological innovation can prevent or reduce the negative effect on the environment of products and activities. Such eco-innovation is a vital means of ensuring that economic development is sustainable. As governments look for effective ways to combat climate change and other negative environmental impacts, eco-innovation can make it possible to realise environmental objectives at lower cost than would otherwise be the case.

At the same time, eco-innovation can contribute to new business opportunities which could make firms or sectors more competitive. Understanding the role that eco-innovation can play in achieving environmental objectives is therefore an important part of policy debates.

Globalisation, particularly the international flow of knowledge, capital, goods and services, along with changes in the way businesses are organised, clearly has a profound effect on how eco-innovation can contribute to reducing pressure on the environment.

How are firms adapting their environmental innovation strategies to the challenges and opportunities of global markets? How do public policies and market factors affect the international diffusion of eco-innovation? How are governments promoting environmentally-related innovation in the context of a globalising economy? Is there a “first mover” advantage? Are emerging economies also “innovative” or just recipients of new technologies?

This *Policy Brief* looks at how eco-innovation can help meet environmental challenges such as climate change in the context of the globalised economy, building on OECD work on environmental policies and on science, technology and innovation policies. ■

How does globalisation affect investment in environmental R&D?

As the economy globalises, business research and development (R&D) is also becoming increasingly international. One of the features of the internationalisation of R&D is the relocation and outsourcing of R&D activities, in order to bring R&D activities closer to new markets and/or to tap new knowledge sources that may exist abroad.

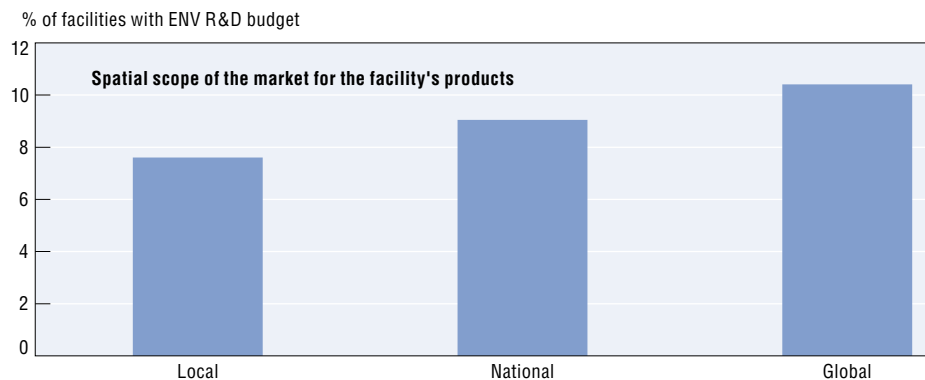
However, it appears that – at least for large multinational firms – what is being outsourced internationally is mostly *development* of new products and processes, in other words *applied* research, while *basic* research still seems to be carried out at headquarters. The internationalisation of R&D strategies is therefore likely to be particularly important in the field of applied research. This is important for eco-innovation, since much of the research being used to realize environmental objectives is applied research.

The idea that *environmental* R&D is becoming increasingly international is supported by evidence from a recent OECD survey of over 4 000 manufacturing facilities in seven countries (Japan, Germany, France, Norway, Hungary, Canada and the United States). This survey found that factories belonging to companies which had foreign headquarters were 20% more likely to devote at least some of their R&D budget to environmental concerns than those with domestic headquarters.

National regulations – both “sticks” and “carrots” – may be playing a role in encouraging the outsourcing of environmental R&D. For example, one reason why companies carry out R&D activities abroad is to benefit from R&D support programmes in other countries. Since many governments already provide support for environmentally-related R&D, companies may move their environmental R&D operations to a country where such support is available. Several of the companies interviewed for another OECD study said that better R&D support abroad than in their home country had been or was soon to be a key reason for carrying out environmental R&D elsewhere.

Firms are also more likely to invest in innovation if they are exposed to international competitive pressure, or if they have access to new global

FIGURE 1.
INVESTMENT
IN ENVIRONMENTAL R&D
AND GEOGRAPHICAL
SCOPE OF MARKETS



market opportunities. While this is true of innovation in general, it is particularly true for environmental innovations. For instance, in the same way that firms are adopting more global strategies in their R&D activities, they are also more likely to invest in environmental R&D if they are exposed to international market forces for their products. Figure 1, which draws upon data from the survey mentioned above, shows that the likelihood of investing in environment-related R&D is greater the more “international” the market for its products.

Large international research projects in the area of “eco-innovation” are also increasingly common, in response to a more global economy. For instance, in February 2006, the UK and Japan started a joint research project, “Developing Visions for a Low Carbon Society through Sustainable Development”, which will investigate how to achieve a low carbon society by 2050. This project is examining actions which would reduce greenhouse gas (GHG) emissions, share ideas for a low-carbon society, and provide the technological and behavioural solutions needed to achieve such a society.

In addition, the International Energy Agency (IEA) is helping to co-ordinate 40 Implementing Agreements which allow interested governments or other organisations to pool resources and to foster the research, development and deployment of particular technologies. This currently involves several thousand participants from 58 countries, working on key new technologies of energy supply and use. These Agreements are open to both IEA members and non-member countries. They cover: fossil fuels (*e.g.* clean and advanced fossil fuel technologies including carbon capture and storage [CCS]), renewable energies (including biofuels) and hydrogen, end-use technologies (transport, buildings, and industry), fusion power, and cross-sectoral activities. ■

How does policy affect transfer of environmental technology?

When “green” R&D is successful, it results in innovative processes or products that may lead to patents for “environmental” technologies. So by tracking patent claims for overseas inventions, it is possible to trace the international transfer of environment-related innovations. For instance, there has been a clear upward trend in recent decades in the average number of countries to which a patented innovation in renewable energy technologies has subsequently been “diffused”.

In the case of motor vehicle emissions abatement, the transfer of Japanese technologies to the US and Europe is striking. Figure 2 illustrates patenting activity at three national patent offices – the US Patent and Trademark Office (USPTO), the Japan Patent Office (JPO) and the German Patent and Trademark Office (GPTO) – classified by the source countries of inventions. Although domestic inventors typically dominate patenting activity in their home countries, in the US, it is the Japanese inventors who account for the highest share of patenting, with 37% of the total, with domestic inventors

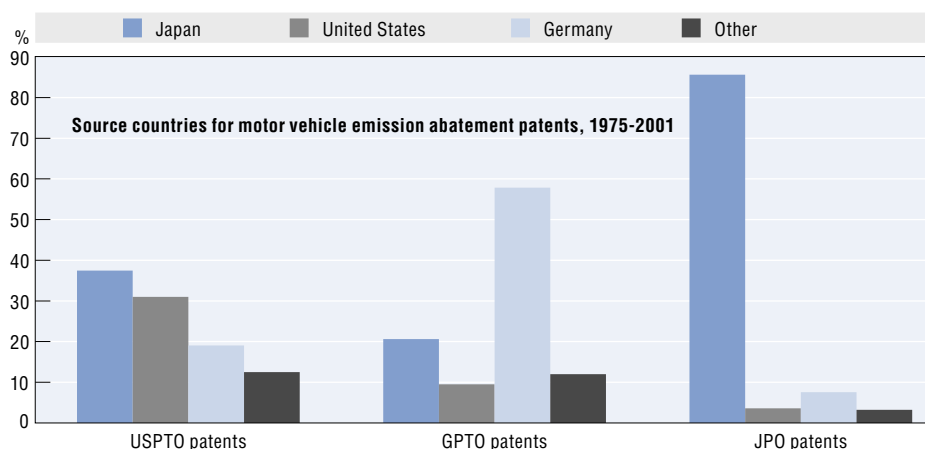
ranking only second with 31%. Part of this can be attributed to the fact that emission standards were introduced in the US that Japanese inventors were already well-placed to meet with existing technologies.

Another question arises as to whether countries can benefit from a “first mover advantage”: do those countries which introduce environmental policies early reap the benefits of international market opportunities for their innovations? The evidence here is mixed. In an OECD study of bleaching technologies in the pulp and paper sector, early policy interventions introduced by Sweden do appear to have resulted in a strong comparative advantage in totally chlorine-free technologies. In this case, the fact that Sweden was ready first with its technology allowed it to successfully penetrate the markets of other major pulp and paper producing countries.

However, in the case of air pollution control devices for coal-fired power plants, it was each country’s domestic regulations which seem to have been the primary drivers of innovation. The nature of the market is therefore likely to have an influence on the relative importance of any “first mover” advantage. The pulp and paper industry is a global market, whereas the power sector is generally less subject to international market pressures, although this is changing.

The nature of the environmental regulations that are implemented by individual governments may also be important. For instance, excessively prescriptive regulations may lead to types of innovation for which there is significant local demand, but little demand in other markets where the regulatory framework differs. In effect, with prescriptive technology-based regulations, there is a danger that markets will be fragmented along national lines, while more flexible policy measures would generate international market opportunities.

FIGURE 2.
PATENTING
IN AUTOMOTIVE
EMISSIONS CONTROL
BY PATENT OFFICE
AND SOURCE COUNTRY



Even if the regulations are similar in nature, technology transfer may be limited by different national testing procedures to verify the environmental performance of new technologies. Mutual recognition of verification programmes and procedures can streamline testing requirements and reduce the cost for vendors wishing to market their technologies in different countries and regulatory regimes, even while supporting the development of markets for environmentally-sound technologies. ■

What about eco-innovation in emerging economies?

The globalisation of eco-innovation is also reflected in the extent to which non-OECD countries are becoming increasingly active in invention and innovation. For instance, in the area of hybrid vehicles, China, Chinese Taipei, Russia, Israel, India and South Africa have become increasingly important players as “inventor countries”, although the G7 countries (Canada, France, Germany, Italy, Japan, UK and US) and Korea still

BOX 1. AN ECO-INNOVATION SUCCESS STORY IN CHINA

Giant Hemu Technology Co., Ltd. (Giant Hemu), a pulp and paper maker, is a joint venture company, with capital support from the Asian Development Bank (ADB), the International Finance Cooperation (IFC), Capital Steel Group, and other domestic investors. The pulp and paper industry has traditionally caused significant environmental impacts, including from black liquor, a side-product of the pulping process. Untreated liquor is highly toxic to humans and animals in case of ingestion, skin and eye contact, and inhalation, and it is proven to be very harmful to aquatic life forms. The company currently benefits from a tax exemption measure for developing environmentally-friendly technologies, and has a patented technology for clean pulping and the comprehensive use of renewable resources in papermaking.

This technology allows for clean production in pulp preparation, as well as producing a multi-element organic compound fertiliser from the recovered substances. This fertilizer can be used, for example, to combat desertification and in agriculture. This technology allows a zero discharge target of black liquor to be met, and the reduction of the discharge of pulp mill pipe-end effluent below the legal minimum, thus giving medium or small paper mills an opportunity to survive under the new strict environmental regulations in China.

In total, Giant Hemu calculates that its technology can reduce CO₂ emissions by 420 000 tons per year. It turns a highly polluting papermaking process into one with useful by-products such as fertilizers or water reducing agents, while producing pulp without using precious wood. The company plans to export its technology to neighbouring Asian countries.

Giant Hemu believes that the main reasons for carrying out R&D as a leader in this technology field lie mainly in the need to create products that meet Chinese environmental regulations and in improving the company's image. Second, it is seen to be important to carry out R&D to comply with regulations abroad – and therefore, to be able to export products, to reduce costs for the client, and to have access to new markets. The major reasons for carrying out R&D in China, compared with doing it abroad, are the cheaper infrastructure and research costs; the availability of large numbers of qualified engineers and scientific experts; and the presence of centres of excellence (science parks, universities, and institutes).

dominated the share of patents for fuel cells and hybrid vehicles over the period 2000-2005.

The same experience has been found with general environmental patents overall. In effect, some non-OECD countries such as Israel, China and India are fast becoming *creators* of environmental innovation, not just *recipients* of technology transfer, as illustrated in Box 1.

Further environmental co-operation between OECD and non-OECD countries can help spread knowledge and technological best practices to mutually benefit from more sustainable production and consumption patterns worldwide. This triggers debates about the appropriate level of protection of inventors through intellectual property rights and about the financial mechanisms that can support technology transfers to countries and groups which cannot access the technologies they need at market prices. This may contribute to addressing global environmental challenges at least cost. ■

Where do we go from here?

With eco-innovation gaining importance on the public policy agenda, the OECD is intensifying work in this area. A review is ongoing of OECD government policies that promote eco-innovation with a view to learn lessons and to identify good practices. The scope of the work on patents will also be widened, to cover additional areas of eco-innovation for further analyses of effects of public policies. Particular emphasis will be placed on the role that domestic regulations can play in hindering or encouraging international diffusion of eco-innovation. New work is planned on the specific links between environmental taxes and innovation processes; the OECD is also examining opportunities for mutual recognition of existing verification programmes among countries.

And the *OECD Innovation Strategy* will also help to find out which policies work and which do not in promoting the development and diffusion of innovation. This *Strategy*, due to be completed in 2010, has three main objectives:

- to compare innovation performance across OECD countries;
- to explain the differences found in this performance; and
- to suggest a comprehensive policy strategy for promoting innovation in the future.

Eco-innovation will obviously be an important part of the discussions leading up to the finalisation of this *Strategy*. ■

For further information

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For further reading

OECD (2006), **Recent Trends in the Internationalisation of R&D in the Enterprise Sector** (DSTI/EAS/IND/SWP(2006)1/FINAL), www.oecd.org/dataoecd/27/59/40280783.pdf.

Popp, David (2006), **“International Innovation and Diffusion of Air Pollution Control Technologies: The Effects of NO_x and SO₂ Regulation in the US, Japan, and Germany”**, in *Journal of Environmental Economics and Management*, Volume 51, Issue 1, pages 46-71.

OECD (2006), **Economic Policy Reforms: Going for Growth**, ISBN: 978-92-64-03591-1 € 57, 162 pages.

OECD (2007), **Environmental Innovation and Global Markets**, available at www.oecd.org/environment/innovation/globalmarkets.

OECD (2008), **Environmental Policy, Technological Innovation and Patents**, ISBN: 978-92-64-04681-8.

OECD (2007), **Environmental Innovation in China**, available at www.oecd.org/environment/innovation/globalmarkets.

Johnstone, N. (2007), **Environmental Policy and Corporate Behaviour** (Cheltenham: Edward Elgar), ISBN: 978-18-47-20032-7, 368 pages.

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