What is 'Genetic Technology'?

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Abstract. The use of the components of biodiversity (i.e. genetic resources), especially as it involves the sale of materials for product development purposes, is often presented as something new. That has been a common perception of the Merck/INBio agreement, which is frequently taken as a model. However the very newness of the situation suggests great uncertainty which in turn tends to deter participation by the majority of agents who are risk averse. Most prefer to await the emergence of a standard practice which reduces the opportunity to make errors.

The sale of genetic materials is proposed to be characterized in terms of transfer of 'genetic technology'. There is long experience with technology transfer, but the present process differs in two key aspects. (1) the trade will be predominately south–north and secondarily south–south as opposed to the long prevailing north–south technology trade, and (2) the products are natural which creates some technical and legal complexities. These differences, once overcome, will facilitate the exchange of genetic resources through the creation of a greater comfort level for sellers and buyers. The development of a technology flow mechanism based on 'genetic technology' necessitates that the technology is available openly and on uniform terms. Such a mechanism would be facilitated by considering biodiversity as genetic technology and this, in turn, would enhance an existing and ongoing process, the sustainable use of germplasm which provides an incentive for biodiversity conservation.

Key words. Biodiversity, genetic technology, prospecting, technology transfer.

GENETIC PROSPECTING AND BIODIVERSITY CONSERVATION

The Convention on Biological Diversity (the Convention hereafter) in its Objective statement (Article 1) refers to the 'sustainable use...and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.' While there are many potential benefits from the utilization of genetic resources, a key one from the perspective of germplasm-rich but materially-poor countries is their sale. For example, the sale of timber and fishery resources is, at its core, the utilization of genetic resources. What differs under the Convention is the emphasis on sustainability. Regrettably, what is a sustainable versus a non sustainable use is not always easily established nor agreed upon. It was in this context that the 1991 agreement between Merck & Co. Ltd, USA, and the National Biodiversity Institute (INBio) of Costa Rica for the collection of specimens and royalty payment for derived products received so much attention (Nature, 1992; Sittenfeld & Gámez, 1993).

Genetic prospecting for pharmaceutical and other products has thus become a focus of interest for germplasm-rich countries, particularly as an alternative source of revenues. Prospecting is often presented as something quite new, and while that is not strictly correct, the considerable interest is certainly recent. The Merck/INBio agreement remains the best known to date, but there are numerous other, less publicized examples (e.g. Laird, 1993; Nature, 1992; The New York Times, 1993). The excitement stemming from prospecting revenues is however having the unfortunate side effect of emphasizing the perceived newness of this opportunity. Newness implies uncertainty which attracts risk takers. Regrettably, people are generally risk averse. Overall, risk aversion is a learned if not an innate response to newness. This is an issue with biodiversity prospecting because the continued emphasis on

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newness will tend to discourage rather than encourage participation until a less risky standard practice emerges.

DEFINING ‘GENETIC TECHNOLOGY’

The purpose of this essay is to hasten the emergence of that standard practice for the transfer, sale, and sustainable use of genetic resources. In terms of the Convention it can be seen as contributing to a realization of the parity in technology trade implied by Articles 15, 16 and 19 and the ‘clearing-house mechanism’ referred to in Article 18. That is proposed to be done through the vehicle of describing genetic resources in the familiar terms of ‘technology transfer’ for a new form of technology, a ‘genetic technology’. Technology therefore can be defined as the geographical movement of productive capacity. That capacity may be in the form of a turnkey integrated steel mill or the means to construct and/or operate such plants. Genetic material too is a technology for it is the means to develop a range of new products; it is productive capacity in an unrefined form. But its sale is technology transfer with significant differences, the major being that the transfer is predominately south-north and secondarily south-south as opposed to the familiar north-south movement, and that the materials are natural products which creates some technical and institutional complexities.

Before the transfer of genetic technology can be made routine, the consequences of these differences must be identified and a procedure established for testing/practising transfer mechanisms. In general, technology transfer can be described in terms of demand and supply issues. Demand factors are most thoroughly detailed, at least in the agricultural literature. From there we know that technology demand is principally related to profitability, the characteristics of the products, technology training, financing and risk shifting. These factors principally refer to private efforts in technology marketing, but governments have a role here as well. The major governmental factors affecting technology demand are product prices, extension, and financing/risk shifting.

To identify the factors affecting the supply of technology, we must distinguish between three forms of technology: material, design and capacity. Material transfer is the movement of the product itself, design the transfer of the capacity to make the product. Capacity transfer refers to the location of research and development, the effort to identify new and improved products and techniques. These forms can also be visualized temporally with a country progressing in sophistication from a user of materials to a research and development centre. In general, there are five factors that affect technology supply, namely expected profits, costs, protection from copying and regulations. Government policy directly affects most of these factors, especially regulatory requirements, but extends to the general business environment, which incorporates intellectual property legislation.

The Convention in Articles 15 and 16 refers to a reverse, south to north flow of biotechnologies which has been interpreted to suggest some ‘implicit bargain’ linking biotechnology with genetic resources (UNEP, 1993). The literature on trading identifies three ways in which such two way flows of goods are handled. These are barter, switch and countertrading. Combined they are estimated to account for up to 10% of world trade by value.

The technologies under consideration—genetic material—are natural products often derived from the wild. While not living organisms in the sense of ability for self regeneration, they are derived from living organisms and with share in many of the special issues which arise in regards to that form of matter. Broad issues relate to varying perspectives of the morality of direct involvement with nature. While those concerns are principally focused on changing living organisms, and especially animals, through the insertion of ‘foreign’ germplasm, the use of genetic materials will be implicated as well. The use of natural products also raises the matter of ownership and the equitable payment of intellectual contributions of the identification of useful products. Principal here is the knowledge of indigenous peoples, but it is not limited to that. Even the ownership factor, declared definitively in the Convention (Article 3 and 15) to be the sovereign right of the government where material is found, must be resolved over time as public/private and transnational issues are adjudicated.

Genetic material once removed from the host does not share all of these technical problems. However, once isolated the maintenance of identity and ownership records becomes complex indeed. This applies especially to analogues and other derivative molecules which were inspired by but not directly related to the natural material.

IMPLICATIONS

Most of the demand factors identified above do not
apply to south-north transfers involving major firms such as Merck & Co. Ltd. Merck is fully competent financially and technically to accommodate the transfers. Indeed, technical training will at least early on be supplied by the buyer rather than to the buyer. However, financial risk is always an issue for private firms, and sellers can reduce risk by emphasizing royalty rather than initial collection fees (see Lesser & Kratiger, 1994). Most of this transfer will be done based on licenses/contracts. However, due to the attributes of the technology, it will not be feasible to incorporate in the contract provisions for tracing all the material and hence substantiating all royalty claims. Such an attempt would be too intrusive and costly as to be unattractive. Thus considerable trust between the parties is essential. Lacking that, an agreement should probably not proceed.

Transferring technology to smaller firms in the north will require a more substantial effort. Greater resources must be put into identifying the buyers and tailoring products to their more particular needs. More specific to the topics discussed here, sellers will be expected to invest more in research and development, and be more knowledgeable about their products. Information is another means of reducing risk. Contracts may not suffice under these circumstances and modified forms of patent law (a governmental responsibility) may be required (see Lesser 1994). But patent law terms in themselves will likely be inadequate so that contracts also need to be developed. The practice of combining patents with contracts is a common one.

Once the buyers are no longer exclusively the major pharmaceutical corporations of this world, their identification becomes more challenging. the Convention (Article 18) makes reference to a 'clearing-house' mechanism for facilitating cooperation. A clearing-house is needed as well as the identification of sellers and buyers, the most basic function of a broker. Such a broker, or facilitator, for 'genetic technology' has recently been proposed (Lesser & Kratiger, 1994) and this mechanism is based on the experience of a recently created broker for biotechnology applications (see Kratiger & James, 1994). Additionally, participants will require information on exchange terms so that sellers are assured of equitable terms and buyers that they are not taking on expenses which will render them uncompetitive. Such an exchange of general (that is to say not associated with any specific transactions) price information is a common role for a trade association. In this case a not-for-profit entity must take on the task initially while the industry develops. Moreover, contract terms are more complex than simple prices so that information on other terms of trade components like training, must be provided as well, the details of which need to be worked out.

South-south transfers in this context can be described as an extension of the needs of transfer to small firms. Southern buyers on average will require yet more support in terms of training, financing and risk shifting. Responsibility for satisfying many of those needs will fall to the governments of both the buying and selling countries. These needs preclude subsidiary arrangements as does the lower profit potential of many of these 'genetic' based products individually. Governments of supplying countries must be prepared to provide some financing directly or as risk-reducing credit guarantees. To the extent the supplying agency is a public sector entity it is one and the same. Governments as representatives of technology sellers should consider enhancing patent protection. For example, India has no patent protection for pharmaceuticals and a substantial generic (or as it is referred to by some, pirate) drug industry. Movement into developing proprietary drugs, which many believe is possible for Indian firms, will require a degree of patent protection; it is as easy to copy Indian drugs as any. Other issues of protection needs will arise with increases in technology exportation.

Requirements for recipient country governments will be greater. They must establish the necessary conditions for allowing imports. Depending on the type of product, this will involve biosafety regulations, technical training, and above all reconsidering regulations within the scope of the new technology transfer.

**EXPECTED BENEFITS OF THE RE-DEFINITION**

Considering the 'useable' components of biodiversity as 'genetic technology' enhances and facilitates an existing and ongoing process, the sustainable commercialization of genetic resources, particularly for chemical prospectivity. By hastening the practice of exchanging this material, humankind will benefit from earlier access to new products, including medicines. Germplasm providers will receive funds for what was previously given free of charge, which indirectly provides an incentive for biodiversity preservation. Germplasm buyers are allowed access to materials on a systematic and uniform basis, which will facilitate the development of the new genetic technologies.
The development of a technology flow mechanism based on genetic technology necessitates that the technology is available openly and on uniform terms. There are short term profits to be made from special deals, but the real benefits for conservation will come from the increased use of genetic technology. It is really to the facilitation of that sustainable use that the re-definition is directed.

REFERENCES


