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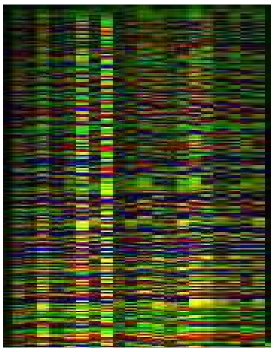
Sharing biotechnology with developing countries

Start document for the symposium 'Reconsidering Intellectual Property Policies (IPP) in public research'

Innovators often have to obtain scores of licenses before they can introduce their biotechnology product destined for poor farmers. The process costs a lot of time and money and does not guarantee success. In this way Intellectual Property Rights can block innovation in developing countries. The question for public research institutes is how they can prevent their intellectual property policy from hampering innovation in poor countries. The most promising strategies so far are 'humanitarian licenses' and 'open source biotechnology'.

By 1995, the Papaya Ringspot Virus (PRSV) had almost completely devastated the papaya industry in Hawaii. Thus there was an enormous need to introduce a disease-resistant papaya. The transgenic papaya developed by Cornell University in New York and Hawaii University had already shown excellent resistance in field trials, so the Papaya Administrative Committee (PAC) in Hawaii asked the American law firm Nixon Peabody to analyze the patent landscape, and negotiate licenses. At least ten licenses seemed to be needed, and the law firm encountered serious problems, but eventually the negotiations succeeded. Nixon Peabody and PAC were able to explain that the true beneficiaries were small papaya growers, and where sympathy for the growers was not sufficient, the United States Department of Agriculture (that created PAC) was helpful. As the USDA is an important regulatory agency, the licensors wanted to remain in the USDA's good books so as to avoid jeopardising approvals for their own projects. All license agreements were completed by April 1998 and distribution of transgenic papaya seeds started in May 1998.


'Genetic information'

Access becomes more difficult

This case, extensively described in the IP Handbook of Best Practices (www.iphandbook.org – free access), demonstrates how difficult it has become to introduce a 'small' crop developed using modern biotechnology. But in this 'best practice' at least, the negotiators succeeded. This was due to a number of factors: The Papaya Administrative Committee had enough money to pay a vested law firm, they received assistance from the influential USDA, and this papaya, developed in 1992, has fewer IPR's than more recently developed transgenic varieties. In many other cases -rarely described in the literature - the negotiators did not succeed, or didn't even start due to lack of money, legal expertise and time.

As biotechnology becomes more complex, the number of IPR's - and the risks of infringing them - increases. A cursory search of plant-related utility patents shows that patents filed under the United States Patent and Trademark Office (USPT) plant classification have increased steadily from 5 in 1981 to 777 in 2006. About 45 patents and 6 material transfer agreements alone are associated with the famous vitamin A enriched Golden Rice. These patents are owned by approximately 30 companies and public institutions. Another example is the International Vaccine Institute in Seoul, devoted to bringing vaccines to the poor. It makes use of at least six distinct technology fields for the plant-derived vaccines they produce: engineering of antigens, antigen production and accumulation in plants, genetic transformation of plants, selectable marker systems (for the identification of plant cells that have successfully taken up the DNA), transcription regulatory elements (to ensure that the introduced genes are expressed in plants), sub-cellular targeting systems and bioprocess engineering for extraction and processing. All these areas are protected by scores of patents, confidential information agreements, and material transfer agreements.

Access to IPR is not only a problem for transgenic crops. Conventional plant breeders are also increasingly making use of molecular technologies. Both these (enabling) technologies and the databases with (genomic) information are often protected.

Two problems for the creators of products

The increasingly complex patent landscape has led to two major problems for the creators of products for neglected markets. The first is the expensive process of analyzing the IPR landscape: which patents and other agreements do they need licenses for, and what are the chances of obtaining them? In many cases, searching for a biotechnology patent has become an inexplicably frustrating process. There is no streamlined, universal approach for searching for patents filed at the various patent offices. The three main repositories of English language filings – the European Patent Office (EPO), the US Patent and Trademark Office (USPTO) and the World Trade Intellectual Property Organisation's Patent Cooperation Treaty – offer databases with online search tools that all work differently, even displaying different results. To make it worse, each patent of interest must be downloaded and printed one page at a time – even though it may be 100 pages long, and although patents and patent applications are disclosed, license agreements are often not. As researchers from the University of Tennessee conclude in Nature Biotechnology of November 2007: 'Add to the mix defensive patenting, a complex classification system and a lack of information available on the license status of certain technologies, and it becomes difficult to know what privately developed technologies are available for use by researchers.'

An even more serious problem is obtaining all licenses free, or for a price that the innovator can afford. In the case of the Hawaiian papaya, Michael Goldman from Nixon Peabody describes the bottlenecks: 'All licensors were sympathetic to the need to introduce a transgenic, disease-resistant papaya in Hawaii', he writes. 'However, each had its own strategic interest, which needed to be protected.' Most public institutions did not, at that time, have an institutional policy of, or experience with, licensing out and were reluctant to proceed with setting a corporate-wide strategy based on a license for a very small crop. Some were concerned that the deal with the Papaya Administrative Committee would dictate the terms for future licenses on more important crops. In addition, when the licensors saw that large, well-known fruit packing companies were members of PAC, questions were usually raised as to who was being aided by the licensors. So PAC had to explain a lot about the papaya industry. What made the negotiations more difficult was that many of the individuals working on business development for the licensors were very busy, and did not have much time for such a small crop with its potentially small economic return.

Dilemma for public institutes

The universities and the National Agricultural Research Institutes are now confronted with a dilemma. Researchers – also in the South – have been increasingly stimulated to protect their knowledge. With a stricter patent policy, financers hope to recoup the investment in research, and stimulate private-public cooperation and 'valorisation'. For instance, the Netherlands Ministry of Education, Science and Culture wants to stimulate patents on universities with a new measure: researchers will receive a part of the return from their own patents for private use, in order to keep top quality scientists in the public sector. Also the private sector – increasingly collaborating with universities – tends to lean toward stronger Intellectual Property protection.

Potato market in Peru (Photo: R. Hoekstra)

However, public institutions also want to assist poor countries. The Wageningen University and Research Centre's 2007-2010 Strategic Plan states that they want to 'both strengthen international cooperation in the field of research and education, and take a more serious look at the possible international applications of existing knowledge.' So on the one side researchers have to protect their knowledge, and on the other they have to share their knowledge in support of development goals. This issue was recently put on the agenda by the Netherlands Minister of Development Cooperation, Bert Koenders, at the 'Knowledge on the Move Conference' in The Hague on 28 February. This ministry is a strong proponent of sharing knowledge. 'In relation to developing countries, access to knowledge is more important than possession of knowledge', Koenders stated. He would also *'urge Dutch universities and research institutes to adopt institutional IP policies that take account not only of valorisation of knowledge and incentives for researchers, but also the importance of access to knowledge and freedom to operate for development purposes.'* The EU is also paying attention to this problem. A workshop at the International Rice Research Institute (IRRI) this year – sponsored by the EU – will address the issue that 'formal intellectual property right protection may impede the transfer of advanced technologies from EU public research to developing countries'.

Adapting the patent policy

So there may be several reasons for public research institutes to reconsider their own intellectual property policy, but what can they do to prevent developmental goals from being hampered by this policy. In the United States, each of the top four public recipients of U.S. patents in 2004 states 'public benefit' as an explicit goal in its patent policy. For instance, the California Institute of Technology (135 patents) has formulated it thus: '(…) *If there are innovations or discoveries that result in the filing of patent applications and the acquisition of patents, the Institute intends to serve the public interest by prudent and appropriate efforts to transfer the technology to those who will facilitate public use.*' And the Massachusetts Institute of Technology (132 patents) writes: '(…) *It is in the context of public service that M.I.T. supports efforts directed toward bringing the fruits of M.I.T research to public use and benefit.'*

Such general policy statements are needed to adapt the usual Intellectual Property strategy in an institute, but they do not provide insight into the management of a specific project. When a Dutch public-private consortium starts breeding a Phytophthora resistant potato, or when an international consortium starts sequencing the banana, how can these consortiums formulate an IP strategy that doesn't hamper the development of crops for neglected markets? Out of the international debates in the past twenty years, two concrete strategies have emerged: Humanitarian Licences and Open Source Biotechnology. Neither option infringes current IPR law, have been practiced, and are being developed for biotechnology.

Humanitarian Licences

Genetic Research on cabbage in India
(Photo: W. Vroom)

Humanitarian Use Licences (HULs) have always been part of IPR law. Governments are even allowed to force HULs, when they think a specific patent blocks a public goal, but they seldom use this right. According to Wikipedia, Humanitarian Use Licences 'set the conditions for the provision of access to innovations for people in need on a royalty-free basis or at lower costs.'

Universities offer several examples of humanitarian IP management. In 1996, the Wageningen University has transferred a patent (on a molecular technology to modify cassava) to the Dutch company Avebe. However, the university has ensured that the cassava technology can be used royalty free for for food security goals and local use, but not for the world trade in starch. The Cornell University has transferred its ring-spot-virus-resistant papaya to Haiiti and Thailand. And the most cited example is Golden Rice. The inventors of the technology (University of Freiburg) licensed their invention related to golden rice to Greenovation, a biotech spinout company, owned by the inventors themselves. Greenovation then exclusively licensed its Golden-Rice-related patents to AstraZeneca (now Syngenta). However, in the licensing arrangements, a humanitarian-use clause was used to commit the inventors to donating their technology to the poor. The arrangement allows for the granting of licenses to any bona fide research organisation for the development of Golden Rice. The rice can be used royalty free and allows farmers to earn up to US $10,000 per year from its sale. Higher sales would require farmers to acquire a commercial license from Syngenta. Other companies holding Golden-Rice-related patents also agreed to the same arrangement.

Multinationals have already shown willingness to segment markets - they facilitate access to some of their technologies in poor countries. Examples include not only Golden Rice, but also the successful commercialisation of the transgenic, insect-resistant hybrid eggplant and the transgenic, disease-resistant groundnut in India. Both are orphan crops, developed with royalty-free licensed technology from Monsanto. In the case of the groundnut story, an agreement was penned for non-exclusive licensing of the so-called Coat Protein (CP) technology. The licenses are free of royalties and upfront payments to public institutions planning to develop the varietal groundnut, but they include upfront payments and royalties for companies planning to develop hybrid groundnut cultivars.

High transaction costs

Companies can win greater esteem from the public by accepting humanitarian licenses and, in some cases they also appear to use humanitarian licenses to open up a new market, for example by including specific obligations in the license. Hence humanitarian licenses may also be favorable for the donator. However, humanitarian licenses alone will probably not provide a solution for the long term, because of the high transaction cost involved with the need to arrange so many different licenses for an individual project. The market is already responding to this problem. Several initiatives aim at supporting technology transfer and lowering transaction costs for the creators of poor farmers biotechnology products. For example, the International Service for the Acquisition of Agri-biotech Applications (ISAAA) and, more recently, the African Agricultural Technology Foundation (AATF) have both been established to provide a broker role between technology users and providers. The ISAAA - financed by companies, foundations and governmental institutes - has brokered several transfers, including the transfer of local varieties of potato from Monsanto to Mexico, as well as the transfers of ring-spot virus resistant papaya from Monsanto and the delayed-ripening papaya from Syngenta - both in Southeast Asia. However, neither the goodwill of the multinationals, nor the mediation by such organizations can provide a structural solution. These broker organizations do indeed reduce the transaction costs for the creators of products aimed at poor farmers, but barely reduce the total transactions costs.

Indian farmer (Photo: W. Vroom)

Formats for humanitarian licenses

Transaction costs may be reduced by services designed to help steer clients to information and access to patented technology, some of which are for free. For instance, PatentMonkey (www.patentmonkey.com) offers free database searching, only charging fees for more extensive services. There are several non-profit organisations that specialise in helping underserved communities in the developing world. The Coalition for Patent Fairness (www.patentfairness.org) is an advocacy group working to reform innovation-stifling practices and address patent litigation issues.

Public institutes could lower transaction costs by accepting a format for humanitarian licenses that could serve as a standard in all cases. Consortia of research institutes could develop a clause in the consortium agreement that automatically grants a humanitarian license to all users of a certain category in a similar manner as the 'Golden Rice' contract. Such a clause has been developed by the participants of the Generation Challenge Programme, a programme of the Consultative Group on International Agricultural Research (CGIAR). The partners in this programme collectively work to use genomic techniques to increase the accessibility of genebank collections and to improve crop productivity in drought-prone environments.

Open source biotechnology

Another solution may be open databanks and pools of biotechnologies made freely available for humanitarian use. Databanks could list technologies, identify the owners and provide information on the specific licensing terms for each listed technology, including type of license, field of use and the intended beneficiaries for the use of the technology. One of the organisations working on this is the Public-Sector Intellectual Property Resource for Agriculture (PIPRA), based in the US. This organisation, funded by the Rockefeller and McKnight Foundations, identifies and develops approaches for encouraging technology managers to adopt humanitarian licensing models, and helps its members (through 40 institutes in the North and the South) access new agricultural technologies. PIPRA analyzes the members' IP policy (on request), gives IP management workshops and has recently released the 'IP Handbook of best cases'. The initiative also involves the development of a database to pool the IP assets (patents and licenses) of the participants.

PIPRA

(Logo taken from website)

The public plant biotechnology institute CAMBIA based in New Zealand (www.cambia.org) develops technology for its own open technology bank, named BIOS. The technology has been patented, but is free under the terms of the group's 'Biological Open Source Licence'. Anyone using the technology has to contribute the improvements they make to the core toolkit – a model similar to the general public license used in open-source software. The CAMBIA technology includes a version of the important GUS technology, called GUSPLUS, and Transbacter, which bypasses the established and heavily patented transformation process for transferring genes into plants.

CAMBIA

(Logo taken from website)

A second, more recent initiative (in an even newer branch of technology) is the open bank of the BioBricks Foundation (http://bbf.openwetware.org/). The BioBricks Foundation is a not-for-profit organization founded by 'synthetic biologists' from MIT, Harvard, and the University of California. This foundation encourages the 'development and responsible use of technologies based on BioBrick™ standard DNA parts that encode basic biological functions'. Everyone is invited to use the free DNA sequences, and to collaborate in building this bank. To stimulate participation, the foundation organizes an annual competition for student teams, called the International Genetically Engineered Machine competition (Igem). Each university team is obliged to put the DNA parts they have used for the Igem competition into the open source.

Are the public institutes really confronted with a dilemma?

Studying these initiatives, a second question may emerge: are the public institutes really confronted with a dilemma? The American Association for the Advancement of Science (AAAS) in the United States anticipates that at least some types of humanitarian IP strategies will have little or no impact on licensing revenues for the technology creator. As Amanda Brewster from the AAAS put forward in the IP Handbook, 'Whether that will be the case may depend on whether humanitarian licensing becomes commonly practiced and accepted.' The same will probably be true for collaborating with open databanks. When biomedical scientists Harold Varmus, Patrick Brown and Michael Eisen put forward their idea of high quality, free PLoS journals in 2000 many scientists were skeptical, but since the start in 2003, an increasing number of leading scientists have started to publish in a PLoS journal. Now, a publication in a PLoS journal has almost the same impact-factor for a research group as a publication in Science or Nature.

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