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Technology Transfer in the
Production of High Yielding
Maize and Bean – A Mexican
Case: Is a Human Rights
Perspective Required?

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Abbreviations

WIPO	World Intellectual Property Organization
FAO	Food and Agriculture Organization of the United Nations
FIRCO	Fideicomiso de Riesgo Compartido
INIFAP	Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias
TRIPS	Trade Related Aspects of Intellectual Property Rights
WTO	World Trade Organization
GMO	Genetically Modified Organisms
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo
CGIAR	Group on Intellectual Agricultural Research
CONACyT	Consejo Nacional de Ciencia y Tecnología
ICESCR	International Covenant on Economic, Social and Cultural Rights
LDC	Less Developed Countries
IPR	Intellectual Property Rights
FDI	Foreign Direct Investment
PVPA	Plant Variety Protection Act
PPA	Plant Protection Act
R&D	Research and Development
IFRI	International Food Policy Research Institute
UDHR	Universal Declaration of Human Rights
UNESCO	United Nations Scientific, Education, and Cultural Organization
UDBHR	Universal Declaration on Bioethic and Human Rights
UPOV	International Union for the Protection of New Varieties of Plants
QPM	Quality Protein Maize

1 Introduction

1.1 Back Ground

Intellectual Property Rights principally contemplates Copyright Law and Patent Law. It is the latter that embraces the field of Technology Transfer.

The World Intellectual Property Organization,¹ defines a patent as a document given by a Government office to protect an invention and constitute a legal situation where the patent can be commercialized with the authorization of the patent's right-holder.² Invention is defined as the creation of one solution to a specific problem in the field of technology such invention can be related to a product or process.³ As a sub-concept of patent law, Technology Transfer refer to the methods that are used to spread knowledge of any technology or invention, showing the process of manufacturing among Institutions, Research Centres, Universities, to any beneficiary called licensee, with commercial objectives. In other words, technology transfer is transfer on the know-how relative to the invention.

One of the main goals of the Developing Countries is to achieve access to such technologies in order to stimulate and develop their economies in diverse sectors e.g. Agricultural, Mining, etc. The agricultural sector is one of the sectors that look for developments in technology.

One of the technologies or tools used in the agricultural sector is Biotechnology; the biotechnology can get more production of crop, and it is used with the cattle as well. The Food and Agriculture Organization of the United Nations⁴ in the article "Can Biotechnology meet the needs of the Poor?" mentions that adopting biotechnology is capable of stop hunger in the poorest countries. The FAO gives the following definition about biotechnology:

...any technique that uses living organisms or substances from these organisms to make or modify a product for a practical purpose.⁵

Also the Convention on Biological Diversity⁶ gives a similar definition both definitions are in a broadly meaning but the Cartagena Protocol on Bio-safety expresses more narrowly as:

¹ Hereinafter WIPO

² WIPO Intellectual Property Handbook, Second Edition, p. 17. Reprinted 2008 WIPO Publication.

³ Ibid.

⁴ Hereinafter FAO

⁵ What is Agricultural biotechnology? FAO report, p.8. FAO Publication 2004.

⁶ Hereinafter CBD

the application of: (a) In vitro nucleic acid techniques, including recombinant deoxyribonucleic acid (DNA) and direct injection of nucleic acid into cells or organelles, or (b) Fusion of cells beyond the taxonomic family, that overcome natural physiological reproductive or recombination barriers and that are not techniques used in traditional breeding and selection.

When agricultural biotechnology uses genetically modified plants and seeds to look for solutions to problems in that specific sector e. g. how to breed stronger plants to resist plagues, climate, etc., and improve the nutritional content of the plants and seeds.

Since the human being settled down started to observe nature they realized that taking plants material can improve their crop and get a better meal. They also discovered fermentation and were able to make beer, wine and cheese. These techniques can be compared with the modern biotechnology.

The modern agricultural biotechnology began in the 1940s with the so-called Green Revolution whose aim was to look for new techniques in the agricultural field and then effect technology transfer of all those inventions to least development countries and developing countries, the green revolution started in Mexico and founded the International Maize and Wheat Improvement Center called CIMMYT. The program was later adopted in other countries (I will talk more about CIMMYT in chapter 2).

However, nowadays more private companies are doing research in biotechnology in developed countries. The primary motivation of these companies is to profit in the transfer of those patents or inventions that resultantly make it more expensive and harder for Least Developed Countries (LDC) and developing countries to acquire them. Furthermore these companies have taken advantage of strong protection of patents under TRIPS thus technical dependence rather than technology transfer.^{7 8}

Similarly, there is a debate whether these technological innovations and its transfer to the agricultural sector could destroy and remove Traditional Knowledge of the farmers because the people who defend that idea say that the farmer has learned from his work in the farmland they get a better comprehension of the soil instead the Scientifics.⁹

⁷ La Biotecnología para ayudar a los pobres, *the Biotechnology to help the poor*, Lilian Joensen, Argentina. Revista Theomai, segundo semestre número 12, Quilmes Argentina, 2005

⁸ Intellectual Property Rights and their Impacts in Developing Countries- An Empirical Analysis of Maize Breeding in Mexico, Adreanne Leger, Institutional Change in Agriculture and Natural Resources (ICAR) Humboldt University Berlin, Department of Agricultural Economics and Social Science , 2005

⁹ Farmers Rights on the protection of Traditional Agricultural Knowledge, Stephen B. Brush, World Development Vol. 35, No. 9, pp. 1499-1514, 2007

1.2 Purpose.

As I mentioned before, there has been a strong criticism against multinational companies whose business is to develop new techniques and inventions to address farm productivity because in the end the farmers becomes dependent on these companies since they must follow all the instructions given to them on how to use the products. Farmers have not been given access to the knowledge of such techniques. There is as well concern about all the possible damage in the environment as a result of using genetically modified plants or seeds.

An example is the case of the so-called Terminator Seeds which was a new genetically modified seed developed in the 90s. The second generation of these seeds would be sterile causing the farmers to keep buying this kind of seeds. The Companies using those seeds looked for protect their inventions in countries that have a no strong intellectual property laws to avoid piracy. In addition, these seeds may harm other plants by cross-pollination creating sterile plants in the nature. Such seeds were prohibited in the Convention on Biological Diversity.

My purpose in this essay is to analyze the problems presented by Technology Transfer in the Agricultural Sector viewed from the intersection of Intellectual Property Law and Human Rights Law. In recent years, scholars have looked at the collaboration between these two disciplines in trying to formulate balanced policies and solutions. I will narrow the thesis to the Agricultural sector in Mexico evaluating the research on the high yielding maize and bean seeds.

1.3 Methodology

To analyze the Technology Transfer in the Agricultural Sector in Mexico, I will present the international legal framework for Technology Transfer. I will analyze the TRIPS agreement and Mexican law, and I will use a Human Right approach mentioning the Conventions that are applicable, as well; I will discuss what roles the government offices and other institutions have on the theme using a comparative approach.

This thesis is using a compilation of legal materials including primary and secondary law, and literature and articles based on Technology Transfer, Agricultural Biotechnology and Human Rights.

1.4 Outline

I have organized the thesis as follows, in Chapter 1, I present the introduction to Technology Transfer and principals objectives of the Agricultural Sector. In Chapter 2, I discuss the History of Technology

Transfer in Mexico. The Chapter 3, I will evaluate the Technology Transfer and its relationship with Economics and Human Rights. In Chapter 4, I will examine the Mexican law, the International and the Human rights conventions. Chapter 5 is about a Mexican case in Technology Transfer to the Agricultural Sector. Chapter 6 is the conclusion.

2 Technology Transfer in Mexico

2.1 Introduction

In this Chapter, I will explain the history of the Technology Transfer in Mexico from the end of the 19th century to the present although in the early years there was a lack of Technology Transfer in Mexico and more in the Agricultural sector.

I believe is important explain how Mexico handled the advances in technology that started with the industrial revolution. I must indicate that after Mexico won his independence from the Spanish Crown in 1821 the years that followed were of political, economical and social instability, with internal struggles to control the country. Likewise, after the Mexican-American war from the end of 1830s to the end 1840s, and the reform war and French intervention in 1860s, Mexico obtained peacetime until 1870s and started to “modernize” as a Country through Technology Transfer. After the Mexican Revolution, Mexico broached the idea of renewing the countryside and started to look for Technology Transfer for application. In the 1940s, CIMMYT was created and in the following years the Universities began to be involved in Technology Transfer programs in the agricultural sector.

2.2 From 1870 to 1910

In the last part of the 19th century, new technologies imported from the United States and Europe were introduced to Mexico.

One of the first successful transfers of technology in Mexico was with the breweries, with the high demand of beer bottled had risen to 50 millions litter annually,¹⁰ but the breweries faced a common problem, to put the stuff in had to be blown by hand. Glass blowers had to be hired by each brewery, and on occasions could not comply with the demand.

The Toledo Glass Company solved the problem with the construction of the Owens automatic glass bottle-blowing machine and its commercial use in the United States.

¹⁰ Approaches to Technology Transfer in History and the case of 19th Century Mexico, Edward Beatty, *Comparative Technology Transfer and Society*, volume 1, number 2, pp. 167-200, 2003.

One Mexican brewery acquired this new technology and signed an exclusive contract; the Chihuahua Brewery paid U. S. \$100,000 for two machines and their patent rights. Other industries followed similar decisions to get new developed automated production machinery. All those acquisitions include either the importation of the artefact itself or the means of replicating it usually by using blue prints, plans, or skilled persons, sometimes a combination of both.

After the acquisition of the Owens automatic bottle-blowing machine the Chihuahua Brewery joined with Cuauhtémoc Brewery to found together the glass firm Vidriera Monterrey. They went to dominate two industries with new bottle-blowing technology: the beer Industry and the glass Industry.¹¹

Later the company would develop its own research and development division, crating a rapid technical education and through decades, it was in position to license its own innovations in glass technology abroad including American companies.

Another example in the late 1890s was the acquisition of the MacArthur-Forrest cyanide process for separating gold and silver from host ores, by the Mexican Gold & Silver Recovery Company getting far greater yields of gold and silver per ton than the traditional amalgamation methods.¹²

However, not all were successful. Over 300 companies applied for federal tax and tariff exemptions but only eight went to commercial production due to diverse obstacles from social issues to environmental landscape concerns (arid clime, etc.), and domestic piracy made by consumers. In addition, in some cases replicating foreign techniques sometimes did not require the acquisition of property rights for example that was the case of cement Industry.

2.3 From 1930 to 1970

Between the 1920s and 1940s, the Mexican Government looked towards improving scientific development with the creation of the National Council of High Education and Scientific Research. After the Mexican Revolution with the new ideas to reform the rural area and have a fair trade with the farmers, came up the first step to develop techniques in the countryside, with technology transfer programs that led to founding of the CIMMYT. Also in the 1960s, there was intent to create a gigantic agricultural complex in Chontalpa, Tabasco to increase the agricultural production.

¹¹ See note 10

¹² Ibid.

2.3.1 CIMMYT

The Mexican Government and the Rockefeller Foundation created the CIMMYT as a pilot program in Mexico in 1943. After the great depression in the United States, the world was concerned about the problems that extended the depression into the farmlands with crop failure and the consequent starvation and poverty. This pilot program looked to fight those problems that were encountered during the depression. One way to do this was developing and improving varieties of wheat and maize, and introducing new improved agricultural techniques to the farmers to improve their livelihood.¹³

Norman Borlaug,¹⁴ was one of the program's researchers who developed wheat seeds varieties that put more energy into grain production and responded better to fertilizer than older varieties, with the good results of those seeds Mexico would become self-sufficient in wheat production in 1950s. Later India and Pakistan would import Mexican wheat seeds to help them to increase their poor harvest, effectively increasing their production two times more. Also the program has been carried out in different countries in Latin America, Asia and Africa and reaserch centers in countries such as Sweden, Canada, and the United Kingdom.

Nowadays, the Consultative Group on International Agricultural Research (CGIAR) supports the CIMMYT.

Regrettably, Mexico has imported more maize rather than export it, in 2007 according to FAO's register, Mexico imported 7'954,729 tonnes of maize and only exported 264, 224 tonnes of maize.¹⁵

2.3.2 CHONTALPA PLAN

Between the 1950s and 1960s, the Mexican government tried to create a new program involving agricultural technology transfer in the region of Chontalpa, Tabasco, this area was marked to build a colossal agricultural area where were resettled 6000 local families into 22 adjacent collective group farms called ejidos formed through the expropriation of existing ejidal¹⁶ and private lands.¹⁷ The aim of this plan was to increase the agricultural production and improve the life quality of the farmers.

Chontalpa is a tropical lowland area in the southeast of Mexico (figure 1) in this area the rain forest like in other parts of the world has a reach flora and

¹³ www.cimmyt.org last visited April 2nd 2010

¹⁴ He would win the Nobel Peace Prize in 1970.

¹⁵ <http://faostat.fao.org/site/535/DesktopDefault.aspx?PageID=535#ancor> last visited April 2nd 2010

¹⁶ Collective farmlands

¹⁷ Nutrition and the Commoditization of Food Systems in Latin America and the Caribbean, Kathryn G. Dewey, Science Medical Journal, Vol. 28 No. 5 pp. 415-424

fauna, in that zone its habitants have learned about all the benefits that can get from the diverse vegetation in the area, such as medicinal and others. That vegetation plays an important role in their daily life.



Figure 1

In the beginning of the plan was built a research centre to make investigations of new agricultural methods with the help of agronomist with the aim to transfer such knowledge to the farmers, also an agricultural school for the children, alongside new elementary school, clinics, and new houses were including in this phase.

However, the Chontalpa plan failed and the research centre and the agricultural school had to close at the end of the plan. I will explain what I consider the mistakes that were made during this plan. There was a council, which function was to communicate to the farmers all the decisions taken by the board of members in this case the Government and other agencies and other function as well was to listen to all the concerns, and inquiring that the farmers could have and answer them. As I mentioned before one aim was to create an agricultural research centre which activity was to develop agricultural techniques and pass those techniques to the farmers.

The problem was that there never existed a good communication between the farmers or “ejidatarios” and the Chontalpa plan’s council, the farmers never felt they were listened by the council and never felt the plan belonged to them.

In the book *Technology Transfer A Project Guide for International HRD* edited by Angus Reynolds. It says that when trainers or people in charge to pass the knowledge to the trainees or receivers, some times the trainers do not know about the culture of the group who is receiving the instruction and

they can not create a good connection to them and this end in that the process to transfer the knowledge fails.

He also mentions that it is important to take into consideration the cross-cultural differences and design a good learning program based on those differences because some cultures see the changes as a loss of tradition and continuity of their established life. Introducing new life styles is usually resisted by the local people that it is necessary to consult local traditions and to connect the new technology with the local tradition.¹⁸

All the Technology Transfer programs should have a good design on the way it will be transmitted to the receivers or learners.

2.4 1970 to present

In the beginning of the 1970s, the Mexican government had the concern to modernize the science and technology policy in Mexico, creating Institutions that would deal with this new politics on science and technology. One of those Institutions is the Consejo Nacional de Ciencia y Tecnología *National Council of Science and Technology* (CONACYT by its Spanish acronym) was crated in the 1970s.¹⁹

The CONACYT proposes and advises the Government all technology policy affairs, promotes the investigation and gives scholarships to study abroad Doctor of Philosophy (Ph. D.) as Master Degrees as well.

In 2000, the Mexican Government established the Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias *National Research Institute for Forestry, Agriculture and Livestock* (INIFAP in Spanish acronym) an Institute that deals with the research and development of new inventions and techniques in the agricultural sector. Further, I will explain more about the INIFAP and its work in the countryside.

In the late 1960s and the beginning of the 1970s the Universities in Mexico started to have a major role on the investigation of technologies to enhance the agricultural sector crating technology transfers programs and their implementation in the farmlands, one of those universities was the Universidad Nacional Autónoma de México *National Autonomous University of Mexico* (UNAM its Spanish acronym).

In addition, the private companies started to be involved in the research of technology in the agricultural sector, more in the investigation to improve

¹⁸ Technology Transfer A Project Guide for International HRD, Angus Reynolds, Ed. Reidel, 1984 pp. 40-41.

¹⁹ Ciencia y Tecnología en México, Antecedentes y características actuales, Rosalba Casas, *Revista Mexicana de Sociología*, Vol. 45, No. 4 pp. 1323-1334, Universidad Nacional Autónoma de México, 1983.

seeds, I will comment two examples of these investigation one made by the UNAM and other made by a private company.

2.4.1 The Biofermel process by the UNAM

The UNAM helped to develop a process called *biofermel* in the 1970s, one problem in those years that faced the cattle was the lack of cereal to feed them, so the cereal had to be imported at an expensive price.

However, in the sugar industry always has produced surplus of sugars called molasses which energetic value as a food is less expensive than the cereal, but present two problems to include only molasses to the cattle, 1) is low in proteins and 2) create problems to the metabolism of the cattle. The process to resolve these problems was investigated by the UNAM's BioMedical Institute and was supported with funds of the Institute for the Development in Cooperation (IDRC) and CONACYT. Getting the answer to the problem 1) using urea supplements to get more protein, because the cattle's stomach can produce protein by themselves through anaerobic fermentation, and the 2) problem using pre-fermenting molasses. Combining these two elements give a better nutritious meal to the cattle with the same nutritious material in the food than the conventional food used to feed the cattle.

The patents rights were held by CONACYT and the UNAM. Later the UNAM and a private company called "Ganadería Pestejé" signed a contract to licensed this technology, creating an agricultural technical training centre, UNAM and one of the sugar industry in Honduras also signed another contract to license the process in that country.

Nowadays is not longer used this process in Mexico.²⁰

2.4.2 Seed improvement and the agrobusiness

The Mexican companies dedicated to the agrobusiness, have made investigation related to the improvement of seeds used in the farmland and their commercialization, those companies focus in four areas their investigations: 1) plants improvement, 2) germplasm development, 3) Pathology and 4) quality research.

Various seeds are developed by cross-pollination techniques and methods of hybridization, making for the farmers easier to obtain better harvest and improving the nutrients of the plant. The hybrid plants are stronger than the "regular" plant and have more defences against pests and insects that usually attack the crop,

²⁰ Fundamentos y casos exitosos de la Biotecnología moderna, Francisco G. Bolívar Zapata, 2nd Ed. El Colegio Nacional 2007, pp. 579-595

The farmers in Mexico are more used to the traditional techniques, but with the use of hybrid seeds, their harvest can be increase from 15 % to 20 % investing less money, some researchers mention that the success of the American agriculture is because they use improved seeds in their fields, the range of use goes from 50% to 70%.²¹

²¹ Ibid. pp. 561-571.

3 Technology Transfer, Society Economy and Human Rights

3.1 Introduction

In this chapter, I will discuss how Technology Transfer interacts with the Economy, Society and the Human Rights.

Ever since technology was used by humanity, it has influenced the communities in developing stronger societies for their technological and scientific advances; this has improved their economy because can create surplus in their Gross Domestic Product (GDP) and be better off than other nations without such technological advances as well as trade and investment overseas.

However, some scholars have criticized this because the Technology Transfer can become a monopoly by the companies who may resort to fixing high prices for the licenses to use them, creating a technological dependence and with a stricter intellectual property regimen it becomes even more difficult for the least developing countries access to those advances.

For example, some learned people support the idea of protecting the traditional agricultural knowledge in opposition to use genetically modified seeds and hybrids seeds in the farmland I will talk about this later.

3.2 Technology Transfer and Society

One of the purposes of Intellectual property regime is to harmonize the moral and economic rights of creator and inventors with the benefits and needs of the society. The International Covenant on Economic, Social and Cultural Rights (ICESCR) cover these arguments by giving incentives to creators to conduct more research and giving to the people the right to access to such inventions.²²

Using technology transfer is a tool that can help the community to reach different aims making to improve various aspects of the people's daily life, through innovation when for example the pharmaceutical industry develops new medicines.²³

²² A Human rights perspective on Intellectual property, scientific progress, and access to the benefits of science, Audrey R. Chapman, *Intellectual Property and Human Rights*, Ed. WIPO 1999, pp. 127- 168

²³ Intellectual Property and the Right to Health, Silvia Salazar, *Intellectual Property and Human Rights*, Ed. WIPO 1999, pp. 65- 91

Within the agriculture sector exists the term “agribusiness” that cover all the companies associated with the food chain production from farming including raw material (seeds), agrichemicals and inputs to the distribution and final sales.

There are two major schools of thoughts about agribusiness: one says the agribusiness is an international system, where the small farmers can get more from be involved in the agribusiness and helping the LDCs to grow up their rural areas, and the other school who believes the opposite, that is that companies hurt the small farmers and these farmers likewise lose their traditional knowledge.²⁴

Traditional agriculture usually tends to have less integrated production processes rather than a food company, here the companies plays a major role when these transfer their knowledge to the farmers seeking to increase the harvest resulting in more crop.

With a major crop more people get food in their houses resulting in a better feed and quality life.²⁵

Using agribusiness can be an important way to help the society, however if this is used more to create profits rather than help people it might become inaccessible. In sub-paragraph 3.4 I will explain more about the negatives aspects that can be generated.

3.3 Technology Transfer and Economy

As I mentioned above the IPR regime aims to protect the inventors’ rights as well as promote innovation through research and development of new inventions.

Furthermore, the research and development of inventions can help developing countries with technological backwardness in building up their economy. This can be effected through foreign direct investment (FDI) and licensing which can reduce the cost of technology, and make them to enter to export markets.²⁶

Companies such as Monsanto and Pioneer Hi- Breed International have opened building research centres and created a distribution chain of their products in the Mexican market. However, some scholars believe than FDI had not had a great impact in the economies of the host countries. These

²⁴ The Private Sector and Rural Development: Can Agribusiness Help the Small Farmer?, Arthur Goldsmith, *World Development*, Vol. 13, No. 10/11, pp. 1125-1138.

²⁵ Nutrition and the Commoditization of Food systems in Latin-American and the Caribbean, Kathryn G. Dewey, *Soc. Sci. Med.* Vol. 28, No. 5, pp. 415-424

²⁶ Intellectual Property Rights, Technology Transfer and Exports in Developing Countries, Lei Yang and Keith E. Maskus, CESIFO Working Paper No. 2464, Category 7 Trade Policy, November 2008

scholars have showed evidence that the former tends to equate FDI to technology transfer, while in most countries and regions of the world FDI encompasses an array of arrangements that goes well beyond pure technology transfer. In addition, the information show that when the FDI is complement with domestic capital the result is a larger impact in economical growth.²⁷

Mexico has been always open to the foreign investment in the country, seeing this as a key to improve the economy whether through licensing or through FDI by multinational corporations, being the main business partner of the USA.²⁸

Since 1970s, the technology transfer in Mexico has been seen as an alternative for the indigenous technology and as an important tool to increase production in the soil.²⁹

Generally speaking on the financial protection that the inventors can get the ICESCR mention that all the inventors have the right to benefit from the protection of be recognize as the intellectual creator as well as to get profit from the marketing of their inventions.

Besides the World Trade Organization in 1994 came up with the Trade Related Aspects of Intellectual Property Rights agreement (TRIPS)³⁰ that established a global harmonization of the intellectual property rights, for the protection of trademarks, patents, design, etc. Some people have however complained because the TRIPS agreement gives a kind of legal monopoly to exploit the invention and enjoy the economical benefits for a limited period.

The governments protect the intellectual creators using the IPR regime and give to the creators' incentives to invest their time in and resources in creative activities that can generate an economic return. Without IPR, others could just copy or replicate the invention without the creator's authorization and harm his rights.

There are two ways to transfer technology; one is buying the license to produce a product, obtaining technical assistance, through blue prints and personnel, but in occasions, this way to acquire technology has limitations for developing countries, because the capital is scarce.

The other way is purchasing equipment for a specific application. This form is accompanied by technical assistance as well, these technicians train local

²⁷ Foreign Direct Investment as Technology Transferred: Some Panel Evidence from the Transition Economies, Nauro F. Campos and Yuko Kinoshita, *William Davidson working paper*, No. 438, January 2002

²⁸ The Private Sector and Technology Transfer to Mexico, H. Eugene Douglas and Victor Basiuk, *Mexican Studies/Estudios Mexicanos*, No. 2 Vol. 2 pp. 253-273

²⁹ Alternative Forms, Fashions and Politics for Technology Transfer: A Mexican Perspective, Gerardo M. Bueno, *Mexican Studies/Estudios Mexicanos*, Vol. 2 No. 2, pp. 235-252

³⁰ This agreement is compulsory for all the WTO member states

personnel in the use of the product building up the economic productivity; however, has its limitations as well, because it will not generate sustained technological growth and once burned out, it must be replaced with more product.

The agribusiness sector, as well, has increased the research and development investment from the private sector, and pursues intellectual property regimes to protect the inventions to prevent free-riding because the cost of copy or replication is minimal rather than the cost of creation.

Regarding the scientific advances in agriculture, the door was opened for a broader definition about patentable material and the use of licenses in the USA with the decision in the case *Diamond v. Chakrabarty*³¹ (1980). This case allow the patenting of life forms making possible patenting plants and animals taking into account the Plant Variety Protection Act (PVPA) for plant seeds and the Plant Protection Act (PPA) for tubular forms of plants, the last act complies with the International Union for the Protection of New Varieties of Plants³² for plant breeding. The most common form of Breeders' Rights, includes farmers' and research exemptions which allow farmers to replant, and researchers to reuse seed of protected varieties without paying royalties to the certificate right holder.

Similarly, the private companies want to protect their products from copycats or piracy. The US Supreme Court held in *J.E. M. Ag Supply, Inc v. Pioneer Hi-Breed International, Inc.*³³ case that the plants innovations were eligible for utility patent protection in plant breeding and hybrids plants. This is because the principal seed market in the US is the maize and soybeans crops; just in 2001, the maize seed represent \$19 billion dollars, having a lot of investment from the private sector in the R & D of these seeds.³⁴

With regard to the agribusiness economy, the TRIPS agreement obliges the WTO's members in theory to make all areas of technology eligible subject matter for patents, but article 27 paragraph 3, allows members to exclude from patentability plants and animals but not microorganisms. However, the TRIPS let member to implement an effective system of protection, to use patents for the protection of new plant varieties or to do something that is a mixture of both, "TRIPS plus agreement".

The patent system has been driving to create innovation, but monopolies on patents have substantial costs. Maybe intellectual property markets can mitigate these costs by facilitating transfer and the use of technology, but

³¹ *Diamond v. Chakrabarty*, 447 U. S. 303 (1980)

³² The Impact of Property Rights in the Plant and Seed Industry, T. Dhar and J. Foltz, *Agricultural Biotechnology and Intellectual Property, Seeds of Change*, Ed. By Jay P. Kesan, pp. 161- 171

³³ *J. E. M. Ag Supply INC. v. Pioneer Hi-Bred International, INC.*, 534 US 124 (2001).

³⁴ See note 32 *supra*

sometimes this market has limitations because R & D generally needs access to techniques that have already been protected by others patents. It is thus difficult for those seeking to exploit earlier discoveries and bring their benefits to the public, the main interest of this market being the performance on innovation rate.³⁵

Likewise, government and private companies can help each other in economic development. Private companies have the economic potential to invest on research, but they do not have enough human capital to remain competitive in the market. In addition, the public institutions compromise with the social welfare and their lack of economical resources, have developed strategies to help their limited budget, and the private companies, on the other hand, with the changes in the market are oblige to become more competitive using more investment in R & D.

However, both sectors have different objectives and ambitions. The public sector's goal is to create economic development, social equity and environmental sustainability; the private sector looks for increased profit and earnings by increasing productivity and product quality. This alliance between the private and public sectors generate more benefits for research in the agricultural sector, and create more jobs, as well.

In 2001, the program called "Public-private partnerships for agroindustrial research" was established in three pilot countries in Latin America.³⁶ This program would be taken later under governance of the International Food Policy Research Institute (IFPRI)³⁷

In addition, awareness on traditional agricultural knowledge has increased in the market where more consumers seek to buy "ecological" products, in other words without the use of pesticides and/or transgenic seeds.³⁸

3.4 Technology Transfer and Human Rights

Since the creation of the WTO and with the TRIPS agreement, governments, institutions and organizations have been studying the relation

³⁵ The Strength and Structure of Intellectual Bio-property Markets, S. Buccola and Y. Xia, *Agricultural Biotechnology and Intellectual Property, Seeds of Change*, Ed. By Jay P. Kesan, pp. 204-215

³⁶ Alianzas para el Desarrollo de Innovaciones Tecnológicas: el caso del Inifap y empresas del Sector privado agropecuario/ *Partnerships for the Development of Technological Innovation: The Case of INIFAP and the agricultural private sector*, José de Jesús Espinoza Arellano and others, *Revista Mexicana de Agronegocios*, enero-junio, Vol. IX No. 16, pp. 439-448

³⁷ Mexico belongs to this Agency

³⁸ Farmers' Rights Protection of Traditional Agricultural Knowledge, Stephen B. Brush, *World Development*, Vol.35, No. 9, pp. 1499-1514

between Human rights and Intellectual property. Scholars have written about a Human Right framework^{39 40} in an attempt to balance both systems.

The Universal Declaration of Human Rights (UDHR) and the ICESCR seek to balance those diverse systems. However, in the opinion of the Professor Peter Yu, the ICESCR is obscure in the obligations that are sought. Likewise, Professor Helfer expresses the same opinion about the ICESCR and adds that the main objective is only the economic interest.

Some people have opposed to the balance of both systems arguing that the Intellectual Property protection is a secondary Human Right. In addition, there are conflicts between the point of view about the compulsory licenses for patent of pharmaceuticals, the relationship among biodiversity, patents and plant breeders' rights.

The United Nations Scientific, Education, and Cultural Organization (UNESCO) has expressed their concern about the technology transfer and the excessive protection to the transnational corporations under the TRIPS agreement. It published the Universal Declaration on Bioethics and Human Rights (UDBHR) about the injustice and inequality in global health. One of its many aims is to promote equitable access to medical, scientific and technological developments as well as greatest possible flow and the rapid sharing of knowledge concerning those developments and the sharing of benefits, with particular attention to the needs of developing countries. The UDBHR contains social principles of technology transfer and transnational benefits.⁴¹

Another conflict that is implicated is about the rights of indigenous people and traditional knowledge. Such knowledge is normally unwritten and based in oral tradition and experience instead of being written. One example is the knowledge about the use of specific plants and seeds for harvesting practices. Such rights have been seen as public domain with the problem of being exploited by others, more in particular the plant breeders' rights.^{42 43}

Plant breeders' rights are used to cover plant varieties and recover their investment in breeding. In the 1980s the FAO and its Commission of Plant Genetic Resources started to mention of the word "common heritage" used together with the traditional agricultural knowledge and creating "the

³⁹ Toward a Human Right Framework for Intellectual Property, Laurence R. Helfer, *U. C. Davies Law Review*, Vol. 40, p. 971

⁴⁰ Challenges to the Development of a Human Right Framework for Intellectual Property, Peter K. Yu in *Intellectual Property and Human Rights 77* (Paul L. C. Torremans, Ed., Kluwer Law International, 2008)

⁴¹ Normative Foundations of Technology Transfer and Transnational Benefit Principles in the UNESCO Universal Declaration on Bioethics and Human Rights, Thomas Alured Faunce and Hitoshi Nasu, *Journal of Medicine and Philosophy*, 0, pp. 1-26

⁴² See Helfer *supra* note 39

⁴³ Intellectual Property Protection and Traditional Knowledge: An Exploration in International Policy Discourse, Dr. John Mugabe, *Intellectual Property and Human Rights*, WIPO, 1999, pp.97-120

International Undertaking of Plant Genetic Resources.” Where the plant resources implies open access and non-exclusion to seeds and plants from farmers’ lands.⁴⁴ Being collected the seeds for this resource usually with the consent of farmers and recognition of the importance of farmers’ need for seed.

This resource has as a rule the “reciprocity” in other words those that taken seeds are expected to provide similar access to crop resources. The wide diffusion of modern crop varieties from international breeding programs is one indication of extent of reciprocity under common heritage.

In the case of GM seeds, although that those kind of seeds offer benefits to the farmers increasing the harvest, for example in one study conducted by the FAO. In this study, the farmers used transgenic cotton seeds of a variety known as Bt seeds. Genes from the common soil bacterium *Bacillus thuringiensis* (Bt) have been inserted into seeds, causing them to produce a protein that is toxic to certain insects, and HT seeds that are more resistant to the use of pesticides and agrichemicals, both seeds are used broadly in the US. The study showed that the US farmers gained about US\$105 million per year in higher net incomes since the adoption of Bt/HT seeds, which lowered their production costs and raised effective yields.

The companies that sold those Bt/HT seeds gained us\$80 million. Increased cotton output reduced consumer prices, producing a gain of about \$45 million per year for consumers in the US.

Nevertheless, the scenario in LDCs and developing countries is different. The same study was conducted in Mexico in the cotton fields where due to climate and soil characteristics the Bt seed were used has been creating more technological dependence rather that technology transfer. Those multinational companies requires farmers to sign a contract that forbids them from saving seeds and re-planting, also, requires to them to have their cotton ginned only in authorized mills.⁴⁵ This harms the farmers right to reuse the seeds as normally have been done in the traditional agriculture. It is understandable that the companies seek to protect their investment and recoup research cost, but the balance between both systems seem to have gone awry.

In this regard, Laurence Helfer offers three frameworks to approach human rights and intellectual property. The first is Using Human Rights to Expand Intellectual Property; here he states that IP could be used to expand intellectual property protection at the expense of human rights and the interest of licensees, users and consumers. Companies invoking inventor’s rights can use this for their own interests. The second framework is: Using Human Rights to Impose External Limits on Intellectual Property; here the

⁴⁴ Farmers’ Rights Protection of Traditional Agricultural Knowledge, Stephen B. Brush, *World Development*, Vol.35, No. 9, pp. 1499-1514

⁴⁵ The State of Food and Agriculture. Agricultural Biotechnology: Meeting the need of the poor? Ed. FAO, 2004, p. 53

right holders can invoke property rights provisions of human rights to demand additional protection, but can face opposition from user groups. One case applying the framework is that of plant breeders' rights and the exemption for farm-saved seed (where the farmers can store the production and re use the seeds, but they are not allowed to sell the seeds) without payment of royalties to the right holders. The last framework is c) Achieving Human Rights Ends Through Intellectual Property Means; this framework is more for the lawmakers, who should identify the outcomes that human rights law requires of states, and the intellectual property only plays a secondary role.

In my opinion, the three frameworks are hard to perform, but I prefer the third framework for the Mexican scenario. The problem with the human rights is that it is soft law and is not coercive. In addition, I believed that is necessary that the lawmakers include a stronger position about to balance both systems, because both groups - right holders and users - can invoke human rights and use them in a selfish way creating damages to both sides instead of helping each other.

4 Mexican Law, International Law and Human Rights Law

4.1 Introduction

Now I will give an analysis of the diverse legal texts governing technology transfer in Mexico, as the existing international legal instruments that are relevant.

I analyze spirit or nature of Mexican law and their justification and compare them with international law, including the US Law because almost all the companies dedicated to research the improvement in seeds are Americans.

4.2 Mexican and International Law

In the 1970s is when the Mexican lawmakers started to harmonize the legislation to the demands that were needed in the international context of technology transfer and become more competitive in the market. The laws that were created in those years were: i) the law of the national registration of transfer of technology and the use of patents and trademarks; ii) the law of inventions and trademarks; and iii) the law to promote Mexican inversion and regulate foreign investment.⁴⁶

The aims of those laws were to increase the ability to negotiate of the Mexican companies to bring technology from abroad, and prevent abuses by foreign licensors in detriment of Mexican economy.⁴⁷

Mexico as well had to fulfil with the provisions of the TRIPS agreement in intellectual property, this because Mexico is member of the WTO and WIPO.

Mexico signed the International Union for the Protection of New Varieties of Plants (UPOV) and created *La Ley Federal de Variedades Vegetales* (Federal Vegetal Varieties Law), with the help of the University of Chapingo for the preliminary draft.⁴⁸

⁴⁶ Ciencia y tecnología en México. Antecedentes y características actuales/*Science and Technology in Mexico. Background and actual characteristics*, Rosalba Casas, *Revista Mexicana de Sociología*, Vol. 45, No. 4, pp. 1323-1334

⁴⁷ Regulating the Transfer of Technology: the Mexican Experience, Hope H. Camp, Jr. and Clarence J. Mann, *Columbia Journal of World Business*, pp. 110-120, Summer 1975

⁴⁸ La Propiedad Intelectual de Variedades Vegetales en México/*The Intellectual Property of Vegetal Varieties in Mexico*, Gilberto Aboites Manrique and Francisco Martínez Gómez, *Agrociencia*, Vol. 39, No. 2, pp. 237-245

4.2.1 Ley de Propiedad Industrial/Law of Industrial Property

This law has the following objectives,

- i) to improve the industrial and commercial activity;
- ii) to promote and give incentives for the creation of inventions and the diffusion of technological knowledge;
- iii) to improve the quality of the industrial products and services to consumers;
- iv) to promote the creativity for the design of new products;
- v) to protect the industrial property by granting patents, registers utility models, industrial designs, trademarks and advertising slogans, publishing trade names, declaration of protection of appellations of origin and regulation of industrial secrets; and
- vi) to impose sanctions and penalties against acts that violate the Industrial Property.

The Institute of Industrial Property is the body responsible for ensuring the objectives of the law. It also coordinates with national and international agencies and institution on technology transfer.

Article 16 defines what may be subject of a patent as being all the inventions that are new, result from an inventive activity and are industrially applicable. It excludes i) essentially biological processes for the production, reproduction and propagation of plants and animals; ii) the biological and genetic material as found in nature; iii) the animals; iv) the human body and the living parts that compose it; and v) plant varieties.⁴⁹

About the trade secret or industrial secret, the article 86 (bis) says that the pharmaceutical chemicals and agrochemical products using new chemical will be protected in terms of International Treaties to which Mexico is party.

It is difficult to get data about how the companies in Mexico including the national and transnational companies register the seeds before the Industrial Industry Institute, but I believe that the seeds are registered under trade secret or industrial secret, because it is a form to avoid rejection under the patent system.

4.2.1.1 TRIPS Agreement

The TRIPS agreement mentions in article 27 (similar with Mexican law) that any invention, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application can be patentable

⁴⁹ The plant varieties have their own legislation.

Moreover, paragraph 3 exclude from patentability plants and animals other than microorganisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, members shall provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof.

4.2.1.2 US Patent Act

In the US, granting a patent in the case of plants is approached differently. Section 101 of Title 35 of the US Code mentions that any person who invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent.

However, the US Law allows patenting of plants. Before 1930, plants and seeds were seen as patentable material because they were in the nature.⁵⁰

the section 161 of the US Patent Act says:

”Whoever invents or discovers and asexually reproduces any distinct and new variety of plant, including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state, may obtain a patent therefore, subject to the conditions and requirements of this title.

The provisions of this title relating to patents for inventions shall apply to patents for plants, except as otherwise provided.”

The grant include the right to exclude others from asexually reproducing the plant, and from using, offering for sale, or selling the plant so reproduced, or any of its parts, throughout the United States, or from importing the plant so reproduced, or any parts thereof, into the United States.

4.2.2 Ley Federal de Variedades Vegetales/ Federal Plant Variety Law

The main purpose of this law is to set the rules and procedures for the protection of plant breeders’ rights.

Article 2 defines various technicalities, with the following being the most important to mention; i) Breeder: a person or company that through a process of improvement has been obtained and developed a plan variety of any genus and species; ii) Improvement process: set of techniques and

⁵⁰ Intellectual Property and Genetically Modified Seeds: the United States, Trade, and Developing World, Haley Stein, *North Western Journal of Technology and Intellectual Property*, Vol. 3 No. 2, pp. 159- 178

procedures to enable develop to a plant variety and that enable its protection as new, distinct, stable and homogenous; and iii) Propagation material: Any material of sexual or asexual reproduction that can be used for production of a plant, including seeds for planting and whole plant or any part thereof from which it is possible to obtain whole plant or seeds; and iv) Plant Variety: a subdivision of species that includes a group of individuals with similar characteristics and is considered stable and homogeneous.

The Secretary of Agriculture, Livestock and Rural Development is the government agency in charge for ensuring the compliance of this law, and coordinate with International Institutes responsible for the protection of plant breeders. In addition, including professional training of personnel, transfer of methodology and organization, exchange of publications and updating of databases and document collections data on the subject, as well as, protect the biodiversity of plant varieties that are in the public domain, and that the communities have the right to exploit them as they have done.

This law gives to the breeders the right to exploit exclusively and temporarily, by themselves or by third parties a plant variety and planting material for its production, reproduction, distribution or sale, as well as, for the production of other plant varieties and hybrids for commercial propose.

These rights have a limit of eighteen years for perennial species and rootstocks, and fifteen years for other species. Once after the time expire, the plant variety its use and exploitation will be in the public domain.

Article 5 mentions exemptions for the use of the plant variety without the consent of the breeders, when the plant variety is used as input source or genetic material for the research and improvement of other plant, in the multiplication of planting material for personal use as grain for consumption or planting, and for human or animal consumption, with benefits only to those who harvest.

In addition, the plant variety must be new, distinctness, stable and homogenous in order to be registered as such.

Chapter IV provides the rules on how compulsory license may be granted for the exploitation of the plant variety when it is deemed essential to meet the needs in a basic sector of the population and there is deficiency in supplies.

4.2.2.1 The International Union for the Protection of New Varieties of Plants (UPOV)

In 1961 the International Convention for the Protection of New Varieties of Plants was established. UPOV was created in 1978 which protected all plant

varieties irrespective of their mode of reproduction or technology used in their development.

The member states that signed the UPOV shall create a system for the grant of plant breeders' rights, within their national laws. Plant breeders' rights are granted in each member state for its own territory.

This law follows a similar criterion to grant protection as in the Mexican law, establishing the physical unit of the plant material selected by the breeder (morphological and physiological characteristics), the identity of the plant, distinctness, uniformity, and stability and homogeneous.⁵¹

The breeders' rights is limited to the exclusive production and sale of reproductive or vegetative propagating material of his variety, in the case of a cereal variety, they have the exclusive right to sell grain of that variety, but only seed. For instance, a farmer who produces seed on his own farm for the purposes of consumption on his own farm can do so freely without obligation to the breeder.

The time of exploitation had an amendment in 1991 extending the time to twenty-five years for perennial plants and twenty years for other species.

The breeders can grant licenses for the exploitation of the plant variety, with the exception when the plant variety is used as an initial source of variation for creating other varieties.

4.2.2.2 The US Plant Patent Act of 1930 (PPA) and the Plant Variety Protection Act (PVPA)

The PPA granted property rights for privately developed plant varieties for asexually reproducing plants. To get the patent the plant needed to be distinctness and new asexually reproduced plants, getting a period of exploitation for seventeen years.

Private companies were not satisfied only protecting asexually plants and in 1970 came the PVPA giving protection for sexual reproduction in plants, including seed germination.

While this was a significant victory for private companies, it was limited by two exemptions: seed saving by farmers, farmers could continue save, replant, and resell protected seeds to other farmers, and the other exemption for research purposes.

⁵¹ Mexico signed the UPOV in 1978

This Act set the bases for the creation of the agribusiness today.⁵²

The US legal system is based in case law as well; there is a case law that gave to the US the legal foundation to become one of the global biotechnology patent leaders.

In *Diamond v Chakrabarty*⁵³, it was held that the threshold question for patentability of an organism was whether it was inanimate, but whether it was a product of nature or human invention. The court's decisions hold that a live, the manufactured bacterium was patentable under the PPA Act. This brought implications for plant life establishing a new standard for invention that focused on natural products and products of human effort opening the doors for wider definitions of what is patentable.

Later in *Hibberd*⁵⁴, plant patents were allowed to be included under the broad category of utility patents, where plant breeders can patent individual components of varieties.

In *Asgrow Seed v Winterboer*⁵⁵, the farmers' right of saving seeds was eroded when a seed company sued a couple of farmers for violating the PVPA Act. These farmers used to sell the second-generation seeds to third parties, claiming protection under the PVPA seed saving exemption, but the US Supreme Court ruled that the seed saving exemption was narrowed to cover only farmers who saved seeds to replant on their own property.

4.2.3 Ley de Bioseguridad de Organismos Genéticamente Modificados/Biosafety Law on Genetically Modified Organisms

There is a debate about the Genetically Modified Organism plants and seeds can be harmful for other plants, the nature group posted an article saying, that GM maize seeds used in US were found growing with native maize plants, with the corresponding complaint of Mexican farmers and indigenous communities. The Commission for Environmental Cooperation (CEC), established as an offshoot of the North American Free Trade Agreement (NAFTA).

The CEC gave some recommendations (not binding) about keeping the seeds and plants only in the farmer lands designated for that purpose as a way for preserving the integrity of the wild races of maize in the nature,

⁵² Intellectual Property and Genetically Modified Seeds: The United States, Trade and the Developing World, Haley Stein, *North Western Journal of Technology and Intellectual Property*, Vol. 3 No. 2, pp. 159-178

⁵³ See note 31 *supra*

⁵⁴ *Hibberd*, 227 US 443 (1985)

⁵⁵ *Asgrow Seed v. Winterboer*, 513 US 179 (1995).

which is important for the indigenous people to preserve them as a part of their traditional customs.⁵⁶

This law was created to deal with Genetically Modified Organisms (GMO) and its aim was to regulate them prior to their commercial release, with the intention of prevent, avoid, or reduce potential risk that those activities could lead to human and animal health, or/and the environment and biodiversity of plants and aquatic life by monitoring the GMOs, as well, establishing the criteria for permissions to release them either as an experiment or commercial relief.

In addition, the law designates the geographical zones free of GMOs in which it is prohibited and those with restriction on certain activities with GMOs especially maize.

Excluded from this law are the Intellectual Property of Biotechnology products and processes under the Industrial Property Law, the Federal Law of Plant Variety, and the International Treaties that Mexico is party.

The body in charge of monitoring this law is the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food.

According to the newspaper *la Jornada Michoacan*, the Mexican government gave fifteen authorizations to plant maize GM to transnational companies in Mexico without taking in consideration the Bio safety Law.⁵⁷

4.2.3.1 The Cartagena Protocol on Biosafety

The Convention on Biological Diversity in January 29th 2000 established an agreement known as the Cartagena Protocol on Biosafety, to protect biological diversity from GMOs resulting from modern biotechnology.

The precautionary principle is to balance public health against economic benefits in developing countries. It is known as principle 15 of the 1992 Rio Declaration on Environment and Development, and states that:

“where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation”

This means that a government may decide on the basis of precaution not to permit a particular GMO to be imported. Also, it includes the risk that importing GM seeds may replace traditional crops, undermine local cultures and traditions or reduce the value of diversity to indigenous communities.

⁵⁶ www.nature.com/naturebiotechnology last visited April 24th 2010

⁵⁷ www.lajornadamichoacan.com.mx/2009/11/02/index.php?section=politica&article=005n2pol last visited April 24th 2010

The protocol deals on regulating the movement from one country to another of GMO, exchanging information about them. The most rigorous procedures are reserved for GMOs that are introduced intentionally into the environment, including seeds, live fish and other organisms that are destined to grow and that have the potential to pass their modified genes on to succeeding generations.

The Protocol empowers governments to decide whether or not to accept imports of GMOs on the basis of risk assessments.

Furthermore, the Protocol promotes international cooperation to help developing countries to build the human resources and institutions needed for biodiversity promoting technology transfer and know-how.⁵⁸

4.3 Mexican Government Agencies responsible for the Technology Transfer in the Agricultural Sector

4.3.1 Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP)/ National Research Institute of Forestry, Agriculture and Livestock

The INIFAP was created with the object of contributing to sustainable rural development by improving the competitiveness and maintaining natural resource base, through a participatory and co-working with other Public and Private Institutions as well as organizations associated with the Mexican countryside, through the generation of scientific knowledge and agriculture technological innovation, in responses to the demands and needs of the agribusiness chains and producers.

Besides the R & D work, the INIFAP also provides training and gives scholarships for postgraduate studies in Mexico and abroad; and coordinate with other Mexican agencies for technology transfer according to the Industrial Property Law and the Federal Law of Plant Varieties licensees.

The INIFAP has worked with transmission of knowledge from Universities to Institutions, the main Universities involve in research on biotechnology

⁵⁸ Biosafety and the Environment. An Introduction to the Cartagena Protocol on Biosafety, 2003, pp. 1-16, available on www.biodiv.org

their graduates work for the INIFAP in research projects, and the Universities have a strong link with this agency.

The transfer of technology is expensive, whereas it should be the opposite, so the Mexican federal government introduced a program called “agricultural and rural development”. This program is reviewed by every Mexican president in their presidential term. Here, I will give a personal critic to this program; the presidential term in Mexico is a six-year period, so every president has his own point of view about how to deal with the agrarian policy, and sometimes there is no continuity in all the decisions made in the agrarian policy, and sometimes there are even budget cuts for research, affecting the progress in the Mexican countryside.

But mainly the agricultural and rural development program is aware about the situation in the countryside, and that the farmers need to know how to improve the agricultural techniques to keep in the market, besides that a lot of farmers’ families also consume what they produce.

The INIFAP actions are addressed under this program, and one of the main objectives of this program is the technology transfer to get a more equity, competitive and a productive countryside.⁵⁹ INIFAP has worked closely with the private sector; for example with the malt Industry, there was interest in improving barley, making the malt industry more competitive at the national and international level, conducting research in barley grains, holding the INIFAP the rights under the federal law of plant varieties and giving the licensees to exploit it to the malt industry.

As well, they have worked with coffee beans and cocoa, celebrating a contract with NESTLE of Mexico, to develop the crops that this company needs, under the project called “research, plant production and technology transfer to improve yields and quality of coffee and cocoa crops”, recognizing the INIFAP with the patent rights.⁶⁰

Nowadays the INIFAP has eight research centres, and thirty-eight farmer lands for research with 1063 researchers.

In 2006, external scholars made an internal assessment of the INIFAP, resulting in a good evaluation of the work done by INIFAP.⁶¹

⁵⁹ Generación y Transferencia de Tecnología en el INIFAP, para el desarrollo de la Agricultura Mexicana/Generation of Technology Transfer by INIFAP, developing the Mexican Agriculture, Rodrigo Alvedaño S. and others, *TERRA LatinoAmericana*, Vol. 17, No. 03, pp. 265-270

⁶⁰ Ibid.

⁶¹ Evaluación Interna del Desempeño de una Institución Pública de Investigación: el caso del Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP)/Internal Evaluation in the Performance of a Public Research Institution: the case of the National Forest Research Institute in Agricultural and Livestock, Georgel Moctezuma Lopez and Jose de Jesus Espinoza Arellano, *Revista Mexicana de Agronegocios*, Vol, X, No. 18

However, some scholars have criticized the INIFAP saying that the Institute creates technological dependence with the farmers rather than independence, and are not taken in relation the traditional agricultural knowledge, these researchers argue that the traditional technology to cultivate the soil is richer in knowledge and that can not be replaced by modern technology and can get better harvest using the traditional knowledge.⁶²

4.3.2 Fideicomiso de Riesgo Compartido (FIRCO)/Shared Risk Trust

The FIRCO began its operations in the 1980s under Presidential decree and has given financial aid to the Mexican farmers helping them to get seeds and raw material, through shared temporal trust, if there was any externality, e.g. bad weather that could make to lose the crop, both FIRCO and the farmers share the losses in the investment. In the early programs were supported different technologies crops such as sunflowers, peanut, cotton, barley, wheat, rye, safflower, soybean, etc. but mainly in maize and beans.

In those years, for example the Jalisco State received support in approximate 150 validation plots of different agricultural cycle technologies and as well as crop demonstration in experimental plots, where the number was increasing approximately 250 per cycle, mainly in maize, in 250,000 ha.

In 1980s, the maize and bean producers did not use Hybrids seeds or high yield seeds or the percent of the producers who used were to low as well the use of agrochemicals.

The financial support programs that was used in those years included the Incentives Program. This was used to encourage the farmers returning to the State through FIRCO part of the cost of certain strategic inputs intended to take at the time, example improved seeds in the case of maize, since a that time was too low to use these, it was planted mostly native seeds were lower yielding than hybrids). Also, support the use of fertilizers and application of agrochemicals such as herbicides and insecticides.

Was supported with the 70% of the cost of improves seeds and 30% agricultural chemicals.

b) Shared Risk Program: this program also sought to adopt a technology, but in a more integral way. Production units were formed with farmers who

⁶² Dependencia Científica y Tecnologías Campesinas. El Caso de los Productores de Maíz en Tlaxcala/Scientific dependence and Farmers' Technology. The Case of Maize Farmers in Tlaxcala, Miguel Ángel Damián Huato and other, *Economía y Sociedad*, Vol. XIV, No. 21

commit themselves to applying the technology proposed, the farmers should have a technician to provide technical assistance and to monitor throughout the agricultural cycle.

These farmers got the same support that the previous program with a risk-sharing scheme (hence the name of FIRCO, Shared Risk Trust Fund). FIRCO shared with farmers the risk inherent in make them change their way of producing to the new technology proposed, and were guaranteed that the new technology would get at least the same utility that came with using their traditional technology, and if not they would be paid.

This was supported with 80% of cost of technical assistance in the first year of participation, the second year with 60%, and in the third year with 40%.

Now, the FIRCO is more involved to help the farmers to acquire modern technology as the main objectives that I show in the table following table.

Strategic Objectives of FIRCO

Sector Program for Agricultural and Fisheries Development 2007-2012	FIRCO's Objectives
Improving the income of producers increasing the Mexican presence in the global market.	Provide temporary supports under shared risk schemes aimed at encouraging the practice of crop or livestock farming activities, forestry and aquaculture, to better harmonize the sustainability and profitable, reflecting the ability of resources, the behaviour of markets and appropriate technology
	To encourage a more efficient integration of farmers in production lines, including those related to production and supply of goods and services for agricultural production, livestock forestry and aquaculture, as well as post-harvest activities

Source provided by Engineer Arturo Ramos⁶³

4.4 International Humans Rights Law

The International Humans Rights started according with the United Nation Human Rights, with the Universal Declaration of the Human Rights (UDHR), on December 10th 1948 in Paris. This Declaration together with

⁶³ I appreciate the help Mr. Arturo Ramos has provided me for having kindly devoted his time to answer all my emails.

the International covenant on Civil and Political Rights and its two Optional Protocols, and the International Covenant on Economic, Social and Cultural Rights, form the called International Bill of Human Rights.

This package of law were designed to promote and protect HR at the International, Regional and Domestic Levels, where most States have included this universal rights into their Constitution, as well, other instruments have been adopted where is required to establish a rule that help to improve the HR, for example the Declaration on the Rights of the Indigenous People.

In the UDHR from the articles 22 to 27, include the social, economic and cultural rights; the ICESCR, include more in detail the rights that cover the articles 22-27 of UDHR.

The UDHR says that the exercises of a person's rights and freedoms may be subject to certain limitations, which must be determined by law, solely for the purpose of securing due recognition of the rights and freedoms of others and meeting the just requirements of morality, public order and the general welfare in a democratic society.⁶⁴

The ICESCR states that the rights provided for therein may be limited by law, but only in so far as it is compatible with the nature of the rights and solely to promote the general welfare in a democratic society.⁶⁵

I will compare these instruments with their relation with the Intellectual Property.

4.4.1 Universal Declaration of Human Rights (UDHR)

The Article 27 in the paragraph one states:

“Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits”

As well, paragraph two mentions:

“Everyone has the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author”

The article 27 brings together the Intellectual Property system and the Human Rights making seems the Intellectual Property Rights are universally recognized.⁶⁶

⁶⁴ Fact sheet No. 2 (Rev. 1), the International Bill of Human Rights, printed by the United Nations, Geneva 1996.

⁶⁵ Ibid.

Some people argue that it is not possible compare as a universally recognized because the Intellectual Property exists for a limited period and it is required to be registered.

With the technological advances on biotechnology, in particular in the agricultural sector such as plant varieties, isolated plant genetic material, as well as GM plants and seeds all must be protected and the principal international instrument on Intellectual Property Rights is the TRIPS agreement, the TRIPS set minimum levels of protection on plants, besides plant varieties need not be patented if they are provided effective alternate protection under a sui generis system alone, or in combination with a patent system as is mentioned by article 27 (3)(b).

However, the TRIPS agreement has some problems about how can be patented the agricultural biotechnology for example how the TRIPS deals with the domestic agricultural social policies in the less developed countries and developing countries, and how the TRIPS deals with the UDHR.

The TRIPS has negative means with fundamental human rights, for example if TRIPS requires plant products to be protected, food security, including the right to food, is considered to be negatively impacted because TRIPS requirements may make that farmers abandon traditional practices that have been associated with their ability to sustain a regular food supply, for example the practice of saving seeds.

The decrease ability to save seeds could lead to the farmers to buy new seeds for each crop to companies that business is creating and selling new improved seeds, making the farmers to become dependent to purchase those seeds. Furthermore, the Intellectual Property may reduce or eliminate the ability of farmers to continue breeding plant varieties as they have been doing traditionally jeopardizing the right to food that they have.⁶⁷

Under the scrutiny of the UDHR in relation to the UPOV, in particular the right to food can be harmed, because the farmers' rights to save seed and reuse it in subsequent crops as well as experiment in new breeding are restricted by the plant breeder's rights, where it may require royalties to them, in the opposite as traditionally used to be: freely saving, using and sharing seeds.⁶⁸

However, there are some provisions that may be useful promoting the right to food, for example the compulsory licenses for public interest.

⁶⁶ The Universality of Intellectual Property Rights: Origins and Development, Dr. Peter Drahos, Intellectual Property and Human Rights, WIPO 1999, pp. 13- 34

⁶⁷ Agricultural Biotechnology under TRIPS and Beyond: Addressing Social Policies in a Pro-Patent Environment, C. M. Ho, Agricultural Biotechnology and Intellectual Property: Seeds of Change, Edited by Jay P. Kesan, pp. 304- 319

⁶⁸ Ibid.

Other problem is that the UPOV permit experimentation with breeding so long as such varieties are not sold in the market.

4.4.2 The International Covenant on Economic, Social and Cultural Rights (ICESCR)

The ICESCR is the principal international human right instrument that seeks to balance the moral and economic rights of creators and inventors with the interests and needs of the society.

The article 15 paragraph 1 states:

- “1. The States Parties to the present Covenant recognize the right of everyone:
- a) To take part in the cultural life;
 - b) To enjoy the benefits of scientific progress and its applications;
 - c) To benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author.”

As Audrey Chapman wrote, article 15 (1)(b) has three central components: i) a right of access to beneficial scientific and technological developments; ii) a right of choice in determining priorities and making decisions about major scientific and technological developments; iii) a right to be protected from possible harmful effects of scientific and technological development, on both individual and collective levels.⁶⁹

The right to the Benefits of science and technology presume that both individuals and communities will have easy access to the technology. Data research centres will certainly help in making available all the scientific advances and in helping other researchers to come up with new inventions that could benefit society.

Article 15 has been criticized for being ambiguous and not clear. Similarly, the stresses created by economic globalization and commercialization of science have made difficult to accomplish the balances mentioned in the said article.⁷⁰

And more importantly, nowadays there is a tendency to favour the interests of large transnational corporations whose main motive is make profits in addition to recovering the huge investments they made in research and development.

4.4.3 The Declaration on the Rights of the

⁶⁹ See Chapman, *supra* note 22

⁷⁰ *Ibid.*

Indigenous People

The United Nations General Assembly adopted this declaration on September 13th 2007. Article 31 of the Declaration highlights the right to protect the peoples traditional knowledge, to wit:

”1. Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge, and traditional cultural expressions.”

Indigenous knowledge is that awareness that is held and is used by people who identify themselves as indigenous. An indigenous person is defined by the International Labour Organization as people who descent from populations which inhabited a geographical region to which the country belongs at the time of conquest or colonization.

Traditional Knowledge is established from experiences and observation and it is usually a collective property of the indigenous community. This knowledge is transmitted from generation to generation. Traditional Knowledge includes the identification of medicinal properties in plants as well as harvesting practices.

Some people say this kind the knowledge is better because the experiences are learned through direct work in the countryside -- experience that cannot be replaced by modern technology. Besides, Traditional Knowledge is helping in the production in modern economies through the world.

Nevertheless, there are concerns about the proper way to implement ethics on intellectual property protection more for the deficiency on how to protect using intellectual property rights to the Traditional Knowledge.⁷¹

The Convention on Biological Diversity presents to two points of view on how Traditional Knowledge relate to Intellectual Property:

- i) Extend the intellectual property protection to cover Traditional Knowledge; and
- ii) Treat Traditional Knowledge as a public good.

The ones who are with the first point of view argue that it could promote technological innovation, besides the developed countries could ensure that

⁷¹ Intellectual Property Protection and Traditional Knowledge. An Exploration in International Policy Discourse, Dr. John Mugabe, Intellectual Property and Human Rights, WIPO 1999, pp. 97-120

they receive a fair and equitable share of benefits for the exploitation of the Traditional Knowledge.⁷²

The ones who are with the second point of view says that if the Traditional Knowledge is treated as a public good this would deny companies access to such knowledge.⁷³

The TRIPS agreement does not mention anything about Traditional Knowledge. It leaves member states open to enact legislation to protect this. The UPOV is inadequate in protecting traditional knowledge as well

⁷² Intellectual Property Protection and Traditional Knowledge. An Exploration in International Policy Discourse, Dr. John Mugabe, Intellectual Property and Human Rights, WIPO 1999, pp. 97-120

⁷³ Ibid.

5 Mexican case in Technology Transfer

5.1 Introduction

As I have mentioned in this paper, using technology transfer in the Agricultural sector not only helps to increase the harvest through new methods on how to work the land or through the use of improve seeds. Using improve seeds, whether GM seeds or hybrids seeds, cross-pollination also seeks to increase its nutritional properties.

For example, according to CIMMYT, using quality protein maize (QPM) increases the growth rate of moderately malnourished children who survive on a maize-dominated diet. QPMs are hybrid seeds, obtained by cross-pollination and is one of the most used seeds by INIFAP.

Since Mexico started to work with the research in hybrids, it has produced 221 hybrids varieties.⁷⁴

The Technology Transfer in the Agricultural Sector in Mexico is performed by INIFAP, private companies, Universities through their research centres, distributors, development banks, consulting firms and skilled technicians.⁷⁵

5.2 Production on High Performance Maize and Bean Seeds

The Mexican countryside is classified in 15 crops areas. These areas are determined according to climate and soil type ranging from tropical to arid, every zone or area has its own problems of growing plants, which can be droughts, crops in acid soils and pests, which can reduce up 57% of production.⁷⁶

⁷⁴ Producción y Tecnología de semillas mejoradas de Maíz por el INIFAP en el Escenario sin la PRONASE/Production and Technology of improved maize by INIFAP in the PRONASE Scenario, Alejandro Espinoza and others, *Agronomía Mesoamericana*, Vol. 14, No. 1, pp. 117-121

⁷⁵ El Proceso de Investigación y Transferencia de Tecnología en el sector agricultura. La experiencia del INIFAP/Research Process and Technology Transfer in the Agricultural Sector. The experience of INIFAP, Alfredo Tapia Naranjo, *Aportes*, Vol. 07, No. 20, pp. 179-183

⁷⁶ Negro Papaloapan, Nuevo Cultivar de Frijol para las Áreas Tropicales de México, Ernesto López Salinas and others, *Agricultura Técnica en México*, Vol. 33, No. 3, pp. 259-269

Improved seeds are a key element in many developing countries to achieve competitive levels in the production of crops, using double cross hybrids and open pollinated varieties. Both varieties are registered under the Federal Plant Variety Law.⁷⁷

The maize and bean are in great demand in the Mexican diet. Besides many small farmers plant both to be consumed by them.

The researchers have worked to improve the maize seeds to different environmental conditions,^{78 79} as well as the bean seeds through agreements with the International Centre of Tropical Agriculture to exchange germplasm studies. The INIFAP has also worked closely with CIMMYT to support and promote the use of QPM maize seeds, which are more nutritious and which help to combat malnutrition in children in developing countries.⁸⁰ The results show that using improved seeds give a better performance of planting in adverse environments by climate and soil.^{81 82}

5.2.1 Technology Transfer Process

The Technology Transfer process used by INIFAP is divided in four stages, namely: i) experimentation, ii) validation, iii) demonstration and iv) adoption.

- i) Experimentation. In this phase, INIFAP and research centres perform research in small plots with a series of repetitions to achieve the desired result or discover a new technology.
- ii) Validation. Once the desired results obtained, “technology validation” plots are used with areas of 1-5 hectares where the results are tested with the handling that the farmer should be given for this is achieved with the participation of cooperating farmers. If the result is favourable, it proceeds to the next stage (demonstration). If it is not favourable, the causes are analyzed

⁷⁷ Producción y Tecnología de Semillas mejoradas de Maíz por el INIFAP en el Escenario sin la PRONASE, Alejandro Espinoza and others, *Agronomía Mesoamericana*, Vol. 14, No. 01, pp. 117-121

⁷⁸ Patrón Heterótico de Maíz Amarillo para la Región Centro-Occidente de México, *Revista Fitotecnia Mexicana*, Vol. 27, No. Especial 1, pp. 13-17

⁷⁹ El Factor Gametofítico-1 (GA1) en Híbridos Comerciales de Maíz en México, Fernando Santacruz and others, *Revista Fitotecnia Mexicana*, Vol. 31, No. 1, pp. 57-65

⁸⁰ Tecnología y Producción de Semillas de Híbridos y Variedades Sobrasaliente de Maíz de calidad proteinica (QPM) en México, Alejandro Espinoza, *Agronomía Mesoamericana*, Vol. 14, No. 2, pp. 223-228

⁸¹ Negro Papaloapan, Nuevo Cultivar de Frijol para las Áreas Tropicales de México, Ernesto López Salinas and others, *Agricultura Técnica en México*, Vol. 33, No. 3, pp. 259-269

⁸² H-562, Híbrido de Maíz de Alto Rendimiento para el Trópico Húmedo y Seco de México, Noel Orlando Gómez Montiel and others, *Agricultura Técnica en México*, Vol. 34, No. 01, pp. 101-105

and if it is because the technology is flawed, it reverts to the previous stage (experimentation). At this stage, INIFAP, FIRCO and Farmers are involved. The support given to the cooperating farmers is in agrochemicals and improved seeds, warranties of risk sharing, and technical assistance.

- iii) **Demonstration.** At this stage, plots with areas between 1-20 hectares of cooperating farmers are publicized and other farmers are invited to adopt it. At this stage, INIFAP, FIRCO, Farmers and Banks are involved. The support given to the farmers is in agrochemicals and improved seeds, warranties of risk sharing, and technical assistance.
- iv) **Adoption.** At this stage, actions are developed so that the new technology is adopted in a massive way by the farmers.

The financial support given to the farmers is called “PROMAF” and is addressed to maize and bean producers rather than to small farmers.

In addition, there are some methods to evaluate how the farmers integrate the new technology.

The first is determined by the degree of modernization of farming and rural society and is called “diffusion of innovations”. Factors that affect the adoption of any technological innovation are investigated. The decision to innovate is taken by each individual. The farmers are classified either as

- i) innovators,
- ii) early adopters,
- iii) the majority adopting soon,
- iv) the majority adopts later, or
- v) laggards.

The second one -- rural modernization -- is defined as the degree of displacement of the peasant system of using natural resources for the agro-production system. Farmers are classified into seven categories according to the value they obtained, as follows:

pure peasants (0.0-0.09),
traditionalist (0.10-0.20),
semi-traditionalist (0.21-0.40),
transition (0.41-0.60),
emerging agro-industrial (0.61-0.80),
agro-industrial (0.81-0.99), and
pure agro-industrial (1.0).

The last classifies the agricultural technology transfer through the adoption of technology level generated by the Autonomous National Institute of

Agricultural Research of the Republic of Salvador, as follows: high (7.1-9.0), medium (5.1-7.0), low and lower (3.1-5.0) and no level of adoption (3.1-0.0).⁸³

An important aspect to mention is that traditional agricultural practices have proved to be effective and efficient ways to increase maize yield, however the results are not included as statistical data.⁸⁴

Besides the use of seeds, new technologies are also introduced in farming lands like conservation tillage through studies that were initiated in 1930s. The conservation tillage leaves the previous crop residues on the surface of the land without plowing or turning the soil, as traditionally is done. According to testing, this kind of tillage improves maize yield,⁸⁵ as well as the new techniques of fertilization.⁸⁶

The knowledge of the small farmers of their farmlands is also considered in order to transfer new technologies based on the knowledge that they have.⁸⁷

5.2.2 Results

The following information regarding the results of production of beans and maize crops that I present are provided by INIFAP and FIRCO.

Regarding the use of QP maize seeds, the INIFAP has varieties with high-quality protein since 2000. The State of Yucatan was hit in 2002 by Hurricane Isidore that affected agriculture. The state government requested INIFAP 105 tonnes of QPM seeds for the planting program in areas strongly affected and with which subsistence producers benefited seven thousand hectares.

⁸³ Apropiación de Tecnología por Productores de Maíz en el Estado de Tlaxcala, México/Appropriation of Technology by Maize Growers in the State of Tlaxcala, Mexico, Miguel Ángel Damián Huato and others, *Agricultura Técnica en México*, Vol. 33, No. 02, pp. 163-173

⁸⁴ Ibid.

⁸⁵ Labranza de Conservación y Fertilización en el Rendimiento de Maíz y su Efecto en el Suelo/Conservation Tillage and Fertilization in Maize Yield and its Effects on the Soil, Mario Galeana de la Cruz and others, *Terra Latinoamericana*, Vol. 17, No. 04, pp. 328-335

⁸⁶ Tecnologías sobre Fertilización, Densidad de Población y Variedades en e Maíz a Escala Comercial/Technologies for Maize Production Including Fertilization Rates, Planting Densities and Varieties in Commercial Plots, Ricardo Mendoza and others, *Terra Latinoamericana*, Vol. 20, No. 04, pp. 485-492

⁸⁷ Clasificación de Tierras Campesinas para la Generación y Transferencia de Tecnología Agrícola entre Pequeños Productores: Caso del Maíz en la Región Central de Veracruz/Peasant Land Classification for the Generation and Transference of Agricultural Technology among Small Producers : Maize in the Central Region of Veracruz, Ricardo Cruz Balcázar and others, *Terra Latinoamericana*, Vol. 16, No. 01, pp. 1-10

Since 2003, the local producers have produced the QPM seeds based on an agreement (license) with the Rural Development Secretariat of the Yucatan's Government.⁸⁸

Relative to the use of improved bean seed, INIFAP's research shows that using regular beans seeds the producers in the States of Veracruz and Chiapas obtained low yields (600 kg/ha). This was caused by biotic factors such as disease and low-acid soils fertility and planting drought season in rain fed and terminal drought in sowings residuals moisture, which can cause partial and total losses in commercial bean crops. Using improved seeds with extensive adaptability to tropical areas like in Veracruz and Chiapas with a yield potential of 1,500 kg/ha. These are tolerant to disease and shows good response to low-fertility acid soils. The variety obtained an average yield of 975 kg/ha, up 33% to the average obtained by the regular seed. In addition, this seed is tolerant to major humid tropical diseases, which prevents the application of agrochemicals and the producers receive a better benefit/cost ratio. This represent beneficial income for the region estimate by INIFAP at \$375'000,000.00 (Mexican pesos).⁸⁹

For the period from 2007 to 2009, the areas supported by the FIRCO increased their maize production to 3.3 million tons, and beans production in about 80 thousand tons, 2.3 million hectares of beans and maize crops with improved technological and technical support, 996, 300 beneficiaries, 35% increase in average yields of maize, and 3.7 million tonnes of extra maize.⁹⁰

As I mentioned earlier, it is difficult to assess the performance of the traditional agriculture in planting maize and beans due to lack of information. Another important point to mention is that there are differences of opinion as whether or not the traditional agriculture is better than the modern agriculture (technology transfer).

There are two studies in the same group of maize growers or farmers in the State of Tlaxcala. One study says that the low result of the maize harvest was because the appropriation of technology was low among farmers; that they did not follow the recommendations or instructions on how to work with the new technology or did not have access to the technology and a greater appropriation of technology carries a higher yield.⁹¹

The other study says the low appropriation of technology was because only the large maize producers or growers can afford to pay it and the small

⁸⁸ Informe Final del Convenio de Desempeño 2003-2007/Final Report of the Performance Agreement 2003-2007, INIFAP

⁸⁹ Informe Final del Convenio de Desempeño 2003-2007/Final Report of the Performance Agreement 2003-2007, INIFAP

⁹⁰ Data provided by FIRCO

⁹¹ Apropiación de Tecnología por Productores de Maíz en el Estado de Tlaxcala, México/Appropriation of Technology by Maize Growers in the State of Tlaxcala, Mexico, Miguel Ángel Damián Huato and others, *Agricultura Técnica en México*, Vol. 33, No. 02, pp. 163-173

producers cannot. Besides, the use of traditional farming methods are producing better results in the harvest, and this is accessible to all the farmers because they use natural resources since it lowers the cost for tillage.⁹²

In my opinion, it is hard to know who has the reason about what technology is better if the traditional or the modern technologies, but I agree that most of the time only the large producers of crops can afford the acquisition of those technological packages.

⁹² Dependencia Científica y Tecnologías Campesinas. El caso de los Productores de Maíz del Estado de Tlaxcala/Scientific Dependence and Rural Units. The case of Maize Growers in the State of Tlaxcala, Benito Ramírez Valverde, *Economía y Sociedad*, Vol. XIV, No. 21, pp. 59-76

6 Conclusions

Technology transfer is the transmission of new technology and its use or application. It is a complex issue within the patent system, particularly in plant patents whether they involves hybrids or genetically modified plants as it is difficult to situate their legal protection in the intellectual property regime.

The US sees patent protection of new varieties of plants and GM seeds in a broader perspective. This is understandable because the largest firms involved in research in the agricultural sector are found in the US. The primary aim of these companies is to generate huge profits as much as possible which could only be realized if it had the best possible protection in favour of their inventions and intellectual property.

The patenting of inventions and the subsequent technology transfer is a great indicator to measure economic development in countries. As such, there are persons, foundations, and organizations that support the research in the development of new technologies in agriculture, from the use of new farming techniques to the use of GM seeds and hybrids seeds, because these technologies create more production of crops. With higher yields and production, the economy becomes active and there is more food for the population especially in countries going through famines. FAO and CIMMYT are great supporters on the research of hybrids and QPM seeds to fight hunger in the world.

Since the beginning of the twentieth century, Mexico has been immersed in the study to generate new agricultural technologies beginning with the green revolution movement. Mexico has engaged in agricultural research at the same level as the foreign companies.

Mexico is also member of the WTO, the Convention for the Protection of New Varieties of Plants, and the Cartagena Protocol on Biosafety. It has therefore harmonized its domestic laws with the treaties as a contracting party.

It has also been criticized for the lack of Human Rights in the Intellectual Property regime in so far as the protection of inventions is concerned. With such right, companies may invoke the protection of their inventions on the ground that the right of property and right to benefit from the protection of the moral and material interest resulting from their inventions are rights that are considered Human Rights. By receive appropriate remuneration or royalties for letting others use their inventions (i.e. royalty payments) companies are given a strong incentive to keep doing research.

However, there are those who claim that the right to knowledge, to access to information and to benefit from scientific advances are human rights and

that the technological advances should be available freely or at lower cost for the benefit of humankind. For example, in the fight against hunger, most developing countries and LDCs cannot afford to pay the rights to use the technology. They are forced to ask financial aid from the developed countries who are the ones that produce and develop all these technological advances.

Traditional agriculture and indigenous knowledge are also complex in that traditional knowledge was considered as public goods. As such, the process of selection of plants and seeds to be planted that has been used since thousands of years ago, for example, were considered as public domain and that includes all the results obtained using this technique. While on the other hand, UPOV recognises the plant breeders' rights to receive royalties' payments from others who are using the new plants variations discovered by them.

Professor Laurence Helfer had proposed three frameworks to approach human rights and intellectual property. He states that policymakers and lawmakers should consider that human rights are important to balance with the intellectual property in any initiative. It is difficult to give a prediction on this issue because each country has its own political and economic interests to protect. The developed countries would particularly protect the interest of inventors considering that transfer of technology through licensing or acquisition of machinery is a business that generates profits to the parties involved on the research and their home state.

Nevertheless, Mexico as a member of the WTO and other conventions has to harmonize its domestic law with the international law to give a more strength to IPR protection. Since the main trade partners of Mexico are the developed countries, human rights should be considered alongside the Intellectual Property in order to balance the different interests at play.

The Mexican legal system has its roots in civil law. To strike a balance between human rights with the IPR, lawmakers should incorporate such consideration in the laws that they pass. Human rights must be included in the laws in order for it to become an integral part and forceful part of Mexican IPR laws.

Most people believe that the most important human rights are the right to freedom, the right to not be tortured, the right to a fair trial but there are other equally important human rights that are not included when the lawmakers make new laws. In my opinion, lawmakers should change the way these rights are viewed so that more balanced laws are promulgated.

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