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**The Evolution of Global Institutions Governing the Movement of  
Plant Genetic Resources**

by

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## ABSTRACT

Much of the world's food supply is supported by crop varieties developed from plant genetic resources by plant breeders in the public, private and smallholder spheres. International movement of plant genetic resources has changed markedly in recent decades due to changes in international treaties, such as the Convention on Biodiversity and the International Treaty on Plant Genetic Resources.

This study uses the SSP institutional analysis paradigm to describe the performance outcomes of the interaction of international treaties with inherent interdependencies such as high information costs, high contracting costs, high exclusion costs and economies of scale. It examines some of the driving forces of institutional change in the negotiation of the three treaties, identifies possible useful institutional linkages at the national level and suggests area for later empirical research.

To my mother, for her constant support

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## LIST OF ACRONYMS

AOSCA—Association of Seed Certifying Agencies

CBD—International Convention on Biological Diversity

FAO—Food and Agriculture Organization of the United Nations

EOS—Economy of Scale

GCDT—Global Crop Diversity Trust

HCC—High Contracting Costs

HEC—High Exclusion Cost

HIC—High Information Costs

IPGRI—International Plant Genetic Resources Institute

IPR—Intellectual Property Rights

ITPGR—International Treaty on Plant Genetic Resources for Food and Agriculture

IUPGR—International Undertaking on Plant Genetic Resources

PGR—Plant Genetic Resources

SSP—Situation, Structure, and Performance

TRIPs—Agreement on Trade-Related Aspects of Intellectual Property Rights

TRIPs+--bilateral and regional Agreements on Trade-Related Aspects of Intellectual  
Property Rights

WTO—World Trade Organization

## CHAPTER ONE: INTRODUCTION

### 1.1 Background and Problem Statement

Planting seed, soil and water are the foundation of the food supply of the world. Saving and trading of planting seed between farmers has occurred since before recorded history. Over the last century, introduction of new technologies has rendered the development and spread of new seed varieties a complex international process with multiple players interrelated at different levels of power.

The new technologies developed in planting seed during the latter half of the 20<sup>th</sup> century have usually been products either of public university and CGIAR research systems or of the private research systems of commercial seed companies. Indigenous farmers in developing nations have also continued to maintain locally adapted varieties for their own use. Indeed, most of the seed for food crops grown by smallholder farmers is not produced by private companies or the public seed sector (FAO, 2001). The institutions facilitating and constraining international movement of plant genetic resources among these three loosely-defined groups have changed in recent decades, changing the opportunities for the actors in the three groups, as well as the paths of development of new crop varieties. The evolution of these institutions through 2004 reflects the growing social capital of developing nations and the smallholder farmers within them, growing international institutional structure in which to express that social capital, and a desire on the part of private and public seed breeders to reduce the transaction costs of procuring genetic material given the increased social capital of those with whom they trade.



Movement of potatoes and corn from the Americas to Europe and beyond gives evidence of movement of crop genetic material in colonial times (Kloppenburg, 1988,4). In the latter half of the 20<sup>th</sup> century, developing nations have increasingly negotiated for control of the genetic resources within their borders. In 1983, the International Undertaking on Plant Genetic Resources (IUPGR) described plant genetic resources (PGR) as a heritage of mankind which should be available without restriction, and enjoined national governments to ensure the equitable and unrestricted distribution of the benefits of plant breeding (FAO, 1983). In 1993, and again in 2004, the rules for such sharing and distribution have changed markedly. In 1993, the International Convention on Biological Diversity (CBD) became effective (CBD, 2001), assigning to nations the legal right to any genetic resource within their borders. Shortly after the CBD became effective, the Intergovernmental Commission on Genetic Resources for Food and Agriculture of the FAO began to organize discussions for an international treaty to organize movement of PGR internationally. In June of 2004 the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR) became effective (FAO, 2004b), which laid the groundwork for preserving, developing and sharing of genetic resources across borders, while respecting the national rights assigned in 1993.

Much has been written concerning the proper management of plant genetic resources in the international context by those advocating for the public, private, and smallholder groups. Some emphasize the need for those plant genetic resources useful for food production to be managed as globally available goods, so that the greatest gains can be made in combating hunger and poverty (Brush, 2004). During the first wave of the Green Revolution, plant genetic resources were typically regarded as common

heritage or globally available goods and seed breeders and smallholder farmers exchanged seed varieties relatively freely (Brush, 2004). Many of these seed breeders worked in the public sphere of universities and international research centers, and the plant varieties developed were made widely available. Major advances in productivity were made possible by the release of these varieties during the 1960's and 1970's (Sullivan, 2004). The 1983 International Undertaking on Plant Genetic Resources is written from the point of view of those who would take plant genetic resources from developing country smallholders, and return the resources to them in the form of widely accessible improved crop varieties.

Those living in the global south began to collect and communicate during the 1980's and 1990's instances in which private-sector seed companies were using plant genetic resources procured in developing countries to develop profitable commercial varieties, without sharing the benefits that came from those resources. A typical case was that of a small, yellow bean, cultivated in Latin America for generations (Pratt, 2001). A variety descended from these beans was patented in the United States by Pod-ners, L.L.C. in 1999. This patent was challenged by the International Center for Tropical Agriculture (CIAT) on the basis that the bean was not patentable because it had been in the public sphere (in CIAT's collection) and was relatively unchanged. The U.S. Patent and Trademark Office is expected to make a ruling on the patent in 2005 (Shand, et. al., 2005). Because of concern over similar cases and others arising from pharmaceutical applications, the International Convention on Biodiversity (CBD) was made effective as a part of international environmental law, which assigned to signatory nations property rights to any genetic resource within their borders.

The lack of agreement between the 1983 and 1993 treaties, and the fear that developing nations would restrict supplies of plant genetic resources for seed breeding, prompted debate among nations to draft another treaty to deal specifically with PGR of use for food and agriculture that would respect the principles of both the previous agreements. The ITPGR acknowledges both the dependence on foreign plant genetic material of most nations and the rights of farmers to share the benefits from the utilization of genetic material maintained by them (FAO, 2004b). Under this treaty, responsibility for protection of these rights is assigned to national governments, which are often struggling to maintain themselves.

This study will explore the inherent transaction costs and those created by the institutional design of the CBD and the probability that those costs will be reduced under the institutions created by the ITPGR. It will also describe the struggle to exclude free-riders by both developing nations and developed nations and the acquisition of social capital by smallholders such that more institution-building will eventually be required to carry out the intent of the treaty.

## 1.2 Research Hypotheses

Because the ITPGR entered into force on June, 2004, insufficient time has passed for enabling legislation at the national level to be widely completed. Thus, empirical research on the efficacy of the treaty may be premature at this point. The purpose of this study is to use institutional analysis techniques to compare possible outcomes of the ITPGR with outcomes from previous institutional structures, to identify possible useful

institutional linkages, and to suggest areas for later empirical research. Formally stated, the research hypotheses are:

(1) Given the inherent and institutionally generated interdependencies of plant genetic resources and the evolution of institutional structures from 1993 to 2004, the performance outcomes of the ITPGR can be expected to include a lowering of transaction costs that were induced by the CBD, a shift of some inherent transaction costs to commercial companies, and an increase in movement of genetic crop resources across national borders and between the three sectors maintaining these plant genetic resources.

(2) There are reasons to believe that the impetus for institution-building to facilitate equitable sharing of benefits from the use of PGR will continue, linking the ITPGR with national-level institutions, and compensating smallholders directly involved in conserving plant genetic resources. Among them are: (1) the reference in both the CBD and the ITPGR to “fair and equitable” sharing of benefits arising from the utilization of PGR, (2) the legal structures created at the national level in various countries to facilitate this sharing after the CBD became active in 1993, (3) the imperfect structure to capture and share the gains possible from cooperation noted by Gatti (2004) and (4) the increase in willingness of private citizens in the global North, typified by the ‘fair trade’ movement, to pay higher prices for assurance that developing-world smallholders are given an ‘equitable’ income.

### 1.3 Methodology and Scope

The situation-structure-performance (SSP) paradigm (Schmid, pg. 13, 2004) will be used to compare the impact of the interaction of the inherent characteristics

of plant genetic resources with the institutional structures in the CBD and the ITPGR on the use of plant genetic resources. It will also be used to trace the emergence of different rules for making rules as the changing treaties mark the evolution of international law governing plant genetic resources.

The objectives of the CBD include both the “conservation of biological diversity” and the “fair and equitable” sharing of the benefits arising out of the utilization of genetic resources. This description indicates that the signatories have made a value judgment that would require that the benefits from the use of PGR be shared more equally between smallholder and commercial breeders of planting seed than has been the case previously. This paper will focus on the struggle to capture benefits arising from the development of plant genetic resources by advocates from the public, private, and smallholder spheres, rather than the effort to reduce the risk of losing important bio-diversity in plant genetic resources.

#### 1.4 Outline of paper

Chapter one will describe the background and introduce the issues and hypotheses. Chapter two will describe the conceptual approach taken to analyze the hypotheses in light of inherent and institutionally generated transaction costs, exclusion costs, and economies of scale.

Chapter three will contain the impact analysis of alternate institutional choices given the interdependencies mentioned in chapter two. Chapter four will contain the change analysis which will describe the process of institutional change in plant genetic

resources, at both the formal and informal levels. Chapter five will summarize the results of the analyses of the hypotheses and outline the major policy implications of the results.

## CHAPTER TWO: LITERATURE REVIEW AND CONCEPTUAL APPROACH

### 2.1 Why Institutional Analysis?

Microeconomic analysis has typically described economic performance within a set of formal and informal rules within which market exchange was conducted. It usually has not examined the rules themselves. North says that economics is a theory of choice, but that it neglects to explore the context within which the choice occurs (North, 2005, 11). Yet, economic analysis is always done in a context of change over space and time.

Over the past three decades, the institutions, or treaties governing the international movement of plant genetic resources (PGR) have evolved rapidly, and this paper will contend, continue to evolve. Because these treaties are institutions that shape markets, and we should examine the performance of the various sets of institutions and the process of institutional change, lest we find our studies apt for describing past situations rather than current ones. “If we are continually creating a new and novel world, how good is the theory we have developed from past experience to deal with this novel world (North, pg. 13, 2005)?”

As the discipline of economics has moved from the study of the industrialized world to the study of transitional economies and the developing world, it has unexpectedly encountered missing and constrained markets. Williamson quotes Arrow on the necessity of further information at this point, “Traditional economic theory stresses the sufficiency of the price system as a source of information, and this is correct enough at equilibrium. In conditions of disequilibrium, a premium is paid for the acquisition of

information from sources other than prices and quantities” (Arrow, 1959, in Williamson, 1985, 9).

Especially in situations such as the international trade in PGR in which there is conflict between the industrialized and less-industrialized nations of the world, there is a need to build international institutions that will bridge disparate systems and agendas. Williamson cites Commons’ recognition that “economic organization was not merely a response to technological features, but often had the purpose of harmonizing relations between parties” (Williamson, 1985, 3). Plant genetic resources have specific characteristics (situation) which interact with the institutional governance of markets (structure) to produce a given outcomes (performance) for the parties involved. The following sections will review conceptual issues related to selected interdependencies of those involved in the exchange of PGR.

## 2.2 Literature Review and Conceptual Issues of Institutional Impact Analysis

The impacts of human interdependences are conditioned by the inherent characteristics of the good or resource in question (Schmid, 2004, 90) interacting with the institutions which include formal rules, informal norms, and their enforcement characteristics (North, 2005, 6). In chapter three, SSP methodology will be used to compare the performance impacts of various sets of formal and informal institutions which have organized international exchange of PGR in recent decades, given the high information costs, high contracting costs, high exclusion costs and economies of scale that are some of the more apparent inherent situational interdependencies characteristic of PGR.



## 2.21 Transaction Costs

North defines transaction costs as the cost of measuring valuable attributes of what is being exchanged and the costs of protecting rights and policing and enforcing agreements (North, 1990, 27). More broadly, transaction costs can be divided into four categories, information or measurement costs, contractual costs, costs associated with asset specificity and the costs of fundamental uncertainty (Schmid, 2004, 113).

Specialization introduces a specific kind of transaction cost—that of ascertaining characteristics of goods alien to one’s specialized knowledge (North, 2005, 73).

Transaction costs, such as information and contracting costs are costs of exchange between individuals or groups.

Because yield potential, adaptation, and other variety characteristics are not apparent to observation in food crop seed, high information cost (HIC) is inherent in the character of the good, but the asymmetry of information between transacting parties creates the interdependence (Schmid, 2004, 113), and so HIC is treated as a transaction cost. The seller usually has superior information about PGR. High information costs for the buyer may be reduced or shifted by voluntary or required labeling, warranties, brands, rules of merchantability, and product standards and liability. These are all methods of mediating the passage of information and creating confidence in this information in market systems. In smallholder seed trading networks, these functions are mediated by the status in the network of the buyer and seller. In smallholder networks, the characteristics of planting seed appears more ‘tacit’ or embedded in a specific situation or process than does knowledge developed by commercial seed breeders which is accompanied by careful written descriptions and records and more recently by DNA

analysis. Codified information can be passed much more readily to a greater variety of buyers, which is why it has been developed to accompany the commercial system of seed exchange. The relative value of codified versus tacit information in PGR is discussed in more detail in section 3.11.

The transactions costs grouped under ‘high contracting costs (HCC)’ can be a function of both the number of necessary parties to the contract and the complexity of the agreement (Schmid, 2004, 117). In the case of PGR, seed varieties may be developed with genetic material originating in various countries, and require transfer permits under various national statutes. However, the complexity of the interdependence between developing countries with many smallholder farmers and commercial seed companies has been such that the perception of the appropriate price for the PGR obtained from smallholders has diverged, especially under CBD. This situation has resulted in a cost to commercial companies in completing transactions, but also to the ability of the global food production system to provide for the population (Brush, 2005).

## 2.22 High Exclusion Costs

Because plant genetic material is alive and self-replicating, biological innovations contained within it are particularly susceptible to exploitation by parties other than the innovator (FAO, 2004a). These characteristics increase the high-exclusion-cost (HEC) aspect of PGR. An HEC good is one where if the good exists for one user, it is costly to exclude others, even if the users can be identified (Schmid, pg. 94, 2004).

The central issue in dealing with exclusion costs is free-riding. Free-riding is a term used to describe situations where some individuals “free-ride” on the efforts of other individuals to provide either a good or a set of rules accompanying use of a good (Becker

and Ostrom, 1995). An intuitive definition of free-riding is that of an individual or group using a resource in a manner that infringes on the rights of another individual or group. It especially refers to the use of resources that should belong to another, because the other person or group is bearing the cost to maintain the resource or right. The normative “should” is an indicator that a value judgment is involved in the perception of the proper distribution of rights to the resource in question.

#### Exclusion by formal and informal institutions

Perception of rights to a good is an integral part of the formation of informal rights. While widely shared habits may be codified into law, they may also be rejected or reversed by formal law. They may also persist as informal institutions, such as tipping in restaurants and ordering precedence in a queue by arrival. Free-riding is a violation of perceived rights, thus the emphasis on the manner and cost of excluding free-riders. Free-riders may be excluded by either formal or informal institutions, and with varying degrees of success.

An example of the function of informal institutions is described by Badstue (2005) among smallholders in Oaxaca, Mexico. A formal seed market has not developed among this group of smallholders in the Mexican state of Oaxaca. These farmers save seed from year to year for planting, and trade and sell seed among themselves when needed. The informal rules that govern these transactions are such that they will exchange seed with other farmers when the other farmer is perceived as a good farmer who will take care of the seed. This informal institution attempts to prevent those perceived as poor managers from free-riding on the skills of the better producers. The

succession of treaties discussed in section 1.1 which govern the international exchange of PGR is an example of formal institutions attempting to limit free-riding by various groups at the international level.

Much of the efficacy of the institutions limiting free-riding depends on informal institutions, including shared perceptions and habits, which uphold any formal institutions. Schmid comments on the informal institutions reinforcing the formal legal institution of individual private property rights: “if the interdependent parties have not learned a whole set of ideas which go along with the notion of individual private property rights, the job of the state or neighbors in insuring the opportunity of an owner will be very much greater, if not impossible. (2004, 7).”

An example of the increased difficulty of enforcing formal institutions with weak informal institutions occurred in the late 20<sup>th</sup> century on U.S. public highways. In response to rising oil prices, the federal government imposed a 55 mile-per-hour speed limit on public highways. The shared habits and perceptions of many of the population supported the previous 70 mile-per-hour speed limit. When perception of the fuel crisis changed, the cost of enforcement of the lower limit became prohibitive, and the law (formal institution) was changed to reflect the informal institutions which guided the behavior of the people. In a similar fashion, given interdependencies characterized by high exclusion cost, the cost (or difficulty) of exclusion should vary inversely with the strength and pervasiveness of the informal institutions supporting that exclusion.

HEC goods are often also common pool goods, or goods in which “inputs to improving the pool have higher returns than if applied to only some portion of the pool (Schmid, 2004, 99) .” Individual actions that maintain or benefit from the use of a

common pool good highlight the actor's tendencies to cooperate or free-ride. Given the tension between cooperating and non-cooperating actors, such situations can also be described as a cooperative bargaining game (Gatti et al., 2004) or a prisoner's dilemma game (Schmid, 2004, 97). In the prisoner's dilemma game, non-cooperation (and lack of concern about the other's welfare) gives the best individual outcome, but cooperation and concern for the welfare of the other gives a better combined outcome (Nicholson, 1998, 277). Gatti describes the interdependency between the global North, which places economic value for biodiversity which exists mostly in the global South, and has the human capital necessary to realize gains from this biodiversity (Gatti et al., 2004). One of the major ideas developed by Gatti et al. is the possibility of movement in the South toward non-cooperating strategies (Gatti, et al., 2004). The interdependence of North and South in PGR is similar, in that the South has maintained biodiversity in PGR that is given value in the North, but the Global South lacks the human capital necessary to realize significant monetary gains from it. In section 3.2, the Common Heritage and CBD regimes governing PGR before the ITPGR will be presented as non-cooperating strategies, and the IRPGR as a cooperating strategy.

### 2.23 Economies of Scale

Goods in which production is influenced by economies of scale are those in which the cost of producing an additional physical unit declines with increasing scale of enterprise. This usually occurs when there are substantial costs to begin the enterprise and lower costs thereafter. Economies of scale do exist in the agricultural biotechnology industry (Rausser, 1999). An inducement to increasing scale in agricultural biotech has

also been the necessity of coordinating the rights to sale inherent in complex technology, such as genetically modified varieties. Rausser (1999) describes the chronology of consolidation necessary to bring together the nine patents necessary to bring Roundup-Ready corn seed to the market. He suggests patent pools as a more effective institution with which to reduce transaction costs for large commercial seed companies. Under current structure, some agricultural biotech companies, such as AstraZeneca, DuPont, Monsanto, Novartis, and Aventis have become large multinational firms (Johnson and Melkonyan, 2003).

In industries that have constant or decreasing marginal costs, target output may be constrained by marketing issues rather than production issues (Schmid, 2004, 110). Rausser, (1999) discusses how customer perceptions of competitive standards in agricultural biotech are shaped. He describes “network externalities” which, at sufficient sales volume, produce positive feedback effects in sales. In the institutional paradigm these might be described as enabling institutions, which shape market flows. An example of this is mentioned by Schmid (2004, 110) in the interaction between economies of scale and advertising. These circular and cumulative forces have given agricultural biotechnology firms a certain level of global financial power, and with it the international political power that comes from protection and promotion by governments intent on protecting citizens who are employees or stockholders of such companies.

### 2.3 Literature Review and Conceptual Issues of Institutional Change Analyses.

Schumpeter’s description of capitalism as a process of creative destruction highlights the process of change in economic institutions. North has described this as a

continually changing landscape that can be understood by examining the intentionality of the actors and their comprehension of the issues (North, 2005, viii). These actors function within a set of formal and informal institutions, which both shape their actions and are shaped by their actions.

The impetus for social change can be described by functional, power, and social learning theories. The functional and social learning theories tend to focus on catalysts for institutional change, while power theories often highlight the path dependence, or circular and cumulative forces, inherent in a given position of power for an actor or group.

The functional theory of economic change assumes that the actors have discovered an opportunity to increase total wealth, and have put their creative skills to work to find institutional ways of achieving a gain (Schmid, 2004, 259). Because institutions and individuals influence each other, there is a tendency to path dependence on previous institutions, which the perceived benefits of a given institutional change must outweigh.

Path dependence is an important aspect of power theories of institutional change. Institutional change occurs in a context in which the rules for making rules favor one party over another. A simple example is patent law. A party with power in the legislature can often obtain patent laws favorable to the generation of higher profits. Industries that generate high profits can also use campaign contributions to influence further legislation. The path dependence of power is one of the major reasons that alternative institutional change that does not favor those in power usually requires cooperative action.

Actors, and groups of actors also learn within the social and institutional context. Individuals (and groups) experience institutions piecemeal in real time and in particular environments. This process is variable and shapes how actors use, shape, and alter institutions, and for what purposes.

The process of institutional change can be analyzed both on the level of change in the operational institutions which govern the daily interaction of the interdependent parties, and the level of the institutions governing the manner of making or changing institutions for governing the interdependent parties. In the first level the outcome is a rule for action, or operational rule, that results from the shape of the institutions making the rule. The second level of analysis examines the shape of the political or constitutional institutions making the rule. The outcome is an adopted procedure for making rules. The first level concerns what institutions govern everyday actions. The second level concerns what institutions are put into place for rule-making.



## CHAPTER THREE. INSTITUTIONAL IMPACT ANALYSIS

The characteristics of plant genetic resources and of the institutions surrounding them result in various interdependencies. This chapter will examine the institutional impact of alternate institutional structures, given high information cost, high cost of contracting, high exclusion costs and economies of scale.

### 3.1 Transaction Costs

There are four broad categories of transaction costs: information or measurement costs, contractual costs, costs associated with asset specificity and the costs of fundamental uncertainty. Two of the more apparent interdependencies concerning exchange of PGR are high information costs and contracting costs.

#### 3.11 Information Costs and Plant Genetic Resources

Information costs are high during transactions involving planting seed, especially of cereal crops, because yield potential, adaptation to agro-ecological niches, disease resistance, etc. are not readily apparent upon observation of the seed itself. Thus, this information may be highly asymmetric. In most transactions the seller has much more information about the probable performance of plant genetic resources than the buyer (Table 1, Item 1a). In commercialized systems the seller is usually required by law to include with the packaging a standardized list of information describing the quality of the seed (Table 1, Item 1b). In the U.S. this includes percent by weight of pure seed, inert matter, objectionable weeds, other crop seeds, other varieties other kinds, as well as percent germination and any evident plant diseases that may be included within the bag

(AOSCA, 2003). Information concerning disease resistance, insect resistance and adaptation to agro-ecological niches may be provided by the company through advertising and field demonstrations.

Plant genetic resources that are developed in the public seed breeding system, in land-grant universities and international research centers, are usually described in seed trial reports that are much more complete and precise than in the commercial system, because there is no incentive to withhold information. Smallholders' informal seed trading systems are mostly based on social alliances and family relations, cast in the context of mutual interdependence and trust (Brush, 2005). The value of information about seed varieties is thus strongly tied to trust developed in these relationships.

Within and between the public and private areas of the seed industry, the provision of legally required information reduces and shifts transaction costs and facilitates exchange. Exchanging information in written form appears to be less appropriate with small-holders seed-trading networks (Table 1, Item 1c). For example, in the state of Oaxaca, Mexico, individual farmers cooperate with each other to provide maize seed and information (Brush, 2005). Information is exchanged verbally rather than in written form and access to seed in the network is based on status.

**Table 1. Institutional Impact of High Information Costs to the Buyer**

Situation	Structure	Performance
High Information Cost	a. Market-caveat emptor	a. Buyer bears the cost of mistakes.
	b. Market-required labeling	b. Seller bears the cost of providing standardized information. Buyer bears fewer costs.
	c. Status	c. Kinship and reputation mediate trust and limit misrepresentation.

Tacit information, embedded in custom or practice is useful in the smallholder context, but codified knowledge is more useful in a commercial context, increasingly so given globalization. Intellectual property rights are the most effective counter-force to imitation (Rausser, 1999) in a market context, which is why commercial companies and the governments that promote them seek to strengthen global IPR with such instruments as TRIPs+. Rausser (1999) highlights the difficulty (from a market perspective) in assigning value to tacit knowledge, but in doing so, he reveals a prejudice toward placing higher monetary value on codified knowledge than tacit knowledge. Codified knowledge is more marketable in a commercial context than tacit knowledge. However, given the thousands of years necessary to domesticate and adapt food crop seed currently used in seed breeding, tacit knowledge has been a significant contributor to codified knowledge. The recent evolution of institutions surrounding PGR could be viewed as a disagreement concerning the relative value and optimal distribution of benefits from the tacit and codified information contained in PGR.

This disagreement has led to adoption of various institutions. The most radical in terms of highlighting assumptions of relative value is the CBD. It requires a more equal sharing of benefits between the commercial and smallholder portions of the international market in crop seed. The assumptions behind the CBD include recovering value for smallholder farmers and the nations that represent them by encouraging developing nations to require extensive verification and testing for each export of PGR. In this way the informal institutions surrounding the CBD increased the information costs of exchanges beyond that which had been typical. The interplay of the competing

institutions is described in terms of relative power of the three groups and will be treated in more detail in section 4.2

### 3.12 Contracting Costs and Plant Genetic Resources

Before 1993, contracting costs of public and private breeders seeking plant genetic resources from smallholders should have been less than after 1993 (Table 1, Item 2), because the common heritage regime that organized access to plant genetic resources implied open access to samples held in international centers, university plant breeding programs and within the smallholder seed trading networks (Brush, 2005). The transaction cost issue was acknowledged as a weakness of CBD in the Bonn guidelines to the CBD (Linarelli, 2004). After the CBD was put in place, plant genetic resources were nationalized, and nations, as new factor owners, often required separate international contracts for each export of plant genetic material. Embedded in the situation that resulted from the 1993 treaty were increased costs for transferring the right to use the plant genetic resource from smallholders in developing countries to private and public plant breeders, given the increased number of owners and national legal codes to satisfy.

In the Bonn guidelines to the implementation of the CBD, signatories were encouraged to widely disseminate information on the procedures for contracting and develop standardized material transfer agreements (Linarelli, 2004). The actual costs of the legal review and supervision by treaty-enforcement officials were, however, often prohibitive (Raloff, 2004). The specific requirement in the ITPGR that transfers be made for minimal costs (FAO, 2000b), indicates that high contracting costs may stem from both demographic and institutional factors. Under ITPGR, the demographic issue of

commercial companies managing transfers of PGR in many small nations remains, but the cost of dealing with many different institutional and pricing structures should be lessened.

**Table 2. Institutional Impact of High Contracting Costs to Companies**

Situation	Structure	Performance
High Contracting Costs between commercial companies and nations	a. common heritage (IUPGR-1983)	a. Companies grab or pay very low costs.
	b. nationalized rights (CBD-1993)	b. Companies pay increased TC due to negotiating under many actors and due to high fees charged by nations for exchange of PGR.
	c. “pooled” rights (ITPGR-2004)	c. Companies pay lower TC while negotiating for the crops in the ITPGR system.

A similar situation faced the U.S. music industry in the early 20<sup>th</sup> century. Music was recorded and sold by a variety of actors holding various rights in relation to the recording. Reimbursement of the different factor owners was complex and costly. In 1914 the American Association of Composers, Authors, and Publishers was formed to license and distribute royalties for the performance of records (ASCAP, 2005). This association brought together the holders of multiple and disparate property rights (Merges, 2004) and coordinated their reimbursement. It also provided for policing of the use of registered music through sampling of station broadcasts. This lowering of contracting costs has facilitated the movement of a wide variety of music from artists, through the radio, to a wide variety of consumers. A similar issue is currently being widely discussed with respect to music transmitted over the internet. The trade-off in

such pooled reimbursement arrangements is that more owners are able to receive some reimbursement for what is produced, but individual owners are not able to easily differentiate their products with respect to price and quality.

The ITPGR is similar to ASCAP in some respects. In Article 12, it replaced multiple national import/export institutions with a standard material transfer agreement and required that transfers be made for minimal costs (FAO, 2004b). It also established a centralized institution that envisions reimbursing the holders of a multiple and disparate property rights in plant genetic resources. In so doing it should lessen the increase in transaction costs facilitated by the 1993 CBD.

The change in contracting costs over the past decades is also indicative of the justice issues embedded in the law surrounding the movement of plant genetic resources from farmer-breeders in the smallholder seed-trading system to seed breeders in the public or the private seed system. Seeds collected from smallholders implicitly contain generations of knowledge in selecting seed for a wide variety of agro-ecological niches, risk levels, cropping systems, etc. Before 1993, when these materials were used to develop improved varieties of food crops in the public system, this knowledge was used for the benefit of the larger population, and the seeds were made widely available. The benefits produced were not corporate profits, but improvements in the national or regional food production system from which smallholders also gain. When the same plant genetic materials are now used by breeders in the private system to produce varieties for the commercial market, many of the benefits generated are captured either by the individual company as profits, or as increased yields for farmers in developed nations. The smallholder gains little benefit from the knowledge he or she has

contributed, certainly nothing in comparison with the gains to the developed nations. The CBD, in its statement of objectives in Article 1 seeks a “fair and equitable sharing of the benefits arising out of the utilization of genetic resources” (CBD, 2001). Unfortunately, in nationalizing the rights to plant genetic resources, it prevented those resources from being used to develop new varieties in many cases, because the nations that owned them could not afford to generate improved varieties.

The ITPGR attempted to resolve the situation by creating a multilateral system of access and benefit-sharing. Though the ITPGR has as an objective to provide a workable, juridical basis for rewarding farmers for conserving PGR (Sullivan, 2004), this aspect of the treaty has not yet been developed. *In situ*, (wild or farmer-maintained sources of PGR) are mentioned briefly by FAO officials, while CGIAR-based *ex situ* collections are emphasized (Diouf, 2004). Planned maintenance of PGR *in situ* is uncommon (Fowler & Hodgkin, 2004).

The first major effort funded by this system is the Global Crop Diversity Trust, which will “support the operational costs of maintaining the world's most important collections and to provide technical and capacity building assistance to important collections in need” (IPGRI, 2004). It was to be expected that the CGIAR system, given its strong institutional development would be the first to secure funding for seed banks containing important *ex situ* collections of plant genetic material. This institution will shift some share of the benefits generated by commercial varieties to the developing nations and the smallholder farmers who have selected many of the genetic components subsequently built into the commercial varieties. Increasing the quality of holdings of plant genetic material in *ex situ* varieties decreases the risk of losing varieties and

characteristics of crops that contribute to sustainable food production, but it does not specifically reward the farmers in developing countries for their contribution to commercial varieties. Smallholder farmers themselves are in a less advantageous position, due to lack of institutional structure to capture in practice the benefits allocated to them by the ITPGR.

### 3.121 Institutional Alternatives at the National Level

It would be unrealistic and perhaps counterproductive to expect that a single institutional pattern could be developed to organize benefit-sharing from PGR at and below the national level. The various nations are home to multiple cultural patterns of benefit sharing and a variety of agro-biodiversity resources. Recent efforts to encourage environmentally stable watershed use in Latin America have generated various institutional structures to remunerate smallholders for maintaining ecological practices (Savy and Turpie, 2004). Savy and Turpie analyze the effectiveness of various programs and describe several enabling institutions that appear generally necessary: (1) clear establishment in national law of the right in question (2) establishment of clear funding channels (3) establishment of clear channels for information flows that make possible the oversight of both the funding and the quality of the service provided (4) establishment of enabling organizations—NGO's or co-ops for producers and firms or municipalities for consumers. (Savy & Turpie, 2004). Presence or absence of these institutions should provide a helpful gauge for the effectiveness of national institutions supporting payment for maintenance of bio-diverse food crop seed.



A variety of laws were written in the years following the adoption of CBD which made institutional provision for the distribution of benefits from the licensing of PGR. Three of these laws will be compared in this section: the model law written by the Organization of African Unity, the Plant Varieties Protection Act of Thailand, and the Plant Varieties act of Bangladesh.

The model law written by the Organization of African Unity (OAU) requires that a fee be paid to the state for access to PGR, the amount of the fee to be conditioned on whether the eventual use will be commercial, on the scope of sample gathering, and whether the rights granted are to be exclusive. The fees collected are to be divided between the state and the communities providing samples in unspecified proportions (OAU, 2000). The OAU law suffers from being a template for the development of specific national laws, and so is less detailed than national law. It does contain guidelines for the development of a legal framework that would satisfy the first three criteria in Savy and Turpie (2004). It assumes the remunerations of communities rather than individuals throughout. It does not provide legal structure for the participation of NGO's or other enabling organizations working to ensure the welfare of communities. It does not define how the boundaries of a community are to be designated, nor does it define how benefits are to be distributed within the community other than to require gender equity.

The law adopted by Thailand in 1999 (WIPO, 2005) is similar to the African model in its provision of institutional structure, except that it provides for the remuneration of a wider variety of actors. It requires that benefits received from the licensing of PGR be divided with 20% to the individuals who conserve the variety, 60%

to the community in which these individuals conserve the variety, and 20% to the local government, farmer's group, or cooperative which assists in the registration process.

The Bangladesh law (Grain, 1998a) is more detailed than that of OAU or Thailand, and details institutions within which the best use of funds generated by the use of PGR can be widely debated by “relevant representatives from the public sector, scientific and professional organizations, people's organizations, women's organizations, development and environmental organizations, and representatives of local and indigenous communities” (Grain, 1998b). Because the debate is accomplished in an administrative committee, the specific distribution of funds can be allowed to change across cultures, regions, and time. With its companion law concerning biodiversity, it clearly establishes the right of communities and farmers to a share of the benefits from commercialization of varieties developed with PGR from Bangla farmers. It establishes clear channels for funding and information flow and the funding both of individuals and the communities and farmer's groups that act as enabling institutions. It supports both *in situ* and *ex situ* activities of farmers and communities in conservation, development, and improvement of local, indigenous, or wild varieties.

These three national laws differ in terms of which actors are rewarded for maintaining bio-diverse crop varieties and the extent to which the benefits gained from the licensing of PGR are returned to the communities from which the PGR originated. If the ITPGR allows governmental or non-governmental organizations to apply for financial support for *in situ* conservation of PGR then the ITPGR becomes the facilitator in the search for good institutional structure on the national level to reward smallholders for involvement in maintaining PGR (Table 3). The nations have drafted laws that indicate

their preference to bestow the right to benefit from PGR on smallholders. These national-level organizations, whether governmental or non-governmental, become the inventors of institutional structures to remunerate individuals, groups, families, and communities of smallholders involved in maintaining bio-diversity in PGR.

**Table 3. Institutional Impact of High Contracting Costs at the National Level**

Situation	Structure	Performance
Global contracting cost reduced under pooled system, but contracting cost at the national level will increase with the number of actors reimbursed.	a. ASCAP-style system alternate pooling structure	a. Highest contract costs, but also potential for very wide benefit-sharing.
	b. Thai-style system- set proportions to growers, communities, and enabling organizations	b. Intermediate in both variables between ASCAP-style and OAU-style systems.
	c. OAU-style system- payment to communities only.	c. Lower contracting costs, but likely narrower benefit sharing because of power structures inside communities.
	d. Bangla style-payment is set by broad-based committee with flexible options.	d. Contract costs could be anywhere on scale between ASCAP and OAU.

Given the wide variety of cultures at the community level in nations containing significant agrobiodiversity, a single best option for institutional structure probably does not exist. The Bangladesh law has the flexibility to allow different benefit-sharing systems within the country if required by multiple cultures, balancing the importance of allocating more payment for contract costs or for preserving and developing PGR.

Justice issues will be further discussed in section 4.1.

### 3.2 High Exclusion Cost

Plant genetic material contained in seeds is compact, easily transported and amenable to multiplication to large quantities. These characteristics facilitate transfer of genetic material between owners. Because of this character, PGR has a higher exclusion cost and greater risk of free-riding than many other materials.

As a result, laws in industrialized nations, such as the U.S. have been written to protect breeder's rights against exploitation by third parties. The U. S. Constitution states that congress shall have power to “ to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries;” (U.S. Constitution, 1789). Though the U.S. and other industrialized nations have long protected ‘breeder’s rights’, these rights still vary among nations. The International Union for the Protection of New Varieties of Plants (UPOV), was formed in 1961 for the purpose of providing an international framework of intellectual property rights to plant breeders to encourage the development of new varieties of plants (UPOV, 1961). The Uruguay round of the WTO attempted to harmonize and extend the various national codes by requiring that WTO members enact some form of plant variety protection in their laws under the Agreement on Trade-Related Aspects of Intellectual Property rights (TRIPs), though TRIPs did not require adherence to UPOV (FAO, 2004a). The ITPGR was intended to draft institutional structure that would take into account both the viewpoints driving the CBD and TRIPs (FAO, 2004b).

The questions being debated in this series of international treaties depend on the perception of who is free-riding. The international treaties that issue from these debates

regulate the distribution of benefits to those involved in developing PGR in the smallholder, public, and private spheres.

### 3.21 Free-riding by developing nations

Before 1993, when the rights to plant genetic resources were regulated as a common heritage regime (Table 2, section 1), commercial seed companies used PGR from developing nations to produce varieties for sale in commercialized production regions. At times very similar varieties were released in other nations that appeared copied from the commercial varieties. Given the complexity of plant genomes and the registration of varieties based on visually observable characteristics, it is difficult to know how many varieties were altered only cosmetically from the best-selling varieties, and which had been developed as part of an independent plant-breeding process (Schmid, 1985). The perception in the industrialized world grew that commercializing areas of developing nations were free-riding on first-world research processes. The U.S. has signed a growing number of bilateral treaties (TRIPs +) which contain intellectual property standards more stringent than the TRIPs article adopted by the WTO which entered into force in 1995. Once a developing nation put into practice the higher level of IPR protection for PGR with the United States, that nation was required by WTO to do the same for all other WTO members (FAO, 2004a).

In this fashion, industrialized nations have attempted to prevent free-riding of private companies in developing nations on the research programs of the major commercial seed companies. This reflects informal institutions or perceptions and habits

common in industrialized nations, that seed varieties are private property and that such property rights of commercial companies should be protected.

**Table 4a. Institutional Impact of High Exclusion Cost in Commercial PGR**

Situation	Structure	Performance
High Exclusion Cost  Commercial PGR	a. Customary + market (Common Heritage regime, pre-1993)	a. Commercial companies in developing nations make cosmetic changes to popular varieties developed by commercial companies in industrialized nations, and free-ride on developed nations research capacity.
	b. Nationally Administered + Market + TRIPs (1993-2004)	b. CBD does not limit such free-riding. TRIPs + limits free-riding of commercial interests in developing nations on research base of commercial companies.
	c. Internationally Administered + Market + TRIPs (ITPGR)	c. ITPGR does not limit such free-riding. TRIPs + limits free-riding of commercial interests in developing nations on research base of commercial companies.

While formal institutions, such as TRIPs+ have been negotiated which have attempted to limit free-riding by commercial interests in developing nations, the inherent characteristics of PGR which are HEC remain unchanged. Free-riding may have been limited to some extent by informal institutions. The fact that the TRIPs+ treaties have been signed by some developing countries may reflect either the power with which developed countries negotiate, or it may reflect the increase of the informal institution by which developing country elites recognize this grabbing as free-riding and some choose not to participate or support it.

### 3.22 Free-riding by developed nations

During the latter decades of the 20<sup>th</sup> century , developing nations and their advocates have focused on “bio-piracy,” or the taking of PGR from developing countries (Table 2, section 2, *in situ*) for a nominal payment, for use in developing seed varieties later commercialized for great profit (Mushita and Thompson, 2002).

**Table 4b. Institutional Impact of High Exclusion Cost in *In Situ* PGR**

Situation	Structure	Performance
<i>“In situ”</i> PGR	a. Customary + market (Common Heritage regime, pre-1993)	a. Private company breeders take PGR from individual farmers at low cost and do not share benefits accrued from sale. Commercial seed companies and farmers in more developed areas are free-riders.
	b. Nationally Administered + Market (1993-2004)	b. HIC trap for developing nations. Limitations on gene pool for seed breeders in the private and public systems. CBD limits free-riding of commercial companies on smallholders.
	c. Internationally Administered + Market (ITPGR)	c. Private company breeders must pay for use rights, which are returned to the multilateral system. Public and private breeders have larger gene pool with which to work. Free-riding should be reduced in both <i>in situ</i> and commercial areas.

A sample of a landrace variety bought from a smallholder contains generations of knowledge in selecting the variety for specific characteristics that fit it for a given agro-ecological niche. Developing nations have argued that when this knowledge is used to generate a profit, and a fair share of that profit is not returned to those who developed the original PGR, then the commercialized farming systems are free-riding on the investment

and knowledge of smallholders in developing nations. CBD was adopted to prevent this form of free-riding (Sullivan, 2004).

Again, the inherent characteristics of PGR which are HEC remain unchanged. Free-riding may have been limited to some extent in this case by informal institutions by which those in developed nations recognized the grabbing of PGR in developing nations as free-riding. This perception may have supported public spending on the CGIAR system, voluntary restraint on the part of visiting plant breeders during CBD and willingness of large commercial companies to pay into the GCDT. Dupont and Syngenta donated one million dollars each to the GCDF in 2004 (GCDT, 2004).

In nationalizing plant genetic resources, developing nations made progress in preventing some free-riding on the part of commercial companies but, as mentioned above, many times have not had the resources necessary to develop and disseminate their own plant genetic resources within their borders in either public or private systems to the benefit of the larger population. By the mid-1990's, debate had begun on the ITPGR, which would attempt to limit free-riding by commercial companies in both developed and developing countries and allow the movement of PGR among countries and plant breeders for those plant species which provide the bulk of human nutrition (Raloff, 2004).

The conflict between the global North and South concerning the proper distribution of benefits arising from the global south's biodiversity has been described by Gatti et. al. (2004) as a cooperative bargaining game. The conflict between the Global North and South concerning PGR is similar. During the 'common heritage' regime, commercial companies grabbed PGR and used it for the benefit of developed-country



agriculture. During the 'CBD' regime, developing countries restricted the movement of PGR, to the detriment of the commercial system in both developed and developing nations. The ITPGR appears to be the cooperating strategy that may produce more benefits for the global food system than either of the previous strategies. The ITPGR should resolve some of the difficulty of funding development of seed varieties in developing countries by facilitating access of plant breeders in the public system to the broader gene pool available in developing nations. Free-riding should be reduced from both sources. If the ITPGR does eventually channel funding to members of smallholders trading networks, then it may build the perception among them of belonging to a group, a perception that has sometimes not existed (Brush, 2005).

The performance of the ITPGR with respect to justice is superior to that of the CBD and TRIPs treaties because it should reduce free-riding from both the commercial and smallholder groups, and acknowledge the contributions of both groups to the development of plant genetic resources that under gird the food supply of the world. It is incomplete in that it fails to specifically reward those smallholders that engage in selecting and developing varieties. Justice issues will be discussed in more detail in sections 4.1 and 4.2.

### 3.3 Economies Of Scale

Because companies such as AstraZeneca, DuPont, Monsanto, Novartis, and Aventis, function on a global scale, it is possible for them to develop varieties for markets in industrialized countries, allow the buyers in these companies to pay the fixed costs of variety development, and leave farmers in developing countries to pay only the

marginal costs, thus increasing market penetration. The feasibility of the latter depends in part on the ability and willingness of developing nations to protect the imported seed varieties, and the extent of irrigation and risk protection for the farmers in the nation, allowing them to plant fewer varieties over multiple agro-ecological niches.

## CHAPTER FOUR: INSTITUTIONAL CHANGE ANALYSIS

Change is a reality that all people, organizations and institutions confront. Population (usually) grows, the availability of all resources changes, and technology changes rapidly, especially in the last generation. In response, people's perceptions change, and their behavior changes. If these changes are widely shared, they are regularized into informal behavioral rules, and sometimes into formal rules. North argues that 'the process of change results from a continuous change in that reality which results in changing the perceptions which in turn induce the players to modify or alter the structure which in turn leads to changes in that reality' (North, 2005, 3). This process of changing the rules is described in institutional change analysis. Change in the rules of behavior allows opportunity for interested groups to alter formal and informal institutions to the benefit of the group. "Which interests count is a function of the political rules for making these working rules and the ability to utilize them" (Schmid, 2004, 234). The CBD treaty demonstrated that developing nations had developed the ability to use the rules for making rules to their benefit. The analysis in section 4.1 will describe the changes in the rules governing international movement in plant genetic resources. The following analysis in section 4.2 will describe changes in the rules for making rules concerning the international movement of PGR.

### 4.1 Institutional Change Analysis, Level 1

The first level of institutional change analysis involves analyzing changes in the rules mediating the interaction of the groups around the good, in this case PGR. As the rules change, 'whose interests count' within an interdependency become observable.

Changes in the rules imply changes in whose interests count. Choice of institutional structure is not value-neutral because different groups of actors affect different portions of the institutional structure. Schmid (2004, 254) contrasts the protection of southern small-town sheriffs for racist social structures in southern society in the 1960's to the president's use of the National Guard to enforce de-segregation of southern schools. Advocates of local control of police and school administration were also supporting a racist system. Advocates of federal involvement in social issues were also supporting racial de-segregation of society. The choice of an institutional structure had ethical effects. One of the advantages of institutional economics is that it allows the description of such multi-layered incentives that cannot be as easily accommodated by neo-classical analysis.

The institutions in flux concerning PGR affect the actors in the economic, political and social realms. Before 1993, the common heritage regime that coordinated seed exchange facilitated the flow of seed among public and private system breeders and smallholders. Formal structures, such as the United Nations, existed with the ability to facilitate multi-party international treaties (Table 4). During the era of the cold war, much of the world's attention was fixed on the permanent members of the Security Council. Informal institutions supporting the rivalry between superpowers left the smaller countries with little credibility in the international scheme (Table 3). During this period, a few large seed companies also became major players on the international seed trade stage. As the power struggle between the U.S. and the Soviet Union lessened in importance, society's consciousness of the growing power of these companies began to be more evident in the world press.

At first the point-of-view of the commercial companies concerning developing nation free-riders was the most evident at the global scale. Concerns that developing-world commercial seed producers were free-riding on the developed-country research capacity, by selling cosmetically altered varieties in countries with little plant variety protection, motivated U.S. negotiators to include TRIPs treaties as a condition of membership of WTO (FAO, 2004a). This development was described in more detail in section 3.2.

The international environmental movement was also growing during this period. Within this movement, awareness was being raised of the plight of smallholder farmers as victims of pollution and encroachment from commercially-driven concerns. These developments within the environmental movement gave the developing nations, smallholder farmers, and their advocates a access to a movement in which to raise consciousness about the free-riding of commercial companies on the crop development knowledge of smallholder farmers. The Convention on Biodiversity which nationalized plant genetic resources in 1993 (Table 5a), was evidence of the growing power of smallholders and their advocates to overcome the path dependence which maintained the power of the commercial companies. It was also evidence of the growing ability of developing countries and their advocates to use the institutions of the United Nations to create coalitions and write treaties that could counter the effect of the cumulative advantages of the multi-national seed companies. North argues that “institutions are not necessarily or even usually created to be socially efficient. Rather they, or at least the formal rules are created to serve the interests of those with the bargaining power to create new rules” (North, 1994). Though his use of ‘efficiency’ begs the question “Efficient for

what purpose?” , North’s comment about power underlines the changing power relationships at the global level concerning PGR. The CBD made obvious a change in the informal structure, which enabled developing nations to counter the power of the commercial seed companies.

**Table 5a. Institutional Change Analysis, Level 1, Change 1 (1983-1993)**

Situation (time <sub>1</sub> )	Structure (rules for making rules)	Performance (time <sub>2</sub> )
Common Heritage (1983)  Factor ownership by commercial interests.	<p>a. <u>Formal structure</u>-Pre-1993-- Bilateral treaties and U.N. exist as institutions <u>Informal structure</u>-- Small countries and small-holders have little international credibility compared to multi-national companies.</p> <p>b. <u>Formal structure</u>- Post-1993, Developing countries learn to form coalitions in writing U.N. treaties to counter power of U.S., Europe, and commercial interests. <u>Informal structure</u>-NGO’s and others make citizens in all nations more aware of the environmental and economic justice due to the peoples of lesser developed countries.</p>	<p>a. Common Heritage continues until 1993. Circular and cumulative advantages in U.S. and Europe continue.</p> <p>Factor ownership by commercial interests continues.</p> <p>b. 1993 CBD adopted. Developing countries gain international recognition of ownership over genetic material within their borders. Any revenue goes to national government.</p> <p>Factor ownership captured by developing country governments.</p>

However, the world food production system is supported by the efforts of plant breeders in the public, private and smallholder groups. Much of the world’s food production sector commercialized in the late 20<sup>th</sup> century, as green revolution technologies spread. These producers depend on seed breeders in the private and public sectors to provide high-quality seed able to take advantage of irrigation and fertilizer technologies. With the ratification of the CBD, these plant breeders were effectively restricted from many landraces and varieties in the developing nations. As soon as the

CBD was signed, negotiations began among the nations for a new treaty specifically dealing with the interdependencies in plant genetic resources and which would work to limit free-riding by commercial companies in both developed and developing nations (Table 5b).

**Table 5b. Institutional Change Analysis, Level 1, Change 2 (1993-future)**

Situation (time <sub>1</sub> )	Structure (rules for making rules)	Performance (time <sub>2</sub> )
<p>CBD (1993)</p> <p>Learning: Process of law-making 1983-2004 affected by world awareness of the environmental and economic justice due to the peoples of developing countries.</p> <p>Functionality: Consciousness of the HIC trap has also developed. Informal norms are more obvious.</p> <p>ITPGR (2004) continues</p>	<p>c. <u>Formal structure</u>- Developing countries form coalitions and use U.N. treaties to counter power of U.S., Europe, and commercial.</p> <p><u>Informal structure</u>-NGO's and others make citizens in all nations more aware of the environmental and economic justice due to the peoples of lesser developed countries, but consciousness of the HIC trap has developed.</p> <p>d. <u>Formal structure</u>-Developing country governments continue with same sovereignty rights in the U.N.</p> <p><u>Informal structure</u>-No change in ideology. The previous informal structure has been formalized at the international and in some cases at the national level. As informal norms increase in strength and reach, more national laws will be written that facilitate the movement of ITPGR finances to smallholders for <i>in situ</i> preservation of agricultural biodiversity.</p>	<p>c. ITPGR goes into effect (2004). Small governments retain factor ownership.</p> <p>d. ITPGR (2004) plus a multiplicity of national projects to either pass benefits from use of plant genetic resources to farmers, or to appear to do so. CBD remains.</p>

This is an example of functionality as a driver of institutional change. This theory of institutional change assumes that a person or group perceives an opportunity to increase total wealth and achieve gains from trade, but it ignores issues of power and the distribution of wealth (Schmid, 2004, 260). The presence of both developed and developing countries at the ITPGR negotiations is evidence that both sides saw the

possibility of capturing (or failing to capture) gains from international seed trade if the proper institutions were set up to reduce transaction costs.

Purely functional theories of institutional change often beg the question of ‘functional for whom’ (Schmid, 2004, 260). Schmid also cites (2004, 210) the case of Ruttan and Hayami’s analysis that factor ownership of increased rice yields should go to the landowners because marginal returns to comparable labor in the urban and agricultural sector had to reach equilibrium. It could have just as well have been assumed that as the agricultural sector was industrializing, the sharecroppers owned the technology and should be paid for its use. This is one of the ways in which circular and cumulative feedback maintains power unless collective action is employed to change perceptions. Previous belief systems not only define the economic and political game, but also determine who will have access to the decision-making process (North, 2005, 52). Those who have power are in a better position to make a case for the continuance of that power. This supports Smith’s assertion that “There are good reasons to think that the distribution of the benefits and burdens of the biotechnology revolution are not going to be distributed in a socially neutral fashion in the global economy. Certain groups will be able to appropriate a disproportionate share of the benefits of this set of innovations, especially first world agribusiness corporations and local elites in the third world.” (Smith, 1999). However, the passage of the CBD in 1993 also demonstrates the ability of smallholder farmers and their advocates to use international institutions to counter the power of commercial companies. It is also a tangible result of changes in ideology generating changes in operational rules while formal rules remain unchanged.



Because the Global Crop Diversity Trust funds *ex situ* PGR collections, rather than *in situ* smallholder's collections, the ITPGR has so far favored the interests of plant breeders in the public and private sectors. With the use of material transfer agreements, the cost and difficulty of obtaining listed plant genetic resources should lessen. This, however, deals with the sustainability issues in plant genetic resources without reference to the justice issues involved in properly reimbursing smallholder farmers for their contributions to global or regional food security.

#### 4.2 Institutional Change Analysis, Level 2

The second level of institutional change analysis is to examine the evolution of rules for making everyday operational rules, which resulted in changes in operational rules in the previous section. During the time in focus, the institutions of bi-lateral and multi-lateral treaties, and the United Nations existed. Before 1993 developing nations may have lacked the skill to work within the multi-national system to produce treaties in their interest (Table 6). They may also have lacked social capital sufficient to produce such treaties when nations more powerful in economic or military terms opposed them.

The 1993 treaty demonstrated a gain in negotiating skill, coalition-building, and social capital for developing countries. The development of institutions is not a simple process, because in the process of unfolding, they interact with the perceptions of the people they govern and vice-versa. Schmid describes the process as emergent:

“Imagining and deciding what system elements to connect, and how, and to what purpose, is an ongoing interactive process of emergence. Some of the knowledge... is supplied (created) by the participants” (Schmid, 2004, 264). Knowledge and social

capital had to be developed over the years between independence and the end of the cold war for many of the developing nations.

**Table 6. Institutional Change Analysis, Level 2**

Situation (t <sub>1</sub> )	Structure	Performance (t <sub>2</sub> )
No significant international, multi-lateral decision-making structures short of war.	Nations begin to make bi-lateral and multi-lateral treaties. U.N. comes into being as a supra-national set of institutions for such treaties. Cold war commands the attention of all and blocks negotiations on many issues.	U.N. contains multi-lateral decision-making institutions, but many issues between nations remain unresolved.
U.N. contains multi-lateral decision-making institutions, but many issues between nations remain unresolved.	Cold war ends, opening space in international discussions of a multiplicity of issues. Developing nations learn to build multi-lateral coalitions. Actors on a world-wide level become more aware of the issues faced by each group.	Significant multi-lateral treaty ability in both U.N. and negotiators for developing countries.
Significant multi-lateral treaty ability in both U.N. and negotiators for developing countries.	Nations, commercial companies and CGIAR's understand that they need to (1) ease constriction of exchange of PGR (2) maintain national sovereignty over PGM (3) shift a share of IUG commercial profits to those who maintain the <i>in situ</i> and <i>ex situ</i> collections of PGR.	Nations develop the ability to build national institutions and to link them to international institutions such as ITPGR and to distribute benefits in multiple fashions depending on social structures.

The CBD also demonstrates the strengths of institutions and resulting social connections forged between developing country smallholders and their advocates in the environmental and fair trade movements in developed economies. Robison, Siles & Schmid, quoting David Hume, notes that we sympathize more with persons contiguous to us than with persons remote from us (Robison et al, 2002). In this case, informal institutions formed by voluntary associations and actions have resulted in better terms in

an international formal institution for people usually disadvantaged. Smallholders may even be donating social capital to the public plant breeding system. Social capital for smallholders may be to an extent driving such things as the donation of vitamin A enriched rice varieties from the private (Syngenta) to the public (IRRI) system (Aguiba, 2005).

Negotiation of the ITPGR was a much more rapid process than negotiation of the CBD. The process of building knowledge and social capital did not require repetition. The shortcoming of the ITPGR is that it contains a structure (the GCDT) for protecting and promoting *ex situ* crop seed collections, but does not yet have a structure for promoting and protecting *in situ* collections such as smallholders' seed trading networks.

However, as the size and global reach of the commercial seed companies has increased, so has their power to influence the terms of international treaties, which maintains their advantage on the global stage. When this sort of circular and cumulative causation occurs, explicit collective action is necessary to change the path of developing institutions. One example of attempts to achieve gains is found in the debate between the United States and developing states over a paragraph in article 12.3d of the ITPGR:

“Recipients shall not claim any intellectual property or other rights that limit the facilitated access to plant genetic resources for food and agriculture or their genetic parts or components, in the form received from the multilateral system (FAO, 2004b).”

During the negotiations, developing states sought to retain ‘or their genetic parts or components’ and delete ‘in the form.’ In this they attempted to keep commercial companies from patenting genetic sequences that could subsequently be used in multiple

seed varieties. They attempted to restrict companies to patenting only individual varieties, thus leveraging multiple payments into the GCDT.

The United States sought to delete ‘or their genetic parts or components’ and retain ‘in the form’ so as to give companies the ability to patent gene sequences in varieties and gain patent protection over more varieties with lower cost (FAO, 2004a). PGR had been recognized as valuable by all negotiators, and the two groups were each seeking to influence the building of the international institution so as to increase its own share of factor ownership of PGR and decrease that of the other side. North, (Pg. 18, 2005) notes that conflict accompanies the creation of formal institutions.

Another strategy that developed countries have used to increase their factor ownership of PGR has been to negotiate TRIPS+ treaties (section 3.2). Bangladesh is one of 29 countries to sign a TRIPS+ agreement with the U.S. or EU during the last 10 years (GRAIN, 2005). Ten more countries are in the process of negotiating a TRIPS+ treaty. The ITPGR states that it shall not be interpreted to imply a change in the rights and obligations of the contracting parties under other international agreements (FAO, 2004a). However, if a country that grants patents to genetic material isolated from PGR signed the ITPGR, its patent law would be in conflict with ITPGR (FAO, 2004a), and it would complicate the use of the TRIPS+ treaty to leverage patent recognition.

The three national laws described in section 3.12 demonstrate that social and knowledge capital exist in many countries to use international treaties, such as CBD to reward smallholder farmers, their communities and advocates for the *in situ* protection of PGR. This same knowledge and social capital should be used to require compliance of

the companies to ITPGR and to build reimbursement systems linking the ITPGR fund to the village and individual level.

The tracing of changes in the institutions governing PGR over the past decades demonstrates an increasing ability of the developing countries to negotiate international treaties such as ITPGR with developed countries, and increasing power to drive the institutional change into forms that benefit their citizens. This is an indicator of the increasing relative power of those who have relatively scarce financial resources. The success of these efforts also demonstrates a growth in global institutions on the informal level. The multi-lateral treaties, the negotiation process producing them, and the wide dissemination among all interested parties of information about performance and trade-off issues of multi-lateral treaties is building informal norms on the international level that would perhaps have been impossible in an earlier technological setting.

## CHAPTER FIVE: CONCLUSIONS AND POLICY IMPLICATIONS

### 5.1 Results from Analysis of the Hypotheses

The first hypothesis stated in section 1.2 was: “Given the inherent and institutionally generated interdependencies of plant genetic resources and the evolution of institutional structures from 1993 to 2004, the performance outcomes of the International Treaty on Plant Genetic Resources can be expected to include a lowering of transaction costs that were induced by the Convention on Biodiversity, a shift of some inherent transaction costs to commercial companies, and an increase in movement of genetic crop resources across national borders and between the three sectors maintaining these plant genetic resources.

#### 5.11 Impact Analyses: Hypothesis 1

The cost of moving PGR from developing-country smallholders to public and private seed breeders should be reduced, due to standardization of material transfer permits and reduction of accompanying fees. The value previously collected under the Convention on Biodiversity should be transferred to the International Treaty on plant genetic resources for those varieties which are commercialized. Aggregate transaction costs for all movement of plant genetic resources may be reduced, depending on what portion of profit from commercialized varieties is negotiated as the proper fee to the International Treaty on Plant Genetic Resources from commercial companies.

## 5.12 Change Analysis: Hypothesis 2

The second hypothesis stated in section 1.2 was: “There are reasons to believe that the impetus for institution-building to facilitate equitable sharing of benefits from the use of plant genetic resources will continue, linking the International Treaty Plant Genetic Resources with national-level institutions, and compensating smallholders directly involved in conserving plant genetic resources.”

Among those reasons are: (1) Both the Convention on Biodiversity and the International Treaty on Plant Genetic Resources call for the “fair and equitable” sharing of benefits arising from the utilization of plant genetic resources. This phrase signals that a value judgment has been made by those drafting the treaties that some of the benefits derived from commercialization of plant genetic resources should be routed from the commercial sector to developing nations and smallholders who contributed plant genetic resources to a commercial variety. (2) Further support for this viewpoint within developing nations can be found in the efforts of developing nations to draft national legislation following passage of the Convention of Biodiversity to pass benefits from international movement of plant genetic resources to communities and smallholders who contributed the *in situ* plant genetic resources. (3) Further support for this viewpoint in developed nations is demonstrated by those involved in development of fair-trade supply chains for coffee, tea, cocoa, and other products typically produced in developing nations. Many in the Global North are willing to pay higher prices to afford a higher income to smallholders in developing countries. (4) Gatti et al (2004) have pointed out the costs of a non-cooperating strategy to both the Global North and South. Such observations may have provided impetus for the International Treaty on Plant Genetic Resources and

should continue to provide political capital for national-level institution-building to connect *in situ* maintenance of agrobiodiversity to remuneration promised in the International Treaty on Plant Genetic Resources.

The presence of representatives of both developed and developing nations at the negotiations of the International Treaty on Plant Genetic Resources is evidence of the determination on both sides to forge international institutions which capture the value from the international movement of plant genetic resources. All parties to the treaty negotiations found that value remained to be captured by the building of coordinating institutions.

National laws written for previous compliance with the Convention on Biodiversity, such as the model law written by the Organization of African Unity, the Plant Varieties Protection Act of Thailand, and the Plant Varieties act of Bangladesh, are valuable resources for legislators in nations building coordinating institutions linking the International Treaty on Plant Genetic Resources with those involved in conserving *in situ* agrobiodiversity.

Empirical research will be valuable later in monitoring the effective coverage of the world's centers of *in situ* (and *ex situ*) agrobiodiversity with enabling institutions for International Treaty on Plant Genetic Resources. Another area of valuable empirical research will be in monitoring the efficacy of the institutions that trace the use of plant genetic resources from its removal from developing nations to private commercial research groups, to its incorporation and sale in commercial crop varieties.



## 5.2 Policy implications:

With the emergence of the International Treaty on Plant Genetic Resources the financial benefit stream from the international movement of plant genetic resources has been theoretically split into three flows. One is the profit made by commercialization of varieties that remains with the commercial companies. The second and third come from profit from commercialization of plant genetic resources paid to the International Treaty on Plant Genetic Resources that supports *ex situ* and *in situ* sources of plant genetic resources. The second is institutionalized in the Global Crop Diversity Trust and benefits public sector seed breeders and those who rely on them. The third is yet to be institutionalized and benefits smallholder seed breeders, their advocates, and their communities.

Commercial systems will continue to create means of capturing wealth from plant genetic resources, and thus impetus remains for bilateral treaties strengthening the Agreement on Trade-Related Aspects of Intellectual Property Rights section of the WTO to continue to enclose intellectual property rights in plant genetic resources and direct benefits from crop breeding technologies to companies, shareholders, and commercial farmers. Countries whose agriculture is more commercialized will tend to support these institutions in international venues.

Smallholders and their advocates will continue to build institutional structures that direct benefits from plant genetic resources to smallholders and developing nations who hold the bulk of the world's agrobiodiversity. Financial support for this process from NGO's and developed-country governments in the form of "good governance" support would be wise, both to reduce food and financial insecurity among smallholders and to

mitigate developing-country resentment of the power of multi-national companies and their supporters in developed countries.

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