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From bioprospecting to reflexive governance

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Abstract

In this paper I evaluate the contribution of new institutional economics to reflexive governance in the field of bioprospecting. My hypothesis is that the design of governance arrangements that are both efficient and legitimate necessitates taking into account the reflexivity of the actors on the proposed institutional design. In considering this hypothesis, I apply current theoretical insights from new institutional economics as developed by Oliver Williamson and Douglas North to the issue of complex contractual relationships in the field of bioprospecting. Building on these insights, I propose some means for ameliorating the current proposals for institutional framing of the contractual relationships.

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1. Introduction

Bioprospecting practices have proliferated as biotechnological and pharmaceutical companies engage in the collection and genetic screening of biological and genetic resources throughout the world. Under the Convention on Biological Diversity (CBD), agreed at the 1992 Earth Summit in Rio de Janeiro, bioprospecting is regulated through “Access and Benefit-Sharing Agreements”, which are bilateral contractual arrangements between ecologically-rich states or communities and private corporations and are based on the principles of “prior informed consent” and

“equitable sharing of benefits”. Numerous benefit-sharing agreements have already been signed and some of them are currently under review by the CBD Secretariat in Montreal.¹ One of the oldest of these contracts is the Merck-INBio agreement in Costa Rica, signed in 1991. Under the terms of the agreement, Merck, a major US pharmaceutical firm, offered a payment to be invested in nature conservation, equipment and training. In exchange, Merck received access to a “limited number of plant, fungal and environmental samples from Costa Rica’s protected

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¹ For an overview of the most important benefit-sharing agreements, see Mulligan (1999); Peña-Neira et al. (2002); Svarstad and Dhillon (2000) and the case studies reported on the CBD website at <http://www.biodiv.org/programmes/socio-eco/benefit/case-studies.asp>.

areas for scientific evaluation” (Mulligan, 1999, p. 40). Merck also agreed to pay a specified royalty if any commercial products resulted from the company’s bioprospecting activities.

Since the 1992 convention a wide variety of bioprospecting contracts have been negotiated, with both state agencies and local communities. However, in spite of the fact that the convention provided a clear set of principles for the attribution of property rights in genetic resources, bioprospecting negotiations have not always been successful, whether because the contracts did not live up to the expectations in terms of financial returns, or because the agreements remained controversial. In particular, the current contracts were confronted with conflicts between competing interests, such as nature conservation versus commercial exploitation, or protection of traditional knowledge versus public use of this knowledge for research purposes. For this reason different authors have proposed the introduction of means of institutionally framing the contracts that would enhance both their efficiency and their legitimacy.

The purpose of this article is to examine the competing proposals for the institutional framing of bioprospecting based on the provisions for access and benefit sharing embodied in the Convention on Biological Diversity. Through this analysis I hope to provide answers to two related questions: what type of institutions is needed to cope with uncertainties involved in the contractual relationships; and how can a process of institutional change be created that is considered both efficient and legitimate?² To answer these questions, I will draw upon two promising research programmes in economics: new institutional economics and evolutionary economics. Both research programmes highlight the possibility of an alternative approach to institutional framing, which takes into account its contribution to organisational

learning and democratic decision-making. I will use insights from these theoretical approaches to identify organisations that have contributed to institutional framing in the field of bioprospecting and formulate proposals for the improvement of the frameworks.

My analysis will proceed in three steps. First, I will analyse the insufficiencies of bioprospecting contracts from the point of view of new institutional economics. Second, I will consider proposals for amelioration in the light of evolutionary economics. Third, I will evaluate how these improvements might contribute to more efficient and legitimate governance structures from the point of view of a theory of reflexive governance.

First, in order to have a better understanding of the issues involved in bioprospecting, we need a more complex analysis of the contractual relations. Traditional economic approaches consider these relationships in an overly simplified way, without being able to take into account the problems of the bounded rationality of the contractual agents. To tackle this problem I will rely for the first step of my analysis on Oliver Williamson’s work on complex contracting in new institutional economics. Williamson proposes to supplement market systems with hierarchical organisations to minimise the transaction costs which result from incomplete contracts and lack of information (Williamson, 1996; see also Brousseau and Glachant, 2002). In the case of bioprospecting, this broadening of economic analysis shows some of the deficiencies of the market and contractual approach to governance.

In practice, the contractual agreements on bioprospecting are indeed incomplete. Following the line of the theory of incomplete contracts, we can characterise this incompleteness through the properties of imperfect foresight of the ex post outcome of the activity, and the lack of verifiability of the contracts because of incomplete information (Furubotn and Richter, 2000, p. 233). In bioprospecting, there is a huge lack of foresight of the outcomes; indeed, as has been shown in the economic literature, there is great uncertainty over the value of biological resources generally. This uncertainty is related to the specific character of the asset (Swanson, 2000). The value of a biological resource is created progressively through the various steps of the process of value creation—from the extraction of the resource itself, through the laboratory screening to product development or new

² Through the provisions on Access and Benefit Sharing, the 1993 Convention defined general principles for the institutional framing of bioprospecting activities. On this basis, a legally binding protocol is currently under discussion at various international forums, including the World Intellectual Property Organisation (WIPO) and the United Nations Environmental Programme’s Secretariat of the Convention on Biological Diversity (CBD). This regime is also on the agenda of the implementation plan agreed at the World Summit on Sustainable Development in Johannesburg in September 2002.

scientific knowledge—and at each stage of this process there is an uncertainty about the outcome of the bioprospecting practice. This uncertainty about the value of the resource is reinforced by the fact that the biological resources are themselves evolving (Goeschl and Swanson, 2002) and so it is difficult to predict which properties will be useful in the near future when confronted with unknown diseases or mutating populations of pests.³

Second, because there is not always full information on the status of existing knowledge about the natural resource, it is very difficult for outsiders to verify the contract compliance. For example, in a recent case involving a bioprospecting agreement between Diversa Corporation and the Bermuda Biological Station for Research a controversy has arisen because it is not clear whether Diversa is simply studying organisms that can be found in many locations in the Atlantic Ocean or is looking for new ones that are specific to the Bermuda Biological Station for Research in St. George (Dalton, 2004, p. 600). In the same way, it is sometimes unclear whether knowledge of the properties of certain local seed varieties (such as species adapted to circumstances of extreme dryness or poor soil in Mexico) is to be considered public knowledge—and thus part of an open access regime—or common property for which an appropriate compensation should be paid (Bellon and Taylor, 1993).⁴

³ In the agricultural field, for instance, the introduction of a new productive seed that is resistant to existing pathogens induces an adaptation in the population of pathogens in such a way as to make them more aggressive (Goeschl and Swanson, 2002, pp. 100–103). As a result, as has been shown, the resistance of productive seeds decreases with time. This means that either the seeds or the means of production must be in a state of permanent adaptation, in reaction to the adaptation of the pathogens in the environment. Similar mechanisms operate in the pharmacological field, where a decrease in the effectiveness of, for example, antibiotics and anti-malarial products, has been observed (Goeschl and Swanson, 2002, pp. 103–107).

⁴ The problem of monitoring the knowledge that falls into the public domain is recurrent in the context of bioprospecting. For instance, a bioprospecting agreement was successfully concluded between Monsanto and the Aguaruna people in Peru, but the lack of monitoring during the execution of the contract led to disagreements. The participants in this contractual arrangement have called for the creation of institutions that could carry out effective monitoring of the knowledge that has become part of the public domain without the explicit intention or agreement of the community (Tobin, 2001).

Moreover, it is unclear how the contribution to biodiversity preservation (or, conversely, the rate of species extinction) be assessed if centuries are needed just to describe the diversity of most current species (Cracraft and Grifo, 1999).

In the light of this double incompleteness of the contracts, the objective of the emergent regime of access and benefit-sharing, according to new institutional economics, is to create coordination structures that can limit opportunistic behaviour. This is precisely what is at stake in the current negotiations, which aim to promote better coordination among the various mechanisms of regulation that are currently available.

However, Williamson's new institutional approach has been criticised by contemporary evolutionary theorists because it relies on a decision theoretic framework at the level of the choice regarding the best possible organisation. This decision theoretic calculus does not take into account the problem of uncertainty and its impact on the evolution of the broader social and economic context (Metcalf, 1997). Further, it cannot account for the heterogeneity of actors' preferences, which do not act according to the sole criteria of minimisation of costs, but instead adopt a plurality of logics of action (Nelson and Winter, 1982; Dosi, 1988). Evolutionary approaches therefore suggest a double improvement, covering both the issue of selection and the issue of learning (Brousseau, 2000b, pp. 1203–1204; North, 1990, pp. 17–26 and 73–82).

In the second step of my analysis I will therefore consider the contemporary criticism of bioprospecting contracts that advocates such a double improvement. A first set of proposals for amelioration aims to supplement the competitive selection mechanisms at the core of the new institutional economics with other mechanisms of public action and community solidarity (Brush, 1998; Cardenas, 2000). Such supplementary mechanisms in the case of bioprospecting are, for instance, the financing of biogenetic resource conservation by research institutions such as the International Plant Genetic Resources Institute (IPGRI), and community management of risk in agrarian societies based on a system of reciprocity allowing for the preservation of a high level of global biodiversity (Brush, 1998, pp. 761–64).

A second line of improvement focuses on the learning process in the institutional environment as a

precondition for moving beyond the “capture” of the innovation by vested interests. In particular, the institutional environment can play an important role in ensuring that the interaction among the criteria of competitive selection, community solidarity and public action will be oriented towards the interest of the largest possible community. This broadening of the new institutional framework therefore emphasises learning processes which seek to act on the evolution of the perception of possibilities by the parties concerned (North, 1990).

Nevertheless, from an epistemological point of view, these improvements to the new institutional approach remain deficient. Indeed, the relative merit of ‘incentive’ approaches to regulation and more dynamic approaches (and thus how to choose between them) remains under-theorised. The criteria for choosing between the different approaches are based on the formal properties of particular contexts (such as the degree of heterogeneity of the actors and of the action logics, or the uncertainty of the development of new technologies). However, every context has its own autonomy and the acceptance of one of the competing theoretical approaches depends on their possible connection to the working programmes of international organisations and social movements involved in biodiversity conservation. In other words, in order to assess the contribution of the double amelioration proposed by the evolutionary approaches, the conditions that guarantee the reflexivity of the concerned actors on the social programming⁵ in organisations involved in biodiversity

⁵ This includes connecting the mechanisms to the goals pursued by the central actors in biodiversity policy (the stabilisation of the programme) and to the content of the objectives of the main organisations involved in the policies (the definition of the problem space). The distinction between “programme” and “mechanism” is currently adopted in cognitive sciences as set out in the work of H. Simon and A. Rosenberg. The programme defines a transformation of an input into an output in order to achieve a certain goal, and the mechanism proposes a concrete means of implementing this transformation through a specific causal chain (for a discussion of the origin of this distinction within the cognitive sciences see Kitcher, 1988). An exploration of the broader theoretical framework falls outside the scope of this paper. The epistemological criticism of the mechanisms of governance relies in particular on research on the limitations of the modelling of behaviour from the viewpoint of contemporary debates in the philosophy of action. For a more detailed discussion, see Dedeurwaerdere, 2002a.

conservation must still be defined. This problem will be the subject of the third step of my analysis, where I propose a critical outcome in terms of a theory of reflexive governance.

For each step of my argument, I will rely on several key authors, without necessarily providing an exhaustive exploration of the literature in new institutional and evolutionary economics. Such an approach nevertheless provides the foundation for an assessment of their contributions to reflexive governance in the field of bioprospecting. This should allow us in turn to develop a better understanding of current incentive policies for biodiversity conservation and proposals for their improvement.

2. Bioprospecting contracts from the point of view of new institutional economics

New institutional economics offers a powerful critique of most of the arguments regarding the efficiency of bioprospecting contracts. It suggests that traditional economic theories consider such contracts in an overly simplified way—as an example of an idealised “spot market” governance structure. Traditionally, bilateral contracts between private parties within a context of a well-defined system of property rights have been perceived as the best way to account for the environmental consequences of economic activities (Coase, 1960). These contractual agreements, reached through negotiations on the allocation of property rights, allow the restoration of a “just price” vis-à-vis market imperfections, secured both through direct monetary incentives (e.g. benefit-sharing) and indirect incentives (e.g. an institutional framework which permits a better flow of information on market-based transactions linked to contracts) (OECD, 1999).

However this kind of ex ante negotiation on the allocation of property rights is necessarily incomplete. Indeed, as I mentioned in the introduction, the contracts are characterised by imperfect foresight of the ex post outcome of the activity and lack of verifiability of the contract compliance because of incomplete information. To overcome this shortcoming, Williamson proposes a broadening of the classical approach of economic incentives to take into account the theoretical lessons derived from the literature on

organisational learning. Through this broadening, Williamson seeks to allow for the ex-post adaptational capacities (Williamson, 2002, p. 10) embedded in the relational and organisational network that allows the opportunity costs created by the vulnerability of the contractual relations to decrease.

2.1. Incentive policies for conservation from the Coase–Williamson perspective

The broadening proposed by Williamson allows the complex contractual relations implied in bioprospecting to be described in a more accurate manner. As Williamson argues, a “spot market” governance structure is the most appropriate solution *only* when individual incentives are high and arrangements for dispute resolution exist (Williamson, 1996, pp. 95–100; see also Fig. 1, below). In the case of bioprospecting, however, both conditions are flawed. First, financial incentives are insufficient because of the low financial return on most bioprospecting contracts, which provide for limited royalties (Mulligan, 1999).⁶ Second, bilateral contracting depends on a well-defined legal regime, a condition that is clearly not met in bioprospecting. For example, the question of how property rights can account for the historical intellectual contributions of local communities—which allowed for the selection of species adapted to extreme circumstances or for the maintenance of a high level of biological diversity—remains controversial. Should such biological diversity simply be dismissed as “wild species” for which no royalties should be paid? Or, for historical reasons, should the original providers or producers be rewarded ex post?

⁶ The problem of low financial return has been extensively documented in the literature and shows one of the core insufficiencies of the classical conception of bioprospecting as bilateral contracting (see Ten Kate and Laird, 2000 for an overview). Moreover, as has been shown, the idea of generating financial incentives through an intellectual property rights mechanism is highly insufficient: it only comes in at the “end of the pipeline” (Swanson, 2000), and only addresses the actual extraction value of the resource and not the broader option value of biodiversity as a public good (Swanson and Johnston, 1999, pp. 52–68). The aim of my analysis is to go beyond this reductionist approach and argue for the importance of combining market values with non-market values in a polycentric governance system (see the analysis of Brush’s work, below) and for the importance of processes of learning (see the discussion of North, below).

This debate, related to the definition of the appropriate *sui generis* regime for intellectual property rights, remains today one of the main difficulties in the evolution to a stabilised legal environment for bioprospecting activities (Dutfield, 2002).

In this context of legal uncertainty and low financial return, bioprospecting agreements can more accurately be considered as a hybrid governance structure characterised by the embeddedness of the contractual relations in hierarchical means of administrative control. Such a governance structure seems appropriate to current situations encountered in bioprospecting, which we can characterise in terms of Williamson’s framework by high asset specificity and high uncertainty of the transaction (Williamson, 2002, p. 8). This asset specificity is well illustrated by Dalton in his assessment of some recent bioprospecting agreements in *Nature*. In this assessment, he writes that bioprospecting “requires not just scientific perseverance but the construction of an intricate web of relationships with local people, landowners and government officials” (Dalton, 2004, p. 598). The building of these relationships in a successful project in Panama, for example, required the bioprospectors “to train people, create jobs and develop local awareness of biodiversity”. So, bioprospecting is clearly not about “waiting for royalties”. Further, the transaction situation is characterised by high uncertainty in the contractual relationship. The timescale of bioprospecting activities is very long and the probability of leaving the contractual relationship very high. As has been argued elsewhere, due to the uncertainty in the option value of the genetic resources being sought in bioprospecting, the parties can exit the process at different points in the process of value creation, whether it be on the level of relationships with the local community, laboratory research, or in the final stage of product development (Swanson, 2000).

Applying Coase and Williamson’s framework to the question of bioprospecting thus offers two important insights:

- (a) *ex ante*: negotiations between interested parties regarding the definition of property rights relative to collected and/or genetically decoded living resources can take into account the social and environmental externalities of bioprospecting; and

Governance structures	Governance attributes		
	Incentive intensity	Administrative control	Contract law regime
	(Direct incentives)	(Indirect incentives)	(Indirect incentives)
Spot market	++	0	++
Hybrid	+	+	+
Hierarchy	0	++	0

Fig. 1. Attributes that define three viable modes of governance (adapted from [Williamson, 2002](#)). In the second and third column (Indirect incentives), I employ the broad definition of incentives used in the OECD handbook on incentive measures, covering both direct and indirect incentives: “The incentive measures presented can be roughly categorised in the following eight groups: fees, charges and environmental taxes; market creation and assignment of well-defined property rights; reform or removal of adverse subsidies; regulations and access restrictions; environmental funds and public financing; information provision and capacity building; economic valuation of environmental benefits and costs; and stakeholder involvement and institution building. Only the first five groups actually comprise “incentive measures” as traditionally understood, i.e. the implementation or abolition of an administrative act by an authority, usually the central government, with a legal grounding and the explicit objective to induce a certain behaviour” ([OECD, 1999](#), p. 73). The others can be considered as indirect incentives that play a role in framework building ([OECD, 1999](#), p. 97) or reflexive implementation processes ([OECD, 1999](#), p. 14; p. 73).

(b) *ex post*: because contracts are embedded in a broader set of agreements with institutions promoting sustainable development, cooperative dynamics can be sustained, notwithstanding the uncertainty and incompleteness of contractual relations.

This broadening of the classical theoretical models of bioprospecting contracts sheds a new light on current agreements. In the case of the Merck-INBio agreement, for example, it explains why the parties remained committed to the cooperative dynamic despite major shortcomings in the contract, including the problems of low price incentives and high transaction costs. Indeed, the success of the Merck-INBio contract is due, in part, to the fact that the arrangement was nested within a whole set of agreements with institutions involved in promoting sustainable development. Breaking the bioprospecting contract would have impacted on the dynamics of confidence and reputation on which the other contracts depended. It was this nexus of contracts that allowed the levels of confidence to be verified in a situation of high uncertainty about the contractual outcomes ([Steinberg, 2001](#), pp. 76–84).⁷ Particularly,

in the case of the Merck-INBio agreement, it is clear that the Costa Rican Office of Biodiversity, created in 1988, played an important role in optimising the coordination costs of the economic actors. This office relied on the well-developed park agency, and was able to enlarge the institutional dynamics engaged by the park agency to include prominent scientists, public administrators and environmental advocates ([Steinberg, 2001](#), p. 78). Two ideas that emerged within this broadened dynamic had direct institutional consequences. The first was to centralise information on biodiversity resources through a comprehensive inventory of the nation’s species, most of which to that time remained unnamed and unknown. The second was the recognition of the need to reform the park management system itself. The first proposal led to the creation of the National Institute for Biodiversity (INBio), while the second facilitated the development of an integrated system of protected areas ([Steinberg, 2001](#)). The coordination of interested parties under the auspices of the Office of Biodiversity thus played a key role in the development of the enlarged institutional environment on which the Merck-INBio contract was predicated.

More generally, several authors demonstrate the important role played by intermediary organisations in framing contracts and managing litigation. In the absence of a central administrative entity for the resolution of conflicts over issues of access and

⁷ For an overview of the transaction costs related to the verification of the confidence in contractual relations, see [Furubotn and Richter \(2000, pp. 167–172\)](#).

benefit-sharing, intermediary organisations can enhance the circulation of information (Brousseau, 2000a). In the context of bioprospecting activities that rely on traditional knowledge, a proposal by WIPO's working group on indigenous knowledge to include a reference to the country of origin in patent applications is a move in this direction.⁸ This reference would allow a more comprehensive verification of the different contributors to a new invention, and would be a first step in the creation of a broadened institutional environment that includes organisations for the certification and monitoring of the origin and use of patents.⁹

2.2. *The limits of incentive politics*

Even with the broadening of the analysis of economic transactions afforded by Williamson's approach, the real characteristics of economic transactions in biological resources remain insufficiently theorised. While Williamson's perspective demonstrates the necessity of institutional framing of transactions, it remains based on a decision-theoretic framework at the level of the evaluation of the choice regarding the best possible institutional arrangement. In other words, Williamson assumes that the best possible institutional solution to the problem of contract incompleteness is the one that minimises transaction costs.

Williamson formulates his basic hypothesis as follows: "transactions, which differ in their attributes,

are aligned with governance structures, which vary in their cost and competence, so as to effect a (mainly) transaction cost economising result" (Riordan and Williamson, 1995). But governance structures are coordination devices which, ideally, allow anticipation of the adaptation patterns of actors within relational networks (Williamson, 2002, note 8; March and Simon, 1958, p. 159). They not only include "decision mechanisms" for actors, such as price mechanisms for individual consumers, but also mechanisms which provide guarantees and control of the transactions. Different types of governance structures can be distinguished, depending on the relative importance of these mechanisms (see Fig. 1).

The choice of an appropriate structure will depend on the attributes of the specific transaction situation. As mentioned above, according to Williamson the main attributes are the specificity (and so the vulnerability) of transactions as a relational system (the so-called "asset specificity"), as well as the uncertainty and frequency of the transactions (Williamson, 2002, p. 8).

However, the application of this alignment hypothesis supposes complete information about the transaction attributes to which the governance structures should be aligned—a condition that is rarely satisfied in practice. First, a given incentive will have an influence on the evolution of this context and may modify the transaction attributes. As a result, its effects cannot always be known in advance. Second, the modified transactions will, in turn, necessitate an evolution of the governance structures and this depends on the incentives for innovation coming from the institutional environment in which the governance structure is nested. The inability to integrate the evolutionary dimension of the context thus imposes a double limit on incentive policies as they are conceived in Coase's and Williamson's perspectives.

The first limit can be illustrated through the problem of the "crowding-out effect," and highlights a major limit of the analysis of bioprospecting agreements in the first section. Crowding-out effects arise in situations where the behaviour of the actors is initially based on cooperative attitudes, but where this behaviour is undermined as a result of the influence of monetary incentives addressed to these actors. This effect can be modelled by considering incentives as

⁸ These questions are debated in the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore of the WIPO, which first met on 30 April 2001.

⁹ In the broader context of the problem of biodiversity governance, the role of intermediary organisations such as the Forest Stewardship Council (an umbrella organisation for the various certification organisations for sustainable forest management, whose objective is to "evaluate, accredit, and control organisations for certification of forest products") should also be considered (Schmidt, 1999, p. 24). It is only through the existence of such intermediary organisations that certification schemes can go beyond the stage of "codes of good conduct" which lack any substantive content and capacity for verification. The weakness of such codes was highlighted by a WWF study which demonstrated that, out of a sample of 80 declarations on environmental protection on paper or wood products, only 3 could be justified, and even then only partially (Schmidt, 1999, p. 23).

informational devices addressed to a population with a certain frequency distribution of cooperative and non-cooperative behaviour. In this setting, under conditions of incomplete information regarding the cooperative attitudes of the different actors, a price incentive operates as a signal that undermines the credibility of altruistic behaviour (Frey, 1994). This crowding-out effect is clearly present in the case of bioprospecting contracts. Indeed, substantial empirical evidence shows that the knowledge and sustainable use of genetic diversity in a local community is linked to the reciprocal cooperative practices that prevent the depletion of such resources (Ostrom et al., 1999; Posey, 1985; Hammer et al., 1993; Cardenas, 2000). By emphasising financial reward for conservation in a given community, however, bioprospecting contracts may undermine the credibility of the altruistic motivation of the actors involved in conservation. From an evolutionary perspective, the monetary incentive enhances the fitness of the egoistic behaviour compared to the altruistic behaviour. In such a situation, the bioprospecting contract will undermine the practice of sustainable use of the resource. In the worst case, this could lead to a silent agreement on the depletion of the resource, in the private interests of both parties, under the umbrella of an incentive measure whose objective is to enhance conservation (see, for example, Hufty and Muttenter, 2002, p. 305).

The second limit is located on the level of capacities for innovation in the relational network in which the incentive structure is nested. According to Williamson's decision-theoretic account, incentives structures adapt through an optimisation process based on the criterion of transaction-cost minimisation. However, in practice, such an optimum is never realised. Instead, the innovation process will depend on the effective capacities for innovation of the relational network, and thus on the perceived benefits by the interested parties (North, 1995, p. 24). Certain groups will have greater influence than others on the adaptation of governance structures. As a result, the innovative capacities of the relational networks will always remain limited by the risk of capture by powerful interest groups.

This phenomenon of capture sheds a new light on the incentive role of the Office of Biodiversity in the Merck-INBio agreement. On the formal level, as we have seen above, the Office of Biodiversity was able

to guarantee the participation of different stakeholders in the reform of the conservation system in Costa Rica, by including prominent scientists, public administrators and environmental advocates in the reform process. In practice, however, the broadening of participation primarily served the goals of two particular interest groups: the science community and the private corporations. Indeed, the science community was able to secure the financial support of the private foundations and companies for achieving the goal of a comprehensive survey of the nation's species (Mulligan, 1999, p. 42). So the innovative capacities of the enlarged community remained limited to the new perspectives promoted by the science community.

According to this analysis, a double limit to incentive politics (as conceived by Coase and Williamson) becomes apparent. First, a gap between the expected outcome of an incentive and its real effects on the behaviour of actors becomes apparent. Second, a gap emerges between the formal requirements, on which the choice of coordination structures is based, and the effective innovation capacities of the relational network, depending on the means to go beyond the capture of the participatory process by certain interest groups.

3. The double improvement proposed by evolutionary approaches in economics

Due to this double limit of incentive policies, the hypothesis of bounded rationality that is at the core of Williamson's approach¹⁰ remains insufficient. As

¹⁰ We can use Simon's concept of bounded rationality to refer to the fact that human beings are limited in knowledge, foresight, skill and time (Simon, 1957, p. 199). As we have seen, the main lesson drawn by new institutional economics from bounded rationality is the incompleteness of all complex contracts. In this respect, new institutional approaches do not incorporate another, more psychological line of research, also initiated by Simon, on the role of satisfying (is this the word that is meant here?) through aspiration level mechanics (Williamson, 1996, p. 37). For my comparison between new institutional and evolutionary economics, I use a "thin" concept of bounded rationality that is common to both approaches (see also Fig. 2 below). For the difference between a "thin" and a "thick" concept of bounded rationality in new institutional economics see also Lindenberg, 1998.

Brousseau has demonstrated, the hypothesis of alignment between transaction properties and governance structures relies on two research heuristics that prevent a more dynamic analysis. First, Williamson maintains a hypothesis of optimisation at the level of choice regarding the best possible hierarchical organisation. He therefore supposes that economic agents select the most efficient forms in a more or less predictable manner (Brousseau, 1999, pp. 200–201). Second, the hypothesis of alignment takes both transaction properties and the institutional environment as given. However, the choice of governance arrangements may affect the properties of the transaction situation and the institutional framework (Brousseau, 2000b, pp. 1203–1204).

Evolutionary approaches have developed a dynamic framework of analysis, where the role of institutions is no longer the static arrangement of resource allocation. Instead, institutions promote the development of an environment of selection which allows for the maintenance of innovative and adaptive capacities in the evolution of the coordination structures. These approaches therefore offer a double improvement over the approach of Williamson (Brousseau, 2000b, pp. 1203–1204):

- with regard to the issue of selection by, developing research that takes into account the effective plurality of preferences that play a role in the selection processes; and
- with regard to the issue of learning, by developing an analysis of the co-determination of the evolution of the institutional environment, the economic coordination structures and the properties of transactions.

In order to appreciate the implications of this change in perspective for the framing of bioprospecting activities, we must understand how the evolutionary approach can go beyond the limits of classic incentive policies. In its broadest sense, evolutionary economics is concerned with evolution as the self-transformation over time of the economic system under consideration (Witt, 2003, p. 13; Witt, 1985, p. 580). The focus of this paper is more narrowly on the evolution of economic institutions in a context where bounded rationality and path

dependency play an important role. That is why, following the line of analysis proposed by Brousseau, I will focus below on two well-developed issues in evolutionary economics that are relevant for the evolution of economic institutions. First, through the issue of selection, I will examine the effects of a new institution on the evolution of the distribution of frequencies of behaviour (Witt, 1992, p. 408). Second, through the issue of learning, I will look at the role of broader attitudes embedded in the institutional environment in the enabling of innovation¹¹ (Hodgson, 1998, p. 185). For each of these issues, I will focus on a particular behavioural model—following respectively the work of Frey and North—and provide illustrations from the field of bioprospecting.

3.1. The issue of selection

A first model that illustrates the contribution of the evolutionary approach draws upon indirect evolutionary game theory as it has been applied to the problem of frequency dependency. A particularly important example of this model has been developed by Bruno Frey (1992) in his work on the crowding-out effect. I will now focus on this model.

Frey's work provides an example of the interaction among a number of selection criteria used by economic agents. As already shown for the case of biodiversity protection, self-interested behaviour and cooperative behaviour can coexist in the users' community of biodiversity resources. In such a context, a monetary incentive for conservation can *increase* the frequency of actors adopting self-interested behaviour and, in turn, *decrease* the survival probabilities of the cooperative behaviour.

¹¹ For the sake of this analysis I will limit myself to considering the role of mental models in creating path dependency and the related role of the institutional environment in enabling learning processes that foster innovation, as developed by North (1990). However this approach was later broadened by North to include, on a second level, the general shared mental models or ideologies that are themselves a factor in the creation of an appropriate environment for innovation (for this evolution in his thought, see North, 1993, pp. 22–23).

More precisely, as Frey demonstrates, what is at stake in the crowding-out effect is a phenomenon of population extension. Cooperative behaviour may survive in the particular case of small populations, where individual agents may suppose that their behaviour has a direct influence on the behaviour of other actors. But, in larger populations, such as the one including a biodiversity users' community, local administrations and companies involved in bioprospecting, actors can no longer assume that they will have an influence on the whole population. Therefore, in the extended population, it is more rational for actors to adopt self-interested behaviour. In the long-run, they therefore adopt behaviour that will conflict with the objective of biodiversity conservation. According to Frey, this conflict can only be resolved through political mechanisms which allow for the strengthening of incentive systems that compel the whole population to act in environmentally friendly ways. As Frey writes, "actors may nonetheless be ready to act in a respectful manner for the environment, as long as other people act in the same way. As this is only the case within limited groups having an imitation behaviour (as demonstrated in the developed model), individuals may rationally request that all the members of the society be compelled to act in a respectful manner for the environment" (Frey, 1992, p. 48). According to Frey, recourse to a "political action" must be made. Such action may consist of imposing charges for non-respectful behaviour, such as eco-tax systems, or of distributing rewards for respectful behaviour. More generally, a modification of the incentive structure must be envisaged if the intention is to support cooperative behaviour. Rather than impacting on bioprospecting practices only through a contractual mechanism, based solely on market logic, the aim should be to act on several selection criteria within the broader environment in order to support environmentally-sound behaviour.

Such a model of bio-cooperation has been developed by Brush (1998) in a case study on the preservation of agricultural genetic resources in Mexico. The general context of the case study is that, in the traditional farmers' communities, seed variety had been successfully managed as a common pool resource through the evolution of well defined property rights on the resource (both private and

common¹²) and the creation of institutions for the permanent exchange of seeds between the farmers. These exchange practices can be considered as an evolutionary trait that allows for the maintenance of a greater global diversity than any individual isolated farmer could guarantee. This diversity plays an important role in risk management within agrarian societies (Brush, 1998, p. 761). It is in this context of an already established system of property rights that Brush addresses the question of the adequate design of a contractual arrangement that would allow for the community to gain some supplementary revenue from their conservation of the genetic diversity of the seed stock. This question leads Brush to compare the contractual regime of bioprospecting and a regime that would be based on voluntary behaviour and public involvement.

In his study, Brush highlights two steps of Frey's reasoning regarding the extension of the population. First, with regard to bioprospecting contracts, Brush points out the inappropriateness of resorting to classical mechanisms for benefit sharing, addressed to individual actors or isolated communities through bilateral contracting, in the context of a resource such as maize, where the ownership of the innovation is properly collective (Brush, 1998, pp. 760–762). Second, in order to take into account this collective character, the broader community involved in the seed exchange should be considered. However, expanding a bioprospecting contract to an agreement with a larger group, in order to take into account the collective character of agricultural innovation, would dilute the benefits and therefore reduce the economic effect of the incentives. Moreover, on the political level, such an extension is not a solution in itself

¹² For this case study, it is important to recall the distinction made by Elinor Ostrom between the character of a good—here seed variety as a common pool resource—and a system of property rights. The character of the good as a common pool resource is determined by some factors (such as the high mobility of the resource or high uncertainty over its exact future value) which make exclusion very difficult, plus joint consumption (Ostrom, 1990, pp. 33–34). However, the choice of what system of property rights is most appropriate for the management of a common pool resource depends on the situation and the historical situation of a community. A common pool resource can be appropriately managed through a private, public or common system of property rights or through a mix of these different categories (Ostrom, 2002).

because it fails to deal with the problem of conflicts that may arise between particular communities on the issue of benefit sharing. Finally, it does not address the crowding out of the cooperative practices through the introduction of the apparently more rewarding monetary incentive schemes.¹³

Brush therefore proposes to move beyond the simple extension of the benefit sharing mechanism to a global modification of the incentives structure in order to favour behaviours that are oriented towards the preservation of biodiversity as a public good (Brush, 1998, p. 764). Thus, he notes that “the conservation of genetic resources requires a long term investment in institutions and in human capital that is beyond the range of contracts” (Brush, 1998). One example of such long-term investment is the FAO programmes for enhancing human capital within agricultural research institutions involved in research programmes on the utilisation of local resources. Mechanisms to expand the frequency of cooperative behaviours of reciprocity, such as mechanisms for voluntary participation in benefit-sharing funds, also conform to Brush’s model. One such fund is the Genetic Recognition Fund, established at the University of California Davis, which is based on an agreement through which researchers agree to pay a fixed royalty to the fund if they discover and patent genes from germ lines obtained from developing countries.

The rationale of this case study is not so much to replace the bilateral market approach to bioprospecting contracting with a different approach, based on public involvement (as in the case of the FAO agricultural research institutions) or voluntary mechanisms of benefit sharing (as in the case of the trust fund at the University of California Davis) but rather to consider the influence of bioprospecting on the

evolution of the preference distribution in the population. It proposes a more balanced view, where the bilateral market approach has to be combined with other mechanisms. In this way the danger of crowding out cooperative behaviour can be counterbalanced by the introduction of complementary institutional mechanisms not based on market logic alone.

3.2. The issue of learning

While such an approach permits the adoption of a more dynamic conceptualisation of incentive mechanisms, it remains unable to adequately theorise the determinants of the evolution of the institutional environment in which incentives structures are embedded. More precisely, Brush’s and Frey’s analyses demonstrate the need to consider a more global modification of the incentives structures in a setting of polycentric governance.¹⁴ However, they do not consider the questions of which actors will modify the rules and which actors will be mobilised to participate in the innovation process? The innovation dynamic in the search for greater efficiency may be hindered through capture by vested interests. That is why a second line of research focuses on learning processes in the political environment—processes that aim to maintain adaptation and innovation dynamics so as to go beyond the inertia that may be in the interests of the more powerful actors (North, 1990).

In order to understand the consequences of this second improvement to the new institutional approach for the topic of bioprospecting, let us briefly compare new institutional and evolutionary

¹³ Brush’s case study is particularly interesting because it makes a direct link between local biodiversity conservation and the cooperative behaviour of exchanging the seed of traditional varieties. However, the crowding out of cooperative behaviour through monetary incentives has also been reported in other case studies on bioprospecting, especially in relation to the differences that exist between collectors for public gene banks and bioprospectors collecting for private purposes. Through the rise in private bioprospecting, suspicion has arisen about the real intents of public collectors, and cooperative relations have come under strong pressure (Alexander, 2003).

¹⁴ The notion of polycentric governance is used here in the sense of the research programme initiated at the *Workshop in Political Theory and Policy Analysis* of the University of Indiana at Bloomington (USA) (see McGinnis (1999) for an overview). Polycentric governance implies a system having many centres of decision making, including those related to different types of social logic, such as market, government and communitarian logic. It was introduced by Vincent Ostrom in the context of his study of metropolitan governance and is defined as a system of “many centres of decision making which are formally independent of each other”, but which nevertheless function as a whole “to the extent that they take each other into account in competitive relationships, enter into various contractual and cooperative undertakings or have recourse to central mechanisms to resolve conflicts” (Ostrom et al., 1961, p. 831).

theories on the evolution of governance structures. From the new institutional perspective, the role of the institutional environment consists of enforcing the economic system of property rights and rules politically. However, there is a dialectic between the evolution of structures of economic coordination, on the one hand, and the institutional environment, on the other. Indeed, as North's work on economic history demonstrates, innovations and adaptations of the coordination structures frequently destabilise the broader institutional frame that allowed their creation, thereby compelling further development and evolution. In order to act upon this dialectical process, learning processes must thus be envisaged, organised at the level of the political environment, which guarantee consideration of the interests of new emerging actors in the choice, implementation and reinforcement of political rules of economic coordination. North thus raises a new question, which was not addressed in Williamson's static framework, namely how to organise an institutional framing of coordination structures that does not solely benefit current interests but which, through its elaboration, also considers its own evolution and incorporates the interests of the largest possible community (North, 1995, pp. 21–22).

Intermediary organisations can play an important role in this process, moving beyond the restrictive function of adjustment and conflict resolution considered above.¹⁵ In practice, intermediary organisations not only play the neutral role of facilitating communication and verifying contractual compliance, they can also limit the opportunistic behaviour associated with certain interest groups within the political environment. For example, as Ostrom et al. (1961) demonstrate with respect to local public economies, intermediary organisations may ensure that the costs associated with the extension of a group, such as the provision of public goods and services, are supported by the whole population. In the field of biospect-

ing, a proposal by the Working Group of Like-Minded Megadiverse Countries to deal with the problem of political opportunism provides an example of such an intermediary organisation.¹⁶ The group aims to formulate common proposals for forthcoming negotiations on the issues of access and benefit-sharing. The group has specifically defended the necessity of attesting to the prior informed consent of a country provider of biological resource in patent applications, a step they argue is necessary to allow for better control over opportunistic practices such as "bio-piracy". More generally, the role of intermediary organisations and informal networks allows for a "modified form of competition" (North, 1995, p. 23; Ostrom, 2000, p. 35) at an inter-organisational level, which provides incentives for actors to modify their perceptions and motivations in order to take into account the interests of new populations.

Thus, if the aim is to apply this dynamic analysis of the innovation process to the issue of access and benefit sharing, Frey's and Brush's analyses must be completed by a consideration of the learning process in the institutional environment that allows for a reorientation of polycentric interaction towards the interests of the largest possible population. Developing work on the different selection mechanisms within a polycentric framework, as envisaged by Frey and Brush, allows market incentives for the sustainable use of biodiversity to be supplemented with incentives for the cooperative management of remaining externalities. However, even if market incentives are supplemented with cooperative management, there is no guarantee that the cost of these externalities will be supported by the whole population. Frey and Brush overlook this danger, believing that the public interest may be simply imposed through a government-type command-and-control structure (Frey, 1992, p. 48) or an international organisation such as FAO (Brush, 1998, p. 764). In particular, it is not clear, given the context of trade and economic liberalisation, whether the agricultural sector would be capable of supporting the additional costs imposed by public regulations in

¹⁵ Intermediary organisations in Williamson's sense can be considered as private orders by which different contractual parties can ensure each other's cooperation ex post (see Brousseau and Glachant, 2002, p. 13). They have to be sufficiently general to allow reliable verification of the transactions, but their explicit aim is not to be as broad as possible in order to represent the general interest (as in political institutions).

¹⁶ The Working Group of Like-Minded Megadiverse Countries includes Bolivia, Brazil, China, Columbia, Costa Rica, Ecuador, The Philippines, India, Indonesia, Kenya, Mexico, Peru, South Africa and Venezuela.

order to manage externalities.¹⁷ Therefore, in the absence of intermediary organisations acting upon the political environment, the threat of the mechanism for interest generalisation within a polycentric framework being captured by certain groups, such as expert communities or the pharmaceutical and the seed industries, remains real. These intermediary organisations could relay the interests of the larger population, which includes new actors such as indigenous people, or propose rules for the participation of the different parties in meeting the costs of economic externalities.

4. Towards a theory of reflexive governance

As I have shown through my analysis of the new institutional approach in economics, the integration into economic explanations of the hypothesis of bounded rationality improves the explanation of the real characteristics of economic transactions associated with biological resources. From an epistemological point of view however, the formal typology of regulatory institutional arrangements, considered within the new institutional economics, remains insufficient. Indeed, the question of how to assess the relative merits of different systems of regulation that rely on market, hierarchical or hybrid organisations remains unaddressed. As I have shown, the choice largely depends on the properties of the context, such as asset specificity, frequency of transactions and uncertainty. This means that the selection principle leading to the adoption of a new system of regulation relies on the reaction to an objective context working as an external control variable. However, the political and social context has its own autonomy, and the chosen approach must still consider its own contextual interpretation according to the work programme of an international organisation, a social movement or an administration involved in biodiversity conservation. In other words, the particular use that will be made of the institutional arrangements proposed by each approach still has to

be taken into account within the concrete context of social programming.

The double improvement we considered using evolutionary economic approaches has already generated some hypotheses on the possible connection of the new means of regulation to the content of social programming in the environment.¹⁸ However, each improvement emphasises only one part of this programming, either the stabilisation of the programme through the goals pursued by the main actors, or the representation of the content of the programme within political institutions. Missing from both is a reflection on the articulation between the two levels.

On the one hand, the polycentric approach to regulation in the work of Frey and Brush develops ways to stabilise the various *selection* criteria that govern the behaviour of the actors. The emphasis here is on taking the purposes of the social actors into account in the institutional design. However, as mentioned above, this approach presupposes a mechanism of self-adjustment of the competing actor logics without considering the role of political institutions in the choice and reinforcement of these different mechanisms.

On the other hand, North proposes acting on the level of the mechanisms of *learning* that allow the cultural preferences to evolve in the broader institu-

¹⁷ See the meeting on 2–4 December 2002 of the expert group on “Capacity Building for Equitable Access and Benefit Sharing” of the CBD Secretariat in Montreal (oral communication from one of the delegates).

¹⁸ The notion of social programming refers to a set of writings that can only briefly be described here. The concept is used in the sense developed by Feenberg (1999). He introduces the notion of social programming in relation to the issue of the democratisation of the development of new technologies (Feenberg, 1999, pp. 116–119) and distinguishes three levels of the democratisation process. The first is the level of the strategies of technological innovation; the second refers to the democratic beliefs mobilised by these strategies; while the third level is that of the effective possibilities that allow a connection between strategies and beliefs too often dissociated in practice (taking into account both the possibilities selected and those non-selected by the social context) (Feenberg, 1999, pp. 142–147). It is this third level that is designated by the notion of social programming. In my epistemological critique of regulation mechanisms, the first level refers to the strategic choices of regulation mechanisms; the second to the beliefs mobilised by the new institutional and evolutionary approaches in the selection of the governance mechanisms; and the third to the implementation of the mechanisms at the level of its connection to the goals pursued by the main actors and the content of the main organisations involved in biological diversity conservation (for an application of these notions in other social fields, see for instance Dedeurwaerdere, 2002b; Maesschalck and Loute, 2003).

tional environment which plays a role in the definition of the general interest, so as to account for the interests of the largest possible population. However, North's analysis of learning is based on an *ex post* historical reconstruction of the innovation processes that allowed Western economies to reach their current state of development. His analysis proceeds in a retrospective manner, subordinating the end state of the learning process to a particular state of development encountered in advanced capitalist societies.

The contextual translation of both approaches therefore remains incomplete. More specifically, each approach mobilises resources, whether of learning or adjustment, without constructing the articulation between these resources in an explicit way. Either it is assumed that the relationship is automatic and the learning processes are considered to be a natural consequence of the interaction between the multiple action logics,¹⁹ or it is assumed, in a retrospective manner, that the characteristics of the learning process are already given, by supposing that in the end the learning process is oriented towards the state of a certain type of society. However, in both cases, the resources allowing for this articulation are taken as given. In the first case, it is assumed that the functional resources of self-adjustment in the actors' orientations are given. In the second case, the cooperative resources allowing for learning processes to be orientated in a certain direction are similarly presupposed.

In order to construct a more complete approach, my proposition is to consider a different, reflexive articulation between the learning processes and the action logics. In this reflexive perspective, the stake is not so much to rely on existing capacities, whether they be capacities of self-adjustment or of cooperative learning, but to act on the conditions of emergence of these capacities through appropriate institutional means. If we take into account this new order of conditionality, we must combine the double amelioration proposed by the evolutionary approaches in a different way. On the one hand, the goal of the learning processes considered by North would be not to generalise the conditions of innovation that have allowed a certain type of society to be successful in the past, but to organise a reflexive learning process

enabling the emergence of new representations of the conditions of performance. Such an approach would necessarily consider a variety of action logics beyond those related to the existing state of a certain society. On the other hand, the adjustment process considered by the polycentric approach should also act on the political institutions that enforce a particular interaction among the selection criteria. Instead of considering an independent action on either the learning within a political environment or the selection principles governing the competition among the different social logics, a reflexive understanding of this process develops a joint action on the processes of learning and selection in order to create the conditions for their common transformation.

I can illustrate the consequences of this epistemological critique by considering again the example of the group of biologically rich countries. As we have seen, the emergence of groups of countries that try to elaborate common proposals is an example of a learning process aiming to transform the political environment. However, this learning process is most often interpreted in a restrictive sense, as a means of controlling the existing regime of market exchange, rather than considering other logics. Indeed this group frequently seeks to control the opportunistic practices of bio-piracy (Dutfield, 2000) and increase the negotiating power of Southern countries, thereby allowing them to obtain more favourable conditions within the emerging regime of access and benefit sharing (Mulligan, 1999, pp. 58–59).

Yet this analysis of the learning process remains incomplete, as it does not take into account the actors' reflexivity on a multiplicity of selection criteria. While it envisages a position with respect to the emerging market regime, it does not consider the enabling of learning processes that may reinforce alternative regimes that are based on other social logics. In particular, no analysis is made of the link between the collective learning with regard to the international regime of biodiversity on the one hand, and the social programming of donors (such as USAID or GEF) that are mobilised in the implementation of this regime on the other. For example, as Hufty and Muttenzer (2002) show in their analysis of forest management in Madagascar, promoting incentive mechanisms based on the potential benefits of the marketing of indigenous knowledge or resources is also a way of making local

¹⁹ This is certainly the case for the polycentric approach discussed above.

people bear the cost of biodiversity protection (Hufty and Muttenzer, 2002, p. 304). Moreover, in the case of Madagascar, the targeted actors of forest conservation programmes, who were mainly the forestry developers and the forest administration, refused to engage in a genuine collective learning process with respect to the international biodiversity regime, as this would imply a change in their management practices. Indeed, the programmes for sustainable use allowed them to gain access to complementary financial resources in the name of conservation without having to abandon the non-sustainable forest exploitation practices in which they were involved (Hufty and Muttenzer, 2002, pp. 305–306).

Hufty and Muttenzer's case study demonstrates the gap between the learning process that resulted in a change of norms at the international level (from conservation to benefit-sharing and sustainable use) and the instrumental use of these new norms, which reproduced the social logic of the dominant actors. However, this reading of the process of implementation of international norms in the interests of the programmes of the dominant organisations is also reductionist. It emphasises the logics effectively selected for in the implementation of norms, without envisaging the possibility that the learning process could play a more reflexive role, consisting of capacity building for a variety of logics that play a role in the implementation of norms.

My reflexive criticism thus argues for the importance of an institutional design that combines incentives for learning and the enabling of a number of action logics. To conclude, I will illustrate the implications of this analysis for the specific case of the protection of traditional knowledge related to the use and conservation of natural resources. The field of traditional knowledge is one of the fields where the gap between learning processes at the international level and the social logics of the actors concerned is very wide. That is why it is one of the fields where the creation of reflexive incentives is a key issue.

As a result of the learning processes in several international forums, alternative conceptions of intellectual property have been proposed that aim to take into account the specificity of traditional knowledge. Here I will focus on proposals for liability regimes that have been put forward by authors such as Dutfield (2002), Swanson (1997) and Drahos

(2000). Unlike a property regime, which provides owners with exclusive rights, including the fundamental right to determine the conditions of access to the property at stake, a liability regime is based on the principle of free use of the resource, with the obligation of an ex post payment. In other words, use is authorised without any permit from the rights holders, without however conferring free usage—ex post compensation is still required. Such a system provides certain advantages in countries where most traditional knowledge and techniques are already freely circulating, thereby negating the possibility of claims by the original owners (Dutfield, 2002, pp. 14–15). The regime of ex post compensation is a pragmatic solution that allows for the free use of traditional knowledge and techniques, but which also requires that the original providers or producers of such knowledge and techniques be rewarded.

Some of the most promising proposals for *sui generis* rights have been elaborated in the context of liability regimes. For example the proposals for the creation of a global bio-collecting society (Drahos, 2000), of an international repository for traditional knowledge (Swanson, 1997, pp. 168–170), or a private collective management institution to monitor the use of traditional knowledge, issue licenses to users and distribute fees to right holders (Dutfield, 2002, pp. 31–32) are all types of ex post rewards system in a liability regime.

Among these proposals, several efforts are already underway to develop reflexive mechanisms in the implementation of liability regimes. For example, Dutfield, in his proposal, mentions the importance of integrating this concern in the institutional design. He writes: “While such organisations have the potential to reduce transaction and enforcement costs, considerations of economic efficiency should not be the only criteria for designing an effective and appropriate *sui generis* system. Traditional knowledge holders and communities will be its users and beneficiaries. They will not be interested in a system that does not accommodate their world views and customs but rather imposes other norms with which they feel uncomfortable and wish to have no part of. Clearly, traditional knowledge holders and communities must be partners in the development of the *sui generis* system to avoid the development of an inappropriate and unworkable system” (Dutfield, 2002, p. 32).

Peter Drahos, in his proposal for a Global Bio-collecting Society is even more explicit on the way that the reflexivity of the concerned actors on the new institutional mechanisms could be organised. The Bio-collecting Society projected by Drahos would act as an office for the notification of community registries of traditional knowledge, facilitating the dialogue between the communities and third parties, each time a third party consults the GBS concerning the notification of such a registry. Such collecting societies already exist in the field of copyright, aiming at defending the interests of property right owners through the creation of registries of existing copyright and existing users' licenses. However, the GBS would be organised in more reflexive way than the copyright organisations, allowing the different parties to evaluate whether the operation of the institution satisfies in practice the objectives specified in theory in the Convention on Biological Diversity (Drahos, 2000, p. 248). Moreover, the GBS may offer local communities assistance in negotiation—balancing the asymmetry in the parties' legal resources—and play a role in alternative dispute resolution through a tripartite process involving representatives from the industry, the indigenous communities and the governments.

Finally, Timothy Swanson's proposal considers an extension of the traditional IPR system through a rights registration mechanism that would award rights in product markets to those states or communities successfully investing in the retention of diverse natural resource stocks (Swanson, 1997, p. 169).²⁰ These property rights could then be licensed to other users by the owner of the rights. The operation of the registration mechanism would require the creation of some sort of centralised office that would have a double responsibility in determining the scope of the rights afforded by the registration: (1) whether a proposed

biodiversity reserve would qualify for inclusion in the regime; and (2) which potentially useful life forms and what characteristics of the life forms in the reserve (chemical, genetic, entire organism) should be the subject of exclusive rights (Swanson, 1995, p. 172). The determination of the first issue depends on the perceived usefulness of the natural habitat being conserved and the second on the scope of the rights that are required to generate a reasonable return on the investment. The functioning of the regime thus depends on the deliberative processes in the centralised office that allow for a balance between these two goals.

5. Conclusion

The aim of this article was to evaluate the contribution of the new institutional and evolutionary proposals in economics to the problem of the institutional framing of bioprospecting contracts. This evaluation has allowed us to conclude that a double amelioration in line with the proposals developed by the evolutionary approaches (see Fig. 2) is necessary. This indicates the need to both take into account the variety of preferences determining the choice of the actors, and to consider the interaction between the political environment and the economic coordination structures. More profoundly, as we have seen, this double amelioration indicates the necessity of completing the mechanism of choice of the governance structures proposed by new institutional economics with a means of connecting these mechanisms to the content of the social programming in the organisational environment. In this respect, this analysis confirms the insufficiency of the current forms of regulation and the necessity to evolve towards more reflexive forms of governance.

The result of this analysis is to define more precisely the conditions of such a reflexive approach to governance in the context of the problem of the emergent regime on access and benefit sharing. In particular, the analysis has shown the necessity of linking the processes of learning and the enabling of a variety of action logics in the implementation of the proposed institutional mechanisms. Such a joint action should allow the effective linking of these mechanisms to the social programming in organisations advocating biodiversity conservation. The implications of this reflexive criticism were highlighted through examples

²⁰ In this manner, the IPR regime would enable a variety of different paths of development to be established. As Swanson writes: "At present, a developing country that wishes to capture the informational value of its diverse resources must become fully integrated vertically (from conservator through to developer) because the exclusive rights do not attach before the final consumer product is developed. The idea of establishing a new level for the registration of property rights in genetic resources is to allow developing countries to specialise in the conservation of genetic resources without the necessity of proceeding to the development of the final consumer product (Swanson, 1997, p. 170).

From Bioprospecting to Reflexive Governance

	Assumptions	Role of institutions	Example of institutional framing cited in the ABS regime
New institutional economics	Bounded rationality and opportunistic behaviour Preferences are given and known Alignment of the economic coordination structures to the transaction situation	Optimisation of transaction costs through the (<i>ex ante</i>) definition of property rights and (<i>ex post</i>) supervisory mechanisms ensuring cooperative behaviour	<i>Ex post</i> verification of the contractual transaction through : disclosure of origin or certification of origin
Evolutionary economics	Bounded rationality and opportunistic behaviour. Evolving distribution of preferences Co-determination of political environment and economic coordination structures	Sustaining the dynamics of innovation and adaptation through learning and the enabling of a number of action logics	Evaluation procedures in traditional knowledge registries

Fig. 2. Methodological assumptions and institutional consequences of new institutional and evolutionary economics in the field of access and benefit sharing (ABS).

of sui generis conceptions of intellectual property rights for traditional knowledge protection.

Beyond the condition of joint action, however, a question remains. It is still unclear whether the practical realisation of this condition can assume the existence of capacities for reflexive learning of the actors and organisations or whether those capacities need to be reinforced through appropriate institutional means. This supplementary question will be the subject of further work on organisational learning in the political science literature.²¹

²¹ The case of the IUCN (International Union for the Conservation of Nature/World Conservation Union) reveals this insufficiency. The social policy program, launched by the permanent secretariat within the perspective of organisational learning in 1992, was suspended by the same secretariat in 1998 despite a resolution on co-management adopted by the General Assembly in 1996 and the success of the program. In fact, the broadening of the organisation's objectives, allowing it to consider social policy issues, was not able to anticipate a change in the global orientation of environmental conservation programmes at the international level. This change increased the dependency of the IUCN on major donors and the adoption of a project-funding logic that was not compatible with the broadening of the organisation's objectives promoted by the member organisations (see McDonald, 2003, pp. 15–20).

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