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Business Society 2010 49: 570 originally published online 11 March 2010
DOI: 10.1177/0007650309360705

>> Version of Record - Nov 21, 2010

OnlineFirst Version of Record - Mar 11, 2010

What is This?

Business & Society
49(4) 570–590

DOI: 10.1177/0007650309360705
http://bas.sagepub.com

Technological Choices in International Environmental Negotiations: An Actor–Network Analysis

Amandine J. Bled[1]

Abstract

This article applies the main findings of actor–network theory to the outcomes of international environmental negotiations on technological issues. Taking the Convention on Biodiversity (CBD) as a case study, and more precisely its developments on biotechnology and bioprospecting applications, the research identifies three successive stages in the negotiation of technological issues under the biodiversity treaty: (i) their emergence on the agenda of the CBD, (ii) the development of two sociotechnical networks in favor of biotechnology and bioprospecting applications, and (iii) the failure of these networks to influence the international agreement. These successive stages are the result of the mobilization of diverse actor networks, arising from the intersection of technological findings on the one hand and the interests of particular businesses, governments, and environmental NGOs with regard to these technological applications on the other hand. Closer scrutiny of these actor networks reveals that coherence between actors' intentions and actions is a key element for their successful influence on international negotiations.

Keywords

actor–network theory, technological issues, biotechnology, bioprospecting, intentions/actions

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At the beginning of the 1990s, the environment was considered a topic destined to remain at the "periphery" of political science and international relations in particular (Smith, 1993). However, there has been a proliferation of studies around environmental politics recently, and several environmental treaties are now as well known as international commercial or armament regimes. Among these environmental treaties, the Convention on Climate Change is one of the most renowned. Furthermore, the Convention on Biological Diversity (CBD), adopted as the climate convention at the Rio Summit in 1992, has proved to be a very dynamic regime:

> Conceived initially as a means of putting some order into disparate agreements regarding the protection of wildlife, the CBD quickly moved beyond this narrow concern. It addresses issues that range from ecosystems to the exploitation of genetic resources, from conservation to justice, from commerce to responsibilities. It is, therefore, criss-crossed by widely differing political dynamics. Indeed, its three goals of conservation, sustainable use and benefit-sharing make it perhaps the first true sustainable development convention. (Le Prestre, 2002, p. 1)

The development of strong environmental regimes raises the question of the basis for such success. This question is at the core of the analysis conducted in this article. In particular, the study looks at the way environmental treaties have progressively established strong regulations on technological issues that are at the center of our everyday life. The article scrutinizes the CBD specifically, as a case study to demonstrate that the way the actors involved in the negotiations have articulated their interests in real-world experiences—by putting in place broad actor networks—is key to understanding their ability to influence the negotiations. The study relies on an extensive literature review as well as CBD documentation and fieldwork observations during several working groups of the CBD, including the third Conference of the Parties to the Cartagena Protocol and interviews with key actors of the negotiation and implementation processes as well as archival material. Unlike other previous studies, this analysis places the emphasis on concrete results as critical to discourses for successful international lobbying.

The article is structured as follows: first, the analysis stresses the way the biodiversity treaty progressively considered technological issues, questioning former international choices on technology management. Second, the conceptual context of international environmental negotiations studies is explored to anchor the research question in a theoretical framework. This section reveals how social network approaches have been predominant in the study of environmental negotiations. However, as this research will demonstrate, actor–network theory provides a more suitable framework for analyzing technological developments in environmental negotiations. In particular, actor–network theory proposes that agency is significant in connecting real-world experiences rather than simply focusing on “intention” as the only significant factor leading to outcomes. Third, to test this conceptualization, the article focuses on the case of biotechnology and bioprospecting policies under the CBD. The empirical analysis illustrates the relevance of actor–network theory by placing agency as expressed through action and real-world experiences as an alternative to prioritizing intentions as central to successful influence.

Regulating Technological Innovations: Biotechnology and Bioprospecting Applications Under the CBD

The CBD has been, since its adoption in 1992 at the Rio Summit, one of the most dynamic regimes in the environmental field. Conceived initially as an international treaty to preserve the world’s natural heritage, the CBD currently addresses, as mentioned earlier, a broad range of issues. To address all these diverse topics, the convention evolved into two related international agreements.

In 2001, the parties to the convention adopted the Cartagena Protocol on Biosafety (henceforth, the Cartagena Protocol) to regulate the transboundary movements of genetically modified organisms (GMOs) obtained from biotechnology manipulations.[1] The Cartagena Protocol secures the international trade in modified seeds by establishing a precautionary principle as the basis for imports and national regulations. Its procedure recognizes that GMOs may have adverse effects on the conservation and sustainable use of biological diversity and reverses the burden of risk assessment to the exporting country. The Cartagena Protocol has served as the basis for the elaboration of several national legislations on biotechnology applications in countries such as Mexico, China, or South Africa (Gupta & Falkner, 2006). It is interesting that the Cartagena Protocol challenges the former principles of substantial equivalence, sound science assessment, and free trade that the World Trade Organization (WTO) planned to apply to biotechnology applications (Andrée, 2005). The developments of the Cartagena Protocol have had significant consequences for biotechnology companies, grain traders, and food retailers worldwide (Andrée, 2005; Falkner, 2008).

In 2002, the parties to the CBD adopted some international guidelines to regulate the access to natural genetic resources through bioprospecting activities.[2] The guidelines recognize the sovereignty of nation-states over their natural resources and are directed at balancing the conditions of access to biological diversity against the profits made from genetic resources and byproducts. The guidelines consequently put an end to the former "common heritage principle" that, before 1992, stated that genetic resources were free to access for any users (Raustiala & Victor, 2004). Moreover, current CBD negotiations concentrate on the establishment of an international binding regime to replace the guidelines by 2010. The regime proposes the use of an international certificate to identify the genetic resources used in intellectual property rights' (IPR) applications. The principles of the CBD regarding the access to genetic resources and benefit sharing have served as a basis for the development of national legislations in Costa-Rica, India, and Brazil (Miller, 2006). Brazil and India also established national legislations on access to biodiversity, requiring the disclosure of the origin of genetic resources in patents' applications. The positions adopted by these countries are aimed at changing the international rules linked to bioprospecting practices. Together with Norway, Brazil and India are joined by a coalition of developing countries seeking an amendment of the agreement on trade-related aspects of IPR in favor of patents' disclosure (WTO, 2004, 2006). The European Union, Norway, and Switzerland have asked the World Intellectual Property Organization (WIPO) to analyze the potential for the international harmonization of genetic resources disclosure requirements (International Patent Cooperation Union, 2007; WIPO, 2005, 2006).

These developments, together with their impact on trade and IPR issues, increase the visibility of the CBD at the international level of policy making (Rosendal, 2006), raising the question of the basis for such success. This article focuses on understanding the precise mechanisms that account for the outcomes in environmental regimes' negotiated decisions relating to technological choices. The next section sets out the theoretical basis for such an analysis.

Studying Global Environmental Negotiations

The Precedence of Social Network Analysis

Global environmental governance is known for the complexity of its processes, architecture, and implementation (Saunier & Meganck, 2007). The broad range of scientific, political, and technical domains covered by environmental issues mobilizes an important diversity of actors: scientists, environmental nongovernmental organizations (ENGOs), states, and firms.

The role played by these different actors in international policy making is at the core of global governance studies in general (Arts, Noortmann, & Reinalda, 2001; Josselin & Wallace, 2001) and environmental studies in particular. Postulating the necessity of cooperation for the production of common public goods, global environmental governance was initially explained by the cognitivist approach to transnational politics that gave special importance to the role of either knowledge disseminated by scientific networks (Haas, 1992) or of ENGOs in environmental agreements (Keck & Sikkink, 1998; Princen & Finger, 1994). The recent literature has broadened this initial focus on science and ENGOs to consider the influence of corporations on international policy making (Braithwaite & Drahos, 2000; Dahan, Doh, & Guay, 2006; Rowlands, 2001).

Social networks are at the center of such studies, being embodied by ENGOs and business groups (Sell & Prakash, 2004) or broader advocacy coalitions (Sabatier, 1988). For these studies, the success of social networks in influencing political decisions depends on the capacities of norm entrepreneurs to mobilize material and discursive and organizational resources (Levy & Scully, 2007). Not only do actors shape international decisions but some of their strategic choices are also shaped by social interactions. Stakeholder theory that usually describes the dyadic interactions at stake in the formulation of corporate strategies (Frooman, 1999) has been extended to the study of the social networks in which firms do evolve (Rowley, 1997).

However, social network approaches encounter two different types of limits when confronted with the issue of decision making related to technological applications in international environmental negotiations. First, though these approaches focus on actor's discourses and interests, they fail to integrate the issue of the implementation of technological choices that is linked to the practical performance of technological applications. This is the case, despite the fact that implementation is crucial to assessing the adequacy of technological developments. In environmental negotiations, the real-world experiences of actors are crucial to understanding their overall influence. As such, the recommendations of multilateral environmental agreements concerning technological applications do not only depend on interactions between a broad range of governmental and nonstate actors; they are also linked to the concrete impact that technological applications have on the environment.

Second, social networks' analysis fails to envisage the possible alliances between different categories of nonstate actors in their efforts to advocate their positions on technological issues. In particular, many studies tend to create a significant barrier between proenvironmental actors and corporations, viewing environmental politics as the result of a permanent battle between pro- and anti-environmentalists. However, the analytical distinction between the interests and strategies of actors involved in “doing well” (making profit) and “doing good” (defending causes) is not so easily discernable in international politics (Sell & Prakash, 2004). For instance, several business actors may engage in environmental regulations to secure their market or to obtain a competitive advantage (Rowlands, 2001). Even if corporations do have primary control of technological applications, they need further support from other categories of actors. In that sense, business-lobbying activities are mainly directed toward alliance building with other actors.

Considering these two limits of social network approaches, this article proposes to adopt one particular framework concerned both with the practical consequences of technological applications and the issue of alliance building in international environmental negotiations: actor–network theory.

An Alternative to Social Network Approaches: Actor–Network Theory

Actor–network theory was developed in the writings of Michel Callon, Bruno Latour, and John Law in the 1980s. The framework they proposed aimed to highlight the inadequacy of “heroic” accounts of technological achievements, while recognizing the intertwined importance of social and technical factors in technological developments (Law, 2008). The cognoscenti of actor–network theory focused on expounding actors’ strategies in the formation of technological issues, by focusing on their actions. According to actor–network theory, actions were no longer defined as a direct expression of an intention but, rather, as a directed construction of real-world relations. Instead of regarding intentions and discourses as the only significant sources of action, these authors suggested that agency was mainly about “connecting things.” The different components put together to act formed a network: a series of interconnections that constituted action. According to actor–network theorists, “The best way to understand the term ‘actor-network’ is to think of it as a network constituting the agency—the capacity to act—of some actor rather than as a network consisting of actors” (Bruun & Hukkinen, 2003, p. 104). The development of such a framework had two consequences for the understanding of technological decisions.

First, actor–network theory described the progressive constitution of relationships in which both humans and nonhuman actors assumed roles and identities. One consequence of such a conceptualization of networks, and also a source of controversy, was actor–network theory’s apparent ascription of agency to nonhuman and even nonliving entities. For example, the design of a military aircraft mirrored both technical and social components of British defense policy (Law & Callon, 1988). The characteristics of the commercial ships used for trading goods were part of the explanation of the Portuguese maritime expansion. The behavior of scallop shells was one of the main determinants of three researchers' success to improve the seashells production in St. Brieux Bay (Callon, 1986). The objects that were mobilized to fill the networks were heterogeneous and could take the form of people, organizations, machines, or scientific findings. The *network* metaphor was thus a way of underlining the simultaneously social and technical character of technological innovation. It was a metaphor for the interconnected heterogeneity that underlined sociotechnical engineering (Law & Callon, 1988).

Second, actor–network theory had particular implications in terms of actors' power and influence on technological decisions. Success was indeed linked with the actors' capacities to organize action. Actor–network theory was, therefore, mainly preoccupied with mapping the way in which actors defined and distributed the different social, political, technical, or bureaucratic roles to assign to the different elements of the network. According to this framework,

> Actors [grew] stronger in some particular course of action as they [gained] credibility as spokespersons for strategically important categories of people, organizations, objects, processes, etc. They [grew] weaker when established representativeness degenerated, for instance as a result of being questioned by a competing actor. (Bruun & Hukkinen, 2003, p. 104)

In particular, in their effort to organize the different elements linked to their desired actions, actors created "negotiation spaces," where they established and discussed the elements of their strategies. Each "negotiation space" appeared with the successful construction of a global network and corresponded to the space, period of time, and set of resources that were provided for a project by each global network in anticipation of a future return (Law & Callon, 1988, 1989).

These two elements seem promising for the study of international environmental negotiations in general and for studying the biodiversity treaty in particular. As outlined earlier, the biodiversity treaty has established several recommendations on technological applications that have had concrete consequences for the practice of firms and governments. Moreover, governments, ENGOs, and business lobbies have worked to build alliances during the whole negotiation of the biodiversity treaty (Andrée, 2005; Burgiel, 2007). This article, therefore, uses actor–network theory's main postulates to analyze the evolution of the CBD treaty. The empirical analysis reveals three stages in the negotiation of technological choices under the CBD: (i) the evolution of the biodiversity treaty agenda toward technological issues, (ii) the development of two sociotechnical networks in favor of biotechnology and bioprospecting applications, and (iii) the failure of these initial actor networks to expand into the international level of biodiversity policy making. The results illustrate the relevance of actor–network theory by placing action and real-world experiences as a critical factor beyond intention for successful influence.

Competing Intentions for the International Biodiversity Treaty: From Biodiversity Conservation to Biotechnology and Biodiversity Screening

The initial aim of the CBD was to preserve biological diversity by carrying out conservation programs worldwide. However, the agenda of the treaty changed progressively in favor of the inclusion of technological issues into the convention's scope. It is this change that is analyzed in this section.

The need to stop international biodiversity loss emerged as a priority for scientists at the end of the 1970s (Arts, 1998, p. 171). Soon, the claims made by the scientific community in the field of biodiversity studies were endorsed by several international organizations and ENGOs that contributed to a wider international debate. Scientific research, programs, and reports multiplied as did conferences and research colloquiums. Among these initiatives, the United Nations Educational Scientific and Cultural Organization created the international program "Man and Biosphere" in 1971, aimed at protecting valuable ecosystems throughout the world. In 1974, the newly created United Nations Environmental Program (UNEP) established an international working group on ecosystems. In 1980, these two organizations joined an initiative launched by the International Union for the Conservation of Nature (IUCN) and the World Wildlife Fund[3] that, together with the Food and Agriculture Organization of the United Nations, created the "World conservation strategy."

The need for an international convention to protect the earth's biodiversity became increasingly visible, and, by 1987, the United States was the first country to submit a proposal for an international agreement on biodiversity to the UNEP Secretariat.[4] The initial American proposal aimed at gathering all the existing international treaties on endangered species and tropical forests[5] under a common umbrella convention (Hopgood, 1998, p. 168). The idea of establishing a system of international biodiversity governance was consequently brought onto the international agenda by the United States, supported by an alliance of Western countries, Northern ENGOs, and scientists (Tolba & Rummel-Bulska, 1998). The expertise of these actors and their pressure on governments turned their concerns into the need for an international convention on global biodiversity conservation.

The initial intention communicated by this first coalition in favor of biodiversity conservation policies was modified for the first time during the Stockholm Summit on Sustainable Development in 1972 and again during the Rio Summit preparation sessions by a competing lobbying alliance gathered around the so-called megadiverse countries.[6] As soon as 1978, Bolivia, Brazil, Colombia, Guyana, Peru, Surinam, and Venezuela gathered around the Manaus Declaration for the establishment of an international treaty that promoted the sustainable use and the sharing of the benefits arising from the Amazon region genetic resources. In 1991, this coalition prepared for the negotiations of the CBD and expressed its intention, in a common declaration, to see the adoption of Article 15 of the CBD on access to genetic resources (Convention on Biological Diversity, 1992). In a parallel effort, Malaysia took the lead to negotiate Article 19.3 of the future convention text on a mandate to negotiate a protocol on biosafety, dealing with access to and management of genetic technology (interview with Colombian delegate, September 7, 2007).

Taking the ecosystem approach as a reference, these actors confirmed that global biodiversity had to be protected. However, to secure their natural assets, these states argued that their sovereignty over their natural resources had to be recognized and stressed the necessity to share the benefits and technology arising out of biodiversity's uses for biotechnology applications or bioprospecting. Local communities and farmers taking care of the world's biodiversity also had to be given recognition and rights (Raustiala, 1997, p. 496). This goal of broadening the scope of a biodiversity convention was supported by several NGOs concerned about environmental and development issues, such as Greenpeace International, Friends of the Earth, Third World Network, Rural Advancement Foundation International (RAFI), Environment Liaison Center International and Cultural Survival.

Under the pressure of this second lobbying alliance, the discourse of the first coalition led by the United States was turned into a global claim for sustainable development (Tolba & Rummel-Bulska, 1998). As Desiree MacGraw, who followed the CBD negotiations from 1993 until 2001, puts it, “As a result, attempts by powerful state and non-state actors to create a convention aimed solely at conserving biodiversity were thwarted” (MacGraw, 2002, p. 7). As the convention was adopted in 1992, three—instead of one—objectives were elaborated, and elements such as biotechnology transfer, access to genetic resources, and IPRs were included in the treaty.

Thus, several actors interested initially only in conservation changed their intentions substantially. The World Wildlife Fund revised its position to consider further the interactions between nature conservation and development (Hopgood, 1998, p. 170). The United States also announced in 1992 the decision not to sign the convention: “The Convention on Biological Diversity was a UNEP-sponsored project which had originally and ironically as it turned out, been proposed by the United States” (Hopgood, 1998, p. 134).

The definition of the biodiversity convention’s scope illustrates the introduction of sociotechnical issues in the international treaty. Soon, with the development and implementation of the two additional objectives linked to bioprospecting activities and biotechnology applications, several challenges emerged that the parties to the CBD had to tackle. The intentions of the different actors involved in biodiversity governance, in order to be successful, had to be turned into concrete action plans. The emergence of technological issues on the CBD agenda led to the development of several actor networks aiming to influence the political process.

Creating “Negotiation Spaces”: The Initial Sociotechnical Networks of Bioprospecting and GMO Technology

Actor–network theory posits that the initial strategy of actors involved in technological developments is to create a “negotiation space” where they can freely combine and elaborate the different elements corresponding to their expectations. As soon as 1992, two dominating actor networks emerged in the negotiations of the CBD and were concerned with bioprospecting on the one hand and agricultural biotechnology on the other.

Though the convention text was being negotiated, bioprospecting was presented as an ideal win–win situation by a coalition of firms, research institutes, ENGOs, and governments represented in the biodiversity negotiations by Germany and Switzerland and closely linked to the American delegation. This alliance was supporting the use of genetic resources as private commercial commodities. Its rationale was embodied in several bioprospecting agreements negotiated at that time between biodiversity-rich countries and private firms. The agreement between the multinational pharmaceutical company Merck and the Costa Rican National Biodiversity Institute (INBio) is an illustration of the different roles assigned to the actors constituting this actor network. In 1991, Merck agreed to pay INBio an initial amount exceeding $1 million in laboratory equipment and, reportedly, to give 1% to 3% of any royalties from successful drugs developed from Costa Rican biological resources. In addition, half of all royalties received was to be used by the Costa Rican Ministry of Natural Resources for the conservation of biological diversity. Merck was to establish research facilities and to train scientists in Costa Rica in the collection of samples, furthering the goal of long-term self-sufficiency for developing countries. The firm was not expected to retain the patents or any IRP related to the products developed, and the agreement was meant to provide benefits to both the environment and economy of Costa Rica (Miller, 2006).

Such success stories were part of the probioprospecting coalition discourse and started to be included in the discourse by firms such as Merck and Diversa that specialized in the use of natural products for biotechnology applications, several research institutes such as the INBio and the American National Cancer Institute, ENGOs such as the World Resource Institute (WRI), and parties to the convention such as Switzerland and Germany. This coalition structured its communication and persuasion strategies around several narratives and metaphors assigning different roles to the actors taking part to the bioprospecting technical chain. Their alliance was tied to a greater interest in natural resources for industrial applications. The alliance narrative presented several kinds of heroes—the organizations or states engaged in bioprospecting, the local communities benefiting from technology transfer, genetic resources that contained miraculous components—but no victims. It was part of the positive rhetoric of debt swaps for nature derived from environmental management studies and represented biodiversity as a commercial commodity to exchange. The systematic screening of natural resources was meant to generate profits protected by companies and governments through secure IRPs and shared with local communities through scientific programs. By convincing more and more countries, the probioprospecting coalition managed to involve a growing number of actors in its "negotiation space" where the roles of the actors were tested and assigned. The Bonn guidelines on access and benefit sharing adopted in 2002 initially confirmed the adoption of the probioprospecting discourse at the international level.

As bioprospecting issues were extended, agricultural biotechnology applications also became the subject of concern for a coalition interested in the widespread use of biotechnology. During the negotiations of the agreement, this coalition was represented by several governments (gathered under the banner of the Miami group[7]) and companies (gathered under the global industry coalition) that argued for a flexible approach to agricultural biotechnology regulation and presented the technology as a solution to global food concerns.

In the scenario elaborated by this coalition, GMOs were meant to produce stronger plants that would give better yields and also protect wildlife. Farmers were supposed to use these seeds to improve their working conditions—genetically modified plants were supposed to require less pesticides and herbicides than other varieties—and thus secure higher profits. The seeds were to be produced by innovative companies, which could develop solutions to any agricultural problem, while reinforcing the competitiveness of governments. Government agencies were asked to maintain a favorable environment for private sector firms, in view of the benefit to be gained from the technology success. Finally, consumers were assigned the role of welcoming products nutritionally equivalent to other food but produced under better environmental and economic conditions. Again, the sociotechnical scenario seduced several actors who created a negotiation space that some authors have called the *biotech bloc* (Andrée, 2005). This biotech bloc developed initially in the United States, where the firm Monsanto engaged forcefully to convince the government, farmers, and consumers of the benefits of biotechnology applications. This actor network became successful at the national level mainly in the United States, where flexible legislations were put in place to monitor and encourage the development of GMOs.

By the end of the 1990s, pro-bioprospecting and pro-biotechnology actor networks were organized to defend flexible international approaches for these innovative and promising technological domains in the international biodiversity negotiations. However, by the beginning of 2000, both actor networks lost their political advantage to actors skeptical of the “benefits” of these technological innovations. Two dependant elements can explain the initial actor networks’ failure to shape the principles of biodiversity implementation: the lack of correspondence between the technological aims and the practical results obtained by the two actor networks, and the rise of competing coalitions in the international negotiations arena.

From Intentions to Action: The Failure of Initially Established Actor Networks

The initial belief in the benefits to be gained from systematic natural components screening progressively became a myth (interview with NGO representative, March 28, 2006). The Merck/INBio agreement did not deliver the expected results: A company spokeswoman reported that no products had emerged from the project (Dalton, 2004). Natural screening was a promising process but in practice took too much time and effort with limited reward. In 2000, two multinational companies, Monsanto and Bristol Myers Squibb, closed down their natural products' divisions (Dalton, 2004).

These practical obstacles to the initial probioprospecting discourse were not calling into question per se the entire strategy developed by probioprospecting actors. However, though companies were having concrete difficulties in developing new products from natural resources screening methods, new actors entered the initial negotiation space to question the probioprospecting rationale. These actors developed an opposing argument to the unregulated exploitation of genetic resources: the biopiracy discourse. The term *biopiracy* was initially elaborated by RAFI as a response to the book *Biodiversity Prospecting* published in 1993 by the WRI that promoted win–win partnerships and contracts for the access to genetic resources (Mooney, 2000, p. 37). Members of RAFI realized that the book echoed pretty well with several complaints formulated by the American government against what it denounced as "patent piracy" of their pharmaceutical and chemical products. Such a despoliation was taking place as a result of nonpayment of the royalties and violations of IPRs relating to American products. Moreover, RAFI members elaborated on a 1970s study on the "genetic piracy" conducted by multinational seed companies that freely used agricultural resources from the South for further research. As a response to these debates, RAFI representatives decided to use the expression "reverse piracy" or "biopiracy" to designate the exploitation of developing countries biodiversity by Northern states. In September/October 1995, the monthly newsletter of RAFI, *RAFI Communiqué*, carried an article titled "Biopiracy Update: A Global Pandemic."

As Pat Mooney, representative of RAFI, explains, "The intent was not to attack the authors' [WRI] sincere effort to protect people and diversity but to point out that the current socio-economic environment [made] mutually-beneficial contracts unlikely or impossible" (Mooney, 2000, p. 37). Soon, a broader coalition formed around the biopiracy narrative. It gathered prominent activists such as Vandana Shiva, an Indian scientist fighting for the recognition of indigenous knowledge; ENGOs such as RAFI and the Third World Network; governments such as Ethiopia and Malaysia that wanted to preserve their natural genetic resources; and firms such as the Dutch company Novo Nordisk, the American firm Shaman Pharmaceuticals, and the Brazilian enterprise Natura that already had some experience of collaboration with local communities. In that discourse, the victims of the exploitation of genetic resources were local communities, whereas the "biopirates" referred to unscrupulous private sector companies and research institutes. This coalition proposed that bioprospecting activities be conducted with the collaboration of indigenous people and local communities and that, to ensure that benefits were distributed equitably, the origin of the resources used in patents' application should also be disclosed.

In the biodiversity negotiations, renowned cases of biopiracy were being publicized during negotiation sessions soon after the adoption of the convention's text. In 1992, one article in the *New Scientist* on the use of catharanthus roseus (Madagascar periwinkle) was widely circulated in negotiation meetings. The periwinkle was a native plant from Madagascar used in treatments against cancer and generated an overall profit of 200 billion dollars for Eli Lilly, the firm that had patented the drug. The lack of redistribution of the benefits from biodiversity conservation was striking, as Madagascar, one of the countries richest in biodiversity, but one of the poorest in terms of development, hadn't received any compensation for giving access to catharanthus roseus. Negotiators soon realized that biopiracy was not occurring only in developing countries when the case of Cyclosporin A, a medicine developed by Novartis in the 1990s from a Norwegian soil sample, was made public (Mateo, 2000, p. 9). In September 2002, in response to the antibiopiracy coalition, the international negotiation process for the issue of bioprospecting under the CBD experienced a new turn at the World Summit for Sustainable Development. In particular, the Johannesburg declaration on sustainable development, and particularly the paragraph 42 of the corresponding implementation plan, called for the development of an international regime on access to genetic resources and benefit sharing to be *in situ* by 2010.

The proagricultural biotechnology coalition experienced a similar policy turn. Things became complicated for this coalition when several actors who were part of their network refused to collaborate according to the roles they were initially assigned. GMOs were unwilling to cooperate, and several publications and reports attested the living nature of GMOs characterized by gene flaws and market contaminations. The risk that modified seeds might enter and reproduce in the wider environment and in turn contaminate biodiversity became highly debated (Gaugitsch, 2002). In 1999, a study published in *Nature* and detailing the environmental impact of a modified corn variety signaled the negative impact of GMOs on the natural fauna and in particular on the Monarch butterfly. In addition to these environmental risks, concern was growing among farmers from several developing countries about technology that they perceived as a tactical attempt to increase their dependence on private sector companies. It is interesting that the promising results of agricultural biotechnology were turning into a "strategic disaster" (interview with biotechnology expert, March 14, 2006). In 2000, the Cartagena Protocol was adopted by the parties to the convention, in order to establish a precautionary approach to agricultural biotechnology.

Contrary to the probioprospecting coalition, the probiotechnology alliance tried to solve part of its problems by working on new technological solutions to reorganize its network. The American company Delta and Pine Land, in collaboration with the U.S. Development Agency, developed, in 1998, a new set of technological applications called genetic-use restriction technologies (GURTS) that could control the introduction of new traits in plants and/or the reproduction of seeds. The technology was touted as an effective means of enforcing biosafety requirements and controlling the production of GMOs. The second type of application on sterility[8] rendered the technology potentially useful in preventing the undesirable leaking of genetic material into the wild. GURTS were also expected to increase agricultural biodiversity through increased activity in the plant-breeding sector, especially while stimulating research for several varieties that had been neglected with the first generation of genetically modified crops (International Seed Federation [ISF], 2003). The development of a new type of genetic technology was presented by the probiotechnology lobbying alliance as a solution to GMOs' risks. However, this new arrangement, which solved part of the practical problems linked to traditional GMOs, failed to take the interests of farmers into account. Armed with the knowledge gained from participation in the cat's cradle of international negotiations, the biotechnology skeptics were in a strong position to undermine the new probiotechnology project. This involved taking the fight into a wider arena and mobilizing new actors.

Just as Delta and Pine Land acquired the patent on GURTS in 1998, RAFI publicized and criticized the agreement christening GURTS innovations as "terminator technology." For the ENGOs, GURTS were a new strategy to control the use of seeds and related IPRs, especially in developing countries. Again, biodiversity was regarded as a crucial element for most of the world's population. The seeds' sterility option was particularly problematic for countries like India where 80% of farmers use their own production to plant from one year to the next. At the beginning of the controversy on GURTS, the commercialization of the products was still pending when one of the leading multinational companies in GM technology, Monsanto, aligned with a precautionary approach on the innovation. The firm had already planned to acquire the patent on GURTS to warranty its cotton production. Confronted with strong civil society protests, Monsanto, followed by AstraZeneca, gave up its project to acquire and commercialize GURTS (Jansen & Vellema, 2004, p. 51).

This change in the corporate strategy of Monsanto marked the success of the supporters of a precautionary approach to GMOs management, and in 2000, the fifth conference of the parties established a de facto moratorium on GURTS, which was confirmed during the CBD conference of the Parties.

Conclusion: Real-World Experiences as a Key Element of Lobbying Alliances

This article applies actor–network theory to analyze technological choices under the CBD. The analysis of the CBD case study reveals three steps in the determination of the treaty policy principles toward biotechnology and bioprospecting applications: (i) the extension of the initial negotiation agenda toward technological issues including biotechnology and bioprospecting, (ii) the consolidation of two actor networks in favor of both technologies, and (iii) the emergence of practical difficulties undermining the initial actor networks strategies and the rise of opponents. Three main conclusions can be drawn from the case study developed.

First, building strategies and alliances is a key factor in influencing international environmental processes. Indeed, actor–network theory underlines a crucial component for the success of international lobbying alliances: the articulation of real-world experiences with coalition discourses and practices. It is interesting that the initial strategies built by actors favorable to biotechnology and bioprospecting were weakened by the disparities between the roles assigned to the different components of the networks and real-world experience. GMOs started to have an impact on wildlife and local agricultural practices, whereas genetic resources remained elusive in revealing interesting pharmaceutical or cosmetics applications. The practical difficulties encountered by the initial actor networks enabled competing coalitions to enter the negotiation space for biotechnology and bioprospecting management.

Second, the analysis reveals that, in each case, the international networks developed to propose international action on biotechnology and bioprospecting include a wide range of actors. Usual distinctions between corporations, states, and ENGOs' interests are blurred at the international level. This result has important implications for the understanding actors' power to influence environmental negotiations. Instead of being predetermined, power emerges with the ability of one actor to align its interests with practical actions.

Third, the study reveals that international environmental governance does not develop antagonistically to technological applications but mostly aims at practically reconciling commercial interests with environmental priorities. The international regime on access and benefit sharing recognizes the need to collaborate with local communities for bioprospecting, without impeding the commercial use of biodiversity. Likewise, the Cartagena Protocol establishes the rationale for a precautionary approach to new technologies to manage their possible negative impacts on wildlife. In both cases, several corporations are engaging in these new developments—as illustrated by the changing strategy of Monsanto regarding GURTS or the positive involvement of several firms, for instance, the Brazilian firm Natura—and in the negotiations on an international regime regulating the access to natural genetic resources.

Declaration of Conflicting Interests

The author declared no potential conflicts of interests with respect to the authorship and/or publication of this article.

Funding

The author declared no financial support for the research and/or authorship of this article.

Notes

1. Biotechnology applications are defined by the Convention on Biodiversity (CBD) as “any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use” (Convention on Biological Diversity, 1992, Article 2).
2. Natural genetic resources are extracted from plants or animals and can serve as the initial basis for a broad range of traded goods at the international level, such as traditional and GM seeds, plant extracts, natural products, and cosmetics and pharmaceuticals. Bioprospecting involves collecting and analyzing natural genetic resources for research and/or commercial purposes.
3. Created in 1948, International Union for the Conservation of Nature (IUCN) is the world’s oldest and largest global environmental network. IUCN membership union comprises more than 1,000 government and NGO member organizations and some 10,000 volunteer scientists in more than 160 countries. The World Wildlife Fund, established in 1968, is an international environmental nongovernmental organization (ENGO) that aims to protecting endangered species.
4. On October 25,1988, then-U.S. president, Ronald Reagan, propsoed a resolution to Congress, seeking the establishment of an international convention for the conservation of the earth’s biodiversity as well as the protection of peculiar ecosystems. In 1991, American representatives restated their intention at a G7 meeting, to adopt an agreement in the following year for the protection of ecosystems without impeding the positive developments of biotechnology (MacGraw, 2002, p. 34). This push is partly explained by the importance of American scientists in international

conferences on biodiversity and in organizations such as IUCN or the International Council on Science (Hopgood, 1998, p. 61).

5. Among others, the International Convention for the Regulation of Whaling adopted in December 1946, the International convention for the protection of birds in October 1950, as well as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) that came into existence in March 1973.
6. These countries rich in biodiversity are known as provider countries of natural genetic resources. These are Bolivia, Brazil, China, Colombia, Costa Rica, Equador, Philippines, India, Indonesia, Kenya, Malaysia, Mexico, Peru, South Africa, and Venezuela.
7. The Miami group comprises the world largest seed-exporting countries: Argentina, Australia, Canada, Chile, the United States, and Uruguay.
8. The first type of application or first generation refers to T-GURTS. T-GURTS technology modifies a crop in such a way that the genetic enhancement engineered into the crop does not function, until the crop plant is treated with an activator compound. The technology is restricted at the trait level, and hence, the term T-GURT. The second type of application or second generation refers to V-GURTS. V-GURTS technology affects the fertility of the crop. Most of the controversy arose around this second type of application.

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