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UNCTAD-ICTSD Dialogue on *Moving the pro-development IP agenda forward: Preserving Public Goods in health, education and learning*
Bellagio, 29 November – 3 December 2004

Public goods and the public domain: the access to knowledge in developing countries, and innovation in health, education and science[#]

DRAFT

Abstract

Information and knowledge may be viewed as public goods when non-rivalry applies to their use (the use by one agent does not deplete what remains available for others) and it is highly costly to exclude others from its use. As a corollary, a piece of knowledge or a set of information may be viewed as global public goods when non-rivalry and non-excludability apply to them on a global scale.

In contrast, the public domain is to be analyzed as one particular institutional setting or arrangement. Information is not in the public domain by its public good nature, or by its Governmental origin, but as the result of a network of formal and informal social agreements, explicit or implicit, but in any case entrenched in common law and in the culture of a society. There is a tradition ascribing most information and knowledge obtained in government-funded science to the public domain, with the important exception of classified research for purposes of national security or economic competitive strategy. Nonetheless, the public domain for information and knowledge could be wider than that. It could include information and knowledge produced by international agencies and information "contractually designated as unprotected", just as a legal definition may state. Intellectual property protection schemes like patent law grant commercial monopolies in exchange for a contribution to the public domain of knowledge. The same cannot be said of trade secret protection, like that recently granted to clinical research data.

Scientific knowledge is close to the ideal of a pure public good, but health and education goods generally combine private and public "components". As these sectors evolve, the knowledge component is combined with rival manufactured products, as a means of ensuring at least partial exclusion in the market. This is the result of research, education and health being activities where market institutions, usually fit for private goods, have for a long time coexisted with non-market institutional arrangements, ensuring incentives for knowledge creation and innovation, where the market fails to provide them.

A proposal for global institutional reform is advanced, stemming from the distinction between global public goods and global public domain. Health problems of the developing world which are not the concern of markets and companies in developed countries could be better confronted under the proposed scheme.

[#] Preliminary version. Please do not quote.

Public goods and the public domain: the access to knowledge in developing countries, and innovation in health, education and science

The general proposition that the market fails in the provision of public goods has resisted myriad attacks in the past half century. First formalized by Paul Samuelson in 1954,[1] this proposition led to the conclusion that, while private goods may efficiently be provided by competitive markets, public goods ought to find alternative provision mechanisms. As Samuelson expressed it, "… no decentralized pricing system can serve to determine optimally these levels of collective consumption" (p. 388). The result implies that, when left to the market, public goods are generally not produced, or produced at levels lower than optimal[2]. Despite the solid structure of this result, which assails the virtues of the market as an optimal institution for the provision of goods when some of these are public, the concept of "pure" public goods on which it rests raises many problems. Still, while few public goods and services in the real world may qualify as "pure public goods", goods such as information, knowledge and scientific research are not too distant from this polar case, and considerably differ from private goods, those for which competitive markets may be efficient.

The political-economy issue at stake is not trivial. If the market fails for goods which are not pure private goods, what are the alternative institutions ensuring optimal levels of pure and "mixed" public goods? (This issue is particularly complex in a globalizing world). Should public goods be provided for free to all those using them? How should they be financed, and what governance structures should be in charge of their production and provision? Are competitive markets (or State provision) sufficiently good second-best solutions for "mixed" goods? What if, besides this market failure, markets providing mixed and pure public goods are not competitive, like it may be the case of many health products and services, educational services, and research?

The case of mixed goods has long ago been dealt with, by considering them as products or services jointly providing a pure private and a pure public good or service, in fixed proportions. The conclusions with respect to market failure remain valid. The problem is certainly more complex than that treated by Samuelson, but the general conclusion that the market has strong limitations to optimally assign public goods remains valid.

An evolutionary approach to the public-private frontier

The formalistic approach leading to a categorical distinction between public and private goods has led many practitioners of political economy to the simplistic rule of assigning private or similar goods to the market, and public or almost public goods to the State. Tautologically, some literature has even identified the concept of public goods with those being provided by the State, confusing the nature of the goods with the institutions set for their provision. In contrast, many authors, following Musgrave (1969)[3] have analytically defined public goods as a polar case for which there is no rivalry in consumption and no possibility of excluding certain consumers.

[1] Paul Samuelson (1954). "The pure theory of public expenditure", *The Review of Economics and Statistics*, 36-4, 387-389.
[2] Many have attempted to prove that over-provision of public goods could also occur. It has been shown that this is true only for a certain and rare class of public goods, not in general.
[3] Musgrave (1958), Public Finance.

Private goods are those whose consumption can be parceled among consumers, and exclusion is viable, allowing market mechanisms to operate. From this perspective, "intermediate" or "mixed" goods are those for which exclusion is costly but not infinitely costly, or where some congestion applies, in the sense that the available amount, level or quality of the public good varies with the number of consumers (Forero, 1976, p.25).

Actually, a historical observation of innovations in the production and provision of public or mixed goods shows that societies evolve in different manners towards systems of provision of services, making them more public or more private, depending upon the economic, social and political context.

Transportation is a good illustration of this evolutionary conception of public goods. In certain cities and countries, transportation is a complex service system where the most important components are shared by citizens, while in other countries, urban transportation has evolved towards a mix of products and services which leans more towards private solutions of the transportation problem. In the former, transportation has evolved towards complex systems involving subway and bus networks; it is usually called "public transportation", appears closer to the non-rival type of consumption, and exclusion is more costly and difficult. Public transportation in these cities may coexist with automobile transportation, but a large majority of the population resorts to public transportation. In the latter, transportation has evolved towards a system centered on individual means (the automobile); while it still needs public streets and roads, the mix of investments in different goods used by the transportation system tends towards the private-good side.

While perhaps less visible, the same is true in such social systems as health, education and research. Each of them combines a large number of private and public goods and services, in proportions that vary from country to country or from region to region. Those combinations jointly provide the complex goods that we call health, education or new knowledge. Economic and political reasons have operated through time and have accumulated, to yield each particular national combination.

This paper concentrates on a specific type of public-good system: that leading to the production, dissemination and use of knowledge and information. The focus is on comparing the impact of market and alternative institutions, regulating the exchange and use of knowledge and information used in scientific research, health and the diffusion of knowledge through education in developing countries. In the past two or three decades, a shrinking of the public domain of scientific knowledge and a continuous process of appropriation of rights over this knowledge has taken place[4], and it is interesting to find out how these institutional changes may affect science, health and education in developing countries.

Public goods and the public domain

Information and knowledge in general (and particularly in science, health and education) may be viewed as public goods since non-rivalry and costly exclusion generally apply to their use. Non-

[4] David, P. A., 2000, "A tragedy of the public knowledge "commons"?: global science, intellectual property and the digital technology boomerang", Electronic Journal of Intellectual Property Rights, OIPRC, Oxford, September.

rivalry means that the use by one agent does not deplete what remains available for others. Costly exclusion means that the possessor of such knowledge has to incur costs if she wants to exclude others from their use.

As a society progresses, it makes technological and institutional choices that determine the combination of private and public goods and services in the provision of scientific knowledge, health and education. The private appropriation of knowledge is secured through the patent system, copyright, trade secret protection and a variety of sui-generis intellectual property protection schemes. The protection of these property rights and the costs of enforcement may themselves be charged to individuals or be socially enforced, also in varying combinations and degrees: different institutional frameworks distribute the costs of prosecuting violators among the owner of intellectual property, the State and the supposed violator in different proportions, historically determined.

In all countries, room has been left for certain knowledge to be collectively owned and freely used. This stock of knowledge is usually referred to as the public domain or the commons of knowledge. Besides the large stock of common traditional knowledge, the public domain of knowledge includes patented knowledge that has expired, scientific knowledge (principles and discoveries included), and knowledge that the law prohibits to appropriate. The intellectual property systems of all countries expressly prevent different types of knowledge from being appropriated through the patent system, copyright and other protection schemes, leaving this knowledge in the public domain, where any user may find and use it, without paying for it.

The public domain does not cover all non-rival or public goods. Non-rivalry and costly exclusion applies to practically all knowledge, but the appropriation of part of this knowledge is allowed by the institutions of all countries. Notwithstanding, there are limitations to the property rights granted through patents and copyright. A general principle of the patent system is that the idea has to be published, and only its commercial exploitation is granted as a monopoly to the applicant. The applicant is granted the monopoly in exchange for publishing the knowledge, which may then be used for the production of new ideas. In the case of copyright, limitations also apply, like the fair-use exception for educational purposes.

Not all public goods are in the public domain. A tradition of Western states ascribes most information and knowledge obtained in government-funded science to the public domain, with the important exception of classified research for purposes of national security or economic competitive strategy. But the frontier of the public domain of knowledge is shifting and, as a consequence, the public domain has become narrower. Industrialized countries traditionally had very large public domains for knowledge, since all research being financed by their governments went directly into the public domain. By its nature, this research was a public good (as non-rival and costly to exclude), and was also in the public domain. However, with the recent appearance of laws allowing the private appropriation of publicly funded research (namely, the Bayh Dole Act in the United States and similar laws in certain European countries), research being financed by the State became appropriable by individuals and firms. The knowledge produced under this particular legal scheme still has the potential to be used by many, and remains a public good, but it is not anymore in the public domain, and therefore its use by third parties is prohibited.

The public domain is to be analyzed as one particular institutional setting or arrangement. Information and knowledge are not in the public domain by their public good nature, or by the Governmental origin of its financing. Rather, being or not in the public domain is the result of a

network of formal and informal social agreements, explicit or implicit, but in any case entrenched in the law and sometimes in the culture of a society.

The shrinking public domain of scientific knowledge

Related to the rapid changes in information and telecommunications technologies, a qualitative transformation of science and technology practices has occurred in the past 20 years. Research groups are now intertwined through national and international collaboration networks often involving academic, state and private organizations. Universities are interested in patenting the results of their research, and scientists are sometimes encouraged by their employers to undertake initiatives leading to the creation of private firms, based on the knowledge created in scientific projects.

Parallel to these transformations, stronger intellectual property rights have been developed by many industrialized countries in the past two decades, reducing the public domain for knowledge in general and especially for scientific knowledge[5]. Intellectual property protection has moved to cover scientific discoveries. Legislations which prohibited granting IP protection to living organisms were dropped. Intellectual property rights, formerly restricted to privately funded research and development, today protects publicly funded scientific and technological results. Services and financial and administrative methods, and the information about scientific information are also covered in the patent laws of some countries. The rising real cost of scientific journals and databases has also contributed to restrict the access to scientific knowledge.

Shifts from publishing towards patenting research results, as well as from patenting to protecting under trade secret have been observed. These trends have also extended from industrialized to developing countries, where it now covers products which were not traditionally patented by these countries, such as pharmaceuticals and medical devices.

As a result of these parallel evolutions, the distinction between the public and the private domain of knowledge has blurred. Innovation networks often involve scientists in public or university laboratories, private market-oriented research firms and industries taking knowledge-intensive products to the market. The rules of scientific communities, especially those concerning the diffusion or appropriation of knowledge, are slowly moving in the same direction. Some Governments have approved laws facilitating the private appropriation of knowledge, previously considered in the public domain. The Bayh Dole Act in the United States, and similar laws in European countries[6], have authorized Universities to patent and transfer the property over knowledge that has been developed with government funds, in contrast with previous legal mandates ascribing this knowledge to the public domain.

The impact of these shifts on scientific activities in developing countries is strong. The access to scientific knowledge is more limited, as a result of the rising cost of scientific journals and intellectual property rights being exercised over databases used as inputs of research. Also,

[5] For further details on these trends, see Forero C. "The Impact of Stronger Intellectual Property Rights on Science and Technology in Developing Countries", working paper, Universidad de los Andes, 2004.
[6] Forero C. "The Impact of Stronger Intellectual Property Rights on Science and Technology in Developing Countries", working paper, Universidad de los Andes, 2004.

precautionary measures now taken in scientific laboratories, to prevent leaks of information related to market-oriented research, are making international collaboration increasingly difficult[7]. The shrinking public domain of science worldwide is thus affecting directly scientific research in developing countries.

The public domain and health

Health and education goods generally combine private and public "components". As these sectors evolve, the knowledge component of health and education products, which is close to the pure public good case, is combined with rival manufactured products, as a means of ensuring at least partial exclusion in the market. This occurs because research, education and health are activities where market institutions have for a long time coexisted with non-market institutional arrangements that ensure some incentives for knowledge creation and innovation where the market fails to provide them.

Intellectual property protection schemes, such as patent laws, grant commercial monopolies in exchange for a contribution to the public domain of knowledge. During the nineteen sixties, many developing countries and some industrialized countries refused to patent pharmaceutical products. In the past thirty years, this situation has progressively evolved towards the recognition of patents for pharmaceutical products in all countries signing the Trade Related Intellectual Property Agreements (Trips), a condition to enter the World Trade Organization. This has shifted the balance, affecting local pharmaceutical industries of developing countries but favoring and giving more incentives to research and development in the pharmaceutical sector, which highly concentrated in industrialized countries. The consequences of this shift on the health of populations residing in developing countries has been the object of much debate[8], and partial agreements between the World Health Organization and the Word Trade Organization.

Actually, the most important impact of TRIPs on developing countries has taken place in pharmaceutics[9]. Following India's legislation of 1970, many developing countries either refused patenting pharmaceutical products or patented processes instead of products in this sector. At the time of the GATT Uruguay round, almost 50 developing countries did not grant pharmaceutical patents[10]. The approval of TRIPs has reversed this tendency and changes have occurred in most developing countries. Member countries of the WTO are required to grant both product and process patents in the pharmaceutical sector.[11] These changes are still debated in several countries, and less-advanced countries have until 2005 to implement intellectual property

[7] Forero C. "Scientific Research, Information Flows and the Impact of Database Protection on Developing Countries", en Julie Esanu and Paul Uhlir (eds.), *Open Access and the Public Domain in Digital Data and Information for Science*, chapter 9, National Academy of Sciences, June 2004.
[8] See for example Jeffrey Sachs (1999). "Helping the world's poorest." *The Economist*, August 14, and Jillian Clare Cohen and Patricia Illingworth (2003). Pharmaceutical Patents and International Commitments: The Inherent Tensions and Implications for Public Health. *Paper Prepared for the Canadian Political Science Association Meeting*.
[9] The rest of this section is based on Forero (2004) op. cit.
[10] Lanjouw, J., 1998, "The introduction of pharmaceutical product patents in India: "heartless exploitation of the poor and suffering"", National Bureau of Economic Research, NBER Working Paper Series # 6366, Cambridge.
[11] Correa (1996). Correa, C., 1996, "Uruguay Round and Drugs", WHO Task Force on Health Economics / Action Program on Essential Drugs (Geneva).

protection laws for the pharmaceutical sector. The advantages and disadvantages of granting patents for pharmaceuticals, from the point of view of consumers, are well analyzed by Lanjouw (1998) in a study about India.

One can go one step further in some aspects of the debate. In those countries where change has operated following the TRIPs agreement, granting trade-secret protection parallel to patent protection is the issue at stake. Trade secret would not cover the product, since the patent is granted in exchange for revelation of knowledge. Instead, trade secret protection would cover the clinical research that is deemed necessary to obtain the approval of sanitary authorities before marketing the product.

The debate over the convenience of granting this parallel protection is equally complex. The analysis in terms of constructing a balance between incentives and diffusion has to take into account additional considerations. First, there is a lag between the sale of the product in developed countries and in developing countries. For this reason, multinational companies are usually asking for secret protection of five years instead of ten years, as they usually expect the protection to be in developed countries. Second, keeping under secrecy clinical studies and not permitting their use for further research implies an additional, important cost to society. Pharmaceutical companies from developed countries fear the proliferation of small laboratories in developing countries dedicated to the production of no-patent and post-patent generics. If one takes into account that these small laboratories produce drugs for illnesses endemic to inter-tropical regions, and that there are economies of scope when these two lines of production are combined, there might be negative effects on public health in the developing country.

But from the point of view of the advancement of knowledge, the protection of this data is definitely negative. The main input for research is research previously done. If this data were public, not only the expensive repetition of clinical research would be avoided, but further knowledge could be constructed on the basis of this research. As shown elsewhere, a strong protection of trade secret, opposite to what happens within the patent system, restricts the stock of knowledge available for further research[12]

Public goods and the public domain: is international reform viable?

Equity pricing, making differences in the price of drugs in industrialized and developing countries has been advanced as a proposal for reform[13]. An alternative solution would envisage differential intellectual property protection. An implication of Deardorff (1992)[14] is that differential IPR protection, and the ensuing development of local manufacturing and R&D sectors, fosters (imperfect) competition among brand-differentiated products that will set the equilibrium price (in this case of drugs) to levels lower than those set by a discriminating monopoly. Besides, differential IPR protection would diminish the impact of the global strengthening of property rights on the international division of labor and, as shown below, on publicly funded research in developing countries.

[12] Forero, C. "Secret of the trade and endogenous exclusion". Conference of the International Society for New Institutional Economics, Paris, September 1998. http://isnie.org/ISNIE98/Program98.htm
[13] See Cohen and Illingworth (2003).
[14] Deardorff, A., 1992, "Welfare effects of global patent protection", Economica 59, 35-51.

But the distinction between the nature of health research as a public good and the public domain, together with the observation that the market fails as an institution in the provision of a public good, suggests still another approach to the problem. Recent debates about the price of pharmaceuticals and about the role of MNCs in research, development and testing of new medications seem to be putting too much of a burden on market mechanisms to solve certain health problems. Private firms often impute the deceleration of world investments in HIV/AIDS research to insufficient IPR incentives granted by many governments in the world. On the other hand, developing-country governments, international organizations and NGO's are critical of the excessive profits that companies seek. Beyond the conflict of interests, the dispute may be a sign that market mechanisms, such as IPR, are reaching their limits. Perhaps the conflict between health in the tropics and the incentives necessary to elicit research might not find a complete solution within the borders of market incentives and intellectual property rights protection. Alternative solutions, where international scientific cooperation plays a leading role should perhaps be envisaged following the experience of other global research networks[15].

[15] One example of international collaboration for research related to developing countries is presented in CGIAR – Consultative Group in International Agricultural Research (2001). What is CGIAR? http://www.cgiar.org/whatis.htm 26/04/2001.