



Contents lists available at SciVerse ScienceDirect

Journal of Environmental Economics and Management

journal homepage: www.elsevier.com/locate/jeem



Innovation and diffusion of clean/green technology: Can patent commons help? ☆



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ARTICLE INFO

Article history:

Received 12 September 2011

Available online 29 April 2013

Keywords:

Patent commons
Green technology
Eco-patents
Diffusion
Climate change

ABSTRACT

This paper explores the characteristics of 238 patents on 90 inventions contributed by major multinational innovators to the “Eco-Patent Commons”, which provides royalty-free access to third parties to patented innovations on green technologies. We compare the pledged patents to other patents in the same technologies or held by the same multinationals to investigate the motives of the contributing firms as well as the potential for such commons to encourage innovation and diffusion of climate change related technologies. We find pledged patents to protect environmentally friendly technologies and to be of similar value as the average patent in a pledging firm's patent portfolio but of lower value than other patents in their class. Our analysis of the impact of the patent commons on diffusion of patented technologies suggests that making patents accessible royalty-free did not result in any significant increase in diffusion as measured by citing patents. This study, therefore, indirectly provides evidence on the role of patents in the development and diffusion of green technologies.

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1. Introduction

Numerous well-known economists have called for policies to encourage both public and private investment in technologies designed to mitigate climate change [27,7,20,3]. Policy in this area confronts a double externality problem [28]: the first is private underinvestment in R&D due to partial lack of appropriability and imperfections in the financial markets and the second is the fact that climate change mitigation and reduction in greenhouse gases is a classical public good, and one with a substantial international component. That is, the benefits of climate change mitigation flow largely to those who do not bear the costs. Hall and Helmerts [10] argue that the existence of the second externality can impact the

☆ Previous versions of this paper have been presented at the EARIE 2011 in Stockholm, SEEK ZEW Conference, March 2011, the ZEW Workshop on the Economics of Green IT, November 2010, the EPIP Annual Meeting in Maastricht, The Netherlands, September 2010, IP Scholars Conference 2010, Berkeley Center for Law and Technology, August 2010, the Workshop on Innovation without Patents, Sciences Po, Paris, June 2010, the APIN biannual meeting, Singapore, May 2011, the USPTO/SIPO conference, Beijing, May 2011, a FEEM workshop, Venice, May 2011, and seminars at the University of Oxford and Copenhagen Business School. We thank participants in these conferences and seminars for useful comments. We also acknowledge helpful comments from the referees, Dirk Czarnitzki, Katrin Cremers, Dietmar Harhoff, Georg von Graevenitz, and the WBCSD. Philipp Schautschick provided excellent research assistance.

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desirability of policies designed to deal with the first externality, shifting policy makers' preferences towards subsidies or prizes and away from intellectual property (IP) protection.¹

To make this argument more explicit, consider the usual policies designed to close the gap between the private and social returns to an activity.² These are subsidizing (or issuing tax credits for) the activity, regulating the activity (mandating its performance or controlling the price of inputs), and internalizing the externality by granting property rights that allow some appropriation of the social benefits. In the case of R&D investment, the first approach has been widely used in the past for research directed towards national needs [26], for corporate R&D via tax credits, and for small and medium-sized enterprises (SMEs) that face credit constraints. Examples of the second approach are the mandate of the State of California for sales of electric-powered automobiles [19] and the U.S. federal government stimulus package, which mandates the diffusion of electronic medical records and their effective use [4].

The most widely available policy designed to encourage private R&D investment in most countries is the intellectual property system. However, in the case of climate change mitigation and environmental protection more generally (as in the case of R&D directed toward other national needs such as public health), allowing firms to appropriate social benefits via their market power and pricing behavior has the drawback that without further policy design, it will tend to inhibit the diffusion of the technologies whose creation it encourages. In addition to the welfare cost of limited diffusion, IP protection also has potential negative consequences for subsequent innovation that builds on the protected technologies. Given the environmental externality, such diffusion and follow-on innovation is highly desirable. This has triggered an active debate on the role and usefulness of IPRs in the generation of climate change related innovation and its diffusion.³ The existing evidence suggests that the IP system, specifically the patent system, may not be the optimal policy to encourage R&D in this area.

A number of large multinational firms such as Sony, IBM, Nokia, etc., claim to address the problems that patents might cause in the area of environmental protection through the creation of an "Eco-Patent Commons" (henceforth *EcoPC*) together with the World Business Council for Sustainable Development (<http://www.wbcsd.org>). Firms pledging patents to this commons are required to sign a non-assertion pledge that allows third parties royalty-free access to the protected technologies. The official purpose of this private initiative is described on the EcoPC website as the following:

- To provide an avenue by which innovations and solutions may be easily shared to accelerate and facilitate implementation to protect the environment and perhaps lead to further innovation.
- To promote and encourage cooperation and collaboration between businesses that pledge patents and potential users to foster further joint innovations and the advancement and development of solutions that benefit the environment.

Obviously, one can imagine an additional purpose: to improve the reputation and public relations of the participating firms, possibly by contributing patents on inventions of little value and the donation, therefore, generating little cost to the firm. However, it is worth noting that several of these firms have a number of other initiatives in the environment and sustainability areas, so this initiative probably forms part of a larger program whose cost is not negligible.⁴

Alternatively, the patents contributed could be those on inventions that need development effort that the firms in question are not willing to undertake.⁵ To date, there are 12 participating firms, and 121 patents have been contributed to the commons.⁶ Relative to the size of these firms' patent portfolios, this is a small number; however, it could be large given the small share of patents directly related to environmental protection in these firms' total patenting.⁷

The question that we ask is whether the EcoPC initiative achieves its ambitious official objectives. In order to provide an answer to this broad question, we answer a range of intermediate questions: (a) how and to what extent are the patented technologies related to environmental protection? (b) Are the patents that protect these technologies valuable? (c) Will royalty-free access to the EcoPC patents lead to more diffusion of the protected technologies and the generation of sequential

¹ The double externality is not specific to R&D directed toward environmental protection, but for example also affects R&D in the area of public health.

² We note in passing that in the case of environmental protection and climate change, formidable incomplete information problems and the global nature of needed policies make the simple "market failure" analysis and corresponding policy predictions not as useful as they might be in other areas. However, the question of the proper role of IP protection in the case of green technologies still remains.

³ For a review of the relevant literature see Hall and Helmets [10].

⁴ For IBM, see (<http://www.ibm.com/ibm/environment/initiatives>); for Xerox, see(<http://www.xerox.com/corporate-citizenship/2011/sustainability.html>); for Bosch, see (http://www.bosch.com/en/com/sustainability/sustainability_at_bosch.html).

⁵ In this case, firms could attempt to license out the patents. However, as reviewed by Arora and Gambardella [2], there are a number of important barriers to licensing out technology, in particular technology that requires further development and investment. For sellers it may be difficult to identify potential buyers and even when a potential buyer has been found, agreeing on a licensing contract for an invention may be difficult in light of technological and commercial uncertainty. Survey evidence on the licensing behavior of a sample of patenting European and Japanese firms supports the argument that identifying licensees constitutes the main barrier to licensing out ([32]). If these perceived costs of licensing out the pledged technologies exceed the expected benefits, firms may favor pledging a patent to the EcoPC over licensing it.

⁶ More precisely, the EcoPC website lists 121 patent numbers. These 121 patent numbers correspond to 90 equivalent groups containing 94 unique priorities, and the total number of equivalent patents is 238. Precise definitions of these concepts are given later in the paper. The firms that have contributed to date are Bosch, Dow, DuPont, Fuji-Xerox, IBM, Mannesmann, Nokia, Pitney Bowes, Ricoh, Sony, Taisei and Xerox. Note that the patent owned by Mannesmann was absorbed and pledged by Bosch, but we nevertheless treat Mannesmann as a separate entity in our analysis. The EcoPC announced on July 1 2010 that Hewlett Packard (HP) has joined the commons and on July 25 2011 Hitachi joined. Yet, we omit HP and Hitachi in our analysis as our core data predates their entry into the commons.

⁷ In fact, the 94 unique priorities accounted for by these patents are 0.02 percent of the priorities claimed by these firms between 1989 and 2005. The share ranges from 0.10 percent for Xerox to negligible for Ricoh, Sony, Nokia, and Fuji Xerox.

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