

# **Non-coordinated Cooperation – A Framework for the Analysis of Decision-making processes in International Regimes and their impacts on International Biodiversity Policy**

**Stefan Jungcurt**

First Draft

(please don't quote)

Stefan Jungcurt  
Humboldt University, Berlin  
Department of Resource Economics  
Luisenstr. 56, 10099 Berlin, Germany  
Contact: [stefan.jungcurt@agrar.hu-berlin.de](mailto:stefan.jungcurt@agrar.hu-berlin.de)

Contents

- 1 Introduction ..... 3
- 2 Overlapping Agreements on PGRFA ..... 4
  - The need for international Regulation ..... 4
  - A lack of integration..... 6
- 3 Explaining the coordination of international cooperation..... 8
  - International Relations and Regime Theory ..... 9
  - Economic Theories of International Cooperation..... 11
  - Different uses of game theory..... 11
- 4 International Negotiations as nested games..... 12
  - The Metaphor of two-level games..... 12
  - Nested Games ..... 14
  - Applying the framework..... 18
  - Embedding the framework..... 19
- 5 Summary ..... 19
- References* ..... 20

## 1 Introduction

The debate about adequate approaches to the conservation and use of Plant Genetic Resources (PGR) has been characterized by a number of multilateral conflicts, arising over the rights of users and providers of genetic resources and related knowledge for biotechnological innovations. The most observed types of these are cases in which innovations have been patented and commercially exploited without the consent or an agreed compensation of the providers of PGR and related knowledge. Such cases of "biopiracy" like the neem patents (Shiva, 1997; Utkarsh et al., 1999; Gadgil and Utkarsh, 1999) or the basmati rice case (Prakash, 2000) have been subject to an ongoing debate about international legislation on PGR conservation and use. Other examples of conflicts in the same area are cases like the species-wide patent on soybeans of Monsanto. Contrary to expectations the patent has been confirmed by the EU patent office, while it was revoked in the US where it was initially granted (ETC- Group May 7<sup>th</sup> 2003).

What these cases of biopiracy and other disputed legal protection on biotechnological innovations on the basis of genetic information show is that many aspects of the property rights and entitlements of providers and users of PGR are currently not clearly defined by the international system. The classification of these conflicts as "biopiracy" indicates that the providers of genetic resources feel unfairly treated respect to the distribution of the benefits arising out of PGR use and the cost of providing or conserving PGR in order to make them available for research and development. Conflicts in this field are not only of an international nature. A recent discussion of Brazil's "biopiracy" law and its negative impacts on the Brazilian biotechnology sector (SciDevNet 2003)<sup>1</sup> is a showcase of the dilemma that many countries may face when they are trying to meet their different priorities in conservation and use of PGR through the implementation of adequate legislation.

The central argument of this paper is that these different types of problems and conflicts observed can be interpreted as symptoms of overlapping regulation through different multilateral agreements with differing objectives, priorities and competencies. The uncoordinated co-existence of these different agreements causes costs of conflicts and complexities in the process of implementation. These costs diminish the gains from cooperation that are the general objective of international cooperation. The history of the cases presented above shows that these costs can be substantial in specific cases as well as in the general process of implementation. In this context the coordination between international agreements and the clarification of the relationship of their provisions becomes a relevant question of the effectiveness and efficiency of the international system. Therefore it is useful to study the development of relationships among multilateral agreements with overlapping provisions and

1

---

<sup>1</sup> *Brazil's biopiracy laws 'are stifling research'* ([www.SciDev.net](http://www.SciDev.net), July 21<sup>st</sup>, 2003) [RECIFE] Brazilian scientists are urging the government to modify laws that have been introduced to reduce biopiracy, in order to give them more freedom to collect and analyze biological material for research purposes. [...] The motion calls for the government to grant 'permanent licenses' to scientists and research students to allow them to investigate biodiversity. Its aim is to end the way in which current regulations, many scientists argue, hinder their ability to work with animals, plants, micro-organisms and ecosystems. [...]

competencies. Such research can provide a basis for the understanding of these situations of uncoordinated international cooperation. The identification and comparison of cases of successful and unsuccessful coordination can yield insights in the conditions under which a more efficient international regulation is likely to emerge and how costs of conflict and complexity can be reduced.

This paper pursues two objectives. First the case of international regulation of the conservation and use for Plant Genetic Resources for Food and Agriculture is presented as an exemplary case of overlapping regulation through several international agreements and some of the initiatives and processes intending to achieve coordination are presented in section 2. Second, an analytical framework is presented for a systematic analysis of such decisions affecting coordination among agreements. Section 3 develops an institutional economics perspective on the problem of international cooperation and presents a brief review of commonly used theories of international cooperation. Section 4 develops the framework based on Putnam's *two-level-games* (Putnam 1989) and the *Nested Games* framework of Tsebelis (1990)

## **2 Overlapping Agreements on PGRFA**

### *The need for international Regulation*

Plant Genetic Resources for Food and Agriculture are an especially relevant part of PGR, as they constitute the basis for advances in plant breeding and are thus an essential resource for agricultural production and food security. They are a source of genetically encoded characteristics (Virchow, 1998) that can be transferred into other plant varieties in order to achieve the necessary adaptations to an ever changing production environment (Swanson and Goeschl, 2000). Most of the currently known PGRFA are conserved and made available for research and development through an international network of gene banks. This global pool however, is diminishing as the use of genetic information depreciates its value over time (Swanson and Goeschl, 1998) and even the best conservation technologies cannot prevent the loss of genetic materials from gene banks in the long run. This loss can only be compensated through complementary measures of in-situ conservation – the conservation of living and dynamically developing populations of plant varieties “on-field” (Berthaud, 1997; Brush, 2000).

Such a dynamic development is currently only possible in the traditionally dynamic agro-ecosystems in the rural areas of poor countries where they are subject to strong pressures for transformation. Economic development and the continuing integration of the rural economy into consumer and supply markets lead to a transformation of land-use patterns, leading to intensified but genetically impoverished production systems (see for example: Brush et al., 1992). This transformation process aggravates the problem of genetic erosion on a global scale and threatens the long-term supply of PGRFA (Swanson, 1996; Swanson and Goeschl, 2000).

Parallel to this development there has been a substantial reorganization of the plant breeding industry in most industrialized countries over the last decades. The formerly public national breeding systems have developed into a highly concentrated and globalized private industry where a few multinational

companies control large shares of the international seed markets. This new situation has been responsible for a sharp increase in the demand for international transactions of PGRFA (Heisey et al., 2002; Pray, 2002).

These parallel processes have led to an increasing demand for international regulation of transactions affecting the conservation, provision and use of PGRFA. On one side are the interests of industrialized countries that, while possessing the technology for plant breeding, have become more and more dependent on PGRFA supplies from the traditional farming systems of non-industrialized countries (Swanson, 1996). The latter countries however, who do not possess the technology to exploit their genetic resource base, have little incentives to invest in the conservation of PGRFA as long as no international mechanism exists that would channel adequate incentives to the providers of PGRFA. Therefore the demand for regulation expands over access and transfer of PGRFA as well as the responsibilities for conservation measures to ensure their long-term availability. On the other side the supplying countries demand regulation that enables them to internalize a part of the value of PGRFA through an entitlement to benefit sharing, and to achieve an even distribution of the cost of conservation through compensatory measures. International agreements seek to respond to these demands through an adjustment of the property rights and entitlements relating to the conservation, transfer and use of PGRFA and the establishment of governance structures for their enforcement.

It has been argued, that the development of an international market for PGRFA would satisfy the demands on both sides. However, the development of such a market is unlikely because PGRFA have several properties that make it difficult to create the necessary property and governance structures. The essential problem is that PGRFA have the character of an information good. Once the information is decoded it is difficult and costly to exclude its unauthorized use. The self-reproducing character of seed materials aggravates the exclusion problem (Janssen, 1999; Lerch, 1996; Morris and Smale, 1997; Sedjo and Simpson, 1995). These and other characteristics of PGRFA have important consequences for the establishment of a property rights structure that supports a sustainable management through an internationally coordinated system of institutions .

The development of international agreements on PGRFA conservation and use reflects these two aspects of the demand for international regulation. Over the last decade two groups of agreements have emerged with a focus on supply related and demand related concerns respectively (Dutfield, 1999)<sup>2</sup>. The most relevant supply-related agreements are the *Convention on Biological Diversity (CBD)* and the recently adopted *International Treaty on Plant Genetic Resources in Food and Agriculture (ITPGRFA)*. The latter has been negotiated under the auspices of the FAO and is currently in the process of ratification. It provides for the establishment of a multilateral system for access to and the use of PGRFA. The system entails an obligation for the users to pay accession fees and royalties into a multilateral fund, which is to be used to compensate farmers for their contributions to the

1 \_\_\_\_\_

<sup>2</sup>An alternative way to differentiate these two groups would be according to their focus on genetic resource protection and new knowledge protection (Virchow, 1999)

development of PGRFA (farmers' rights) and for investments in conservation measures. The ITPGRFA emphasizes the importance of PGRFA conservation for global food security and the role of the suppliers of PGRFA (Cooper, 2002).

The CBD has been created in reaction to the Conference of Rio in 1992 in order to develop and implement a global program to combat the loss of biodiversity. The CBD recognizes the sovereign rights of states over their own genetic resources and stresses their responsibility to conserve and sustainably use this resource base. States are encouraged to develop their own legislation for the management of PGRFA according to the principles of sustainable conservation and use, fair and equitable benefit sharing and the prior informed consent of the holders of PGRFA when their resources are to be used for research and development. CBD and ITPGRFA both stress the rights of the suppliers of PGRFA and entitle states to develop legislation for the protection of these rights

On the demand-related side there are several agreements addressing the interests and rights of plant breeders as predominant users of PGRFA. Most of the provisions aim at the establishment and the harmonization of legal systems for the protection of new knowledge related to plant varieties and other biotechnological innovations in agriculture through the establishment and enforcement of intellectual property rights. The intention is to solve the exclusion problem that such knowledge-based innovations are faced with, in order to generate and secure benefit streams towards the innovators, which should serve as incentives for investments into research and development (Janssen, 1999; 1997 ;Swanson and Goeschl, 2000). The Agreement on the *Trade Related Aspects of Intellectual Property Rights* (TRIPS) of the WTO has become the leading agreement in this ambit. It is complemented by the provisions of the *International Union for the Protection of new Varieties of Plants* (UPOV), which lays out more specific requirements for the development of Plant Variety Protection laws. As third organization the *World Intellectual Property Organization* (WIPO) influences the development of international regulation. Since the signing of an of a cooperation agreement between the WTO and WIPO in 1995, WIPO has played mainly a role as counseling agency and forum for developing countries without major influence on the ongoing negotiations.

The property rights and entitlements over access, transfer and use of PGRFA lie in the overlap between these two groups of agreements. Changes in the PR structure initiated by either side will have impacts on the options for effective regulation on the other. The objectives of the different conventions are interdependent and may in some cases be negatively related in the sense that increasing the gains from cooperation on one side (e.g. through stronger IPR regulation) may diminish the gains with respect to the objectives of the other (e.g. by stronger farmers rights).

[... section on essential areas of controversy to be added]

#### *A lack of integration*

So far the development of international regulation on PGRFA management has been marked by the parallel appearance of these two groups of international agreements with their different foci on supply and demand-related aspects. In the course of this development there has been much controversy about the relationship between the agreements and the options for a coherent implementation of their

provisions. It became increasingly obvious that the joint implementation of provisions will be a difficult task to countries that are parties to one or several agreements of each side (Leskien and Flitner 1997; Löffler, 2001)

Within each of the two groups, some steps towards integration and cooperation could be observed in the past. The most extensive harmonization took place between the CBD and the FAO's International Treaty. In this case the provisions of the ITPGRFA were brought in line with those of the CBD before its adoption in November 2001. The text includes many references to the relationship with CBD provisions and guidance for future cooperation and coordination (FAO 2001: Articles 1, 15, 17, 19, and 20 of the International Treaty). On the side of the CBD the relationship with the International Treaty is reflected in Decision VI/6 (CBD 2002) of the Conference of the Parties.

On the side of the demand-related organizations there have been two very different developments that led to a clarification of the relation between the negotiating bodies of the agreements. In 1995/96, an agreement was signed between the WTO and WIPO, in order to establish *appropriate arrangements between them* (WTO, 1996). With this agreement most of the responsibilities for negotiation, implementation and monitoring of IP-related issues was transferred to the WTO in an effort to create a spanning legal agreement for the various conventions that had been administered by WIPO before. In the area of PGRFA, WIPOs activities focused on technical assistance and informal meetings. But still WIPO continues to be the negotiating body for the establishment of a World Patent System. In the course of these negotiations the essential issues of controversy relating to PGRFA were brought up and they currently represent the most difficult challenge in the negotiating process.

The relation between UPOV and TRIPS has developed in a less spectacular way. The revision of the initial UPOV agreement of 1978 had already been concluded with the adoption of a revised treaty in 1991. The '91 version entails a strengthening of Plant Breeders' Rights and a limitation of the scope of Farmers Rights. In the discussion about options for implementing the TRIPS agreement the TRIPS council has made reference to UPOV '91 as an appropriate option for the implementation of TRIPS. Under UPOV '78 the provisions for Plant Breeders Rights were still considered to be *not incompatible with farmers rights* on the side of the FAO (FAO Resolution 4/89). This however is not the case under UPOV '91 (Leskien and Flitner, 1997).

These developments show, that the main problem of coordination lies between the two groups of agreements. Despite the ongoing debate, whether or not the provisions of the two sides are actually in legal conflict with each other, the question if they have a mutually negative impact on the achievement of their objectives is raised. The past development shows, that the regimes within each group are becoming more and more aligned, while the divergence between the groups seems to have increased. This is particularly obvious if we consider that there have repeatedly been initiatives on both sides to increase the coherence of the regimes<sup>3</sup>, which have not lead to any substantial changes so far.

1 \_\_\_\_\_

<sup>3</sup> For example the CBD has repeatedly applied to be granted observer status at different committees of the WTO, which have always been turned down; developing country groups have asked for the inclusion of supply-related

What is puzzling about this evolution is that the structure of the problem and the asymmetric endowments of most of the participating countries give rise to the expectation that much greater gains from cooperation could be achieved if an integrated solution was realized. A group of technology rich but resource poor countries (most industrialized countries) is faced by a group of technology-poor but resource-rich countries (most developing countries). Most theoretic approaches to the analysis of international cooperation would predict that such asymmetric endowments would provide a chance for the negotiation and implementation of mutually beneficial agreements, solving jointly supply- and demand-related concerns. [to be reviewed]

### **3 Explaining the coordination of international cooperation**

This section briefly reviews the most commonly applied approaches to the explanation of the existence and the development of international cooperation: Regime Theory (RT) and the Economic Theories of International Environmental Cooperation (ECTIEC). The objective is to derive some corner stones for the development of the analytical framework presented in section four. As mentioned above, this paper adopts the view of international agreements as institutions. Therefore it will be helpful to devise some terms and viewpoints in order to set the frame for the analysis.

The focus of institutional economics is on the formal and informal rules that guide and restrict human interactions. At the core of these interactions are transactions of goods and resources that are realized between different Actors within a given institutional environment. The rules are part of the institutional environment. They may be changeable (subject to higher order rules) or unchangeable, formal or informal. In this conception international agreements have two objectives. First, they seek to guide and restrict interactions among states or other international actors (NGO, industry etc.) through the enforcement of rules that are negotiated on a consensual basis among states. Richter and Furubotn view international relations as a market for political transactions that is comparable to economic or political markets in a domestic environment. In a competitive global environment states that are subject to their own bounded rationality and opportunistic behavior of their competitors, seek to build coalitions and strategic partnerships in order to reduce competitive uncertainty (Richter and Furubotn, 1996).

The second objective of international agreements can be seen in guiding and restricting national level interactions that have an unintended impact on the well being of other states (negative externalities such as the emissions of pollutants), or to set incentives and rules for the coordination of states behavior in order to provide a global public good (i.e. to ensure the sustainable management of the global pool of PGRFA). In both cases the rules for interaction are subject of international agreements (Conventions Treaties and Protocols) that are reached through negotiations and become legally

---

1

provisions into TRIPS without success. Another example is the current debate under the WTO Doha-agenda on the trade-specific obligations of multilateral environmental agreements.



binding to those states that officially ratify the text. The rights and responsibilities of states that have ratified are laid out in the text (substantive aspects), as well as their options for changing the agreement (procedural aspects) and objectives for future development of the agreement (symbolic aspects see Congleton, 2001)<sup>4</sup>. The conflicts and complexities that were described in section one stem from incoherence or even contradictions in the substantial provisions of overlapping agreements. In view of the process of development of international agreements the analysis and explanation of the origin of such incoherence implies two questions:

First, in order to explain the relationship and lack of coordination among international agreements, it is necessary to study the development of the individual agreements and the interactions between them. How is coordination organized, and how do the secretariats communicate and most importantly, how do the negotiating bodies address issues of incoherence. Secondly the behavior of states and their negotiators need to be studied. Most countries are parties to agreements from both sides. Are the negotiators aware of the potential conflicts and incoherence among the provisions they negotiate? Are these problems reflected in the decision-making processes on the domestic level where the mandate of the negotiators are determined? Addressing these questions requires a framework that relates the impact of interactions among agreements (on the international level) to interactions between the international and domestic processes of decision making (domestic-international interactions).

### *International Relations and Regime Theory*

In the study of international relations in political sciences the systemic concept has for a long time dominated the development of theories that seek to explain the emergence of interstate relationships and to study the determinants of international stability and cooperation. For the study of international environmental agreements the concept of Regime Theory (Krasner, 1991) has become one of the most successful approaches currently applied (Gehring 1994; Neumayer, 2001; Henne, 1997) . Regimes are understood as issue-specific systems of norms that consist of formal and informal international arrangements (Gering and Oberthür, 1997). As such they represent a forum for bargaining and information exchange, for the development of rules and norms and for the solution of environmental conflicts. The central actors of a regime are states that take rational decisions in order to maximize power or wealth. The factors determining the behavior of the individual state origin in the regime structure (e.g. issue specific power relations, relative orientations for action, reputation etc).

Next to Regime Theory many other approaches to the study of international relations exist in the field of political sciences. The great majority of these approaches, apply systemic theory to their analysis. The development of such explanations in international relations has been accompanied by an extensive debate about the specific insights that can be expected from the analysis of different

1

---

<sup>4</sup> Congleton differentiates *stages in treaty making* that have different types of agreements as outcomes. Over time the character of the agreements changes from symbolic to procedural and then to substantive. Congleton notes that treaties are unlikely to be of a pure nature, but that elements of all types can be found in all agreements. However it can be noted that conventions tend to be more procedural in their nature while protocols will be more substantial. (Compare also Barrett, 1998).

systemic levels (individual, state and international system) and in what ways the different levels influence each other (Walz, 1959; Singer, 1961). The debate has differentiated between two alternative viewpoints. One being that the structure of the international system alone determinates states behavior in foreign policies, while the other claims that *states behavior does not respond to the international system it constitutes it* (Moravcsik, 1993). The latter position favors domestic explanations for the development of interstate relationships while the former is restricted to international factors. The separation of *international* from *domestic* explanations is characteristic for international relations theories, not least due to the widely accepted recommendation that analysts should stick to a single level of analysis (Singer, 1961). This has led to a dominance of *international* explanations in international relations theories. For the purpose of systemic analysis the domestic level determinants are treated as constants. In order to allow for pure systemic analysis it is assumed that (1) states are unitary actors that respond to external incentives (2) states have stable and broadly similar domestic preferences (3) states have stable and broadly similar decision making procedures and (4) states have stable and broadly similar abilities to extract resources from society. These assumptions are very restrictive, which causes the problem that...

*...pure international theories, while attractive in principle, tend to degenerate under the collective weight of empirical anomalies and theoretical limitations into explanations that include domestic factors. (Moravcsik, 1993, p.6)*

Domestic variables are introduced by relaxing any of the fundamental constraints in order to account for "residual variance" in the explanations of international systemic theory. Such a practice however,

*...tends to encourage ad hoc interpretations rather than explicit theories about the interaction between domestic and international politics. [...] the analyst is left without guidance about which domestic influences to emphasize (Moravcsik, 1993, p.14)*

The limitation of systemic theory to international explanations has thus prevented the development of a systematic approach for the study of the relationship between domestic decision-making and international politics. Yet, such a systematic approach is needed if the study of international cooperation is to be able to differentiate between actors with different characteristics such as different endowments or differing institutional structures of the negotiating states. A framework for the study of international cooperation needs to take into account that countries may have differing preferences, that these preferences are influenced by their affectedness by the problem and that they may change over time. Furthermore it is important to acknowledge that preferences are expressed through the domestic institutions of politics and decision-making. These may or may not adequately represent the interests of the majority of the population, depending on the relative power of different interest groups (Putnam, 1988; Fredriksson and Gaston, 2000; Michaelowa, 1998). This level-of-analysis problem limits the explanatory power of systemic theory and so far there have been only few efforts to overcome this problem. An additional problem lies in the concentration of the analysis on individual regimes. The conception of issue-specific relations among states makes it difficult to account for overlaps and interferences with other regimes.

### *Economic Theories of International Cooperation*

In Economics the analysis of international cooperation has focused primarily on the study of the conditions and determinants of *self-enforcing* and *re-negotiation-proof* agreements (see Barrett, 1999; Helm, 2000; Neumayer, 2001). These conditions are derived from the characterization of international cooperation as *cooperation under anarchy* (Oye, 1986) referring to the lack of an enforcing supra-national agency. Just as regime analysis, economic theories refer to game theory to derive its conclusions, with the difference that economists seek to develop theoretically sound and empirically testable models of state behavior, relying on broadly similar fundamental assumptions as regime analysis does<sup>5</sup>. Under these assumptions it is analyzed how problems of free-riding, voluntary and involuntary defection and leakage effects can be overcome. In extensions, the models can be used to investigate conditions such as fair burden sharing, scientific uncertainty and dynamic and iterated interactions (Helm, 2000). The application of game theoretical modeling has led to fruitful and enlightening results about many phenomena of international cooperation including a theoretically sound assessment under which conditions it is likely to emerge. The phenomenon of multiple regimes that resist to integration against the expectation that gains from cooperation could be achieved is difficult to model under the fundamental assumptions. Like regime theory, economic theories face level of analysis problem as they cannot systematically account for variances in domestic factors.

### *Different uses of game theory*

The discussion of regime theory and economic theories of international cooperation points towards another issue that, next to the level-of analysis problem will have to be addressed in the discussion of the framework. The application of game theory is fundamentally different. Regime theory uses game theory as *heuristic concept* or as *metaphor* while economists seek to develop complete *theoretical models* of interstate relationships. Snidal (1986) describes the differences in using game theory as metaphor – establishing correspondences between the international political system and firms in an oligopolistic market - and as theory – developing a deductive structure plus an interpretation of fundamental assumptions and theoretical constructs that provides for a greater richness of explanation. He argues that the metaphorical use of game theory restricts its explanatory power to descriptive rather than analytical uses:

*Too many “applications” of game theory have merely been in the spirit of sorting out whether the Cuban missile crisis was really a Chicken or a Prisoners’ Dilemma. Such usage may be helpful for reconstructing and interpreting particular events, but it misinterprets the primary value of game theory as that of redescribing the world, and is therefore limited as a test of game theory. It would be a more appropriate test of deductive theory to investigate the empirical correctness of its analytical predictions. This requires giving empirical content through its assumptions (Snidal, 1986, p.26)*

1 \_\_\_\_\_

<sup>5</sup> States are assumed to be unitary, utility maximizing actors that decide rationally, taking into account all available information. All aspects of costs and benefits are assumed to be represented in a utility function, such that the actors are faced with a well-specified payoff matrix. Therefore the achievement of mutual gains are the general driving force of cooperation (Neumayer, 2001).

In this view, Economic Theories of International Cooperation meet the demand to make assumptions about the key elements of game theoretical explanations (actors, rules, payoffs, timeliness). But from a reversed angle they restrict the usefulness of game models as heuristic guideline to stimulate exploration and discovery in the search for explanations. At the same time the assumptions that are made define and restrict the range from which explanatory variables can be chosen. At the current state of the art most scholars stick to the assumption of the state as self-interested actor, but as Snidal points out:

*While it necessarily treats actors as rational, its empirical assumptions need assert neither that the key actors are states nor that they maximize power. (Snidal, 1986, p.35)*

This means that attempting to solve the level of analysis problem does not necessarily imply that a use of game theory has to be restricted to metaphorical uses. However, taking the complexity of the interactions into account, it has to be carefully evaluated what level of theoretical rigor can be expected from an approach that alters the fundamental assumptions of the theoretical framework for the application and interpretation of game theory as *theory* of international cooperation.

To summarize, an approach that would allow to systematically evaluate the interactions between domestic and international levels of decision making faces the challenge of the level-of-analysis problem. The concept of issue-specificity makes it difficult to explore the issue using regime theory and the complexity of the interactions that need to be studied make it unlikely that sound modeling will be feasible. The following section suggests an analytical framework that addresses these challenges and discusses some aspects of how the framework could be applied to the case of non-coordinated regulation in the case of PGRFA.

#### **4 International Negotiations as nested games**

*The Metaphor of two-level games*

Putnam in his *logic of two-level games* (Putnam, 1988) argues that the behavior of states can only be explained systematically, if the interactions between the institutions of international and domestic policy making and their decision making procedures are properly accounted for.

*The politics of many international negotiations can be conceived as a two-level game. At the national level, domestic groups pursue their interests by pressuring the government to adopt favorable policies and politicians seek power by constructing coalitions among those groups. At the international level, national governments seek to maximize their own ability to satisfy domestic pressures, while minimizing the adverse consequences of foreign developments (Putnam, 1988, p.436)*

Putnam views the negotiating statesman as an individual who seeks to maximize his payoffs in two simultaneous and interdependent games on the national and international level. The payoffs of the statesman are determined by the effects of a given decision on the politicians' domestic power, the effect on the realization of the states' interests on the international level and by the realization of

private preferences of the statesman. The set of feasible decisions that the statesman can negotiate is constrained on two sides. On the domestic level the set is restricted to the options the constituency will ratify. On the international side the statesman must bargain with his opponents for solutions that lie in the overlap of his own and his opponents' domestic feasibility sets. This region of overlap – the set of negotiable and ratifiable solutions – is called *win-set*. Within the win-set the statesman possesses “partial autonomy” to negotiate. The win-set is the central conception to understanding the behavior of the negotiator and to explain the outcomes of international negotiations through an analysis of domestic and international factors and their interactions. Putnam mentions three sets of factors (Putnam, 1988, pp.443)

- *The distribution of power, preferences and possible coalitions among Level II (domestic level) constituents.* The size of the domestic win set generally depends on the cost of no-agreement (the benefit foregone of maintaining the status quo) of those groups and coalitions that support the statesman (political parties, labor unions, environmental associations etc.). The lower their cost of no-agreement, the more skeptical will they be about international solutions and thus, the smaller will be the win-set of the negotiator
- *The size of the win set depends on the Level II political Institutions.* These are primarily the domestic ratification procedures and institutional factors that increase or decrease the likeliness of ratification. The win-set is smaller if the majority necessary for ratification is weaker (a simple majority requires less support than a two-thirds majority). Other factors such as coalition or single party governments, political discipline within the governing party, or the general autonomy of the government from domestic pressures affect the win set as well
- *The size of the win-set depends on the Strategies of the Level I negotiator.* If a negotiator has a large win set it will be easy conclude an agreement, but the bargaining position is stronger if the win set is small<sup>6</sup>. Therefore the negotiator has interest in applying strategies to influence the own or the opponents win set, such as increasing the popularity of the opponent at home, international side payments or the choice of the chief negotiator (A head of state has an easier stand in achieving ratification and signals a certain degree of national commitment)

Putnam's framework includes further notions on bargaining tactics and uncertainty problems affecting the negotiator that go beyond the scope of this paper. It can be noted that the two level games approach allows to focus on the interactions between national and international politics and that it assigns a central importance to the political economy of domestic level decision making. Furthermore it differs from regime theory and economic theories of international cooperation in the emphasis that it

1

<sup>6</sup> This is due to the lower risk of involuntary defection. A large win set implies high costs of no-agreement to the domestic constituency making it unlikely that the state defects. A small win set on the other hand, increases the risk of involuntary defection (which is beyond the control of the negotiator). This may either lead to an increased willingness of the other side to concede in order to “save the negotiations”, or – if the majority of the win sets are small – to the abortion of negotiations (see Moravcsik, 1993; Putnam, 1988)

puts on the statesman as central strategic actor (Moravcsik, 1993)<sup>7</sup>. It thereby offers a possibility to solve the level-of-analysis problem and to systematically explore the interdependent and dynamic relationship between different levels of decision-making. Using the metaphor as heuristic guideline it can lead to the formulation and testing of further hypotheses in course of research. However, two problems remain:

- The explicit design of the framework to analyze domestic–international interactions does not allow for the analysis of interdependencies among negotiations in different organizations
- The metaphorical use of game theory restricts its application to explorative discovery and the descriptive study of domestic–international interactions, rather than serving as an analytical tool.

### *Nested Games*

To a certain extent these problems can be addressed with the more generally structured *Nested Games* framework of Tsebelis (1990):

The intention of the nested Games framework is to *provide an empirically accurate, and theoretically coherent account of apparently sub-optimal choices* (Tsebelis, 1990, p.1). Apparently sub-optimal choices are cases where an actor, confronted with a series of choices, does not pick the alternative that appears to be best. Such behavior can be puzzling because it seems to violate the (implicitly or explicitly made) assumption that actors are rational and seek to make choices that maximize their benefits. Contrary to many scholars who argue that the rationality assumption is inadequate or should be at least relaxed to certain degree to allow for the assumption of bounded rationality (as in institutional economics), Tsebelis argues that cases of apparently sub-optimal choice *are in fact cases of disagreement between the actor and the observer* (Tsebelis, 1990, p.7). If the rationality assumption is maintained, there are only two possible reasons for sub-optimal choices. One would be an error of the actor. In this case the ex-post evaluation reveals that the actor has not taken – or was not able to take – all consequences of her choice into account. Such errors could be consistently explained under the assumption of bounded rationality. The second possibility is that the perspective of the observer was incomplete. That is: there is substantial disagreement between the actor's optimal choice in reality and the observers' perception of this choice. The reason for this being that...

*The observer focuses attention on only one game, but the actor is involved in a whole network of games – what I call **Nested Games**. What appears sub-optimal from the perspective of only one game is in fact optimal when the whole network of games is considered* (Tsebelis, 1990, p.7)

1 \_\_\_\_\_

<sup>7</sup> Moravcsik (1993) discusses two further departures from previous theory: (1) As a theory of bargaining it allows to consider not only the constraints that are caused by the patterns of independence, but also the new possibilities that can emerge through *creative statecraft* (Moravcsik, 1993, p.16). (2) *The statesman's strategies reflect "double edged" calculation of constraints and opportunities on both domestic and international boards. The two-level games approach recognizes that domestic policies can be used to affect outcomes of international bargaining, and that international moves may be solely aimed at achieving domestic goals* (Moravcsik, 1993, p.17)

Such an approach allows broadening the perspective of the observer to better understand the rationality of an actor's choice. Tsebelis conceptualizes two types of nested games: Games multiple arenas and games in institutional design

- **Games in multiple arenas** are games in which the *payoffs* in one game (the principal arena – the arena that attracts the observers attention) are contingent on the actors' choice in another arena. In this case the observer may not be aware that the actor is maximizing benefits over several games. Games in multiple arenas are games with variable payoffs. The game is played in the principal arena, and the variations of the payoffs in this arena are determined by events in one or more other arenas. Games in multiple arenas provide a tool to take the *contextual factors* of a decision into account.
- **Games in institutional design** are games in which the *rules of the game* are contingent on the actors' choice in another arena. Here the actor is involved in a higher order game where choices between different games (different sets of rules in the principal arena) can be made. The rules of the game are variable and the actor may be able to choose a previously unavailable option. Games in institutional design provide a tool to interpret *institutional change* as conscious planning by the actors involved.

The advantage of the framework is, that it allows to differentiate between contextual factors influencing decisions and processes of institutional change. The conception of conscious action for institutional change can help to understand decisions as fragments of inter-temporal optimization by the actor. Games in institutional design expand the observers' perspective over longer time horizons, while games in multiple arenas broaden the view over contextual games.

Tsebelis develops a full theoretical treatment of games in multiple arenas that can be used to analyze the effects of different interdependencies among games, how they alter the payoffs in the principal arena and what is the ultimate effect on the outcome of the game. The framework allows to analyze scenarios of contingent strategies and iterated games under different assumptions with regard to available information, game sequence and structure using the backward induction argument and the criterion of subgame perfectness.

Such a consistent theoretical analysis is not possible for games in institutional design, as *institutional change by definition involves political innovation, and it is difficult (if not impossible) to know its rules, much less to have a complete theory about them.* (Tsebelis, 1990, p.11) But it does allow to explore processes of institutional design, and to derive a preliminary analysis of the conditions under which they are likely to occur. The framework does not solve the problem of being restricted to a metaphorical use of game theory in the analysis of institutional change but it does provide a tool for the differentiation of the effect of games in multiple arenas from processes of institutional change. Once separated, we can approach each with the appropriate level of theoretical vigor.

If one applies this basic differentiation to the problem of interdependent decision making in international arenas a few basic propositions can be derived. The rules that guide and restrict the interactions among states during negotiations are either fixed or subject to change by the decision of

the members of the negotiating body. Actors outside of the negotiation process cannot change the rules. Therefore we can infer that

***The interdependencies among different international regimes are exclusively games in multiple arenas (Proposition 1)<sup>8</sup>***

Furthermore, if we recall Putnam's conception of the win-set as conceptual link between the domestic and the international negotiation game, we can state that influences that can be explained as effects of changes in the size of the win set can also be exclusively understood as games in multiple arenas. This is because of the two main implications that Putnam derives:

- The size of the Level II win-set determines the probability of reaching a level I agreement, while the overlap between the win-sets of different negotiators determines the area of possible consensus (i.e. the total possible gains from cooperation). Together these two effects determine the expected payoffs of the game.
- The relative size of a negotiator's win-set determines the distribution of the joint gains from the international bargain (Putnam, 1988, p. 441). A small domestic win set is a bargaining advantage because the negotiator can demand higher concession in order to ensure domestic ratification. Therefore the win-set influences the relative size of the payoffs of the domestic game.

These implications constitute the second proposition:

***The interdependencies between games in domestic and international arenas that can be explained as effects of the size of the win-set are also exclusively games in multiple arenas for a given and constant win-set (Proposition 2)***

Differentiating the strategies the negotiator can apply in order to influence the size of the win set is a bit trickier. For example the negotiator can try to increase the win set by influencing the preferences and coalitions among the constituency or by changing the rules of the ratification process (e.g. changing the necessary majority). Both activities will eventually alter the size of the win set but their character as nested games is different. Similarly the negotiator could try to move towards a procedural decision in the current agreement to alter the decision rules in a future round of negotiations. In both cases the decision is likely to be postponed, which points towards the long time horizons associated with games in institutional design. However, there may be many other reasons for the postponing of decisions that can lead to changes in payoffs as well. One possible solution would be to define second order nested games on the domestic level allowing to further differentiating the interactions between the negotiator and the constituency. However, this would evidently lead to a framework too complex to handle. We can avoid such complexity by making a simple assumption:

1 \_\_\_\_\_

<sup>8</sup> Note that Proposition 1 implies that the procedural aspects of an agreement that may change the rules for future interactions (agenda items, decision rules) are treated as part of the output of the current negotiations. If decisions on these aspects are influenced by ongoing negotiations on other agreements the impacts can be considered as changes in the payoffs of the games as well.



Standard game theory defines a game as a triplet composed of a set of players, a set of strategies and a set of payoffs for each player. The payoffs for each player are a function of the strategies each player selects. In the nested games framework the rules of the game are defined as the set of players and the set of their strategies. Consequently the only variations possible in a game are variations in rules or variations in payoffs (Tsebelis, 1990, p.93). If we adopt the assumption that these variations are mutually exclusive in the games we seek to analyze, the number of possible constellations can be limited to a feasible number. Based on this assumption we can make a third proposition:

**Games that alter the size of the win set vary either in rules or payoffs, not both. Long time horizons (e.g. adjournment of a decision to the next round of negotiations) are a condition, but not a proof of variations in rules. (Proposition3)**

With these propositions we can define and elaborate an analytical framework for the decision-making in international regimes as nested games as depicted in Figure 1 below:

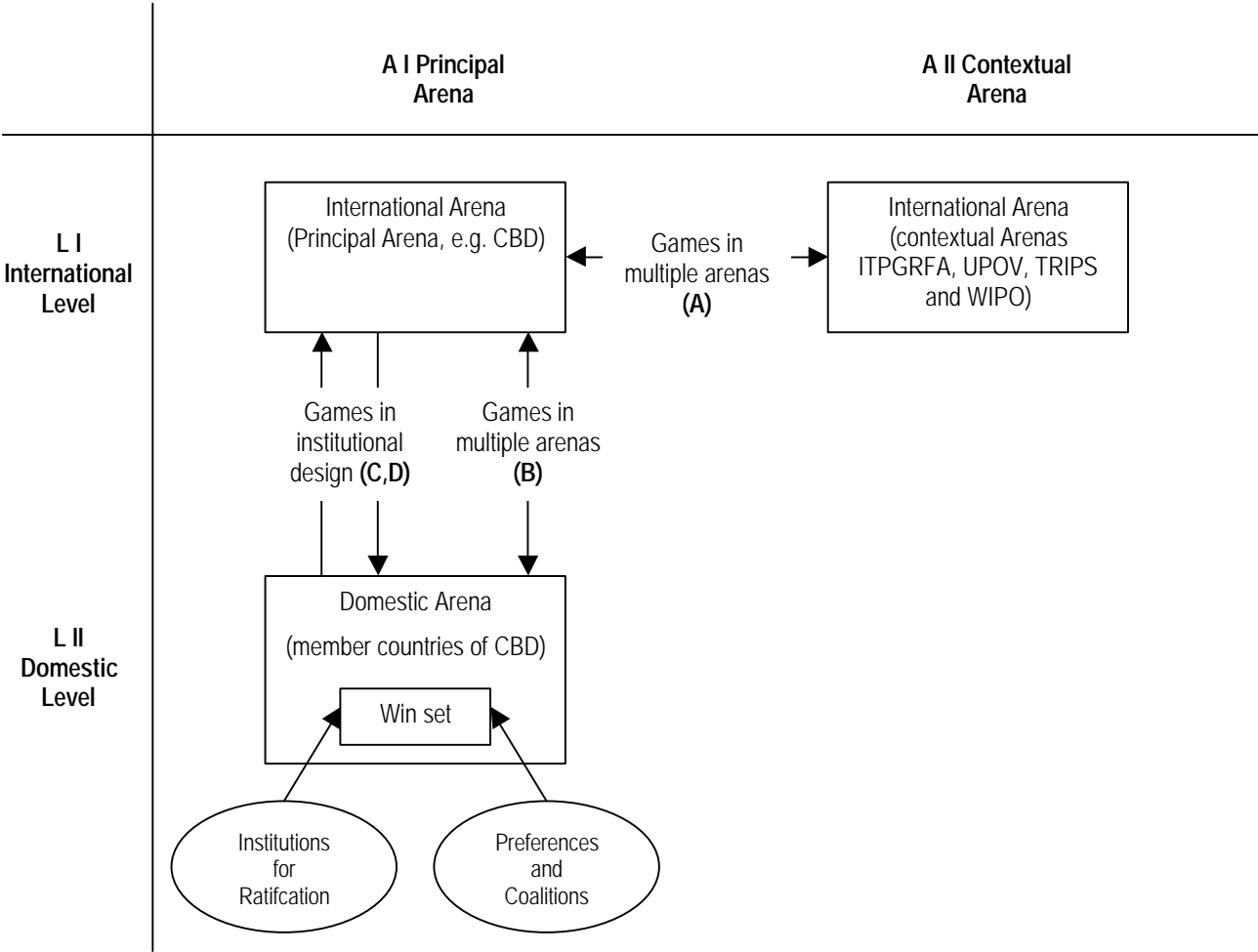


Figure 1: Graphic representation of the framework

### Applying the framework

Returning to the problem of coordination among overlapping international agreements on the conservation and use of PGRFA, the objective is to explain under which conditions decisions affecting the relationship among the different agreements are taken (e.g. the decision of the TRIPS council to turn down a request for observer status by the secretariat of the CBD, or its upcoming decision on the obligation to disclose the origin of genetic resources). The negotiating body where a decision is taken becomes the principal arena (box in the upper left corner). On the international level all other negotiation processes may be contextual arenas for the analysis of games in multiple arenas (A). On the domestic level the parliaments (the ratifying bodies) of all member countries can be considered as contextual arenas (B) or as nested games in institutional design (C,D).

According to the propositions one, two and three these are the exhaustive constellations of nested games to be studied. They can be characterized by the variability of the rules, payoffs and the win sets of the negotiators, as represented in Table 1 below.

	Principal Arena	Contextual Arena	Win set	Rules	Payoffs
<b>Games in multiple international arenas (A)</b>	International	International	-	Fixed	Principal: variable Contextual: fixed/variable
<b>Two-level games (B)</b>	International	Domestic	Fixed	Fixed	Int. Variable Dom. Variable
<b>Games in international institutional design (C)</b>	International	Domestic	Variable	Int. Variable Dom. fixed	Fixed
<b>Games in domestic institutional design</b>	Domestic	International	Variable	Int. Fixed Dom. Variable	Fixed

Table 1: Possible Game constellations

Despite the reduction of game constellations the approach would yield a number of games far beyond any feasible study. Therefore it is necessary to identify actors and interactions of significance to the outcome of the process. Developing the criteria for case selection and a methodology for studying the interactions of the actor in the nested games framework are the challenges to be addressed in order to put the framework to practice. For the purpose of this paper it may suffice to add a few general considerations

In international negotiations it can be frequently observed that a single country or a defined group of countries has a disproportionate influence on the decision taken. Sometimes a country or a group can block a decision. In other cases one actor speaks for a large group of countries (e.g. G77, JUSCANZ, EU). In such cases it is possible to identify *pivotal actors* that have a strong impact on the final decision. Similarly an analysis of past negotiations can reveal which actors or groups presented the most extreme or controversial viewpoints and how their position changed in order to reach an

agreement. If issues are debated controversially over many rounds of negotiations it often is the case that individual countries take the role of the speaker for the group of opponents or supporters ("like minded groups"). Such actors can be identified in the course of an explorative study of the negotiation process for a detailed analysis of the factors that have influenced the decisions.

### *Embedding the framework*

As a tool for research the framework does not only provide for the identification of the interdependencies and incidents to be studied, it also serves as heuristic guide in the search for adequate theories that can serve as a basis for explanation and stimulation of the generation of new hypotheses. Putnam suggests studying the distribution of power, preferences and possible coalitions as well as the nature of the political institutions on the domestic level as factors for the explanation of international decision-making. These can be studied and interpreted on the basis of New Political Economics theory, referring to the works of for Example Olson (1971;), Knight (1997) or Kirsch (1997). Recently, some scholars have addressed the problem of the political economy of international environmental agreements (Congleton, 2001; Fredriksson and Gaston, 2000; Michaelowa, 1998). The results of these and other works can guide the further development and application of the framework.

## **5 Summary**

The development of the relationship between different international agreements that regulate overlapping aspects of issues requiring international cooperation represents a phenomenon that is difficult to analyze applying common theories on international cooperation. The issue of regulation of PGRFA in the overlap of five or more international agreements shows that the development does not always lead to a better coordination among agreements over time. Uncoordinated international cooperation however, may cause conflicts and require complex legislation on the national level. The costs of these diminish the gains from international cooperation.

It was argued, that interactions among international agreements, as well as domestic-international interactions need to be studied in order to explain the why coordination emerges in some cases and not in others. In order to do so, the level-of-analysis problem inherent in systemic approaches such as regime theory needs to be solved. Similar problems arise if the assumptions of Economic Theories of international cooperation are relaxed or altered for the purpose of such an analysis.

The paper attempts to address these problems through a nested games framework that allows to identify types of interactions that can be approached using different levels of theoretical vigor in order to derive adequate explanations and hypotheses for further research.

In order to apply the framework to international PGRFA policy it needs to be complemented through guidance for the selection of significant examples of interactions and an adequate methodology for empirical analysis.

## References

- Barrett, S., 1998. On the Theory and Diplomacy of Environmental Treaty-Making. *Environmental and Resource Economics* , 11:317-333 pp.
- Barrett, S.A., 1999. A Theory of Full International Cooperation. *Journal of Theoretical Politics*, 11:519-541 pp.
- Berthaud, J., 1997. *Strategies for Conservation of Genetic Resources in Relation with their Utilization*. *Euphytica* 96 pp. 1-12
- Brush, S.B., 2000. The issues of in situ conservation of crop genetic resources. In: S.B. Brush (Editor), *Genes in the Field, On-Farm Conservation of Crop Diversity*. Lewis Publishers, New York.
- Brush, S.B., Taylor, E.J., and Bellon, M.R., 1992. Technology Adaptation and Biological Diversity in Andean Potato Agriculture. *Journal of Development Economics*, 365-387 pp.
- CBD, 2002. Report of the sixth meeting of the Conference of the Parties to the Convention on Biological Diversity. CBD, Montreal
- Congleton, R.D., 2001. Governing the Global Environmental Commons: The Political Economy of International Environmental Treaties and Institutions. In: G. Schulze and G. Ursprung (Editors), *Globalization and the Environment*. Oxford University Press, New York.
- Cooper, D.H., 2002. The International Treaty on Plant Genetic Resources for Food and Agriculture. *Review of European Community & International Environmental Law*, 11:1-16 pp.
- Dutfield, Graham. *Sharing the Benefits of Biodiversity: Access Regimes and Intellectual Property Rights*. Science, Technology and Development Discussion. Paper No. 6. 1999. Cambridge, MA, USA, Harvard University. Center for International Development and Belfer Center for Science and International Affairs.
- FAO, 2001. *International Treaty on Plant Genetic Resources for Food and Agriculture*. FAO, Rome
- Fredriksson, P.G. and Gaston, N., 2000. Ratification of the 1992 climate change convention: What determines legislative delay? *Public Choice*, 104:345-368 pp.
- Gadgil, M. and Utkarsh, G., 1999. IPR and Agricultural Technology: Linking the Micro- and the Macro- Scales. *Indian Journal of Agricultural Economics*, 54:327-341 pp.
- Gehring, T., 1994. *Dynamic International Regimes: Institutions for International Environmental Governance*. Europäischer Verlag der Wissenschaften, Frankfurt/M, Germany.
- Gering, T. and Oberthür, S., 1997. Internationale Regime als Steuerungsinstrumente der Umweltpolitik. In: T. Gehring and S. Oberthür (Editors), *Internationale Umweltregime: Umweltschutz durch Verhandlungen und Verträge*. Leske und Budrich, Opladen, Germany, pp. 9-26.
- Heisey, P.W., Srinivasan, C.D., and Thritle, C., 2002. Privatization of Plant Breeding in Industrialized Countries: Causes, Consequences and Public Sector Response. In: D. Beyerlee and R.G. Echeverria (Editors), *Agricultural Research Policy in an Era of Privatization*. CAB International Publishing, London, pp. 177-198.
- Helm, Carsten. *Economic Theories of International Environmental Cooperation* . 2000. Nothampton, Massachusetts, Edward Elgar. *New Horizons in Environmental Economics*. 2000.
- Henne, G., 1997. Das Regime über die biologische Vielfalt von 1992. In: T. Gehring and S. Oberthür (Editors), *Internationale Umweltregime: Umweltschutz durch Verhandlungen und Verträge*. Leske und Budrich, Opladen, Germany, pp. 185-200.
- Janssen, J., 1999. Property Rights on genetic resources: economic issues. *Global Environmental Change*, 9:313-321 pp.
- Kirsch, G., 1997. *Neue Politische Oekonomie*. Werner Verlag, Düsseldorf, Germany.
- Knight, J., 1997. *Institutionen und gesellschaftlicher Konflikt*. Mohr Siebeck.
- Krasner, Stephen D. *International Regimes*. 1991 . Ithaca, New York, Cornell University Press. *Cornell Studies in Political Economy*.

- Lerch, Achim. Verfügungsrechte und biologische Vielfalt: Eine Anwendung der ökonomischen Analyse der Eigentumsrechte auf die spezifischen Probleme genetischer Ressourcen. 21. 1996. Marburg, Germany, Metropolis Verlag. Hochschulschriften. 1996.
- Leskien, D. and Flitner, M., 1997. Intellectual Property Rights and Plant Genetic Resources: Options for a Sui Generis System. International Plant Genetic Resource Institute, IPGRI, Rome, Italy.
- Löffler, Kerstin. Genetische Ressourcen: Biodiversitätskonvention und TRIPS-Abkommen. [FS II 01-405]. 2001. Berlin, Wissenschaftszentrum Berlin für Sozialforschung, WZB.
- Michaelowa, A., 1998. Climate policy and interest groups - a public choice analysis. *Intereconomics*, 33:251-259 pp.
- Moravcsik, A., 1993. Integrating International and Domestic Theories of International Bargaining. In: P.B. Evans, H.K. Jacobson, and R.D. Putnam (Editors), *Double-edged Diplomacy: International Bargaining and Domestic Politics*. University of California Press, Ltd., London, England.
- Morris, Michael and Smale, Melinda. Organization and Performance of the National Maize Seed Industries: A New Institutionalist Perspective. Economics Working Paper[97-05]. 1997. Mexico, CIMMYT. CIMMYT Economics Working Paper.
- Neumayer, E., 2001. How Regime Theory and the Economic Theory of International Environmental Cooperation Can learn from Each Other. *Global Environmental Politics* , 1:1:122-147 pp.
- Olson, M., 1971. *The Logic of Collective Action. Public Goods and the Theory of Groups*. Harvard University Press, Cambridge MA.
- Olson, M., 1982. *The Rise and the Decline of Nations*. New Haven. Yale University Press, Yale.
- Oye, K.A., 1986. Explaining Cooperation under Anarchy: Hypotheses and Strategies. In: K.A. Oye (Editor), *Cooperation under Anarchy*. Princeton University Press, Oxford, pp. 1-24.
- Prakash, S., 2000. WTO Rules: Do they conserve or threaten Biodiversity? *The Journal of World Intellectual Property*, 3:155-165 pp.
- Pray, C., 2002. The Growing Role of the Private Sector in Agricultural Research. In: D. Beyerlee and R.G. Echeverria (Editors), *Agricultural Research Policy in an Era of Privatization*. CAB International Publishing, London, pp. 35-50.
- Putnam, R.D., 1988. Diplomacy and Domestic Politics: the Logic of Two-Level Games. *International Organization*, 42:427-460 pp.
- Richter, Rudolf and Furubotn, Eirik G. *Neue Institutionenökonomik*. 1996. Tübingen, Mohr Siebeck. 1996.
- Sedjo, R.A. and Simpson, D.R., 1995. Property Rights, Externalities and Biodiversity. In: T. Swanson (Editor), *The Economics and Ecology of Biodiversity Decline*. Cambridge University Press, Cambridge, pp. 79-88.
- Shiva, Vandana. *Biopiracy: the plunder of nature and knowledge* . 1997. Boston, Massachusetts, South End Press. 1997.
- Singer, J. D. The Level of Analysis Problem in International Relations. Knorr, K. and Verba. *The International System: Theoretical Essays*. 77-92. 1961. Princeton, N.Y.
- Snidal, D., 1986. The Game Theory of International Politics. In: K.A. Oye (Editor), *Cooperation under Anarchy*. Princeton University Press, Oxford, pp. 25-57.
- Swanson, T., 1996. The Reliance of Northern Economies on Southern Biodiversity: Biodiversity as Information. *Ecological Economics*, 17:1-8 pp.
- Swanson, T., 1997. *Global Action for Biodiversity*. Earthscan Publications Ltd., London, UK .
- Swanson, Timothy and Goeschl, Timo. *The Management of Genetic Resources for Agriculture: Ecology and Information, Externalities and Policies*. CSERGE Working Paper GEC 98-12. 1998.
- Swanson, T. and Goeschl, T., 2000. Property Rights Issues Involving Plant Genetic Resources: Implications of Ownership for Economic Efficiency. *Ecological Economics*, 32:75-92 pp.
- Tsebelis, George. *Nested Games: Rational Choice in Comparative Politics*. 1990. Berkley and Los Angeles, California, University of California Press Ltd. 1990.

- Utkarsh, G., Gadgil, M., and Sheshagiri, R.P.R., 1999. Intellectual Property Rights on Biological Resources: Benefiting from Biodiversity and People's Knowledge. *Current Science*, 77:1418-1425 pp.
- Virchow, Detlef. Der Markt für genetisch kodierte Information als effizienter Austauschmechanismus für genetische Ressourcen: Konzeptionelle Überlegungen zu einem entstehenden Informationsmarkt. Beitrag zur 39. Jahrestagung der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaus e.V. 1998 Bonn. Landwirtschaftsverlag Münster-Hiltrup. 1998. Münster-Hiltrup, Landwirtschaftsverlag. 1998.
- Virchow, D., 1999. Conservation of Genetic Resources: Costs and Implications for a Sustainable Utilization of Plant Genetic Resources for Food and Agriculture. Springer-Verlag, Heidelberg, Germany.
- Walz, K. N. Men, the State and War. A Theoretical Analysis. 1959. New York.
- WTO, 1996. Agreement between the World Intellectual Property Organization and the World Trade Organization, WTO, Geneva