AGRICULTURAL BIOTECHNOLOGY TRANSFER TO DEVELOPING COUNTRIES UNDER THE COOPERATION-COMPETITION PARADOX[1]

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ABSTRACT

This is a time of cooperation, competition and contradictions. The paper provides a historical framework for understanding (i) how the process of transferring agricultural technology from developed to developing countries has evolved from colonial times to the present; (ii) how international cooperation initiatives have developed from the era of exploitation without cooperation to the era of cooperation for convenience to the era of cooperation and competition; and (iii) why some major contradictions are emerging under the cooperation-competition paradox. The paper also reveals how over time the degree of (under)development of S&T has influenced the strategies used by developed countries to benefit from developing countries' weaknesses built by the scientific and technological gap between them; from the era of economic botany to the era of agricultural chemistry to the era of Mendelian genetics to the era of molecular genetics.

RESUMO

Esta é uma era de cooperação, competição e contradições. O trabalho apresenta um marco histórico para compreender (i) como o processo de transferência de tecnologia agrícola de países desenvolvidos para países em desenvolvimento se desenvolveu do período colonial até o presente; (ii) como iniciativas de cooperação internacional evoluíram da era da exploração sem cooperação à era da cooperação por conveniência à era da cooperação e competição; e (iii) porque algumas grandes contradições estão emergindo sob o paradoxo da cooperação-competição. O trabalho

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também revela como, ao longo do tempo, o grau de (sub)desenvolvimento da C&T influencia as estratégias usadas por países desenvolvidos para tirar vantagens do *gap* científico e tecnológico existente entre eles e os países em desenvolvimento; da era da botânica econômica à era da química agrícola à era da genética Mendeliana à era da genética molecular.

INTRODUCTION

This is a time of cooperation, competition and contradictions. Under this premise, this is a paper about social, political, and ethical awareness. This is not a paper against international cooperation, transnational corporations, genetic engineering, capitalism and the like; it is a paper against social, political and ethical naiveness as it relates to the transfer of agricultural biotechnology from developed to developing countries.

Since there is a great deal of publications on the positive contributions of international cooperation and technology transfer, this paper focuses specifically on the controversial side of international relations associated with agricultural technology transfer from developed to developing countries in general, including agricultural biotechnology.

The paper introduces the "cooperation-competition paradox", under which countries are supposed to cooperate with actual and potential competitors while competing with others from which sooner or later cooperation may be necessary; due to the increasing interdependence among national economies and the globalization of the agri-food production and consumption systems. This paradox is already shaping the rationale behind the re-design of international cooperation relations and influencing the nature and direction of the existing and emerging international negotiating mechanisms.

The paper provides a historical framework for understanding (i) how the process of transferring agricultural technology from developed to developing countries has evolved from colonial times to the present; (ii) how international cooperation initiatives have developed from the era of exploitation without cooperation, to the era of cooperation and convenience, to the era of cooperation and competition; and (iii) why some major contradictions are emerging under the cooperation-competition paradox. The paper concludes by claiming the need for an international campaign to build the social, political and ethical awareness necessary to address the issues of international, asymmetrical power relations, unequal exchange, and

contradictory cooperation initiatives in order to improve cooperation in agricultural biotechnology.

FROM COLUMBUS TO CONAGRA: A FRAMEWORK FOR UNDERSTANDING

From Columbus to ConAgra is the title of an excellent book by Bonanno and colleagues (Bonanno et al., 1994) about the globalization of agriculture and food. Like that book, this paper is about neither Columbus nor the transnational corporation ConAgra, but about the global agricultural and food sector of which Columbus and ConAgra are two "temporal poles".

Columbus symbolizes the era of world explorations during which the global system was established; while ConAgra represents the new emerging global actors: transnational corporations (TNCs). "Though they are not the only players in the new global economy, TNCs are already the most influential actors in the reorganization of the socio-economic system and are major forces of change. If the era of Columbus is long gone, its legacy remains in the era of ConAgra. The challenge for us, as it was for Columbus, is to understand what lies ahead in a now truly global society" (Bonanno et al., 1994:vii).

The paper is a brief reconstruction of the history of agricultural technology transfer from developed to developing countries, from colonial times to the present, In this process, the paper reveals how over time the degree of development-underdevelopment of science and technology has influenced the strategies used by developed countries to benefit from developing countries' weaknesses built by the scientific and technological gap between them; from the era of economic botany, to the era of agricultural chemistry, to the era of Mendelian genetics, to the era of molecular genetics (Silva, 1996).

International cooperation is a complex, multidimensional process. Hence, it is vulnerable to many environmental, social, economic, political, technological, institutional, legal, and ethical conflicts which always emanate from international relations. Unfortunately, not all actors involved in the process are aware of the dialectical interplay between economic as well as political forces shaping it. In developed and developing countries, too many managers and scientists integrating the international cooperation community are naive enough to believe that everything they do is for the good of all societies involved. This false premise has lead to many false

promises. There are too many contradictions denying the "ideology of philanthropy" which has permeated international cooperation since colonial times. This paper provides past and present evidence for demonstrating just that.

However, our conscious participation in the construction of a better future for all of us depends to a large extent upon our comprehension of some historical patterns which have shaped our present. Here, the paper outlines the rationale behind some "institutional movements" associated with the grade of development-underdevelopment of science and technology, which strongly influenced the nature and direction of the process of agricultural technology transfer from developed to developing countries. Many of the present international inequalities have their genesis and logic rooted in the nature and form of these "institutional movements", from the network of botanical gardens, to the network of agricultural experiment stations, to the network of international agricultural research centers, to the network of transnational corporations (Silva, 1996).

ECONOMIC BOTANY AND IMPERIAL SCIENCE

European empires practiced the exchange of plants, not of technology, with their tropical colonies; an asymmetrical process aimed at benefiting only the former. The discovery of North America by Columbus in 1492 triggered an impressive transfer of plants; first from the Old World to the New--oats, rye, wheat and Old World vegetables; then from the New World tot he Old--cassava, the common bean, maize, peanuts, potatoes, squash and sweet potatoes. Initially, temperate crops came to the tropics just to assure a home-like meal for the European immigrants; tropical plants were exchanged among tropical colonies to create new markets and to feed the growing slave labor force necessary to spur the empire's economic competitiveness abroad (Busch et al., 1995).

By that time, science, leaded by economic botany, could only identify, describe, classify and compare, but not transform the botanical richness of the tropics. That is why European empires decided to further their interests in the tropical world by creating the first massive wave of institutional mechanisms to advance their economic interests disguised as scientific interests. They created a great network of botanical gardens which, by 1800, were over 1,600 in number. Botanical gardens permitted the systematic, institutionalized introduction of plants brought from abroad through

methods that were not always legal (Brockway, 1979). For instance, the botanical garden of Rio de Janeiro, Brazil, was a product of this initiative. Its first name was "Estação de Aclimatação", where avocado, breadfruit, and hogplum were introduced illegally by a Portuguese, Luiz Abreu Vieira da Silva. The British Royal Botanic Gardens at Kew supported the same strategy with *Cinchona* specimens from Bolivia, Ecuador and Peru; sisal from Mexico; natural rubber from Brazil; and potatoes from the Andean region (Silva, 1989).

AGRICULTURAL CHEMISTRY AND DEPENDENT SCIENCE

Selfishness, not cooperation, marked the process of agricultural technology transfer from European empires to their tropical colonies. As science advanced, so did the strategy to explore tropical lands. Soon after the German agricultural scientist Justus von Liebig made available his agricultural chemistry, European empires promoted the second wave of institutional mechanisms to advance their economic interests in the tropics, again disguised as scientific interests. They created a network of agricultural experiment stations in their own lands to work with temperate crops associated with their growing demand for food, fiber and medicinal crop plants; and imposed them on tropical societies in order to have researched the tropical crops that also interested Europe, but which could not be grown in temperate regions (Busch and Sachs, 1981). This explains why most tropical experiment stations went through certain cycles in their research agenda: sugar-cane, coffee, cocoa, cotton, etc.

Because it was in the interest of European empires that tropical colonies held a minimal capacity to carry out some agricultural experiments, some native professionals were sent to European scientific institutions to be trained in scientific matters. However, this meant the building of a colonial science based exclusively on the European scientific culture and tradition. This dependent science was designed to make possible a research and development agenda in which the problems and priorities were those defined as relevant by European reality and standards. Thus, agricultural technology transfer was just a political and economic convenience, whose benefits were ripped mostly by European empires. By 1930, there were over 1,400 experiment stations worldwide. The "Instituto Agronômico de Campinas" (IAC), Brazil, was created in 1887 as a result of this movement. As most tropical experiment stations created after the European agricultural research

paradigm, IAC had part of its initial history marked by the replication of well-known European experiments.

MENDELIAN GENETICS AND SUBSERVIENT SCIENCE

Under the politics of a bi-polar world, the so-called "Green Revolution" provides the best example of how science and politics have walked hand and hand in the project of the "gene-poor" developed countries to exploit the "gene-rich" tropical countries. With the political independence of most tropical colonies, the use of force and subterfuge for smuggling tropical plants became a political inconvenience for developed countries. Thus, botanical gardens and experiment stations lost their past glamour to a 'network of international agricultural research centers' (IARCs) created after World War II in order to provide a more systematic and efficient institutional mechanism to influence the nature and direction of agricultural development worldwide, and to facilitate developed countries' access to tropical plant genetic resources. Central to the performance of the IARCs was Mendelian genetics, the genetics which produced hybridization--the crossing of two varieties of the same crop species, a built-in biomechanism that meant a biological patent in agriculture. Mendelian genetics also gave the IARCs the scientific power to take the leadership in the so-called "Green Revolution".

In order to facilitate the hidden agenda of the IARCs, the United States took the leadership to articulate and support an institutional movement for advancing from the old agricultural experiment station model to the national agricultural research institute model in the 1960s and 1970s in the developing world. Most of these institutes were created (i) to resemble the existing logic and organization of the IARCs; (ii) to reproduce the agriculture that would be relevant to the international, commercial agriculture whose inputs and products were of economic interest to developed countries; and (iii) to demand and supply the genetic resources stored in the genebanks of the IARCs (Busch et al. 1995). In Brazil, the "Empresa Brasileira de Pesquisa Agropecuária"-Embrapa (Brazilian Public Agricultural Research Corporation) was created in 1972 under the guidance of a U.S. scientist who recommended that it must be created resembling as much as possible the model of the IARCs (Albuquerque et al., 1986a; 1986b).

Politics was a very central dimension of this revolution since its beginning. For instance, Norman Borlaug, also known as the Father of the Green Revolution, became a Nobel recipient for Peace, not for biology. As the Soviet Union lead a "red revolution", so the United States promoted the need for a "green revolution. In this context, the IARCs were utilized as institutional tools to counterattack communism, not necessarily to transfer the technical-scientific capacity that developing countries needed to help themselves. As Busch et al. (1995:49) have analyzed, "[t]he role of the IARCs ranged from helping to stabilize the internal conditions of Third World countries and providing for a urban industrial class by ensuring a more secure and cheaper supply of food to preventing a 'red' revolution from occurring by creating instead a 'green' one".

Obviously, some developing countries gained some scientific-technological autonomy as a result of international cooperation in agricultural research in the era of Mendelian genetics; but as unintended consequence not as a goal (Deo & Swanson 1991).

MOLECULAR GENETICS AND COMMODIFIED SCIENCE

In the context of a multipolar world, technology transfer is being affected in many ways; among them, (i) competition is prevailing over cooperation, confirming the pattern in the history of agricultural technology transfer from developed to developing countries; (ii) agricultural biotechnology is being privatized, enforcing the irreversible tendency for the commodification of science itself; and (iii) very important decisions made at national level before are increasingly being transferred to international negotiating mechanisms.

Under the phenomenon of increasing interdependency among national economies and the globalization of the world agri-food production and consumption systems (Bonanno et al. 1994), most countries are (inter)locked into a situation in which, sooner or later, they are supposed to compete with countries from which cooperation will be needed while cooperating with present and potential competitors. In technology transfer, this is what I call the cooperation-competition paradox (Silva, 1989).

Under the umbrella name of "biotechnology", science is now providing agricultural scientists with the tools to enter the plants and animals and scrutinize their molecules and cells. This scientific power for literally re-writing, re-designing the genetic code of plants and animals has called the

attention of the private sector, more than the power of hybridization by Mendelian genetics did. That is why, at the world level, the Green Revolution was shaped by the public sector and leaded by the IARCs; while the biorevolution is being shaped by the private sector and leaded by TNCs. As in the recent past a subservient science practiced by the IARCs served the interests of developed countries, by introducing the chemical paradigm in agricultural development, so now a science for profit practiced by TNCs and their "public partners" will do the same by introducing the biological paradigm in the overall socio-economic development process.

With great power over the nature and direction of scientific development, global actors, such as Governments and TNCs of world powers with economic expansionist ambitions, need globalized processes and mechanisms to advance and support their interests globally. This explains the proliferation of "trans" and "supra" national negotiating mechanisms. These international negotiating mechanisms are used for defining the rules and mediating, integrating and enforcing economic and technological deals. The World Trade Organization (WTO) derived from the GATT negotiations is the most recent example of this institutional strategy to turn impersonal the process through which developed country will intensify their influence over national policy-making worldwide.

Under these tendencies, developed countries are even more prone to use international cooperation as a political tool for influencing developing countries to introduce some control mechanisms which interest and benefit the former rather than the latter (Silva, 1996). For instance, most developing countries are under pressure to introduce strong property protection systems; yet, no developed country had strong protection systems as they were developing. The U.S. until the first half of this century, and Japan after World War II, engaged a great deal of intellectual piracy and "reverse engineering". Industrialized nations refused product patents on drugs until their own pharmaceutical industries and business were well established: France in 1958, West Germany in 1968, Japan 1976, Switzerland in 1977, The "four Asian tigers" – Taiwan, South Korea, Hong Kong, and Singapore--became industrialized with very weak intellectual property protection regimes. In short, developed countries are more interested in ensuring profits and opening markets in the South than in providing the transfer of advanced technologies to reduce the scientific and technological gap between them.

INTERNATIONAL COOPERATION?: FROM EXPLOITATION TO CONVENIENCE TO COMPETITION

International cooperation may have evolved from the fish-giving model to the hook-giving model, but definitively not to the transfer of the art of hook-making model. This part of the paper is a critical analysis of the history of agricultural technology transfer from developed to developing countries, from colonial times to the present, to reveal that, over time, we have evolved from the era of exploitation, to the era of cooperation and convenience, to the era of cooperation and competition.

EXPLOITATION WITHOUT COOPERATION

At the beginning of the period of colonial expansion, European empires promised to extend civilization as well as religious salvation to the native people of their tropical colonies, without asking anything in exchange. However, the promise was false because the premise was false: the colonial empires had no philanthropic goals. As a result, there was no cooperation, just exploitation of natural resources, including genetic resources. Even the now appreciated diversification of the world diet occurred as a consequence, not as a goal of colonial expansion. For example, breadfruit and banana were introduced in most tropical colonies as cheap food to feed their growing African slave labor force.

Reviewing the activities of plant exploration by nineteenth-century European 'plant hunters' in Venezuela, Arnal (1987) found no evidence that the 'Museo Nacional' held any collection left or sent by European explorers. Venezuelan institutions did not receive even news about the discoveries made by foreign explorers on their soil. As in the case of Venezuela, in Brazil, the European 'plant hunters' came, surveyed, took what they liked, and sent it back to their empires without much regard to sharing any of their findings with Brazilian institutions. A knowledge of several aspects of Brazilian society could be obtained only through foreign literature (Pastore, 1978).

In the colonial period, when only the sciences related to the expansionism of the colonial project – botany, zoology and geology – were financially and politically supported. The usefulness of new plants to the national economy of European empires was the goal. Every new plant was being scrutinized for its use as food, fiber, timber, dye, or medicine. This

was a period of an imperial science, where the pattern of plant exploration became a one-way process: only European scientists, naturalists, and amateur botanists--priests, travelers, missionaries, businessmen, military personnel, physicians, merchants, and bureaucrats--searched, gathered, and took back useful plants and information without sharing them with local populations. The rationale behind this strategy was one of "plant monopoly"; for market monopoly of most commercial products required the monopoly of their production process. There was no cooperation, just competition between European empires. Tropical colonies were used just as the richest reservoir of tropical products and raw materials. And, as Brockway (1979:75) states, in the time of "plant hunters", "botanical gardens consciously served the State as well as science, and shared the mercantilist and nationalist spirit of the times". By that time, force was the major factor shaping the equation of power. That is why under the logic of exploitation,

When legal means for obtaining...germplasm were unavailable, the European powers commonly resorted to outright theft (Busch, 1984:114).

COOPERATION FOR CONVENIENCE

After WWII, the Soviet Union, on one side, promised to liberate developing countries from hunger and other miseries caused by capitalism through a "red revolution" without asking anything in exchange; except loyalty to the nature and imperatives of its communist system. On the other side, the United States promised to protect developing countries against communism, which caused hunger and other miseries, through a "green revolution", without asking anything in exchange; except loyalty to the nature and logic of its capitalist system. However, their promise was false because their premise was false: the purpose of both world powers was to establish their hegemonic role, not genuinely and necessarily to end world hunger or to help developing countries. This could be achieved, but as a consequence not as a goal. As a result, there was cooperation only for convenience. As a type of compensatory policy, cooperation was practiced just to assure the continuous access of the most powerful industrialized countries to tropical products and raw materials as well as to new markets.

As most tropical colonies became politically independent, old 'imperialist strategies' for establishing plant monopolies became a political inconvenience. Force was not the most appropriate tool anymore. Money

would do better. For instance, this was the rationale that shaped the foreign policy of the United States after WWII towards developing countries; including international cooperation programs such as "Alliance for Progress" and "Food for Peace". Two strategies were developed to implement this foreign policy: (i) the creation of dependence on food production and consumption worldwide and (ii) the establishment of international relations convenient to facilitate the continuous access to tropical products and raw materials as well as the expansion of U.S. markets.

The best way to understand the first strategy is by going all the way back to 1957, when the U.S. Senator Hubert Humphrey influenced the shaping and approval of the Public Law PL480. Formulated under the fish-giving approach to international cooperation, in order to create food dependence, the PL480 program was shaped by this argument:

> "I have heard... that people may become dependent on us for food. I know that was not supposed to be good news. To me that was good news, because before people can do anything they have got to eat. And if you are looking for a way to get people to lean on you and to be dependent on you, in terms of their cooperation with you, it seems to me that food dependence would be terrific" (Senator Hubert Humphrey, *apud* Deo & Swanson 199: p.193).

By the same token, we need to go back to the creation of the IARCs to understand the nature and logic of convenient international relations. Where are located the IARCs? Very conveniently, they are located in the world regions of greatest genetic diversity for food and industrial crops. Over 90% of the plant genetic materials stored in the IARCs come from tropical countries. However, the "gene-rich", but scientifically weak, African, Asian, and Latin American countries together contribute with over 90% of the stored germplasm but hold the capacity to use only about 15% of these materials. North America alone, which contributes with less than 0.1%, uses over 20%, as shown below.

Table 1. Donors of germplasm duplicates to the IARCs Genebanks.

Regions of the World	Germplasm Duplicates Donated (%)
Latin America	22.9
Asia	34.2
Africa	34.0
Western Europe	8.6
All others	0.3

Source: Adapted from Mooney (1985: p.141).

Table 2 Beneficiaries of germplasm from the IARCs Genebanks.

Regions of the World	Germplasm Duplicates Received (%)
Latin America	6.3
Asia	4.2
Africa	4.6
Western Europe	15.9
Eastern Europe	1.9
IARCs	41.3
North America	23.8
All others	1.9

Source: Adapted from Mooney (1985:142)

These numbers demonstrate that even an international policy of free access to or free exchange of plant genetic resources will be of most benefit to those countries with the greatest scientific and technological capability to collect, evaluate, use and transform socially and economically relevant genetic materials. The network of IARCs also offers the 'convenience' of freeing any given country or TNCs from being blamed of overexploiting the genetic resources of another country or from being accused of unequal germplasm exchange. It is not by chance that collaborative research is a permanent part of the U.S. foreign policy. Consider, for instance, this quotation:

Collaborative research with the Third World has benefited U.S. Agriculture...through the infusion of yield-producing genetic materials into seeds of our cultivated crops.... Continued scientific and technical assistance

to the developing countries is essential and in the long run will provide expanded trade opportunities for U.S. agriculture and Industry.... Countries such as Taiwan, Korea, Brazil, and Nigeria, which were recipients of U.S. technical assistance, are now among the major purchasers of U.S. food exports.

Nyle C. Brady, as Senior Assistant Administrator for Science and Technology, USDA, and former Director General of IRRI, in Science, November 1, 1985: 499

COOPERATION AND COMPETITION

Less than five years from the year 2000, developed countries are once again promising to free developing countries from their most pressing socio-economic problems through a new technological revolution in agriculture; what will be done through the transfer of the scientific-technological wonders of modern biotechnology. However, the promise is once again false because the premise is once again false. Production technology does not replace distribution policy. The world already produces more than the world population can eat. Thus, if even excess does not guarantee access, what can biotechnology do?

It is ironic that most biotechnology-related promises are based upon its scientific-technological potential, not in actual deeds; yet, many of these promises assure the solution for chronic socio-economic problems in developing nations through a "biorevolution" in agriculture. However, a critical analysis of its promises against its current trends indicates that the future use and impact of biotechnology in developing nations rely presently upon crucial contradictions. As a result of such contradictions--social goals vs. private gains, social problems vs. technical solutions, agricultural vs. industrial revolution, cooperation vs. competition, and control over nature vs. control over certain social segments and their social institutions--there is a high likelihood that (i) traditional farming will become increasingly obsolete in commercial terms, (ii) technological and economic dependence of developing countries on developed countries will persist and even increase, (iii) food and fiber production will be increasingly dislocated from developing to developed countries and from farms to industries, (iv) the market for specific tropical products will be destroyed and therefore entire economies may collapse, (v) hunger and poverty will persist and even increase, and (vi) social unrest may increase worldwide (Silva, 1988).

Thus, in order to avoid false promises based upon false premises, let us not talk just about cooperation or just about competition. Let us talk about cooperation, competition and contradictions. To demonstrate that competition is prevailing over cooperation, this part of the paper reveals how a developed country, the U.S., and a developing country, Brazil, are positioning themselves under the cooperation-competition paradox. Consider, for instance, a recommendation made to the U.S. Government by the "U.S. Interagency Working Group on Competitive and Transfer Aspects of Biotechnology" (United States, 1983: A-12).

Because of its potential importance in a number of critical industries, foreign governments have established comprehensive national policies and programs to foster the commercial development of biotechnology in their countries. These targeting programs have the potential to enhance the international competitiveness of their domestic firms, while simultaneously weakening that of U.S. firms. In recognition of the importance of this core technology to the nation's economic well-being and its national security**,** the U.S. Government should: ... vigorously pursue unfair trade practices through its trade laws and bilateral and multilateral negotiations (emphasis added).

Ironically, on the other hand, following the policy of "do what I say not what I do", the U.S. is not satisfied with countries which follow its footsteps, as China, for instance. In the words of the United States Secretary of Agriculture, Dan Glickman, "as China best overall customer, the U.S. is not unreasonable in its desire to see China open its markets and remove unfair trade barriers" (emphasis added) (Glickman, 1996:3)

Now consider the logic of the "Bumpers Amendment", passed by the U.S. Congress in May 1986, according to an article in **Biotechnology and Development Monitor**.

This Amendment sets a legal precedent over the orientation of US aid on agricultural research. The Amendment stipulates that:

> "None of the funds to be appropriated to carry Chapter 1 of the Foreign Assistance Act of 1981 may be available for any testing or breeding, feasibility study, variety improvement or introduction, consultancy, publication, or training in connection with the growth or production in a foreign country for export if such export would compete in world markets with a similar commodity grown or produced in the United States" (*apud* Manicad, 1995: p.8).

The Bumpers Amendment was the response to a protest by the American Soybeans Association (ASA) over the USAID research project INTSOY, which was developing soybean varieties in competing countries such as Argentina and Brazil. ASA, with the help of Senator Bumper, demanded the termination of research and technical assistance to foreign nations that compete with the USA, and asked for a redirection of research funds (Manicad, 1995). As a result of the Bumpers Amendment, the allocation of USAID funding is now subject to different requirements, including compatibility with US trade interests. Also, private companies are now funded by USAID to prioritize research projects of importance to developing countries, but not of top significance to private companies (Manicad, 1995).

However, for confirming that we are already operating under the age of the cooperation-competition paradox, it is necessary to identify the same logic shaping the performance of some developing countries. Let us examine Brazil's position in the area of plant genetic resources exchange as an example. Brazil is addressing the imperatives of this paradox by practicing "implicit policies". Explicitly, Brazil does not put any legal or official barrier on exchange of germplasm; while, implicitly, it has restricted access to the germplasm of its most relevant native crops: pineapple, cashew, cocoa, Brazil nut, rubber, "guaraná" (*Paulinea cupana*), and "caiuaê" (*Elaeis oleifera*). Of course, no Brazilian government document states such a restriction.

In short, Brazil does not prevent access to germplasm of these crops; it restricts their exchange only to increase its bargaining power "vis-à-vis" other countries that prevent access to plant germplasm of interest to Brazil. For example, India has a law that prohibits the exchange of its black pepper germplasm, and Ethiopia has one that prohibits the exchange of its coffee germplasm. Brazilian policy makers cite these laws as excellent examples of "inconvenient", "misguided", and "distorted" policies. They defend Brazil's implicit policy of restricting access to the germplasm of its most important native crops not as an indicator of Brazil's desire to prevent access to it, but as a way of increasing Brazil's power to negotiate access to germplasm of interest with countries that attempt to prevent access to it. That is why Brazil has "unofficially" conditioned India's access to Brazil's cashew germplasm to India's permitting Brazil to have access to its black pepper germplasm (Silva, 1989).

As one Brazilian scientist puts it, “implicit policies give more political flexibility to a country to act on a case-by-case basis”. The germplasm of “restricted exchange” is always available through bilateral agreements (Busch et al. ,1995: p.166).

Under the cooperation-competition paradox, the growing proliferation of international negotiating mechanisms reveals its meaning. These mechanisms, created primarily to establish equal procedures for unequal capacities, are just part of the latest neocolonial strategy designed and promoted primarily by some world capitalist powers to get developing countries behaving according to the political and (specially) economic interests of the former (Bonanno et al., 1994). At least, this is what one may infer from the connection between President Bush’s decision of not signing the Convention on Biological Diversity (CBD) during the UNCED-92, in Rio de Janeiro, Brazil. As Lawrence Busch and colleagues rightly explain (Busch et al., 1995: p.62-63): “Intellectual property rights may well have been the key to President Bush’s decision [of not signing the Convention on Biological Diversity during the Eco-92 in Rio de Janeiro]. Biotechnology trade associations, including the Industry Biotechnology Association, and the chief executives of some largest biotechnology companies lobbied vociferously against the [CBD] treaty, arguing that it would restrict rights to intellectual property and undermine the competitive advantage of U.S. companies by forcing them to transfer valuable technology to developing countries. They further believed that it could adversely affect trade negotiations and agreements such as the General Agreement on Tariffs and Trade (GATT). Finally, in the last round of negotiations the United States won a major concession in a sentence calling for ‘adequate and effective protection’ of intellectual property rights in any technology transfer carried out under the agreement. This concession neutralized the alleged threats to U.S. business interests.”

Finally, it is ironic that most agricultural biotechnology transfer initiatives stress just the transfer of intermediary, i.e., tissue culture and micropropagation – rather than frontier technologies (Sorj & Wilkinson 1994: Goldstein, 1995; Thurow, 1996). Unfortunately, this strategy has made many developing countries very happy. They think that they now master advanced biotechnology, while mastering just the “biotechnologies of the poor.”

CONTRADICTIONS UNDER THE COOPERATION-COMPETITION PARADOX

This is an era of cooperation, competition and contradictions. Old practices as well as emerging strategies associated with agricultural biotechnology transfer from developed to developing countries are already being shaped by the cooperation-competition paradox. This process is not without contradictions, such as those outlined below:

Science for profit not for the people. Technoscience, the result of the interplay between modern science and modern technology, is becoming increasingly commodified. Specially after the latest scientific advances in several biotechnology-related fields, the trend towards the privatization of agricultural biotechnology development is irreversible. In the U.S., the Government invested over thirty years in public infrastructure and basic research that the private sector needed but would not fund it (Thurow, 1996). Now, the government is deliberately shrinking public budgets for science and technology so that public universities and research institutes are more easily coopted through research contracts which use publicly funded research infrastructure and basic research results to promote the private gains of a few private groups. If this tendency gets established, the development and transfer of biotechnology will lead to the commodification of science and nature, the extension of the commodity logic and form to scientific practice and its products as well as to all life forms and their products. Poor people and their needs will not be a priority in private companies' and their associated public institutions' agendas.

Alliance vs. partnership. There is an urgent need to distinguish between alliances and partnerships in international relations and in the process of technology transfer. International cooperation initiatives generally promise to be partnerships; yet, history has provided evidence that they are nothing more than convenient alliances. History has demonstrated that alliance we make even with our actual or potential enemies; while partnership we make only with our actual and potential friends. Alliances are made out of short or medium term convenience which generally establishes a temporary relationship. Partnerships are developed around long term goals which generally establish permanent relationship. Finally, while in alliances the most powerful generally benefits most, in partnerships power is not a factor shaping the sharing of the benefits. The history of agricultural technology transfer, however, provides enough evidence that, most of the times,

developed countries have made sure that, in the long run, they will benefit most.

Genetics and hunger. The world already produces more than the world population can eat; yet, presently, about one billion people go hungry any day. The United States, the world largest food producer, exporter and donor had 20 million of hungry people in 1986; ten years later they are already 30 million, and the number is rising. Finally, Brazil, the world third or fifth world largest exporter of agriculture-derived products, holds the eighth most ill-fed population in the planet. Surely, production and productivity constitutes a necessary but never sufficient condition to assure access to food. Thus, it is a shame that still today developed countries try to cheat developing countries through promises based on false premises. Socio-economic problems, such as hunger and poverty, are growing everywhere (Thurow, 1996); and they will not be solved through technological solutions. Ironically, because of the existing asymmetrical power relations, unequal exchange, and contradictory international cooperation initiatives, the more science has developed the more hunger and poverty have also grown.

Sustainable agriculture vs. unsustainable institutions. Development is a product of intervention; for without intervention there is no development, just evolution. That is why society creates, funds and maintains public institutions; for them to carry out sets of development activities relevant to society development. However, most international cooperation programs in agricultural biotechnology promise a great contribution to the development of a sustainable agriculture in developing countries without no explicit concern with the sustainability of their public institutions. On the contrary, it seems that a campaign to demoralize public institutions in developing countries, with the help of some international funding agencies and technical cooperation organizations is underway. As a result, there is a growing tendency to privilege private organizations as recipient of international funding support, with the excuse that public institutions are not reliable as development agents. Obviously, this is a cynical argument, for private organizations are driven just by profits and are not accountable to any public mechanism over which the general public may control them. Unfortunately, the policy of “privatization as salvation” is a false premise. There will be no sustainable agriculture without sustainable public institutions to formulate and carry out consistent, sustainable development interventions.

CONCLUDING COMMENTS

False premises always lead to false promises. Which developed countries would provide technical assistance to a developing country to the point of it holding equal scientific and technological capacity, to the point of it becoming their competitor? None.

However, there is a growing movement to promote agricultural biotechnology transfer from developed to developing countries (Commander, 1996; Heissler, 1996; Manicad, 1996), with the promise of benefits for the latter as a result of collaboration from the former. This paper has provided past and present evidence to anticipate that competition rather than cooperation will prevail in this process, and that most advantages will be appropriated by developed rather than by developing countries, as in most historical examples of the transfer of agricultural technology to tropical countries.

Under the premise of the cooperation-competition paradox, this paper ends by making an invitation. If we are actually interested in improving international cooperation in agricultural biotechnology, let us face the need to build the social, political and ethical awareness necessary to address the issues of asymmetrical power relations, unequal exchange, and contradictory cooperation initiatives associated with the process of agricultural technology transfer from developed to developing countries.

Let us accept that scientific neutrality is a myth (Silva, 1995; 1996), and that science has always been politics by other means (Latour, 1987); specially now that many scientists are, more than ever, looking for fame, patents and profits. Let us complain for the lack of an explicit ethical dimension in international cooperation initiatives. Let us agree with the need for the protagonism of developing countries in the process of designing and implementing cooperation programs and projects which will affect them. Let us ask for the creation of philosophy of science and ethics courses in all graduate and post-graduate programs worldwide. Let us hope that profit does not become the only parameter to decide over the future of agricultural biotechnology development for developing countries. Let us then hope that science will be practiced also for the people, not just for profit. The contrary is already well known. Until when? At what cost?

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