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THE INTERPLAY BETWEEN THE SYSTEMS OF PATENTS AND PLANT VARIETY PROTECTION: THEIR IMPACTS ON PLANT INVENTIONS – LESSONS FOR THAILAND

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Abstract

Plant breeding has recently been accepted as a branch of scientific enterprise because of its swift scientific development. As plant breeding techniques have been greatly enhanced, the pressure to extend the protection of intellectual property rights to plant innovations is on the rise. *The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement)* does not obligate its members to provide intellectual property protection on plants and plant-related inventions nor force them to provide patent protection for plant varieties. However, since its adoption, there has been an increasing number of bilateral and regional agreements, putting unprecedented pressure on their parties to adopt the TRIPS-plus standard of IPRs protection. This includes the requirements for the adoption of a plant patent system or to conform with *sui generis* plant variety protection system under *the 1991 International Convention for the Protection of New Varieties of Plants (the 1991 UPOV Convention)*.

On the other hand, in order to create plant innovations, the breeding process needs access to the broadest range possible of existing germplasm due to the fact that plant innovation is a sequential and cumulative innovation where continued progress depends largely upon the access and preservation of a robust public domain. Since plant innovations are distinctive from other kinds of inventions, many scholars believe that plant intellectual property laws must be specifically designed.

Under the current situation, none of the traditional paradigms of intellectual property mechanisms provided by the TRIPs Agreement are developed specifically to address the issue of plant intellectual property protection and neither of them seems to be ideally suitable for plants. Also, the large majority of developing countries believe the systems of plant intellectual property rights are inappropriate for them as their adoption may become a threat to food security, a major impediment to research and development in public sectors and a contrast to the ongoing conventional practices of farmers.

Under the pressure from developed countries to provide intellectual property rights on plants, the main goal of this research is to design the most appropriate statutory model for Thailand to preserve and maintain their self-supporting agriculture while enabling them to be gradually modernized. In finding an

appropriate model, it analyzes international legal mechanisms, namely, the TRIPS Agreement, the 1991 UPOV Convention and the FAO International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). Also, it makes a comparative analysis on the practices, of India, the United States and the European Union. These jurisdictions were chosen as they use different mechanisms to protect the intellectual property rights of plant breeders and to address farmers' rights. India adopted a *sui generis* system for the protection of breeders' rights and farmers' rights. The United States allows concurrent protection of both patents and plant breeders' rights. As for the European Union, since plant variety is not patentable, there exists some interface problems in practice.

This research poses the hypothesis that developing countries should be encouraged to adopt patents on plants and plant-related inventions only on the condition that the special interface provisions between the patent system and plant variety protection system have been established. Furthermore, the 1991 UPOV Convention should not be considered as "the only" effective *sui generis* system for plant variety protection. Moreover, the adoption of an indirect benefit-sharing concept as initiated by the ITPGRFA should be encouraged, instead of a monetary benefit-sharing mechanism. As for Thailand, this research suggests the overhaul of its intellectual property protection for plants, including the introduction of plant patents, the amendment of the current plant variety protection systems, and the establishment of mechanisms to prevent cumulative protection between both systems.

Abbreviations

AAN	Alternative Agriculture Network
AIPPI	International Association for the Protection of Intellectual Property
ASEAN	Association of Southeast Asian Nations
ASSINSEL	International Association of Plant Breeders for the Protection of Plant Varieties
BPAI	Board of Patent Appeals and Interferences
CBD	Convention on Biological Diversity
CGIAR	Consultative Group on International Agricultural Research
CPC	Convention for the European Patent for the Common Market
CPV	Council Regulation 2100/94/EC on Community Plant Variety Rights
CPVO	Community Plant Variety Office
CPVR	Community Plant Variety Rights
DNA	Deoxyribonucleic Acid
EC	European Community
EDV	Essentially Derived Variety
EPC	European Patent Convention (1973)
EPO	European Patent Office
FAO	Food and Agriculture Organization of the United Nations
FTA	Free Trade Agreement
GATT	General Agreement on Tariffs and Trade
ICAR	Indian Council of Agricultural Research
ICC	Rules of Arbitration of the International Chamber of Commerce
ICJ	International Court of Justice
ICNCP	International Code of Nomenclature for Cultivated Plants
ICSID	International Centre for Settlement of Investment Disputes

ITPGRFA	International Treaty for Plant Genetic Resources for Food and Agriculture
LDCs	Least-developed Countries
MFN	Most-favored Nation Principle
MLS	Multilateral System
NGO	Non-governmental Organization
NT	National Treatment Principle
OECD	Organization for Economic Cooperation and Development
PPA	Plant Patent Act of 1930 (United States)
PPVFR Act	Protection of Plant Varieties and Farmers' Rights Act (2001) (India)
PVP Act	Plant Variety Protection Act B.E. 2542 (AD1999) (Thailand)
PVPA	Plant Variety Protection Act (1970) (United States)
PVPC	Plant Variety Protection Certificate
RTA	Regional Trade Agreement
SAUs	State Agricultural Universities
SMTA	Standard Material Transfer Agreement
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
UNEP	United Nations Environment Programme
UPOV	International Union for the Protection of New Varieties of Plants
USDA	United States Department of Agriculture
USTPO	The United States Trademark and Patent Office
V-GURT	Genetic use restriction technology operating at variety level
T-GURT	Genetic use restriction technology operating at trait level
WIPO	World Intellectual Property Organization
WMO	World Meteorological Organization
WTO	World Trade Organizations

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Chapter I: Introduction

This dissertation attempts to provide an analysis on the two sets on intellectual property rights which are both employed to govern the creative activities concerning plants, namely, patent rights and plant variety rights. The fact motivating this dissertation is, while developed countries have long permitted patentability on plant inventions in parallel with plant variety protection system, most of the developed countries still view patent system on plant inventions as a "threat" to their livelihood and sustainable development. Hence, this dissertation considers the impacts of each intellectual property system, as well as the possibility of overlapping between the two systems. Also, it analyses how national patent laws should be modified in order to balance the exclusive rights given to the owner of intellectual property rights with the freedom to operate in traditional farming activities and the accessibility to plant genetic resources by public sector. This dissertation suggests that developing countries should adapt its laws in response to technological advancement in the field of biotechnology through patent. Meanwhile, the national patent laws must provide mechanisms to prevent the situations where the exemptions provided by plant variety protection system is overridden the patent claims which cover a plant variety. The emphasis of this dissertation is on the search for the most appropriate model for Thailand's intellectual property protection for plant inventions. It should be noted here that the term "plant invention" in this dissertation refers to all creative activities with respect to plants such as plants, plant varieties, their parts and the methods of breeding or development and not just limited to the subject matters of patent protection.

This dissertation takes "instrumental approach to intellectual property rights"[1] which maintains that the ultimate purpose of providing intellectual property protection is not to allow inventors to

[1] There are two main philosophical approaches which explain the rationale of the States to grant these exclusive rights to the creators. The protectionist intellectual approach holds that the law needs to grant creators both moral and economic claim to exclude all free-ridings by the third parties; as a result, a vigorous intellectual property regime is needed. In contrast, the instrumental approach to intellectual property rights holds that the rights are granted because their creations enrich the culture, enhance knowledge and improve social welfare. Thus, the rights should be granted to the extent where they can provide adequate incentives for the creators to invest the time,

maximize their profits, but to improve the quality of life or social welfare through the accessibility of the new data contained in the improved inventions. Thus, the granting of exclusive rights on plant inventions is justified only to the extent where the owners of such rights are allowed to recoup the costs of their investments and make some reasonable profits.

1.1 Background of the Research

Within the next five decades, the world demand for food will rise to above 70 percent according to the Food and Agriculture Organization of the United Nations (FAO).[2] The capacity of the existing agriculture system will not be sufficient to feed the world population.[3] This rising demand has brought about an increasing pressure on the global agricultural resources. To fulfil the growing needs of the world population, many countries are demanding new plant innovations which will allow farmers to produce more within their limited farmland and resources.[4]

The creation of elite plant innovations costs a large amount of money and is very time-consuming. However, the self-duplicating nature of plants causes this type of development to become especially vulnerable to exploitation by third parties. [5] In other words, once new plant species are created, it is not difficult for them to be duplicated because the costs to reproduce them are very small. Accordingly, the States obviously need to provide some form of reliable intellectual property protection in order to allow the plant breeders to make adequate profits to recover their costs of production. Those rights will ensure that breeders receive appropriate compensation at the time of marketing for the value-added costs based on underlying biological resources.[6]

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resources and money in creating new products; Mark A. Lemley, "Property, Intellectual Property, and Free Riding" *Texas Law Review*, no. 83, 1031 (2005): 1058-1059.

[2] Food and Agriculture Organization [FAO], "How to Feed the World in 2050," *High-level Expert Forum* (2009): 4.

[3] John H. Barton and Peter Berger, "Patenting Agriculture," *Issues in Science and Technology* 17, no. 4 (2001), http://issues.org/17-4/barton/.

[4] Food and Agriculture Organization [FAO], "World Agriculture: Towards 2015/2030 - An FAO perspective," accessed May 08, 2017, http://www.fao.org/docrep/005/y4252e/y4252e13a.htm.

[5] Mark D. Janis, Herbert H. Jervis, and Richard Peet, *Intellectual Property Law on Plants* (Oxford University Press, 2014), 2.

[6] W. H. Lesser, *The Role of Intellectual Property Rights in Biotechnology Transfer under the Convention on Biological Diversity*, vol. 3 (ISAAA, 1997), 10-11; Organization for Economic Co-operation and Development

The exclusive rights obtained through intellectual property systems are a major impetus for commercial plant breeders to further invest their resources, labor and time required to develop new plant species. This would in turn lead to the reduction of the government funding spent in research and development activities.[7] In contrast, in a market economy, private parties will not invest in the new developments unless the return from making such investment surpasses the expenses of doing so**.**

Despite the demand from private sectors to create intellectual property protection for this rapidly growing field of technology, the subjection of plant innovation under the protection of intellectual property systems creates several prominent challenges which cannot be encountered in other types of inventions. Plant inventions have to be built on already existing plant genetic resources; thus, continued progress of creation essentially depends upon the conservation of the robust public domain. To create new plant innovations, the breeding process needs access to the broadest possible range of existing plant genetic materials.[8] For example, the plant variety, namely *India Rice 8,* has been developed from over ten thousand rice varieties.[9] As a result, many commentators believe that the introduction of intellectual property rights on plants can be considered a discouragement, rather than an incentive for new species since they prevent the plant breeders from freely accessing crucial genetic resources for improving the existing varieties.[10]

(OECD), "Intellectual Property. Technology Transfer and Genetic Resources," *An OECD Survey of Current Practices and Politics*, 1996, 7-8, accessed May 8, 2017, http://www.oecd.org/science/biotech/1947170.pdf.

[7] Laurence R. Helfer, "Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments," *Food and Agriculture Org. of the United Nations, FAO Legislative Study*, no. 85 (2004): 2-3.

[8] Janis et.al., *Intellectual Property Law on Plants*, 2.

[9] Tim Folger, "The Next Green Revolution," National Geographic, accessed July 10, 2017, http://www.nationalgeographic.com/foodfeatures/green-revolution/.

[10] Srividhya Ragavan and Jamie Mayer, "Has India Addressed Its Farmers' Woes? A Story of Plant Protection Issues," *Georgetown International Environmental Law Review* 27 (2007): 109-110; Claudio Chiarolla, *Intellectual Property, Agriculture and Global Food Security: The Privatization of Crop Diversity* (Cheltenham: Edward Elgar: 2011), 119-121; *Food Ethnics Council, "TRIPS with everything? Intellectual property and the farming world,"* 35; Organization for Economic Cooperation and Development [OECD], *Competitive Policy and Intellectual Property Rights* (1989): 14-15; Janis et.al., *Intellectual Property Law on Plants*, 12; Hope Shand, "The Big Six: A Profile of Corporate Power in Seeds, Agrochemicals & Biotech," *The Heritage Farm Companion* (2012): 1-2; Genetic Resources Action International [GRAIN], "For a Full Review of TRIPS 27.3(b): An Update on Where Developing Countries Stand with the Push to Patent Life at WTO" *GRAIN* (2000): 3.

Additionally, plant innovations usually incorporate genetic resources developed and maintained for many generations by various people along their development paths, yet the final person to make a change receives the benefits of exclusive use under intellectual property systems. Also, plant innovations usually have cultural implications. Over ten millennia, agricultural advancement has been a result of creativity and the innovative steps of the small holder farmers who have developed the wide range of today's plant varieties and maintained the agricultural biodiversity. The farming systems of the low-income and middle-income countries are usually informal, meaning that farmers produce seeds themselves, use the saved seeds as propagating materials for every farming season; and exchange them among their communities. Intellectual property rights may restrict these practices and negatively affect the way they earn their living.

Moreover, due to the self-duplicating nature of plants, the breeding process has been viewed as intuitive and unpredictable; therefore, some scholars contend that the rules forbidding duplication under intellectual property law is inappropriate for this type of innovation.[11] This has led to the controversial issue of the infringement of patent via *pollen drift* by bystanding farmers.[12]

Due to the lack of proper consideration and true understanding on the special nature of plants and plant-related innovations, many believe that the inherent excessive granting of intellectual property rights on plants has distorted the market away from the competitive norm.[13] Before the establishment of plant intellectual property rights in the 1990s, the top 10 international seed corporations accounted for approximately 37% of the global commercial seed sales.[14] However, only a decade afterwards, the international corporations have become the core users of patents on transgenic varieties as the top three corporations accounted for nearly three quarters of all U.S. patents issued for plant varieties between 1982

[11] Janis et.al., *Intellectual Property Law on Plants*, 2-3.
[12] Pollen-drift is a term used for plant pollination resulting from pollen dispersed by wind or gravity. The example where the Court found patent infringement by pollen-drift is the case of *Monsanto Canada Inc. v. Schmeiser, 2004 SCC 34, D.L.R. (4th) 271, 320 N.R. 201, 1.S.C.R. 902 (2004*).
[13] Food Ethnics Council, *"TRIPS with everything? Intellectual property and the farming world,"* 35; Organization for Economic Cooperation and Development [OECD], *Competitive Policy and Intellectual Property Rights*,14-15; Janis et.al., 2; Shand, "The Big Six: A Profile of Corporate Power in Seeds, Agrochemicals & Biotech," 1-2.
[14] ETC Group, "Who will control the Green Economy?" GMWatch, 2011, accessed May 8, 2017, 29, http://www.keine-gentechnik.de/fileadmin/files/Infodienst/Dokumente/11_11_etcgroup_control_greeneconomy.pdf.

and 2007.[15] Moreover, those top ten international corporations have taken control over 73% of the world seed market.[16] This illustrates that the small number of multinational corporations hold a monopoly or oligopoly over elite seeds, keeping out small competitors.

Notably, the adoption of intellectual property rights on seeds and propagating materials can give rise to the increase in the costs of farm inputs. For instance, from 1994 to 2010, the prices of the seeds in the U.S. dramatically rose more than other inputs for farming to approximately double the prices farmers gained from selling their crops. [17] In accordance with the United States Department of Agriculture (USDA), the rise was because of "the increase in value-added characteristics developed by private seed and biotech companies through R&D programs."[18] It is estimated that around 32 to 74 percent of the price of corn, cotton, sugar beet and soybeans obviously reflects technology fees.[19] As a result, when plants grown for food are subject to intellectual property rights, many people in the developing countries have raised concerns that the prices of the farm outputs will subsequently rise to the extent that their people would be unable to afford. [20]

Consequently, it appears that the existing arrangements for protection of plants have some problems to be reformed. The question on how to design the intellectual property law on plants is thus one crucial aspect of the problem in intellectual property law since the design has direct impact on agricultural advancement, food security, and the sustainability of traditional agricultural practices of each country. In designing an intellectual property system for plants, it is essential to strike the balance between the two impulses of creating incentives for the commercial plant breeders, such as big international biotech corporations, on the one hand and allowing an appropriate degree of accessibility to

[15] Keith O. Fuglie, Paul W. Heisey, John L. King, Carl E. Pray, Kelly Day-Rubenstein, David Schimmelpfennig, Sun Ling Wang, and Rupa Karmarkar-Deshmukh. "Research Investments and Market Structure in the Food Processing, Agricultural Input, and Biofuel Industries Worldwide," *ERR-130. U.S. Dept. of Agriculture, Econ. Res. Serv.* (2011): 11.
[16] Ibid.
[17] Fuglie et.al., "Research Investments and Market Structure in the Food Processing, Agricultural Input, and Biofuel Industries Worldwide," 13.
[18] Ibid.
[19] Ibid.
[20] Geertrui Van Overwalle, "A Man of Flowers: A Reflection on. Plant Patents, the Right to Food and Competition Law," *Technology and Competition: Contributions in Honour of Hans Ullrich* 311 (2009).

plant innovations to those in the public sector on the other hand. To avoid dynamic market inefficiency, the law makers must ensure that the intellectual property rights will not interfere with the intelligence of other plant breeders to create new plant species or with the farmers' ability to produce and use their own seeds.

1.1.1 International Mechanisms to Address Plant Inventions

The members of the World Trade Organization (WTO) have different views on the appropriate systems and levels for the protection of intellectual property rights on plants. Reflecting the differences in national policy concerning plants and biological resources between developed and developing countries, Article 27.3(b) of *the Agreement on Trade-Related Aspects of Intellectual Property Rights* (TRIPS Agreement)[21] leaves it at the discretion of member States whether to adopt patents on plant[22] and plant-related innovation.[23] Nonetheless, it requires its members to protect plant variety through (1) a patents system, (2) an effective sui generis system, or (3) a combination of both a patents system and a sui generis system.[24] To put it another way, Article 27.3(b) of the TRIPS Agreement deviates from the norm of harmonization of patent rights.[25] Each member State is, thus, free to choose and design its plant intellectual property systems depending on the needs of its population and its unique social and economic conditions and national policies.[26]

Despite the flexibility of the TRIPS Agreement on the mechanisms to protect plant intellectual property, most developed counties view that the development of plant breeders' rights established under

[21] *Agreement on Trade-Related Aspects of Intellectual Property Rights in Marrakesh Agreement Establishing the World Trade Organization*, open for signature 15 April 1994, 1869 UNTS 229 (entered into force 1 January 1995) annex 1C, (TRIPSAgreement).
[22] A patent on plant refers to a patent granting exclusive rights over plant as a whole.
[23] A patent on a plant-related invention refers to a patent on genes which are inserted into that plant's genome or the process which is used to create the plant innovation.
[24] *TRIPS Agreement*, Article 27.3(b).
[25] *TRIPS Agreement*, Article 27.1, requires its members States to provide patent protection for any invention, both products and processes, in any field of technology, if the inventions are novel, distinctive and industrially applicable.
[26] Claudio Chiarolla, "Commodifying Agricultural Biodiversity and Development-Related Issues*," The Journal of World Intellectual Property* 9 (2006): 28; Doris Estelle Long, "The Impact of Foreign Investment on Indigenous Culture: An Intellectual Property Perspective," *North Carolina Journal of International Law and Commercial Regulation* 23 (1998): 263–64.

the *International Convention for the Protection of New Varieties of plants* (UPOV Convention)[27] is the only "effective" *sui generis* system mentioned by the TRIPS Agreement.[28] On the contrary, developing countries, including Thailand and India,[29] are reluctant to adopt the UPOV model mainly owing to a too broad scope of breeders' rights and too limited scope of farmers' rights.

After the adoption of the TRIPS Agreement, the number of bilateral and regional agreements, as well as investment treaties, are gradually rising.[30] Through those agreements, developed countries usually require developing countries to adopt the TRIPS-plus standard of intellectual property protection. This pressure includes the requests to adopt a system of plant patents and to accede to or to conform to the 1991 UPOV Convention.[31] The opposite approaches to the TRIPS Agreement are pursued through three various forms.[32]

(a) Some of the FTAs create a direct obligation to provide for intellectual property protection on plants. For example, Article 14.8(2) of the trade agreement between the United States and Bahrain states that "each Party shall make patents available for plant innovations." Additionally, the FTA between the United States and Morocco establishes the same mandatory command.[33]

(b) Some other FTAs contain a "reasonable effort" obligation to allow intellectual property protection on plants. Such provision is usually read as obliging the parties to make their endeavor to reach the desired goal. For example, the agreement between the United States and Chile, Article 17.9.2,

[27] *International Convention for the Protection of New Varieties of plants*, 33 UST 2703, 815 UNTS 109 (1961); revised by 33 UST 2703 (1978); revised by 815 UNTS 89 (1991) (UPOV Convention).
[28] For instance, the *Protection of Plant Varieties and Farmers' Rights Act* (2001) (India); the *Plant Variety Protection Act* (1999) (Thailand). Other developing countries include Bhutan, Indonesia, Laos, Malaysia and the Philippines.
[29] Ragavan and Mayer, "Has India Addressed Its Farmers' Woes? A Story of Plant Protection Issues," 98; Kuanpoth, "TRIPS-Plus Rules under Free Trade Agreements," *Intellectual Property & Free Trade Agreements: International Intellectual Property Law Series* (2007): 41.
[30] Helfer, "Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments," 41.
[31] Chiarolla, "Commodifying Agricultural Biodiversity and Development-Relate-Issues," 37.
[32] Jean-Frédéric Morin, "Tripping up TRIPS debates IP and health in bilateral agreements," *International Journal of Intellectual Property Management* no.1 (2006); Denis Borges Barbosa and Karin Grau-Kuntz, "Exclusions from Patentable Subject Matter and Exceptions and Limitations to the Rights," *World Intellectual Property Organization [WIPO]*, SCP/15/3, Annex III (1 January 2010).
[33] *The 2006 US-Morocco Free Trade Agreement,* Article 15.9(2), states that "Each Party shall make patents available for the following inventions: (a) plants, and (b) animals…"

provides that the parties will endeavor to establish and adopt national law within four years from the date of the entering into effect of the FTA to provide for patents on plants which are novel, non-obvious, and capable of industrial application.

Even though such obligation seems to be reciprocal, it is, in fact, not relevant for the United States in which intellectual property protection for plants had been well established at the time of signing the FTA.[34] As of December 2017, Chile has not yet allowed patents on plants.[35] Importantly, the Chilean government has faced strong internal opposition against the implementation of the 1991 UPOV, as required by the same FTA. Due to the resistance from farmer groups, indigenous peoples and concerned stakeholders, the Chilean government had to withdraw the draft of the bill adopting the UPOV standard from its Congress in 2014, after over 10 years since the FTA with the United States was signed.[36] It is arguable that the parties to the FTA would not breach a reasonable effort of obligation provided that a government faces internal resistance to the adoption of intellectual property standards for plants, or if other specific conditions cannot be fulfilled, such as the inadequacy of their capacity to examine patentability of innovations.

(c) Lastly, some agreements do not directly require the patent protection on plants, yet this type of subject matter is not included in the provisions concerning subject matter for which preclusion from patentability is permitted. The FTAs between the United States and Australia, Jordan, and Singapore, which only provide the exceptions set forth in Article 27.2 and 27.3(a) of the TRIPS Agreement, without

[34] Frederick M. Abbott, "Intellectual Property Provisions of Bilateral and Regional Trade Agreements in Light of U.S. Federal Law," *UNCTAD - ICTSD Project on IPRs and Sustainable Development* (2006): 4-5; It should be noted that, even though FTAs appear to be found upon reciprocal treatment, the United States has not taken further steps to domestically implement obligations created by FTAs which are stricter (or under narrower exceptions) than those provided by its domestic law: "Congress has made a practice of expressly denying self-executing effect to the FTAs in its implementing legislation… [t]he FTAs do not change existing federal law unless specifically mandated by Congress. An individual may not directly invoke the provisions of an FTA in a court of the United States… To the extent that FTAs may impose obligations on the United States that are inconsistent with existing federal law, this is not relevant for domestic legal purposes (even if the United States may incur international legal liability."
[35] *Law No. 19.039 on Industrial Property (Consolidated Law approved by Decree-Law No. 3) (Chile)*, Article 37(b).
[36] Asha DuMonthier, "Chile Derails Monsanto Law That Would Privatize Seeds," New America Media, March 28, 2014, accessed February 02, 2018, http://newamericamedia.org/trending/2014/03/chile-derails-monsanto-law-that-would-privatize-seeds.php.

referring to plants and essentially the biological processes for plant production.[37] Another example is the FTA between the United States and Oman which authorizes the preclusion of patent protection in respect to animals, without mentioning plants.[38]

In addition, those agreements usually provide for dispute settlement mechanism allowing both states and private parties, including multinational corporations, to make a complaint to arbitration tribunals, such as International Centre for Settlement of Investment Disputes (ICSID) in order to challenge the legitimacy of measures against investment covered by the FTAs. As a consequence, even the case where investment agreement fully accommodates the discretion of its parties to adopt intellectual property rights on plants, seed companies are able to challenge the discretion not to adopt IPRs laws under the investor-to-state dispute settlement mechanism.

Meanwhile, two main international environmental agreements, i.e., *the Convention on Biological Diversity* (CBD) and *the International Treaties on Plant Genetic Resources for Food and Agriculture* (ITPGRFA) of the Food and Agriculture Organization of the United Nations (FAO) were established with the obligations to ensure the rights of farmers to save and exchange seeds and to share the benefits obtained from commercializing of plant innovations developed using prior-existing genetic materials. Particularly, the Multilateral System (MSL) of the ITPGRFA explicitly requires that the genetic materials transferred under the system cannot be subject to intellectual property rights. The obligations created by these agreements also pose a challenge for the law designers and policy makers to devise the law

[37] Barbosa and Grau-Kuntz, *Exclusions from Patentable Subject Matter and Exceptions and Limitations to the Rights*.

[38] *The 2006 U.S.-Oman Free Trade Agreement*, Article 15.8, states that "each party…shall make patents available for any invention, whether product or process, in all fields of technology, provided that it is new, involves an inventive step, and is capable of industrial application; and (b) confirms that it shall make patents available for any new uses for, or new methods of using, a known product, including new uses and new methods for the treatment of particular medical conditions. 2. Each Party may exclude from patentability: (a) inventions, the prevention within its territory of the commercial exploitation of which is necessary to protect ordre public or morality, including to protect human, animal, or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by law; (b) animals other than microorganisms, and essentially biological processes for the production of animals other than non-biological and microbial processes; and (c) diagnostic, therapeutic, and surgical procedures for the treatment of humans or animals"

according to the socio-economic condition of each country in attempting to satisfy the obligations of both international intellectual property agreements and environmental agreements.

1.1.2 Situation of Thailand

Under the current Thai law, it does not allow plant innovation to be protected under patent law.[39] However, Thailand has enacted *Plant Variety Protection Act B.E.2542 (AD1999)* (PVP Act of Thailand)[40] to fulfill its obligations under the TRIPS Agreement, requiring its members to protect plant varieties. This Act is considered a *sui generis* system for the protection of plant varieties, differing from the system provided under the UPOV Convention. The PVP Act of Thailand evidently reflects the country's major concern to protect traditional farming while promoting the rights of plant breeders by providing two categories of plant variety protection: new plant varieties and existing varieties (local domestic plant varieties and general wild plant varieties).

The first type of protection incorporates benefit-sharing obligation under the CBD by requiring the owners of the plant breeders' rights to share benefits with farmers who have developed, protected or maintained the materials used in creating such varieties.[41] The aim of second type of protection is to recognize the attribution and to share benefits for farmers and local communities. This Act is, in fact, one of the solutions to avoid acceding to the UPOV Convention, which would directly impact over 25 million small-scale farmers in Thailand.[42]

Nevertheless, the existing Thai PVP Act has been criticized by private corporations that a sole PVP Act might not be sufficient to encourage new innovation in the country and therefore a more

[39] *The Patent Act B.E. 2542* (AD 1999) (Thailand) amended in B.E. 2522 (AD 1979) and B.E.2535 (AD 1992), article 4.
[40] *The Plant Variety Protection Act B.E.2542* (Thailand) (PVP Act of Thailand).
[41] *The PVP Act of Thailand*, article 19 (5).
[42] "Resisting free trade agreements to protect local seeds, Thailand," Environmental Justice Atlas, February 17, 2015, accessed May 11, 2017, https://ejatlas.org/print/resisting-free-trade-agreements-to-protect-local-seeds-thailand.

stringent intellectual property regime for the protection of plant innovation should be established.[43] This is illustrated by a relatively low number of new plant varieties registered each year.[44] Moreover, the current Act insufficiently protect the benefits of farmers, who contribute to more than one third of the whole Thai population, since no actual benefits have been shared by the plant breeders. As for the protection of existing varieties, it appears that not a single local community nor a farmer are able to successfully register their varieties under the PVP Act local domestic plant variety protection system.[45]

Despite the established PVP Act, for many years, Thailand has been put under pressure by the United States and the European Union to adopt more rigorous intellectual property regimes on plants, i.e., the 1991 UPOV Convention and full fledge plant patents, through FTA negotiations to ensure revenue streams for the seed industry. However, there have been expansive social movements against such adoption by farmer groups and local communities disrupting the negotiation process due to the concern about the distortion of the seed market and the restriction on traditional practices of saving, exchanging and replanting seeds.[46] For instance, in 2006, approximately 10,000 Thai farmers, as well as their allies, besieged the venue of negotiating the US-Thailand FTA in order to voice their opposition to the adoption of stricter plant intellectual property regimes. Due to this opposition, the negotiation has stagnated. Moreover, in 2013, many thousands of farmers protested the implementation of the 1991 UPOV under FTA with the EU by marching in the streets of Chiang Mai. Since then, the FTA between EU and Thailand has been put on hold. Yet, the negotiation between Thailand and the European Free Trade Association are soon to be concluded while the farmers are still strongly against the idea of such adoption.

[43] "BIOTHAI's Opposition to the Proposal to Amend Thai Plant Variety Protection Act," [translation of: ออกโรงค้านกรมวิชาการเกษตรฉวยโอกาสแก้กม.คุ้มครองพันธุ์พืช] Prachachat News, October 06, 2017, accessed October 23, 2017, https://www.prachachat.net/economy/news-50742.
[44] Plant Variety Protection Division, *Report on Plant Varieties* (Bangkok, Ministry of Agriculture and Cooperatives, Thailand: 2012).
[45] Ibid.
[46] "Thailand :Assembly of the Poor demanding Thai-EU FTA Talk must not restrain freedom of seed," La Via Campensina, September 20, 2013, accessed May 11, 2017, https://viacampesina.org/en/index.php/actions-and-events-mainmenu-26/stop-free-trade-agreements-mainmenu-61/1481-thailand-assembly-of-the-poor-demanding-thai-eu-fta-talk-must-not-restrain-freedom-of-seed.

Consequently, Thailand is in need to find an appropriate model of law on plant intellectual property rights that efficiently promotes the protection of the rights of plant breeders, while at the same time adequately guarantees the rights of local farmers. The decision concerning the types of plant intellectual property protection must be urgently made so that the government of Thailand can take the next step on negotiating FTAs or RTAs containing TRIPS plus provisions.

1.2 Research Objectives

The originality of this research is based on the combination of normative scholarship and empirical evidence with regard to plant patent and plant variety protection from various jurisdictions. The main goal of this research is to design the most appropriate statutory model for Thailand to preserve and maintain its self-supporting agriculture while enabling it to be gradually modernized. Furthermore, since many countries are confronting the same challenge as Thailand to design an appropriate model, the results of this research provide crucial suggestions on how to balance the rights of plant breeders and the privilege of farmers. Also, it may be able to serve as an effective statutory model for their protection systems.

In doing so, this paper aims to address the following questions:

(i) Should patents on plants be introduced in developing countries and whether and to what extent patent law can develop elaborate rules which are especially tailored to plant genetic resources?

(ii) In case a patent system and a plant variety protection system are overlapping, what mechanisms are able to guarantee that the use of IPRs on plants does not obstruct the accessibility to a genetic pool while encouraging new innovation?

(iii) Is UPOV system considered to be an appropriate *sui generis* option for the plant variety protection in developing countries?

(iv) How can developing countries effectively implement the benefit-sharing obligations of the CBD and the ITPGRFA?

1.3 Methodologies

In addressing the thesis questions, firstly, this dissertation examines the current international mechanisms for the plant intellectual property protection, which are plant patents under the TRIPS Agreement and a plant variety protection system under the 1991 UPOV Convention. Moreover, two international treaties related mainly to the protection of biological diversity, i.e., the CBD and the ITPGRFA are also analyzed due to the overlap between the issues of resource conservation, equitable sharing of benefits deriving from the use of biological resources, their recognition of farmers' rights, and intellectual property rights.

For the purpose of examining whether the existing statutory regime which governs plant variety protection in Thailand is appropriate to promote agricultural advancement and sufficiently protect the rights of the plant breeders and the rights of farmers and the benefits of local communities, this disseration analyzes the key provisions of the PVP Act of Thailand. Also, to truly comprehend the particular problems of the framework for plant protection in this country, the dissertation critically investigates the empirical evidence, statistical analysis, and interviews.

Moreover, this dissertation makes a comparative analysis on the legal mechanisms utilized in implementing the TRIPS obligations, as well as the practices, of India, the United States and the European Union. These jurisdictions were chosen because they use different mechanisms to protect the rights of plant breeders and farmers' rights. India adopts a *sui generis* system for the protection of breeders' rights and farmers' rights. The United States allows concurrent protection of both patents and plant breeders' rights. The European Union also provides dual protection of both plant patent and plant breeders' rights; however, they have established special interface provision.

1.4 Structure of the Thesis

This dissertation consists of seven chapters. Chapter II provides the basic understanding on the special nature of plant innovations, highlights the significant roles of plant innovations in maintaining food security and briefly discusses the different categories and development of this type of invention. Chapter III then discusses the provisions of two main international intellectual property agreements which govern plant innovation, namely the TRIPS Agreement and the UPOV Convention. Next, Chapter IV examines the provisions of the CBD and the ITPGRFA which are, in fact, environmental agreements; however, they establish some provisions to address the relationship between plant genetic resource protection and intellectual property rights. Chapter V then analyses the implementing experience of four main jurisdictions, i.e. India, the United States and the European Union (EU). Those jurisdictions were chosen because they use different mechanisms to protect the intellectual property rights of plant breeders and to address farmers' rights. India adopts a *sui generis* system for the protection of breeders' rights and farmers' rights. The US allows concurrent protection of both patents and plant breeders' rights. As for the EU, although plant variety is not patentable, there exists some interface problems in practices. Chapter VI critically provides an analysis on the socio-economic condition of Thailand, the roles of various stakeholders in Thai agricultural management, and the effectiveness of the current statutory framework with respect to plant variety protection. Moreover, this Chapter embraces the implementing experience of another four jurisdictions and develops the model particularly for intellectual property rights for the protection of plant innovations in Thailand. Last Chapter, Chapter VII, tenders the conclusion and provides suggestions to developing countries. This dissertation is based on the legal mechanisms and materials available up to May 25th, 2018.

Chapter 2: Plant Inventions

Inventions in the field of plant biological technology have different characteristics which cannot be found in conventional fields of inventions such as mechanical inventions. Technological advancement since 1990s has changed the position of plant innovations from mere discoveries to innovations. Moreover, it has crucially transformed the status of traditional farmers in some countries from original inventors of plant innovations to mere users or consumers of genetic resources.[47] In fact, the technological advancement in the field of plants such as hybrids were the motive power behind the development of the booming seed industry, which brought about the segregation of farming from breeding and the emergence of *sui generis* plant variety protection systems. In addition, plant biotechnological innovations have changed the force of attraction in plant research and development from visible features of a plant (phenotype) to the paradigm of the genetic or molecular makeup (genotype).[48] This has challenged the standard of intellectual property protection for plant innovations.

At the same time, there is an increasing attention on the relationship between intellectual property rights, food security, agrobiodiversity[49] and climate change. These attention corners around the impacts of

[47] Viktor Braun and Cornelius Herstatt, "Barriers to User Innovation: Moving towards a Paradigm of 'Licence to Innovate' *International Journal of Technology, Policy and Management* 7, no. 3 (2007): 302.
[48] Maarten Koornneef and Piet Stam, "Changing Paradigms in Plant Breeding," *Plant Physiology* 125, no. 1 (2001): 156–59; M. Morris, G. Edmeades, and E. Pehu, "Building Capacity for International Plant Breeding: What Roles for the Public and Private Sectors," *HortScience* 41, no. 1 (2006):30-39 clarify that, owing to the shifts on plant breeding technological enhancement, private research programs have gradually altered their core interests, as funding has changed from applied experiments in the field to biology at genomic and molecular levels.)
[49] Agrobiodiversity is a crucial subset of the term biodiversity. It is the outcome of biological processes such as crossing and selection by farmers and their careful preservation and inventive developments of genetic resources over millennia; "Food and Agriculture Organization of the United Nations [FAO]," What is Agrobiodiversity?," accessed January 20, 2018, http://www.fao.org/docrep/007/y5609e/y5609e01.htm.

intellectual property rights on farmers' freedom to their traditional practices and research limitations, as well as the question of the viability of modern technologies.[50]

This chapter analyses the significance of plant inventions, their main features distinct from other types of mainstream inventions and their development from farmers' varieties to those created by scientific methodologies. Also, the major challenges regarding this category of innovation are presented in this Chapter.

2.1 The Significance of Plant Inventions

The United Nations anticipated that by the year 2050 the global population will significantly increase by over two billion people.[51] Half of this population will be conceived in the area of sub-Saharan Africa, and the rest in South and Southeast Asian countries.[52] Those regions are, in fact, where the impacts of natural disasters, such as drought, heat waves, climate change usually are anticipated to strike heaviest.[53] *The Intergovernmental Panel on Climate Change*[54] has recently warned that the global food supply is in an endangered condition.[55] In these past 20 years, owing to drastic climate change, the growth rate of food crop yields has noticeable decreased especially for staple crops such as rice and wheat.[56] In

[50] Geoff Tansey and Tasmin Rajotte, *The Future Control of Food: A Guide to International Negotiations and Rules on Intellectual Property, Biodiversity and Food Security* (International Development Research Centre, 2008), 103.
[51] World population is predicted to arrive at 9.8 billion in 2050 and projected to reach 11.2 billion in 2100 "World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100 | UN DESA Department of Economic and Social Affairs," United Nations, accessed January 20, 2018, https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html.
[52] Ibid.
[53] Tim Folger, "The Next Green Revolution," National Geographic, accessed January 10, 2018, https://www.nationalgeographic.com/foodfeatures/green-revolution/.
[54] The Intergovernmental Panel on Climate Change is the international organization established in 1988 by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) for evaluating the scientific issues with respect to climate change. The aim of establishment is to provide policymakers with regular evaluation on climate change based on scientific methods, its effects and long-term risks, and alternatives for mitigation such effects.
[55] Caitlin Kennedy, "Is the Next "Green Revolution" Right Around the Corner?" BIOtech Now, September 30, 2014, accessed January 10, 2018, http://www.biotech-now.org/food-and-agriculture/2014/10/is-the-next-green-revolution-right-around-the-corner.
[56] Rajendra K. Pachauri et. al., *Climate change: synthesis report* (Intergovernmental Panel on Climate Change, 2015), 8-16.

some countries, these crops have ceased to grow entirely.[57] As a result, this could soon lead to the failure of global food systems.

Around five decades ago, food shortage was expected. In accordance with the research by Paul Ehrlich, hundreds of millions of the world population, especially Indian, would die from famines in the 1970s and 1980s.[58] However, before those visions could actually happen, the transformation of world agriculture by *green revolution*[59], especially wheat and rice occurred. For example, through selective breeding techniques, an American biologist, Norman Borlaug, developed a wheat variety which put the vast majority of its vitality into edible grains, not in inedible stems, resulting in more yield per plot of land.[60] Similar achievement at the International Rice Research Institute (IRRI) in the Philippines significantly enhanced the yield of the grain which sustains about a half of the global population.[61] As a result of the research and development on plant innovations during the period of the 1960s to the 1990s rice and wheat yields in Asia increased more than 50 percent; even when the Asian population grew by 60 percent, the prices of grain fell, the regular consumption of Asian people increased by around one third more calories, and the rate of poverty was decreased by 50 percent.

Consequently, in order to keep increasing the crop yields between present to 2050, the next green revolution is needed. One possible way for the next green revolution to occur is through advanced plant innovations, with a strong emphasis on the ongoing crossing and selection practices to breed better crops. The next revolution can be definitely achieved with more advancement of biological techniques, particularly through the manipulation of plant genes. Robert Fraley, chief technology officer at Monsanto and a winner of the prestigious World Food Prize in 2013 claimed that the next green revolution can

[57] Ibid.
[58] Paul R. Ehrlich, *the Population Bomb* (Rivercity Press, 1975), 1-2.
[59] The Green Revolution was the distinguished rise in production of grains in many developing countries in the 1960s and 1970s, resulting from the better varieties of wheat, rice, and corn, as well as the utilization of heavy chemical fertilizer; "Green Revolution," Encyclopedia of Food and Culture, accessed February 03, 2018, http://www.encyclopedia.com/plants-and-animals/agriculture-and-horticulture/agriculture-general/green-revolution.
[60] Folger, "The Next Green Revolution."
[61] K. G. Cassman, *Breaking the Yield Barrier* (International Rice Research Institute, 1994), 5.

accelerate the traditional mechanisms since nowadays the scientists can detect and manipulate large varieties of plant genes for traits such as dry season resilience or disease protection.[62]

The marked innovation of this approach, the one that has conveyed both achievement and contention to Monsanto, is genetically modified crops.[63] Those crops were first released in the middle of the 1990s and, around 28 countries have adopted and planted them on 11 percent of the cultivable global areas, as well as over half the arable land in the United States.[64] Approximately 90 percent of the crops cultivated in the United States are genetically modified and their citizens have consumed genetically modified crops for almost three decades.[65] In contrast, in Europe, Africa, and the majority of the Asian countries, the controversies over genetically modified crops, including the issues of safety and impacts of environment, have mainly barred the use of those crops.[66]

Recently, attention has been shifted from a heavy-input system by scientific methodologies to an organized traditional farming system which can endure climate change through establishing a farming system which respects the landscape and diversity of biological resources by enhancing the capacity of informal traditional farming.[67] For these respective purposes, many believe that farmers' varieties can outperform elite varieties in formal farming system particularly when employed in severe environments. The example is the rapidly-growing and higher-yield Indian Rice 8. This rice variety was the result of cross-breeding the Taiwan dwarf rice variety and an Indonesian taller variety and has been known in India for its essential part in overcoming famine and food shortage in the country.[68] Notably, newly developed

[62] Andrew Pollack, "Executive at Monsanto Wins Global Food Honor," The New York Times, June 19, 2013, accessed January 20, 2018, http://www.nytimes.com/2013/06/20/business/monsanto-executive-is-among-world-food-prize-winners.html.
[63] Folger, "The Next Green Revolution."
[64] Nigel G. Halford, "The Use of GM Crops in Agriculture" *Genetically Modified Crops* (2011): 51-52.
[65] Ibid.
[66] Joe N. Perry "Genetically-Modified Crops" *S & CB* no.15 (2003): 158.
[67] G. Keneni, E. Bekele, M. Imtiaz and K. Dagne, "Genetic Vulnerability of Modern Crop Cultivars: Causes, Mechanism and Remedies," *International Journal of Plant Research* 2, no.3 (2012): 69–79; G. Balcha and T. Tanto, "Conservation of Genetic Diversity and Supporting Informal Seed Supply in Ethiopia," *Wageningen International* (2008): 148.
[68] Sanchari Pal, "50 Years of IR8: A Tribute to the 'Miracle Rice' that Helped India Fight One of Its Worst Famines," The Better India, December 21, 2016, accessed January 20, 2018, https://www.thebetterindia.com/76041/ir8-miracle-rice-irri-india-famine-gurdev-khush/.

genetic materials developed by traditional farming are necessary when farmers are unable to afford inputs recommended to enhance the performance of elite materials in the formal sector but still need to increase their yield to compete in the market.[69] What is more, they usually play a crucial part in emphasizing cultural identity and sustainability.[70]

2.2. Main Features of Plant Inventions

Plant invention has been defined as "the application of genetic principles and practices associated with the development of cultivars more suited to the needs of humans than the ability to survive in the wild; it uses knowledge from agronomy, botany, genetics, cytogenetics, molecular genetics, physiology, plant pathology, entomology, biochemistry, and statistics."[71] The main features of plant inventions are as follows

a. Path dependent

Plant innovations are path dependent.[72] Most of the plants for food and agriculture have been domesticated over centuries. Over the period of hundred years, in certain cases thousands of years, those plants have been exchanged or transferred across the globe, principally through intentional intervention of humans[73] For example, wheat encompassing over 20 plant species, entered into the United States more

[69] Chidi Oguamanam, "Agro-biodiversity and Food Security: Biotechnology and Traditional Agricultural Practices at the Periphery of International Intellectual Property Regime Complex" *Michigan State Law Review* 215 (2007): 236.

[70] The significance of certain plants to cultural identity is displayed in, for instance, the 2014 *Costa Rica Decree No. 38.538/C/MAG*, which announces that maize varieties and their uses are cultural inheritance of Costa Rica. Likewise, *the 2014 Guatemala Legislative Decree No. 13* provides that maize varieties are one of the most important intangible cultural heritage of Guatemala and establishes 13 August of every year as their national maize day. Also, *Peruvian Supreme Resolution No. 009-2005-AG* creates 30 May as their national potato day in order to appreciate the fact that Peru is the center of both wild and farmers' potato varieties; A. Argumedo and M. Pimbert *Protecting Indigenous Knowledge against Biopiracy in the Andes* (International Institute for Environment and Development: 2006).

[71] Rolf Schlegel, *Encyclopedic Dictionary of Plant Breeding and Related Subjects* (New York: The Haworth Reference Press, 2003).

[72] Path dependency is a concept that illustrates the persisting utilization of innovations which are based on historical preference or actual application.

[73]Secretariat of the CGIAR System-wide Genetic Resources Programme [SGRP], *Developing access and benefit-sharing regimes: Plant Genetic Resources for Food and Agriculture* (2006): 1.

than 500 years ago, while rice was introduced from Asia for around 200 years.[74] Columbus carried maize with him on the way from the United States to Europe and such maize was offered to Africa, where African farmers have managed, maintained and further developed until the present day.[75] Barley rice was the very first domesticated plant in agricultural history and it was introduced into Ethiopia 2000 years ago. Ethiopia has ever since become the second most diverse center of maize.[76]

Frequently, some plants can grow better in new environments than in the original place of emergence, for instance, in case the new environment is pest and natural disaster free, unlike in their original place.[77] However, if such pests or diseases are able to reach those new environments, farmers or plant breeders in the new environment may have to return to the place of origin or other places with diversity of specific plants in order to detect those with natural characteristics of disease resistance.[78]

In attempting to satisfy the needs of national agricultural industries, not a single State is self-sufficient in genetic materials.[79] Due to the movement of plant genetic resources for food and agriculture, most of the countries are dependent on major food crops originating from outside their territories, and in many circumstances from outside their regions.[80] The average degree of food dependency on non-native main crops in Sub-Saharan countries is 73 percent,[81] while the dependency rate for non-native main crops in European nations vary from 54 percent to 99 percent, that of South American countries ranges from 81

[74] Food and Agriculture Organization of the United Nations [FAO], *the Estimation of Countries' Interdependence in the Area of Plant Genetic Resources*, Background Study Paper No.7 Rev.1, W/W5246/e, 13.
[75] Secretariat of the CGIAR System-wide Genetic Resources Programme [SGRP], *Developing access and benefit-sharing regimes: Plant Genetic Resources for Food and Agriculture*, 2.
[76] Ibid.
[77] Paul Gepts, "Crop Domestication as a Long-Term Selection Experiment," *Plant Breeding Reviews* 24, no.2 (2004): 2.
[78] Ibid.
[79] Cary Fowler, Melinda Smale, and Samy Gaiji, "Germplasm Flows between Developing Countries and the CGIAR: An Initial Assessment," *Global Forum on Agricultural Research* (2001): 86.
[80] Cary Fowler, Melinda Smale, and Samy Gaiji, "Unequal Exchange? Recent Transfers of Agricultural Resources and Their Implications for Developing Countries," *Development Policy Review* 19, no.2 (2001): 181–204
[81] Ximena Flores Palacios, "the Estimation of Countries' Interdependence in the Area of Plant Genetic Resources," *Background Study Paper No. 7, Rev. 1*.

percent to 95 percent and that of the countries in the Indian ocean ranges from 85 percent to 100 percent.[82] Therefore, path dependency of plant innovations is expected to subsist.

b. Sequential as requiring initial innovations as inputs

The notion that typical innovations are the beginning point for developing further innovations has long been noted in the study of the economics of intellectual property rights. Scotchmer has distinguished between three major categories of sequential inventions: (i) an initial innovation bringing about some subsequent innovations (ii) an innovation with a more elevated amount of development requiring several initial innovations as inputs, and (iii) a quality-ladder innovation in which each of the innovations is established on the innovation of an earlier generation of the identical product serving as a ground or base for subsequent development. [83] According to Scotchmer, plant innovations are considered as the second category of the sequential innovations due to the fact that the access to existing plant genetic materials must be used as inputs for further development in this field.[84]

Modern plant breeders, in the same manner as traditional farmers, need to have access to a wide range of existing genetic variation either within or outside the same plant genera in order to expand the potential genetic resources available for plant breeding and development purposes.[85] Nowadays, plant genetic resources are also accessible through global data networks such as the *ex situ* (off-site)[86] collection of gene banks.[87] These collections are widely available with a reasonably low exchange cost, which permits germplasms to be transferred and accessed by many jurisdictions.

c. Cumulative

[82] Cary Fowler and Toby Hodgkin, "Plant Genetic Resources for Food and Agriculture: Assessing global availability," *Annual Review of Environmental Resources* 29 (2004): 145.
[83] Suzanne Scotchmer, "Standing on the shoulder of giants: Cumulative research and the patent law," *Journal of Economic Perspectives*, 5 (1991): 41.
[84] Suzanne Scotchmer, *Innovation and Incentives* (The MIT Press, 2004), 133.
[85] Philip G. Pardey and Brian D. Wright, "Agricultural R&D, Productivity, and Global Food Prospects," *Plants, Genes, and Crop Biotechnology* (2003): 22.
[86] *Convention on Biological Diversity*, article 2, defines "*ex situ* conservation" as the elements of biodiversity which do not presenting within natural habitats of such plants.
[87] Trevor R. Hodkinson et al., "DNA Banking for Plant Breeding, Biotechnology and Biodiversity Evaluation," *Journal of Plant Research* 120, no. 1 (2007): 17–29.

The recombination of genetic materials is the main element of plant breeding, regardless of breeding method. The examples of cumulativeness in terms of genetic resources are shown in the pedigrees of existing plant varieties. For example, the materials for the wheat variety, namely Sonalika, was a combination of at least 15 genetic materials.[88] Also, another variety of wheat, Veery, is the outcome of 3,179 crossing between over 50 parental lines, and, similarly, main spring bread wheat is the outcome of approximately 2,000 combinations of parental lines, with around 50 farmers' varieties in its recognized lines.[89] Furthermore, IR-72, the honored variety of rice from the era of the Green Revolution, has around 22 farmers' varieties in its pedigree.[90]

For the purpose of breeding new varieties, plant breeders need a sum of genetic materials containing gene sets with desirable traits for food and agriculture and then combine it with an initial plant variety. Even modern plant varieties developed by scientific methods are not self-sufficient. In case desired characteristics are not found in existent modern plant varieties, it is essential to the breeders to gain an access to farmers' varieties or wild varieties for the desired set of genes. [91]

d. Self-replicating

Plants by themselves, in the identical manner as other plant innovations such as cell lines, genes, and other living organisms, exist in a state of continuous self-duplication, allowing them to self-maintain for further utilization.[92] For instance, cells containing commercially valuable characteristics of plants can, from generation to generation, replicate themselves within host cells, permitting reproduction of more nucleic corrosive duplicates.

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[88] Michael Halewood and Kent Nnadozie, "Giving Priorities to the Common: the International Treaty on Plant Genetic Resources for Food and Agriculture," *The Future Control of Food: A Guide to International Negotiations and Rules on Intellectual Property, Biodiversity and Food Security*, ed. Geoff Tansey and Tasmin Rajotte (Earthscan, 2008), 117.
[89] Ibid.
[90] Susan Bragdon, *International Law of Relevance to Plant Genetic Resources: A Practical Review for Scientists and Other Professionals Working with Plant Genetic Resources* (Bioversity International, 2004), 59.
[91] Anke van den Hurk, "The Seed Industry: Plant Breeding and the International Treaty on Plant Genetic Resources for Food and Agriculture," *Plant Genetic Resources and Food Security: Stakeholder Perspectives on the International Treaty on Plant Genetic Resources for Food and Agriculture* (Routledge, 2011).
[92] Jeremy N. Sheff, "Self-Replicating Technologies," *Standford Technology Law Review* 16, no.2 (2013): 231-232.

Due to the fact that the plant breeding is path dependent, sequential, and cumulative with prior existing plant innovations, the theoretical model of intellectual property rights for the this type of innovation attempts to deal with the transfer of benefits from achieved application of an IP protected invention to the initial inventors.[93] The primary question which should be addressed is whether the initial inventor, farmers in particular, should be allowed to cover their costs through benefit-sharing mechanisms and how the scope of patent should be set in order to allow the second-generation innovations to be profitable.

The self-replicating characteristic of plant innovations makes them easily susceptible to exploitation by third parties other than the innovators.[94] Moreover, this characteristic causes some difficulties for the law makers when defining the extent and limitations of intellectual property rights. Such a difficulty, in fact, emphasizes the importance of reliable intellectual property protection to ensure fair remuneration for plant breeders when marketing improved plant materials. In the lack of exclusive monopoly rights, the third party can free ride the self-replicating innovations without difficulties.

2.3 Farmers' varieties

In general, people use the terms farmers' variety, landrace, conventional variety, traditional variety and farmer selection interchangeably.[95] Those terms are defined as a plant variety with a high ability to endure biotic and abiotic stresses bringing about a high stability in reproduction with a regular yield under a traditional horticultural system.[96] The principal utilization of these terminologies was to differentiate certain propagated plants from plant species existing in the wild and from the outcomes of

[93] Jerry R. Green and Suzanne Scotchmer, "On the division of profit in sequential innovation" *Journal of Economics*, 26, no. 1 (2005): 20-33.
[94] Laurence R. Helfer, "Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments," *Food and Agriculture Org. of the United Nations, FAO Legislative Study*, no. 85 (2004): 3.
[95] Jeremy Cherfas, "Technical challenges in identifying farmers' varieties," *Farmers' crop varieties and farmers' rights* (2016): 27.
[96] A. C. Zeven, "Landraces: A Review of Definitions and Classifications," *Euphytica: Netherlands Journal of Plant Breeding* 104, no.2 (1998): 127.

scientific plant breeding.[97] Farmers' varieties and improved modern varieties are alike in the sense that they are both considered to be lower than the rank of species.

2.3.1 Characteristics of Farmers' Varieties

The most essential characteristic of farmers' varieties is human intervention needed to develop and sustain them.[98] In other words, farmers' varieties owe their subsistence to the practices of farmers. Farmers' varieties do not occur naturally as Halewood and Lapena mentioned "they are epiphenomena of the farmer-centered innovation systems, which create and continuously maintain them (or alternatively allow them to fall into disuse and disappear)."[99] The farmers' practice of domestication of wild species has continued up to present.[100] Such practice plays a crucial part in creating and sustaining the agrobiodiversity which exists nowadays. Farmers play a role in acknowledging and differentiating landraces with a precision that equates to the precision of standard of scientific taxonomic mechanism.[101] Moreover, farmers' practices of crossing and selection can benefit the sustenance of varieties in an environment that might otherwise lead to their extinction. While certain farmers simply reproduce the crops, others began creating the new plant varieties so that they would be suitable not only for some particular areas, climates or farming types but also for a wide range of other applications which farmers have innovated.

The way for farmers to develop new plant varieties is by "crossing and selection" through three main breeding techniques, namely, in-breeding of self-pollinating plants, out-breeding of cross-pollinating plants and cloning. First, for self-pollinating plants such as barley, beans, rice and wheat, even though they can only slowly be altered, new features which occur in an in-bred plant variety would be

[97] Ibid.
[98] T. Hodgkin, R. V. Ramanatha and K. Riley, "Current Issues in Conserving Crop Landraces in Situ," *On-farm Conservation Workshop, Bogor, Indonesia* (1993): 30.
[99] Michael Halewood and Isabel Lapena, "Farmers' varieties and farmers' rights: challenges at the crossroads of agriculture, taxonomy and law," *in Farmers' Crop Varieties and Farmers' Rights* ed. Michael Halewood (Earthscan, 2016), 1.
[100] R. Vodouhe, A. Dansi, H. T. Avohou, B. Kpèki and F. Azihou, "Plant Domestication and its Contributions to In Situ Conservation of Genetic Resources in Benin," *International Journal of Biodiversity and Conservation* 3, no. 2 (2011): 40.
[101] Awegechew Teshome et.al., "Maintenance of Sorghum (Sorghum bicolor, Poaceae) Landrace Diversity by Farmers' Selection in Ethiopia," *Economic Botany* 53, no.1 (1999): 79–88.

fairly easy to pick out; therefore, new plant varieties are not difficult to be created.[102] Rice varieties around the world, for example, are mostly grown through this method.[103] For farmers who generally save their seeds from their own holdings and do not obtain fresh seed in mass, this is a crucial source for adaptation and new creation.[104] For instance, Pesagi swamp farmers in Pahang, Malaysia typically grow sticky rice along with normal (*japonica* and *indica*) rice varieties, allowing a transfer of genes between the those kinds of varieties.[105] The farmers plant them side by side, which permits them not only to choose desired traits for next harvesting seasons but also to banish undesirable types.[106]

The second type is out-breeding of cross-pollination for the varieties of the plants such as brassica, maize or pearl millet. Because this type must be bred by a genetically different variety, therefore combing genes,[107] this way would be the most rapid way of breeding and less difficult for farmers to innovate novel and distinctive traits.[108] Nonetheless, it is difficult for farmers to sustain the trait of this type of plant variety because genes can be easily transferred from other identical varieties and even similar plant species; [109] therefore, farmers are usually concerned with the way to maintain the traits of a variety against introgression from their domesticated and wild relatives.

Last, as for clones, plant genera which can be reproduced clonally such as cassava, dates, olives and potatoes, would sustain their distinct features over time because gene does not flow by way of normal selections and, therefore, the sole source of genetic alteration is somatic mutation.[110] Farmers must firstly notice such mutations and afterward propagate them to create a novel plant variety; as a result, to

[102] George Acquaah, "Conventional Plant Breeding Principles and Techniques," in *Advances in Plant Breeding Strategies: Breeding, Biotechnology and Molecular Tools* ed. Jameel M. Al-KhayriShri Mohan JainDennis V. Johnson (Springer, 2015), 116.
[103] Ibid.
[104] Jeremy Cherfas, "Technical challenges in identifying farmers' varieties," *in Farmers' Crop Varieties and Farmers' Rights* ed. Michael Halewood (Earthscan, 2016), 34.
[105] Donald Lambert, *Swamp Rice Farming: The Indigenous Pahang Malay Agriculture System* (Westview Press, 1985).
[106] Ibid.
[107] Zeven, "Landraces: A Review of Definitions and Classifications," 98.
[108] Ibid.
[109] Cherfas, "Technical challenges in identifying farmers' varieties," 34-35.
[110] Acquaah, "Conventional Plant Breeding Principles and Techniques," 117.

establish a new plant variety by cloning is considered to be relatively easy.[111] This mechanism to create new plant variety is, as a matter of fact, a very common origin of new plant varieties, especially long-lived perennials, including the prime examples of fruit trees, such as the pink grapefruit, Shamouti orange and Red Delicious apple.[112]

Another main characteristic of farmers' varieties is that they are comprised of individual cultivars with various genotypes.[113] The genetic diversity of farmers' varieties brings about a stable production system flexibility in response to biotic and abiotic stresses, decreasing the chance of total crop failures.[114] Such stability of production connecting with adaptability and biological diversity, is another feature generally utilized to identify farmers' varieties and to differentiate them from those bred scientifically. Consequently, farmers' varieties can sometimes outperform modern plant varieties in formal seed sectors, especially when they are used in severe environments, and in areas where farmers are unable to afford inputs recommended to increase their performance through modern propagating materials of formal seed sectors.[115] Also, they can contribute to major and optional sources of nutrition in various food systems.[116] Therefore, farmers varieties have long been accepted as a valuable element of global food security.[117]

The study by Jean-Francois Soussana, an agro-economist, who spent many years examining farmers' varieties, shows that the farmers in this study had a strong commitment to preserve and create

[111] Ibid.
[112] Cherfas, "Technical challenges in identifying farmers' varieties," 33.
[113] Carlos M. Correa, "*Sui generis* protection for farmers' varieties," *in Farmers' Crop Varieties and Farmers' Rights* ed. Michael Halewood (Earthscan, 2016), 169.
[114] S. Ceccarelli, E. P. Guimarães and E. Weltizien, *Plant Breeding and Farmer Participation* (FAO, 2009).
[115] Gemechu Keneni, Endashaw Bekele, Muhammad Imtiaz and Kifle Dagne, "Genetic Vulnerability of Modern Crop Cultivars: Causes, Mechanism and Remedies," *International Journal of Plant Research* 2, no.3 (2012): 69–79; Girma Balcha and Tesema Tanto, "Conservation of Genetic Diversity and Supporting Informal Seed Supply in Ethiopia," in *Farmers, Seeds and Varieties: Supporting Informal Seed Supply in Ethiopia* ed. M. H. Thijssen et.al. (Wageningen International: 2008), 141–49.
[116] Timothy Johns and Pablo Eyzaguirre, "Linking Biodiversity, Diet and Health in Policy and Practice," *Proceedings of the Nutrition Society* 65, no.2 (2006): 182; Browen Powell et.al., "Improving Diets with Wild and Cultivated Biodiversity from Across the Landscape," *Food Security* 7 (2015): 553–54; Emile A. Frison, Jeremy Cherfas and Toby Hodgkin, "Agricultural Biodiversity Is Essential for a Sustainable Improvement in Food and Nutrition Security," *Sustainability* 3, no.1 (2011): 252.
[117] United Nations Human Rights Council [UNHCR], *Report of the Special Rapporteur on the Right to Food, Olivier De Schutter*, A/64/170 (24 January 2014).

diversity of plant varieties adapted to various environments, climates.[118] However, their practices have faced some serious hindrances, including the legal prohibition of the exchange of seeds of protected varieties and that their farmers' varieties cannot be protected since they are heterogenous and thus not in conformity with the uniformity requirement for plant breeders' rights protection.[119]

In some areas, the whole farming development system comprising of conservation of biological diversity, variety development, multiplication of propagating materials, exchange and utilization is thoroughly farmer-led without connection with formal farming systems, and totally not regulated by the government.[120] By contrast, in some countries, farmers' varieties and the management of biological diversity have still taken an important part in both formal and informal seed systems,[121] for instance, access to propagating materials developed by formal sectors through domestic markets or neighbors and then blending those plant varieties with farmers' varieties, or contributing their farmers' varieties developed in their own holdings for research or breeding programs of formal sectors.[122]

In summation, the definition of the term "plant variety" set forth by the UPOV Convention and the definition of the term "cultivar" provided by *the International Code of Nomenclature for Cultivated Plants* (ICNCP) refer to "attributes or a combination of attributes" that are "clearly distinct, uniform and stable when propagated by appropriate means"[123] As can be seen, farmers' varieties definitely can satisfy those requirements if they wish. If farmers could not, they would not be able to identify their varieties.

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[118] *Carlo Fadda*, "The farmer's role in creating new genetic diversity," *in Farmers' Crop Varieties and Farmers' Rights* ed. Michael Halewood (Earthscan, 2016), *50-51.*

[119] Ibid.

[120] Stephen Brush, *Farmers' Bounty: Locating Crop Diversity in the Contemporary World* (Yale University Press, 2004), 301.

[121] Formal seed systems are portrayed by a vertically organized production and distribution of approved seeds and plant varieties, while informal seed systems refer to domestic seed reproduction by farmers themselves, utilizing seed selection, production and conditioning practices in their own farm holdings or neighborhood; J.D. Van der Ploeg, "the Peasantries of the Twenty-first Century: the Commoditisation Debate Revisited," *The Journal of Peasant Studies* 37 no.1 (2010): 1–20.

[122] Niels P. Louwaars and Walter Simon De Boef, "Integrated Seed Sector Development in Africa: A Conceptual Framework for Creating Coherence between Practices, Programs and Policies," *Journal of Crop Improvement* 26 (2012): 39–59.

[123] *International Code of Nomenclature for Cultivated Plants*, Article 2.2.

In contrast, the question on whether a specific farmers' variety is able to maintain its unique features for a reasonable period of time or if it is able to be unmistakably associated with a farmer or a community is much more problematic. Certainly, when farmers propagate their crops by using appropriate means, their expectation is not to maintain their features since one of the objective of their landrace management, is to permit the plant to adjust to fluctuating climates or environments. Therefore, provided that farmers were to be convinced to fix the features of farmers' varieties, they might no longer be suitable for their needs and might not even be considered as farmers' varieties.

A further important question that should be raised here is whether the traits chosen by farmers are sufficiently consistent over place and time to be considered "distinct" or detectable enough for the protection systems of plant breeders' rights or patent. The answer to this question is "possibly" with a challenge of sustaining a wide range of plant varieties which are suitable and adapted for their particular environmental conditions and their specific preferences.[124]

In the South, it is estimated that small holder farmers access at least 90 percent of their genetic resources and propagating materials through informal systems, such as, from the harvests in their own farms, through exchanging with neighbors and by purchasing at local markets.[125] However, there is a risk that the expansion in extent and utilization of the formal seed sector for commercial purposes reinforced by supportive policies, such as intellectual property (and concurrent decrease in research and plant breeding in public sector) will put informal farming systems under rising pressure, with the outcome that negatively affects the ability of farmers to invent and contribute to the creation and protection of plant genetic diversity.[126]

In case farmers select or are required by formal seed systems to buy seeds every season, the system of farmer-managed crop might be disturbed. In this regard, it is necessary to find the legal

[124] Cherfas, "Technical challenges in identifying farmers' varieties," 39-40.
[125] Mathieu Thomas et.al., "On-Farm Dynamic Management of Genetic Diversity: The Impact of Seed Diffusions and Seed Saving Practices on a Population-variety of Bread Wheat," *Evolutionary Applications* 5 no.8 (2012): 779; M. Pautasso et.al., "Seed Exchange Networks for Agrobiodiversity Conservation. A Review," *Agronomy for Sustainable Development*, 33, no.1 (2013): 151.
[126] United Nations Human Rights Council [UNHCR], *Report of the Special Rapporteur on the Right to Food*.

mechanism to avoid a situation barring farmers from performing normal farming practices and to benefit from others' utilization of their varieties for commercialization.

2.3.2 Farmers' rights

As farmers play the important roles of both the guardians and the creators of plant genetic materials, the international community commonly agrees that the rights of farmers need to be ensured in order to enable them to pursue this role. Farmers' rights establish a keystone in environmental protection treaties, including the CBD and the ITPGRFA. Nonetheless, with the lack of official definition, it is uncertain what ideas are involved and how such rights can be recognized.

Prior to the adoption of the ITPGRFA, without a common ground at the international stage, the notion of farmers' rights is defined differently according to the groups of people or regions. One of the reasons why the States, despite the fact that they mutually agree upon the notion of farmers' rights, were not able to settle on the exact definition of these rights was because the circumstances of local farmers greatly differ from one State to another, as does the awareness about those rights.[127]

While some people associated these rights with new category of intellectual property protection for plant genetic materials developed by farmers at first, to other people the concept of farmers' rights was more of a political policy aiming at recognizing and supporting the contribution of farmers to the protection and sustainable utilization of plant genetic resources for food and agriculture.[128] To many people, this concept also referred to the protection of the farmers' ability to continue preserving genetic resources and the use of them in a sustainable manner, and the enablement for farmers to participate actively in decision-making processes concerning genetic diversity.[129]

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[127] Regine Andersen, "Farmers' rights: Evolution of the international policy debate and national implementation," *in Farmers' Crop Varieties and Farmers' Rights* ed. Michael Halewood (Earthscan: 2016), 131.
[128] Subash Dasgupta and Indrajit Roy, "Report of the First National Focal Point Meeting of the Project: Enhancing Understanding and Implementation of the International Treaty on Plant Genetic Resources for Food and agriculture in Asia (GCP/RAS/284/JPN)," *Food and Agricultural Organization of the United Nations Regional Office for Asia and the Pacific* (2013): 58.
[129] Cary Fowler, "By Policy or Law? The Challenge of Determining the Status and Future of Agro-Biodiversity," *Journal of Technology Law & Policy* 3, no. 1 (1997): 3.

Years of negotiations and deliberations have led to the clear recognition of farmers' privilege or farmers' rights in the international sphere. They appeared in the 1980's as an opposing demand to intellectual property rights over new varieties of plants.[130] Eventually, the FAO has given the definition to farmer's rights in its Conference Resolution 5/89 as "rights arising from the past, present, and future contributions of farmers in conserving, improving, and making available plant genetic resources, particularly those in the centers of origin/diversity."[131] These rights are bestowed as a guarantee for both present and the following generations of farmers, for the objective of granting fair benefits to farmers, and for encouraging the perpetuation of the contributions of farmers, as well as the fulfillment of the common objectives of "the International Undertaking."[132]

Afterwards, the FAO Conference acknowledged, in the identical manner to the CBD's negotiations, that plant genetic resources for food and agriculture were under the sovereignty power of the States.[133] This confirms the renunciation of the until-then dominant notion that plant genetic resources were the common heritage of mankind.[134] Such change is regarded as a forerunner to the dominant trend to respect the farmers as owners which portrays most of the existing debate on the rights of farmers.[135]

There are two main distinct viewpoints concerning specific end goals and the mechanism to address farmers' rights. The first takes the ownership approach, referring to the farmers' right to get individually or collectively compensated or rewarded for genetic resources obtained from their farm holdings and utilized in commercial varieties, which might or might not be protected under intellectual property protection systems.[136] The ultimate goal is to create an impetus for the persisting protection of

[130] Alejandro Argumedo and Michel Pimbert, "Protecting Farmers' Rights with Indigenous Biocultural Heritage Territories," *International Institute for Environment and Development, IIED Asociacion ANDES* (2008): 3.
[131] "ITPGRFA: Relevant provisions for the realization of Farmers' Rights." Food and Agriculture Organization of the United Nations [FAO]. Accessed December 18, 2017. http://www.farmersrights.org/about/treaty.html.
[132] FAO Conference, Resolution 5/89.
[133] FAO Conference, Resolution 3/91.
[134] Argumedo and Pimbert, "Protecting Farmers' Rights with Indigenous Biocultural Heritage Territories," 3.
[135] Regine Anderson, "the Farmers' Rights Project - Background Study 1: The History of Farmers' Rights: A Guide to Central Documents and Literature," *FNI-Report 8/2005 the Fridtjof Nansen Institute* (2005): 30-31.
[136] Lauren Winter, "Cultivating Farmers' Rights: Reconciling Food Security, Indigenous Agriculture, and TRIPS," *Vanderbilt Journal of Transnational Law* (2010): 248

biological diversity.[137] The access and benefit-sharing system established by law and intellectual property rights of farmers are proposed as core instruments to achieve the goal.[138] The system can be devised in many forms; however, according to ownership approach, this mechanism would neccessitate the establishment of a direct benefit-sharing system in which the benefits could be directly shared between the resource holders and purchasers, relied upon a prior informed consent as required by the CBD.[139]

Second, the stewardship approach seeks to guarantee collective farmers' right to carry on their practices as guardians and inventors of agrobiodiversity.[140] The concept refers to the legal space needed for farmers to carry on these roles and to support farmers for their contribution in the maintaining agrobiodiversity on behalf of mankind.[141] The mechanism proposed the national laws to ensure farmers' rights to save, use, exchange and sell propagating materials by granting farmers some kind of intellectual property rights on farmers' varieties which are equivalent to breeders' rights.[142] A benefit-sharing mechanism might be established; nevertheless, supporters of the stewardship approach propose an indirect benefit-sharing, meaning that the benefits are expected to be shared between all peoples or every steward of agrobiodiversity at large.[143] This is because of the difficulties to identify exactly who should get compensated since the circumstances in each country differ.[144] Another is that direct benefit-sharing may bring about discouragement to share seeds and other genetic materials between farmers owing to

[137] "The contents of Farmers' Rights: Two approaches to Farmers' Rights," Farmers' Rights - Resources Pages for Decision-makers and Practitioners, accessed January 23, 2018, http://www.farmersrights.org/about/fr_contents_1.html.
[138] Ibid.
[139] Winter, "Cultivating Farmers' Rights: Reconciling Food Security, Indigenous Agriculture, and TRIPS," 248.
[140] Regine Andersen, "Realising Farmers' Rights under the International Treaty on Plant Genetic" Resources for Food and Agriculture, Summary of Findings from the Farmers' Rights Project (Phase 1)," *the Fridtjof Nansen Institute* (2006): 4.
[141] Ibid.
[142] Ibid.
[143] "The contents of Farmers' Rights: Two approaches to Farmers' Rights," Farmers' Rights - Resources Pages for Decision-makers and Practitioners, accessed January 23, 2018, http://www.farmersrights.org/about/fr_contents_1.html.
[144] Regine Andersen, "Farmers' rights: Evolution of the international policy debate and national implementation," 133.

expectations of benefits.[145] This way of thinking originates from the early days of negotiations in the FAO. The example of this indirect benefit-sharing mechanism is the MSL under the ITPGRFA. This approach claims that different fields of laws, including intellectual property laws, are gradually narrowing this legal space, thereby reducing the abilities of farmers to sustain and reproduce plant genetic materials, including to preserve their livelihoods.[146]

At a national level, some developing countries, such as India and Thailand have established legal mechanisms on direct benefit-sharing. Certainly, there might be some ways of combining the ideas under the two approaches to achieve the ultimate goal of realizing the rights of farmers. What matters in this context is that the approach that is chosen must not conflict with the principles of the stewardship approach, which has been the primary goal of the FAO since the issue was first taken up as well as the rationale behind the ITPGRFA. The ultimate objective is not only to maintain the legal space to guarantee that farmers would continue to sustain plant genetic resources, but also to create an appropriate mechanism for rewarding those who have developed and maintained those resources. The obligation concerning farmers' rights under the CBD and the ITPGRFA is discussed later in Chapter IV. Moreover, the achievement of benefit-sharing mechanisms established in India and Thailand is analyzed in Chapter V and VI respectively.

2.4 Plant inventions created by scientific methodologies

This section explains the brief historical development of plant inventions developed by scientific methodologies. It crucially divided the main development of plants into three different eras in accordance with the scientific methods used in their breeding and creating.

2.4.1 Hybridization

[145] The Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture, *Information Paper on Farmers' Rights Submitted by the Fridtjof Nansen Institute, Norway, Based on the Farmers' Rights Project*, Doc. IT/GB-3/09/Inf (1-5 June 2009).
[146] Ibid.

Due to the experiments in hybridization of plants by ways of crossing of two inbred plant varieties[147], plant breeders started to acknowledge plant innovation, and it was later on accepted as one of the formal scientific fields.[148] Such crossing of two inbred plants created heterogeneity, leading to higher yield in the first generation (F1) known as "hybrid vigor".[149] However, after F1, hybrid vigor considerably decreases since their offspring are not the result of "true-breeding".[150] In other words, only F1 is vigorous enough for farming use. Hence, hybrids do not encourage farmers to save seeds for replanting since farmers need to buy hybrid F1 every single harvesting season in order to produce a sufficient yield.[151] This in turn sharply decreases competition between farmers as seed producers.[152]

The first commodified hybrids were those of corn, adopted in the United States due to environmental constraints.[153] In 1943, only around twenty-three years after such adoption, 90 percent of the corn harvested in the United States was hybrid.[154] Such trends were extended across the United States, including Latin America, Sub-Saharan countries and Asia, even though the scale was not comparable to the US.[155] In 2010, around half of the rice planted in China was hybrid, leading to an increase in the degree of food security by feeding around sixty million more people in this country alone.[156]

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[147] An inbred plant refers to plants which are unified genetically and are created and reproduced by inbreeding through self-pollination.
[148] Graham Dutfield, "Turning Plant Varieties into Intellectual Property: The UPOV Convention," *The Future Control of Food: A Guide to International Negotiations and Rules on Intellectual Property, Biodiversity and Food Security* (2008): 24.
[149] Elisa Rives, "Mother Nature and the Courts: Are Sexually Reproducing Plants and Their Progeny Patentable under the Utility Patent Act of 1952," *Cumberland Law Review* 32 (2002): 192.
[150] Ibid.
[151] Dutfield, "Turning Plant Varieties into Intellectual Property: The UPOV Convention," 24; Haley Stein, "Intellectual Property and Genetically Modified Seeds: The United States, Trade, and the Developing World," *Nw. J. Tech. & Intell. Prop.* 3 (2004): 160.
[152] Zvi Griliches, "Hybrid Corn and the Economics of Innovation," *Science* 132, no. 3422 (1960): 275-80.
[153] Richard Sutch, "The Impact of the 1936 Corn Belt Drought on American Farmers' Adoption of Hybrid Corn," *The Economics of Climate Change: Adaptations Past and Present* (2011): 195-223.
[154] A. R. Hallauer, W. A. Russell, and K. R. Lamkey, "Corn Breeding.," *American Society of Agronomy Publication* No. 18 (1988): 463-564.
[155] Marcel Bruins, "The Evolution and Contribution of Plant Breeding to Global Agriculture," *Responding to the Challenges of a Changing World: The Role of New Plant Varieties and High Quality Seed in Agriculture. In Proceedings of the Second World Seed Conference. UPOV, Switzerland* (2009): 18–31.
[156] Jiming Li, Yeyun Xin, and Longping Yuan, "Hybrid Rice Technology Development: Ensuring China's Food Security," *Proven Successes in Agricultural Development: A Technical Compendium to Millions Fed* (2010): 271–94.

Also, it is worth noting that, at present, hybrid corn in the United States receives over USD1 billion of private investment for the purpose of research and development.[157] In this regard, some argue that if the same amount of private investments had been made in the improvement of traditional breeding techniques through open-pollination, the similar amount of production would have been achieved with the benefit of cutting costs of plant production as seeds are one of the main farm inputs and farmers need to buy F1 hybrid every planting season.[158] However, for the crops which cannot be hybridized such as cotton, soybeans and wheat, farmers and public sectors are still the dominant origins of new varieties.[159]

The success of hybridization has given rise to a global surge in genetics studies, shifting the emphasis of research and development from phenotype to genotype. Due to scientific advancement, tissue and cell culture techniques were developed afterwards in the 1960s. Those technologies have not yet taken the place of traditional plant breeding by farmers, but they have enabled the regeneration of a large amount of genetically identical crops.[160] Comprehensive genetic research on hybrids has brought about a number of new plant varieties, yet the revolution of DNA in the middle of the 20th Century greatly enhanced the science of plant breeding.

2.4.2 DNA sequence

The identification of deoxyribonucleic acid or DNA by Francis Crick and James Watson has paved the way for direct manipulation of genes in the genetic engineering of plants, opening the door of molecular breeding techniques. DNA are the blueprints of nature designating hereditary traits or features

[157] Jorge Fernandez-Cornejo et.al., "The Seed Industry in US Agriculture: An Exploration of Data and Information on Crop Seed Markets, Regulation, Industry Structure, and Research and Development" *Agriculture Information Bulletin* 786 (2004): 31.
[158] R. C. Lewontin, *The Doctrine of DNA: Biology as Ideology Penguin Books* (London, 1993); Jack Ralph Kloppenburg, *First the Seed: The Political Economy of Plant Biotechnology* (University of Wisconsin Press, 2005), 19.
[159] Ralph Kloppenburg, *First the Seed: The Political Economy of Plant Biotechnology* (University of Wisconsin Press, 2005), 20.
[160] Graham Dutfield, "Turning Plant Varieties into Intellectual Property: The UPOV Convention," *The Future Control of Food: A Guide to International Negotiations and Rules on Intellectual Property, Biodiversity and Food Security*, (2008): 24.

to be passed on to the next generations of plants, and are the main constituent of genes.[161] The knowledge about function of DNA has brought about the advancement of tools, including cloning vectors, marker assisted selection, and high-throughput sequencing, permitting the isolation of gene sequences and genome sequences.[162] As a result, the scientific focal point has then changed to direct manipulation of genes and molecular breeding techniques which require operation at DNA level.[163]

Subsequently, owing to the next-generation sequencing technologies (NGS),[164] scientists can faster and more precisely create plant varieties with higher yield than those achieved through traditional breeding techniques.[165] This is because traditional breeding techniques need more backcrosses and it is difficult to trace parenting lines of the new plant variety. [166] These technologies save the time for genetic purity in commercial plant production due to its exact insertion of the genetically modified genes with the specific traits. Moreover, DNA sequencing technique can be employed to precisely remove all unwanted traits, which creates the possibility for developing new plant varieties with no allergic or toxic elements

As of 2013, scientists have achieved the sequencing of 55 genomes of plants belonging to 49 various plant species.[167] Currently, genetic modification techniques in the agricultural field has mostly concentrated on the creation of plant varieties with herbicide resistant traits in order for the seed companies to produce their own pesticide by employing bacterial DNA functions, such as *Bacillus thuringiensis* (Bt)[168] Most of all commercially planted transgenic crops are modified genetically for such pesticide-resistant traits. In 2011, international shares of genetically modified plants with pesticide-

[161] Edmund J. Sease, "From Microbes, to Corn Seeds, to Oysters, to Mice: Patentability of New Life Forms," *Drake L. Rev.* 38 (1988): 551.
[162] Ibid.
[163] M. Blakeney, "Patenting of Plant Varieties and Plant Breeding Methods," *Journal of Experimental Botany* 63, no. 3 (2012): 1069–74.
[164] Marie E. Bolger et al., "Plant Genome Sequencing—applications for Crop Improvement," *Current Opinion in Biotechnology* 26 (2014): 31–37; Junpeng Shi and Jinsheng Lai, "Patterns of Genomic Changes with Crop Domestication and Breeding," *Current Opinion in Plant Biology* 24 (2015): 47–53.
[165] Agnès E. Ricroch and Marie-Cécile Hénard-Damave, "Next Biotech Plants: New Traits, Crops, Developers and Technologies for Addressing Global Challenges," *Critical Reviews in Biotechnology* (2015): 1–16.
[166] Yves Tourte and others, *Genetically Modified Organisms: Transgenesis in Plants.* (Science Publishers, Inc., 2003), 61.
[167] Todd P. Michael and Scott Jackson, "The First 50 Plant Genomes," *The Plant Genome* 6, no. 2 (2013): 2-3.
[168] N. P Louwaars, *Impacts of Strengthened Intellectual Property Rights on the Plant Breeding Industry in Developing Countries: A Synthesis of Five Case Studies* (Wageningen, 2005).

resistant traits accounted for around 59 percent, insect-resistant traits made up 15 percent and 26 percent have both traits.[169]

2.4.3 Agro-nanotechnology

Agro-nanotechnology or the agronomic application of nanotechnology in plants, can potentially change traditional plant production systems worldwide. Based on the cumulative field of engineering and biology, this type of technology applies engineering to design new plant materials by genetic modification.[170] Therefore, it may bring about predictive breeding methods, where some particular traits can be put together by devices and transferred to plant breeders in order to cross and select plant lineage.[171] A better understanding of the interplay between nanoparticles and responses of plants could possibly revolutionize the production system of plants through better disease resistance, increased nutrient, and higher crop yield.[172]

This technology is still in its infancy phase, but a handful of developing projects of this type of technology are in their laboratory phase and patent applications are expected.[173] Once these synthetic plants are placed on the market, our concepts about what constitutes "plants" might be challenged. There has been a wide range of potential applications of agro-nanotechnology suggested, including the transformation of crops into electronic devices that can generate biotic fertilizers or into bullet nanoparticles which release herbicides, chemicals.[174] For the food and agricultural sector, those technologies potentially permit plant breeders to control the discharge of chemicals used in agriculture

[169] Ibid.
[170] Jane Calvert, "Synthetic Biology: Constructing Nature?," *The Sociological Review* 58 (2010): 95–112.
[171] Mike Bevan, "The Role of Genomics in Crop Improvement," in *Plant Science and the Future for Plant Breeding* (Symposium on Plant Breeding for the Future, UPOV, 2011), 22.
[172] Ibid.
[173] Kalpana Sastry, H. B. Rashmi, and N. H. Rao, "Nanotechnology Patents as R&D Indicators for Disease Management Strategies in Agriculture," *Journal of Intellectual Property Rights* 15 (2010): 197–205.
[174] Bhupinder Singh Sekhon, "Nanotechnology in Agri-Food Production: An Overview," *Nanotechnology, Science and Applications* 7 (2014): 31

such as fertilizers, pesticides, or herbicides, as well as target-a particular conveyance of biomolecules such as vitamins, proteins, and activators.[175]

Even though agro-nanotechnology is in its infancy, it has received growing attention in both the domestic and international sphere. The capability of technology to reinvent the plants' metabolic pathways may lead to unexpected consequences; therefore, the parties to the CBD have requested a precautionary way to address the field release of synthetic plants.[176] As of 2015, the Secretariat of the CBD have begun to conduct intensive research on the possible effects of the components, organisms, as well as products derived from synthetic biology technologies on the protection of biological diversity and sustainable utilization of global genetic resources.[177]

2.5 Conclusion

In conclusion, before the middle of the 20th century, when hybridization of self-pollinating plants had not yet proved possible, plants were regarded as natural products belonging to public.[178] Since they were considered merely natural and evident discoveries, they did not warrant intellectual property protection. Farmers at that time were able to save, replant, and resell seeds without legal restrictions, and propagating materials were still freely available to the public. The role of private plant breeders was usually limited to the breeding and cleaning seeds of plant varieties developed by farmers and they did not invest a large amount of capitals into the creation and improvement of new and better plant varieties,[179] while plant innovations were precluded from intellectual property protection worldwide. Simply put, farmers could freely compete with the breeders' supply using seeds from their own harvests. Farmers and plant breeders during that time only addressed the competition by creating business

[175] Peng Wang, Enzo Lombi, Fang-Jie Zhao, Peter M. Kopittke, "Nanotechnology: A New Opportunity in Plant Sciences," *Cell Press* 8 (2016): 699-712.
[176] Conference of the Parties to the Convention on Biological Diversity, New and Emerging Issues: Synthetic Biology, UNEP/CBD/COP/12/L.24, 1 (17 October 2014).
[177] Secretariat of the Convention on Biological Diversity, "Synthetic Biology," *CBD Technical Series No. 82* (2015): 3-4.
[178] Cary Fowler, *Unnatural Selection: Technology, Politics and Plant Evolution* (Switzerland; Langhorne, Pa., U.S.A: Routledge, 1994), 99.
[179] Brian D. Wright and Philip G. Pardey, "The Evolving Rights to Intellectual Property Protection in the Agricultural Biosciences," *International Journal of Technology and Globalisation* 2, no. 1 (2006): 12–29.

reputations and pricing systems involving charging extra for novel seeds only for the first planting season.[180]

What is more, before the 20th Century, apart from the important roles of farmers, the creation and improvement of this type of innovation was conducted principally by public sectors, i.e., research institutes sponsored by the government and universities. The results of their research and development were made free for the public to access without any cost. A handful of examples of those results can be seen during the "Green Revolution," such as the wheat and rice varieties developed through partnerships between the International Agricultural Research Centers of the Consultative Group on International Agricultural Research (CGIAR) and other public research institutes.[181]

Technological advancement in biology has dramatically altered this situation. As scientific method development progressively increased the roles of the public sector in creating plant innovations, it also strengthened and encouraged research and development by the private sectors. The creation of hybrid varieties has given rise to a shift from seed-saving practices for replanting to practices of buying (F1) hybrid seed each planting season in some countries. This has led to the booming of today's modern seed industry.

The research and development on other applications of transgenic plants are ongoing in both the North and the South with a wider scope of plant species and traits such as abiotic-stress resistance, fungal resistance, or higher nutrient.[182] Modern plant innovations demand substantial investment and both of

[180] The case study of England illustrates that plant breeders contributed their efforts to create their good reputation among the groups of farmers and the scientists. To encourage farmers and scientists to use certain seeds, plant breeders promote them through advertising literature and publications in scientific journals, attempting to convince them of the advantages of purchasing novel seeds rather than reproducing themselves. In France and Italy, plant breeders and farmers removed the buds from flowers to bar competitors from taking cuttings from the stems. In the United States, plant breeders used to seek protection through other intellectual property protection systems such as trademarks, the promotion of business reputation and pricing strategies such as selling the first generation of seeds at a high price, assuming that they could not charge for floowing generations of seeds; Mercedes Campi "Protecting Plants: Incentives to Innovate and Access to Biological Resources. A Historical Overview," *Instituto Interdisciplinario de Economía Política de Buenos Aires, IIEP-Baires* (2014): 8.
[181] Kennedy, "Is the Next "Green Revolution" Right Around the Corner?".
[182] Alexander J. Stein and Emilio Rodríguez-Cerezo, "International Trade and the Global Pipeline of New GM Crops," *Nature Biotechnology* 28, no. 1 (2010): 23–25.

their processes and products can be duplicated without difficulty. In accordance with the report from the International Service for the Acquisition of Agri 'biotech Applications (ISAAA), "biotech crops are the fastest adopted crop technology in the world" as the international planting areas of these crops have risen greatly from 17,000 square kilometers in 1996 to 1,815,000 square kilometers in 2014.[183]

In the same year, 18 million farmers in 28 States planted genetically modified crops while the United States held the largest scale of using transgenic crops.[184] Interestingly, out of those 28 States, only 8 of them were from the North while the other 20 nations were developing countries.[185] Such swift development indicates an upcoming paradigm change in this area, the landscapes of genetic pools, but also unexpected changes in the seed market and social structure, as well as legal mechanisms, particularly intellectual property protection systems.

Regardless of the controversy cornering genetically modified seeds regarding the negative effects they might have on the environment and public health modern biotechnology may be the answer to the predicted issue of food shortage. Moreover, as previously discussed, modern plant biotech still largely depends on the farmers' knowledge systems which have continuously and mainly sustained the worldwide stock of genetic materials.[186]

The demand for hybrid seeds has brought about an increasing number of seed corporations, along with the demand for reliable intellectual property protection.[187] Moreover, this era witnessed the establishment of international plant breeder associations, such as the International Association of Plant Breeders for the Protection of Plant Varieties (ASSINSEL), which afterwards become the driving force for the introduction of intellectual protection for technologies relating to plants. The role of ASSINSEL in relation to the establishment of the UPOV Convention will be later discussed in Chapter 3.

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[183] Clive James, Global Status of Commercialized Biotech/GM Crops, Vol. Brief No. 49 (Ithaca, N.Y.: ISAAA, 2014).
[184] Ibid.
[185] Ibid.
[186] Chidi Oguamanam, "Open Innovation in Plant Genetic Resources for Food and Agriculture," *Chi.-Kent J. Intell. Prop.* 13 (2013): 13.
[187] D. N. Duvick, "Crop Improvement: Emerging Trends in Maize," in *Crop Productivity and Sustainability-Shaping the Future* (Oxford & IBH Publishing Co., New Delhi, 1998), 127–38.

At the same time, traditional breeding techniques, based on the crossing and selection of phenotypes are necessary for an appropriate experiment in the real field and further transfer of scientifically-modified genes to the breeding pools in order to achieve new plant varieties.[188] Moreover, those techniques are still the most cost effective to breed many plant varieties.[189] Importantly, traditional farming has proved to be the best breeding technique to endure climate change and maintain the diversity of biological resources.

Since the international community still has various opinions about the effects of monopoly rights on genetic materials for food and agriculture and about how to address the conflicts within the informal farming systems, as well as how to design intellectual property mechanisms for path dependent, sequential, cumulative and self-replicating inventions, *sui generis* systems for plant intellectual property rights protection was established at both the international level, i.e., the UPOV Convention, and at national levels in some countries as alternatives to the mainstream patent system.

[188] J. H. Dodds et al., "Biotechnology, the Gene Revolution, and Proprietary Technology in Agriculture," *A Strategic Note for the World Bank, IP Strategy Today*, no. 2 (2001): 17.
[189] Ibid.

Chapter III: International Agreements Concerning the Protection of Intellectual Property Rights on Plants Inventions

Since the beginning of 1990s, there has been an extensive development in the regulatory frameworks governing the utilization of plants genetic resources worldwide in light of negotiations in complicated sets of international institutions, both in areas of environment and trade and intellectual property. Generally, different domestic governmental bodies involved themselves in each area of negotiation without proper coordination among them.[190] This Chapter discusses the regulatory framework governing international intellectual property mechanisms with respect to plants.

First, the TRIPS Agreement does not provide a specific section for the protection of plant biological resources. Nevertheless, it addresses the issue of plants in section V concerning patent protection. Due to the uniqueness of plant innovation as a subject matter of protection under patent law, the TRIPS Agreement particularly creates some flexibilities for member States under Article 27.3(b).

Second, another international framework administered by the International Union for the Protection of New Varieties of Plants (UPOV) is particularly devised to govern plant variety protection. This international framework has been revised four times in order to satisfy the interests of commercial

[190] Michel Petit et. al., *Why Governments Can't Make Policy - The Case of Plant Genetic Resources In The International Arena* (International Potato Centre, 2001), 7.

plant breeders while balancing the needs of European farmers and has later on been encouraged to be enforced outside European territories.

3.1 Plant Patent System under the TRIPS Agreement

The TRIPS Agreement of the WTO has been considered the most significant international mechanism which creates a major incentive for most states in the world to implement plant intellectual property protection and has a considerable impact on the structure of domestic laws dominating plant protection.[191] The fundamental understanding of the TRIPS Agreement is provided in this section, followed by a full explanation on the historical background and the TRIPS obligations to implement plant intellectual property protection.

3.1.1 Overview of the TRIPS Agreement

The TRIPS Agreement is the law of 164 WTO member States, governing intellectual property which is one of the three pillars of the WTO apart from trade in goods and trade in services.[192] The TRIPS Agreement entered into effect in 1995 as a result of the eight rounds of the General Agreement on Tariffs and Trade (GATT) negotiations at the end of 1994.[193] The Agreement established the minimum standards of protection for all categories of intellectual property rights[194], and requires all member States to implement these standards in their national legislation.[195] The minimum standards include patent and plant variety protection set forth in part II, section V, of the Agreement. Simply put, it permits a higher level of protection while forbidding lower ones. The WTO initially required the deadline for developing

[191] Cullet Philippe, "Revision of the TRIPS Agreement concerning the Protection of Plant Varieties: Lessons from India concerning the Development of a Sui Generis System," *Journal of World Intellectual Property* 2, no. 4 (1999): 617.
[192] Food Ethics Council (FEC), "TRIPS with everything? Intellectual property and the farming world," *A Food Ethics Council Report*, 2002, 13.
[193] *General Agreement on Tariffs and Trade*, open for signature 30 October 1947, 58 UNTS 187 (entered into force 1 January 1948) was incorporated into the *General Agreement on Tariffs and Trade in Marrakesh Agreement Establishing the World Trade Organization*, open for signature 15 April 1994, 1867 UNTS 3 (entered into force 1995) annex 1A (GATT). There were eight multilateral trade negotiations or rounds during the GATT era (1947–1994).
[194] The TRIPS Agreement provides minimum standards for the protection of copyright, trademarks, geographical indications, industrial designs, patents, layout-designs of integrated circuits, trade secrets, and anti-competitive practices.
[195] *TRIPS Agreement*, Article 1.2.

countries and least-developed countries (LDCs) to comply with all obligations by 2000 and 2006 respectively; however, the deadline for compliance was later on postponed, with a new deadline for the LDCs at 2021 to fully implement all obligations under the TRIPS Agreement.[196]

Further, the TRIPS Agreement also requires the member states to establish effective enforcement procedures to ensure compliance to its provisions.[197] The Agreement is also supported by a dispute settlement mechanism of the WTO with the ability to sanction in the case of nonconformity with its decisions. Due to its legally-binding dispute settlement and its sanctions, the WTO has become uniquely powerful.

Since the TRIPS Agreement forms an essential part of the WTO system, it is subject to "trade without discrimination principles", namely the National Treatment principle (NT) stipulated in Article 3 and the Most-favored Nation (MFN) principle stipulated in Article 4.[198] The NT principle refers to the obligation of all members to provide the same standards of protection as that for their own nationals.[199] Put differently, the national legislation of a member should not treat foreigners less favorably than their own nationals. As for the principle of MFN, each member country is required to grant equally an advantage or a special favor to all of the WTO trading partners.[200] The provisions under the former conventions concerning intellectual property rights are incorporated into the TRIPS Agreement's relevant provisions by reference.[201]

The ambition of the developed nations to spread intellectual property protection in developing nations has been criticized, especially in the field of patents where its exclusive nature has been viewed as responsible for having restricted the public from being able to afford certain products such as plant

[196] Ibid, Article 65 and 66.
[197] Ibid, Article 41.
[198] *TRIPS Agreement*, Article 3 and 4.
[199] *TRIPS Agreement*, Article 3; the national treatment principle has been a keystone component of the pre-TRIPS international intellectual property treaties.
[200] Ibid, Article 4.
[201] The former conventions include the *1967 Paris Convention*, *the 1971 Berne Convention*, *the 1961 Rome Convention*, and *the 1989 Treaty on Intellectual Property in Respect of Integrated Circuits*.

biological resources or drugs. The protection of plant biological resources under the TRIPS Agreement is discussed in the next section.

3.1.2 Obligations under the TRIPS Agreement

In general, article 27 of the TRIPS Agreement obliges its member States to provide patent protection for any inventions, either products or processes, covering every field of technology, if such inventions are novel, non-obvious and industrial applicable.[202] However, the Agreement, article 27.3(b) sets forth the types of inventions which the member states may exclude from patentability as follows:

> Members may also exclude from patentability: […]
>
> (b) plants and animals other than micro-organisms, 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. The provisions of this subparagraph shall be reviewed four years after the date of entry into force of the WTO Agreement.[203]

To put it another way, the exception under Article 27.3(b) does not totally forbid plant genetic resources from patentability. Member states may subject any type of plant biological resources to a patent regime; nevertheless, the members are not required to do so as regards every type of plant resource to the extent that such resources are not considered micro-organisms nor the products resulting from a microbiological or non-biological process. Moreover, the TRIPS Agreement requires intellectual property protection for plant varieties either through a patent system or an effective *sui generis* system, or a combination of both.

3.1.3 Drafting History of Article 27.3(b)

The exception for plant innovation provided under article 27.3(b) is the result of the controversy during the negotiations of the TRIPS Agreement, reflecting differences in economic and social policies

[202] World Trade Organization [WTO], "Intellectual property - overview of TRIPS Agreement," World Trade Organization, accessed August 05, 2017, https://www.wto.org/english/tratop_e/trips_e/intel2_e.htm#patents.
[203] *TRIPS Agreement*, Article 27.3(b).

among the WTO members, not limited to only between the developed world and developing countries.[204] The issue of plant patentability concerns highly complicated political considerations such as food security and ethical questions.[205] Since the language of this provision could have a great impact on many critical issues, the drafters of the Agreement were particularly aware of the terms and wordings used in this provision.[206]

At the time of negotiations, despite the fact that some developed countries permit patentability of plants and other living materials,[207] most of the WTO member countries still take a negative approach to the intellectual property protection of plant varieties.[208] The main reason is that, for decades, plant breeders have generally sought intellectual property protection through the patent system; however, they have faced many technical issues when applying patent provisions designed for mechanical innovations to plant genetic resources such as the difficulties to satisfy eligibility requirements, especially novelty and inventive steps, and disclosure requirement.[209] Moreover, most of the countries, including European countries, considered that it is against public interest to allow extensive monopoly over plants, given their collective significance.[210] Underlying this was the idea that it was preferable to hold, in so far as it was conceivable, the convention of free exchange of novel plant genetic materials between public plant breeding institutes to guarantee the broadest possible distribution and use of the new mixes of genetic

[204] Daniel J. Gervais, *The TRIPS Agreement: drafting history and analysis* (London: Sweet & Maxwell, Thomson, 2012), 147.
[205] UNCTAD-ICTSD, *Resource Book on TRIPS and Development* (Cambridge University Press, 2005), 390.
[206] Ibid.
[207] For example, while most of the low- and middle-income countries did not provide any form of protection, the United States has specifically provided intellectual property protection on plants since 1930s through the establishment of the Plant Patents Act.
[208] Food and Agricultural Organization [FAO], *Multilateral Trade Negotiation on Agriculture: A Resource Manual IV* (A Resource Manual IV, 2000), 89.
[209] Nuno Pires de Carvalho, *The TRIPS Regime of Patent Rights* (The Hague: Kluwer Law International, 2002), 178-179.
[210] Margaret Llewelyn, "The Legal Protection of Biotechnological Inventions: An Alternative Approach," *European Intellectual Property Review* 19 (1997): 115.

information.[211] In other words, many countries believed the patent protection does not present sufficient flexibility and is too expensive for conventional plant breeders.[212]

During the process of the Agreement negotiations, there were three main proposals submitted with respect to the question of the patentability of plants. The first one was proposed by some developed countries, including the United States, Japan, the Nordic countries and Switzerland,[213] to protect all fields of technology without any exclusions from the general rule of patentability.[214] The second proposal suggested that plant varieties and essentially biological processes for the production of plants other than micro-biological processes be excluded from the scope of patent protection in the same manner as *the European Patent Convention* applied throughout Europe.[215] The last proposal granted the Member States a freedom to exclude all categories of plant innovations from the patent protection.[216]

In the end, the final result of the negotiations was the combination between the proposal by the European countries and the developing countries. The wording contained in article 53(b) of the EPC concerning the exclusion from patentability was subsequently embodied into the language of the TRIPS Agreement, article 27.3(b).

> Article 53(b) of the EPC provides:
>
> European patents shall not be granted in respect of: […]
>
> (b) plant or animal varieties or essential biological processes for the production of plants or animals; this provision does not apply to microbiological processes or the products thereof.[217]

The difference between the provision of the TRIPS Agreement, article 27.3(b), and the EPC, article 53(b) is that, plant varieties and essentially biological processes for the production of plants may

[211] Ibid.
[212] Food and Agricultural Organization [FAO], *Multilateral Trade Negotiation on Agriculture: A Resource Manual IV* (A Resource Manual IV, 2000), 89.
[213] Terence Stewart, *The GATT Uruguay Round. A negotiating History 1986–1992* (Kluwer Law and Taxation Publishers, 1993), 2294.
[214] Genetic Resources Action International [GRAIN], "For a Full Review of TRIPS 27.3(b): An Update on Where Developing Countries Stand with the Push to Patent Life at WTO" *GRAIN* (2000): 8-11.
[215] Ibid.
[216] Ibid.
[217] *Convention on the Grant of European Patents*, of 5 October 1973, Article 53(b).

be protected under the patent system depending on the national policy while they are evidently excluded from patentability under the EPC. The WTO member States were granted broader exclusions from patentability than initially suggested by the second proposal as, not only plant varieties, but plants in general are also able to be excluded from general rule.

TRIPS negotiators deliberately adopted ambiguous language in article 27.3(b) in order to effectively reach a compromise between the member countries.[218] The terms contained in this article are not defined by the TRIPS Agreement; therefore, it depends on the members' discretion to define and to design the protection system.

Another issue involving the draft of Article 27.3(b) was the possibility to establish the connection between the *sui generis* system for plant variety protection and the plant variety protection system established under the auspices of the UPOV Convention. There was opposition from the South against the incorporation of the UPOV Convention into the TRIPS Agreement for several primary reasons. First, as the number of the state parties to the UPOV Convention is relatively small compared to the TRIPS Agreement, many countries argued that the UPOV regime was not sufficiently accepted by the international community.[219] Second, many countries were concerned that the eligibility requirements provided under the UPOV regime make it difficult for the plant varieties developed by farmers to obtain the protection.[220] Therefore, it depends on the discretion of the member States either to adopt the breeders' rights regime of the UPOV Convention or to establish a national intellectual property mechanism for the protection of plant varieties.

In summation, illustrating the differences in policies among members, the open-end text of Article 27.3(b) gives freedom to the Members to apply a kind of protection, deviating from the norm of harmonization generally provided under the TRIPS Agreement. Considering no definitions of the terms

[218] Food Ethics Council (FEC), "TRIPS with everything? Intellectual property and the farming world," 15.
[219] Cullet Philippe, "Revision of the TRIPS Agreement concerning the Protection of Plant Varieties: Lessons from India concerning the Development of a Sui Generis System," 97; Srividhya Ragavan and Jamie Mayer, "Has India Addressed Its Farmers' Woes? A Story of Plant Protection Issues," 97 *Georgetown International Environmental Law Review* 97, no.20 (2007): 98.
[220] Carvalho, *The TRIPS Regime of Patent Rights,* 178-179.

are provided, the final language adopted is free to different interpretations of each country or region. The drafters of this Agreement consider the language of Article 27.3(b) "constructive ambiguity" which leads to an achievement of the TRIPS negotiations.[221]

3.1.4 Plant Patent System

In case a member country chooses to provide the protection for plant innovations through patents, the domestic mechanism for such protection must therefore meet the minimum standards for patent protection laid down by the TRIPS Agreement. This section analyses the patent provisions of the TRIPS Agreement in relation to plant innovations.

a. Subject Matter of Protection

Article 27.3(b) of the TRIPS Agreement mentions plant inventions by dividing them into three categories with different mechanisms for intellectual property protection. The first sentence of this Article states that the members can choose to provide for the protection of plant and essential biological processes through patent. However, it obliges the member States to provide patent protection for micro-organisms. The second sentence of Article 27.3(b) requires the member States to protect plant varieties by patent, by the *sui generis* system or a combination of both. Therefore, it is of importance to distinguish between the two parts of this article when interpreting this provision.

1. The First Sentence of Article 27.3 (b)

Since the Agreement does not provide the definition to the term "plants" set forth in the first sentence of Article 27.3(b), the members can choose whether to allow patent on plants which refers generally to any living organism in the plant kingdom.[222] Meanwhile, the TRIPS Agreement does not oblige its parties to provide a patent mechanism for the protection of plant-related innovations which seeks to protect a particular characteristic of a plant such as the process used in creating or breeding or plant genes. However, recalling that the members may provide a higher standard of protection than those

[221] Food Ethics Council (FEC), "TRIPS with everything? Intellectual property and the farming world," 15.
[222] UNCTAD-ICTSD, *Resource Book on TRIPS and Development*, 388

set forth under the Agreement, the national governments have an alternative to either include plant-related innovations within their current utility patent legislation or to establish a separate legal mechanism exclusively governing plant innovations. Some jurisdictions thus choose to allow patents on plant-related innovations[223]

In spite of the flexibility of Article 27.3(b) to exclude plants from patentability, not every State provides for an exclusion of this subject matter. For example, in the United States, plants and plant varieties are patentable under utility patents; asexually duplicated varieties of plants can also be protected a *sui generis* form of intellectual property protection under *the 1930 Plant Patent Act*. The plant intellectual property protection in the United States will be discussed in detail in Chapter V.

The States which have agreed on FTAs with the United States have been obligated by those agreements to provide patents on plants. Most States, nonetheless, provide for a different scope of exceptions relating to plants and plant varieties. Some domestic laws also make patent protection ineligible for genetic materials without particular referring to plants.[224] The study of WIPO Secretariat shows that the exceptions are shaped under domestic laws using different wording, including: "plants and animals except microorganisms";[225] "plants and animals in whole or any part thereof other than microorganisms, but including seeds, varieties and species";[226] "biological and genetic material occurring in nature or derived therefrom by reproduction";[227] "natural living beings, in whole or in part, and biological material, including the genome or germplasm of any natural living being, when found in nature or isolated therefrom".[228]

[223] In Europe, plant-related inventions, including conventional breeding processes, genetics technologies, and plant genes are protected by biotechnology patents, namely the *EU Directive 98/44/EC of 6 July 1998, O.J. L213 on the legal protection of biotechnological inventions (Biotech Directive)* provided that the technical teaching is not only applicable to a single plant variety.
[224] Carlos M. Correa, "Patent Protection for Plants: Legal Options for Developing Countries," *South Center* no.55 (2014): 8.
[225] *The Law No. 19.039 on Industrial Property* (2007) (Chile), Article 37.
[226] *The Patent Act* (2005) (India), Article 3(j).
[227] *The Law on Patents and Utility Models* (1995) (Argentina), Article 6.
[228] *The Patent Law (1996) (Brazil)*, Article 10(9).

Significantly, if a member State of the WTO provides for patents in the field of plants, it can restrict the rights granted in a way that would be prohibited for other subject matters such as restriction on some particular species or some type of plant-related innovations. Provided that the States comply with the principles of NT and MFN, such a restriction would not be incompatible with the Agreement because *qui potest plus, potest minus*[229].

Essentially, as the WTO members may completely preclude patent protection for plants, the States also have the alternative of allowing patent protection while restraining the exclusive rights granted in various ways. For example, domestic legislation might limit the extent of the preclusion so as to permit the patent protection of non-food plants yet preclude it for plants for food crops or for those essential for maintaining food security; restrict patent protection to plants that are principally used as exported goods, like flowers; provide patent protection over transgenic plants in case they satisfy some environmental conditions only; or preclude genetic use restriction technology or "terminator" technology from patentability.[230] Domestic legislation may also restrict the monopoly rights granted by patents on plants and initiate, for example, exclusions in respect to the utilization of patented genetic materials to develop and make profitable new varieties of plants.

1.1 Plants Discovered in Nature

In the jurisdictions where plants are excluded from patentability, as verbatim permitted by the TRIPS Agreement, plants, whether discovered in the wild, or developed by traditional breeding or genetic modification techniques, would not be considered patentable subject matters. In the lack of any distinction, the term "plants" is sufficiently broad to include any possible form in which plants can exist. Consequently, under the national patent regime precluding "plants," a transgenic plant that, for example,

[229] This Latin phrase can be literally defined as "who are able to do more, can do less".
[230] *The Protection of Plant Varieties and Farmers' Rights Act (PPVFR Act) (India)*, Article 29 (3) forbids the grant of breeders' rights where a technology is employed to restrain plant reproduction.

is tolerant to a particular disease due to the insert of a transgene[231] or of an artificially constructed transformation event[232] could not be patentable.

Notably, national laws generally accept that the mere discovery of natural substances or phenomena does not constitute an innovation.[233] Hence, a person who merely identifies the plant varieties formerly maintained or developed by a local or traditional community or an unexplored wild variety are not eligible for patent protection.[234] However, some countries, such as the United States, the European Union and Japan, have recognized that an isolated or purified form of a plant is sufficient to constitute an "innovation".[235] For instance, *the European Union Directive 98/44/EC on the Legal Protection of Biotechnological Invention (The biotech Directive)*[236], Article 3.2, provides specifically that isolated biological materials may be patentable.[237] Yet, most developing nations refuse this interpretation and choose to prohibit patentability of plant materials which are found in nature albeit isolated or purified by intervention of humans.[238] The refusal to protect isolated or purified genes is considered to be consistent with the TRIPS obligation considering it does not expand to cover genetically-modified genes which, in general, differ greatly from the substances occurring in nature.[239]

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[231] Transgene refers to the gene taken from the genome of a living organism and inserted into the genome of another living organism by using artificial techniques "Transgene." Merriam-Webster, accessed February 04, 2018, http://www.merriam-webster.com/dictionary/transgene; Patent US 7888122 B2 on a "transgenic plant comprising in its genome a transgene encoding a member FLOWERING LOCUS C (FLC) gene family; having early timing of its flowering."

[232] A genetically modified plant, including all following identical clones, which are the outcome of a transformation process are cumulatively called as a transformation event; for example, US patent 6040497 claiming "Glyphosate resistant maize lines' modified by an artificially constructed transformation event."

[233] Lawrence R. Helfer, "Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments," *Food and Agriculture Org. of the United Nations, FAO Legislative Study*, no. 85 (2004): 44-45.

[234] Ibid.

[235] Carlos Correa, *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options* (London: Zed Books, 2002), 177 – 178; Dan Leskien and Michel Flitner, "Intellectual Property Rights and Plant Genetic Resources: Options for a Sui Generis System," *Issues in Genetic Resources* 6 (1997): 8.

[236] *Council Directive 98/44/EC on the Legal Protection of biotechnological inventions, 1998 O.J. (L 213) 13 (EC)*, http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1998:213:0013:0021:EN:PDF.

[237] Ibid.

[238] Correa, *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options*, 186; Jayashree Watal, *Intellectual property rights in the WTO and developing countries* (Den Haag, 2001), 155-156.

[239] Leskien and Flitner, "Intellectual Property Rights and Plant Genetic Resources: Options for a Sui Generis System," 9.

The national laws which generally preclude biological materials may also bring about the unpatentability of plants and plant varieties, as well as parts and components of plants. Nevertheless, it will be reliant upon whether the preclusion applies to every plant material or only to those existing in nature.[240] In the latter case, the preclusion would cover plants found in the wild, as well as their parts and components, yet not extend to transgenic plants, transformation events, genetically modified plant cells and varieties developed with intervention of human. Therefore, a provision in domestic law of the category "living materials and substances already existing in nature" does not exclude from patentability transgenic plants, as well as their parts and components, nor varieties of plants. Such type of provision defines what is considered an innovation, instead of precluding from patentable subject matter which would otherwise be patentable.

1.2 Plant Varieties

An exclusion of 'plants' would also extend to plant varieties. In contrast, another question may occur as to whether States which grant patents on plants necessarily expand patent protection to new plant varieties. States can, in fact, recognize that plants and plant varieties are two distinct kinds of subject. For example, Article 27.3(b) differentiates between these two subjects and treats them differently, even though the second sentence of Article 27.3(b) concerning plant variety protection may support the hypothesis that the term "plants" encompasses all botanical taxa.

1.3 Parts and Components

Another question arises as to whether an exclusion of plants from patentability according to the TRIPS Agreement may be construed as covering their cells, genes and sub-cellular components, whether they exist in nature, or are artificially made. In practice, the unpatentability of a whole plant may not be relevant in the case that the patentability of its parts and components is permitted. A holder of a patent will generally have the right to prevent the commercialization and other activities with respect to a plant

[240] For instance, *the 1995 law on patents and utility models of Argentina and the Decision 486 of the Andean Community* consider that any substance prior exists in nature are unpatentable.

containing a protected material, even when the plant *per se* is non-patentable. This could be the case even when a single genetically modified gene is inserted into a plant comprised of hundreds of coding genes.

Also, while Article 27.3(b) does not specifically make mention about parts and components of plants as non-patentable subject matter, the members to the TRIPS Agreement can preclude them from patent protection as it would be irrational to allow the preclusion of plants from patentability while denying the identical treatment to the parts and components of plants in the manner that might frustrate the preclusion itself. Such an interpretation would be contrary to the notion of effectiveness in customary international law which is a fundamental analogy of the interpretive provisions of *the Vienna Convention on the Law of the Treaties*.[241]

This view is affirmed in the case of *US-Gasoline*[242] where the Appellate body of the WTO maintained that the deduction of the fundamental rule on interpretation under *the Vienna Convention on the Law of the Treaties* is that interpretation must give significance and impact to every one of the terms of the agreement and that the interpreter cannot freely adopt an interpretation that would lead to the reduction or frustration of any clause or paragraph in the agreement "to redundancy or inutility".[243] An interpretation allowing for the unpatentability of plants and their parts and components is the only one which ensures a practical impact of the authorized preclusion. It should be noted that cells and their sub-cellular parts, such as genes, do not fall within the definition of "microorganisms," which are living organisms invisible with the eye.

1.4 Essentially Biological Processes

[241] *Vienna Convention on the Law of Treaties*, 1155 U.N.T.S. 331, 8 I.L.M. 679.
[242] *United States - Standards for Reformulated and Conventional Gasoline*, Panel and Appellate Body Report adopted on May 20,1996, WT/DS2/9.
[243] *US-Gasoline*, WT/DS2/AB/R , 23, DSR 1996:I, 3. In Canada – Dairy, the Appellate Body also stated that "… the task of the treaty interpreter is to ascertain and give effect to a legally operative meaning for the terms of the treaty. The applicable fundamental principle of effet utile is that a treaty interpreter is not free to adopt a meaning that would reduce parts of a treaty to redundancy or inutility", WT/DS103/AB/R, WT/DS113/AB/R, WT/DS103/AB/R/Corr.1, WT/DS113/AB/R/Corr.1, para. 133. The European Court of Justice, similarly, mentions *effet utile* which means that, amongst many legal interpretations, the one which can best ensure the practical impact of existing law may prevail.

As for the essential biological process for the production of plants which is also allowed to be excluded from patentability under the TRIPS Agreement, this term generally refers to a plant production process by way of the sexual crossing of whole plant genomes and selection of plants.[244] The major impact of the preclusion of essentially biological processes from patent protection would be to avoid patenting over conventional breeding methods, while maintaining the possibility of granting patent protection on non-essential methods depending, for example, on the manipulation of cells or the gene transfer. Nevertheless, the rise in the grant of patent protection on native traits applying traditional breeding methods (generally with the use of molecular marker-assisted selection) has led to concerns about the extent of such preclusion.

In case a process for creating or breeding plants is protected, any plant which is the result of the production using a patented process can also be subject to the exclusive rights of the patent holder.[245] On the contrary, the expansion of the scope of protection of the process to the specifically obtained product provided under the TRIPS Agreement, Article 28.1(b), applies only in case the process is granted patent protection. Simply put, Article 28.1(b) cannot not be claimed in case of non-patentability of essentially biological processes. Otherwise, the unpatentability of essential biological processes could be easily overcome. An amendment to *the German patent law* that came into effect in 2013 has clarified this matter by clearly stating that patents shall not be awarded for plants exclusively obtained from essentially biological processes.[246]

Lastly, the flexibility set forth by the TRIPS Agreement related to essentially biological processes does not cover microbiological processes, for example, fermentation. This widely provided exemption to the exemption can be found in the European laws and in the national laws of many States. In fact, the exemption does not appear to be the rationale in the ambience of Article 27.3(b) provided that the reason

[244] European Patent Office, "Guidelines for Examination No. X-232.2," Essentially biological processes for the production of plants or animals, accessed August 15, 2017, http://www.epo.org/law-practice/legal-texts/html/guidelines/e/g_ii_5_4_2.htm.
[245] Philip Webber, "Does CRISPR-Cas Open New Possibilities for Patents or Present a Moral Maze?," *Nature Biotechnology* no. 32 (2014): 331-332.
[246] *Patent Act of Germany as amended up to Act of October 19, 2013*, Article 2a(1).

for the preclusion is that essentially biological processes occur naturally or are carried out with insufficient intervention of humans. Microbiological processes may also be natural. As a result, natural microbiological processes should be precluded from patentability for the same reasons as essentially biological processes since they are not considered innovations. Therefore, the exemption related to microbiological processes has to be interpreted as merely allowing for the grant of patents when such processes do not occur naturally but are the result of a detectable technical intervention by humans.

1.5 Micro-organism

The meaning of "micro-organism" according to the Oxford dictionary is an organism not perceptible to the naked eye of humans.[247] The scientific notion of this term is illustrated broadly to include those in the plant kingdom such as algae and fungi.[248] Even so, there is no consensus on the definition of this term available under the TRIPS Agreement. [249] Consequently, the member States define the scope of the term "microorganisms" which need to be protected by patent differently. For example, Argentina, Brazil, the Andean Pact countries, where there is an Agreement requiring patentability on microorganisms, they interpret this term narrowly and do not allow the patenting of naturally-occurring microorganisms but only provide the protection for genetically-engineered microorganisms.[250] Some countries consider an isolated microorganism patentable subject matter if the patent applicant can point out its use.[251]

In addition, it is generally accepted that the member States are required to grant patent protection to microbiological processes.[252] The definition of "microbiological process" refers to the process that

[247] J. B. Sykes, *The Concise Oxford Dictionary* (Oxford: Oxford University Press, 1982).
[248] J. Coombs, *Macmillan Dictionary of Biotechnology* (Macmillan: London and Basinstoke, 1986), 198.
[249] The World Trade Organization [WTO], *Communication from the European Communities and their Member States to the Council for TRIPS*, IP/C/W/383 (2002): 1.
[250] Mike Adcock and Magaret Llewelyn, "Micro-organisms, Definitions and Options under TRIPS," Institute for Agriculture and Trade Policy, 2002, accessed August 15, 2017, https://www.iatp.org/files/Micro-organisms_Definitions_and_Options_under_.htm.
[251] UNCTAD-ICTSD, *Resource Book on TRIPS and Development: An authoritative and practical guide to the TRIPS Agreement,* 392.
[252] Philip W. Grubb et al., *Patents for chemicals, pharmaceuticals and biotechnology fundamentals of global law, practice and strategy* (Oxford University Press, 2016), 297.

utilizes or modifies microorganisms.[253] Plus, some regional laws such as *the Biotech Directive* of the European Union further construes that the process is deemed "microbiological" in the case that at least one crucial step is microbiological.[254]

2. The Second Sentence of Article 27.3 (b)

Since Article 27.3(b) of the TRIPS Agreement does not provide the definition of the term "plant varieties," domestic laws are free to determine the definition, which need not to be based on a scientific definition and provide their own requirements for plant variety for protection purposes. Also, the UPOV Convention evidently defines the term "plant variety" as a grouping of plants by some specific features within that plant species.[255]

In implementing the obligations of the TRIPS Agreement, a number of domestic patent laws partially utilize the flexibility of Article 27.3(b) by allowing for the preclusion of plant varieties. Codified in such a way, the preclusion does not impact the patent protection for individual plants. The preclusion of plant varieties is much narrower than the laws mentioning "plants" without referring to any botanical taxa. Noticeably, the TRIPS Agreement does not require its member States to restrict the preclusion of patent protection to plant varieties.

b. Eligibility Requirements

According to the TRIPS Agreement, an invention of all fields is patentable if such a subject matter is considered an invention and if it satisfies the requirements of novelty, non-obviousness, and industrial applicability.[256] First, the condition of novelty means that the claimed innovation has never had

[253] Ibid.
[254] *EU Directive 98/44/EC.*, Article 2.2.
[255] A "plant variety" is a grouping or population of plants that share certain characteristics. The 1991 UPOV Convention, Article 1(vi), for instance, defines that concept taxonomically as "a plant grouping within a single botanical taxon of the lowest known rank, which grouping, irrespective of whether the conditions for the grant of a breeder's right are fully met, can be - defined by the expression of the characteristics resulting from a given genotype or combination of genotypes, - distinguished from any other plant grouping by the expression of at least one of the said characteristics and -considered as a unit with regard to its suitability for being propagated unchanged."
[256] *TRIPS Agreement*, Article 27.1.

been found in "prior art" at the time the application is filed.[257] Some jurisdictions, including the United States, limit the concept of prior art to "everything which has been made available to the public anywhere in the world by means of written disclosure;" as a result, provided that a plant-related innovation has been widely known, used or disclosed in a foreign jurisdiction in any form other than written form, it is likely that an inventor can be granted patent for a plant-related innovation.[258] On the contrary, the European Union interprets the state of arts to include anything which has been published either in oral or written form.[259]

Second, the innovative step condition is determined if the claimed innovation is non-obvious to a person skilled in the art.[260] Even though most international treaties and domestic laws construe the innovative step condition in this manner, its application to plant-related innovations differs and may become an impediment to patentability due to the rapid progress in this field of technology.[261]

Last, the condition of industrial applicability refers to the practical utility of an innovation and particularly, in the case of plant innovation, this condition is considered if the claimed innovation is capable of being used in the agricultural industry.[262] Industrial applicability does not seem to run counter to the patentability of all types of plant inventions, taking into account their usefulness in various areas, including agriculture, food industry, plant breeding and horticulture.

In addition to the requirements provided under Article 27.1, the Agreement further obliges the applicant to provide a detailed disclosure of an innovation in a sufficient manner for a skilled practitioner in the same field of technology to follow through the innovation.[263] This disclosure requirement allows

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[257] Helfer, "Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments," 45.
[258] Correa, *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options*, 188 and 189; Graham Dutfield, *Intellectual property rights, trade and biodiversity: seeds and plant varieties* (London: Earthscan, 2000), 64, 68.
[259] *The European Patent Convention*, Article 54(2).
[260] Leskien and Flitner, "Intellectual Property Rights and Plant Genetic Resources: Options for a Sui Generis System," 13.
[261] Ibid.
[262] *The European Patent Convention*, Article 7.
[263] *TRIPS Agreement*, Article 29(1).

third parties to have access to the disclosed innovations for further improving or creating new innovations.[264] With respect to plant innovations, domestic laws permit the innovators to fulfill this requirement by way of either a written detailed description of the claimed innovation or by a deposit of the plant material such as seeds, tissues or genetic materials of germ cells.[265] Domestic governments, however, are not obligated to establish any specific form of disclosure, nor to provide specific timing and conditions for the access purpose; therefore, the practices of member States varies greatly.[266]

Many scholars view that the eligibility requirements are too rigid for the breeders of plant varieties to fulfill, especially for those who develop their cultivars through the conventional breeding techniques of crossing and selection.[267] Their development would result in a distinct expression of a plant, but such plant would be genetically identical to the initial materials;[268] thus, the products from conventional breeding do not usually fulfil the criteria of novelty or the innovative step. In reality, plant breeders have successfully obtained patent protection for their newly improved plant varieties, hybrid plants and inbred plant lines.[269] For example, the United States Patent and Trademark Office (USPTO) has granted hundreds of utility patents on various aspects of plant inventions including propagating materials.[270]

c. Exclusive Rights and Limitations

Once a product or process is protected by the patent law, the patent owners can enjoy exclusive monopoly rights over such products or processes, including the rights to exclude unauthorized third

[264] Burcu Kilic and Hannah Brennan, "The TPP's New Plant-Related Intellectual Property Provisions," *Public Citizen* (2014): 1-15.
[265] Helfer, "Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments," 45.
[266] Correa, *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options*, 191.
[267] Michael K. Hansen, "Genetic Engineering is Not an Extension of Conventional Plant Breeding," *Consumer Policy Institute* 1 (2000): 1; Miguel A. Altieri, *Genetic engineering in agriculture: the myths, environmental risks, and alternatives* (Food first, 2004), 27.
[268] Ibid.
[269] Correa, *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options*, 183.
[270] Mark D. Janis and Jay Kesan**,** "Designing an optimal intellectual property system for plants: A US Supreme Court Debate," *Illinois Public Law and Legal Theory Research Papers Series*, no. 19 (2001): 981.

parties from making, using, offering for sale, selling or importing for the aforementioned purposes the patented product or the product derived from the patented process.[271] The rightful owners can enjoy the exclusive monopoly over their protected product or process for a minimum of twenty years from the date of filing the application.[272]

Nonetheless, the exclusive rights can be derogated. In most jurisdictions, this set of rights is limited respecting certain activities conducted by third parties, either for commercial or non-commercial purposes, under Article 30 of the TRIPS Agreement.[273] Depending on the domestic policy of each member State, there may be some exemptions to the monopoly rights of patentees under some determined situations.[274] The purposes of limitations may include acceleration of market competition or reduction of obstacles to future research and experimentation.[275] Limitation under Article 30 can function automatically; thus, the third parties do not need to ask for permission from government or domestic courts in order to conduct the exemption activities throughout the term of the patent protection.

Still, the exceptions to the exclusive rights of patent holders permitted under the TRIPS Agreement, Article 30, is considered much narrower than plant breeders' rights provided under the UPOV Convention. The TRIPS members are permitted to provide only "limited exceptions" to the rights of patent owners provided that such exception does not run counter to "a normal exploitation of the patent" and "does not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties".[276]

Most of the domestic patent laws provide experimentation exemption or research exemption allowing third parties to conduct research on the protected products without prior authorization from the

[271] *TRIPS Agreement*, Article 28.
[272] *TRIPS Agreement*, Article 33.
[273] UNCTAD-ICTSD, *Resource Book on TRIPS and Development: An authoritative and practical guide to the TRIPS Agreement,* 388.
[274] The *ordre public* exception should be distinguish from the exception from patentability under Article 27(3) that precludes a particular subject matter from patent regime and, thus, results in the non-granting of a patent.
[275] Justin Malbon, "Article 30: Exceptions to Rights Conferred," *The WTO Agreement on Trade-Related Aspects of Intellectual Property Rights*: *Elgar Commentaries series* (2014): 473.
[276] *TRIPS Agreement*, Article 30.

patent holders.[277] Nevertheless, some countries such as the United States have interpreted this exception narrowly to prohibit commercial exploitation of the products or processes derived from experimentation or research in case they include patented products without the authorization of patent holders.[278] Consequently, a plant breeder is not allowed to use patented propagating materials to develop new plant varieties if the results of research and experiments are for commercial activities.[279] Some of the WTO member countries, including the European countries, allow experimental exceptions for some commercial activities,[280] yet such commercial activities would be in contrast to "a normal exploitation of the patent" and would therefore constitute "a substantial curtailment" of exclusive patent rights, conflicting with Article 30 of the TRIPS Agreement and could be challenged before the dispute settlement panel of the WTO.

The rights of farmers to save and reuse seeds produced on their own holdings without prior authorization from the patent owners are generally not allowed under domestic patent systems, including the utility patent law of the United States. Even so, the European Union provides for this exception under *the Biotech Directive*, Article 11.

d. Compulsory Licenses

TRIPS Agreement provides a set of provisions which allows the member States to force patent holders to license their protected products or processes with either government or private entities. The Agreement does not designate the grounds for justifying the grant of compulsory licenses, since *the Paris Convention for the Protection of the Industrial Property*,[281] article 5(a)(2) is embodied into the TRIPS Agreement by reference, it is assumed that the compulsory licenses can be justified for the purpose of

[277] UNCTAD-ICTSD, *Resource Book on TRIPS and Development: An authoritative and practical guide to the TRIPS Agreement*, 388.
[278] Ibid.
[279] Correa, *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options*, 192
[280] W.R. Cornish, "Experimental Use of Patented Inventions in European Community States," *Int'l Rev. Indus. Prop. & Copyright L.* 29 (1998): 735, 736.
[281] *Paris Convention for the Protection of Industrial Property*, 20 March 1883, last revised 14 July 1967, 21 UST 1538.

preventing abuses caused by the exercise of the monopoly rights granted to the patent holder.[282] Additionally, in a case where the abuses occur, Article 31 creates extra conditions for obtaining such licenses, which are individual considerations of each case, failure to negotiate with the patent holder for a voluntary license and scope and duration restriction.[283] Further, it requires the license to be terminated when the situation leading to the grant of the license in question is changed.[284] Significantly, the holder of a patent must get a share and equitable remuneration, taking into consideration of the value of the licensed rights.[285]

3.1.5 *Sui generis* System

A *sui generis* system generally refers to the forms of intellectual property protection designed for that particular subject matter and does not exist in any other form of traditional IP protection systems.[286]Although a patent regime is governed by the TRIPS Agreement under markedly detailed standards, the only requirement as for a *sui generis* system is that it be "effective".[287] The Agreement does not provide any further guidance on the definition of "effectiveness". The lack of definition leaves considerable discretion for the member states with respect to the scope and contents of their domestic laws which they may enact.

However, the national mechanism must satisfy four main conditions to be considered as an effective *sui generis* regime:

(1) The domestic law must provide protection to every plant variety without discrimination between species or botanical taxonomy;[288]

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[282] Daniel Gervais, *The trips agreement: drafting history and analysis* (London: Sweet & Maxwell, 1998), 165.
[283] *TRIPS Agreement*, Article 31.
[284] Ibid.
[285] Ibid.
[286] Michael Blakeney, "International Proposals to regulate Intellectual Property Rights in Plant Genetic Resources" *The Regulation of Agricultural Biotechnology*, 2004, 43.
[287] *TRIPS Agreement*, Article 27.3(b).
[288] *TRIPS Agreement*, Article 27.3(b) requires the member States to protect plant varieties without providing further specific exceptions. However, the obligation to protect all plant varieties does not prohibit different level of protection between different plant genera.

(2) It must ensure the plant breeders exclusive rights over some specific acts concerning the protected varieties or, at a minimum, the rights to equitable remuneration from the use by third parties;[289]

(3) It must ensure the principles of NT and MFN for the plant breeders from all member countries of the WTO;[290]

(4) It must provide an effective enforcement mechanism in case of an infringement by any third parties.[291]

The UPOV Convention has been considered as a leading example of an effective *sui generis* system for plant variety protection.[292] Even so, in the end, the TRIPS Agreement neither gives emphasis on plant breeders' rights nor does it refer to the UPOV Convention.[293] This omission strongly contradicts other traditional categories of intellectual property, including copyrights, trademarks or patents, which the Agreement clearly requires member States to comply with also with the provisions provided in preexisting intellectual property agreements, such as *the Berne Convention for the Protection of Literary and Artistic Works*[294] and *the Paris Convention for the Protection of Industrial Property*. What is more, the members are not required to ratify the UPOV Convention to comply with the TRIPS obligations.

3.1.6 The Review of Article 27.3(b)

[289] Leskien and Filtner, "Intellectual Property Rights and Plant Genetic Resources: Options for a sui generis system," 29. It is not compulsory for the member States to adopt the approach of exclusive rights to the protection of new plant varieties; however, economic studies suggest that exclusive right approach is more effective in creating incentives to create new innovation than the approach of remuneration; R.P. Merges "Contracting into Liabilities Rules: Intellectual Property Rights and Collective Rights Organization" *California Law Review* 84 (1996): 1302.
[290] The WTO Appellate Panel has interpreted that the TRIPS Agreement, Article 3(1) shall also be applied to the *sui generis* protection of plant varieties; World Trade Organization [WTO], *the United States – Section 211 Omnius Appropriations Act of 1998*, AB-2001-7 (2002), 360.
[291] An effective enforcement mechanism refers to Part 3 of the TRIPS Agreement concerning the enforcement of intellectual property rights against the infringement act by the third parties; Leskien and Filtner, "Intellectual Property Rights and Plant Genetic Resources: Options for a sui generis system," 32.
[292] Blakeney, "International Proposals to regulate Intellectual Property Rights in Plant Genetic Resources," 43.
[293] Food and Agriculture Organization [FAO], "International IPR Agreements Regulating Plant Varieties and Plant Breeders' Rights," FAO Corporate Document Repository, accessed August 16, 2017, http://www.fao.org/docrep/007/y5714e/y5714e03.htm.
[294] *Berne Convention for the Protection of Literary and Artistic Works, 9 September 1886, Can. T.S. 1948 No. 22, 828 U.N.T.S. 221, revised most recently by Paris Act relating to the Berne Convention, 24 July 1971, 1161 U.N.T.S. 3; Paris Convention for the Protection of Industrial Property, 20 March 1883, last revised 14 July 1967, 21 UST 1538.*

The last sentence of article 27.3(b) provides that the language of this subparagraph is subject to review four years after the Agreement coming into force. The TRIPS Agreement came into effect on 1 January 1995; therefore, this provision was reviewed in 1999. [295] In 2000 and 2001, the member countries submitted their proposals on the issues once again to the TRIPs Council, yet no decision has been made.[296] Later on, with the launch of the 2001 Doha Round trade talks, eleven developing countries have formally proposed to amend the TRIPS Agreement in accordance with the provision of the CBD by requiring the applicants of patents on biological resources to disclose the plant resources used in the process of creation.[297] Meanwhile, the European countries proposed "a self-standing disclosure requirement" allowing the countries which grant the access to their genetic resources to keep track of patent applications at an international level.[298] In 2003, developing countries requested to incorporate into the TRIPS Agreement not only disclosure of origin provision, but also demanded evidence of a benefit-sharing agreement and prior-inform consent from the countries providing the resources utilized in the creation of the plant innovation.[299] However, such review has not been finalized, principally due to the continuing controversial issues between developed and developing countries.[300]

Referring to the ongoing review of Article 27.3(b), the African Group has suggested the amendment of Article 27.3(b) in the way that no plants, nor any living processes, can be subject to patent protection; in addition, the Group declared that a review should reserve policy space existing at the domestic stage for developing particular models for traditional knowledge protection.[301] Just recently, Bolivia has suggested the amendment of article 27.3(b) by prohibiting the patent protection on all life

[295] Genetic Resources Action International [GRAIN], "For a Full Review of TRIPS 27.3(b): An Update on Where Developing Countries Stand with the Push to Patent Life at WTO" 3-5.
[296] Ibid.
[297] World Trade Organization [WTO], *Article 27.3(b), The Relationship Between the TRIPS Agreement and the Convention on Biological Diversity and the Protection of Traditional Knowledge*, IP/C/W/356 (2002), 10-11.
[298] World Trade Organization [WTO], *Article 27.3(b), The Relationship Between the TRIPS Agreement and the Convention on Biological Diversity and the Protection of Traditional Knowledge*, IP/C/W/400/Rev. 1 (2003), 1.
[299] World Trade Organization [WTO], *Taking Forward the Review of Article 27.3(b) of the TRIPS Agreement: Joint Communication from the African Group*, IP/C/W/404 (2003) 4–6.
[300] Genetic Resources Action International [GRAIN], "For a Full Review of TRIPS 27.3(b): An Update on Where Developing Countries Stand with the Push to Patent Life at WTO," 3-5.
[301] World Trade Organization [WTO], *Preparations for The 1999 Ministerial Conference: Communication from Kenya on behalf of the African Group*, WT/GC/W/302 (1999).

forms, protecting plant innovations and farming practices of local and indigenous farming communities and protecting the rights of farming communities.[302] Even though such proposals are not likely to be agreeable to many member States of the WTO, these countries have pointed to the need to retain the existing flexibility provided by the TRIPS Agreement and adopt the exclusion from patent protection on plants and plant varieties in their domestic legislation.

3.2 Plant Variety Protection under the UPOV system

Intellectual property rights for the protection of plant varieties are not new as plant breeders' rights were introduced in the 1920s and 1930s in some jurisdictions.[303] Those rights allow the breeders to have exclusive monopoly of plant propagating materials such as seeds, cuttings, divisions and tissues culture, as well as harvested materials such as cut flowers foliage and fruits; at the same time, these rights generally allow the farmers to use or replant the saved-seeds from their own production and usually tolerate other plant breeders to utilize the protected plant varieties for the further developing of new varieties. This set of rights has been recognized at a regional level through the establishment of the UPOV regime in the 1960s.[304]

The UPOV Convention provides minimum standards for the protection of plant breeders' rights and initially does not grant the accumulations protection with a patent.[305] It was adopted in1961 in Paris. Since then, it has been considered to be the most significant and only international mechanism

[302] World Trade Organization [WTO], Review of Article 27.3(b) of TRIPS Agreement: Communication from Bolivia, IP/C/W/545 (2010); Bolivia proposes to amend article 27.3(b) to prohibit the patenting of life forms and parts thereof.
[303] UNCTAD-ICTSD, *Resource Book on TRIPS and Development: An authoritative and practical guide to the TRIPS Agreement,* 394.
[304] International Union for the Protection of New Varieties of Plants [UPOV], Overview, June 19, 2015, accessed August 15, 2017, http://www.upov.int/about/en/overview.html.
[305] *The 1978 UPOV Convention*, Article 2; however, Article 37 further states that the limitation provided in Article 2 is not applied to parties providing dual protection before the end of the period for signature of the 1978 UPOV Convention.

specifically designed for the protection of plant varieties.[306] As a consequence, the analysis in this section is conducted based upon the two most recent UPOV Conventions.

It should be noted that, once the 1991 UPOV Convention came into effect, the 1978 Convention no longer accepted future accessions; however, it is not compulsory for the member countries of the 1978 Convention before 1991 to upgrade to the 1991 Convention. Therefore, even though the 1991 Convention is most relevant today, the analysis on the 1978 Convention is still necessary to show the development of the ideas underlying the 1991 Convention.

3.2.1 Development of the UPOV Regime

The history of the UPOV regime can be traced back to 1956 when the plant breeder associations in Europe, namely the International Association for the Protection of Intellectual Property (AIPPI) and the International Association of Plant Breeders (ASSINSEL), called for a new establishment of a regional mechanism for plant variety protection.[307] They requested the French government to organize the conference in order to discuss the matter.[308] This conference established the fundamental principles for the protection of plant varieties embedded in the language of the UPOV Convention to date.[309] Afterwards, in November 1961, a followed-up conference was held with 12 European countries and the United International Bureau for the Protection of Intellectual Property (BIRPI) taking part in the meeting while the Food and Agriculture Organization of the United Nations (FAO) observed the conference.[310]

The conference found that the European plant breeders faced some difficulties in satisfying the criteria for patent protection, namely novelty and inventiveness, as well as the requirement to provide a detailed disclosure of the plant inventions; additionally, some were concerned about the balance of the

[306] UNCTAD-ICTSD, *Resource Book on TRIPS and Development: An authoritative and practical guide to the TRIPS Agreement*, 394.
[307] Andre Heitz, "The History of Plant Variety Protection" *The First Twenty-five Years of the International Convention for the Protection of New Varieties of Plants* (1987): 53.
[308] Ibid.
[309] Graham Dutfield, "The Role of the International Union for the Protection of New Varieties of Plants (UPOV)" *Global Economic Issue Publications* 9 (2011): 7.
[310] Subsequently becoming the World Intellectual Property Organization (WIPO).

public interest concerning food security and incentives to create new plant varieties.[311] As a result, many believed that the results of plant breeding for agriculture should not be treated in the same manner as traditional industrial property provided under *the Paris Convention for the Protection of Industrial Property*.[312]

With only a slight involvement of representatives from governments, the AIPPI and the ASSINSEL were intensely involved in the negotiations and establishment of the Convention.[313] The Convention sought to ensure the commercial interests of the European plant breeders while, at the same time, addressing the concerns of the European farmers.[314] Consequently, the early years of the Convention was applied solely to the members in Europe.[315] Up to the present, the interests of plant breeders in Europe remains influential in the operations of the UPOV.

The UPOV Convention was finally adopted in December 1961 and came into force in 1968. Initially, it had been ratified by only three European countries, i.e. the United Kingdom, Germany and Switzerland, forming the Union.[316] It took seven years for the Convention to enter into force because a few countries already had plant variety protection systems in place, and ratification requires a national plant variety protection system to be established.[317] The Convention was revised three times in 1972, 1978 and 1991. As from August 2017, 74 states were parties to the UPOV Convention.[318] The 1991

[311] Margaret Llewelyn and Mike Adcock, *European Plant Intellectual Property* (Oxford: Hart Publishing, 2006), 136
[312] *Paris Convention for the Protection of Industrial Property, 20 March 1883, last revised 14 July 1967, 21 UST 1538.*
[313] Dutfield, "The Role of the International Union for the Protection of New Varieties of Plants (UPOV)," 7.
[314] Jay Sanderson, *Plants, people and practices: the nature and history of the UPOV convention* (Cambridge, United Kingdom: Cambridge University Press, 2017), 58.
[315] Ibid.
[316] B. Laclavière, "A new intellectual property union is born: the International Union for the Protection of New Plant Varieties," *Industrial Property* (1969): 154-155; Rolf Jördens, "Progress of Plant Variety Protection based on the International Convention for the Protection of New Varieties of Plants (UPOV Convention)," *World Patent Information* 27 (2005): 232.
[317] Jördens, "Progress of Plant Variety Protection based on the International Convention for the Protection of New Varieties of Plants (UPOV Convention)," 233.
[318] International Union for the Protection of New Varieties of Plants [UPOV], "Members of the International Union for the Protection of New Varieties of Plants: Status on April 15,2016," 2016, accessed August 15, 2017, http://www.upov.int/export/sites/upov/members/en/pdf/pub423.pdf.

version entered into force in 1998 while the 1978 version is no longer open to accession.[319] This study will focus on the two most recent UPOV Acts.

3.2.2 The 1978 UPOV Convention

The 1978 Convention endorses most of the main obligations for international intellectual property right protection such as the definition of the protected subject matters, eligibility requirements, exclusive rights conferred, NT principle[320], terms of protection and exceptions and exemptions to such rights. Nonetheless, it does not require the MFN principle and does not contain enforcement provisions.

a. Subject Matter of Protection

The 1978 UPOV Convention required its member States to provide protection for the propagating of materials of plant varieties; however, the Convention did not oblige its members to protect harvested materials of those varieties, unless such materials are the ornamental plants to be propagated for commercial purposes.[321] As for discovered varieties, although the UPOV Convention aims at protecting plant innovations created by traditional breeding methods, the Convention requires its members to provide protection to discovered varieties. This can be presumed from article 6.1(a) which stipulates that a protected plant variety may be a result of "a natural source of initial variation".[322] It is worth mentioning that the 1978 Convention does not define the term "plant variety". Also, it does not require the members to protect all types of plant varieties.[323]

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[319] Dutfield, "The Role of the International Union for the Protection of New Varieties of Plants (UPOV)," 7.
[320] *The 1978 UPOV Convention*, Article 3 and 5(4) provides that the parties to the UPOV must also grant the monopoly rights provided under this Convention to the plant breeders of their national in the same manner as the breeders' residing in other parties; nevertheless, if a party extends the scope of protection more than those provided under this Convention, such party may prohibit granting the additional protection to plant breeders from other members' states which do not provide the same additional rights their domestic breeders.
[321] *The 1978 UPOV Convention*, Article 5(1).
[322] Crucible Group, *Seeding solutions, v.2: options for national laws governing control over genetic resources and biological innovations* (International Development Research Center, 2001), 137.
[323] *The 1978 UPOV Convention*, Article 4 sets forth that the parties must provide plant variety protection to at least five plant species on the date which the Convention come into force; within eight years afterwards, the parties must provide the protection for a minimum of twenty-four plant species. Further, a party can restrict the application of this Convention to certain particular plant varieties with certain type of reproduction or end-use.

When the protection is granted, the plant breeders can exclude any unauthorized third party from producing for purposes of commercial marketing, offering for sale and marketing the protected materials.[324] The general term of protection is no less than fifteen years from the date the exclusive rights are granted. However, the breeders of vines, forest trees, fruit trees and ornamental trees, can wield their rights for a minimum term of eighteen years.[325]

b. Eligibility Requirements

The eligibility requirements to obtain the protection under the 1978 UPOV Convention is novelty, distinctiveness, uniformity and stability.[326] In the case of a plant variety meeting these requirements, the variety will be registered in a domestic catalogue or publicly disclosed in order to display that plant breeders' protection is granted within a specific jurisdiction.[327]

First, the criterion of novelty is set forth to avoid granting intellectual property protection to the plant varieties which are common knowledge or have been commercially exploited for more than a provided period of time before the application date.[328] The novelty criterion differs from the novelty requirement under the patent provisions of the TRIPS Agreement since it is considered in terms of commercial exploitation, not the fact that it has never previously existed.

Second, the criterion of distinctiveness suggests that the protected variety be distinct in one or more prominent characteristics from other plant varieties existing in the public domain at the time of application.[329] In addition, *the guidelines for the conduct of tests for distinctness, homogeneity and stability (UPOV Guidelines)* applies to both qualitative and quantitative approaches in examining whether a characteristic is distinct such as the shape of the leaf, or the length of the stem.[330]

[324] *The 1978 UPOV Convention*, Article 5.
[325] *The 1978 UPOV Convention*, Article 8.
[326] *The 1978 UPOV Convention*, Article 6.
[327] Ibid.
[328] *The 1978 UPOV Convention*, Article 6(1)(b).
[329] *The 1978 UPOV Convention*, Art. 6(1)(a).
[330] *The guidelines for the conduct of tests for distinctness, homogeneity and stability*, TG/153/3 (2006).

Third, uniformity generally means that a protected variety must be uniform in particular characteristics.[331] The UPOV Guidelines further provides that to qualify for the requirement of uniformity, the diversity displayed by a plant variety must be "as limited as necessary to permit accurate description and assessment of distinctness and to ensure stability."[332] It is worth noting that this criterion has been criticized by many scholars for its opposition to genetic diversity which is crucial for ensuring the productivity of agricultural products in extreme weather.[333] Also, uniformity arguably precludes farmers' varieties or landraces from plant breeders' rights protection since farmers' varieties usually present more varied traits.[334]

Last, stability requires the plant breeders to show that the prominent feature of a variety remains unchanged after repeated propagation or reproduction. Practically, varieties which qualify for the uniformity requirement are usually regarded to be stable as well. As a consequence, criterion of stability has faced a similar criticism as the previous requirement with respect to its exclusion of conventional plant varieties.[335]

c. Exclusive rights and Limitations

The authorization of plant breeders is needed when the reproductive or vegetative propagating material of plant varieties are used in the "production for purposes of commercial marketing, the offering for sale or the marketing."[336] There are two main exceptions introduced under the 1978 UPOV Convention, i.e., breeders' exemption and farmers' privilege. First, the breeders' exemption laid down by article 5(3) prohibits protected breeders from banning other plant breeders to utilize the protected varieties for the purpose of creating new varieties or commercializing such newly developed varieties.[337] The rights owners may preclude other breeders from those acts only in case that the repeated use of the protected

[331] *The 1978 UPOV Convention,* Article 6(1)(c).
[332] *The guidelines for the conduct of tests for distinctness, homogeneity and stability,* TG/153/3 (2006).
[333] Leskin and Filtner, "Intellectual Property Rights and Plant Genetic Resources: Options for a sui generis system," 51-52.
[334] Ibid.
[335] Ibid.
[336] *The 1978 UPOV Convention,* Article 5(1).
[337] *The 1978 UPOV Convention*, Article 5(3).

variety is necessary for the commercial production of the new variety. In other words, protected plant varieties can be utilized as initial genetic materials without prior consent from the holders of plant breeders' rights. In accordance with the International Seed Federation, this exemption is of importance for the processes of new plant variety development which are sequential and cumulative as they involve a considerable number of initial plant varieties.[338]

Second, the 1978 convention is interpreted to allow the farmers' privilege to use or exchange the protected plant varieties without the authorization for noncommercial purposes.[339] The extent of the privilege varies, depending on the domestic plant variety protection law. For instance, some countries allow their farmers to replant seeds which have been saved from former purchases, while some countries allow the practice of "brown-bagging" where, even though the law does not permit replanting, farmers have the rights to sell a restricted quantity of seeds for the purposes of reproduction.[340]

d. Compulsory Licenses

The Convention allows the member States to limit the rights of plant breeders on the grounds of public interest.[341] This limitation is created to guarantee the broad distribution of the variety in question. For example, a plant breeder who does not sufficiently fill the demand for such variety in terms of quantity or price, or a breeder, without reasonable cause, declines to license the protected variety to the third parties. However, the breeder must receive appropriate remuneration in return.[342]

3.2.3 The 1991 UPOV Convention

[338] International Seed Federation, "ISF Position on Access to Plant Genetic Resources for Research and Breeding" (2008).
[339] Crucible Group, *Seeding solutions, v.2: options for national laws governing control over genetic resources and biological innovations*, 170.
[340] Leskin and Filtner, "Intellectual Property Rights and Plant Genetic Resources: Options for a sui generis system," 61.
[341] *The 1978 UPOV Convention*, Article 9(2).
[342] Ibid.

Under the 1991 UPOV Convention, the scope of plant breeders' rights has been greatly enhanced. In contrast, the exemptions and limitations to plant breeders' rights have been greatly limited in the current version of the UPOV Convention. The 1991 the UPOV Convention provides clearly what was ambiguously stipulated in its predecessor, that the activities for private, noncommercial use are beyond the scope of exclusive rights enjoyed by the plant breeders; therefore, farmers are no longer permitted to utilize the protected materials for any purpose other than private consumption. Some prominent amendments are pointed out in this section.

a. Subject matter of protection

Under this version of the UPOV Convention, it is the first time that the UPOV Convention clearly gives definition to the term "plant variety" as a "plant grouping within a single botanical taxon of the lowest known rank" which can be "defined by the expression of the characteristics resulting from a given genotype or combination of genotypes; distinguished from any other plant grouping by the expression of at least one of the said characteristics; and considered as a unit with regard to its suitability for being propagated unchanged."[343] Therefore, the member States can exercise less discretion on the subject matter of protection. The 1991 Convention obliges its member States to initially provide plant variety protection for fifteen plant genera minimum when ratifying this Act and to protect all genera of varieties within ten years after the date of ratification.[344]

What is more, the 1991 Convention explicitly requires the protection of discovered varieties when Article 1(4)[345] includes the person discovering plant varieties to the definition of "plant breeders". At the same time, this Convention extends the extent of exclusive rights to cover harvested materials, such as cut flowers and fruits, in case the plant breeders do not have a chance to exercise his or her rights over propagating materials of the harvests.[346]

[343] *The 1991 UPOV Convention*, Article 1(5).
[344] *The 1991 UPOV Convention*, Article 3(2).
[345] *The 1991 UPOV Convention*, Article 1(iv) evidently includes "a person who bred, or discovered and developed, a variety" to the definition of "plant breeder".
[346] *The 1991 UPOV Convention*, Article 6(1).

b. Eligibility requirement

The eligibility conditions provided under the 1978 UPOV Convention, i.e., novelty, distinctiveness, uniformity and stability are maintained under the current Convention.[347] As a consequence, it has faced the same critique about the discouragement of genetic diversity and the failure to protect the products of conventional plant breeding or farmers' varieties.[348]

c. Exclusive rights and Limitations

In addition, the most pervasive amendment to the 1978 UPOV Convention was the expansion of the scope of the monopoly rights granted to the plant breeders over their protected materials. According to Article 14(1), the authorization of the plant breeders must be granted before the use of protected materials for the purposes of production or reproduction, conditioning for the purpose of propagation, offering for sale, selling or marketing, exporting, importing and stocking for any of these purposes.[349] Furthermore, the Convention allows its members to grant supplementary rights in addition to those provided by Article 14(1), such as the exclusive rights over products resulting from the protected harvest.[350] Moreover, the Convention expands the general protection term to at least 20 years while it also extends the term of protection for tree and vine varieties to a minimum of 25 years.[351]

As for breeders' exemptions, in the same manner as the 1978 Convention, it guarantees the rights of other plant breeders to utilize the protected plant varieties for developing new varieties without prior authorization.[352] Also, the Convention obviously prohibits plant breeders to wield their rights over "acts done for experimental purposes", allowing public institutions to conduct research and development on the protected varieties even when such conduct aims are for commercial purposes.[353] However, it

[347] *The 1991 UPOV Convention*, Article 7-9.
[348] *The 1991 UPOV Convention*, Article 15(1).
[349] *The 1991 UPOV Convention*, Article 14; Leskin and Filtner, "Intellectual Property Rights and Plant Genetic Resources: Options for a sui generis system," 57.
[350] *The 1991 UPOV Convention*, Article 14(4).
[351] *The 1991 UPOV Convention*, Article 19(2).
[352] *The 1991 UPOV Convention*, Article 15(3).
[353] *The 1991 UPOV Convention*, Article 15(2).

should be noted here that the breeders' exemption is not applicable if a plant variety is considered as an "essentially derived variety" (EDV).[354]

The 1991 Convention has introduced the new concept of EDV[355] to restrict the second generation breeder from committing plagiarism or making only cosmetic modification[356] to initial varieties for the purposes of claiming plant variety protection for their EDV.[357] The definition of this concept provided under article 14(5)(b) as a variety which is "predominantly derived from the initial variety" or "from a variety that is itself predominantly derived from the initial variety" but still maintain the main expression of the important feature resulting from the genotype of the initial variety. The EDV is distinguishable from the variety of the first generation as a result of derivation; however, without such distinguishable characteristics, it adheres to the initial variety.[358]

EDV is eligible to be protected in the same manner as any plant variety provided that they can satisfy the eligibility requirements set forth in the Convention.[359] Nevertheless, in case an EDV is protected, the authorization of the breeder of the initial variety is compensated for the activities set forth in Article 14 (1) of the UPOV Convention. For the third parties who are not the initial plant breeders and the breeders of the protected EDV, in order to conduct any act of commercialization provided under Article 14(10), the Convention requires the consent from both the breeder of the initial variety and the breeders of such EDV.[360]

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[354] *The 1991 UPOV Convention*, Article 14(5).
[355] *The 1991 UPOV Convention*, Article 14(5).
[356] Cosmetic change, such as the case where merely a single gene is transferred into a protected plant variety, refers to a modification to a feature of plant which is essential to the distinction of plant grouping within a species but the modification does not generally lead to the improvement of quality. This type of modification is considered as piracy of initial variety since the original breeders will not get remuneration. This is so because technological advancement nowadays escalates the possibility that the insertion of a single gene with no or little added value into the germplasm of a plant is adequate for obtaining patent protection.
[357] Catherine Saez, "Farmers' Rights At Heart Of Plant Breeding IP Debate; UPOV Ponders New Members, Communication Strategy," Intellectual Property Watch, October 22, 2014, , accessed June 21, 2018, http://www.ip-watch.org/2013/10/29/farmers-rights-at-heart-of-plant-breeding-ip-debate-upov-ponders-new-members-communication-strategy/.
[358] *The 1991 UPOV Convention*, Article 14(5)(b).
[359] *The 1991 UPOV Convention*, Article 5.
[360] International Union for the Protection of New Varieties of Plants [UPOV], *Explanatory Notes on Essentially Derived Varieties under the 1991 Act of the UPOV Convention*, UPOV/EXN/EDV/2 (2007) 9.

This EDV concept has been widely criticized since there is no agreed standard concerning the genetic distance between the variety of the first generation and the second generation which might qualify as an EDV which falls under the control of the breeders of the first generation.[361] In case any conflict regarding EDV emerges, such a conflict would be resolved case by case through agreements between the rights holders and developers or court litigation. The examples concerning scope of the EDV differently interpreted by national courts are, for instance, the case of *Astée Flowers vs. Danziger* before the Appeal Court of The Hague,[362] and the case of *Danziger v Azolay* before the District Court of Tel-Aviv, Israel.[363] Upon examining the same plant varieties and evidence, those national Courts made different decisions. the Appeal Court of The Hague interpreted the scope of EDV narrowly and rendered decision in favor of the defendant who developed the plant varieties using the protected initial varieties, emphasizing that the expansion of the scope of monopoly rights over initial varieties to encompass EDV should be regarded as an exemption and thus must be construed in a restricted manner.[364] On the contrary, the District Court of Tel-Aviv interpreted the concept broadly and found that the defendant had infringed the exclusive rights of plant breeders since the defendant's developed variety was too close to the initial variety.[365] Moreover, the EDV concept was criticized inferring that this concept gives too broad a scope for the plant breeders while subjecting many farmers' varieties to be under the authorization of plant breeders.[366]

With regard to farmers' privilege, even though the 1991 Convention guarantees the rights of farmers to save and replant seeds, the scope of their rights has been greatly limited and has become optional. Particularly, the member States may exercise their discretion to permit the privilege of farmers if the farmers use those protected materials only "on their own holdings" and "within reasonable limits

[361] Claudio Chiarolla, "Commodifying Agricultural Biodiversity and Development-Related Issues," *The Author Journal Compilation* (2006): 33.
[362] *Danziger v Astée 10*5.003.932/01, Court of Appeal, The Hague (2009).
[363] *Danziger v Azolay 1*228/03, District Court, Tel-Aviv-Jaffa (2009).
[364] *Danziger v Astée 10*5.003.932/01, Court of Appeal, The Hague (2009).
[365] *Danziger v Azolay 1*228/03, District Court, Tel-Aviv-Jaffa (2009).
[366] Ibid.

and subject to the safeguarding of the legitimate interests of the breeder."[367] The term "reasonable limits" obliges the member States to limit the area, quantity and plant genera to which the privilege of farmers can be applied. [368] In addition, the "legitimate interests" language obliges farmers to pay remuneration to the protected breeder for selling and exchanging seeds with other farmers for the purpose of propagation.[369]

Many leading scholars believe such limitations to farmers' privilege disallows the farmers' practices in the developing world, where the exchange of seeds is of great importance for new variety creation, as well as crop rotation to improve the quality of soil and maintain biological diversity.[370] Moreover, this condition impedes national governments from granting concessions to farmers when they need to secure their social welfare.

Even so, the requirement for remuneration has not been fully adopted under any of the domestic laws of the member countries. For instance, *the European Community's Council Regulation on Community Plant Variety Rights*[371], obliges the farmers to pay remuneration from their acts of seed-saving and exchange; however, such payments are exempt for small farmers. Also, the United States does not require remuneration in this case at all under *the 1994 Plant Varieties Protection Act*[372].

b. Compulsory Licenses

The 1991 UPOV Convention also contains a compulsory license tool in the same manner as that of its predecessor. This allows its parties to limit the breeder's rights on the ground of public interest on the condition that fair and equitable remuneration must be paid to such a breeder. [373]

[367] *The 1991 UPOV Convention*, Article 15(2).
[368] International Union for the Protection of New Varieties of Plants [UPOV], Explanatory Notes on Exceptions to Breeders' Rights Under the 1991 Act of the UPOV Convention, UPOV/EXN/EXC/1 (22 October 2009).
[369] Watal, *Intellectual property rights in the WTO and developing countries*, 141.
[370] Leskin and Filtner, "Intellectual Property Rights and Plant Genetic Resources: Options for a sui generis system," 60.
[371] *Council Regulation on Community Plant Variety Rights*, No. 2100/94 of 27 July 1994.
[372] *Plant Varieties Protection Act* of 1994, 7 U.S.C. Sec. 2543
[373] *The 1991 UPOV Convention*, Article 17.

3.3 Comparative analysis on plant patent under the TRIPS Agreement and plant breeders' rights under the 1991 UPOV Convention

The distinctions between the plant variety protection system and patent system emerged in order to circumvent the doubts of international communities on the effects of a patent system on public interests and technical difficulties surrounding the requirements to obtain patent protection.[374] This section emphasizes the differences between the two intellectual property systems and points out some implications which should be considered.

3.3.1 Subject Matters of Protection

The term "plant" under the TRIPS Agreement is obviously wider than "plant variety" under the UPOV Convention. The protection of plant variety under the UPOV system refers only to the protection of propagating or harvested materials of plant varieties which are invented or discovered.[375] Therefore, unlike the patent system, plant-related innovations, including genes, cells and plant breeding processes do not fall under the scope of protection, leaving them available in the public domain for future research and development. Moreover, the protection of breeders' rights does not include technical processes for the production of plant variety.

3.3.2 Requirements to Obtain Intellectual Property Protection

Unlike a patent system which requires a high level of novelty, distinctness and industrial application, the UPOV regime established its own eligibility requirements for protected plant varieties in that they have to be novel in term of commercialization, distinct from prior existing varieties "whose existence is a matter of common knowledge at the time of the filing of the application", adequately uniform and stable in its significant characteristics after repeated reproduction.

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[374] Michael Blakeney et al., "Plant Variety Protection, International Agricultural Research, and Exchange of Germplasm: Legal Aspects of Sui Generis and Patent Regimes.," *Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices, Volumes 1 and 2*, (2007): 401.

[375] Peggy G. Lemaux, "Genetically Engineered Plants and Foods: A Scientists Analysis of the Issues (Part II)," *Annual Review of Plant Biology* 60, no. 1 (2009): 771-774.

Compared to a patent system, the requirements to obtain the protection for plant breeders are not rigid. This is because plant variety protection system is particularly designed to fulfill the interests of plant breeders; therefore, the requirements to obtain the protection of novelty, distinctiveness, uniformity and stability are revised to suit the reproduction mode of plant varieties. Also, the requirement of novelty is defined with respect to commercial novelty, meaning that a variety cannot be granted protection if it has been commercialized in the relevant market before the application date.[376] At the same time, this system does not require an inventive stop nor industrial application. In other words, even the wild varieties may enjoy plant breeders' rights in the case that such varieties are distinct from prior known varieties.

As for the patent system, it is extremely difficult for the plant inventions generated by way of conventional plant breeding process to obtain patent protection. Due to a high level of novelty and inventive step criteria, although conventional plant breeding can result in some distinguishable features, such features are not considered to be novel since it does not create new plant species. Also, it is not sufficiently obvious to be considered distinctive since it uses naturally occurred processes of sexual and asexual reproduction. This is supported by Hansen who pointed out that the results of conventional breeding processes are the characteristics presenting for thousands of years within the genetic potential of a particular plant species.[377]

Still, with respect to the criteria of uniformity and stability provided under the UPOV Convention, they exclude most of farmers' varieties or landraces from the scope of protection due to the fact that plant varieties developed by farmers are generally genetically diverse and unstable. Yet, these features of farmers' varieties make them remain productive even in detrimental and unstable

[376] *The 1991 UPOV Convention*, Article 6.1, provides that a variety is considered to be novel in case it has not been commercialized with the authorization from the plant breeders prior to one year before the application date within the jurisdiction of the country where such application is submitted, prior to 4 years for vine varieties or prior to 6 years outside the jurisdictions of the member countries.

[377] Hansen, "Genetic Engineering is Not an Extension of Conventional Plant Breeding," 1-2.

environments. Hence, considering the interests of farmers and local people in developing countries, less rigid eligibility requirements are arguably more beneficial to promote new innovation.

3.3.3 Disclosure Requirement

Public disclosure is clearly omitted under the UPOV regime. Also, it does not obligate the plant breeders to disclose the origin of the genetic materials utilized to create new plant varieties. Instead, the applicants must provide adequate evidence to demonstrate that his or her new varieties are distinct, uniform and stable or alternatively submit some samples of their varieties to relevant national authorities for the purpose of inspection.

As for a patent system under the TRIPS Agreement, to satisfy its disclosure requirement, particularly written description and enablement requirements, has been a main obstracle to claims over plant innovations. Nevertheless, such difficulties have diminished owing to *the Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure (Budapest Treaty)*[378]. This treaty applies solely to microorganisms; nonetheless, many national patent offices have adopted it as a model and expanded its application to plants, plant varieties and other germplasms.[379] As a result of this treaty, instead of written descriptions, disclosure requirement of plant innovations can be fulfilled by depositing samples of the plants *per se* with an access by the depositary authority.[380] However, recently, the controversy concerning disclosure requirements under the TRIPS Agreement mainly hover around the question whether patent applicants should be required to disclose genetic resources utilized in the processes of creation of new plant inventions in patent applications and if there should be any sanction if they fail to do so. This issue is discussed in Chapter IV.

3.3.4 Scope of Protection

[378] Budapest Treaty is an international agreement made in Budapest, Hungary, in 1977, later on came into effect in August, 1980, and was amended in September, 1980. The World Intellectual Property Organization (WIPO) is in charge of administering this treaty.
[379] Dan Leskien and Michael Flitner, *Intellectual Property Rights and Plant Genetic Resources – Option for Sui Generis System* (IPGRI, 1997), 11.
[380] Ibid.

Under the patent system, the scope of the monopoly rights appears to be much broader than those of the plant variety protection system because of the exemptions existing in most of the plant variety protection systems. For instance, the UPOV Convention introduced two significant limitations to exclusive rights, namely (1) breeders' exemption precluding the rights of intellectual property owners to forbid other plant breeders from developing new plant varieties using their protected products or commercializing such new varieties; (2) farmers' privilege allowing farmers to use protected varieties for non-commercial activities without being authorized. After the UPOV 1978 coming into force, some developing countries, including India and Thailand, used this Convention as a model for their national plant variety protection system and have designed their plant variety protection systems by combining the idea of farmers' privilege with the benefit-sharing obligations of the CBD.[381]

Breeders' exemption is considered to be a fundamental composition of the UPOV regime since this provision acknowledges the unique nature of plant innovations which requires the access to new and diverse genetic information in their further development.[382] Even if the UPOV regime provides such exemptions, the 1991 UPOV Convention extends the scope of plant breeders' rights to cover EDV. This idea was initiated in the UPOV Convention as a fence to protect plant breeders against any form of plagiarism of their plant varieties. Nevertheless, the limitations on access to protected plant varieties for the purposes of research and development or breeders' exemption does not apply to this newly developed legal concept.

There are two main implications in this regard: first, the breeders' exemption remains intact for non-EDV plant varieties. In contrast, a payment of reimbursement and prior authorization of the plant breeder of the original plant variety are needed when a plant variety "essentially derived" from the original. Second, the distribution or commercialization of EDVs become limited. Notably, the decision on

[381] Michael Blakeney, "Trends in Intellectual Property Rights Relating to Genetic Resources for Food and Agriculture," *Background Study Paper No* 58 (2011): 16.
[382] Rolfe Jördens, "Legal and Technological Developments Leading to This Symposium: UPOV's Perspective" *WIPO-UPOV Symposium on the Co-Existence of Patents and Plant Breeders' Rights in the Promotion of Biotechnology Developments* (2002).

whether a plant variety is EDV depends on the interpretation of domestic courts while this issue is not examined by Plant Varieties Protection Offices.[383]

With reference to farmers' rights to save and replant seeds, the 1991 UPOV Convention, unlike its predecessor, has banned the activities of selling and exchanging seeds among farmers for the purposes of breeding or propagation since it only allows States to choose whether to provide the privilege of farmers if the farmers use those protected materials on their own holdings. It also obligates the member States to restrict the area, quantity and plant genera to which the privilege of farmers can be applied. What is more, farmers have to pay remuneration to the plant breeders in case they sell or exchange seeds with other farmers for reproduction of plant varieties.

Limitation on farmers' rights might greatly shift the role farmers to consumers of plant varieties. In 2014, the seeds obtained through seed-saving in developing countries accounted for 75 percent of the total amount of seeds utilized in farming production; additionally, the practice of seed saving has been conducted by around 100 million farmers in South America, 300 million in Sub-Saharan Africa and 1 billion in Asia.[384] As a result, the impact of such limitations might be particularly huge for the developed countries which still use informal seed systems and where conventional breeding methods and the practices of seed-saving and exchanging are still common.[385]

Patent regime does not introduce the same exemptions. It does not provide either the limitations on the rights of patent holders for the purposes of research and development nor does it guarantee the farmers' rights to save and exchange seeds. Nevertheless, the need to take into account the special nature of plant innovations with respect to the use of materials in further breeding programs has been acknowledged in some national patent regimes by way of imposing specific exceptions similar to breeders' exemption under plant variety protection regime. For instance, Article L613-5-3 of *the French*

[383] Watal, *Intellectual property rights in the WTO and developing countries*, 143.
[384] Luca Lombardo, "Genetic Use Restriction Technologies: A Review," *Plant Biotechnology Journal* 12, no. 8 (2014): 995–1005.
[385] Rob Tripp, D. J. F. Eaton, and N. P. Louwaars, "Intellectual Property Rights: Designing Regimes to Support Plant Breeding in Developing Countries," in *Agricultural and Rural Development Department Report* (Washington, D.C: World Bank, 2006).

Intellectual Property Code (as amended in 2004) provides that the monopoly rights granted by a product or process patent on a plant material do not cover the activities undertaken with a purpose to create, discover and develop other varieties. Also, *the 2005 German Patent Act*, Article 11.2, similarly stipulates that the impacts of a patent shall not cover the utilization of a plant material for breeding, discovering and developing a variety. *The Swiss Patent Act (as amended in 2007)*, Article 9(e), sets forth that the patent rights do not include the "use of biological material for the purpose of the production or the discovery and development of a plant variety." Also, Article 27 of Agreement on a Unified Patent Court creates the "limitations to the effects of a patent" consisting of an exemption concerning the utilization of plant materials in breeding, discovering or developing other plant varieties.[96]

These exceptions are compatible with Article 30 of the TRIPS Agreement, even if this Article is narrowly construed as in the ruling of the panel in *Canada–Patent Protection for Pharmaceutical Products.*[386] In fact, up to the present, no complaint has been filed with the WTO claiming that these exceptions defy the TRIPS Agreement.[387] Still, this limited exemption does not allow the third parties to commercialize the results of their development. A comprehensive application of breeders' exemption might arguably defy fundamental premises of patent regime.

3.3.5 Term of Protection

As already mentioned, both of the TRIPS Agreement and the 1991 UPOV Convention require a minimum term of protection of twenty years.[388] However, the Convention provides longer terms of protection for the new varieties of trees and vines for a minimum period of twenty-five years after the breeders' rights are granted. The Convention offers a longer term of protection for those varieties due to

[386] The WTO panel in the case of *Canada–Patent Protection for Pharmaceutical Products* affirms the admissibility of the limited exception under which it is possible to initiate the processes for commercializing approval of a drug prior to the expiry date of a patent protecting it for the purpose of speeding up the marketing of a generic version of the medicine once the patent is expired; WTO Panel, WT/DS114/R (2000).
[387] The limited exemption adopted by the European Union under the Agreement on a Unified Patent Court, is an exceptional indicative of a general comprehension on the TRIPS-compatibility of a breeding exemption.
[388] *TRIPS Agreement*, Article 30; *The 1991 UPOV Convention*, Article 19(2).

the rarity of the varieties of trees and vines.[389] Therefore, countries which are member parties to both international agreements must provide higher minimum standards than that of the TRIPS Agreement especially for trees and vines.

3.3.7 Compulsory Licenses

A field in which compulsory licenses might have an effect on plant breeders is that of the dependent patents whose utilization needs the consent of an earlier patent owner. This type of patent is common in plant breeding field since new plant varieties can be subsequently produced by way of adaptations or enhancements of existing plant varieties, instead of profoundly new creation.[390] As sequential and cumulative invention usually demands access to proprietary plant germplasms, State governments may decide to enforce compulsory licenses in favor of other plant breeders who have unsuccessfully negotiated voluntary licenses in order to have an access to a patented variety. Nonetheless, the compatibility of the compulsory licenses in this case with the TRIPS Agreement has not been tested. Furthermore, the State which seeks to impose such licenses must make sure that it complies meticulously with all conditions imposed by Article 31 of the TRIPS Agreement.

As the provision concerning patent compulsory licenses under the TRIPS Agreement is significantly more definitive and narrower than those imposed under the UPOV system, scholars have different opinions with respect to the usefulness of this provision on plant subject matter. For instance, Leskien and Flitner view that compulsory licenses will be greatly beneficial in this area;[391] At the same time, some commentators assert that the States may impose compulsory licenses to guarantee access to proprietary genetic materials for the purpose of attaining a particular agricultural goal, such as availability

[389] Adam Masarek, "Treetop View of the Cathedral: Plant Variety Protection in South and Southeast Asia Least-developed countries" *Emory International Law Review* 24 (2010): 464.
[390] Correa, *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options*, 194.
[391] Leskien and Flitner, "Intellectual Property Rights and Plant Genetic Resources: Options for a Sui Generis System," 25.

of the protected varieties in farm production or food security.[392] In contrast, some scholars argue that, although it is allowed by the TRIPS Agreement to grant compulsory licenses for a particular agricultural purposes, the limitations imposed by the TRIPS Agreement considerably restricts the ability of the States to confer such licenses on the third parties.[393]

It is worth pointing out that, at present, the supporters of the biotech industry are apprehensive about the UPOV Convention being further reinforced.[394] They rationalize their reform proposal contending that plant genes are rigidly protected under the current intellectual property environment, while plant varieties do not receive the identical level of intellectual property protection.[395] In accordance with this proposal, a strengthened level of protection for new plant varieties will provide more possibility to encourage investment in genetic resource development programs rather than providing incentives for merely minor genetic modifications on varieties that are already available.[396] For example, the American Seed Trade Association believes that, by strengthening the plant variety protection system, there will be more opportunities for plant breeders to negotiate the access to plant innovations developed by others.[397] Consequently, the genetic pool, from which newly-developed varieties can be produced, would not be narrowed down, and the possible negative effect on biological diversity could be lessened.

On the contrary, some commentators, including the International Seed Federation acting on behalf of most of the European plant breeders, expresses that the 1991 UPOV Convention should not be amended.[398] Some even comment that an exception provided specifically for plant innovation should be

[392] Correa, *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options*, 194.
[393] Helfer, "Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments," 51.
[394] John Donnenwirth et.al., "Intellectual Property Rights, Patents, Plant Variety Protection and Contracts: A Perspective from the Private Sector," *IP Strategy Today* no.9 (2004): 26.
[395] Ibid.
[396] Ibid.
[397] Jay Sanderson, *Plants, people and practices: the nature and history of the UPOV convention* (Cambridge, United Kingdom: Cambridge University Press, 2017), 212.
[398] Jean-Christophe Gouache, "Balancing Access and Protection: Lessons from the Past to Build the Future," *ISF International Conference*, *Berlin* (2004); Chiarolla, "Commodifying Agricultural Biodiversity and Development-Related Issues," 31.

incorporated in patent regime.[399] For instance, Gouache strongly supports full implementation of the 1991 UPOV Convention; however, he expresses his concern that when the protected variety is, at the same time, granted patent protection, it might lead to the risk of the inapplicability of breeders' exemption and thus halt genetic technology progress. He also points out that the scope of exclusive rights for the plant variety granted dual protection is left for the "creativity" of the patent examiner and relevant judicial bodies to determine.[400]

Another related aspect to consider is the fact that the TRIPS Agreement does not prohibit the dual protection between a patent system and plant variety protection regime. In this regard, the 1978 UPOV Convention does not forbid its members to protect plant varieties through patent law; however, it prevents the States from granting cumulative protection with a patent system.[401] Even so, due to the increased demands from the plant breeders in the developed world, the 1991 Convention removed the prohibition of dual protection of patent and plant breeders' rights.[402]

As a result, some countries, such as the United States, provides concurrent protection for plant varieties. In the countries where those intellectual properties interface, a more rigorous scope of protection of patent law has threatened the functionality of exemptions provided by plant variety protection laws.[403] In other words, even in the countries of which the domestic laws on plant variety protection allow breeders' exemption or farmers' privilege, those rights cannot operate if such varieties are also granted patent rights. The example of this issue can be illustrated by the ruling of *the 2002 Monsanto Co. v McFarling*[404] by the United States Court of Appeals for the Federal Circuit concerning Monsanto corporation and two commercial farmers. In this case, the Court affirmed that the rights of

[399] J. Straus, "Measures Necessary for the Balanced Co-Existence of Patents and Plant Breeders' Rights—A Predominantly European View," *WIPO–UPOV Symposium on the Co-Existence of Patents and Plant Breeders' Rights in the Promotion of Biotechnological Developments* (2002).
[400] Gouache, "Balancing Access and Protection: Lessons from the Past to Build the Future,".
[401] *The 1978 UPOV Convention,* Article 2(1)
[402] Watal, *Intellectual property rights in the WTO and developing countries*, 149.
[403] Chiarolla, "Commodifying Agricultural Biodiversity and Development-Related Issues,": 33-34.
[404] *Monsanto Co. v. McFarling, 302 F.3d 1291, 1298 (Fed. Cir. 2002).*

farmers to save seeds allowed under the United States' Plant Variety Protection Act (PVPA) does not function when the same materials are protected under the Patent Act.[405]

Chapter IV: International Environmental Agreements Overlapping with Intellectual Property Rights on Plant Inventions

This Chapter analyses two main international environmental agreements which have implications toward intellectual property rights on plant innovation. The Convention on Biological Diversity (CBD) is established under the auspices of the United Nations is the first Convention which explicitly establishes some mechanisms for governing innovations derived from biological resources. Meanwhile, the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) of the Food and Agricultural Organization (FAO) specifically provides mechanisms for treating plant genetic resources for food and agriculture. The core obligations and impacts of these two international agreements are analysed and compared in this Chapter.

4.1 Convention on Biological Diversity (CBD)

The CBD is the first multilateral environmental treaty which seeks not only to protect plants, animals, micro-organisms and their ecosystems, but also aims at securing benefits for locals and indigenous communities, and fulfilling their needs for food security, medicines, fresh air and clean water, and a safe environment.[406] In light of global biological diversity protection, the benefits of locals and indigenous peoples are ensured by means of prior-informed consent obtained from the country of origin and communities owning those resources, and sharing of benefits after those resources being commercially exploitn. The CBD ensures the access to genetic resources by the nationals of the countries

[405] Ibid.
[406] "The Convention on Biological Diversity," Convention on Biological Diversity, accessed November 21, 2017, https://www.cbd.int/convention/.

where resources are located by referring to the concept of sovereignty of the State.[407] Despite the fact that the CBD, as an environmental treaty, does not directly concern intellectual property rights, it creates a new means for governing innovations which are derived from genetic resources.

4.1.1 Objectives and Obligations under the Convention

In 5 June 1992, the CBD was allowed for signing and, later on, came into effect in 1993. As of November 2017, 196 countries have become the parties to this agreement.[408] The origin of this Convention can be traced back to the 1992 United Nations Conference on Environment and Development, held in Rio de Janeiro, where it addressed the important issues of economic development, social development, and environmental protection. The results of the meeting were the adoption of five main legal mechanisms, one of which was the CBD.[409] Three primary objectives of the CBD are "conservation of biodiversity; sustainable use of biodiversity; fair and equitable sharing of the benefits arising from the use of genetic resources".[410]

To achieve its goals, the CBD created tools for *in situ* plant genetic resource conservation[411]. Such tools concern the conservation of ecosystems, natural environment and the preservation of viable living creatures in such natural habitats.[412] The conservation occurs, for instance, when locals, traditional communities or farmers preserve and maintain traditional plant varieties in the settings where they are

[407] In order to maintain legal order between States, the principle of sovereignty is a component of every sovereign state, requiring that the public power is not dependent on any other countries. This principle is the common characteristic of all States, which displays the supremacy and independence of pulic authority in showing and carrying out the will and policy of the governors; Jana Maftei, "Sovereignty in International Law," *Acta Universitatis Danubius. Juridica* 11, No. 1 (2015): 55.
[408] "List of Parties," Convention on Biological Diversity, accessed November 21, 2017, https://www.cbd.int/information/parties.shtml.
[409] "History of the Convention," Convention on Biological Diversity, accessed November 21, 2017, https://www.cbd.int/history/.
[410] Secretariat of the Convention on Biological Diversity, "Living in harmony with nature," United Nations Decade on Biodiversity, accessed November 21, 2017, https://www.cbd.int/2011-2020/about/goals.
[411] *In situ* conservation refers to the process of conserving of plant species, variety or breed within its natural habitat.
[412] Laurence R. Helfer, "Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments," *Food and Agriculture Org. of the United Nations, FAO Legislative Study*, no. 85 (2004): 12.

created, grow and are cultivated.[413] In other words, the CBD specifically recognizes the role of local communities in conserving and sustainably utilizing the plant resources; as a result, it sets forth the obligations to equitably share benefits derived from the utilization of the plant resources developed, preserved and sustained.[414] The core obligations of the CBD are as follows

a. Access to Genetic Resources and Prior-Informed Consent

The Convention affirms the sovereign right of each member state over the exploitation of its own genetic resources and guarantees the authority of the state to provide some conditions for national resources' accessibility according to their national policy.[415] The preamble of the Convention sets forth that genetic resources exiting within the territories of State parties belong to such a particular State.[416] This confirms the concept of State sovereignty over its own genetic diversity, implying the authority to control bioprospecting from external power and the freedom to provide some conditions on how those genetic resources are exploited.[417] Moreover, the CBD encourages the State parties to establish some national legal mechanisms to govern genetic resource exploitation according to their domestic policies and socio-logical conditions.[418] As a result, to exploit genetic resources, the Convention stipulates that the consent from relevant authorities must be obtained.[419] In addition, the *Open-ended Working Group on Access and Benefit-sharing* suggests that conditions for commercial exploitation set forth at the national level must engage all concerned stakeholders, ranging from the local community level to the

[413] Ibid.
[414] *Convention on Biological Diversity*, Preamble, states in the concerning part, "conscious of the intrinsic value of biological diversity and of the ecological, genetic, social, economic, scientific, educational, cultural recreational and aesthetic values of biological diversity and its components".
[415] *Convention on Biological Diversity*, Article 3 and 15;
and 15).
[416] *Convention on Biological Diversity*, Preamble.
[417] The principle of permanent sovereignty over biological resources existing in a country is addressed under the framework of the Office of the United Nations High Commissioner for Human Rights; General Assembly Resolution, *Permanent Sovereignty over Natural Resources*, 1803 (XVII) (1962).
[418] Hanns Ullrich "Traditional Knowledge, Biodiversity, Benefit-Sharing and the Patent System: Romantics v. Economics." *EUI Working Paper* 7 (2005): 15.
[419] *Convention on Biological Diversity*, Article 15.5.

governmental level.[420] In other words, it further requires the approval and involvement from the communities which developed, protected and maintained those resources.

The main objective of prior-informed consent obligation is to ensure that national conditions for natural resource exploitation has been followed and that the benefit-sharing would actually occur.[421] What is more, the prior-informed consent would permit the local communities holding genetic resources to negotiate or even decline access and to actively take part in the international propagating material transfer program.[422]

b. Fair and Equitable Sharing of Benefits

Article 8(j) of the CBD requires that the benefits obtained from commercial utilization of genetic resources must be shared with the people who are responsible for creating, developing and using those resources; hence, whether or not the genetic resources or plant varieties are subject to intellectual property protection systems, the holders of genetic resources are entitled to earn benefits from their knowledge, innovations and traditional practices.[423] Article 15.7 of the CBD additionally sets forth that fair and equitable sharing of benefits derived from the exploitation of genetic resources have to be concluded with local communities under mutually agreed terms. The "benefits" imposed by the Convention is broadly construed to cover non-monetary benefits such as capacity building, technology transfer, research and development program, and training.[424] The rationale behind the benefit-sharing mechanism is that, if the benefits flow back to the country of origin of the genetic resources, it would encourage locals to continue protecting those biological resources, and they would also be incentivized to make such resources

[420] United Nations Environment Programme [UNEP], *the Ad Hoc Open-ended Working Group on Access and Benefit-sharing*, UNEP/CBD/COP/6/6 (2001), 20.
[421] World Trade Organization [WTO], *The Relationship between the TRIPS Agreement and the Convention on Biological Diversity and the Protection of Traditional Knowledge: Submission from Brazil and India*, IP/C/W/443 (2005).
[422] Ibid.
[423] Vinod Sople, *Managing Intellectual Property: The Strategic Imperetive*. (Prentice-Hall of India, 2012), 104.
[424] Colombia University School of International and Public Affairs, "Access to Genetic Resources: An evaluation of the Development and Implementation of Recent Regulation and Access Agreements" *Environmental Policy Studies Working Paper* No.4 (1999): 5.

available to public and relevant industries.[425] This would lead to the achievement of the main objectives of the Convention to conserve and sustainably utilize biological resources.[426]

4.1.2 Mechanisms to Ensure Compliance with the CBD Obligations

Even though the CBD clearly sets forth these international obligations, it obviously lacks a monitoring mechanism and a dispute settlement mechanism. In fact, both mechanisms are significant elements of any international treaty to ensure that the obligations are followed by the member States. In case any dispute concerning the interpretation and application of the CBD erupts, the Convention merely provides that the parties should seek resolutions through negotiation.[427]

Afterwards, in 2014, *Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (Nagoya Protocol)* was established as a supplementary agreement to the CBD. This Protocol aims at promoting compliance to the obligations of the CBD, namely promoting access to genetic resources and fair and equitable sharing of benefits.[428] Moreover, it further clarifies access obligation by requiring the States to establish legal provisions and procedures for prior informed consent and mutually concluded terms, provide for grant of a license or comparable for showing that access is allowed and take into account the significance of genetic resources for food and agriculture for the purpose of promoting food security.[429] Also, it states that a national level of a benefit-sharing mechanism from the "use" of genetic resources must be provided mainly through contractual agreements and such "use" includes research and development on the resources themselves, as well as their compositions, and following commercialization

[425] Michael Hassemer, "Genetic Resources" In *Indigenous Heritage and Intellectual Property*, ed. Silke von Levinski (Kluwer Law International, 2004), 151.
[426] Ibid, 184.
[427] *Convention on Biological Diversity*, Article 27.1.
[428] The implementation of the Nagoya Protocol might interface with the scope of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) of the Food and Agriculture Organization (FAO) which seeks to implement the benefit sharing concept for all plant genetic resources for food and agriculture through monetary benefit sharing fund and supplement non-monetary benefit-sharing systems at request of authorities of each jurisdiction, including information exchange and technology transfer. See, Jorge Medaglia "The Interface between the Nagoya Protocol on ABS and the ITPGRFA at the International Level." *FNI Report*, 1 (2013).
[429] *Nagoya Protocol*, Article 6.

and application.[430] Benefits can be either monetary, such as royalties, or non-monetary such as the sharing of a research outcome.[431]

It is obvious that the Nagoya Protocol definitively provides clearer and more detailed provisions related to the mechanisms for sharing relevant data with national patent offices, and for sharing benefits with locals.[432] Moreover, it creates more specific obligations to support compliance of the national laws of the contracting parties providing biological materials, i.e., the requirements to take "appropriate, effective and proportionate legislative, administrative or policy measures" in case genetic resources used within their territories have been accessed according to prior informed consent, and that benefit-sharing agreements have been created, as demanded by another contracting party;[433] to make available an opportunity to find legal recourse under their domestic legal systems when any dispute occurs from mutual agreements concerning access and benefit-sharing;[434] and to take necessary measures to monitor the use of biological resources after leaving countries of origin including by establishing efficient checkpoints at any step of the value-chain, research and development, innovation, prior to commercialization[435]

Nonetheless, without proper adoption and implementation at a national level, the Protocol cannot achieve its goal.[436] In addition, some scholars point out that the compliance provisions provided by the Protocol are not adequately stringent since it does not provide any specific tools to ensure compliance, yet merely obligates its parties to take any "appropriate, effective and proportionate" mechanism or action in the cases of non-compliance with the CBD provisions.[437]

4.1.3 The relationship between the CBD and intellectual property rights

[430] *Nagoya Protocol,* Article 6.
[431] Ibid.
[432] Ryan Abbott, "Documenting Traditional Medical Knowledge." *World Intellectual Property Organization* (2014): 26.
[433] *Nagoya Protocol,* Article 14.
[434] *Nagoya Protocol,* Article 18.
[435] *Nagoya Protocol*, Article 17.
[436] Lionel Bently and Brad Sherman, *Intellectual Property Law* (Oxford University Press, 2014), 402-403.
[437] Ibid.

Despite the fact that the CBD does not explicitly refer to any international intellectual property agreements, it includes some provisions relating to intellectual property rights. Specifically, Article 16(5) of the CBD acknowledges that intellectual property rights may have a considerable impact on the CBD's implementation. Additionally, this Article obligates its member countries to collaborate to make sure that the intellectual property rights are "supportive of and do not run counter to" the goals of the Convention.[438] Yet, other provisions clearly provide that the Convention is to be construed so as to maintain the intellectual property rights guaranteed by international laws, for instance, Articles 16(2) - (4) stipulates that the technology transfer and mechanisms employed to gain accessibility to transferred technology must comply with the efficient and sufficient protection of intellectual property rights guaranteed by international law. As a result, if a national government promotes direct foreign investment in some fields of technologies, such as a process for inserting DNA sequences into some extant plants, it must guarantee intellectual property rights which the holders of that technology has attained.

Even though the CBD provides such provision, the countries which are both a party to the CBD and the TRIPS agreement are facing an unavoidable problem. Both agreements are legally binding legal mechanisms; however, the different rationales and objectives behind the obligations of these two agreements pull the States in various directions in attempting to fulfil those obligations. It is highly probable that a State seeking to implement strict intellectual property rights could find itself contravening the obligations provided by the CBD.

Under the CBD, States have control over their plant biological resources by referring to the principle of sovereignty. The national sovereignty principle suggests that States can ban intellectual property rights on life forms, including plant genetic resources. In the meantime, the TRIPS Agreement requires the States to control their resources by granting plant variety protection and optionally providing patent protection on plants while compulsory licensing and public interests are limited. According to the CBD, States must promote and provide mechanisms for conservation and sustainable utilization of

[438] *Convention on Biological Diversity*, Article 16.5.

biodiversity as a common property of humankind. The exploitation or utilization of plant genetic resources creates the duty for the genetic resource users to obtain prior-informed consent from the relevant authorities and the local communities and to fairly and equitably share the benefits from commercialization of the products derived from those resources. However, in accordance with the TRIPS Agreement, generally, the protection of public health and nutrition is subject to the private rights of the owners.[439] P rior-informed consent and benefit-sharing are not mentioned.

In recent years, the approaches to intellectual property rights provided under a biodiversity system have developed beyond the CBD's provisions. In the Conference of the Parties (COP), the assembly of member countries which determines how the CBD provisions should be implemented, has paid significant attention to the harmonization of intellectual property regimes with the goals of the CBD.[440] What is more, the State parties which are developing countries have regarded international patent law as a potential means to track the compliance of the CBD obligations.[441] Particularly, some active countries in the South, with the support of non-governmental organization (NGOs), have voiced their concern about the negative impacts of intellectual property and have tried to harness international intellectual property laws to ensure conformity with the obligations of the CBD.[442] In order to address such concerns, official statements of the COP have expressed the necessity to "promote increased mutual supportiveness and integration of biological diversity concerns and the protection of intellectual property rights."[443] Members of the COP have gathered data, commissioned case studies, held some workshops and drafted guidelines and recommendations, aiming towards the core objectives of the Convention. For

[439] *TRIPS Agreement,* Article 8(1), provides that "Members may, in formulating or amending their laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provisions of this Agreement."
[440] Helfer"Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments," 13.
[441] Convention on Biological Diversity, 6th meeting, *Role of Intellectual Property Rights in the Implementation of Access and Benefit-sharing Arrangements*, VI/24/C,UNEP/CBD/COP/6/20 (7-9 April 2002).
[442] Ibid.
[443] CBD Decision IV/15, para. 9.

instance, in 2002, the COP issued the "Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising Out of their Utilization."[444]

The most essential recommendation of the Bonn Guidelines encourages the applicants for patent and plant variety protection to fully disclose the origin of the plant genetic materials upon which their innovations are based. The Bonn Guidelines support the disclosure requirement for the purpose of monitoring if the applicants for patent or plant variety protection have gained the prior informed consent from the relevant authority and fulfilled the requirements for accessibility which the country of origin has specified.[445] The disclosure requirement obligates applicants of plant intellectual property rights to disclose the sources of genetic resources used in the process of creating plant innovation, the evidence of the acquired consent from the concerned authorities and the benefit-sharing agreement with local communities.[446] Failure to sufficiently disclose the sources, the sanctions proposed by member States include a rejection of the application or an invalidation of the granted patent,[447] a limitation of the scope of patent protection, or a partial or full transfer of the exclusive rights where another person or community is a real inventor or a part inventor.[448]

Even though the member countries of the COP have endorsed the Bonn Guidelines unanimously, the fact that the Guidelines rely on intellectual property laws to ensure the CBD compliance is still contentious. In particular, a Communication from the European Commission to the European Parliament on the European Community (the EC)'s implementation of the Bonn Guidelines in 2003 determines the necessity to adopt "a self-standing disclosure requirement" for the applicants of patent and plant breeders'

[444] CBD Decision VI/24, App. II, Annex, Part C.
[445] Ibid.
[446] Jaques de Werra "Fighting Against Biopiracy: Does the Obligation to Disclose in Patent Applications Truly Help?" *Vanderbilt Journal of Transnational Law* 42 (2009): 147.
[447] Dominic Keating, "Access to genetic resources and equitable benefits sharing through a new disclosure requirement in the patent system: An issue in search of forum," *J. Pat & Trademark Off. Soc'y* 87 (2005): 525.
[448] World Trade Organization [WTO], *Relationship Between the TRIPS Agreement and the Convention on Biological Diversity (CBD) and the Protection of Traditional Knowledge—Elements of the Obligation to Disclose Evidence of Benefit-Sharing Under the Relevant National Regime*, IP/C/W/442 (Mar. 18, 2005).

rights.[449] According to such Communication, if disclosure requirement is adopted, it would not be incorporated into domestic or regional intellectual property laws; on the other hand, the failure to comply with the new disclosure requirement would incur consequences outside the scope of intellectual property laws.[450] Nevertheless, the Communication from the EC mentions that the EC and its member countries should prepare to discuss the issue of incorporating disclosure requirement to intellectual property laws.[451]

At the same time, under paragraph 19 of the Doha Ministerial Declaration (Doha Declaration),[452] the TRIPS Council is directed to examine the interplay between the CBD and the TRIPS Agreement in the review of Article 27.3(b) concerning plant variety protection. The Doha Declaration evidently states that: "We instruct the Council for TRIPS, in pursuing its work program included under the review of Article 27.3(b),…to examine, *inter alia*, the relationship between the TRIPS Agreement and the Convention on Biological Diversity, the protection of traditional knowledge and other relevant new developments…[453] Consequently, it is obvious that the obligations provided by the CBD have been taken into account when establishing the provision for plant variety protection.

In the Mini-Ministerial talks in 2008, the issue of genetic resource disclosure has been brought to the consideration of the TRIPS Council. Due to the advantages of dispute settlement mechanisms and sanction system provided under the auspices of the WTO, the incorporation of CBD obligations to the TRIPS Agreement has been upheld by the African, Caribbean and Pacific Group of States; as a result, the

[449] Communication from the Commission to the European Parliament and the Council - The implementation by the EC of the "Bonn Guidelines" on access to genetic resources and benefit-sharing under the Convention on Biological Diversity /* COM/2003/0821 final.
[450] Ibid, 5.
[451] Ibid, 9.
[452] World Trade Organization [WTO], Declaration on the TRIPS Agreement and Public Health, Ministerial Conference, Fourth Session, Doha, WT/MIN (01)/DEC/W/2 (14 November 2001).
[453] Doha WTO Ministerial 2001: Ministerial Declaration, WT/MIN(01)/DEC/1 (20 November 2001).

formal number of supporters to TRIPS amendments accounted for approximately 80 countries out of 152 WTO member countries.[454]

There are three forms of TRIPS amendments suggested by developing countries: an amendment to Article 27 concerning disclosure requirement as an exception to patentability;[455] an introduction of a supplementary paragraph to Article 29 concerning disclosure requirement when applying for patent protection[456] and an addition of Article 29bis concerning the disclosure of origin of plant biological materials.[457]

However, the developed countries broadly opposed the incorporation within intellectual property systems as the European Union proposed the enforcement outside the regime of the patent. The European Union member countries suggested that legal force of a non-compliance to the disclosure requirement should rest outside the scope of patent regime, for example by imposing sanctions under administrative law or civil law, such as a claim for monetary reimbursement.[458] Significantly, it is suggested that the sanction should not completely invalidate the patent, but rather make it unenforceable by allowing the patent applicants to correct it afterwards.[459] The United States suggested the implementation of genetic resource disclosure through *sui generis* law or contract.[460] This is so because of the developed countries concern that such implementation might cause uncertainty in patent regime, diminish patent value, and discourage research and development.[461] Due to the complicated legal matters it causes and the high

[454] Kaitlin Mara "TRIPS Council: Half of WTO membership Backs Biodiversity Amendment" *Intellectual Property Watch*, (2008). http://www.ip-watch.org/weblog/index.php?p=961.
[455] World Trade Organization [WTO], *Article 27.3(b), Relationship Between The TRIPS Agreement and the CBD, and The Protection of Traditional Knowledge and Folklore: Communication from Peru*, IP/C/W/447 (8 June 2005).
[456] World Trade Organization [WTO], Doha Work Program – The Outstanding Implementation Issue on the Relationship between the TRIPS Agreement and the Convention on Biological Diversity, IP/C/W/474 (5 July 2006).
[457] Ibid.
[458] World Trade Organization [WTO], *Communication from European Community*, IP/C/W/383 (17 October 2002), 55.
[459] Ibid.
[460] World Trade Organization [WTO], Article 27.3(B), *Relationship between the TRIPS Agreement and the CBD, and The Protection of Traditional Knowledge and Folklore: Communication from the United States*, IP/C/W/434 (26 November 2004).
[461] Keating, "Access to genetic resources and equitable benefits sharing through a new disclosure requirement in the patent system: An issue in search of forum," 525.

political controversy it faces, the "consensus" on this matter has not been reached to incorporate the disclosure requirement to the TRIPS Agreement of the WTO to satisfy the obligations of the CBD.

4.2 International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

The CBD has created the obligation for States to develop a mechanism of contractual provisions for the access and benefit-sharing from the commercial utilization of biological resources, based upon bilateral agreements.[462] Nevertheless, for research and development on food and agricultural products, the negotiation of each bilateral agreement between providing country and recipient is an element which may affect long-term international movement of plant genetic materials.[463] This might create a negative impact on farming and food sustainability. For example, costs of transactions associated with negotiations of bilateral agreements for gaining access to plant biological diversity from various jurisdictions would be adequate enough to discourage plant research and development efforts from the beginning. Further, these difficulties are intensified by the immense interdependency between jurisdictions in terms of biological resources, and a large number of propagating materials crucial for creating new plant varieties.

In 2001, an assembly of 120 government representatives settled the series of seven-year negotiations, resulting in a binding international treaty on access to plant genetic resources for food and agriculture, namely ITPGRFA.[464] After the coming into enforcement of the ITPGRFA, this treaty seems to provide some solutions to those problems by establishing an internationally contractual framework for the protection and sustainable utilization of genetic resources and the fair and equitable benefit-sharing according to the CBD. The main goal of the treaty is "the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of benefits arising out of their use, in harmony with the Convention of Biological Diversity, for sustainable agriculture and food

[462] Queen Mary Intellectual Property Research Institute, CEAS Consultants (Wye) Ltd Centre for European Agricultural Studies and Geoff Tansey, "Study on the Relationship between the Agreement on TRIPs and Biodiversity Related Issues," *WTO Agreement on Trade Related Aspect of Intellectual Property Rights and Convention on Biological Diversity, Final Report for DG TRADE European Commission* (2005): 76-77.
[463] M. Halewood and R. Sood, "Genebanks and Public Goods: Political and Legal Challenges" *the 19th session of the Genetic Resources Policy Committee* (2006).
[464] Ali Mekouar, "A Global Instrument on Agrobiodiversity: The International Treaty on Plant Genetic Resources for Food and Agriculture," *FAO Legal Papers Online* no. 24 (2002): 3, http://www.fao.org/3/a-bb057e.pdf.

security".[465] Additionally, another primary goal of this treaty is to encourage the access to all plant genetic resources for food and agriculture.[466] It promotes the open access to plant genetic resources for food and agriculture through the use of the Multilateral System (MLS) and also creates particular access and benefit sharing obligations in the Standard Material Transfer Agreement (SMTA) which implements them.

The SMTA was designed in order to particularly meet the needs of food security and agricultural sustainability. Specifically, each country does not have to conduct *ad hoc* negotiations with various providers or recipients of genetic resources; therefore, it decreases time and costs of transaction. Moreover, it does not require a troublesome tool to track accessions by each individual country, while making sure that fair benefits return to the MLS when plant-related products derived from the MLS materials become commodities on the market. Lastly, as for non-compliance with the SMTA by the receiving parties, the treaty essentially refers to legally binding international arbitration and bestows the third-party beneficiary's rights upon the FAO in order to represent the MLS interests.

What is more, ITPGRFA is the first international treaty which evidently recognizes the rights of farmers. However, it fails to provide precise definition and to indicate the exact ways of guaranteeing this set of rights. This Chapter, first of all, explains the provisions concerning the rights of farmers and briefly analyses the challenges the States might face in implementing the obligations to ensure these rights. Secondly, the next section describes the MLS to facilitate access to plant genetic resources for food and agriculture and how the SMTA works and enforces. The analysis on provisions concerning intellectual property is conducted in the last section.

4.2.1. Recognition of Farmers' Rights

The ITPGRFA guarantees two main aspects of the rights of farmers. First, it ensures that all farmers taking part in the use and conservation of agrobiodiversity have the rights to receive some

[465] *ITPGRFA*, Article 1.
[466] *ITPGRFA*, Article 11.2 and 11.3.

benefits from the commercial uses of plant genetic resources for food and agriculture. Second, it expressedly ensures the rights of farmers to maintain their traditional agricultural practices to to save, use, exchange and sell farm-saved seed.

4.2.1.1 Right of Farmers to Benefit-Sharing

Article 9.2(b) of the treaty guarantees the right of farmers to equitably participate in benefits derived from the use of plant genetic resources for food and agriculture. In order to explain this provision, Article 13 of the ITPGRFA provides some guidance on benefit-sharing under the MLS by listing the most crucial benefits, which include: (1) facilitated access to genetic resources under the MLS; (2) information exchange; (3) transfer of technology; (4) building of farming capacity; and (5) monetary benefit-sharing from commercialization of plant genetic resources for food and agriculture.[467] In addition, it indicates that benefits arising from such utilization shared under the MLS should flow mainly, either directly or indirectly, to farmers who preserve and use plant genetic resources for food and agriculture in every member State, especially countries in the South and nations under economic transition.[468]

Although these Articles are directly associated with the MLS, they display a line of ideas concerning benefit-sharing relevant for construing Article 9.2(b) as a tool to preserve and support farmers' privilege. First, the form of benefit-sharing is evidently not limited to monetary benefits.[469] Second, the benefits are not only to be distributed among the few farmers who possess plant varieties used by commercial plant breeders, but also with local farmers in every State who are involved in the preservation and sustainable utilization of agrobiodiversity. This approach is consistent with the FAO policy after the concepts of farmers' rights and benefit-sharing were, for the first time, officially established in 1989.[470] It is, thus, different from the bilateral and direct benefit-sharing provided under the CBD, where benefits are mandated to be distributed between the initial owners and purchasers. This is usually referred to as indirect way of benefit-sharing.

[467] *ITPGRFA,* Article 13.
[468] Ibid.
[469] *SMTA,* Article 6.9.
[470] FAO Conference Resolution 5/89.

In developing nations, some benefit-sharing provisions exist in their national plant variety protection system or sometimes can be found in the law on the biological diversity protection.[471] Most of these laws involve direct benefit-sharing between the providers and recipients of plant genetic resources for food and agriculture, it often relies on prior informed authorization and on mutually agreed contracts, as established in the CBD.[472] Yet, to date, the examples of direct monetary benefit-sharing as a consequence of those laws have been ineffective.

Nonetheless, there are other forms of benefit-sharing, usually referred to as indirect ways of sharing benefits. These forms comply with the mandate of the FAO during the initial days of farmers' rights negotiations. As mentioned in Chapter II, a fundamental idea to share the benefits among all people who have taken part in the stewardship of plant genetic resources for food and agriculture and humankind at large.[473] This principle is founded on the concept that it is the natural rights of farmers to obtain reward for their contribution to the genetic pool from which all mankind benefits; hence, the international community has responsibility to make sure that such rights are recognized and rewards are actually granted.[474]

The next question arises as to where the funds should come from to enable such indirect sharing of benefits. Under the MLS, it is not certain how much this mechanism can bring about funding and even whether this framework will accomplish and genuinely have a considerable effect on the farmers. The ITPGRFA funding strategy set forth under Article 18 states that "the Contracting Parties that are developed countries also provide, and Contracting Parties that are developing countries and Contracting Parties with economies in transition avail themselves of, financial resources for the implementation of this Treaty through bilateral and regional and multilateral channels…" and that "voluntary contributions may

[471] Regine Andersen, "Farmers' rights Evolution of the international policy debate and national implementation," *in Farmers' Crop Varieties and Farmers' Rights* ed. Michael Halewood (Earthscan, 2016), 138-140.
[472] For example, *India's 2001 Protection of Plant Varieties and Farmers' Rights Act* and *Thailand's 1999 Plant Variety Protection Act*.
[473] Food and Agriculture Organization of the United Nations [FAO], *Report of the Second Session of the Commission on Plant Genetic Resources*, Doc. CL 91/14, Appendix F, Section 8 (1987).
[474] Andersen, "Farmers' rights Evolution of the international policy debate and national implementation," 139.

also be provided by Contracting Parties…" However, as of 2011, the affirmed voluntary contributions accounted for merely 13.7 percent of the mutually agreed target.[475]

Apparently, since there are no fixed mandatory commitments provided under the treaty, it is not certain how much money this fund can create. For now, Article 7 on international cooperation and Article 8 on technical assistance are the principal provisions to achieve benefit-sharing, which create the mandate for the member States to promote technical assistance to developing nations and countries in the period of their economic transition. Another source of monetary benefit-sharing, which is considered to be the most successful channel so far, is official development assistance through international cooperation or collaboration with NGOs.[476] There are many instances of international organizations or NGOs which are able to support or which have played important roles in assisting farmers in developing countries and have significantly contributed to the sharing of benefits such as the United Nations Foundation for international environmental research.[477]

According to the international survey conducted by Anderson, the most frequently use non-monetary forms of benefit-sharing were: access to propagating material and other relevant information; engagement in the breeding goals' definition; collaboration in participatory plant breeding with farmers or scientists; improvement of seed systems by farmers; activities related to preservation of agrobiodiversity, including national gene banks; enhancement of the use of farmers' varieties, as well as access to the market.[478] Such survey indicates that, benefit-sharing is, in fact, more promising and favorable when the main goal for sharing is the farmer communities which are truly involved in the preservation of agrobiodiversity rather than the resource providers to commercial recipients.[479] Yet, the prevalent opinion

[475] Subash Dasgupta and Indrajit Roy, "Report of the First National Focal Point Meeting of the project," *The FAO Regional Project - Enhancing understanding and implementation of the International Treaty on Plant Genetic Resources for Food and Agriculture in Asia*, GCP/RAS/284/JPN (27-28 May 2013), 7.
[476] Stephen B. Brush, "Protecting Traditional Agricultural Knowledge," *Washington University Journal of Law and Policy* 17 (2005) 59.
[477] Barbara Gemmill and Abimbola Bamidele-Izu, "The Role of NGOs and Civil Society in Global Environmental Governance," *in Global Environmental Governance Options and Opportunities* (2002): 11.
[478] Regine Andersen, "the Farmers' Rights Project – Background Study 2: Results from an International Stakeholder Survey on Farmers' Rights," *FNI Report* no. 9 *Fridtjof Nansen Institute* (2005): 117.
[479] Ibid.

on benefit-sharing in many States, especially in the South, is of direct sharing of benefits between the resource holders and purchasers.[480]

While such direct sharing of benefits seems fair and equitable, many difficulties accompanying this approach can be foreseen such as the difficulties to identify the exact person or group of people who should get rewarded. Furthermore, the demand for landraces or farmers' varieties by commercial plant breeders is relatively limited, not many farmers would gain benefits and the vast majority of the contributors to the genetic pool across the globe would stay unrewarded. Importantly, direct benefit-sharing might create disincentives to seed sharing among farmers due to the desires of individual advantage or the advantage to a group.

It is also important to point out that, even though some developing countries such as Thailand, have enacted national laws providing direct benefit-sharing, no examples of actual benefit-sharing have occurred with respect to agrobiodiversity.[481] Moreover, the costs of transaction in creating access and benefit-sharing are too considerable for many countries.[482] Therefore, the approach of direct benefit-sharing has not turned out to be particularly promising, and these aforementioned factors should be taken into consideration when national mechanisms are devised.

4.1.2.2 Right of Farmers to Traditional Practices

The treaty is not clear regarding the rights of farmers to save, utilize, exchange and commercialize seeds saved from their own farm. Article 9.3 stipulates that nothing in Article 9 on farmers' rights "shall be interpreted to limit any rights that farmers have to save, use, exchange and sell farm-saved seed, subject to national law and as appropriate," yet this Article does not exactly give much guidance, except for marking such traditional farming practices as "rights." The preamble provides

[480] Andersen, "Farmers' rights Evolution of the international policy debate and national implementation," 140.
[481] Pawarit Lertdhamtewe, "Reinventing Thailand's Plant Protection Regime," *Journal of Intellectual Property Rights* no. 20 (2015): 320; Andersen, "Farmers' rights Evolution of the international policy debate and national implementation," 139.
[482] Bill Bowen, "Developing an effective international regime for access and benefit sharing for genetic resource using market-based instruments," *The Australian APEC Study Centre*, 22.

further that the rights of farmers to save, utilize, exchange and commercialize seeds saved from their own farm are "fundamental to the realization of farmers' rights." This text portrays the significance of these rights; however, it does not provide much of a direction on how to implement them since they are so vaguely addressed.

Despite such vagueness, it establishes the obligations for member States to ensure the rights of farmers in this area, yet each State can freely define the legal space that it views to be adequate for their national farmers with respect to their rights to save, utilize, exchange and commercialize farm-saved seeds. This freedom is, however, limited by other international obligations. Under the 1991 UPOV Convention farmers have the rights to save and reuse seeds, yet those rights are only within stringent limits; meanwhile the rights to exchange among farmers and to commercialize seeds is forbidden. Yet, all of these limitations to farmers' rights only apply to proprietary seeds, not to farmers' varieties.

The UPOV regime has faced resistance from many groups of people in many countries for fear that their signatory to the 1991 UPOV Convention would have negative impacts on the farmers' rights to traditional practices. The TRIPS Agreement, however, establishes only minimum standards while leaving sufficient flexibility for any other *sui generis* solution which is more suitable with the national policy on farmers' rights. Consequently, the primary challenge is for the nations which are both the members of the WTO and ITPGRFA to fulfill their TRIPS obligations concerning plant variety protection, while also upholding the essential legal space to acknowledge farmers' rights to traditional farming practices. Yet, it is doubtful how much legal space is left for the States to maneuver within the current international arrangement in order to allow the farmers to enjoy their rights to save, utilize, exchange and commercialize seeds.

4.2.2 Multilateral system (MLS) to facilitate access to plant genetic resources for food and agriculture

In order to achieve the goal of conserving and sustainably using plant genetic resources, the ITPGRFA facilitates the exchange of plant materials through a MLS to which its parties and their citizens

will obtain "facilitated access."[483] Essentially, the MLS is a shared seed treasury consisting of 29 feed plants 35 plants for food[484] currently under ‘‘the management and control of the contracting parties and in the public domain’’ are immediately incorporated into the MLS.[485] Plants held by the States, either *in situ* on public lands or *ex situ* in domestic seed banks, and by the *ex situ* collection of the Consultative Group on International Agricultural Research, automatically fall within the coverage of the system[486].[487] Such shared materials must be utilized solely for the aims of use and preservation for research and development, plant propagating and training for food and agriculture.[488] In other words, the MLS excludes the utilization of plant genetic resources for other objectives, such as chemical, pharmaceutical or non-food uses.

The concluding text of the treaty expresses the opinions of the vast majority of countries appearing at the FAO Conference, setting forth the first condition for gaining access to MLS.[489] Specifically, article 12.3(d) provides that facilitated access to the plant germplasms encompassed in the multilateral system will be allowed only if the receiving countries would not grant any intellectual property rights and other monopoly rights over biological resources for food and agriculture derived from the system, including their genetic parts and components, in the version obtained from the system. As a consequence of this provision, not only would this Article bind the States to the obligations under the treaty, the text of this Article would also be incorporated in the SMTA which every private party attempting to access to such multilateral system shall enforce.[490]

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[483] *ITPGRFA*, Article 10.
[484] Those 64 plants, to which MLS provides the access, are claimed to be the most significant plants for the purpose of ensuring global food security; Claudio Chiarolla, “Plant Patenting, Benefit Sharing and the Law Applicable to the Food and Agriculture Organisation Standard Material Transfer Agreement,” *The Journal of World Intellectual Property* 11 (2008): 4.
[485] *ITPGRFA*, Article 11.2.
[486] Specifically, the Tropical Agricultural Research and Higher Educational Center (CATIE), along with other 11 CGIAR Centers, has entered into agreements with the ITPGRFA Governing Body, through which they have deposited their genetic resource collections within the MLS; UNEP/CBD/GTE-ABS/1/3/ADD2.
[487] *ITPGRFA*, Annex I;
[488] *ITPGRFA*, article 12.3(a).
[489] Helfer, "Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments," 88.
[490] *SMTA*, Article 12.4.

4.2.2.1 Implementation of benefit-sharing requirement under MLS

For the purpose of gaining the access to this communal genetic pool, those who develop commercial plant innovation incorporating resources derived from the MLS must share some percentage of their benefits to the fund administered by the Governing Body of ITPGRFA. The fund will be utilized for the purposes of protection and sustainable utilization of plant resources, specifically by groups of farmers and indigenous peoples, whose contributions to biological diversity and their rights are explicitly guaranteed by the treaty.[491]

The ITPGRFA sets forth the degree, form and methods of fair and equitable benefit-sharing to be implemented through the international standard agreement, namely SMTA. Under this international standard contract, the recipients can freely transfer received genetic resources to the third parties without prior informed consent from the resource providers; nevertheless, they are obligated to make sure that those third parties follow the standard requirements provided under the SMTA.[492] In other words, during the plant development chain, the SMTA mechanism makes sure that obligations concerning benefit-sharing are passed onto any third person or entity that further develops plant innovations based on germplasms received from the MLS.[493]

Benefit-sharing under this treaty is not restricted to monetary form;[494] consequently, the SMTA has established the guidance for non-monetary benefit-sharing,[495] while encouraging recipients to voluntarily offer to the trust fund under the auspices of the FAO.[496] Moreover, the treaty allows the users of SMTA to choose between compulsory payment scheme or the alternative payment scheme.

a. Compulsory Benefit-Sharing

[491] Mekouar, "A Global Instrument on Agrobiodiversity: The International Treaty on Plant Genetic Resources for Food and Agriculture," 5-10.
[492] *ITPGRFA*, Article 12.4 states that ''the recipient of PGRFA shall require that the conditions of the MTA shall apply to the transfer of PGRFA to another person or entity, as well as to any subsequent transfer of those PGRFA''.
[493] *SMTA*, Article 6.10.
[494] B. Visser et.al., "Options for Non-Monetary Benefit-Sharing - An Inventory," *Background Study Paper 30. FAO Commission on Genetic Resources for Food and Agriculture*, (2005): 5.
[495] *SMTA*, Article 6.9.
[496] *SMTA*, Article 6.8.

When some legal conditions are satisfied, compulsory sharing of benefits of 1.1% of the total incomes generating from the sale of plant innovations must be offered to the MLS.[497] The first condition is that such a commodified product[498] incorporates the plant genetic material derived from the MLS or its part and component.[499] Despite the lack of definition provided by the SMTA, this incorporation requirement is interpreted by many scholars to include the "progeny"[500] and "unmodified derivatives"[501] of the derived genetic materials.[502]

The second condition is that the product derived from MLS is no longer freely accessible for further research, development and breeding.[503] To put it another way, the condition requires some form of legal restrictions on such product by intellectual property systems, restrictions obtaining from specific technologies, including Genetic Use Restriction Technologies (GURTs)[504] or some practices of licensing.[505] Hence, Article 6.7 of the SMTA not only seems to legitimize the intellectual property rights

[497] *SMTA*, Article 6.7.
[498] *SMTA*, Article 2, defines that ''product'' shall exclude products other than plant genetic resources for food and agriculture and those utilized for fodder and processing. Therefore, the commercialization of bulk items ''sold or traded as commodities'' does not fall within article 6.7. For instance, the commercialization of grains as reproductive materials would be considered as products under article 6.7 while the trade of flour acquired from such grains would be irrelevant.
[499] *SMTA*, Article 6.11; The SMTA does not gives any clear definition to ''material''. Therefore, it is not certain if this term solely covers the transferred materials or also implies progeny of such material, as well as its unmodified derivatives.
[500] "Progeny" generally refers to every descendant from the genetic material which has not been modified.
[501] "Unmodified derivatives" refer to every substance which is developed by the recipient and constitutes "an unmodified functional subunit or product not changed in form or character and expressed by the provided material". Hence, this term may cover genetic components or gene sequences derived from the MLS materials through way of isolation and purification.
[502] Chiarolla, "Plant Patenting, Benefit Sharing and the Law Applicable to the Food and Agriculture Organisation Standard Material Transfer Agreement," 5.
[503] *SMTA*, Article 6.11.
[504] GURTs, commonly recognized as suicide seeds or terminator technology, is the methods for limiting the utilization of transgenic plants by, for instance, making second generation of seeds to be infertile. The utilization of this technologies has been recently discussed in many international stages. More information available at: https://www.cbd.int/agro/gurts.shtml [Accessed December 2017].
[505] For example, the practice of Monsanto to license its own developed technology for insect resistance, namely Bollgard or Roundup Ready cotton, to producers, who are obligated to sublicense such technology to their customers with some further limitations. Specifically, the purchasers are not allowed to save those high-tech seeds or give to the third parties or to plant another kind of crop. Purchasers cannot also conduct research on those seeds; Patent Litigation "Monsanto's Patent and License Agreement Again Upheld," *Biotechnology Law Report* no.5 (2006): 564–67.

over plant inventions which incorporates genetic resources derived from the MLS, but it also creates an obvious link between the plant patent protection and benefit-sharing.[506]

b. Alternative Payment Scheme

In practice, the development, as well as commercialization of a plant innovation, may take up to 10 years or more.[507] Thus, the compulsory payments might take a long time before being received. To solve this problem, the alternative payment scheme provides that recipients may choose at their will to make "crop-based" payments, where the developing product is still available for further research and breeding without intellectual property restriction, at a lower rate according to article 6.11 of the SMTA.[508]

The recipients are, therefore, encouraged to select this option owing to two principal reasons. First, the rate of payments is markedly lower than that of the compulsory scheme set forth under article 6.7. Second, the recipients only have to satisfy a single benefit-sharing obligation, regardless of how many agreements they have concluded, because Article 6.11(f) clearly sets forth that the recipients can be relieved of making payments under compulsory benefit-sharing scheme under Article 6.7 and will also be discharged from payments under any former or subsequent SMTA concluded in regard to the identical crop.[509] This scheme can guarantee an immediate flow of monetary resources to the MLS.[510] In addition, it can boost transparency while reducing the costs of monitoring which would in turn pave the way to promote voluntary contributions. The validity term of this alternative is 10 years.[511]

4.2.2.3 Enforcement and settlement of dispute

[506] *SMTA*, Article 5(d), clearly requires the parties to respect intellectual property rights, as well as other property rights.
[507] Chiarolla, "Plant Patenting, Benefit Sharing and the Law Applicable to the Food and Agriculture Organisation Standard Material Transfer Agreement," 6.
[508] *SMTA*, Article 6.11(d), provides that payments under alternative payment scheme are discounted by 0.5 percent of the total sales of propagating materials associated with the identical plant species derived from the MLS. For instance, in case the recipient obtains access to rice, payments will be calculated based on his or her total rice sales.
[509] *SMTA*, Article 6.11(f) and Appendix 3.5.
[510] Food and Agriculture Organization of the United Nations [FAO], *Working Group on the Drafting of the Standards Material Transfer Agreement, African Proposal*, CGRFA\IC\CG-SMTA-1 (21 July 2005).
[511] *SMTA*, Article 6.11(b).

During the period of SMTA negotiations, the States parties to the ITPGRFA concluded that providers of plant genetic resources may not have the capacity and the willingness to monitor and to enforce compliance by receiving parties with the SMTA terms.[512] This is due to the fact that the benefits would be granted to the MLS, not to the providing States which are the real sources of the genetic materials. Moreover, recipients may later on agree to transfer genetic resources received from the MLS to third parties who might not have contractual relationship with the providing States. Therefore, the reference to the FAO as the "third party beneficiary" provides an institutional solution to the matters of capacity to monitor and compliance.[513] This unique characteristic of the SMTA has never pre-existed in international law.[514]

As third-party beneficiary, the FAO has the right to act as a legal person representing the Governing Body of the ITPGRFA when a dispute settlement is required.[515] Simply put, the FAO is vested with the legal capacity to engage in a lawsuit and to monitor rights and interests under the MLS. Nonetheless, the validity of a third-party's beneficiary's rights *per se* must be recognized by the substantive law applicable to the SMTA to be enforceable.[516] No domestic law in any country recognizes the rights of third parties in contract; however, *the UNIDROIT Principles of International Commercial Contracts* (UNIDROIT Principles) obviously guarantee that the parties to a contract can freely transfer

[512] Food and Agriculture Organization of the United Nations [FAO], *Food and Agriculture Organization Commission on Genetic Resources for Food and Agriculture, Report of the First Session of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture*, Appendix G.,IT/GB-1/06/Report (12–16 June 2006).
[513] FAO Resolution 2/2006, *The Standard Material Transfer Agreement*, paragraph 8.
[514] In a presentation to the Council of UPOV, the FAO described it as "the unusual situation of payments to an international body administering a global pooled good, as the result of a contract under private law" (Stannard, 2006).
[515] *SMTA*, Article 8.1 and 8.2.
[516] The substantive applicable law refers to *lex causae* or the law chosen by the court of forum as a basis to make judgment on substantive matters.

rights to a third party.[517] As a result, it is not unexpected that the SMTA, Article 7, regards the UNIDROIT Principles as one of the sources of applicable law.[518]

The dispute settlement process provided under the SMTA is established in a number of sub-options involving some steps. Failure to amicably settle the dispute through mediation, the parties to SMTA can submit the dispute on the agreement's terms to an international arbitral tribunal.[519] The respective parties to the agreement can freely choose the arbitrators under "the arbitration rules of an international body".[520] Nonetheless, in case they cannot agree on this matter, *lex arbitri* shall be the Rules of Arbitration of the International Chamber of Commerce (ICC).[521] The award of such arbitration is binding to the parties.[522] In other words, the procedures of the arbitral tribunal shall be regulated by the ICC as per its arbitral standards. In addition, the joined use of this arrangement with an obvious choice of law provision guarantees that the SMTA is deciphered and applied in an identical way crosswise over various locales.[523] Particularly, the 1958 New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards (the New York Convention) obligates the domestic courts of its contracting parties to recognize arbitral agreements concluded in writing and to deny the recourse to domestic courts when the disputes are clearly subject to an arbitral agreement. Accordingly, the litigation before national courts are mostly excluded in the case of disputes associated with the SMTA.[524]

As for the law applicable to substance, the SMTA, Article 7, stipulates that the substantive applicable law shall be General Principles of Law and the 2004 UNIDROIT Principles of International Commercial Contracts, as well as the purposes and the related provisions of the ITPGRFA and the

[517] *UNIDROIT Principles,* Articles 5.2.1 and 5.2.2.
[518] [518] Food and Agriculture Organization of the United Nations [FAO], *Food and Agriculture Organization Legal Office, Third Party Beneficiary, Including in the Context of Arbitration*, CGRFA/IC/CG-SMTA-2/06/Inf.4. (24–28 April 2006).
[519] *SMTA,* Article 8.4.
[520] Ibid.
[521] Ibid.
[522] Ibid.
[523] Gerald Moore, "International Arbitration," *Commission on Genetic Resources for Food and Agriculture Acting as Interim Committee for the International Treaty, Background Study Paper No. 25*.
[524] Nevertheless, uncertainty may occur in case SMTAs are not agreed in writing form such as the cases of shrink-wrap or click-wrap agreements, and in case the SMTAs are not enforced in the non-member States to the New York Convention.

decisions of the Governing Body. Hence, an essential part to note here is that the provision on choice of law only mentions international standards, without referring to any national law. Such reference is commonly seen in international commercial arbitration.[525] This is because those international standards have been viewed as an impartial avenue, while choosing a specific national law may be unacceptable by some parties. The SMTA is, in fact, the first established case of an international commercial contract directly referring to international standards.

4.2.3 Intellectual Property Provisions of the ITPGRFA

The ITPGRFA is established based on the concept of open access of plant biological resources; therefore, there are some tensions arising with respect to the legal regimes granting monopoly rights over those resources. The drafters of the treaty took these tensions into account, and the matter of intellectual property rights over plant genetic resources was, in fact, one of the most controversial during the negotiations on the treaty. At the same time, the drafters acknowledged that the ITPGRFA could not possibly operate if private sectors were not allowed to develop and commodify derivative products utilizing raw germplasm derived from the system. The reason is that solely through commercialization could profits be generated to support the Fund established by the treaty. In contrast, in case the components of the materials under the MLS could be commercialized through intellectual property right systems, the MLS itself might fail to meet the objectives of the treaty.[526]

4.2.3.1 Controversy over the Patentability of Isolated and Purified Forms of Plant Germplasms

As above mentioned, article 12.3(d) provides that facilitated access to the plant germplasms encompassed in the multilateral system will be allowed only if the receiving countries would not grant any intellectual property rights and other monopoly rights over "genetic parts and components" for food

[525] Anonymous, "General Principles of Law in International Commercial Arbitration," *Harvard Law Review*, 101 no.8 (1988): 1816–34.
[526] Lawrence R. Helfer, "Regime Shifting: The TRIPs Agreement and New Dynamics of International Intellectual Property Lawmaking," *Yale Journal of International Law* 1, no.29 (2004): 40-41.

and agriculture "in the form obtained from the system," including their genetic parts and components, in the version obtained from the system. There are two main components provided in this article, "their genetic parts and components" and "in the form obtained from the system", these were put in different brackets at the time of negotiations.[527] Developing countries opposed intellectual property protection and tried to keep the first component and get rid of the second; meanwhile, the United States wished the first component be deleted and retain the second one. [528] Eventually, both elements were kept after the United States lost majority voting.[529] The whole treaty was, later on, adopted by a majority vote of 116 for, zero against and two abstentions by the United States and Japan.[530] This controversy illustrates some of the difficulties to reach compromise between State parties. The crucial problem here is whether the extraction of a plant gene from a seed is considered an adequate modification of the biological material such that the extraction is not viewed as still in the version obtained from the MSL.

Some commentators view that this Article's exclusion on intellectual property rights covers only raw genetic materials and is therefore not extended to plant genes or fragments of DNA isolated and purified; as a result, isolated and purified forms are sufficiently altered from the raw materials and are not covered by this Article.[531] However, some commentators support expansive interpretation, insisting that this Article allows plant breeders to use exchanged plant materials, extract genes for commercial purposes, insert those genes into plants or plant varieties, and obtain an intellectual property protection either *on the whole plant, plant variety* or on the extracted and purified genes "as adapted to the new varieties."[532] In accordance with this view, the raw genetic materials, as well as its components, would remain in the MLS available for others to exploit them. None of the treaty interpretation and domestic laws are likely to answer this question. Moreover, as the ITPGRFA and the SMTA do not define the

[527] Helfer, *Intellectual property rights in plant varieties: International legal regimes and policy options for national governments*, 88.
[528] Earth Negotiations Bulletin, "A Reporting Service for Environment and Development Negotiation" *the International Institute for Sustainable Development* 11, no.44 (2001): 8.
[529] Ibid.
[530] Ibid.
[531] Helfer, *Intellectual property rights in plant varieties: International legal regimes and policy options for national governments*, 89.
[532] ETC Group, "the Law of the Seed," *ETC Translator* 3, No. 1 (2001): 4.

terms "genetic parts" and "components," it is difficult to evaluate if patent protection on the "progeny" and "unmodified derivatives" of received materials is permitted.

After the ITPGRFA came into effect in 2004, this Article can be interpreted through two channels. Firstly, the Governing Body of the treaty may request advice from intergovernmental organizations such as WIPO or the TRIPS Council. Secondly, a controversy over the interpretation of the treaty can be settled by arbitration or by *the International Court of Justice* (ICJ) in case the relevant parties have agreed upon one of these dispute settlement mechanisms.[533] Whether or not the Governing Body will seek harmonization of the interpretation with intergovernmental organizations or dispute settlement bodies are still not certain at the moment. This leads to the issues on how international bodies cooperate or go up against each other in the attempt to create international legal norms.[534]

4.2.3.2 The Relationship between the ITPGRFA of the FAO and TRIPS Agreement of the WTO

Regardless of the way of interpretation which the Governing Body of ITPGRFA would finally take, the treaty establishes the possibility for conflicts with the TRIPS Agreement, TRIPS-plus the standard provided under the FTAs or RTAs and domestic intellectual property regimes. To cope with such possibilities of any conflict, the drafters of ITPGRFA only provide ambiguous text regarding the relationship of the treaty with other international agreements by providing that the provisions of the ITPGRFA should not be construed as indicating an alteration in the rights and obligations of the member States under other treaties in any way or to be seen as setting a hierarchy between those agreements.[535]

The potential conflicts between the ITPGRFA with other intellectual property agreements particularly tends to occur within the states which grant patent protection to isolate and purify plant genes. The extensive interpretation of this Article might bring about the tension with the domestic patent laws of those states allowing patentability on plant genetic resources which have been isolated and purified by

[533] ITPGRFA, Article 22.
[534] Victor Mosoti, "Institutional Cooperation and Norm Creation in International Organizations" in *Human Rights and International Trade*, ed Thomas Cottier, Joost Pauwelyn, and Elisabeth Bürgi, (Oxford Scholarship, 2005), 165-179.
[535] *ITPGRFA*, Preamble, paras. 10 and 11.

human efforts or created by some technical processes. If such countries ratify ITPGRFA, they might need to follow the obligation to abstain from awarding patents on genes extracted from genetic materials received from the MLS. To comply with this obligation, it might be necessary for those countries to amend their domestic patent laws.

As for the benefit-sharing provision of the ITPGRFA, the conflict might spring from the notion that any person who commercializes the products developed from genetic materials derived from the multilateral system has to pay "an equitable share of the benefits arising from the commercialization of that product."[536] This creates an obligation with respect to patents on biotechnology not required by any other type of patents. As a consequence, it might run counter to Article 27.1 of the TRIPS Agreement, requiring the WTO members to provide patent protection without discrimination with regard to the field of technology.

Taking into account the *Canada – Patent Protection of Pharmaceutical Products* case, the WTO dispute settlement body provides that a neutral provision provided under Canadian patent law, which applied solely to pharmaceutical products, did not violate the patent non-discrimination principle under Article 27.1 of the TRIPS Agreement.[537] The dispute settlement panel evidently avoided deciding on the issue of whether mechanisms which are restricted to a single field of technology are considered "discriminatory" owing to that basis alone, or if under some situations they may qualify as special mechanisms necessary to reinforce equality of treatment to a particular field of technology.[538] At the same time, some critiques view that the TRIPS Agreement does not forbid its members from imposing fees or levies affiliated with the enjoyment of intellectual property rights, taking those commonly imposed by

[536] *ITPGRFA*, Article 13.2(d)(ii).
[537] World Trade Organization [WTO], Canada - Patent protection of pharmaceutical products, WT/DS114/R (17 March 2000).
[538] Ibid, para. 7.105.

domestic patent offices as examples.[539] Therefore, it is not obvious if the TRIPS Agreement obliges that fees or levies be, to a large extent, equivalent for every kind of technology.

Chapter V: Comparative Studies between the Approaches by the United States, the European Union and India

The TRIPS Agreement evidently allows the WTO members to preclude plants, animals and essentially biological processes from patent protection while obligating them to provide patent protection for microorganisms and non-biological and microbiological processes. Also, every WTO member is obliged to provide some form of plant variety protection. Obviously, the Agreement permits the members to use extensive discretion to devise their national law with respect to this particular subject matter. Accordingly, different approaches have been adopted by the WTO member states according to their national policies.

This Chapter investigates the different legal approaches governing plant inventions adopted three main jurisdictions, as well as their historical development and the impacts of these national or regional mechanisms. The United States takes a liberal approach by allowing plants to be protected by either the plant patent system, the utility patent system or the plant variety protection system without special provision to govern the grey areas where more than one form of protection may apply to a single plant variety. The European Union takes a modified approach by allowing a patent on plants but excluding plant variety from patentability. In the meantime, the European Union also establishes the plant variety protection system adopted from the UPOV regime, with some special mechanisms to address the interface problems of the two systems. Lastly, India was chosen as a prime example of a country adopting a restrictive approach by apparently excluding plant innovations from patent protection, while creating a *sui*

[539] R.J.L. Lettington, "The International Undertaking on Plant Genetic Resources in the Context of TRIPs and the CBD. Bridges: Between Trade and Sustainable Development," *International Center for Trade and Sustainable Development* 5, No. 6 (2001): 11.

generis plant variety protection system in the same manner as many developing countries, including Thailand.

5.1 The Approach of the United States

By way of plant phenology modification and the incorporation of genes with disease resistant traits, plant breeding in the United States has greatly improved in terms of both quality and quantity.[540] After World War II, an agro-industrial food system has emerged in this country, "rural America has been adjusting itself…in an effort to meet the priorities and expectations of the nation as articulated by metropolitan political and economic elites. Central among these has been the goal of establishing a stable, highly predictable, generally healthful, and cheap food-supply system that would meet the needs of a burgeoning urban-industrial and now postindustrial population."[541] The most significant goal of farm policy after World War II has been to establish an agricultural sector that is similar to manufacturing industries in their effectiveness and mass productivity.[542] Plant breeders have played significant roles in this agricultural transformation, caused by the enhanced scientific knowledge due to discoveries of genes and DNA; At this time, intellectual property on plants was established as the private sector needed a reliable legal system to secure and recoup their monetary investment, as well as increasing profitability of their production.[543] For instance, plant breeders sought to improve a number of plant varieties being handled by machines in a vertically integrated production process.[544]

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[540] Keith E. Woeste, Sterling B. Blanche, Karen A. Moldenhauer, and C. Dana Nelson, "Plant Breeding and Rural Development in the United States," *Crop Science* 50 (2010): 1626.
[541] M.B. Lapping and M.J. Pfeffer, "City and country: Forging new connections through agriculture," in *Visions of American agriculture*, ed. W. Lockeretz (Iowa State Univ. Press, 1997), 91.
[542] Ibid.
[543] R. E. Evenson, "Intellectual property rights, access to plant germplasm, and crop production scenarios in 2020," *Crop Science* 39 (1999): 1630–1635; S. Smith, "Intellectual property protection for plant varieties in the 21st century," *Crop Science* 48 (2008): 1277–1290.
[544] D. S. Douches, D. Maas, K. Jastrzebski, and R.W. Chase, "Assessment of potato breeding progress in the USA over the last century," Crop Science 36 (1996): 1544–1552; J. D. Kelly, J.M. Kolkman, and K. Schneider, "Breeding for yield in dry bean (*Phaseolus vulgaris* L.)," *Euphytica* 102 (1998): 343–356; C. Finn and V.H. Knight, "What's going on in the world of *Rubus* breeding?" *Acta Hortic*. 585 (2002):31–38; Joe Bouton, "The economic benefits of forage improvement in the United States*," Euphytica* no.3, 154 (2007): 263–270.

Plants are the only life form for which the United States has evidently provided *sui generis* intellectual property protection. There are two Federal statutes which particularly grant exclusive monopoly rights to this subject matter of protection, namely *the Plant Patent Act of 1930 (PPA)*[545] and *the 1970 Plant Variety Protection Act (PVPA).*[546] In addition, the decision of the Supreme Court in the case of *Diamond v. Chakrabarty*[547], together with the *Ex Parte Hibberd case*[548], provides the extra alternative of being protected by a utility patent to for new plant inventions. The inventors in the United States have the chance of being granted protection through three different sets of intellectual property rights based on three different statutes. From time to time, these three mechanisms create overlapping protection.

After the adoption of plant intellectual property protection systems, together with the policy of "adapt or die" or "get big or get out" imposed by the USDA in the 1950s, some effects in relation to the transformation of the farming system could be detected. Firstly, it is obvious that the agricultural industry in this country is highly concentrated.[549] The dominance of the agricultural industry has posed some risks for food sustainability and inequality in terms of wealth in the food system.[550] In non-urban areas, even though some small farmers maintain their farms, their main income no longer comes from farming, but from other nonfarm professions.[551]

5.1.1 History and Types of Plant Intellectual Property Protection Systems in the United States

The protection of the rights of inventors by providing them with an exclusive monopoly right to their creations for a restricted period of time is guaranteed under the Constitution of the United States, and

[545] *The Plant Patent Act of 1930 (PPA) (35 U.S.C. 161-164).*
[546] *The 1970 Plant Variety Protection Act of 1970 (PVPA) (7 U.S.C. 2321 et seq.).*
[547] *Diamond v. Chakrabarty, 447* U.S. 303 (1980).
[548] *Ex Parte Hibberd, 227* USPQ 443 (PTO Bd. Pat. App.& Int. 1985).
[549] L. Lobao and C.W. Stofferahn, The community effects of industrialized farming: Social science research and challenges to corporate farming laws," *Agriculture and Human Values* 25 (2008): 219–240.
[550] B. D. McIntyre, H.R. Herren, J. Wakhungu, and R.T. Watson 2009, "Agriculture at a crosssroads: North America and Europe (NAE) report," *International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)* (2009).
[551] A. K. Mishra and C.L. Sandretto, "Stability of farm income and the role of nonfarm income in U.S. agriculture," *Review of Agricultural Economics* 24 (2002): 208–221.

patent protection has existed since 1790 in line with the Constitution.[552] Nonetheless, until the late 1920s, three elements were taken into account in order to weigh against plant patent and plant variety protection.[553] Firstly, the belief that plants were the products of nature and therefore could not be protected by patents under the general patent Act;[554] Secondly, the concept that a novel plant variety could not be sufficiently described in order to be in compliance with the disclosure requirements of the general patent Act;[555] and thirdly, the conclusion of legislature that plant breeding technology was not reproducible enough to create stable, uniform and true-to type plant material appropriate to obtain patent protection.[556] In addressing these concerns and other relevant matters, the courts, the Congress, and the United States Patent and Trademark Office (USPTO) have developed a series of deliberations which span almost six decades of argument about intellectual property protection for plants.[557]

5.1.1.1 The 1930 Plant Patent Act (PPA)

Before 1930, plant research and development generally depended on the federally funded program on agricultural research and the attempts of local plant breeders to create new disease-resistant, drought-tolerant, cold-tolerant traits of plant varieties which can be used for medicinal purposes; however, while these goals seemed essential to development in the agricultural sector, financial impetus for the private sector in the United States to create new plant innovations was not enough to cover their costs for research and development and to gain commercial profits.[558] When new propagating materials were in the hands of farmers or other plant breeders, such materials could be easily duplicated in a large quantities. The only chance for the private plant breeders to gain their financial reimbursement was through the sales prices of the first two or three years of reproductions after the initial availability of a

[552] Herbert Hovenkamp, "The Emergence of Classical American Patent Law," *Arizona Law Review* Vol.58 (2016): 263.
[553] U.S. Congress, Office of Technology Assessment, *New Developments in Biotechnology: Patenting Life* (Government Printing Office, 1989), 70.
[554] H. Thorne, "Relation of Patent Law to National Products," *Journal of the Patent Office Society* no. 6 (1923): 23.
[555] U.S. Congress, House Committee on Patents, *Plant Patents: hearings before the Committee* (U.S. Government Printing Office, 1930), 1-20.
[556] Ibid.
[557] U.S. Congress, Office of Technology Assessment, *New Developments in Biotechnology: Patenting Life*, 87.
[558] Philip G. Pardey et. al., "The evolving landscape of plant varietal rights in the United States," *Nat Biotechnol.* No, 31, 1 (2013): 25–29.

plant variety *per se*. The private sector, thus, sought to obtain greater remuneration through legislation governing plant protection to make up for their rising capital investments.[559]

As a result, Congress adopted the PPA in 1930. The PPA specifically provides the proprietary protection for novel and distinctive asexually propagated plant varieties which are not tuber-propagated varieties, for example, apples or roses which are commonly propagated by cutting parts of their stems rather than by planting seeds.[560] Tuber-reproduced crops, such as potatoes, were not included in the coverage of the patent protection since the part of the crop utilized for asexual reproduction was also the part utilized as food.[561] It, also, did not extend the scope of protection to a right to preclude third parties from propagating the protected plants by seeds. At that time, it was commonly believed that seeds did not have sufficient capability to duplicate true-to-form.[562] Two extra questions for obtaining plant patents were taken into consideration: if all plant species were natural products;[563] and if a comprehensive, written detailed disclosure of this type of invention was plausible.[564] In the establishment of the PPA, Congress reached the conclusion that the outcome of the work of the plant breeders actually assists nature and therefore could be protected by patent.[565] With respect to the latter question, the Congress acknowledged the existing problem of describing a plant variety in writing and, as a consequence, loosened up the requirement for a written description[566] by allowing it to be according to conventional botanical descriptions.[567]

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[559] U.S. Congress, Senate Committee on Patents, *Plant Patents, Senate Report No. 315* (U.S. Government Printing Office, 1930).
[560] *The PPA*, Section 161; asexually propagated plant varieties which are not tuber-propagated varieties refer to the plant genera asexually reproduced for commercial purposes by grafting or cloning techniques. Nevertheless, the PPA preclude potato and other tuber plants.
[561] "Protecting Plant Varieties in the US: Options," Plant Patent & Breeder Rights | Perennial Patent Co., accessed June 27, 2018, http://perennialpatents.com/utility-vs-plant-patents/.
[562] U.S. Congress, Office of Technology Assessment, *New Developments in Biotechnology: Patenting Life*, 71.
[563] H. Thorne, "Relation of Patent Law to National Products," *Journal of the Patent Office Society no.* 6, 23 (1923).
[564] U.S. Congress, House Committee on Patents, *Plant Patents: hearings before the Committee, Apr. 9, 1930* (U.S. Government Printing Office, 1930) 1-20.
[565] U.S. Congress, Senate Committee on Patents, *Plant Patents: Senate Report No. 315* (U.S. Government Printing Office, 1930).
[566] *The PPA*, Section 162.
[567] U.S. Congress, Senate Committee on Patents, *Plant Patents: Senate Report No. 315*.

The proponents of plant patents claim that the protection under the PPA was devised due to the changes in technologies related to plants, which had made plant breeders "inventors" of new plant innovations.[568] Also, at that time, phony peach disease had broken out in the United States, which had harmed the supply of peaches upon which the State of Georgia was largely dependent.[569] Moreover, their farmers also suffered from "chestnut blight" which had essentially wiped out the whole timber resource.[570] It was, thus, urgent for their plant breeders to reproduce plants with new disease-resistant traits to expand the scope of fruit crops and to reduce the impact of severity in weather patterns.[571]

The proprietary protection under the PPA is for a single plant variety, such as the rose "Peace", not a group of plant varieties possessing an identical trait, such as varieties of corn having a yellow kernel.[572] The protection also included cultivated sports[573], mutants and hybrids.[574] Moreover, it was still ambiguous as to whether the protection by plant patent also covered plant parts such as cuttings, flowers, and fruits, which may be the practical commercial elements of the plant variety, but might not necessarily be capable of asexually duplicating. However, later on, the 1998 Amendments Act of the PPA defined explicitly that the Act also protects the holder of a plant patent against the use of plant parts taken from plants reproduced illegitimately without the permission of the right holder.[575] In other words, a plant patent not only grants the exclusive rights to preclude others from asexually duplicating the protected plants, it also precludes the third parties from using, offering for sale, or selling any of their parts, within this country, or from importing such items into the United States. The exclusive rights are authorized for a

[568] Cary Fowler, "The Plant Patent Act of 1930: A Sociological History of its Creation," *Journal of Patent & Trademark Office Society* 621 (2000): 621.
[569] U.S. Congress, Office of Technology Assessment, *New Developments in Biotechnology: Patenting Life*, 71.
[570] Ibid.
[571] Ibid.
[572] *The PPA*, Section 161.
[573] The term "cultivated sport" refers to a mutation of plant, caused by a faulty chromosomal replication. The outcomes of such a mutation are a division of the plant distinctly differs from the parental lines in both phenotype and genotype.
[574] Ibid.
[575] *The PPA*, Section 163

term of twenty years from the date of filing the application, not from the date of issuance, as in the manner as the plant variety certificates.[576]

In order to obtain protection, the Act requires general eligibility requirements of patentability, i.e., novelty and non-obviousness, which are more rigid than those provided under the UPOV Convention.[577] Additionally, naming requirements are more particular than that of the UPOV system in compliance with *the 1980 International Code of Nomenclature for cultivated Plants*.[578] Furthermore, it is worth noting that plant deposit is not obligated under PPA.

5.1.1.2 The 1970 Plant Variety Protection Act (PVPA)

Between 1930 and 1970, the development of new sexually-reproduced plants such as non-hybrid varieties which are pure lineage and true breed were carried out by plant breeders at agricultural experiment stations of the State.[579] Since it has become commonly accepted that sexually reproducing plants can duplicate true-to-form, private industry sought more capital impetus to invest in new non-hybrid cultivars' research and development.[580] At the time, the role of private plant breeders was generally limited to corn and sorghum varieties, of which the commercial products are hybrids.[581]

In addition to the purpose of securing private investment in creating improved sexually reproduced varieties, some events occurring at an international level influenced the deliberations of the United States to protect plants which can be sexually reproduced.[582] In 1961, the International Union for the Protection of New Varieties of Plants (UPOV) was created by a number of the European countries to

[576] *The PPA*, Section 161
[577] Ibid.
[578] *The International Code of Nomenclature for Cultivated Plants* was firstly entered into force in 1953 and was amened in 1995. This Code provides that the first legitimately publicized name for a specific plant is the one assigning this plant; Chris Brickell and Piers Trehane, "The Royal Horticultural Society Advisory Panel on Nomenclature and Taxonomy" *The New Plantsman no.*4, 2 (1997): 115-119.
[579] U.S. Congress, Office of Technology Assessment, *New Developments in Biotechnology: Patenting Life*, 72-73.
[580] Jim Chen, "The Parable of the Seeds: Interpreting the Plant Variety Protection Act in Furtherance of Innovation Policy," *Notre Dame Law Review no.1*, 81 (2005): 127.
[581] United States Department of Agriculture, Seed Industry Structure Is Characterized by Growth and Consolidation/ AIB-786," *Economic Research Service*, 25.
[582] U.S. Congress, House Committee on Agriculture, *Plant Variety Protection Act, House Report No. 91-1605* (U.S. Government Printing Office, 1970).

provide plant variety protection. The majority of these countries had established national laws guaranteeing legal protection to commercial plant breeders, yet the United States still does not have such a law in place, except for the protection of asexually reproduced plants under the PPA. The concern that national agriculture and their breeders would not be able to compete in international seed markets led to the decision to provide intellectual property protection for sexually reproduced plants.[583] Following a 1968 failed attempt to extend the scope of protection of the PPA to sexually reproduced plants, the PVPA was enacted in 1970 to encourage the creation of new, sexually reproduced crops by creating a monetary impetus for private corporations to handle the costs and risks existing in breeding new plant varieties, as well as hybrids.[584]

a. Eligibility Requirements

In accordance with the UPOV Convention, plant varieties protected under this Act must be novel, uniform, stable and distinct from other plant varieties.[585] To be regarded as novel, a plant variety, in general, must not have been marketed in the State for over one year before the date of the filing of the application, or over four years in other States (six years if such variety is a tree or vine).[586] Notably, the Plant Variety Protection Office does not conduct trials to make sure that the claimed plant variety satisfies the criteria for protection; the applicants must therefore point out the most similar plant variety and then differentiate the two plant varieties as to their genetic information and morphologies.[587]

b. Rights Conferred by the Act and Limitations

The holder of the plant variety protection certificate can enjoy the rights to exclude others from selling, offering for sale, marketing, conditioning or stocking the protected varieties or reproducing,

[583] Jorge Fernandez-Cornejo, "The Seed Industry in U.S. Agriculture: An Exploration of Data and Information on Crop Seed Markets, Regulation, Industry Structure, and Research and Development" *Agricultural Information Bulletin No. (AIB-786)* (2004): 25.
[584] Ibid.
[585] *The PVPA*, Section 42(a).
[586] Ibid.
[587] Muriel Lightbourne, "Plants and intellectual property rights in the US, Japan and Europe," *IIP Bulletin* (2005): 78-79.

importing or exporting a protected plant variety, or utilizing it to obtain a hybrid.[588] The term of protection is 20 years or 25 years in the case of trees and vines from the date of certificate issuance.[589] Any person who actively induces another to conduct such acts is also held responsible for infringement.[590] The exclusive rights under this Act are extended to cover EDVs and indistinct varieties, as well as harvested materials derived from the unauthorized utilization of propagating materials of a protected cultivar, unless the rights holder has already had a chance to exercise his or her rights as regards the propagating material.[591]

Two significant limitations to the right holders are provided under the PVPA. Firstly, a plant breeder cannot preclude others from utilizing the protected plant varieties to develop new plant varieties (breeders' exemption).[592] However, according to the 1994 amendment, the breeders' exemption has been limited not to cover EDVs.[593]

Secondly, farmers can enjoy the farmers' rights. Any person whose main occupation is growing plants for sale for other than the purpose of reproduction is allowed to save the protected seeds and utilize such seeds in the production of plants on their own farm.[594] Farmers are eligible to sell the protected seeds to other individuals whose main occupation is also growing plants; nevertheless, the 1994 amendment to the PVPA has restricted the farmers' rights in line with the 1991 UPOV Convention.[595] As a consequence, even though farmers are still permitted to save the protected materials for utilization on their own holdings, they can no longer sell protected seeds to others whose main occupation is farming.[596]

It should be noted that this farmers' exemption has been subjected to the interpretation of the Court. For instance, in the case of *Delta and Pine Land Co. v. Peoples Gin Co.*, the court interpreted that

[588] *The PVPA*, Section 83 (a).
[589] *The PVPA*, Section 83 (b).
[590] *The PVPA*, Section 111 (a)(10).
[591] *The PVPA*, Section 111 (c); This Section adopted "cascading principle" in the identical manner as the 1991 UPOV Convention.
[592] *The PVPA*, Section 114.
[593] Ibid.
[594] *The PVPA*, Section 113.
[595] Ibid.
[596] Ibid.

the farmer's exemption is not applicable to both nonprofit agricultural cooperative arranging the sales of a proprietary cultivar nor to a corporation which dispenses the proprietary cultivar without notifying about the protected cultivar.[597] The court also added that any intervention by such a cooperative or corporation as a broker or sales agent would go against the fundamental objective of the PVPA since it was bigger in size than just a sole farmer and more aggressive.[598]

5.1.1.3 Utility Patents

In 1980, the *Diamond v. Chakrabarty* case provides clearly that living organisms, specifically micro-organisms, are patentable subject matters.[599] Later on, in 1985, the case of *Ex Parte Hibberd* case guarantees that plants, as well as seeds, tissue cultures, hybrid plants, hybrid seeds, and processes for plant production, can be patentable under 35 U.S.C. section 101 although such specific plants can be protected under the PVPA at the same time.[600] The Terminator patent is a clear instance of a utility patent on plant as it protects the method utilized in making Terminator plants, including the seeds and plants which are reproduced.

Moreover, this case was the first time the issue of cumulative protection with *sui generis* intellectual property protection systems provided particularly for plants were addressed. In this case, the examiner of the USPTO upheld that, even though life forms made by human, including plants, were patentable subject matters under 35 U.S.C. section 101 according to the *Diamond v. Chakrabarty*, plants were not included under the scope of utility patent protection by the prior establishment of the PPA and the PVPA. The main reason was that the PPA and the PVPA, which are the exclusive types of plant intellectual property protection, stipulate how and under what circumstances plants should be protected.[601] However, the Board of Patent Appeals and Interferences (BPAI) did not agree with the USPTO and

[597] *Delta and Pine Land Co. v. Peoples Gin Co.*, 694 F.2d 1012 (5th Cir.1983).
[598] Ibid.
[599] *Diamond v. Chakrabarty*, 447 U.S. 303 (1980).
[600] *Ex Parte Hibberd*, 227 USPQ 443 (PTO Bd. Pat. App.& Int. 1985). The claims in this case were related to the isolated and manipulated corn mutant acquired from cultured tissue of a hybrid corn line with the special abilities of self-regeneration and heritability.
[601] Ibid.

claimed that the entire plants, plant varieties, seeds, and tissue cultures, could be protected by utility patent and that the availability of a specific type of intellectual property protection does not exclude the possibility of protection by another type.[602] Since the *Ex parte Hibberd* case, plants thereafter have been accepted to be patentable subject matters under 35 U.S.C. section 101 governing utility patents.

This decision was affirmed by the Supreme Court in the *J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred International Inc.* case,[603] rendered in 2001. Based on the decision in *Chakrabarty*, this decision stipulates that "the relevant distinction was not between living and inanimate things, but between products of nature, whether living or not, and human-made inventions."[604] The Court further notes that it has previously given force to two interfacing statutes; as long as each statue may reach some different cases, and that both of the PPA and the PVPA do not contain any language of exclusivity.[605] While 35 U.S.C. section 101 is a non-exhaustive provision devised to cover novel and unanticipated innovation, the coverage plant patents under the PPA is very limited and the requirements to obtain proprietary protection are less rigid than those of utility patents.[606] As a consequence of this case, in the United States, it is possible for a plant variety to be protected by more than one intellectual property systems, depending on the types of plants and inventions.

With regard to exemption to patent rights, the patent Act, as well as common law doctrine, does not provide for any applicable statutory research exemption permitting a third party to override the exclusive rights bestowed on patent owners. The sole statutory limitation in the law of the United States is provided under *the 1984 Waxman Hatch Act*[607]; nevertheless, this limitation is particularly provided for experiments conducted on drugs and medical instruments for the purpose of getting an approval from the

[602] Ibid.
[603] *J. E. M. Ag Supply, Inc. v. Pioneer Hi-Bred International Inc.*, 534 U.S. 124 (2001).
[604] Ibid.
[605] Ibid.
[606] Ibid, Decision, II – A, paragraphs 5 and 9.
[607] *The 1984 Drug Price Competition and Patent Term Restoration Act* or *the 1984 Hatch Waxman Act* (*21 U.S. Code*, Section 355) is a federal law of the United States, aiming to encourage generic drug manufacture by the pharmaceutical companies and set up the generic drug regulation system in the United States.

Food and Drug Administration.[608] With respect to the jurisprudence of the United States, the Court of Appeals of the Federal Circuit held in the case of *Madey v Duke University* that

> Regardless of whether a particular institution or entity is engaged in an endeavor for commercial gain, so long as the act is in furtherance of the alleged infringer's legitimate business and is not solely for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry, the act does not qualify for the very narrow and strictly limited experimental use defense. Moreover, the profit or non-profit status of the user is not determinative.[609]

Hence, it is difficult to invoke the experimental use against the alleged breach of exclusive rights of patent holders over genetic materials utilized in a breeding program, notwithstanding its private or public nature. In this country, a license from the patentee is required for accessing to patented plant materials in any case.

5.1.2 Analysis on the Liberal Approach of the United States

As formerly explained, there are three forms of proprietary protection of plants in the United States: plant patent regime, the plant variety protection system, and utility patent. The interaction between these three systems according to the model of the United States does not create a problem in theory. *The principle of independence between various intellectual property right regimes*[610] is deemed adequate for maintaining a fitting harmony and balance between these regimes.[611] Accordingly, there is no particular provision addressing interface problems provided to regulate the possible conflict between different sets of intellectual property rights in the legal grey areas. Nonetheless, the acts allowed under one intellectual property system might be regarded as an infringement in another system, since the rights given are established under a different regime. This section compares three forms of intellectual property protection

[608] *21 U.S. Code*, Section 355 (i).
[609] *Madey v. Duke University*, 307 F.3d 1351 (Fed. Cir. 2002).
[610] The principle of independence between intellectual property rights systems is based on the presumption that those systems grant the owners only the right to exclude, meaning that all acts that evidently do not need prior permission from the owners can be performed without restriction as regards the subject matters of protection.
[611] Wu Handong, "Fundamental principles of the international protection system of intellectual property rights and the applications," *Front. Law China* 3(2006): 329-348; Claudio Chiarolla, "Commodifying Agricultural Biodiversity and Development-Related Issues*," The Journal of World Intellectual Property* 9 (2006): 34.

available to plant breeders, considers factors affecting the choice of protection form and looks into the impacts of these three systems on the United States from various aspects.

5.1.2.1 Comparison between Three Types of Plant Proprietary Protection in the United States

a. Plant Patents and Utility Patents

Benefits of holding a utility patent for an asexually reproduced plant are many. While a plant patent is only restricted to a single claim; a utility patent does not have such limitations.[612] Furthermore, unlike a plant patent system, a utility patent system does not require an infringing plant to be asexually reproduced; as a result, it covers sexual reproduction of the patented plant variety.[613] Lastly, the coverage of a utility patent also extends to any plant encompassing a patented gene, not a mere single plant variety incorporating such a gene.[614] Moreover, hybrids and the processes of plant breeding and development precluded from the scope of the PPA can be protected.[615] As a result, it is possible for a plant breeder to obtain many forms of intellectual property protection on an identical plant invention. For instance, in the case of the invention concerning the treatment of orange trees which makes every fruit ripen on the same day for harvest, the whole orange tree can be patented under the utility patent system, and a particular orange variety can be protected by plant patent system.

In this case of asexually reproduced plants, the issue concerning dual protection of a two plant intellectual property protection system and the period of two patents could only be addressed by a "terminal disclaimer," which refers to a mechanism whereby the holder of the patent denies a portion of the period of another set of intellectual property protection so that it can expire on the identical date as the other set of rights, and contracts that both patent rights will be enforceable in as much as they are commonly held.

[612] U.S. Congress, Office of Technology Assessment, *New Developments in Biotechnology: Patenting Life*, 76.
[613] Brian D. Wright, "Plant Genetic Engineering and Intellectual Property Protection," *Agricultural Biotechnology in California Series Publication* (2006): 1.
[614] Ibid.
[615] Ibid.

One disadvantage of utility patents for commercial plant breeders is that the disclosure requirement is stricter than that requested under the plant patent regime. In order to meet this requirement for utility patents, it may be necessary for plant breeders to place a sample of plant or seeds on deposit, relying upon whether the production of such plant can be sufficiently described by texts alone.[616]

b. Plant Variety Protection System and Utility Patents

In the identical manner as the case of plant patents, utility patents grant broader scope of protection for the same plants than that offered by the PVPA. Several features of utility patent coverage for plants which are sexually reproduced appear to be more advantageous to commercial plant breeders. First, hybrids are precluded from the plant variety protection system yet are considered patentable subject matters under the utility patent system.[617]Moreover, a broad extent of the scope of protection is another especially favorable position of utility patents over the PVPA. Utility patents can cover the entire plant, seeds, plant parts, genes, plants which have a particular physical characteristic, and processes for creating or improving new plant varieties and hybrids. In other words, a utility patent is not restricted to the particular plant variety described, but it can also protect other plant varieties which have the identical traits and functions.

Another pivotal distinction between these two systems is that utility patents do not accommodate farmers' exemption. Accordingly, in case any person other than the owner of the patent makes, uses, or sells the seeds for reproductive purposes, it is considered a breach of the rights of the utility patent's owner, subject to enforcement by the Court. Likewise, breeders' exemption does not exist under this system. Hence, the rights of utility patents' owners are infringed if a person utilizes his or her patented plant invention in developing a new plant variety or new hybrid.

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[616] Even though a deposit of seeds or plants is not necessarily obligated, such a deposit is one way of fulfilling the disclosure requirement of 35 U.S.C. § 112. In the case of *Enzo v. GenProbe*, the Federal Circuit ruled that deposit of a plant material in a public repository, together with written description was another way to fulfill the disclosure requirement and that the generic coverage of claims of patent would be that which one having ordinary skill in the art would believe the patent owner to possess depending on the disclosure, including genetic data attainable from such deposits; *Enzo Biochem, Inc. v. Gen-Probe Inc*., 296 F.3d 1316, 1326 (Fed. Cir. 2002), 1325-1327.

[617] *Ex Parte Hibberd*, 227 USPQ 443 (PTO Bd. Pat. App. & Int. 1985).

Moreover, any Federal agency cannot mandate compulsory licensing in case of a plant invention which is protected by a utility patent.[618] Meanwhile, under the PVPA, the Secretary of Agriculture may direct the holders of plant variety protection certificates to grant licenses to a third party in case the Secretary finds that such a license is needed due to the reasons concerning public interest.[619] The holders have the right to gain a reasonable sum of royalties but cannot refuse not to grant the license.[620]

On the contrary, a benefit of the PVPA over the utility patent system is that, the latter has a stricter disclosure requirement which may call for the deposit of the plants or seeds and such deposit is to be made publicly available once the utility patent is issued. Even though the PVPA requests a deposit of seeds, the current policy of the Plant Variety Protection Office is not to allow the major part of deposited seeds to be accessed by the general public.[621]

c. Plant Patents and Plant Variety Protection System

The PPA grants exclusive monopoly rights to plant breeders and farmers who discover, improve or create novel and distinctive plant varieties and asexually multiply them. On the contrary, the PVPA provides protection for those discovering improving or creating novel, uniform, stable, and distinct cultivars sexually propagated. The protection under these two systems, therefore, complement each other in protecting new plants varieties of asexually replicated through plant patents and sexually replicated by plant variety protection system.

A single cultivar may be granted both a plant variety certificate and a plant patent for a method of cloning or a mutant of such cultivar. When overlapping protection occurs, the acts restricted by the PVPA, but allowed by the PPA, can be performed, even in a case where a protected cultivar is asexually reproduced, provided that such acts are conducted with respect to a valid plant patent. Hence, an owner of

[618] Unlike the patent laws of the majority of the countries, the patent code of the United States does not contain a general provision concerning compulsory. Nonetheless, other national laws might have provisions allowing for the compulsory licensing such as the Clean Air Act, the Atomic Energy Act and the Plant Variety Protection Act.
[619] *The PVPA*, Section 44.
[620] U.S. Department of Agriculture, *Regulations and Rules of the Practices,* Section 97.700.
[621] Ibid.

a plant patent does not infringe plant breeders' rights, as long as such patent owner reproduces the respective cultivar asexually.[622] This important measure to coordinate between the two plant intellectual property systems, therefore, restricts the exclusive rights granted through the PVPA. The purpose of this mechanism is to avoid the obstructing of the improvement of further plant innovations.[623]

5.1.2.2 Factors affecting the Choice of Protection Form

Profitability and innovation in the seed and plant industries in the United States depend upon their competence to protect their inventions through the law. This section analyzes the factors generally taken into account when selecting the types of plant intellectual property protection systems since the different mechanisms of intellectual property protection are not equal in their value and utility for all stakeholders in the seed and agricultural industries. Opportunities for intellectual property protection differ with both the biology of different plants and legal grounds. Main elements to consider in deciding the forms of protection include types of crops, farmer's exemption, research exemption, litigation, compulsory licensing, and deposit.

a. Types of Crops

Intellectual property protection differs from plant to plant depending on the natural processes of reproduction, either sexually or asexually. If a type of plant can be reproduced both sexually and asexually, the type of plant intellectual property protection is chosen in accordance with the practical method by which the claimed plant is actually propagated. Plus, in the case of utility patents on plants, new processes to reproduce propagating materials can also be potentially patented.

b. Farmer's Exemption

The farmers' exemption is provided under the PVPA, reflecting traditional farming practices tracing back to the beginning of the United States' agricultural communities; these practices include

[622] U.S. Congress, Office of Technology Assessment, *New Developments in Biotechnology: Patenting Life*, 75.
[623] Lightborne, "Plants and intellectual property rights in the US, Japan, and Europe," 84.

maintaining seeds for next harvesting season, as well as exchanging seeds.[624] Particularly unique to the PVPA, the Act permits farmers to maintain protected propagating materials for farming and for sale to those whose main occupation is also farming.[625] This is the sole provision of the PVPA which has been under the interpretation of the Courts.[626]As a result of such exemption, farmers are able to compete, to a limited extent, straightforwardly with the seed industry which improved the plant varieties, in as much as the main occupation of the farmers is agricultural production. The practice of seed-saving was common for certain crops, such as cotton, soybeans and wheat.[627] In accordance with the 1986 USDA survey on plantings, only 54 percent of the soybean seeds grown in the fields of farmers was bought and only 60 percent of seeds of wheat grown was bought.[628]

Therefore, from the perspective of the private sector, intellectual property rights granted under the PVPA are regarded inferior to the exclusive rights granted by the utility patents and plant patents, and the overall impact of this exemption is that the PVPC owners will not profit as greatly as their plant variety is grown. [629] Some evidences express that seed industries prefer the protection through the utility patent due to this reason, but still they acknowledge that utility patents are,also not without a flaw.[630]

c. Litigation

Although the issue of litigation applies to every form of plant intellectual property protection, the consequence of this results in significant costs to initiate or to defend claims. A corporation should expect

[624] Ibid.
[625] *The PVPA*, Section 113, provides that "…a bona fide sale for other than reproductive purposes, made in channels usual for such other purposes, of seed produced on a farm either from seed obtained by authority of the owner for seeding purposes or from seed produced by descent on such farm from seed obtained by authority of the owner for seeding purposes shall not constitute an infringement…"
[626] U.S. Congress, Office of Technology Assessment, *New Developments in Biotechnology: Patenting Life*, 74.
[627] W. H. Isser, and R.T. Masson, *An Economic Analysis of the Plant Variety Protection Act* (American Seed Trade Association, 1985).
[628] U.S. Congress, Office of Technology Assessment, *New Developments in Biotechnology: Patenting Life*, 79.
[629] W. H. Lesser, "The Impacts of Seed Patents," *North Central Journal of Agricultural Economics* no. 9, 1(1987): 37-48.
[630] In 2005 to 2009, the protection of plant varieties through utility patents has dramatically increased. Specifically, the number of utility patents granted for corn and soybeans doubled that of plant variety protection certificates; GianCarlo Moschini, "Competition Issues in the Seed Industry and the Role of Intellectual Property," Agricultural and Applied Economic Association no.25, 2 (2010): 3.

to pay around USD3 to USD10 million for litigating crucial utility patents.[631] Not every patent on plant-related claim is able to commercially accommodate such costs. A regular corn, soybean or wheat variety may maintain profitability for only around half a decade to a decade, even though some of the irregular plant varieties, including Pioneer Hi-Bred 3780, could be sold for over two decades.[632] In the case of utility patent, it is reasonable to predict that for plants for which the profit margins are relatively small, or for plant varieties for which the overall market is narrow, the costs of litigation could be a substantial element in decision-making to obtain plant proprietary protection.

d. Research Exemption Under PVPA

Both the utility patent system and the PPA do not provide for an exemption on the research utilization of protected plant innovations. On the contrary, in order to protect public interest, plant varieties protected under the PVPA system can evidently be utilized for research purposes. Private corporations with programs on plant breeding research and development must take into consideration that their newly improved plant varieties under the PVPA system can be directly utilized, without reimbursement, in breeding programs by other researchers, farmers, plant breeders, including their competitors.

e. Licenses

Generally, licensing agreements are able to resolve patent lawsuits and increase profits; they are the core of intellectual property management, as well as proprietary protection of plants. One facet of licensing which is unique to plant protection is the compulsory licensing issued by the Secretary of Agriculture under the PVPA for the purpose of public interest.[633] Mainly, decisions whether to apply for

[631] World intellectual Property Organization [WIPO], "IP Litigation Costs," *WIPO Magazine* 1 (2010): 3-5.
[632] U.S. Congress, Office of Technology Assessment, *New Developments in Biotechnology: Patenting Life*, 79.
[633] *The PVPA*, Section 44.

a PVPC or a utility patent may partly depend on the compulsory licensing provision of the PVPA, which does not exist in general utility patent law. Since the date of PVPA promulgated in 1970, Secretary of Agriculture has never exercised this authority in reality. It should be noted that a compulsory licensing mechanism has been supported by seed corporations yet disagreed to by biotechnology firms according to the survey conducted by the Congress, Office of Technology Assessment, Technology.[634] The main reason is that seed corporations need a mechanism to ensure the access to new plant innovations developed using biotechnologies such as cell culture and genetic engineering in the situations where the biotech firms refuse to grant a license, leading to their inability to use a crucial biotechnology.[635] Meanwhile, biotech firms are concerned that through compulsory licensing, they might not be able to insure sufficient return for their research investment.[636]

f. Deposit

The consideration concerning risk is another essential aspect of a private corporation's management of intellectual property on plants due to the risk they have to take when a biological deposit is made. The PVPA requires a statutory deposit, yet the access to such deposited material needs authorization from the owner of the PVPC.[637] On the contrary, deposit for utility patents granted by the USPTO obliges the owner of patents to give unrestricted access to deposited biological materials after a patent being granted.[638] Such deposit is therefore considerably more dangerous than the required deposit under the PVPA and creates a more accessible tool through which a utility patent might be pirated.

5.1.2.3 Impacts of Plant Proprietary Rights in the United States

[634] J. L. Ihnen, R. T. Gallegos, and R. J. Jondle, "Intellectual Property Protection for Plants and Varieties," *the Office of Technology Assessment, U.S. Congress* (1987).
[635] Ibid.
[636] Ibid.
[637] *The PVPA*, Section 52(4).
[638] "Planting Innovation: A Look into Plant Patent Protection and the Deficiencies of the Plant Protection Act and Plant Variety Protection Act," The UC Law Review Forum, May 07, 2015, accessed April 1, 2018, https://uclawreview.org/2015/05/26/planting-innovation-a-look-into-plant-patent-protection-and-the-deficiencies-of-the-plant-protection-act-and-plant-variety-protection-act/.

Proprietary protection on plants has impacted and still goes on to influence the direction of research and development in the field of plant innovations. This part analyses the crucial role plants and seeds play in the society of the United States, and the importance in solving the concerns of the private sector beyond the economic impacts of advanced plant inventions.

a. Effects on Economy

As of the adoption of the PVPA and the Court's decisions in the cases of *Diamond v. Chakrabarty* and the *Ex Parte Hibberd case*, the interests of the private sector in conducting research and development in this field has blossomed. Commencing with the enactment of the PPA in 1930, the dominant sector in developing new, asexually reproduced plant varieties has shifted from government experimental programs to the private sector.[639] The increased number of granted plant patents and the increased size of the present nursery industry can display the economic impacts of the PPA.[640] The rise in the number of investments from the private sector in plant breeding program as a result of the PPA was extensively deliberated during the Congress' discussions on the PVPA.[641] Some regard the alternative of seeking plant utility patents as central to triggering progress and boosting the monetary flow in the seed and plant industry by essentially providing the proprietary protection necessary the to generate research investment and the swift diffusion of information portraying the improved technology derived from research on plants.[642]

b. Research and Development Concentration

After the adoption of plant proprietary rights in the United States, private sector investment on plant research and development has risen 14-fold within the period of 1960 and1996, while investment

[639] Joe Bouton, "The economic benefits of forage improvement in the United States," 263-270.
[640] Ibid.
[641] J.L. Ihnen, R.T. Gallegos, and R.J. Jondle, "Intellectual Property Protection for Plants and Varieties," *the Office of Technology Assessment, U.S. Congress* (1987).
[642] S. B. Williams, "Utility Product Patent Protection for Plant Varieties," *Trends in Biotechnology no. 4*, 2(1986):33-39.

from the public sector remains the same.[643] In 2007, the total budgets of agricultural research and development from the top ten giant seed corporations was 9 times more than the spending of the Agricultural Research Service, United States Agricultural Department.[644]

However, the research and development programs are concentrated on some big companies. By way of cross-licensing proprietary plant genetic resources and technologies, the top six seed companies, i.e., BASF, Bayer, Dow Agrosciences, DuPont, Monsanto and Syngenta, consolidate efforts on research and development. This has helped them avoid spending on costly patent litigations and maintains their market power.[645] For instance, Monsanto has cross-licensed with other top 5 corporations; Dow has cross-licensed with four out of five corporations; and DuPont and Syngenta have cross-licensed with three out of four corporations.[646] On the contrary, according to the USDA, other private corporations seem to be spending less on research and development in connection with the their individual market share than when more corporations were taking part.[647] Moreover, as for corn, cotton and soybean varieties, the intensity of research and development has, in fact, stagnated as a result of market concentration.[648] Therefore, it is not surprising that some scholars claim the market concentration and reliance on private funding for plant variety research and development have distorted research activities and priorities.[649]

c. Effects on Farm Operation

In the United States, the farmers' practices of saving and exchanging seeds was once a norm; however, such practices have developed into seed companies that rely on improving and selling

[643] Hope Shand, "The Big Six: A Profile of Corporate Power in Seeds, Agrochemicals & Biotech," *The Heritage Farm Companion* (2012): 10.
[644] Keith O. Fuglie, Paul W. Heisey, John L. King, Carl E. Pray, Kelly Day-Rubenstein, David Schimmelpfennig, Sun Ling Wang, and Rupa Karmarkar-Deshmukh. "Research Investments and Market Structure in the Food Processing, Agricultural Input, and Biofuel Industries Worldwide," *ERR-130. U.S. Dept. of Agriculture, Econ. Res. Serv.* (2011): 19.
[645] Shand, "The Big Six: A Profile of Corporate Power in Seeds, Agrochemicals & Biotech," 12.
[646] Ibid, 38.
[647] Jorge Fernandez-Cornejo and David Schimmelpfennig, "Have Seed Industry Changes Affected Research Effort?" USDA ERS, accessed April 10, 2018, https://www.ers.usda.gov/amber-waves/2004/february/have-seed-industry-changes-affected-research-effort/.
[648] Ibid.
[649] David Schimmelpfennig and Paul Heisey, "U.S. Public Agricultural Research: Changes in Funding Sources and Shifts in Emphasis, 1980-2005." *Economic Information Bulletin No. 45* (2009).

propagating materials, including seeds, and plants.[650] At the same time, after the introduction of plant intellectual property rights, the costs of seeds have increased dramatically. From 1994 to 2010, the price of seeds in the United States increased sharply more than the prices of other agricultural inputs, more than twice as much as the prices farmer gained for their farm harvests. [651] The USDA claimed that such hiking in seed prices, was partly due to the rise in value-added features created by private seed corporations and biotech firms through their research and development programs.[652] Moreover, around 32 to 74 percent of the price of seeds of some important crops such as beets, cotton, corn, and soybeans apparently exhibits technology fees and *seed dressing*[653] costs.[654] Nationwide expenditures for seeds accounted for 5.8 percent of total farm-operating costs in 2015 to 2016 and totaled USD21.3 billion.[655] Even though these expenditures constitute not a high portion of the overall farming operation costs, it is considered to be a fundamental and the most important element to the achievement of the farming operation.[656]

d. Dysfunctionality of Agricultural Exemptions

The effects of the cases where cumulative protection applied to a cultivar is expressed by the results of a legal proceeding involving Monsanto an American farmer. In the Court of the Federal Circuit in *Monsanto Co. v McFarling* decision points out that "there are no exemptions for research or saving seed under a utility patent" and that "the right to save the seed of plants registered under the PVPA does not impart the right to save the seeds of a plant patented under the Patent Act."[657] Therefore, when plant materials fall within the coverage of patent claims, not only the right to save seeds under the PVPA is not

[650] Brian C. Campbell and James R. Veteto, "Free seeds and food sovereignty: anthropology and grassroots agrobiodiversity conservation strategies in the US South," *Journal of Political Ecology* 22 (2015): 446-447; U.S. Food Sovereignty Alliance, *A Preliminary Report on Seeds and Seeds Practices across the U.S* (2014): 1.
[651] Keith O. Fuglie, Paul W. Heisey, John L. King, Carl E. Pray, Kelly Day-Rubenstein, David Schimmelpfennig, Sun Ling Wang, and Rupa Karmarkar-Deshmukh. "Research Investments and Market Structure in the Food Processing, Agricultural Input, and Biofuel Industries Worldwide," *ERR-130. U.S. Dept. of Agriculture, Econ. Res. Serv.* (2011): 13.
[652] Ibid.
[653] Seed dressing is a typically antimicrobial or fungicidal chemical, with which seeds are dressed before planting.
[654] Fuglie et al., "Research Investments and Market Structure in the Food Processing, Agricultural Input, and Biofuel Industries Worldwide," 13.
[655] U.S. Department of Agriculture USDA], *Farm Production Expenditures 2016 Summary* (2017), http://usda.mannlib.cornell.edu/usda/current/FarmProdEx/FarmProdEx-08-03-2017.pdf.
[656] Campbell and Veteto, "Free seeds and food sovereignty: anthropology and grassroots agrobiodiversity conservation strategies in the US South,"450.
[657] *Monsanto Co. v. McFarling*, 302 F.3d 1291, 1299 (Fed. Cir. 2002), cert. denied, 537 U.S. 1232 (2003).

applicable, the research and experimental utilization of germplasms is limited and an authorization from the patent holder is needed. The research shows that it costs the farmers in the United States at least an additional USD500 million per year for the seeds and propagating materials used as farm inputs.[658] What is more, the inapplicability of research exemption has led to the situation where public research on biotech plants independently conducted by scientists has been obstructed by patent claims of private sectors. For instance, in 2009, 26 university scientists conducting research on corn, filed complaints with the Environmental Protection Agency of the United States complaining that patents on transgenic genes have impeded scientists in the public sector from conducting studies on transgenic plants.[659]

In conclusion, there are three systems of plant intellectual property protection available in the United States. Not one of them is completely exclusive; some types of crops are eligible for only a single type of protection while some crops can be eligible for more than one system of protection. The PPA created patent rights for plant breeders of asexually reproduced plants. While the *Ex Parte Hibberd* case has ensured that utility patents could be applicable to plants, the private sector usually seeks utility patents for plant innovations concerning genetic engineering since a utility patent is able to protect the method utilized for engineering a crop with, DNA sequences inserted into plant cells, and the plants as a whole. Under both systems, farmers' rights and the rights of plant breeders to utilize patented materials are not guaranteed. As for the plant variety protection system under the PVPA, it provides exclusive rights for plant breeders of sexually reproduced plants, not including F1 hybrids. Under this Act, farmers are permitted to save protected seeds for their own use, but they can no longer sell those seeds to other farmers. Also, plant breeders can utilize protected plants to develop new plant varieties without consent from the rights holders.

Plant breeders in the United States can choose the protection system according to the types of innovations and types of plants. Since some protection systems provide broader scope of protection than

[658] W. H. Lesser, "The Impacts of Seed Patents," *North Central Journal of Agricultural Economics no. 9, 1 (1987): 37-48.*
[659] A. Pollack, "Crop Scientists Say Biotechnology Seed Companies Are Thwarting Research," *New York Times* (2009).

others and some are more difficult to obtain and more expensive in terms of litigation costs, it is evident that each system has its own advantages and disadvantages which a plant breeder needs to evaluate prior to determining the most suitable system of protection.

Even though the approach of the United States ensures benefits with respect to legal certainty and powerful impetus for private companies to invest in agricultural research and development programs as shown from the considerable increase in the investment from the private sector in this field, some drawbacks are still present. Firstly, it has led to the concentration of the seed industry in the hands of some private corporations, while the investment from the public sector has slowed down due to inaccessibility to the necessary germplasms. Moreover, the most visible disadvantage in the United States is the rigid limitation in "freedom to operate" in the area of agrobiotechnology since only the plant variety protection system allows for the breeders' exemption and farmers' rights to save seeds. This problem is even aggravated in the circumstances where the patent regime and the plant variety protection system interface. The higher the level of protection granted by patents for plant innovations weakens the functionality and applicability of the breeders' exemption and farmers' exemption, which are both considered to be core and feature of every *sui generis* plant variety protection system. The research exemption under the utility patent system is significantly inequivalent to the breeders' exemption since it has been narrowly interpreted and hence cannot replace the breeders' exemption under the PVPA.

5.2 The Approach of the European Union

The European Union shares similar cultural traditions and concerns towards the issues of intellectual property on agriculture with Thailand as shown in the draft history of article 27.3(b) of *the TRIPS Agreement* where the European Union proposed that plants biological resources should be excluded from patent protection system.[660] The circumstance in Europe is portrayed by the concurrence of

[660] "Multilateral Trade Negotiations on Agriculture: A Resource Manual IV. Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) - Implementation of Article 27.3(b): Drafting and Enacting National Legislation (Sui Generis Systems)," Food and Agriculture Organization of the United Nations [FAO], accessed May 25, 2017, http://www.fao.org/docrep/003/x7355e/x7355e07.htm.

domestic systems for the protection of plant intellectual property on the one hand, and of a community system on the other hand.

At the regional level, there are three main pieces of regional legislation applied to the protection of plant innovation, i.e., *the 1973 European Patent Convention (EPC)*[661], *Directive 98/44/EC on the Legal Protection of Biotechnological Invention (The biotech Directive)*[662] and *Council Regulation 2100/94/EC on Community Plant Variety Rights* (CPV)[663]. The provisions of the EPC are followed by *Implementing Regulations to the Convention on the Grant of European Patents (Implementing Regulations)*, serving as an interpreting instrument of the provisions of these Convention. Rules 26 to 34 of the Regulations concerned with inventions derived from plant biological materials. significantly, rules 26 to 29[664] were included into the Regulations in order to bring the EPC into compliance with *the Biotech Directive*, which aims at harmonizing European patent law with respect to biotechnological inventions.[665] Section 26(1) clearly provides that *the Biotech Directive* is an additional way of interpreting the text of the EPC.

The community Plant variety rights provided under the CPV, implemented in compliance with the UPOV Convention, are effective and can be enforced throughout the jurisdiction of the European Union when granted, transferred and annulled.[666] The Union itself became a UPOV party in 2005 while

[661] *Convention on the Grant of European Patents (European Patent Convention)*, October 5, 1973, 13 I.L.M. 276; This convention is an intergovernmental treaty widely recognized as the Munich Convention, signed in Munich in 1973 by fourteen parties. Its constitution, organs and functions do not depend on European Community legislation. The Convention entered into effect in 1977**,** and the existing parties are all the members of the European Union, along with Switzerland, Liechtenstein, Monaco and the United Kingdom. According to the Convention, the first process of application occurs at the European Patent office (EPO), which is responsible for receiving and examining the application, and afterward it grants or declines the corresponding patent. The second process is patent validation, taking place at the domestic authorities, requiring the applicant to file the respective translation pursuant to the requirements of each State. Therefore, once the community patent is granted, it is subject to the domestic laws of each member; Jorge Cruz, "The Community Patent Convention: What Sort of Future?," *The Journal of World Intellectual Property* no.1, 5 (1998): 819.

[662] *Council Directive 98/44/EC on the Legal Protection of biotechnological inventions, 1998 O.J. (L 213) 13 (EC)*, http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1998:213:0013:0021:EN:PDF.

[663] *Council Regulation 2100/94 on Community plant variety rights*, 1995 O.J. (L 173) 14 (EC).

[664] Originally published as *Rules 23b-3 EPC (1973)*.

[665] Franz-Josef Zimmer and Markus Grammel, "Plant Patents in Europe," *Grunecker* (2015): 3.

[666] Muriel Lightbourne, "Plants and intellectual property rights in the US, Japan, and Europe," *IIP Bulletin* (2005): 80.

the member countries had become UPOV parties long before in the 1960s or 1970s.[667] The CPV is administered by the Community Plant Variety Office (CPVO) situated in Angers, France.[668]

In addition, in Europe, holding concurrently community plant variety rights and domestic plant variety rights or patents for the same plant variety is not permitted.[669] In case such domestic rights existed before the protection of community rights were granted, those rights are held off until the term of the community plant variety rights.[670]

5.2.1 European patent system with respect to plant innovations

European patents are granted in accordance with the EPC.[671] Under the EPC, as a general principle, every field of technology shall be granted patent protection if they are novel, non-obvious and industrial applicable; as a consequence, plant innovations are considered one of the patentable subject matters.[672] Therefore, plant-related innovations, including unconventional breeding techniques, genetic technologies, and plant genes are protected under the patent law. *The Biotech Directive* further sets forth that plant biological technologies are patentable in the case that the technical teaching is not limited to a particular plant variety,[14] while Rule 27(b) of *the Implementing Regulations* confirms this principle. The adoption of the EPC according to the text of *the Biotech Directive* is evidence of the European Patent

[667] International Union for the Protection of New Varieties of Plants [UPOV], "Members of the International Union for the Protection of New Varieties of Plants: Status on April 15,2016," 2016, accessed August 15, 2017, http://www.upov.int/export/sites/upov/members/en/pdf/pub423.pdf.
[668] The CPV, Article 4, 67 and 73; the Appeals of the CPVO's decisions relating to the grant of the rights might be taken to the CPVO Board of Appeal, whose decisions are under the review by the courts.
[669] *The European Patent Convention*, Article 92(1).
[670] *The European Patent Convention*, Article 92(2).
[671] Zimmer and Grammel, "Plant Patents in Europe," 2.
[672] *The European Patent Convention*, Article 52(1).

Office (EPO)'s potential to work towards regional harmonization in patent law on plants and plant-related innovations.[673]

At a national level, the extent to which patentability is allowed for plants and plant-related innovations is different in each European country. Generally, in Europe, patent protection is permissible for an extensive range of plant-related innovations, including genetically-modified plants, herbicides, pesticides, and microorganisms.[674]

5.2.1.1 Exclusions from patentability

This permissive approach with respect to plant innovations is, nevertheless, subjected to some exceptions evidently provided in Article 53 of the EPC. Among the exceptions provided, this article obviously excludes "plant varieties" and "essentially biological processes for the production of plants", such as breeding and crossing, from the scope of patent protection.[675] Rule 26 of *the Implementing Regulations* clearly give the definition to the terms "plant varieties"[676] and "essentially biological processes for the production of plants"[677] for the purpose of exclusion from patentability. The definition provided for the term "plant varieties" follows the definition provided under *the 1991 UPOV Convention*

[673] The EPO is not a part of the European Union and thus is not obligated to comply with EU law and the precedence of the Court of Justice of the European Union (CJEU). On the contrary, the EPO established the Boards of Appeal and the Enlarged Board of Appeal, quasi-judicial bodies. Their decisions are independent are not bound by any other regional agreement other than the EPC and by their jurisprudence. The Enlarged Board only takes part where the decisions handed down by the Boards of Appeal are divergent, where an essential question of law arises that catches the attention of the Enlarged Board, or where a breach of principal appeal proceeding takes place and such b breach detrimentally impacts a party to the dispute; European Patent Office, "Boards of appeal." EPO. Accessed September 19, 2017, https://www.epo.org/about-us/boards-of-appeal.html; Zimmer and Grammel, "Plant Patents in Europe," 3.
[674] "Plant Related IP Rights in Europe," Mathys & Squire LLP | Intellectual Property Attorney firm, accessed September 27, 2017, http://www.mathys-squire.com/knowledge-hub/patent/patent/plant-related-ip-rights-in-europe/.
[675] *The European Patent Convention*, Article 53 states that plant or animal varieties or essentially biological processes for the production of plants and animals do not constitute patentable inventions and that the provision is not applicable to microbiological products or processes.
[676] "Plant variety" is defined as "any plant grouping within a single botanical taxon of the lowest known rank, which grouping, irrespective of whether the conditions for the grant of a plant variety right are fully met, can be:
(a) defined by the expression of the characteristics that results from a given genotype or combination of genotypes,
(b) distinguished from any other plant grouping by the expression of at least one of the said characteristics,
(c) considered as a unit with regard to its suitability for being propagated unchanged."
[677] "Essentially Biological Process" is defined as a process for the plant production which consists wholely of natural phenomena, including crossing or selection.

and in the CPV[678]. As for the term "essentially biological processes for the production of plants", its definition exactly follows that of Article 2(2) of *the Biotech Directive*.

The exclusion of plant varieties is a duplication of the existing regional agreement regarding patent at the time that the EPC was drafted, i.e., *the 1963 Convention on the Unification of Certain Points of Substantive Law on Patents for Invention (Strasbourg Convention)*[679], Article 2(2).[680] Nevertheless, it is worth noting that, while *the Strasbourg Convention* leaves it to the discretion of its parties to decide whether to exclude plant subject matters from patentability, the EPC explicitly excludes plants and essentially biological processes due to the adoption of *the 1961 UPOV Convention* which totally bans dual protection for the same plant variety. Although *the 1961 UPOV Convention* does not obviously preclude plant varieties from patentability, since plant breeders' rights were not well established in every EPC member country, the drafter decided to carefully respect the doctrine of uniform patent protection within all of the EPC jurisdictions.[681] Consequently, when adopting both the provisions of UPOV and the text of the Strasbourg Conventions, it was easier for the drafters to adopt such an explicit exclusion for housekeeping reasons.[682]

In the particular case of essential biological processes, unlike the practices of the United States, the EPC and the case law in Europe show that patent protection is not allowed. This is confirmed by the rulings of the Enlarged Board of Appeal in the landmark *broccoli and tomato cases*[683] where the Enlarged Board of Appeal sets forth, that if a single essentially biological process step is included in the production process, the whole method of produced plant is precluded from patent protection even though it contains any further step of a technical nature to traditional breeding method or even such a method directed to

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[678] *The Biotech Directive*, Article 5(2).
[679] *Convention on the Unification of Certain Points of Substantive Law on Patents for Invention*, Strasbourg, 27.XI.1963.
[680] *The 1961 Strasburg Convention*, Article 2(2) states that the 1961 Strasburg Convention, article 2(2) sets forth that its he Contracting parties are, nonetheless, not obliged to extend the scope of patent protection plant varieties or of essentially biological processes for the production of plants; S.A. Bent, R.L. Schwaab, D.G. Gonlin and D.D. Jeffery *Intellectual Property Rights in Biotechnology Worldwide* (M. Stockton Press, 1987).
[681] *Transgenic Plant/Novartis II (G1/98),* 3.5.
[682] Ibid.
[683] *Tomato I* (G 1/08) & *Broccoli I* (G 2/07).

genetically engineering the plant genome.[684] In other words, the production process of plants which is comprised of crossing and selection does not fall within the scope of patent protection even though it includes an innovative step to the process occurring by nature. Even so, the Enlarged Board of Appeal added that, in case a process of production involves the additional steps of sexually crossing or selection, which such steps presents a trait into the plant genome or modifies a trait in the plant genome, but the introduction or modification of the trait is not directly caused by the combination of the plant genes selected for sexual crossing, such a process can be patentable under Article 53(b) of the EPC.[685]

Notably, according to the ruling of the Enlarged Board of Appeal, plant products derived from a method involving an essentially biological process, either in an unprocessed form (such as fruit, seeds or tubers) or a processed form (such as oil or meal), are patentable if the eligibility requirements are satisfied.[686] Nevertheless, the applicants must demonstrate that the processed product retains the same innovative characteristics as the plant of the innovation.[687] In making its decisions, the Board applied the methodologies of interpretation set forth in Articles 31 and 32 of *the Vienna Convention on the Law of Treaties*[688],[689] and found that both grammatical, systematic and teleological interpretation did not extend the scope of the exclusion clause provided by Article 53(b) of the EPC to processed products.[690]

5.2.1.2 Eligibility requirements

In general, an innovation is patentable if it fulfills three conditions under the EPC, Article 52, i.e., novelty, innovativeness and industrial applicability. The novelty requirement conveys that an innovation

[684] Ibid.
[685] *Tomato I* (G 1/08).
[686] "Plant Related IP Rights in Europe," Mathys & Squire LLP | Intellectual Property Attorney firm, accessed September 27, 2017, http://www.mathys-squire.com/knowledge-hub/patent/patent/plant-related-ip-rights-in-europe/; *Tomato II* (G 1/12) & *Broccoli II* (G 2/13).
[687] Ibid.
[688] *Vienna Convention on the Law of Treaties, 1155 U.N.T.S. 331, 8 I.L.M. 679, entered into force Jan. 27, 1980.*
[689] Ibid, Article 31 specifies the grammatical, the systematical and the teleological interpretation of a Convention as the fundamental principal of interpretation. Moreover, Article 32 sets forth that the preparatory works, known as *travaux preparatoires*, can be utilized as an additional way of treaty interpretation when the means of interpretation provided under Article 31 still leaves the text of treaty in question any ambiguous or unreasonable meaning.
[690] *Tomato II* (G 1/12) & *Broccoli II* (G 2/13).

is not a part of knowledge or the state of art existing in the public domain.[691] State of art refers to anything which is publicized by ways of either an oral or a written description, utilization or in any other means prior to the application date.[692] In the respective case of plant innovations, unlike the experience of the United States, the novelty of plant innovations is generally accepted and thus is not considered a controversial issue. The availability of an innovation does not automatically exclude such innovations from being patented. For instance, in cases of plant gene fragments and DNA sequences, the EPO views that the isolated and purified forms of such subject matters are considered novel because they do not naturally exist in those particular forms.[693] Nonetheless, some plant innovations, although they are recognized as novel, they are un -patentable in the European Union due to the fact that their exploitation might run counter to *ordre public*, morality, the environment or health of humans and animals.[694]

The requirement of an innovative step indicates that, in comparison with the state of art, the claimed invention is non-obvious to a person skilled in the art.[695] In addition, the practices of the EPO employs "problem and solution" means,[696] drawn from Rule 27(1)(c), indicating that innovation must be sufficiently disclosed in order to provide adequate understanding of a technical problem and its solutions to the problem.[697] As a result, the examiner needs to evaluate whether the solution provided is obvious to the person skilled in the art. In doing so, everything in the state of the art, apart from prior unpublished applications of patent, can be considered.[698] In the case of plant innovations, inventive step means that the plant in question possesses at least one innovative feature, whose "problems and solutions" need to be

[691] *The European Patent Convention*, Article 54.
[692] N. S. Sreenivasulu and C. B. Raju, *Biotechnology and patent law: patenting living beings* (Noida: Manupatra, 2008), 76.
[693] Ibid, 77.
[694] Ibid.
[695] *The European Patent Convention*, Article 56.
[696] M. R. Sreenivasamurthy and Syamala Kandadai, *Patenting of biotechnological inventions: a comparative study of EU, USA and India* (New Delhi, India: Satyam Law International, 2016), 64.
[697] Ibid.
[698] Ibid.

evaluated by the patent examiner.[699] Moreover, unlike the distinctness requirement under the CPV, this innovative requirement is not necessarily defined by the whole plant genome.

With regards to industrial applicability, in accordance with the EPO, this requirement covers every type of industry, including the agricultural industry.[700] With respect to the application of this requirement to plant innovations, the European Union interprets this requirement in the identical manner as the United States.[701] In 2000, the United States and the EPO carried out a joint research on their practices concerning patentability on biological technology and found that all biotechnological innovations including nucleic, acid, molecules and DNA sequence without specification of any function or utility is not patentable.[702] On the contrary, isolated and purified forms of plant biotechnological innovations, whose functions and credible utility are disclosed, these can satisfy the industrial application requirement.[703] The rationale behind this interpretation is to prevent a disproportionate power for patent holders to limit research or production of plant breeders and farmers; hence, the exclusive rights must be restricted to the function or utility specified by the holders of patents.[704]

5.2.1.3 Exemptions and Limitations of Exclusive Rights

Domestic patent laws of the country members of the European Union generally establish some mechanisms for research exemption, particularly relating to the acts of which the outcome is to develop or upgrade the patented subject matter.[705] Even though it is seen that the member countries of the European Union have achieved some level of harmonization, regionally, it is unclear if protected plant biological

[699] Siobhán Yeats, "Latest Developments in Patenting Plant Inventions in Europe" In Brussels, 11th October 2011.
[700] Sreenivasulu and Raju, *Biotechnology and patent law: patenting living beings, 77.*
[701] Ibid, 102.
[702] "Report on Comparative Study Carried Out under Trilateral Project B3b," *Trilateral Technical Meeting, Tokyo, JPO* (14-16 June 2000).
[703] Ibid.
[704] *Monsanto Technology LLC v Cefetra BV et al.* (C428/08), para.7; Particularly, the ECJ General Advocate stipulated that the Biotech Directive allows and requires the patent protection granted to DNA sequences to be bound by a "purpose".
[705] Claudio Chiarolla, "Commodifying Agricultural Biodiversity and Development-Related Issues," *The Author Journal Compilation* (2006): 34.

resources can be utilized for breeding without prior consent from the owner of the patent.[706] Article 27 (b) of *the Community Patent Convention (CPC)*[707] precludes activities carried out for experimental purposes from the exclusive rights of patent holders;[708] yet it has never come into force. As a consequence, future rulings are necessitated to specify the existence, ambit and application of this exemption.

With reference to the farmers' privilege, the mechanism employed by the European Union expresses that *the Biotech Directive* guarantees farmers' exemption to save and replant provided by the CPV and extends the application of this privilege to plant patents.[709] However, such activities of farmers, except small farmers, are subject to payment of remuneration to the holders of plant breeders' rights.[710] In other words, the farmers in European Union enjoy the right to save and replant seeds under the same requirements of the CPV notwithstanding whether or not proprietary seeds per se are protected by the patent law or the CPV.

As for a compulsory licensing mechanism, in the European Union, the EPC does not clearly specify any provisions related to compulsory licensing of patented innovations. However, the provisions of CPV expressly stipulate compulsory exploitation of plant breeders' rights.[711] Afterwards, once *the Biotech Directive* came into force, the mechanism of compulsory licensing of innovation concerning plant innovations was consolidated. The Directive provides that if the patent owner of plant biotechnological innovation is not able to exercise his or her rights without breaching the pre-existing plant breeders' rights, he or she is eligible to file an application for a compulsory license.[712] In this situation, a license can

[706] Rainer Moufang, "the Interface between Patents and Plant Variety Rights in Europe," *WIPO–UPOV Symposium on Intellectual Property Rights in Plant Biotechnology* (2003): 6.
[707] The Convention for the European Patent for the common market or Community Patent Convention (CPC) was established at the "Luxembourg Conference on the Community Patent" held on 15 December 1975 by the 9 members of the European Economic Community; nonetheless, the Convention has never been into effect. This is due to the fact that it was not signed by the adequate number of countries; Justine Pila and Christopher Wadlow, *The Unitary EU Patent System* (2015, Bloomsbury Publishing), 33–35.
[708] *The Community Patent Convention*, Article 27(b).
[709] *The Biotech Directive*, Article 11(1).
[710] *The Biotech Directive*, Article 11(2); the CPV, Article 14.
[711] *The Community Patent Convention*, Article 29.
[712] *The Biotech Directive*, Article 12(2).

allow for non-monopoly exploitation of the respective plant variety with a fair and equitable remuneration to the owner of plant breeders' rights.[713] This mechanism is influenced by article 31 of *the TRIPS Agreement* which applies merely to compulsory licenses on patents.[714] Simultaneously, the owner of plant breeders' rights can apply for a cross-license.[715] This mechanism will be later discussed in detail in Chapter 4.2.3.

5.2.2 Community Plant Variety Rights

Plant breeders can obtain plant variety protection in the European Union by filling in an application for domestic rights in each member State in which it is established in 21 out of 25 States,[716] or by filing an application for a community plant breeders' right to extend the scope of application to all 25 States in just one single application. Community plant breeders' rights are identical to those conferred by the 1991 UPOV Convention and mostly identical to the patent rights.[717] The scope of plant breeders' rights granted by the CPV covers the exclusive rights to produce and reproduce, conditions for the purpose of propagation, selling, marketing, importing, exporting and stocking the whole or parts of the variety of harvested materials.[718] This section explains the main characteristics of the CPV.

5.2.2.1 Subject matter of protection

The substantive provisions of the CPV relies upon the 1991 UPOV convention.[719] Thus, the subject matter of protection under Community Plant Variety Rights (CPVR) is a plant variety. The term "plant variety" is defined by the CPV as follows

> a plant grouping within a single botanical taxon of the lowest known rank, which grouping, irrespective of whether the conditions for the grant of a breeders' right are fully met, can be defined by the expression of the characteristics resulting from a given genotype or combination of genotypes, distinguished from any other plant

[713] *The Biotech Directive*, Article 12(1).
[714] Lightbourne, "Plants and intellectual property rights in the US, Japan, and Europe," 34.
[715] *The Biotech Directive*, Article 12(1).
[716] Bart Kiewiet, "Plant variety protection in the European Community," *World Patent Information* 27 (2005): 319.
[717] Kiweit, "Plant Variety Protection in the European Community," 321.
[718] *The CPV*, Article 13(2)
[719] Ibid, 320.

> grouping by the expression of at least one of the said characteristics and considered as a unit with regard to its suitability for being propagated unchanged.[720]

A plant grouping is described as being comprised of a whole plant or a part of a plant as long as those parts are can produce the whole plant.[721] The scope of CPV protection covers plant varieties of all botanical genera and species.[722]

What is more, the CPV expands the scope of protection to the EDV.[723] Importantly, in addition to the obligation under the UPOV system, the CPV provides a standard definition to the term EDV,[724] and allows the promulgation of implementing regulations which stipulate potential acts of derivation deemed to fulfill the definition.[725] As for the methods to evaluate derivation, the court in the case of *Van Zantan Plants B.V. v. Hofland B.V.* further provides that DNA analysis establishes a significant identification of an act of derivation. [726]

Additionally, the CPV extends the protection scope to cover hybrids of the protected plant varieties,[727] as well as the varieties which are not evidently distinct from the initial varieties.[728] In fact, the reference to plant varieties lacking distinctiveness makes the CPV redundant since article 7 provides clearly that the exclusive rights should not be granted to plant varieties which sufficiently qualify distinctness. However, as some commentators argued, this text is set forth to avoid the cases where plant breeders make cosmetic alterations to the registered varieties, revoking research exemption allowed under the CPV.[729]

5.2.2.2 Eligibility Requirement

[720] *The Community Patent Convention*, Article 59(2).
[721] *The Community Patent Convention*, Article 5(3).
[722] *The Community Patent Convention*, Article 5(1).
[723] *The CPV*, Article 13(1) and (2).
[724] *The CPV*, Article 13(6).
[725] *The CPV*, Article 13(7).
[726] *Van Zanten Plants B.V. v. Hofland B.V.*, Dist. Ct. Hague, Aug. 6, 2008 (Case Summary 177)(Neth.).
[727] *The CPV*, Article 13(5)(c).
[728] *The CPV*, Article 13(5)(b).
[729] Margaret Llewelyn and Mike Adcock, *European Plant Intellectual Property* (Hart Publishing: 2006), 228.

For the purpose of obtaining plant breeders' rights under the CPV, a claimed variety has to fulfil the requirements of distinctness, uniformity and stability.[730] The examination of these three requirements relies upon the protocols established by the CPVO on the basis of the guidelines adopted under the auspice of the UPOV system.[731]What is more, a variety must be novel and possess sufficient variety denomination.[732] The term of protection is 25 years for general varieties and 30 years for trees and vines.[733]

The distinctness criterion specifies that a variety is evidently distinguishable by referring to the expression of the features which is associated with a specific genotype or combined genotypes from other plant varieties which belong to a common knowledge on the application date.[734]Simply put, the new expression has to be perceptible at the phenotype level.[735] Besides its biological features, such as shape of a twig or color of a flower, this criterion can also rely on physiological features, including drought tolerance or disease resistance.[736] Therefore, this requirement has to be examined in comparison with other existing plant varieties of which the characteristics are similar to the claimed varieties.

Uniformity criterion is accomplished when the composed plants distinct characteristic is genetically identical.[737] Therefore, at the time of assessment, the specific number of the respective characteristics must be taken into consideration.

Stability criterion suggests that, after a variety is successively propagated or multiplied, its essential feature remains unchanged.[738] Since the examination for these eligibility requirements has a time limit, the examination of stability can usually be evaluated by tentative opinion.[739] Hence, afterwards, the

[730] *The CPV*, Article 5 and 6.
[731] *Protocol for Distinctness, Uniformity and Stability Tests*, CPVO-TP/020/1 Final, 06/11/2003, http://cpvo.europa.eu/sites/default/files/documents/TP/agricoles/TP_020-1_AVENA_SATIVA.pdf.
[732] *The CPV*, Article 10.
[733] *The CPV*, *The CPV*, Article 19(1).
[734] *The CPV*, Article 7.
[735] Kiewiet, "Plant variety protection in the European Community," 321.
[736] Ibid.
[737] *The CPV*, Article 8.
[738] *The CPV*, Article 9.
[739] Kiewiet, "Plant variety protection in the European Community," 321.

CPVO has to inspect ‘‘the continuing unaltered existence of the protected varieties’’.[740] In case such examination finds that a variety no longer qualifies for the uniformity or stability criteria, the CPVR must be revoked.[741]

As for the novelty requirement, it is not concerned with the features of the claimed variety, but linked to prior commercialization of such variety. [742] A plant variety qualifies for the novelty requirement provided that such a variety has not been sold or disposed of for exploitation, with the breeder's authorization, more than one year before the application date within the jurisdiction of the European Union or more than four years, or six years for trees and vine varieties, if such activities are conducted outside the Union.[743]

5.2.2.3 Exemptions and Limitations of Community Plant Breeders' Rights

The CPV allows a certain degree of derogation to the rights of plant breeders in Articles 14-16. Article 14 provides an exemption for agricultural products or farmers' privilege. This privilege permits farmers to utilize saved seeds from their farm production without prior authorization of the plant breeders of the protected varieties.[744] This exemption is only applicable to the agricultural varieties listed in Article 14(2). Remarkably, soybeans are not included in the list; however most of the disputes regarding seed-saving in the United States have involved soybeans. Further, the exemption does not cover hybrids and synthetic plant varieties.[745] For the varieties in the list, farmers are permitted to produce seeds by planting them on their own farm holdings; nevertheless, the acts of replanting must only be "for propagating purposes".[746] Farmers revoking this privilege, other than those with small farm holdings, must pay a fair and equitable reimbursement to the rights holders which shall be reasonably less than the remuneration

[740] *The CPV*, Article 64
[741] *The CPV*, Article 21(1).
[742] *The CPV*, Article 10;
[743] Ibid.
[744] *The CPV*, Article 14(3).
[745] *The CPV*, Article 14(1).
[746] Ibid.

paid for the licensed variety.[747] Also, upon request of the rights holders, the CPV obliges farmers to provide information concerning such seed-saving and replanting activities; Failure to fulfill this obligation, farmers are subject to infringement liability.[748]

To clarify the rights and obligations of the plant breeders' rights owners and the farmers claiming this exemption, implementing rules governing farmers' exemption was promulgated in 1995 and was, later , amended in 1998.[749] For instance, the rules evidently set forth that the rights to save and replant seeds cannot be transferred.[750] Further, the rules define the equitable level of reimbursement that, in the case that there is no agreement between the parties concerning the reimbursement, the farmers should pay 50 percent of the reimbursement paid for the licensed production of the plant variety in question.[751] Moreover, they elaborate on who constitute "small farmers".[752] Importantly, the rules cope with the matter of monitoring by the protected plant breeders whether the farmers comply with the reimbursement obligations.[753]

Additionally, the CPV limits the monopoly rights of the plant breeders by allowing activities conducted "privately and for non-commercial purposes", and activities conducted "for experimental purposes", as well as "for the purposes of breeding, or discovering and developing other varieties".[754] It is evident that the CPV mentions both activities of "breeding" and the activities of "discovering and developing", while the UPOV Convention only refers to the breeding activities. This breeders' exemption is regarded as one of the most essential elements of legislation adopted from the UPOV Convention which is not present in patent regime.[755]

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[747] *The CPV*, Article 14(3)
[748] *Christian Schulin v Saatgut-Treuhandverwaltungsgesellschaft mbH* (c305/00).
[749] *Commission Regulation No. 1768/95 implementing rules on the agricultural exemption provided for in Article 14(3) of Council Regulation (EC) No. 2100/94 on Community plant variety rights*, 1995 (Regulation 2605/98).
[750] *Regulation 2605/98*, Article 4(1).
[751] *Regulation 2605/98*, Article 5.
[752] *Regulation 2605/98*, Article 5(3).
[753] *Regulation 2605/98*, Chapter 4.
[754] *The CPV*, Article 15.
[755] Kiewiet, "Plant variety protection in the European Community," 322.

Furthermore, following the UPOV Convention, the CPV provides that compulsory exploitation rights can be granted on the grounds of public interest.[756] There is no time restriction to apply for a license, and it is not necessary to display that the variety is not sufficiently exploited. Currently, the CPV introduces a paragraph to article 29(1) providing the way to obtain such rights from the patent holder for a patented innovation embodied in a protected plant variety. The additional text specifies that, to be entitled to obtain a compulsory license, the patent owner needs to show evidence of failure to get a contractual license from plant breeder right holder, as well as evidence of significant technical enhancement of extensive economic interest when compared to the protected plant variety.[757]

In the case that the owner of CPVR is being granted a compulsory license for a non-exclusive utilization of a patented innovation embodied in the protected plant variety, the patent owner can *vice versa* obtain a cross-license on application.[758] It is worth noting that, even though a license might require the payment of fair and equitable remuneration, the law does not oblige the grantee to pay royalty fees.[759]

5.2.2.4 Relation to National Systems

As of October 2017, all of the European Union's members, except four countries, have established their own plant variety protection system.[760] Those systems vary as the members ratify different versions of the UPOV convention. The CPVR exists in concurrence with the domestic plant variety protection regime of each EU member country.

There are two major rules defining the relationship between community systems and domestic systems. Firstly, EU member states are not obliged to conform their domestic laws to the CPV, since the CPVR regime is not created in a form of a harmonization Directive, but by a Regulation. Secondly, the

[756] *The CPV*, Article 29(1).
[757] *The Biotech Directive*, Article 12(3).
[758] *The CPV*, Article 29(5a)
[759] *Regulation 2605/98*, Article 29.
[760] Cyprus, Greece, Luxemburg and Malta still do not have plant variety protection mechanisms in place.

CPV does not totally ban national plant variety protection systems.[761] Nonetheless, simultaneous protection is forbidden in these following scenarios: any plant variety which is granted CPVR cannot be protected by (1) a domestic plant variety protection in the European Union; or (2) a patent right in the European Union.[762] The UPOV 1978 had also up-held this methodology, but later abandoned it when the 1991 UPOV Convention came into force, largely due to the position of the United States.[763] Nevertheless, the resistance of the European Union against simultaneous protection was still expressed in the existing CPV.[764]

Once the CPVR protection is granted, the community rights are valid throughout the jurisdictions of every EU member country.[765] Meanwhile, the domestic system is restricted to the jurisdiction of the state where the application is filed. Therefore, it depends on the plant breeder who seeks plant variety protection to decide whether he or she needs to commercialize plant variety in a single or more than one EU member country. In accordance with article 92 of the CPV, a variety which is protected by CPVR cannot be the subject of protection under a domestic plant variety system or patent system.[766] However, it should be noted that plant innovation incorporated in a plant variety, such as a plant gene or cell, is allowed to be granted patent protection while the respective variety, at the same time, falls under the scope of CPVR protection.

5.2.3 Analysis on Modified Approach of the European Union

[761] *The CPV*, Article 3; "the Regulation shall be without prejudice to the right of the Member States to grant national property rights for plant varieties".
[762] *The CPV*, article 2(1).
[763] Mark D. Janis, Herbert H. Jervis, and Richard Peet, *Intellectual property law of plants* (Oxford: Oxford University Press, 2014), 152.
[764] Ibid.
[765] *The CPV*, Article 2.
[766] *The CPV*, Article 92.

In the European Union, even though the exclusion of plant varieties and essentially biological processes from patent protection is evidently provided, the border between the patent on plants and the plant breeders' rights could not be easily drawn following the adoption of the 1991 UPOV Convention, which permits the dual protection of the same varieties by both sets of intellectual property rights.[767] Moreover, the exclusion of patentability for plant varieties has been narrowly interpreted by the Enlarged Board of Appeal in the *Novartis case*. The Board considered *the Novartis* case by looking into the background of Article 53(b) of the EPC derived from Article 2(2) of *the Strasbourg Convention* and found that the Convention seeks not to preclude subject matters which cannot be granted plant breeders' rights.[768] As a result, there are some cases where plant varieties may fall under the scope of patentability, leading to an overlap in the subject of protection. The scope of patent protection may still cover plant varieties in the following circumstances:

a. The technical teaching of the innovation, such as a genetic modification, is not exclusive to a particular plant variety

Since the term "plant variety" provided under EPC is defined in the same manner as *the UPOV Convention* and patent claim can include one or more plant varieties, the Enlarged Board found that the exclusion should apply strictly to the situations where a specific variety is directly claimed.[769] In other words, the EPC, article 53(b) can only exclude plant variety from patentability in the case that a single plant variety is mentioned in the application. This is affirmed by *The Biotech Directive* which provides that plant biological technologies are patentable in the case that the technical teaching is not limited to a single plant variety,[14]

b. Plan varieties resulting from a patented non-biological process for plant production

[767] Lightbourne, "Plants and intellectual property rights in the US, Japan, and Europe," 83.
[768] *Transgenic Plant/Novartis II* (G1/98), 3.4-3.7
[769] Ibid.

The scope of the protection of a process patent is expanded to cover the products derived directly by the patented process, even though the products themselves cannot be patentable.[770] Hence, plant varieties may be protected by both intellectual property regimes if they are the direct product of a patented non-biological process, whose protection through the patent system is mandatory under *the TRIPS Agreement.*

c. The introduction of a patented DNA sequence in a plant variety

Overlapping protection can also occur as a result of expeditious advancement in breeding techniques, leading to gradually increasing patented innovations which are inserted into plant varieties.[771] The examples of these advanced breeding techniques are the case of the recombination of DNA sequence in a plant variety or where the patented cell or gene is inserted into a variety which is granted breeders' rights. This is affirmed by article 9 of *the Biotech Directive which* provides that "the protection conferred by a patent on a product containing or consisting of genetic information shall extend to all material, save as provided in Article 5(1), in which the product is incorporated and in which the genetic information is contained and performs its function". [772]

In general, when the two sets of intellectual property are overlapping, other plant breeders or farmers cannot revoke the derogations provided under the plant variety system against the patent owners. Moreover, it might also create blocking circumstances provided that two different parties are dependent on a license below the other, making one or both parties unable to exploit the protected plant innovations. However, the European Union has interestingly employed two solutions to prevent such situations.

First, *the Biotech Directive*, article 12, functioning in concurrence with the compulsory exploitation rights set forth by the CPV,[773] provides a cross-compulsory licensing mechanism. This

[770] Ibid.
[771] Chiarolla, "Commodifying Agricultural Biodiversity and Development-Related Issues," 33.
[772] *The Biotech Directive*, article 9.
[773] *The CPV*, Article 29; either natural or legal person, from private or public sector, is eligible to apply for a compulsory license. A member State of the European Union, an organization established at the community level or a commission can also be able to apply. Compulsory license can be enforced within the territories of some EU

mechanism grants non-exclusive license for utilizing a patented genetic material when the exploitation of the plant breeders' rights is impossible without violating the patent rights and *vice versa*. To put another way this mechanism makes sure that the holders of plant breeders' rights can commercially exploit new plant varieties which contain the patented innovations of the third party; meanwhile, the holders of plant breeders' rights cannot block the access of such propagated or harvested materials from patent owners.

In applying for this license, the patent owner must satisfy two requirements. First, the plant variety must establish a significant technical progress of considerable economic interest and, second, the applicant must have failed to acquire a contractual license from the owner of plant breeders' rights.[774] The same conditions must be satisfied by the plant breeders wishing to acquire a compulsory license for commercializing plant innovation contained in a variety.

However, having a cross-compulsory license in place does not eradicate the necessity of an appropriate research exemption. This is because the cross-compulsory license between the holders of patent and plant breeders' rights alone might not achieve the goal of finding the balance between the exclusive rights and the rights of those in the public sector since the licenses can be granted only if the plant variety, which contains patented material, establishes a significant technical progress of considerable economic interest compared with the patented innovations. Thus, without an appropriate research exemption, proprietary genetic resources under the process of creation or development, of which economic value is difficult or unable to be evaluated, remain inaccessible. In contrast, it is only able to function when the newly created variety has been bred and determination of its economic value before the date of application for the license. Moreover, some scholars mention that the way to evaluate if a new plant variety establishes a ''significant technical progress'' might also create some uncertainties.[775] Additionally, the scope of patent protection and plant breeders' rights are not always overlapping. Therefore, in case concurrent protection does not exist, there is no guarantee for accessibility to

members or within the entire jurisdiction of the European Union. In case the situations which cause the issuance of such license have changed after a year, by requesting of any relevant parties, the license can be revoked.

[774] *The Biotech Directive*, Article 12(3).

[775] Chiarolla, "Commodifying Agricultural Biodiversity and Development-Related Issues," 33.

proprietary plant materials. As a result, an exemption to conduct the research or experiment utilizing protected plant genetic resources is still needed.

Secondly, another tool created to solve the overlapping problem between two sets of intellectual property rights is the extension of farmers' privilege to save and replant patented seeds as provided by *the Biotech Directive*.[776] As discussed earlier, this tool decisively extends the scope of this privilege provided by the CPV beyond the application of the CPV itself to a patent regime, allowing farmers' privilege to function regardless of whether the plants genetic materials are protected through a patent regime or plant variety protection system. Nevertheless, the Directive limits the plant genera which farmers can replant the seeds of their production to fodder plants, cereals, potatoes, oil and fiber plants[777] while, on the other hand it, does not restrict quantity or the rank of their farm holding. Also, only small farmers are immune from reimbursement to the holder of the exclusive rights. Therefore, there might be some difficulties in monitoring and the corresponding anticipation of oversight by the courts might be an unfortunate outgrowth of a system that allows seed-saving activities while requiring reimbursement.

5.3 The Approach of India

In India, agriculture is the main income source for approximately half of its population and a major raw material source for various fields of industries.[778] Small farmers account for over 67 percent of its overall farming citizens.[779] The informal sector constitutes of around 86 percent of the total work force

[776] *The Biotech Directive*, Article 11.1; the sale or commercialization of patented plant variety for the use in agricultural sector implies that the rights' holder gives authorization to the farmers to utilize their harvested products for propagation or multiplication on their own farms.
[777] *The Biotech Directive*, Article 11.1; The CPV, Article 14.
[778] India has around 600 million farmers; Comparing this fact with the United States, where only around 1 million people can be classified as farmers; Agricultural sector contributes 26 percent of its GDP; thus, any policy or governmental decision related to agriculture can greatly affects the livelihoods of local Indian people as a whole; Shanti Chandrashekaran and Sujata Vasudev, "The Indian Plant Variety Protection Act Beneficiaries: The Indian Farmer or the Corporate Seed Company*?," Journal of Intellectual Property Rights* 7 (2002): 508.
[779] Mrinalini Kochupillai, "India's Plant Variety Protection Law – Historical and Implementation Perspectives," *International Max Planck Research School for Competition and Innovation Max Planck Institute for Intellectual Property and Competition Law* (2011): 5.

of (395 million people) and around 253 million people belong to the agricultural sector, principally based on a self-employment.[780]

Moreover, it is estimated that the production of food grain during the year 2011 to 2012 constitute around 259.32 million tons, comprised mainly of cereals and pulses.[781] Other important crops produced in this country are, for example, cotton, jute, oil seeds and sugarcane.[782] Even though food insecurity is a serious issue at the individual and family levels, India considers itself to be self-sufficient in its food production.[783] Such self-sufficiency in food production is the direct result of a vast diversity of plant genetic germplasms.[784] Moreover, within its territory, owing to the substantial amount of investments in agricultural and horticultural research during the period of the Green Revolution, India possessed a strong scientific specialization in the field of biotechnology.[785] Furthermore, another reason for advancement in biotech in this country is that, since biotech is manpower intensive, India has a great number of highly skilled workers to develop new plant innovation at half the cost, compared to other countries.[786]

In the meantime, the farmers' practices of seed-saving and replanting in the following year is common.[787] Farmer-selected propagating materials have usually given rise to the creation of new plant varieties. For instance, one of the Gujarat local farmers, namely Thakar Singh, selected and crossed

[780] National Commission for Enterprises in the Unorganised Sector, *Report on Conditions of Work and Promotion of Livelihoods in the Unorganised Sector* (Dolphin Printo Graphics, 2007), 8.
[781] Ministry of Statistics and Programme Implementation of India, *Statistical Year Book* (2014), 4.
[782] Ministry of Agriculture of India, *State of Indian Agriculture 2012-2013* (2013), 1.
[783] S. Mahendra Dev and Alakh N. Sharma, *Food Security in India – Performance, Challenges and Policies* (Oxfam India Working Paper Series – VII, 2010), 2.
[784] Ibid.
[785] Rohan Dang and Chandni Goel, "Sui Generis Plant Variety Protection: The Indian Perspective," *American Journal of Economics and Business Administration* no.1, 4 (2009): 308.
[786] S. Sahai, "Intellectual Property Rights and Community Rights, Bioresources and Biotechnology: Policy Concerns for the Asian Region," *Gene Campaign* (1999): 124-25.
[787] Chandrashekaran and Vasudev, "The Indian Plant Variety Protection Act Beneficiaries: The Indian Farmer or the Corporate Seed Company?," 508.

groundnut plants and created "Morla," a pure variety with large kernels, in order to overcome one of the most severe droughts in India in 1987.[788]

In India, the idea of purchasing seeds was adopted around 40 years ago in the 1960s with the establishment of the National Seeds Corporation (NSC), State Farms Corporation of India (SFCI) and the Tarai Development Corporation (TDC).[789] Seeds in hybrids has replacement conducted much more frequently than that of the pure varieties.[790] Even so, the replacement of seeds certified or labelled accounts for only around 5 percent in the case of pulses and around 42 percent in the case of pearl millet.[791] In other words, about 60 to 95 percent of the seeds planted in India are saved from the harvests of earlier years. Although seed agencies run by the Indian government have attempted to provide new seeds at affordable prices for farmers, most of the small farmers still cannot afford these reasonable hybrid seeds annually.[792] Meanwhile, the Indian farmers often retain a variety of local genetic materials at their own personal cost.[793]

Main players in research and innovation in the field of agriculture are members of the public sector, especially the Indian Council of Agricultural Research (ICAR), its allied institutes and the State Agricultural Universities (SAUs).[794] The public sector has conducted over 75 percent of the research in agriculture in this country.[795] At the same time, the private sector's contribution is around 16 percent while that of international centers accounts for approximately 8 percent.[796] Further, it is estimated that

[788] Anil Gupta, "The 'Honey Bee' network strengthens knowledge for crops, creativity and compensation," *Diversity*, no.12 (1996): 76-78.
[789] Czech Conroy, "Institutional Innovations in India's Crop Improvement System: Rainfed Agriculture Impact Assessment Study No. 5," (2009): 11.
[790] For the case of most self-pollinating crops such as wheat and pulses, these practices are followed until decreased yields necessitate them to purchase new seeds. Meanwhile, farmers who choose to plant hybrids have to repurchase seeds every season.
[791] R. P. Katiyar, *Recent Advances in Seed Science and Technology* (IARI, 1999), 137-143.
[792] Ibid.
[793] Chandrashekaran and Vasudev, "The Indian Plant Variety Protection Act Beneficiaries: The Indian Farmer or the Corporate Seed Company?," 509.
[794] Sujith Koonan, "India's Sui Generis System of Plant Variety Protection," *IELRC Breifing Paper* 1 (2014): 2.
[795] Ibid.
[796] Kochupillai, "India's Plant Variety Protection Law – Historical and Implementation Perspectives," 5.

around 80 percent of the seed demand in India is filled by the informal seed sector, primarily consisting of seeds saved by farmers and the rest by both the private and public sector.[797]

Previously, India did not provide any legal mechanisms to protect the plant varieties and, as a matter of fact, there was no immediate need to do so. Nevertheless, after it became party to the TRIPS Agreement in 1994, such legal mechanism had to be established. The 1970 Indian Patent Act evidently precludes plants, plant varieties, and agriculture and horticultural methods of production from patent protection. However, in 2001, *the sui generis* system for plant variety protection, that is *the Protection of Plant Varieties and Farmers' Rights Act (PPVFR),*[798] was formulated incorporating the exclusive rights of plant breeders and the rights of farmers and local communities and the benefit-sharing ideas of the CBD and ITPGRFA. The PPVFR includes plants of all genera except microorganisms. However, the genera and species of the plant varieties protected under this Act must be notified by the government through a gazette.[799]

It is worth pointing out that India elected the *sui generis* system in order to protect new plant varieties. However, although the law differs from the UPOV Convention in many aspects, it was, in fact, borrowed largely from the text of the UPOV Convention, especially the eligibility requirements.[800] Therefore, India did not, in fact, exploit totally the opportunity to devise a plant breeders' rights system in accordance with its socio-economic interests, although the system of India is different from that of the UPOV in many aspects.

5.3.1 Patentability of Plant Materials

[797] National Commission for Enterprises in the Unorganised Sector, *Report on Conditions of Work and Promotion of Livelihoods in the Unorganised Sector*, 14; Anitha Ramanna-pathak, *Farmers' Rights in India: A Case Study* (The Fridgtof Nansen Institute, 2006), *10.*

[798] *The Protection of Plant Variety and Farmers Right Act (Act no. 53 of 2001) (India).*

[799] *The PPVFR Act,* Section 29 (2).

[800] India is currently not a party to the UPOV Convention. However, it initiated the action to become a party to the 1991 UPOV Convention in the year 1998 and 2002. This has led to strong opposition from many stakeholders as well as a public interest litigation submitted before the Delhi High Court; as for data available on the website of the UPOV, India is still in the list of the countries which have commenced accession procedure; Prabhash Ranjan, "Recent Developments in India's Plant Variety Protection, Seed Regulation and Linkages with UPOV's Proposed Membership," *The Journal of World Intellectual Property* no.12, 3 (2009): 219.

Under the *Indian Patents Act*[801], a patentable subject matter must be an innovation, not just a discovery of "any living thing or non-living substance occurring in nature,"to be eligable for patent protection.[802] Moreover, the Act clearly denies patentability of any part of plants, as well as seeds, plant varieties, the entire plants themselves, and essentially biological processes, [803] as well as agricultural and horticultural methods.[804] Therefore, plants which are developed by way of plasmids and DNA cannot be patented in India, while new processes, which are not considered "essentially biological" for producing the plants are patentable.

With regard to microorganisms, in compliance with the TRIPS Agreement, the Indian Patents Act allows patent protection on new microorganisms.[805] What is more, other technologies which involve microorganisms can be patented in India. For instance, a synergistic combination encompassing either novel or known microorganisms, and a procedure utilizing microorganisms to create a substance are both patentable.[806] Also, the biosynthesis process of a microorganism can be patented.[807] Additionally, the question on whether or not a process involving living microorganisms as an end product can be patented was addressed by the Calcutta High Court in 2002. [808] The Calcutta court decided that the law did not preclude a living end product from the scope of innovation and that "where the end product is a new article, the process leading to its manufacture is an innovation," not just an un-patentable discovery.[809]

5.3.2 Plant Variety Protection and the Protection of Farmers' Rights in India

[801] *Patents (Amendment) Act (Act No. 15 of 2005) (India).*
[802] *Patents (Amendment) Act*, Article 3(c); In order to satisfy this initial requirement, the product or process must be "isolated from nature by the application of human intellect" to be regarded as an invention, not mere discovery.
[803] *Patents (Amendment) Act*, Article 3(j).
[804] *Patents (Amendment) Act*, Article 3(h).
[805] *Patents (Amendment) Act*, Article 3(j).
[806] N. R. Subbaram, "Protection of biotech inventions," The Hindu, accessed March 03, 2018, http://www.thehindu.com/biz/2003/12/29/stories/2003122900321600.htm; Robyn Ott, "Patentability of Plants, Animals and Microorganisms in India," *OKLA. J.L. & TECH* no.2, 16 (2004).
[807] Ibid.
[808] *Dimminaco A. G. v. Controller of Patents Designs and Ors.*, AID No. 1 of 2001, Jan. 15, 2002.
[809] Ibid.

Before the TRIPS Agreement entered into effect, plant innovations for the purpose of agriculture were not subject matters of intellectual property protection.[810]Afterwards, India complies with the obligations under the TRIPS Agreement, Article 27.3(b), by enacting the 2001 PPVFR Act for plant variety protection, which became thoroughly functional in 2007. The main purposes of the Act are to create effective systems for plant variety protection, to guarantee the rights of plant breeders and those of farmers, to encourage investment for research and development and to promote the advancement of the seed industry in India and to make sure that high quality seeds and planting materials of improved varieties are available to farmers in sufficient quantities[811] Simply put, this Act has created dual mandates. While it seeks to ensure the recognition and the protection of farmers' rights for their contributions to the preserving, developing and creating of plant genetic resources, it also aims at protecting plant breeder's rights to generate investment for plant research and development, both from public and private sectors. The objectives of this Act are, therefore, much wider than that of the UPOV system.

a. Breeders' Rights under the PPVFR Act

To reflect the interests of each stakeholder in the agricultural sector, the PPVFR Act divides the types of plant varieties allowed to be registered for exclusive plant breeder rights into four categories, i.e., new plant varieties, extant varieties[812], EDVs[813] and farmers' varieties[814].[815] At the same time, the Act retains the power of the government to limit the scope of registration.[816] This means that only the plant genera and species notified by the government are eligible to be registered under the plant variety

[810] Philippe Cullet and Radhika Kolluru, "Plant Variety Protection and Farmers' Rights – Towards a Broader Understanding," *Delhi Law Review* 24, no. 41(2013): 55.
[811] *The PPVFR Act,* Preamble.
[812] *The PPVFR Act,* Section 2 (j); Extant variety refers to a broad type of plant variety which covers varieties available in the Indian territory notified under the 1966 Indian Seeds Act, Section 5, in circumstances where it is crucial to regulate the seed quality of any particular plant variety sold for agricultural use. Moreover, extant varieties also include plant varieties available in the country which are a farmers' variety, commonly known plant variety, or varieties available in public domain.
[813] *The PPVFR Act,* Section 2 (i); essentially derived varieties refer to plant varieties which can be clearly distinguished from the original plant varieties; however, they still maintain essential features of their original varieties.
[814] *The PPVFR Act,* Section 2 (l); farmer's varieties refer to any variety which have been conventionally harvested and improved by the farmers in their own fields; or a wild relative of a plant variety about which the farmers have commonly known.
[815] *The PPVFR Act,* Section 14.
[816] Sujith Koonan, "India's Sui Generis System of Plant Variety Protection," 5.

protection system.[817] Furthermore, registration may be declined in case "prevention of commercial exploitation of such varieties is necessary to protect public order or public morality or human, animal and plant life and health or to avoid serious prejudice to the environment."[818] As a result, the first phase towards the PPVFR implementation is for the Indian government to notify the genera of plants in order to create the listing of varieties for the objective of registration.[819] The conditions for selecting the genera of plants could include the plants upon which the locals depend for food security, such as major cereals, oilseeds, pulses, vegetables or fruits, plant species significant for import or export, plant genera of Indian origin, or crops where India could benefit from advanced germplasms and foreign investment. The core features of this Act can be described as follows:

In the case that the certificate of registration under this Act is issued for a plant variety, it shall bestow a monopoly right upon the plant breeder, his or her successor, and his or her agent or licensee, to produce, sell, market, distribute, import or export the protected plant variety.[820] Such registration is valid for 9 years in the case of trees and vines and it can be renewed up to 18 years; the validity of the registration for other plants is 6 years and can be renewed up to 15 years.[821] In case of a breach of the rights of plant breeders, either to the protected variety itself or to its packaging, the Act imposes penalties of 50,000 Rupees to one million Rupees.[822] In addition, the sanction might include an imprisonment term of three months to two years; in cases of repeated offences, fines may increase up to two million Rupees and an imprisonment term of three years.[823] On the other hand, there are some duties imposed on plant breeders bestowed with these monopoly rights. For instance, the plant breeders or licensees empowered to

[817] Brahmi, Saxena and Dhillon, "The Protection of Plant Varieties and Farmers' Rights Act of India," 395-396.
[818] *The PPVFR Act*, Section 29.
[819] For the list of the plant genera open for registration under the PPVFR Act as of March, 2018, see "List of 147 Crop species open for registration under New/Extant/Farmers Variety." Protection of Plant Varieties & Farmers' Rights Authority, India. Accessed March 12, 2018. http://plantauthority.gov.in/List%20of%20147%20Crop%20species%20registration%20under%20Extantaandfarmers.htm.
[820] *The PPVFR Act*, Section 28 (1).
[821] *The PPVFR Act*, Section 24 (6)
[822] *The PPVFR Act*, Section 71.
[823] Ibid.

produce, market or sell the seeds or propagating materials of the protected varieties have the duty to provide such seeds to farmers "in a timely manner" to fulfill their necessities at a sensible market cost.[824]

b. Eligibility Requirements

In order for a plant variety to be entitled to registration, the variety must meet the requirements of novelty, distinctiveness, uniformity and stability.[825] Under the PPVFR Act, a plant variety is deemed to be novel in the situations where, at the time of applying for protection, the propagating materials or harvested materials of a plant variety *per se* have not been sold or disposed of by or with the authorization of the plant breeders or his or her licensees for commercial exploitation purposes earlier than one year in India; or outside the country, in the case of vines or trees earlier than six years, or earlier than four years for other types of plants.[826] In the case that a mere trial of a new plant variety which has not been sold or disposed of shall not impact the right to obtain plant breeders' rights protection.[827] Additionally, if the propagated or harvested material of the claimed variety has come to be a subject of common knowledge through any means other than through the aforementioned methods, it shall not impact the novelty requirements for the claimed variety.[828] Simply put, novelty requirement is defined thoroughly by commercialization and not by the fact that such plant variety has not had prior existence in the same manner as that of the UPOV Convention.

A plant variety is deemed distinct, in such a circumstance that it can be indisputably distinguished by one or more important features from any other plant variety whose presence is considered to be common knowledge in any nation on the date of application.[829] Uniformity criterion is

[824] *The Protection of Plant Varieties and Farmers' Rights Rules, 2003 (as amended in 2012),* Rule 36A.
[825] *The PPVFR Act,* Section 15 (1) - (3).
[826] *The PPVFR Act,* Section 15 (3)(a).
[827] Ibid.
[828] Ibid.
[829] *The PPVFR Act,* Section 15 (3)(b).

met in the case where, a plant variety is adequately uniform in its important features, taking into account the variation which may be predicted from the specific features of its propagation.[830] Moreover, stability is satisfied, in the situation where its important features do not change after repeated reproduction or, in the case of a specific course of reproduction, at the end of each course. [831]

Another essential requirement provided under of the PPVFR Act is the disclosure requirement which obliges the plant breeders to disclose the information concerning the utilization of any genetic resources developed or preserved by local communities in situations where they use such resources for new variety development. In particular, this disclosure obligation requires "a complete passport data of the parental lines from which the variety has been derived along with the geographical location in India from where the genetic material has been taken and all such information relating to the contribution, if any, of any farmer, village community, institution or organization in breeding, evolving or developing the variety; Failure to fulfill this requirement leads to the denial of the application for registration."[832] However, it is not evident if the term "parental line" covers only immediate parents or that of previous generations or if the provision applies only to the case of hybrids.

Further, along with the application, the Act requires the applicants to certify that the materials used for creating the variety have been legitimately obtained.[833] Moreover, the applicants have to submit an affidavit showing that the claimed varieties do not contain any gene or gene sequence which involves terminator technology or a Gene Use Restricting Technology (GURT). Generally, there are two major categories of GURT, i.e., variety-level GURT (V-GURT) and trait- level GURT (T-GURT). V-GURT causes the propagating materials of the plant varieties to be sterile while T-GURT provides tool for trait expression into the plant variety which are able to be turned on or turned off, by way of treatment with

[830] *The PPVFR Act*, Section 15 (3)(c).
[831] *The PPVFR Act*, Section 15 (3)(d).
[832] *The PPVFR Act*, Section 18 (e).
[833] *The PPVFR Act*, Section 18 (h).

particular chemical inducers.[834] These genes can be expressed at some specific stages or plant generations. In case concealment is found in the passport data, the certificate of the protected plant breeders can be cancelled.[835] This mandatory disclosure requirement is directly connected with the benefit-sharing mechanism provided under the Act since the implementation of such mechanism would be utterly difficult in the lack of disclosure of information.

c. Research Exemption

Under the PPVFR Act, the researchers can freely access to protected plant varieties if the objective of access is for genuine research purposes. The Act states that "nothing contained in this Act shall prevent (a) the use of any variety registered under this Act by any person using such variety for conducting experiments or research; and (b) the use of a variety by any person as an initial source of a variety for the purpose of creating other varieties."[836] Therefore, this provision permits scientists and other plant breeders to free access to protected plant varieties for the purposes of research and development. The authorization from the plant breeders is only required when the protected variety have to be repeatedly employed as a parental line for commercial production of a new plant variety.[837]

d. The Protection of Farmers' Rights

The early draft of the PPVFR Act was designed solely for the protection of breeders' rights; however, provisions concerning the rights of farmers were subsequently included as an outcome of consultation series by the Indian Parliamentary Standing Committee.[838] The features of farmers' rights incorporated in this Act is as follows:

[834] Di Saurabh Bhatia,Kiran Sharma,Randhir, *Modern Applications of Plant Biotechnology in Pharmaceutical Sciences* (Elsevier Inc., 2015), 382.
[835] *The PPVFR Act,* Section 40.
[836] *The PPVFR Act,* Section 30.
[837] Ibid.
[838] Biswajit Dhar and Sachin Chaturvedi, "Introducing Plant Breeders' Rights In India: A Critical Evaluation of the Proposed Legislation" *Journal of World Intellectual Property* no.1, 2 (1998): 245; Shaila Seshia, "Plant Variety Protection and Farmers' Rights: Law Making and Cultivation of Varietal Control," *Economic and Political Weekly* 27, no.37 (2002): 2741.

First, the PPVFR Act broadly interprets the term "breeder" to include farmers.[839] As a consequence, farmers can also register their new plant varieties and they are set at the same standard as plant breeders. Moreover, the registration of extant varieties and farmers' varieties is allowed under the PPVFR Act. The eligibility requirements of distinctness, uniformity and stability are also applicable to the registration of extant varieties; nevertheless, the criterion of novelty is not necessary[840]

Furthermore, farmers do not have to follow the identical procedure and formalities applied to new plant variety registration.[841] Moreover, in applying for farmers' variety registration, farmers are exempt from submitting some documents including an affidavit to the fact that such a variety does not incorporate any gene or gene sequence which involves GURT, as well as complete parental line passport data.[842]

Third, the expected performance of a plant variety is to be disclosed to the farmers at the time of purchase of seeds or propagating materials of such a variety.[843] a farmer, a farmer group or a farmer's organization is eligible to claim compensation in case a plant variety does not bring about the expected performance under prior set forth conditions.[844] Moreover, a term of imprisonment may be provided in case of repeated offences.[845] Notably, this provision leaves rather broad discretion to the Indian authority to decide the amount of compensation. In accordance with some NGOs involving in the field such as Gene Campaign, this has led to arbitrary decisions.[846] They make a suggestion that if it can be proved that a plant breeder made false claims, resulting in a crop failure suffered by the farmers, compensation of more than twice the value of the projected harvest should be awarded.[847]

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[839] *The PPVFR Act*, Section 2 (c).
[840] *The PPVFR Act*, Section 15 (2).
[841] *The PPVFR Act*, Section 18 para. 2.
[842] *The PPVFR Act*, Section 39 (1), only requires farmers to provide "a declaration that the genetic material or parental material acquired for breeding, evolving or developing the variety has been lawfully acquired." In accordance with Section 18 (1)(h).
[843] *The PPVFR Act*, Section 39 (2).
[844] Ibid.
[845] *The PPVFR Act*, Section 73.
[846] Shaila Seshia, "Plant Variety Protection and Farmers' Rights: Law Making and Cultivation of Varietal Control," *Economic and Political Weekly* 27, no.37 (2002): 2741.
[847] Ibid.

Forth, the farmers have also been guaranteed immune of innocent infringement in case a farmer is not aware that breeder rights exist over such a particular variety at the time of the infringement.[848] This right is a clear discrepancy from the UPOV systems since neither of the 1978 nor the 1991 version mentions this right of farmers.

Fifth, in the same manner as the practices of farmers before the coming into force of the PPVFR, farmers have the right to save, use, sow, re -sow, exchange, share and sell farm production of the protected plant varieties.[849] However, the Act explicitly provides that this is except for the sale of branded seeds contained in a package or container and labelled in a way displaying that such seeds are of a protected plant variety under a commercial marketing arrangement.[850]

Last, any farmer engaging in the preservation and improvement of genetic materials of farmers' varieties or wild relatives of crops with an economic value, shall be entitled to recognition and reward from "the Gene Fund" on the condition that their materials were utilized as gene donors in any plant variety registered under the PPVFR Act.[851] The PPVFR Act requires sharing of benefits derived from the protected plant varieties which are developed from indigenous plant genetic materials.[852] This mechanism means that some proportion out of the total benefits generated by the plant breeder by virtue of the plant breeders' rights, as may be designated by the authority to be shared with the beneficiaries under this Act. The benefit-sharing must be in monetary form.[853] After giving an opportunity for the plant breeders and others to be heard, the authority would designate the amount of benefit-sharing by taking into account the scope and nature of the utilization of genetic resources of the claimant in developing any new plant variety, as well as the business utility and the demand for such a new plant variety.[854] The money received would be deposited in the Gene fund and would be utilized in implementing this mechanism and in

[848] *The PPVFR Act,* Section 42 (1).
[849] *The PPVFR Act,* Section 39 (1).
[850] Ibid.
[851] *The PPVFR Act,* Section 45.
[852] *The PPVFR Act,* Section 26(1).
[853] *The PPVFR Act,* Section 2 (b).
[854] *The PPVFR Act,* Section 26 (5).

conserving plant genetic diversity.[855] In this regard, the PPVFR authority has created two mechanisms, namely *the Plant Genome Savior Community Award*[856] and *the Plant Genome Savior Farmer Reward and Recognition*[857] for these particular purposes of recognition and reward for the farmers and farming communities' contributions in agrobiodiversity.

e. Provisions Concerning Public Interests

The PPVFR Act encompasses public interest provisions, including the preclusion of certain varieties from plant breeders' right protection and the issue of a compulsory license. First, for the purpose of safeguarding the interests of the public, some plant varieties may not be able to be registered or the registration may be revoked due to the prevention by the commercial exploitation policy.[858]

Second, the PPVFR Authority has the power to issue a compulsory license, provided that the plant breeder cannot satisfy the reasonable demand of the public for the protected seeds or other types of propagating materials or in case such protected seeds or propagating materials have been offered to the public at an unreasonable price.[859] A compulsory license can be given to any person who is interested in taking up such activities after three years from the date of the certificate of registration being granted for the purposes of production, distribution or sale of propagating materials of the protected varieties.[860] The plant breeder is eligible to file an opposition to the authority. If the charge is proved to be valid, the plant breeder may be directed to grant a license under some conditions and may be allowed to collect some

[855] *The PPVFR Act*, Section 26 (6).
[856] "Plant Genome Saviour Community Awards," Protection of Plant Varieties & Farmers' Rights Authority, India, accessed March 12, 2018, http://plantauthority.gov.in/PGSFA.htm.
[857] "Plant Genome Saviour Farmer Recognition," Protection of Plant Varieties & Farmers' Rights Authority, India, accessed March 12, 2018, http://plantauthority.gov.in/PGSFRCG.htm; see "Plant Genome Saviour Farmer Rewards," Protection of Plant Varieties & Farmers' Rights Authority, India, accessed March 12, 2018, http://plantauthority.gov.in/PGSFR.htm.
[858] *The PPVFR Act*, Section 29 and 34.
[859] *The PPVFR Act*, Section 47(1).
[860] Ibid.

reasonable license fees.[861] Nevertheless, a compulsory license will not be awarded in the case that the plant breeder can show that there is an appropriate reason for his or her failure to produce the seeds.[862]

5.3.3 Analysis on the Restrictive Approach of India

India has an agricultural economy that aims towards the market within India itself. Their economy largely depends on seeds produced by local farmers who are the majority of their population; hence, for India, it is utmost essential to acknowledge farmers' rights. Furthermore, owing to the significant contribution of farmers to their genetic diversity preservation and development, India seeks to ensure the sharing of the information and knowledge on adaptive plant characteristics and the improvement of domestic plant varieties by maintaining the ability to exchange new genetic germplasms for the purposes of improving and adapting to local planting conditions. The *sui generis* system for the protection of plant varieties presents the possibility for India to devise a new form of intellectual property protection which is not based upon the existing patent system under the TRIPS Agreement.

5.3.3.1 Effects on Farmers

The PPVFR Act seems to be a revolutionary legislation since it recognizes that the farmers' varieties can be viewed as intellectual property rights in the identical manner as other outcomes of creativity of mankind. The Act acknowledges the fact that farmers are both innovators and preservers of agrobiodiversity. Hence, in the situations where farmers contribute to the preservation of genetic resources of farmers' varieties and wild varieties whose genes have been utilized in plant varieties protected under the PPVFR Act or where they take part in the improvement of those plants by ways of selection and preservation, they have rights to recognition and reward.

Moreover, Indian farmers still maintain the rights to save use, sow, resow, exchange, and share or sell seeds of their own harvests, as well as the seeds of a protected plant variety, while they are not able to sell seeds branded with the name of the holders of plant breeders' rights. Thus, while the farmers can

[861] *The PPVFR Act*, Section 47(3).
[862] Ibid.

still enjoy their rights to traditional farming practices and save the costs of their farm inputs, the plant breeders crucially maintain the control over the commercial exploitation in this way without barring the ability of the farmers to their traditional practice. Obviously, the PPVFR Act incorporates some provisions which include a broader set of norms for the protection of farmers' privilege outside the purview of the UPOV Convention.

The main feature of this Act is the possibility of farmers to be granted the identical monopoly rights as commercial plant breeders for their newly improved varieties. In addition, the Act exempt the "fees in any proceeding" for a farmer or a group of farmers and local community, [863] as well as the registration fees.[864] Therefore, from the year 2007 to 2012, as much as 32.3 percent of the total plant varieties registration in India are farmers' varieties.[865] Nevertheless, given the fact that farmers have to satisfied the criteria of distinctness, uniformity and stability adopted from the UPOV Convention designed for commercial breeders in particular, some farmers might find it is difficult to meet these eligibility criteria due to the nature of farmers' varieties which need to be inconsistent and unstable to survive various environmental conditions at different harvesting seasons.[866]

5.3.3.2 Effects on Seed Industry

With respect to the Indian seed industry, the seed industry basically stands to pick up massively from the PPVFR Act which should support the seed sales. Nevertheless, the relatively rigid farmers' right element provided in this Act restricts the benefits from the improvement and sale of plant varieties with

[863] *The PPVFR Act*, Section 44; "Fees in any proceeding" refer to "any fees payable for inspection of any document or for obtaining a copy of any decision or order or document under this Act or the rules made thereunder."
[864] Details of Fees," Protection of Plant Varieties & Farmers' Rights Authority, India, accessed March 12, 2018, http://plantauthority.gov.in/registrationfees.htm.
[865] P. Venkatesh, V. Sangeetha, and Suresh Pal, "India's Experience of Plant Variety Protection: Trends, Determinants and Impact," *Selected Paper prepared for presentation at the 2015 AAEA & WAEA Joint Annual Meeting, San Francisco, California* (2015): 7.
[866] Koonan, "India's Sui Generis System of Plant Variety Protection," 3; Pratibha Brahmi, Sanjeev Saxena and B. S. Dhillon, "The Protection of Plant Varieties and Farmers' Rights Act of India," *Current Science*, no.86, 3 (2004): 397.

pure line.[867] Due to this fact, the private plant breeders in India generally concentrate on the sales of highly profitable hybrid seeds while leaving the onus of improving pure line varieties to public sector and the farmers.[868] This is evident from the massive increase in the number of vegetable hybrids distributed for harvest by the private sector in the past ten years which has risen from less than 50 to around 400.[869] At the same time, every farmer does not benefit equally from such an increase in seed options because the small and medium farmers still primarily rely on seeds and biotechnology generated by the public sector due to the scarcity of capital. Therefore, under the current system, it seems that the farmers in India are able to maintain their important roles as developers and producers of seeds.

Plant breeding institutions in the public sector, particularly the breeding programs carried out by the ICAR has been the spine of the green revolution during the 1960s; however, in the past decades, productivity levels have diminished and the production of food grain has tapered off to 1.5 percent.[870] Therefore, if India wishes to maintain their food security in as sustainable manner, it cannot ignore the private investment on modern biotechnological technology in the field of plant breeding.

5.3.3.3 Benefit-Sharing Mechanism

It is obvious that India has elected to adopt bilateral contractual mechanism for monetary benefit-sharing rather than multilateral system for benefit-sharing which focuses on genetic resource sharing. This approach of India is more compatible with the approach of the CBD rather than that of the ITPGRFA. While the direct approach may not automatically give rise to weak implementation, it reveals that the choice of a contractual mechanism may not be a very effective choice for this country.

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[867] Chandrashekaran and Vasudev, "The Indian Plant Variety Protection Act Beneficiaries: The Indian Farmer or the Corporate Seed Company?," 512.
[868] Ibid.
[869] S. Mitra, "Patent and food security-opening Pandora's box," *Journal of Intellectual Property Rights* 13 (2008): 145-151.
[870] S. Kocchar, "Institutions and capacity building for the evolution of intellectual property rights regime v-analysis of review of trips agreement and r and d prospect in Indian agriculture under IPR regime," *Journal of Intellectual Property Rights* 13 (2008): 536-547.

Although India has created an intricate structure with legal norms to achieve the goal of benefit-sharing, the present situation indicates some practical limitations. Not only have the benefits collected been rather insignificant, but there have also been not very many genuine instances of benefit-sharing with the locals as some problems in transferring the benefits in mutually agreed amounts to the Indian communities have arisen in most of the cases.[871] The determination of the amounts of money to be collected has itself been a problem. As pointed out by Tvedt and Kabir, Indian Authorities normally exercise a "rule of thumb"[872] where the amount of shared benefit is pre-determined rather than setting from a negotiation process.[873] This problem occurs owing to the absence of time and expertise of the authority to properly examine the benefit-sharing applications.[874] The identification of the communities or local individuals who should be granted the parts of the shared benefits is another primary stumbling difficulty.[875]

Evidently, India is in need to review the objectives of its benefit-sharing approach and provide evidently what this approach seeks to achieve and concentrate on it. Ramanna-Pathak suggests that community development should be the first primary goal and that the quick regulatory changes cannot fix the underlying problems.[876] Also, some administrative changes are also needed for this mechanism to run effectively. Further, it has been obvious from the experience of India that benefit-sharing mechanism cannot be depended on as a main source of monetary income. More viable solution would be to focus on not only monetary reward, but also on non-monetary rewards and recognition for Indian local communities. Further, India has to change from a state-led sharing of benefits, to the one that encourages a more inclusive strategy with the local people. And lastly, India should seek to reach the international objectives of benefit-sharing provided under the ITPGRFA of the FAO with national frameworks.

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[871] For the details of rewards granted to farmers, see "Plant Genome Saviour Farmer Rewards," Protection of Plant Varieties & Farmers' Rights Authority, India, accessed March 12, 2018, http://plantauthority.gov.in/PGSFR.htm.
[872] "Rule of thumb" is the broad application of a principle which does not intend to be strictly accurate or reliable for every situation.
[873] Tvedt, Morten Walloe, "Into ABS Implementation: Challenges and Opportunities for the Nagoya Protocol", *Biores* no.8, 8 (2014): 9-14.
[874] Ibid.
[875] Anitha Ramanna-Pathak, "Benefit Sharing: Reframing India's Policy," *FNI Report 1* (2017): 34.
[876]Ibid, 28.

Chapter VI: Analysis on Thailand toward protection mechanisms for developing countries

This Chapter is devoted to evaluating the situation of Thailand on intellectual property protection. The main aim of this Chapter is to identify the statutory and practical problems in the inherent system and find the solutions to those problems by learning from the texts of relevant international arrangements and the implementation experience of the United States, the European Union and India. In doing so, it is divided into three parts. First, it analyses the factors affecting the government's discussion on the development needs of Thailand, namely the social and economic conditions of Thailand, as well as the stakeholders involved in Thailand's agricultural management. Second, it considers the existing Thai PVP Act which seeks to conform to the obligations of the TRIPS Agreement of the WTO and the CBD. Last, it crucially attempts to analyse the most appropriate and preferrable model for intellectual property rights on plant inventions in Thailand. It is worth noting that Thailand has not yet been a party to the UPOV convention. Despite the attempt by the government to introduce the UPOV model in Thailand through the proposal of the new Draft on PVP Act, because of the wide opposition by farmer groups and those in academic sector, it is unlikely for the new Draft to be adopted in the near future.

6.1 Agricultural Sector in Thailand

The agricultural sector has always been the backbone of the development of the Thai economy for many centuries. Not only is the domestic agricultural system the main source of food security, food supply, and national income for Thai people, it is also one of the most vital reasons why the unemployment rate of Thailand is remarkably low.[877] The agricultural sector has created job opportunities for a large number of the Thai population, particularly in the rural areas.

Thai population accounted for around 69 million in April, 2018, with 41.4 percent of the total population residing in rural areas.[878] Around 90 percent of people living in rural areas, or approximately 5.2 million families, earn a living through farming, especially rice and other cultivated crops grown on a large scale.[879]

Agriculture has been and will remain an important driving force to Thai economic growth. At the same time, the service sector and the industrial sector have expanded at an astonishing pace over the past decades. At present, these two sectors have contributed to the largest and second largest sectors in Thailand's overall Gross domestic product (GDP).[880] Meanwhile, the contribution of the agricultural sector in overall GDP has constantly dwindled. The contribution of the agricultural sector to Thailand' national GDP decreased from 25.08 percent in 1980 to 8.2 in 2017;[881] however, agriculture is still essential for maintaining domestic food security and providing fundamental resources for other industries,

[877] In 2014, the official unemployment rate of Thailand is of 0.56 percent and is among the States which have the lowest unemployment rate in the world, Suttinee Yuvejwattana, "Thailand's Unemployment Rate Is a Ridiculously Low 0.6%. Here's Why," Bloomberg.com, February 02, 2015, accessed April 29, 2018, https://www.bloomberg.com/news/articles/2015-02-02/thailand-s-unemployment-rate-is-a-ridiculously-low-0-6-here-s-why.
[878] "Thailand Population (LIVE)," Thailand Population (2018) - Worldometers, accessed April 29, 2018, http://www.worldometers.info/world-population/thailand-population/.
[879] Biothai, "Policy concerning Seed Managements and Plant Varieties in Thailand," *Biothai* (2011): 1 – 4.
[880] In 2017, Thailand's total GDP value is 406.8 billion USD with the main contribution generated by the service sector (55.6%), followed by industrial (36.2%) and the agricultural sector (8.2%); "Thailand GDP - Composition by Sector," Index Mundi, accessed April 29, 2018, https://www.indexmundi.com/thailand/gdp_composition_by_sector.html.
[881] Ibid.

such as agroindustry. Many important industries for the Thai economy, including those of cotton and jute textiles and sugar, are directly dependent upon the input from the agricultural sector.[882]

The major advantage of Thai agriculture is that there are plentiful areas of land. Farm holdings contribute to approximately 41.5 percent of the total area of Thailand.[883] Both irrigated and non-irrigated farm holdings employ around 5.2 million families in order to generate agricultural products for the purposes of consumption within the country and for export.[884] Such plentiful areas of harvested land are the direct result of the expansion of harvested land into forests.[885] Consequently, land-intensive field crops, such as rice or maize, and permanent trees, specifically rubber, are widely grown in this country for commercial purposes**.**[886] However, during 1990-2000, as forest areas sharply declined, this advantage of Thailand has been extensively reduced.[887] Also, due to agronomic conditions, Thailand has always been disadvantaged in producing protein-based crops such as oil palm, soybean, or coconut.[888]

At an international level, Thailand is the thirteenth-biggest exporter of agricultural products, with an overall share in the global market of 2.2 percent.[889] Moreover, it is one of the biggest global exporters of cassava, rice and rubber.[890] In 2018, Thailand was the world's second largest rice exporter after India with a total rice export of USD4.4 billion (21.9 percent).[891] Other main exported goods include corn, sugarcane, coconuts, palm oil, and pineapple.[892] Moreover, according to the Thai Seed Trade Association,

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[882] Thanwa Jitsanguan, "Sustainable Agricultural Systems for Small-scale Farmers in Thailand: Implications For The Environment," *Kasetsart University* (2012): 1-11.
[883] Chavalvut Chainuvati and Withaya Athipanan, "Crop Diversification in Thailand," Food and Agriculture Organization of the United Nations [FAO], accessed April 29, 2018, http://www.fao.org/docrep/003/x6906e/x6906e0c.htm.
[884] Ibid.
[885] Nipon Poapongsakorn, "R&D and Performance of the Thai Agriculture and Food Processing Industry: The Role of Government, Agribusiness Firms, and Farmers," *Thailand Development Research Institute* (2011): 405-406.
[886] Ministry of Agriculture and Cooperatives of Thailand, *Agricultural Census in Thailand* (2014).
[887] Ibid.
[888] Poapongsakorn, "R&D and Performance of the Thai Agriculture and Food Processing Industry: The Role of Government, Agribusiness Firms, and Farmers," 406.
[889] Ibid.
[890] "Thailand Economy Profile 2018," Index Mundi, accessed April 18, 2018, https://www.indexmundi.com/thailand/economy_profile.html.
[891] "Rice Exports by Country," World's Top Exports, February 05, 2018, accessed April 29, 2018, http://www.worldstopexports.com/rice-exports-country/.
[892] Ibid.

Thailand is the largest seed exporter among Association of Southeast Asian Nations (ASEAN) and the fourth largest in the Asia Pacific region. The total value of the export of Thai seeds contributes more than BHT10,000 million per annum.[893]

There are three main stakeholders who play important roles in Thailand's agricultural management, research and development: farmers, private plant breeders, and public research institutes. Conventionally, agricultural research and development has largely been in the hands of the public sector because plant materials are available at national gene banks and the view is that those materials are public goods.[894] However, genetic improvement research has also been conducted by the private sector or farmers since they are the ones who directly gain the benefits from their efforts.

a. Farmers

The agricultural sector in Thailand largely consists of small-holding farmers.[895] For centuries, Thai farmers have been able to produce sufficient staple food production, as well as its substitutes, to fulfill the domestic demand of Thai people. In addition, Thai farmers usually save seeds for replanting in the following seasons, select particular traits of plant varieties and cross them to create better plants which suit the local environment. The Thai government estimates that farmers' saved seeds accounts for 75 percent to 85 percent of overall seed utilized in Thailand for farming purposes.[896] Thai farmers mostly use open-pollinated cultivars and farmers' varieties due to the difficulties to afford costly hybrid seeds which can bring about higher yields and generate more income.[897] Up to the present, farmers in Thailand still supply the large majority of seeds used in farming.

[893] Nanchanok Wongsmut, "New Draft on Plant Variety Protection Act Takes Advantages of Farmers or Promote New Innovation?" [translation of: ร่าง ก.ม.พันธุ์พืชฉบับใหม่ เอาเปรียบเกษตรกร หรือส่งเสริมการวิจัย?], BBC News, November 04, 2017, accessed April 29, 2018, http://www.bbc.com/thai/thailand-41854880.
[894] Poapongsakorn, "R&D and Performance of the Thai Agriculture and Food Processing Industry: The Role of Government, Agribusiness Firms, and Farmers," 429.
[895] Biothai, "Policy concerning Seed Managements and Plant Varieties in Thailand," *Biothai* (2011): 1 - 4.
[896] Ibid.
[897] Ibid.

Moreover, Thai farmers have the practices of exchanging seeds taken in various different forms. The forms of exchange include bilateral agreement which may involve the obligation for the genetic material recipients to return an equal or better quantity of seeds after their harvest.[898] Also, seed exchange can occur at seed fairs, in which farmers from different areas come together to share and learn about plant varieties from each other and also to exchange different varieties. In seed fairs, farmers usually learn about either domesticated or semi-domesticated plant varieties which do not exist or have already become extinct from their localities.[899] The example of this seed fair is Ku Ka Singha Indigenous Seed Fair held every year at Roi Et province in Northeastern Thailand, sponsored by the Alternative Agriculture Network (AAN) with some local NGOs for the purpose of supporting countrywide seed-sharing of rice and vegetables.[900] Also, ECHO Asia Impact Center partnering with Mae Jo University (Thailand), has from time to time organized seed fairs in the Northern area of Thailand.[901]

b. Private Plant Breeders

In the 1920s, after the importation of foreign vegetables and their seeds through Thailand's fresh vegetable market, *Pak Klong Talad*, the merchants started to establish specialized farms for the purpose of testing imported plant varieties.[902] This establishment has led to an expansion of the roles of the private sector in Thailand. In 1975, the first seed company, *the Charoen Pokphand* or *the CP Group*[903], was set up under the support of the Board of Investment to promote, produce and distribute seeds of corn throughout the country. This has given rise to the formation of other private seed companies to distribute

[898] Ibid.
[899] Laura S. Meitzner Yoder and Vincent Ricciardi, "Seed fairs: Fostering local seed exchange to support regional biodiversity," *ECHO Asia Notes* (2012): 1.
[900] Daniel Robinson, "Local Agri-cultural and Environmental Knowledge: working with local institutes and communities in Thailand," in *Jennings J., Packham R., Woodside D. Eds. Shaping Change: Natural Resource Management, Agriculture and the Role of Extension* (2011): 7.
[901] Yoder and Ricciardi, "Seed fairs: Fostering local seed exchange to support regional biodiversity," 1-3.
[902] Wichar Thitiprasert et. at., "Country Report on the State of Plant Genetic Resources for Food and Agriculture in Thailand (1997-2004)," *FAO/Government Coorperative Programme* no. 9 (2007): 13.
[903] The holding company CP Group (CPG) is comprised of four main corporations and a number of small corporations, including CPF dealing with livestock and fishery; CP All running the Seven-Eleven; CP Inter Trade involving in trading of rice; and last, CP Seeds dealing with business of seeds and seedlings. Moreover, the main shareholder of CPG, the Chiarawanond family, also has the control over Chia Tai Company, the first agribusiness company in Thailand, producing seeds and fertilizers, as well as drugs.

the seeds of corn, as well as other field crops, leading to a demand for the establishment of a legal mechanism for plant variety protection, especially for the protection of hybrid production.[904] At present, the seed industry consists of approximately three hundred private corporations.[905]

However, the agroindustry has become all the more concentrated. Rice export section is dominated by only five Thai corporations, and the seed market is dominated by the CP Group and only a few multinational corporations.[906] These large-scale companies have established long-term research and development strategies and have put investments into these strategies.[907] For example, the CP Group invests approximately one billion baht ($31 million) per annum on their research and development projects, constituting around 30 percent of the overall expenditure on agricultural research and development.[908] The company has hired more than a hundred researchers and scientists from universities or public research institutes.[909] Since only a few companies have put such serious efforts in improving new technologies in the food industry, some commentators claim that, it is an opportunity for other medium and small companies to copy plant innovation without actual spending on investment.[910] Up to the present, the private research and development in agriculture has given rise to the advent of hybrid seeds, including those of baby corn, vegetable crops, and rice, as well as the genetic advancement of rubber tree varieties.[911] In the same manner as India, the research and development and the supply of seeds by private sectors concentrates more on hybrid seeds and leaves the pure line development in the hands of public research institutes and farmers. [912] The percentage varies depending on the types of crops.

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[904] Thitiprasert et. at., "Country Report on the State of Plant Genetic Resources for Food and Agriculture in Thailand (1997-2004)," 59.
[905] Wongsmut, "New Draft on Plant Variety Protection Act Takes Advantages of Farmers or Promote New Innovation?."
[906] Poapongsakorn, "R&D and Performance of the Thai Agriculture and Food Processing Industry: The Role of Government, Agribusiness Firms, and Farmers," 414.
[907] Ibid.
[908] Suphannachart Waleerat, "Research and Productivity in Thai Agriculture," *The Australian Journal of Agricultural and Resource Economics* (2011): 35-52.
[909] Ibid.
[910] Patarapong Intarakumnerd, "Seven Habits of Thailand's Highly Ineffective Technology and Innovation Policies," *Institutions and Economies* no.7, 1(2015): 80-95.
[911] Ibid.
[912] Biothai, "Policy concerning Seed Managements and Plant Varieties in Thailand," 1 - 4.

Private sector supplies approximately 12 percent of paddy seeds, 8 percent of wheat seeds; in the meantime, it provides as much as 29 percent of maize and 72 percent of pearl millet seeds.[913]

c. Public Research Institutes

Public research institutes in Thailand have played an active role and are considered to be the most important sector in agricultural research in this country.[914] The research on self-pollinating crops, such as rice, vegetable crops, cassava and sugar cane, is usually carried out by the public sector because the farmers who use the improved plant materials can simply save the seeds from their own harvest to replant in the next seasons;[915] therefore, the private sector cannot generally recover the costs of research and development.

At the same time, the genetic research on cross-pollinating crops,[916] such as hybrid corn or sorghum, was initiated by the public research institute which developed the maize variety "Suwan" with the downy mildew resistant trait.[917] However, since 1999, after the introduction of a plant variety protection system, the private companies can recover some of their investment on research from the sale of hybrid seeds. Therefore, the private sector in Thailand has since carried out the research and supplied the maize propagating materials to local farmers, as well as exporting them.[918]

With regard to the research on the genetic improvement of tree plants, such as rubber, as it can take a few decades for a tree to grow or to reach its full size, it is expensive to conduct research on a trial-

[913] Ibid.
[914] The formal agricultural research institute was, for the first time, established in the late 1950s. Later on, in 1960s, the Thai government formed a research institute in the Ministry of Agriculture, that is the Department of Rice, Department of Agriculture (DOA). In addition, some public universities, including Kasetsart University, also play an important part in agricultural research and development. Afterwards, in 1983, the National Center for Genetic Engineering and Biotechnology was established to carry out the research particularly on plant biotechnology.
[915] The public research institutes have improved many high-yield varieties (HYVs) for important plants for Thai economy. For instance, the Department of Rice has developed many rice HYVs such as RD6, RD15, RD21, RD25, Supan Buri 60, Chainat 1, as well as thirty-two sugarcane varieties, eight casava varieties, and twenty-three rubber varieties.
[916] Cross-pollinating crops can be naturally outcrossed; thus, the seed quality can be swiftly deteriorated in subsequent generations; therefore, the private commercial companies have arisen to supply hybrid seeds for farmers.
[917] Poapongsakorn, "R&D and Performance of the Thai Agriculture and Food Processing Industry: The Role of Government, Agribusiness Firms, and Farmers," 430.
[918] Ibid.

and-error basis. The private sector in Thailand does not have adequate incentives to conduct research on these types of plants; as a consequence, crossbreeding activities are mostly conducted by farmers and public institutions. [919]

Recently, some policy makers and scientists have expressed their concerns about a gradual decrease in the competitiveness of Thailand in the global market. One reason which has been pointed out is that the number of investments in research and development in Thailand is considerably lower than other countries.[920] Moreover, some scholars claim that Thailand is facing a shortage of highly-competent researchers on agriculture and biotechnology, particularly the researchers with Ph.D. degrees, due to the low salary at the government research institutions and lack of incentives.[921]

To sum up, it is apparent that, since the land available for harvesting is decreasing, without modern technologies to deal with the resource shortage and rapid increase in the costs of production, the exports of Thai agricultural products will gradually lose their competitiveness in the global market. Therefore, new plant innovations which enable Thai farmers to produce higher-value and less labor-intensive farming products are needed. Thailand demands for more investment in plant innovation; however, the research budget from the public sector, as well as, the number of competent researchers, is not sufficient.

6.2 Thailand's Intellectual Property Protection on Plants

As one of the WTO Members, Thailand has participated in the TRIPS Agreement since 1994. Since Article 27.3(b) of the TRIPS Agreement allows its Members to exclude plants from patentability and adopt *sui generis* system for plant variety protection, *the Patent Act of Thailand* [922]does not allow

[919] Intarakumnerd, "Seven Habits of Thailand's Highly Ineffective Technology and Innovation Policies," 80-95.
[920] Waleerat, "Research and Productivity in Thai Agriculture," 35-52.
[921] Poapongsakorn, "R&D and Performance of the Thai Agriculture and Food Processing Industry: The Role of Government, Agribusiness Firms, and Farmers," 440-441.
[922] *Patent Act B.E. 2542 (AD 1999) (Thailand)* amended in B.E. 2522 (AD 1979) and B.E.2535 (AD 1992) (Patent Act of Thailand).

patents on plants by specifically stating that plants are not patentable.[923] The existing legal mechanism for plant variety protection, the *Plant Variety Protection Act B.E.2542 (AD1999)* (PVP Act)[924], is analyzed in this section in attempting to answer the question as to whether the Thai plant variety protection law is sufficiently effective to promote Thailand's agricultural development and to protect the rights of plant breeders and local farmers.

6.2.1 Drafting History

Plant variety protection was initiated in Thailand during the final round of the General Agreement on Tariffs and Trade (GATT) negotiations.[925] Following the series of GATT negotiations in 1994, the WTO members, including Thailand were obligated to create legal mechanisms in compliance with the TRIPS Agreement. As a result, Thailand immediately attempted to establish the intellectual property regimes which had not previously been protected in the Kingdom, including plant variety protection. The concerned government bodies, namely, the Ministry of Commerce and the Ministry of Agriculture and Cooperatives, were tasked to commence research on the effects of the plant variety protection regime on this country.[926]

The technical assistance to establish the plant variety protection regime in Thailand was provided by the UPOV and Japan.[927] In particular, in 1994, the UPOV provided a workshop, aimed at promoting the model of the 1978 UPOV Convention with the monetary support from the Ministry of Agriculture, Forestry and Fisheries of Japan. In other words, the Thai government was, in fact, advised by the UPOV

[923] *Patent Act of Thailand,* Article 9 (1).
[924] *The Plant Variety Protection Act B.E.2542* (1999) (Thailand) (PVP Act).
[925] The final round of the multilateral trade negotiations in the period of GATT between 1947 to 1994 is commonly cited as the Uruguay Round.
[926] Jaroen Compeerapap, "The Thai Debate on Biotechnology and Regulations," *Biotechnology and Development Monitor* 32 (1997): 1315.
[927] Rajeswari Kanniah, "Plant Variety Protection in Indonesia, Malaysia, the Philippines and Thailand," *Journal of World Intellectual Property* no. 8, 3 (2005): 285 - 287.

to design a plant variety protection system. Consequently, the contents of the two drafts proposed by the Ministry of Commerce and the Ministry of Agriculture and Cooperatives were based upon the language of the UPOV Convention.[928]

The drafts on the plant variety protection Act, modelled after the 1978 UPOV Convention, have led to extensive public debates and controversies among different actors in the agricultural sector.[929] In particular, academics, farmers' groups, and public research institutes, as well as some NGOs, strongly opposed the adoption of these drafts.[930] To seek a compromise, the Drafting Committee for Plant Variety Protection Act, comprised of delegates from various stakeholders, such as plant breeders, farmers, academicians, and NGOs, was established in 1997 to design a new draft on the Plant Variety Protection Act.[931]

Finally, the drafting committee combined the text of the two drafts with the new provisions guaranteeing the idea of farmers' rights and the rights of local communities over natural resources existing in their territories.[932] The Act was eventually enacted in 1999 owing to a compromise between the farmers' communities and the pressure from private corporations and the international sphere to adopt intellectual property rights on plants.[933]

6.2.2 The Plant Variety Protection Act B.E. 2542 (AD 1999) (PVP Act)

Despite the controversies on plant intellectual property protection in the country, the PVP Act of Thailand finally entered into effect in 1999 under the administration of the Ministry of Agriculture

[928] Ibid.
[929] Witoon Lianchamroon, "Community Rights and Farmers' Rights in Thailand," *Biotechnology and Development Monitor* 36 (1998): 11.
[930] Two primary arguments were claimed by relevant civil groups against the draft on PVP Act. First, they commented that the Draft relied only on the demands of transnational seed companies. Second, the Draft did not sufficiently acknowledge the rights of farmers; therefore, if the draft was adopted it would harm local plant breeders and small farmers; Jakkrit Kuanpoth, "Protection of Traditional Knowledge in the Face of Globalisation: Balancing Mechanism between CBD and TRIPS," *Thailand Journal of Law and Policy* no.1, 12 (2009), http://www.thailawforum.com/articles/Legal-Protection-Of-Traditional-Knowledge.html.
[931] Lianchamroon, "Community Rights and Farmers' Rights in Thailand," 11.
[932] Pawarit Lertdhamtewe, "Asian approaches to international law: focusing on plant protection issues," *Journal of Intellectual Property Law and Practice* no. 5, 8 (2003): 388.
[933] Compeerapap, "The Thai Debate on Biotechnology and Regulations," 1316.

and Cooperatives. The main goals of this Act were to reduce the concern that the Thai agricultural farming system might be negatively impacted by the stronger intellectual property protection, i.e. patent regime and the 1991 UPOV Convention, and to preserve Thai conventional farming practices, while promoting new plant innovations for Thai agriculture to compete at an international level.[934] Moreover, it was the main purpose of this Act to enforce Thai sovereign rights over all plant genetic resources available within the country.[935] Nonetheless, instead of granting exclusive monopoly protection for all categories of plant varieties, in the identical way as the Protection of Plant Varieties and Farmers' Rights Act 2001 of India,[936] has led to a complicated undertaking, [138] Thailand only grants exclusive monopoly rights to the owners of new plant varieties, while it creates special types of protection for local plant varieties and a general category.

a. The Rights of Plant Breeders

To protect the rights of plant breeders and to promote the development of plant inventions in Thailand, the Act creates the "new plant variety protection system" to reward plant breeders for their newly improved cultivars.[937] The plant breeders' rights are awarded if certain requirements are met: it must be uniform in some characteristics; the production must be stable in subsequent cycles of harvests; it must be distinct from other pre-existing plant varieties[938] and such distinctiveness must be directly relevant to "the feature that is beneficial to the cultivation, consumption, pharmacy, production or transformation."[939] In addition, the variety must be new in the sense that over a year before the application date, the new variety must have been unexploited in any manner, either in or outside the country.[940] These requirements are the same as the conditions set forth to obtain plant breeders' rights under the UPOV Convention.

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[934] The PVP Act, Article 4.
[935] Daniel Robinson, "Exploring components and elements of sui generis system for plant variety protection and traditional knowledge in Asia" *ICTSD Programme on IPRs and Sustainable Development* (2007): 19.
[936] *The Protection of Plant Varieties and Farmers' Rights Act (2001) (India).*
[937] *The PVP Act*, Article 12 - 42.
[938] *The PVP Act*, Article 11.
[939] *The PVP Act*, Article 12(2).
[940] *The PVP Act*, Article 12(1).

The exclusive rights of plant breeders are subject to some limitations. The Act allows anyone to use the protected new plant varieties without prior authorization from the owners in the case that the aim of utilization is not for breeding purposes, and in the case that the breeding of such varieties is for education, research, study or experimentation.[941] Moreover, farmers are allowed to use without authorization the protected plant varieties which are bred from the propagating materials produced by themselves; however, the Minister has the power to forbid the farmers to cultivate more than three times the quantity of the plant varieties obtained.[942]

Importantly, Article 19(3) compells the applicants to disclose the new plant variety origin, as well as the plant germplasms utilized in the process of breeding to avoid piracy of domestic plant varieties existing in the public domain.[943] For the purpose of satisfying the obligations of the CBD, if a new variety was created from a domestic plant variety or a wild plant variety existing in the Thai jurisdiction or from any part of these varieties for profit-making purposes, the Act requires the applicants to make an agreement on benefit-sharing with the particular local communities where such plants exist.[944] The benefits accruing from the agreement is supposed to become another impetus for local communities to preserve Thai plant varieties and biological diversity. The compensation system makes this mechanism clearly distinct from the system of the TRIPS Agreement. In addition, as allowed by the TRIPS Agreement and the CBD, the PVP Act clearly indicates that any plant variety which has the possibility to negatively impact the environment, the health or public welfare might not be allowed protection.[945]

b. The Collective Rights of Local Communities

[941] *The PVP Act*, Article 33(4).
[942] Ibid.
[943] Pawarit Lertdhamtewe, "Developing country sui generis options - Thailand's sui generis system of plant variety protection" *The Quaker United Nations Office*, 5.
[944] *The PVP Act*, Article 19 (5).
[945] *TRIPS Agreement*, Article 8, states that "Members may, in formulating or amending their laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provisions of this Agreement"; *Convention on Biological Diversity*, Preamble, recognizes that "it is vital to anticipate, prevent and attack the causes of significant reduction or loss of biological diversity at source."

To recognize the rights of people who take part in the preservation and improvement of plant varieties available in Thailand, the protection of local plant varieties was established under the PVP Act.[946] Despite the fact that this Act does not clearly use the term "farmers' rights", the protection of "local plant variety" is, in fact, designed to acknowledge and reward the farmers for their invented plant innovations. Under this category of protection, local farmers can register a specific local plant variety existing in a specific "locality" in territories of Thailand.[947] The PVP Act defines "locality" as a community of people residing, possessing common traditions and constantly conveying their traditions to the next generations.[948]

Having registered, the community's members are granted exclusive rights to preserve, use, research, sell, and market the local variety *per se* in the same manner as the plant breeders over their newly created varieties.[949] This system of protection reflects the attempt of the Thai government to implement the CBD obligations, Article 8 (j) to

> maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and to promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and to encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.

In applying for local plant variety protection, the claimed plant variety does not have to be new, yet it must be distinct, uniform, and stable.[950] Eligible applicants for this category of protection are a *sui juris* person, who protects or develops local plant variety *per se* registering as a community; the local community itself; the farmers' group or co-operative group acting on behalf of the local community.[951] For the purpose of designating beneficiaries to this form of protection, the applicants must submit the details of the developed, conserved or maintained plant variety, the management plan on preservation and

[946] Lertdhamtewe, "Asian Approaches to International Law: Focusing on Plant Protection Issues", 144.
[947] *The PVP Act*, Article 43.
[948] *The PVP Act*, Article 3.
[949] *The PVP Act*, Article 47.
[950] *The PVP Act*, Article 11.
[951] *The PVP Act*, Article 44, 45.

improvement, the name list of community members, and a map sufficiently describing the community boundary and neighboring territories.[952]

In order to satisfy the CBD obligations, the PVP Act provides that any commercial entity that wishes to use a local plant variety for its profit-making purposes must provide a profit-sharing system with the local governmental entity, group of farmers or co-operative group acting on behalf of the community.[953] The profit-sharing agreement must be approved by the Plant Variety Protection Commission (the PVP Commission).[954]

Moreover, the PVP Act specifies that twenty percent of the profits accruing from such agreement is to be allocated to the people who preserve or create the local plant variety; sixty percent is to be awarded to the respective community as a whole and the surplus twenty percent is to be given to the governmental entity, the group of farmers or the co-operative group which concluded the benefit-sharing agreement.[955] Essentially, the harvest or replication of the protected domestic plant varieties conducted by farmers for any purpose other than commercial purposes is excluded from the benefit-sharing obligation.[956]

c. Sovereignty of the State over Genetic Resources

The PVP Act also creates the specific tool to manage "wild plant varieties"[957] and "general domestic plants"[958] which exist in the public domain in Thailand. This legal mechanism expresses the underlying principle of sovereignty guaranteed by the CBD.[959] The PVP Act sets forth that, those who need to gather, procure or utilize general domestic plant varieties or wild plant varieties shall get an

[952] Ibid.
[953] *The PVP Act*, Article 48.
[954] Ibid.
[955] *The PVP Act*, Article 49.
[956] *The PVP Act*, Article 47(3).
[957] Wild plant variety is defined as a plant variety which exists in the nature and has not been extensively exploited; *The PVP Act*, Article 3.
[958] General domestic is defined as a plant variety which originates from or exists in Thailand and has been extensively exploited; *The PVP Act*, Article 3.
[959] The sovereign right ensured by the CBD refers to the right of the State to control over its natural resources existing within its jurisdiction and the right to exploit them in line with its domestic laws and policies.

approval from the Ministry of Agriculture and Cooperatives before pursuing such activities,[960] and shall conclude the profit-sharing agreement, together with details of those activities provided that such activities are done for profit-making purposes.[961] Therefore, it is obvious that the drafters of the PVP Act have attempted to incorporate the prior-informed consent principle and the benefit-sharing concept provided under the CBD. The profits gained from the benefit-sharing agreement shall go to the Plant Variety Protection Fund.[962] This Fund principally contributes to the preservation and improvement of local plant varieties.[963]

6.2.3 Problems Governing the Plant Variety Protection System in Thailand

The current *sui generis* plant variety protection system in Thailand attempts to encourage new innovation whilst guaranteeing the rights of farmers to save seeds and rewarding them for their roles in preserving local plant varieties through local plant variety protection. However, in practice, the PVP Act does not seem to truly encourage research and development on new plant varieties due to too low eligibility requirements, too short terms of protection and unclear provisions on compulsory licensing. As a result, up to present, the number of new plant variety registrations in Thailand are still relatively low as shown in the table 1 below. Moreover, the local plant variety protection system has been proven to be ineffective since no farmers are able to actually register their plant varieties. This section explains the main statutory problems existing under the current Thai PVP Act.

Table 1: Plant Varieties Registered in Thailand

Type of Crop Varieties	Numbers of Crops with Registered Plant Varieties	Type of Registrants	Numbers of Registration
Field Crops	150	Local farmers	84

[960] *The PVP Act*, Article 52.
[961] *The PVP Act*, Article 52-53.
[962] *The PVP Act*, Article 54.
[963] Robinson "Exploring components and elements of sui generis system for plant variety protection and traditional knowledge in Asia", 19-20.

Fruit Crops	63	Thai government and Research Institutions	132
Vegetables	145	Seed Corporations	246
Ornamentals	58		
Trees	46	-	-
Total	**462**	**Total**	**462**

Source: Plant Variety Protection Division, Report on Plant Varieties (Bangkok, Ministry of Agriculture and Cooperatives, Thailand 2018).[964]

6.2.3.1 Problems Governing New Plant Variety Protection

a. Eligibility Requirements

The PVP Act of Thailand grants plant breeders the exclusive monopoly rights over novel, distinct, uniform, and stable plant cultivars.[965] In the same way as the UPOV regime, the novelty criterion refers to commercial novelty, meaning that the actual marketing of plant materials is the par for determining novelty.[966] Therefore, a particular level of plant breeding is not necessary to be considered as a new plant variety. Plant varieties which are commonly known, as well as wild plant varieties, may also be regarded as sufficiently novel if they have not been exploited commercially for over a year. Thus, a person can simply find a plant in the wild and register it as a new plant variety. An example of this problem is the case where Papaya, a native and widely known Thai fruit, was registered as a new plant variety in 2008, although it had long been planted by local farmers and households.[967] The presence of new plant variety rights has restricted others from carrying out further research and experimentation on this fruit. Another example is the registration of a variety of chili pepper which was commonly planted in

[964] Department of Agriculture, Plant Variety Protection Office, "List of the Registered New Plant Varieties in Thailand," [translation of: รายการพันธุ์พืชได้หนังสือสำคัญแสดงการจดทะเบียนพันธุ์พืชใหม่], Department of Agriculture, Plant Variety Protection Office, accessed May 01, 2018, http://www.doa.go.th/pvp/index.php?option=com_content&view=article&id=216:2012-09-14-16-33-55&catid=39:2012-12-07-10-08-18.
[965] *The PVP Act*, Article 11 and 12.
[966] *The PVP Act*, Article 12(1).
[967] Registration Number 11/2551 (2008).

the backyards of local Thai people in 2004.[968] These examples express that the novelty requirement under the Thai PVP Act is not rigid enough to exclude commonly known plant varieties in Thai territories; hence, it is not certain whether this low standard of novelty can truly promote new and inventive plant breeding activities.

As for the distinctiveness requirement, this criterion in the Thai PVP law differs from that of the UPOV Convention[969] since it is determined by differentiating the claimed cultivar from other inherent plant varieties in terms of "cultivation, consumption, pharmacy, production or transformation."[970] Therefore, the claimed cultivar can be regarded as distinctive even if it is indistinguishable from the commonly known plant varieties unregistered under this Act. Once again, the registration of the varieties of chili pepper and Papaya can be raised as outstanding examples. This implies that the plant variety protection system of Thailand encourages non-innovation and discovery, rather than creativity, by utilizing a mixture of a low distinctive requirements and weak novelty standards. Furthermore, the relatively low eligibility requirements might lead to illicit individual appropriation of local plant cultivars, which is harmful to further research and development on such plants by the public sector.

To sum up, the existing eligibility requirements, particularly the novelty and distinctiveness criteria, do not seem to be able to stimulate research and development of new plant varieties from either the private or public sector. The standard of requirements for new plant protection under the Thai PVP Act, thus, needs to be reconsidered.

b. Duration of Protection

The duration of protection for a new plant variety also creates concern in respect to the sufficiency of the Thailand's *sui generis* system to encourage new plant innovations since the term is shorter than that of international standards of the UPOV Convention. According to the PVP Act,

[968] Registration Number 30/2547 (2004).
[969] *The 1991 UPOV Convention*, Article 7; a cultivar is distinct in case it is evidently distinguishable from other commonly known cultivars on the date of the filing of the application.
[970] *The PVP Act*, Article 12.

exclusive rights of plant breeders have the protection terms of 12 and 17 years, depending on the plant categories, shorter than that of the UPOV system, which grants a minimum term of 20 years.[971] The only generous protection term in the PVP Act is that of trees, which provides for a 27-year period of protection, 9 years longer than the term of protection under the UPOV Convention.[972]

While the *sui generis* system of Thailand establishes various terms conforming to the commentators who do not concur with providing the identical duration of protection to different categories of plants,[973] the shorter term might not be sufficient for the plant breeders who have spent a considerable amount of time, money and effort in breeding activities to recover their investment and make some reasonable profits. The breeding process of a new plant variety is time-consuming and arduous. It generally takes approximately seven to ten years from the first crossing process to produce a plant variety in demand by farmers, seed and chemical corporations, food-processing corporations, or supermarkets. [974] Therefore, to grant short-term protection would not bring about the incentives for investors to register for intellectual property protection and might be the main reason why the number of registered new plant varieties in Thailand are relatively low compared to other countries. Moreover, in practice, the typical delay in the application process consumes a large part of the protection term. Specifically, the average duration for examining and inspecting an application usually takes as long as one to two years.[975]

c. Compulsory Licensing

In the same manner as other plant variety protection regimes, the PVP Act of Thailand also contains a compulsory licensing provision. This provision allows those other than plant breeders to utilize

[971] The PVP Act, Article 31.
[972] Ibid.
[973] The scholars who share this opinion are such as Adam Masarek, "Treetop View of the Cathedral: Plant Variety Protection in South and Southeast Asia Least Developed Countries" *Emory International Law Review* 24 (2010): 463-464; Philippe Cullet, "Plant Variety Protection in Africa: Towards Compliance with the TRIPS Agreement" Journal of African Law, no.1, 45 (2001): 121; Dan L. Burk and Mark L. Lemley, *The Patent Crisis and How the Courts Can Solve It* (Chicago, University of Chicago Press: 2009), 32-33.
[974] Graham Dutfield and Uma Suthersanen, *Global Intellectual Property Law* (Cheltenham: Edward Elgar, 2008), 182.
[975] Plant Variety Protection Division, *Procedure and Guideline for the Examination of New Plant Variety Protection Application* (Ministry of Agriculture and Cooperatives, Thailand).

the registered plant varieties without the approval of the plant breeders.[976] The Director-General of the Department of Agriculture is empowered to authorize any person to exploit the protected variety without the approval of the right owners.[977]

Recently, there have been some concerns raised by the business sector with respect to compulsory licensing provision. First, the PVP Act does not clearly define the scope of the licensees; as a consequence, the licensees may be business competitors of the owner of the plant breeders' rights.[978] Second, the Act does not impose the time limitation on the period of the license. Moreover, the Thai PVP Act that does not provide any provision concerning the termination of the compulsory license provided that the situations which gave rise to its issuance no longer exist.

6.2.3.2 Problems Governing Local Plant Variety Protection

Despite the fact that the PVP Act has established the mechanism of "local plant variety protection" to reward local farmers who take part in the preservation and improvement of plant varieties, it is not certain if farmers can truly benefit from this mechanism. Up to the present, no local communities nor farmers have successfully registered their landraces under this system.

One of the reasons is because the farmers are unable to meet eligibility requirements of uniformity and stability set forth to obtain the protection.[979] More importantly, the Thai PVP Act states that, "when a plant variety exists in a particular locality and has been conserved or developed exclusively by a particular community, that community shall have the right to submit, to the local government organization in whose jurisdiction such community fall;"[980] Nevertheless, local people usually migrate from one locality to another; hence, it is difficult to define the exact beneficiaries from local plant variety

[976] *The PVP Act*, Article 37.
[977] Ibid.
[978] Personal Interview with the representative of the CP Group (Bangkok, Thailand: 9 October 2017).
[979] Rohan Dang and Chandni Goel, "Sui Generis Plant Variety Protection: The Indian Perspective*" American Journal of Economics and Business Administration* no.4, 1 (2009): 307; Pawarit Lertdhamtewe, "Effective Plant Variety Protection as Development Policy: A Perspective for Thailand" *Thailand Journal of Law and Policy* no. 14, 1 (2011), http://www.thailawforum.com/articles/plant-variety-protection-as-developmentpolicy-for-Thailand.html.
[980] *The PVP Act*, Article 45(1).

protection system. Also, there is usually more than one community adjacent to the identical local cultivars; accordingly, a single community cannot claim monopoly rights to register and claim for benefits derived from such varieties just for themselves.

6.2.3.3 Problems Governing the Protection of General Domestic and Wild Plant Varieties

To access general domestic and wild plant varieties, the Act requires a wide range of conditions for accessibility including the license from the government as evidence of authorization, and the disclosure of the purpose of accessibility and profit-sharing through the Plant Variety Protection Fund. [981] Farmers and local communities have expressed their concern about this Fund, especially on the issue as to whether the government has actually rightfully allocated the benefits in a fair and equitable manner.[982] Some farmers' organizations, including the Alternative Agriculture Network, NGOs, and scholars, have claimed that the benefits from the Plant Variety Protection Fund are not delivered to farmers in reality.

Moreover, the Act requires the license from the relevant governmental bodies for collecting, using, developing, and researching for commercial purposes. This applies to all users of genetic resources of general domestic plants and wild plant varieties for commercial purposes, including subsistence farmers selling wild cultivars for survival, have to apply for approval and share the benefits, regardless of their levels of income. In fact, the application procedure has created technical complications for many farmers. Also, if anyone, including small farmers, illegally use such resources without the license and sharing of benefits, it could even bring about criminal punishment. In case of infringement, the Act provides for fine penalties of THB 400,000 (around USD 12,674.27) or imprisonment of not more than two years, or both.[983] As a result, there have been many cases of legal violation by small holdings since the use of general domestic plants and wild plant varieties is vital for their livelihood and the conservation of agrobiodiversity.

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[981] *The PVP Act*, Article 52.
[982] Daniel Robinson, "Sui Generis plant variety protection systems: liability rules and non-UPOV systems of protection," *Journal of Intellectual Property Law and Practice* no.3, 10 (2008): 663.
[983] *The PVP Act*, Article 66.

6.2.4 The New Draft on of the Plant Variety Protection Act (Amendment)

Recently, in 2017, the Ministry of Agriculture and Cooperative has proposed *the New Draft on of the Plant Variety Protection Act (Amendment) (New Draft).*[984] The Department of Agriculture has been open to online feedback through the Department's website from October 5th, 2017 to November 20, 2018. [985] The main reason for the amendment is to adapt the existing law to the current conditions of competition, trade, investment and to comply with the international standards set forth by the UPOV Convention in preparation for Thailand to become a member of the UPOV system.[986]

This new Draft extensively broadens the scope of plant breeders' rights. In line with the UPOV Convention, the draft attempts to introduce the EDV concept to the Thai plant variety protection system.[987] This means that a payment and prior-consent of the original plant breeders is required even for the act carried out for research and experimental purposes.

In addition, the new draft lengthens the term of protection for the rights of plant breeders from 12-17 years to 20-25 years.[988] As a result, if this draft is adopted, it would solve one of the inherent statutory problems of the inadequate period of time for plant breeders to exploit their exclusive rights. Moreover, the draft extends the protection of plant varieties to products.[989] For instance, in case protected mango seeds are stolen for the purpose of breeding and afterwards the mango fruits are processed into preserved products and are sold in the market without the authorization from the rightful holder, the sale of such products is also considered to be in violation of the exclusive plant breeders' rights.

Moreover, the new Draft crucially increases the level of distinctive requirement in the same fashion as that of the UPOV Convention. Under this Draft, the distinctive requirement is no longer determined by differentiating the claimed cultivar from other inherent plant varieties in terms of

[984] "The Draft on Plant Variety Protection - Who Gains/ Who Loses," Thansettakij, accessed May 17, 2018, http://www.thansettakij.com/content/219117.
[985] "Public Hearing on the New Draft on Plant Variety Protection Act," Department of Agriculture, Plant Variety Protection Office, accessed May 17, 2018, http://www.doa.go.th/main/index.php?option=com_content&view=article&id=106:opinion&catid=105:open.
[986] Ibid.
[987] *The New Draft,* Article 40.
[988] *The New Draft,* Article 31.
[989] *The New Draft,* Article 38.

"cultivation, consumption, pharmacy, production or transformation. In other words, a cultivar cannot be considered as "distinctive" if it is not distinguishable from the plants commonly found in the wild. Essentially, the new Draft no longer requires private seed companies to share the benefits of using native plant varieties to develop new plant varieties.[990]

However, the plant breeders and farmers are still obliged to get an approval in case they utilize local plant varieties and wild plant varieties and share benefits accruing from the commercial uses of such varieties. In contrast, the rights of farmers to save and replant seeds are further restricted since the Draft empowers the Ministry to totally or partly forbids farmers not to save seeds in case the government has a policy to promote the enhancement of some particular cultivars by the private sectors.[991] Also, to address the practical problem regarding local plant variety registration, since it is difficult to find the plant variety which exists only in a particular locality in Thailand, the Draft sets forth that any locality which has such a cultivar in their jurisdiction is eligible for local plant variety protection in order to enjoy the rights of developing and preserving such a particular cultivar.[992]

The farmers group has widely opposed this draft because of the traditional view that seeds belong to all Thai citizens, not to an individual. For example, the Farmer School Network Nakhon Sawan, with more than 4,500 members, has improved over 20 plant varieties, four varieties of rice have been successfully introduced and 165 cultivars are under the development processes. None of these varieties are registered under the PVP Act as they strongly disagree with the privatization of seeds and plants.[993]

In the meantime, some scholars in Thailand expressly oppose this draft. For instance, Ratanachueskul,[994] has expressed his opposition, claiming that this draft excessively broadens the monopoly rights of plant breeders, and the introduction of EDV concept in this system would discourage

[990] *The New Draft,* Article 18.
[991] *The New Draft,* Article 35.
[992] *The New Draft,* Article 51.
[993] Wongsmut, "New Draft on Plant Variety Protection Act Takes Advantages of Farmers or Promote New Innovation?".
[994] Professor Somchai Ratanachueskul is the Dean of the Faculty of Law, Pridi Banomyong Dhurakij Pundit University, Thaniland.

the plant variety improvement by the local communities and farmers.[995] Although the Draft is in the process of public hearing, the possibility of it being adopted in the near future is rather remote owing to both strong opposition from various stakeholders and political Instability in Thailand.

6.3 Developing a Model for Thailand

It is evident that reliable and effective intellectual property systems to protect plant inventions is critical for the enhancement and sustainability of Thailand's economic sector since agriculture has long been one of the most important industries in the Thai economy and the vast majority of Thai population. The inherent system of plant variety protection of Thailand was the direct outcome of the pressure from its trading partners,[996] the attempts to enter into free trade agreements with developed countries, and the establishment of WTO multilateral trading system. These external factors have led to Thailand's swift establishment of plant variety protection which conforms to the international standards required by the TRIPS Agreement. In the rush to satisfy the TRIPS obligations, the Thai PVP Act was adopted as a compromise between all relevant actors in agricultural management without the proper examination of its coherence with long-term economic situations and demands.[997]

The PVP Act of Thailand seemed to be able to fulfill the needs of the local agricultural industry at the time it came into force in 1999 when the research and development of new plant varieties largely

[995] Wongsmut, "New Draft on Plant Variety Protection Act Takes Advantages of Farmers or Promote New Innovation?".

[996] In 1989, the United States Trade Representative (USTR) categorize Thailand as a Priority Watch Country (PWC), citing it for its failure to establish sufficient intellectual property protection; as a result, Thailand became a main target of continuous monitoring by the USTR. Following certain monitoring periods, the USTR, later on, put Thailand in the Priority Foreign Country (PFC) List for the countries which failed to provide enough intellectual property protection. In 1992, the United States decided to apply the procedures under Section 301 of *the 1974 Trade Act* in order to pressure Thailand to establish intellectual property protection mechanisms, including the protection of plant varieties; Laura Sallstrom, "U.S. Withdrawal of Thailand's GSP Benefits: Real or imagined?" *TDRI Quarterly Review* no.9, (1994): 15.

[997] Jade Donavanik, *The Implications of Compliance with the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) For Thailand's Development: Focusing on Plant Protection* (Stanford University, 1997), 20 - 23.

relied on the fund by the government on public research and development program. Nonetheless, at present, public funding is inadequate to support research and development by scientific methodologies of genetic engineering. In the meantime, the private sector in Thailand lacks incentive to invest in research and development programs of elite plants produced by scientific methods since the existing plant variety protection system alone cannot ensure their recovery from their substantial investment in agro technology, which would require a sum of money, a number of capable scientists and a sufficient amount of time.

Under the present situation, Thailand is gradually losing its ability to compete in the world market while the agricultural sector constantly contributes less to the Thai economy. Due to the decrease in harvesting land, Thailand urgently needs modern technologies to enable farmers to boost the yield and increase the value of farming products. As the governmental fund in agricultural research in support of public research institutes each year is not sufficient, the sum of investment on new plant technologies needs to be drawn from the private sector.

The solutions to the present situations would be (1) to create the legal mechanism which can raise the amount of public sector expenditure in plant innovations and modern breeding technologies and make sure that the results of modern breeding technologies can be accessed by farmers; (2) to make sure that the law promotes robust competition between public and private investment in the research and development program of new plant varieties; (3) to ensure that small and medium farmers are equipped with the ability to adopt new plant technology developed by scientific methods; and (4) to assist the farmers in *in situ* preservation of agrobiodiversity, especially by enabling the provisions of "benefit sharing" in the PVP Act to be implemented in practice.

To achieve these goals, Thailand could exploit the flexibilities offered by the TRIPS Agreement to adopt a plant patent system in order to protect plant innovations created by scientific methodologies or genetic engineering in particular while maintaining its *sui generis* system for the protection of plant

variety to protect the fruits of traditional plant breeding.[998] The existing *sui generis* system should be amended to make sure that its provisions work in practice. Notably, the adoption of the UPOV Convention might not be appropriate for the situation of Thailand since the problems regarding eligibility requirements and the scope of exclusive rights, especially the issue of the EDVs, is still problematic in both theory and practice. At the same time, it is important for Thailand to have special provisions governing the interface between the two sets of intellectual property rights.

6.3.1 The Introduction of Patent on Plants in Thailand

Under the current system, Thailand only grants protection for the results of conventional plant breeding techniques without a reliable system to protect non-biological processes and products of the direct manipulation of genes or operation at DNA level. Therefore, the introduction of a patent on plants which would permit the better characteristics of plants such as the modern processes used in creating or breeding of plants, plant genes or DNA is needed for Thailand to maintain its competitiveness in the global market.

The important question that should be addressed here is whether a patent system would create the excessive privatization of domestic and wild genetic resources available in Thailand. In fact, because of the eligibility requirements of novelty and distinctiveness provided under the TRIPS Agreement and *the Patent Act of Thailand*,[999] such requirements automatically preclude commonly known domestic cultivars and wild plant varieties out of the potential subject matters of protection. Also, it should be emphasized that the mere discoveries of plants or natural phenomenon do not constitute "inventions" under the patent system.

Moreover, the TRIPS Agreement allows its members to limit the extent of subject matter of protection so as to prevent the patentability on the plant species essential for maintaining food security or

[998] *TRIPS Agreement,* Article 27.3 (b); In fact, many jurisdictions, such as the United States, Japan, the European Union, have also taken this flexibility by allowing their plant breeders to acquire the patent on plants while adopting plant variety protection system.
[999] *TRIPS Agreement,* Article 27.1; *Patent Act of Thailand,* Article 5(1)-(2).

environmental condition or to even prevent the terminator technology from patent protection in accordance with the national economic and social policies of their members. Further, for the purpose of preventing the exclusivity on the outcomes of traditional breeding techniques, it is important for Thailand to exclude "plant varieties" and "essential biological processes" from the range of patent protection. This would translate into the preclusion of patenting on plant varieties created by conventional breeding methods while maintaining the patentability on transgenic plants, transformation events, genetically modified genes or cells and unconventional breeding techniques.

However, to guarantee that the use of patents on plants would not obstruct the accessibility to the genetic pool and to avoid market concentration on some giant companies, it is of utmost necessity to include the breeders' exemptions into patent systems since plant innovations are path-dependent, sequential and cumulative and, therefore, require the existing germplasms as inputs for further development. However, under the current Patent Act of Thailand, it does not allow study, research, experimentation or analysis on patented products provided that such an act conflicts with the normal exploitation of the patent or impacts the legitimate interests of the patent owner.[1000] As a result, the introduction of breeders' exemption to patent system would allow other breeders to use the protected materials for breeding or creating new varieties or species either for commercial or non-commercial purposes. The attempts to incorporate the breeders' rights into the patent system is, for instance, *the 1930 Plant Patent Act of the United States* which provides that, in order to establish a patent infringement, it is adequate to demonstrate that the "alleged infringing plant has the same essential characteristics as the patented plant;" Thus, the protected variety can be utilized without prior-consent as a parent in a breeding program for commercial purposes as patent infringement would be established solely when the claimed variety was asexually deduced from the protected variety.[1001] Recently, Article 27(c) *of the Agreement on*

[1000] *Patent Act of Thailand*, Article 36.2(1).
[1001] Victoria Henson-Apollonio, "Patent protection for plant material," *WIPO-UPOV Symposium on the co-existence of patents. and plant breeders' rights in the promotion of biotechnological developments* (2002), http://www.upov.int/export/sites/upov/meetings/en/Symposium2002/pdf/wipo-upov_sym_02_4.pdf.

a Unified Patent Court also includes the exemption on the utilization of biological resources for the objectives of breeding, discovering or creating new plant varieties.[1002]

Furthermore, provided that the plant patent system is introduced in Thailand, the implementation experience of the European Union shows that, although the preclusion of plant varieties and the essential biological processes from patent protection is evident provided, the range of patent protection may still cover plant varieties. Such circumstances occur when the technical teaching of the innovation, such as a genetic modification, is not exclusive to a particular plant variety; when plant varieties result from a patented non-biological process for plant production; and when the introduction of a patented DNA sequence in a plant variety is owed to the expeditious advancement in biological technology.

In the situations where the two sets of intellectual property are overlapping, other plant breeders or farmers cannot revoke the agricultural exemptions provided under the plant variety system against the patent owners. In addition, it might also create blocking circumstances when the owner of a patent or plant breeders' rights rely upon a license under the another, making one or both parties unable to exploit their own developed innovations. In this case, the two mechanisms can be introduced to solve such problems.

Firstly, cross-compulsory licensing mechanisms, which grant a non-exclusive license for utilizing a patented genetic material when the exploitation of the plant breeders' rights is impossible without violating the patent rights and *vice versa*, can be provided under both systems. Following the provision of *the Biotech Directive of the EU,*[1003] two conditions would be satisfied to be granted such a license. First, plant variety should establish a substantial technical progress to the Thai economy and, second, when the applicant attempted, yet failed to get a voluntary license from the owner of plant breeders' rights.

[1002] *Agreement on a Unified Patent Court (2013/C 175/01)*, Article 27(c).
[1003] *The Biotech Directive*, Article 12(3).

Secondly, farmers' rights established can be extended beyond the plant variety protection regime to patent regime. In the same fashion as *the Biotech Directive*[1004] of the European Union, which enhances the scope of this privilege provided by the CPV to patent regime, allowing the farmers' privilege to function under any circumstance. This confirms the positive nature of farmers' rights as positive rights or self-standing rights, not just an exemption to positive rights, which exists without dependence upon a particular law and, thus, can be invoked beyond the system of a plant variety protection regime.

6.3.2 Effective *Sui Generis* System for the Protection of Plant Varieties

Conventional plant breeding differs greatly from scientific breeding both in the involving processes and the generated products. The characteristics of the products of conventional breeding are not considered novel for the species. In other words, the features within the genetic potential of such species are still present; therefore, the products of conventional breeding are not normally considered as sufficiently new acquire patent protection. Moreover, this level of plant innovations is usually considered as inseparable from the subsistence and tradition of this country. As a consequence, in parallel with the plant patent system, the *sui generis* system for the protection of plant varieties with different eligibility requirements to obtain protection should be particularly tailored outside the scope of patent regime. This section analyses the main elements of a *sui generis* system for plant variety protection which Thailand should adopt to encourage more advancement at this level of innovation. Meanwhile, the fruits of conventional plant breeding still remain important to the agricultural system. Not only because it provides cheaper farm inputs, but it also ensures that the planted crops possess the ability to endure climate change and to enhance agrobiodiversity.

a. The option for Thailand to adopt the 1991 UPOV Convention

The term *sui generis* system under Article 27.3(b) of the TRIPS Agreement seems to provide some level of flexibility regarding the individualization of plant variety protection. However, at an international level, the UPOV Convention appears to be the sole *sui generis* system currently available. Although the

[1004] *The Biotech Directive*, Article 11.1.

TRIPS Agreement does not make any reference to the UPOV Convention, unlike its reference under Article 3 to *the Berne Convention, the Paris Convention, the Rome Convention,* and *the Treaty on Intellectual Property in Respect of Integrated Circuits*, some scholars claim that the UPOV regime remains the only effective *sui generis* option which WTO member States are able to choose apart from the patent system.[1005]

However, the current version of the UPOV Convention presents some controversial issues which might not be appropriate to the Thai socio-economic condition at the moment. In particular, it incorporates the concept of EDV[1006] to restrict the second-generation breeder from making only cosmetic modification to initial varieties. Hence, if a farmer develops a new cultivar from the protected variety, but such cultivar is not sufficiently distant from the initial variety, he or she has to seek approval from the breeder of the initial variety for any commercial activities. The breeders' exemption cannot function in this case. Moreover, there is no standard on the genetic distance between the initial variety and the variety of the second generation which might be regarded as an EDV. Hence, it can deter the farmers and small plant breeders from developing cultivars since the outcomes might still be subject to the exclusive rights of the initial plant breeders. As a consequence, the concept can easily change the role of farmers from inventors to mere consumers of seeds.

Another problem of the 1991 UPOV model lies with the restricted farmers' rights to save and replant seeds since the Convention concedes that farmers may enjoy those rights only "within reasonable

[1005] Daniel Gervais, *The TRIPS Agreement: Drafting History and Analysis* (London: Sweet & Maxwell, 1998), 151; Nuno Pires de Carvalho, *The TRIPS Regime of Patent Rights* (The Netherlands: Kluwer Law International, 2002), 219; Suzi Fadhilah Ismail, *Intellectual Property Protection for Agricultural Biotechnological Inventions: A Case of Malaysia* (University of Nottingham, 2010).

[1006] *The 1991 UPOV Convention*, Article 14(5) defines the term "essentially derived varieties" as
"(i) varieties which are essentially derived from the protected variety, where the
protected variety is not itself an essentially derived variety, while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety,
(ii) it is clearly distinguishable from the initial variety and
(iii) except for the differences which result from the act of derivation, it conforms to the
initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety."

limits" as long as such activities do not affect the "legitimate interests" of the plant breeders.[1007] Thus, if this model is adopted, the farmers' practices of saving and replanting seeds cannot be conducted for commercial purposes unless the authorization of the plant breeders is acquired. This would lead to the disruption of the sustainable way of farming practices, increase the farming costs and might result in the loss of competitiveness of Thai agriculture in the global market.

To sum up, the adoption of the current UPOV Convention is not the most appropriate way for the Thai socio-economic condition where farmers constitute the majority of the Thai population in the rural areas and still play an active role in agricultural management and development. At the moment, there is no urgent need and it would be more sustainable for Thailand not to overhaul its agricultural management system by abruptly shifting the role of farmers to mere consumers of seeds through the adoption of the UPOV model.

b. The Protection over Discovered Plant Varieties

The UPOV Convention, Article 6.1(a) requires its members to provide protection to the discovered varieties while Article 1(4) allows the person discovering the plant variety to be granted breeders' rights.[1008] The "new" requirement for protection is determined by the actual marketing of plant materials. Thus, widely known cultivars and wild varieties, can be regarded as "new" if they have not been exploited commercially for over a year. In this regard, the proponents of the UPOV regime view that the discovery of mutations or variants among a population of harvested cultivars is an origin of plant varieties with high economic value;[1009] therefore, it may be necessary to encourage local people to discover new cultivars. Thailand has followed this idea of the UPOV Convention and adopted it in the

[1007] *The 1991 UPOV Convention*, Article 15.
[1008] *The 1991 UPOV Convention*, Article 1(4) and 6.1(a).
[1009] Crucible Group, *People, Plants and Patents: The Impact of Intellectual Property on Trade, Plant Biodiversity, and Rural Society* (International Development Research Centre, 1994), 139.

PVP Act. Also, the current PVP Act provides a lower standard of distinctiveness than that of the UPOV Convention since it differentiates the claimed cultivar from other inherent plant varieties in terms of "cultivation, consumption, pharmacy, production or transformation." Therefore, the claimed cultivar can be regarded as "distinctive" even if it cannot be distinguishable from the commonly known plant varieties in the public domain. However, the intellectual property protection of discovered landraces may give rise to abuse. For instance, there has been a pattern of plant variety protection granted for the "discoveries" of wild varieties and traditional varieties commonly known in another country.[1010] Again, the case where "Papaya" and "Chili" acquired plant breeders' protection in Thailand can be taken as prime examples.

There are some other alternatives that Thailand may implement to catch the benefits of encouraging the discovery of new varieties while avoiding the possibility of abuses. For instance, Thailand can ban the protection on plant varieties "discovered in the wild" and, instead, protect the discoveries that must be appraised and propagated by humans at a certain level prior to commercial exploitation. Optionally, Thailand can comprehensively give the definition to "prior art" for plants and request a plant breeder to show that the claimed variety has not been commercialized and widely known in any country. In addition, the standard of distinctiveness should be heightened according to international standards where distinctiveness is also evaluated in comparison with the plants commonly found in the wild. Essentially, the protected discovered varieties must not cover the plant varieties which are subject to the "multilateral system" of the ITPGRFA.

c. Terms of Protection

The duration of new plant variety protection under the current PVP Act is substantially shorter than the international standard due to the lack of empirical studies on the actual duration of plant production at the time of drafting the PVP Act.[1011] This term of protection appears to be insufficient for

[1010] Rural Advancement Foundation International in Partnership with Heritage Seed Curators Australia, *An Inquiry into the Potential of Plant Piracy through International Intellectual Property Conventions* (Plant Breeders Wrongs, 1999), 6-16.
[1011] Adam Masarek, "Treetop View of the Cathedral: Plant Variety Protection in South and Southeast Asian Least-Developed Countries"*Emory International Law Review* 24 (2010): 433.

commercial plant breeders to secure their investment, and, in turn, creates little incentives for plant breeders to apply for the protection.

According to the economic analysis by Christie and Rotstein on the appropriate terms of protection for plant innovations, the 20-year term of protection is actually the optimal bounds for the plant breeders to recover their expenditure and allow them to gain some reasonable benefits.[1012] As a result, the period of protection provided by *the 1991 UPOV Convention* can be adopted as it requires the minimum period of 20 years. Moreover, the methods for providing different terms of protection for different plant categories can be employed by way of the sub-categorization of protection terms. For instance, Article 19(2) of the 1991 UPOV Convention also provides a longer period of protection for trees and vines. This would allow Thailand to maintain a more favorable protection period for trees in order to generate private investment since Thai public institutes cannot generally afford to breed this type of plant on a trial-and-error basis.

It appears that *the New Draft* provides the extension of the terms of protection for general plants from 12-17 years to 20-25 years.[1013] As a result, if it is adopted, it would solve one of the inherent statutory problems of an inadequate time period for plant breeders to exploit their exclusive rights.

d. Rights of Farmers

Under the PVP Act of Thailand, it guarantees the rights of farmers to cultivate and propagate the protected plant varieties from the materials generated by him or herself with the only limitation being that the Ministry might order him or her to do so in the quantity not over three times the quantity obtained according to the national policies. Such restriction seems to be fair and reasonable; however, to balance the legitimate rights of plant breeders, the Act should allow the plant breeders to maintain control over the commercial exploitation of their own development without limiting the knowledge of the farmers

[1012] Andrew F. Christine and Fiona Rotstein, "Duration of patent protection: does one size fit all?" *Journal of Intellectual Property Law and Practice* no.6, 3 (2008): 402-408.
[1013] *The New Draft*, Article 31.

regarding their traditional practices. Therefore, in the identical manner of the PVPFR of India,[1014] the farmers should not be permitted to sell seeds which are branded with the name of the holders of plant breeders' rights. On the other hand, the registration of genetic technologies devised to bar farmers from saving seeds such as V-GURTs and T-GURTs should not be allowed. In this case, the Indian PVPFR Act which apparently precludes those technologies from registration should be taken as an example.[1015]

Moreover, according to the Ministry of Agriculture and Cooperatives,[1016] it is possible for farmers to register new plant varieties; however, the number of the registrations are not very high in comparison with the number of registrations by private companies. To encourage farmers to register, Thailand may adopt the idea of the Indian PVPFR[1017] by allowing farmers and local communities not to follow the identical procedure and formalities applied to private companies or research institutes, and to be exempt from the fees in any proceedings, including registration fees. Last, due to the special feature of plants which can be duplicated by themselves, as can be learnt from India's implementing experience, Thai farmers should be guaranteed the immunity of innocent infringement in order to avoid the cases of pollen drift.

e. Benefit-Sharing Mechanism

Since Thailand is under the obligations of the CBD to implement the prior-informed consent concept and benefit-sharing mechanism, it is widely accepted that these obligations must be incorporated under the plant variety protection regime. As required by the PVP Act, plant breeders must share the benefits derived from the exploitation of the local plant varieties, farmers' varieties and wild plant varieties. The achievement of the system relies on the plant breeders to disclose the genetic materials used in the breeding or the production of plants at the time of application. Also, it depends on the farmers to

[1014] *The PPVFR Act*, Section 39 (1).
[1015] *The PPVFR Act*, Section 18 (h).
[1016] Department of Agriculture, Plant Variety Protection Office, "List of the Registered New Plant Varieties in Thailand," [translation of: รายการพันธุ์พืชได้หนังสือสำคัญแสดงการจดทะเบียนพันธุ์พืชใหม่], Department of Agriculture, Plant Variety Protection Office, accessed May 01, 2018, http://www.doa.go.th/pvp/index.php?option=com_content&view=article&id=216:2012-09-14-16-33-55&catid=39:2012-12-07-10-08-18.
[1017] *The PPVFR Act*, Section 18 and 44.

register the local plant varieties and on the government to effectively distribute the benefits in a fair and legitimate manner in the case of wild and general plant varieties. The primary objective of the benefit-sharing mechanism is to achieve various goals to safeguard the conservation of genetic resources, sustainable utilization, and development of community and reward for the farmers who develop the farmers' varieties utilized in the breeding program.

The implementing experience of Thailand on "the protection of local plant varieties" demonstrates that, up to present, no farmers are able to register for protection in order to receive the benefits. This is because the current Act sets forth the condition that the local plant varieties eligible for registration must exist in one defined locality since this mechanism aims at rewarding a specific group of people taking part in preserving and developing a cultivar. The difficulties in defining the exact locality where a particular local plant variety exists and the problems in identifying beneficiaries arises in practice. *The New Draft* attempts to solve this problem by relaxing such condition and allowing the cultivars which exist in more than one locality to be registered.

Moreover, taking into consideration the actual condition of farmers in Thailand, farmers may not be able to apply for or are unaware of the local plant variety protection system. Hence, a practical way to deal with this problem is to empower local governmental bodies or NGOs to assist in applying for benefit-sharing rewards in the same way as the system for the protection of Thailand's geographical indication. Further, the same organizations may also take on the responsibility to raise the required awareness among farming communities.

In reference to wild and general plant variety protection, the Act requests any person to obtain the license and to enter into a profit-sharing agreement when he or she uses such varieties in a breeding program for commercial purposes. This requirement actually seeks to convey the benefits to local farming communities as a whole. The conditions apply to everyone, including subsistence farmers with harsh criminal punishment, yet it is unrealistic to require small farmers who normally use wild and general plant varieties for subsistence to obtain the license and conclude the agreement every time they have to collect

those varieties. The solution to this problem is obviously to exempt the small farmers from following these conditions in the same manner as the European Union which exempts their small farmers from remuneration for saving and replanting seeds. In this regard, the criteria of what constitutes "small farmers" such as the individual incomes must be carefully established.

Nevertheless, even when those problems are solved, it should be noted that such direct benefit-sharing may, in fact, curtail discouragement among farmers to share and exchange seeds owing to their expectations of benefits. This may lead to even more detrimental effects on the inaccessibility to genetic pools by farmers, local communities and even private plant breeders. A more viable alternative would be to concentrate on non-monetary rewards for local communities such as training programs or to assist them with modern farming technologies and better seeds or propagating materials. These mechanisms would provide the small medium farmers with the ability to adopt modern technologies, to preserve *in situ* agrobiodiversity and make sure that they have the access to modern agricultural technologies.

f. Compulsory Licensing

The PVP Act of Thailand allows the possibility for a person other than the holders of plant breeders' rights to have access to the protected cultivars through compulsory licensing. The Ministry of Agriculture and Cooperatives is empowered to grant such a license without authorization from the rights holders.[1018] However, there are many statutory problems which concern the private sector, that is, the Act does not designate the scope of the licensees; as a result, even the competitors of the right holders can acquire the license. Moreover, the Act does not provide time limits for a license or any condition which could lead to the termination of such a license. Lastly, the rights holders are not provided with any channel for appeal regarding the grant of a compulsory license.

These statutory problems can be solved following the model of Article 31 of *the TRIPS Agreement*, which has been incorporated into *the Patent Act of Thailand*. In the same way as the Patent Act, the PVP Act should allow the patented innovations to be subject to compulsory licensing under some

[1018] *Patent Act of Thailand,* Article 37.

conditions, including the failure to obtain the voluntary license from the patentee.[1019] If the government decides to grant a license, the government must designate reasonable remuneration and set forth some restrictions regarding the extent of the use and duration of the license, such as the forbiddance to further license to some categories of third parties, or the requirement to supply predominately for the domestic market. Importantly, the PVP Act should designate the case and the situation which gave rise to the termination of the license. Lastly, the patentees must be granted the right to appeal the order of the Ministry to the court within a set period of time. Setting forth the PVP Act in this way would balance the private sector with public interest, relieve the concern of the private sector and it would also avoid any complicated undertaking in case of cross-compulsory licensing mechanism is being introduced.

6.4 Conclusion

To summerise, the proposed statutory reform of Thailand's plant protection systems shows the extent to which the developing countries can take advantage of the flexibility of Article 27.3(b) of the TRIPS Agreement in devising their national law in accordance with national policies to promote agricultural innovations and to balance the interests of all relevant stakeholders. This Chapter proposes that, under the current system, the private sectors lack the necessary incentives to conduct further research on modern plant technologies since the PVP Act does not allow them to sufficiently cover their costs. Moreover, the plant variety protection system, in fact, protects only a limited group of plant innovations, i.e. the propagating materials and harvests of plant varieties, and is designed to accommodate the mode of production by way of natural crossing and selection. Nonetheless, a wide range of plant innovations involving modern scientific technologies have been left unprotected, including but not limited to plant genes, DNA, nano -biotechnology, modern breeding methods, isolated and purified forms of plants etc. Therefore, the patenting system of plants should be introduced in Thailand in order to provide intellectual property protection to plant breeders of all levels.

[1019] *Patent Act of Thailand,* Article 47, 50 and 50bis.

However, it is utmost important to ensure that in case a patent system and plant variety protection system are overlapping, it would not lead to the further extension of exclusive rights, create a blocking situation for any party to access genetic materials for research and development purposes or become a hindrance to traditional farming practices and the livelihood of small farmers. Therefore, the mechanisms to avoid the blocking situation is to adopt cross-compulsory licensing mechanisms to make sure that the holders of intellectual property rights can exploit their own innovations. Moreover, in order to make sure that farmers' rights can function, these rights should be recognized as self-standing rights which can be raised outside the plant variety protection regime, particularly to patent owners. Lastly, the research exemption provided under the current Patent Act of Thailand need to be interpreted to cover the rights of plant breeders.

As for a plant variety protection system, many flaws can be detected from the inherent *sui generis* system for plant variety protection of Thailand. Not only does it insufficiently accommodate the needs of private sectors, but the provisions concerning the guarantee of farmers' rights and local communities are also far from being effective. The practical problems exist particularly in implementing benefit-sharing mechanisms from the stage of registration to the stage of benefit distribution. At an international level, the only option available for *sui generis* plant variety protection is the 1991 UPOV Convention; However, this Convention does not suit Thai social and economic conditions at the moment, especially the concept concerning the protection of discoveries, the extension of plant breeders' rights to cover the EDV and the limited farmers' privilege to save and replant seeds. In this case, Thailand has to take the alternative of improving the current PVP Act, particularly on the protection of discoveries, terms of protection, benefit-sharing mechanisms for local plant varieties and wild and general varieties and compulsory licensing, taking into account that the system must be acceptable and most preferable by all actors in the agricultural management system.

Chapter VII: Conclusion

This dissertation sets out to examine the extent to which the available international mechanisms, i.e., the patent system under the TRIPS Agreement and the plant variety protection system under the 1991 UPOV Convention, are able to strike a balance between the incentives to create new plant innovations while guaranteeing access to the genetic pool for further research and development and the freedom to operate in the field of agriculture. Also, it aims to analyze how the main jurisdictions exploit the flexibilities set out under Article 27.3(b) of the TRIPS Agreement to establish the most appropriate model for plant protection in accordance with their national policies and socio-economic conditions, as well as incorporating the obligations of the CBD and ITPGRFA.

This dissertation finds that plant variety protection system alone is not sufficient to encourage new plant innovations, particularly those developed by modern scientific methods. Therefore, patent protection for plants and plant-related innovation should be initiated in developing countries, including Thailand, in order to promote new plant innovations developed from a high level of agrobiotechnology and the modern processes of breeding plants which have been left unprotected outside the scope of plant variety protection system. However, this dissertation maintains that the granting of a patent can be justified only to the degree that such rights are essential to provide impetus to create, not the total elimination of all possible free-riding activities. Hence, considering the unique nature of plant innovations, national patent systems must elaborate some legal mechanisms especially tailored to plant genetic resources to maintain some generous space for the public sector to conduct future research and to allow the farmers to maintain their traditional farming practices for their subsistence. As for the *sui generis* plant variety protection system, this dissertation emphasizes the importance of the alternative to allow the WTO members to develop their own system and that the UPOV Convention might not be the most suitable plant variety protection system for developing countries, including Thailand.

7.1 The Rationale to Protect Plant Inventions through Patent System in Developing Countries

In the past, *sui generis* plant variety protection system, particularly designed to protect propagating materials and harvested materials of plant varieties, might have been sufficient to provide incentive for plant breeders to invest in research and development programs since the production mode of plants solely relied upon natural methods of crossing and selection. However, in recent years, biotechnology has been greatly developed and finally been accepted as a field of scientific technology. The technological advancement has altered the gravity of concentration in plant research and development program from the paradigm of phenotype (the outer features of plants which are visible to the eye) to the paradigm of genotype (the inner genetic constitution or molecular information of plants).

These developments leave the wide range of plant-related inventions unprotected outside the scope of a plant variety protection regime while the costs of investments in this type of agrobiotechnology are considerable. The unprotected subject matters include technical processes for the production of cultivars. Furthermore, plant genes, combinations of genes and DNA sequences are left outside the protection scope.

As a result, the patentability on these modern plant innovations and unconventional biological processes for the production of plants should be allowed for the plant breeders to recover their expenditure and earn some reasonable profits for their time and effort. The attribution of patent rights is needed in developing countries for the better promotion and distribution of technologies, responding to the economic and social demand and to lessen the gap between high-level biotechnology and local communities.

Plant patent does not necessarily lead to seed market monopoly, especially in the jurisdictions comprised of the number of private companies or where public sectors and farmers play active roles in producing seeds. This is because there are many varieties of the same plant species as the new plants protected by patents, meaning that farmers do not have to rely on the protected varieties. Hence, if the seed of a variety is too expensive, farmers can choose to buy from another company or use a traditional variety. Market forces of demand and supply will work on their own. There is no way all companies would raise prices at the same time. However, to allow the market forces to work, some special mechanisms have to be introduced in the patent law. In particular, the intellectual property laws need to make sure that the results of modern breeding technologies can be accessed by farmers and public research institutes in order to promote robust competition between public and private investment in the research and development program of new plant varieties.

7.2 Mechanisms to Ensure That Granting of a Patent Will Not Obstruct the Accessibility to Genetic Pool While Still Encouraging New Innovations

Considering the sequential, cumulative and path-dependent characteristics of plant inventions which always require a wide range of existing genetic resources as inputs for creating new innovations, scientists generally practice with identical things to create new plant varieties. Patent rights can, therefore, greatly affect the ability of the public sector to create better cultivars.

The exemption to conduct, research and experiment under the patent law is usually interpreted in such a narrow way. For example, the experimental use exemption of the United States only exempts research and experiments conducted "for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry" from the scope of patent rights.[1020] Moreover, "the profit or non-profit status of the user is not determinative."[1021] Consequently, this exemption can rarely be called forth against the alleged infringement.

This problem is exacerbated by the fact that, although plant variety protection systems and the patent system are designed to protect different subject matters, in accordance with Article 28 of TRIPS Agreement, the scope of patent rights assigned to plant innovations might encompass plant varieties, leading to the situation where a plant variety is protected by two sets of intellectual property rights.[1022] In the field where the patent regime and the plant variety protection system interface, the more rigid level of protection granted by patents is dysfunctional on two fundamental exemptions to exclusive rights of plant breeders which are generally provided by a plant variety protection system. First, "breeders' exemption" allowing other plant breeders to utilize the protected cultivars as starting inputs for the creation of a new variety without conditions for a prior consent or any reimbursement and to even commercialize such a new variety is dysfunctional in this case. For instance, in case a patented gene is expressed in a new plant variety, the plant breeder cannot commercialize such variety unless he obtains a consent from the patentee at the time of reproduction (other than private and non-profit objectives). Second, "farmers' privilege" or

[1020] *Madey v. Duke University*, 307 F. 3d 1351, 1362 (Fed. Cir. 2002).
[1021] Ibid.
[1022] The overlapping protection systems can occur when:
1. the technical feasibility is not restricted to a single variety of plant;
2. the process patent claims a unconventional biological process for plant production; and
3. a patented gene or DNA sequence is inserted into a plant variety in which it operates to function.

"farmers' rights" allowing farmers to save seeds for replanting in their own holding and to exchange them for non-commercial purposes also do not work.

Consequently, even in the absence of any modification of available international agreements, the patent system for the protection of plants and plant-related innovations can be established in the case that some legal mechanisms are provided to ensure that the use of patent rights in plant innovations does not excessively restrict access to the genetic resources and bar traditional practices of farmers. Hence, national law must enact some particular provisions governing the interface between the two sets of intellectual property rights. The legal mechanisms which the WTO member countries may adopt are as follows:

First, the TRIPS Agreement creates some space for the domestic laws to exclude some limited categories of plant innovations from patent protection. Since the members of the TRIPS Agreement can deny patentability for plants as a whole, *a fortiori*, the members also have the alternative of allowing patent protection but confining the rights granted in various ways. For example, domestic laws might lessen the number of plants so as to exclude some food which is especially important for food security from patentability, limit patentability to genetically modified crops in the case that they satisfy certain environmental conditions or preclude genetic use restriction technology or terminator technology.

Second, the cross-licensing of protected plant materials should be established to ensure accessibility to plant resources which are not in the public domain. This mechanism makes sure that the holders of plant breeders' rights can commercially exploit new plant varieties which contain the patented innovations of the third parties and *vice versa*. As stipulated by Article 31 of *the TRIPS Agreement,* the applicant of the license must show that he or she had failed to obtain the contractual license from the rights holder and that the innovation or plant variety constitutes an "important technical advance of considerable economic significance."[1023] However, this model might be inefficient because of the difficulties in evaluating economic interests in an early stage of the process of breeding. Thus, having

[1023] *TRIPS Agreement*, Article 31(i).

cross-compulsory licenses in place does not eradicate the necessity of an appropriate research exemption since proprietary genetic resources under the process of creation or development, of which economic value is difficult or unable to be evaluated, remain inaccessible.

Third, the demand to take into consideration the special nature of plant innovations with respect to the use of materials in further breeding programs has been acknowledged in some national patent regimes by way of imposing specific exceptions similar to breeders' exemption under plant variety protection regime such as *the French Intellectual Property Code (as amended in 2004)*, Also, *the 2005 German Patent Act*, *the Swiss Patent Act (as amended in 2007)* and Article 27 of Agreement on a Unified Patent Court which creates the "limitations to the effects of a patent" consisting of an exemption concerning the utilization of plant materials in breeding, discovering or developing other plant varieties. The limited exemption adopted by the European Union under the Agreement on a Unified Patent Court, is an exceptional indicative of a general comprehension on the TRIPS-compatibility of a breeding exemption. In fact, up to the present, no complaint has been filed with the WTO claiming that these exceptions defy the TRIPS Agreement.

Yet, the limited exceptions are not fully equivalent to the "breeder's exemption" under the UPOV Convention and most *sui generis* regimes because it does not allow the developers to commercialize the results of their own improvement. The chance to obtain the consent from the patentee to do so is not certain, and the time and money invested in developing further cultivars may be totally wasted until the expiry date of the term of the patent protection. A limited breeding exception, therefore, may not be enough to promote continuous innovation in plant breeding. Thus, comprehensive breeding exception established by the plant variety protection regimes should also be incorporated in patent law. Even so, the degree to which the Dispute Settlement Body of the WTO would subordinate the interests of patentees to this public policy is uncertain, especially if such an exception is established without remuneration to patentees. Consequently, to avoid the possibility of objection, this dissertation suggests the option to

provide a liability regime under which the patentee may be reimbursed through royalties determined as a settled percentage of his or her overall gross income.

Fourth, another important issue that should be raised is that farmers in many countries usually exchange propagating materials to identify the traits that are beneficial in their specific soil or under particular climate conditions. Moreover, they generally produce the seeds on their own farm and then save them to be replanted in the subsequent planting seasons. The unrestrained seed exchange and the freedom to utilize them for the breeding of new and better cultivars has been a core element of the agricultural system. Granting of a patent on plants would disrupt these practices since the third parties can no longer do so without the authorization of the patent owners. This therefore imposes a complicated set of social and economic costs as it could easily shift the role of farmers from seed producers to mere consumers of seeds Meanwhile, the ITPGRFA clearly creates the obligations for its parties to guarantee the fundamental rights of farmers to save, use, exchange and sell farm-saved seeds; however, it does not specify the exact mechanism or guidance on how the States should implement them. Hence, each State is free to define its legal space.

The incorporation of the farmers' privilege from a plant variety protection system to patent system is another tool which developing countries can adopt, for example, by embodying in their domestic patent regimes the exemptions envisaged in their plant variety protection system. Such incorporation does not necessarily require royalty payment to the patentee provided that it is also not obliged under the plant variety protection system to do so. The matter concerning whether the exemption equivalent to farmers' privilege applied to patent law is compatible with the TRIPS Agreement has never been brought before the dispute settlement mechanism of the WTO while Article 11 of *the Biotech Directive* of the European Union has been implemented for over two decades. However, it is important to permit the plant breeders to maintain some control over the commercial exploitation of their innovations; accordingly, the national law should impose the restriction on farmers not to sell seeds branded with the name of the owners of plant breeders' rights.

7.3 Plant Variety Protection System: *Sui Generis* Options for developing countries

Article 27.3(b) of the TRIPS Agreement requires the member states to provide plant variety protection by either a patent system or by an "effective" *sui generis* system. The alternative of a *sui generis* system was introduced as a viable option to the member States to devise a system that fits most to their development goals; as a result, the requirement of "effectiveness" should also be interpreted as the introduction of an intellectual property regime which thoroughly protects every actor involved in plant development and conservation.

TRIPS Agreement makes no reference to the UPOV model as an effective *sui generis* system. Nonetheless, since it is the only international agreement specifically designed to protect plant variety available at the moment, many countries which lack time or resources to establish their own local *sui generis* regime or under pressure to adopt this system by FTAs or RTAs have adopted the 1991 UPOV Convention without sufficient consideration of its effects.In contrast, the 1991 UPOV Convention has certain deficiencies which have led to small improvement in the field of plant breeding despite of too broad exclusive rights granted to plant breeders.

First, it provides low novelty and distinctiveness requirements of protection, resulting in its inability to aptly identify creativity in the field of plant breeding. Cultivars which are commonly known or found in the wild may still be considered as new plant varieties protectable under the UPOV system.

Second, the exclusive rights bestowed on plant breeders are not proportionate. Under the 1978 UPOV Convention, the monopoly rights of plant breeders include all cultivars not clearly distinguishable from the protected plant varieties. Yet, the 1991 UPOV Convention extends the scope of protection to cover EDVs, which are apparently distinguishable from the initial protected varieties. In other words, breeders' rights cover both indistinguishable and distinguishable cultivars which are derived from the initial protected varieties. This allows the owners of plant breeders' rights to claim their rights over the development of other plant breeders or farmers.

Third, unlike its predecessor, the 1991 UPOV Convention makes farmers' rights to save seeds for replanting an option. Monetary compensation to the holders of breeders' rights or the restriction on the quantity or types of seeds saved from their own farm might be imposed. Further, Article 15.2 of the 1991 UPOV Convention bans informal sale and offers for sale from the scope of the farmers' privilege. The rights of plant breeders may only be restricted to permit farmers to use for propagating, on their own holdings, the product of the harvest obtained by planting, on their own holdings, the protected varieties.

Consequently, the 1991 UPOV Convention should not be considered as the only effective *sui generis* option for developing countries. On the other hand, the countries in the South should be encouraged and assisted in developing their own *sui generis* system for plant variety protection in virtue of the flexibility provided under the TRIPS Agreement of the WTO.

7.4 Incorporation of Benefit-Sharing Obligations of the CBD and the ITPGRFA into the National System

Under the CBD, the exploitation of plant materials obligates the genetic resource users to get prior-informed consent from the relevant authorities and the local communities and to share benefits from commercialization of those resources. In the South, benefit-sharing mechanisms have been established in some national plant variety protection regimes. These laws adopt direct benefit-sharing between the providers and recipients of plant genetic resources based on prior consent and contractual agreement, in line with the CBD. However, this direct approach has proven to be ineffective in practice due to the difficulties in defining the exact group beneficiaries. Plus, the demand for farmers' varieties by commercial plant breeders is relatively limited, so only small groups of farmers actually gain benefits while the vast majority of the contributors to the genetic pool stay unrewarded. Further, direct approach of benefit-sharing might discourage seed-sharing among farmers owing to their desires of benefits from others.

This dissertation suggests that the concept of benefit-sharing under the CBD and the ITPGRFA is designed to reward those who contribute to the improvement and maintenance of biological diversity, not

to condemn the free-riding by the resource users. As a result, the providers of the benefits are not necessarily the owners of intellectual property rights. The benefit-sharing mechanism, thus, should focus on the reward to society at large rather than the profits made by the intellectual property owners. Moreover, developing countries should concentrate more on non-monetary rewards for local communities such as facilitated access to genetic resources, transfer of technology or building of farming capacity in accordance with the guidance provided by the ITPGRFA. In addition, conforming to the idea of indirect benefit-sharing under the ITPGRFA, benefits should not just be distributed among few farmers who possess plant varieties, but with all farmers involved in the preservation and sustainable utilization of agrobiodiversity. Hence, each State has responsibility to make sure that such rights are recognized and rewards actually benefit the people involved in the agricultural system at large. In this regard, the question on how farmers can be granted benefits and the sizes of benefits needs to be determined.

As for the question whether the incorporation of benefit-sharing obligation into the patent system is possible, the compatibility of this idea with the TRIPS Agreement is uncertain, however, considering the *Canada – Patent Protection of Pharmaceutical Products* case, the WTO dispute settlement panel held that a neutral provision provided under Canadian patent law, which applied solely to pharmaceutical products, did not violate the patent non-discrimination principle under Article 27.1 of the TRIPS Agreement.[1024] The dispute settlement panel evidently avoided deciding on the issue of whether mechanisms which are restricted to a single field of technology are considered "discriminatory" owing to that basis alone, or if under some situations they may qualify as special mechanisms necessary to reinforce equality of treatment to a particular field of technology.[1025] Meanwhile, some critiques view that the TRIPS Agreement does not forbid its members from imposing fees or levies affiliated with the enjoyment of intellectual property rights, taking those commonly imposed by domestic patent offices as

[1024] World Trade Organization [WTO], Canada - Patent protection of pharmaceutical products, WT/DS114/R, (17 March 2000).
[1025] Ibid, para. 7.105.

examples.[1026] Nonetheless, it is not obvious if the TRIPS Agreement obliges that fees or levies be, to a large extent, equivalent for every type of technology.

In attempting to avoid any probable contradictions, extensive interactions between the State representatives negotiating in the TRIPS Council of the WTO and the government officials associating with the Governing Body of ITPGRFA are likely to occur. This is specifically so in the case the Board of the WTO ministers instruct the TRIPS Council to take into account any "relevant new developments raised by Members" when considering Article 27.3(b) concerning patents on plants and plant variety protection.[1027] Still, since any conclusion agreed to during the Doha will include a large number of issues not related to plant innovations, it is not easy to anticipate the final result.

7.5 Recommendations for Developing Countries when Entering into Trade Negotiations

To avoid the application of the international intellectual property right system, particularly, the 1991 UPOV Convention, to agricultural innovations which may result in an imbalance of resource distribution with a potential negative effect on the national agricultural sector, this dissertation proposes that the countries in the South should take a proactive position at the WTO TRIPS Council. Through this way, the developing countries can incite the developed countries to provide concrete evidence of the economic benefits which could justify the departure from the intellectual property standard established by the TRIPS Agreement.

Essentially, developing countries under the obligations of bilateral or regional trade agreements or investment agreements, requiring their parties to adopt TRIPS-plus standards for the protection of plant innovations, should attempt to at least identify and preserve their ability to enunciate crucial legal mechanisms governing the interface problems between the patent system, plant variety protection system

[1026] R.J.L. Lettington, "The International Undertaking on Plant Genetic Resources in the Context of TRIPs and the CBD. Bridges: Between Trade and Sustainable Development," *International Center for Trade and Sustainable Development* 5, No. 6 (2001): 11.
[1027] Maria Julia Oliva and Sisule F. Musungu, "the TRIPS Agreement at a crossroads: intellectual property and sustainable development in the Doha round," in *Sustainable Development in World Trade Law*, ed Markus W. Gehring, Marie-Claire. (Kluwer Law International, 2005), 276.

and traditional practices governing agricultural resource management. At the local level, to avoid the internal conflicts between each actor in agricultural management, the legislative process which will finally result in the formation or introduction of new intellectual property system for the protection of plants should be inclusive and encompass the opinions of all relevant local stakeholders and future users of the system.

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