ACCESS AND BENEFIT-SHARING REGIMES CONCERNING THE UTILIZATION OF PLANT GENETIC RESOURCES AND TRADITIONAL KNOWLEDGE REGARDING THE USE OF PLANT GENETIC RESOURCES: USING LAW, ECONOMICS, AND EMPIRICAL METHODS TO ANALYZE PLANT GENETIC RESOURCES ISSUES, INCLUDING BIOPIRACY, BIOPROSPECTING, AND INTELLECTUAL PROPERTY

BY

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DISSERTATION

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Abstract

The developed and developing worlds have different perspectives regarding plant genetic resources (PGRs) and traditional knowledge regarding the use of PGRs. The developed world favors intellectual property rights (IPRs), and terms the collection of PGR samples from the developing world to be “Bioprospecting.” The developing world terms the collection of PGRs from national sovereignties to be “Biopiracy,” and favors limitations on the collection of PGRs and promotes the sharing of benefits with the origin countries of PGRs.

This dissertation uses Probit Regression to uncover interactions between access and benefit-sharing (ABS) regimes and IPRs regarding PGRs and traditional knowledge regarding the use of PGRs. Regression analysis shows that the more PVP applications that are filed in a given country, the higher the probability that such a country will adopt an ABS regime. This dissertation concludes that ABS regimes do not conflict with the application of IPRs, which is contrary to the existing literature.

This dissertation evaluates these issues objectively using law, economics and regression analysis (Probit Regression). The regression analysis shows countries that experience net inflows of foreign direct investments and increased numbers of plant variety protection (PVP) applications adopt ABS regimes. This dissertation suggests the elimination of the complicated administrative procedures that are currently required for accessing PGRs. The regulation of “intermediaries” and “culture collections” as sources of PGRs and the sharing of non-monetary benefits in return for access to PGRs and traditional knowledge regarding the use of PGRs can promote the creation of ABS regimes. Taiwan provides a case example of an ABS regime but has both many good points as well as room for improvement.

Future research should focus on finding more concrete ways to harmonize IPRs and ABS regimes, and examine specific national laws to determine whether such laws promote the implementation of ABS regimes.
To Father and Mother
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# TABLE OF CONTENTS

LIST OF TABLES AND FIGURES ................................................................. x

CHAPTER 1 - INTRODUCTION........................................................................ 1
1.1 WHY IS THE ISSUE OF PLANT GENETIC RESOURCES (PGRs) IMPORTANT?.. 1
1.2 DEFINITION OF THE FAIR AND EFFICIENT USE OF PLANT GENETIC
RESOURCES (PGRs) ...................................................................................... 3
1.3 THE STRUCTURE AND METHODOLOGY OF THE DISSERTATION .......... 6

CHAPTER 2 - CONFLICTS REGARDING “BIOPIRACY” AND “BIOPROSPECTING”
BETWEEN THE DEVELOPED AND THE DEVELOPING WORLDS ..................... 11
2.1 “BIOPIRACY” VERSUS “BIOPROSPECTING”........................................ 11
2.1.1 The Definitions of “Biopiracy” and “Bioprospecting” ......................... 12
2.1.2 Perspectives on “Biopiracy” ................................................................. 15
2.1.3 The Perspective of “Bioprospecting” ................................................... 23
2.2 THE MAJOR DISPUTES CONCERNING “BIOPIRACY” AND
“BIOPROSPECTING” .................................................................................. 24
2.2.1 Issues related to Plant Genetic Resources (PGRs) .............................. 24
2.2.2 Issues related to Traditional Knowledge regarding the Use of Plant Genetic
Resources (PGRs) ....................................................................................... 54
2.3 THE INFLUENCE OF THE U.S. INTELLECTUAL PROPERTY REGIME FOR
PLANT INNOVATION ON GLOBAL “BIOPIRACY” AND “BIOPROSPECTING” .... 69
2.3.1 The Utility Patent .................................................................................. 70
2.3.2 The 1930 Plant Patent Act (PPA) .......................................................... 72
2.3.3 The 1994 U.S. Plant Variety Protection Act (PVPA) ........................... 73
2.3.4 The U.S. Intellectual Property Regime for Plant Innovation Played an Important
Role in the Development of the World’s Biotechnology Industry .............. 79
2.4 THE INTERNATIONAL LEGAL REGIMES RELATED TO “BIOPIRACY” AND
“BIOPROSPECTING” ................................................................................. 82
2.4.1 Trade-Related Aspects of Intellectual Property Rights Agreement (TRIPS) .... 84
2.4.2 The Patent Cooperation Treaty (PCT) and the Patent Law Treaty (PLT) ...... 86
2.4.3 The International Convention for the Protection of New Varieties of Plants
(UPOV Convention) ................................................................................ 90
2.4.4 The Manila Declaration ...................................................................... 95
2.4.5 The Convention on Biological Diversity (CBD) ................................. 96
2.4.6 The International Treaty on Plant Genetic Resources for Food and Agriculture
(ITPGR) ...................................................................................................... 99
2.4.7 The International Undertaking on Plant Genetic Resources (IUPGR) ................. 103
2.4.8 The Bonn Guidelines on Access to Genetic Resources and the Fair and Equitable Sharing of the Benefits Arising out of Their Utilization ......................... 105
2.4.9 The Cancun Declaration of Like-minded Megadiverse Countries ..................... 107
2.4.10 The Universal Declaration of Human Rights (UDHR) .................................... 108
2.4.11 Declaration on the Rights of Indigenous Peoples ........................................... 109

CHAPTER 3 - HOW TO VIEW THE “BIOPIRACY” AND “BIOPROSPECTING” DEBATES IN THE TWENTY-FIRST CENTURY? ................................................................. 110
3.1 ANALYZING THE CONFLICTS REGARDING THE CONSERVATION OF BIOLOGICAL DIVERSITY AND INTELLECTUAL PROPERTY RIGHTS USING A NEW METHOD .......................................................... 111
3.2 ANALYZING THE BENEFITS OF TRADE (TECHNOLOGY TRANSFER OR CHANGE) USING THE ECONOMIC PERSPECTIVE .............................................. 113
3.3 THE IMPACT OF THE GLOBAL RECESSION ON BIOTECHNOLOGY INDUSTRY RESEARCH AND DEVELOPMENT (R&D) INVESTMENTS .................. 118
3.4 USING EMPIRICAL METHODS IN LAW TO ANALYZE LEGAL ISSUES CONCERNING PLANT GENETIC RESOURCES (PGRs) AND TRADITIONAL KNOWLEDGE ABOUT THE USE OF PLANT GENETIC RESOURCES (PGRs) ....... 120

CHAPTER 4 - AN EMPIRICAL STUDY OF ACCESS AND BENEFIT-SHARING LAWS AND POLICIES CONCERNING PLANT GENETIC RESOURCES (PGRs) AND TRADITIONAL KNOWLEDGE REGARDING THE USE OF PLANT GENETIC RESOURCES BY SELECTED PARTIES TO THE CONVENTION ON BIOLOGICAL DIVERSITY (CBD) AND THE INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE (ITPGR) ......................................................... 122
4.1 LITERATURE REVIEW REGARDING ACCESS AND BENEFIT-SHARING LAWS AND POLICIES OF PLANT GENETIC RESOURCES (PGRs) AND TRADITIONAL KNOWLEDGE REGARDING THE USE OF PLANT GENETIC RESOURCES (PGRs) ........................................................................................................ 123
4.2 AN EXAMINATION OF CURRENT ACCESS AND BENEFIT-SHARING LAWS AND POLICIES (ABS) OF THE WORLD ................................................................. 129
4.2.1 Overview of the Implementation of Access and Benefit-Sharing Regimes (ABS) among 194 Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resource (ITPGR) ........................................ 129
4.2.2 Comparison of the Adoption of the Convention on Biological Diversity (CBD), the International Treaty on Plant Genetic Resources (ITPGR), and Access and Benefit-Sharing Regimes (ABS) of the Developed and the Developing Worlds ... 146
4.3 EMPIRICAL RESEARCH REGARDING CURRENT ACCESS AND BENEFIT-SHARING (ABS) LAWS AND POLICIES OF THE WORLD .....................150
  4.3.1 The Interpretation of Collected Data related to Current Access and Benefit-Sharing (ABS) Laws and Policies and the Proposed Research Hypothesis ..............151
  4.3.2 Hypothesis 1: The More Plant Variety Protection (PVP) Applications that are Filed in the 194 Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resource (ITPGR), the Lower Probability that These Parties will Adopt Access and Benefit-Sharing Regimes (ABS).......................159
  4.3.3 Hypothesis 2: The More Plant Variety Protection (PVP) Applications that are Filed in Developed Countries, the Lower Probability that They will Adopt Access and Benefit-Sharing Regimes (ABS).............................................................................179
  4.3.4 Hypothesis 3: The More Plant Variety Protection (PVP) Applications that are Filed in Developing Countries, the Lower Probability that These Countries will Adopt Access and Benefit-Sharing Regimes (ABS) .................................................202

4.4 FURTHER ANALYSES AND RESEARCH FINDINGS REGARDING THE OUTCOMES OF PROBIT REGRESSION RELATED TO THE ACCESS AND BENEFIT-SHARING LAWS AND POLICIES (ABS) OF PARTIES TO THE CONVENTION ON BIOLOGICAL DIVERSITY (CBD) OR THE INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE (ITPGR) ..................................................217
   4.4.1 Further Analyses of the Probit Regression concerning the Access and Benefit-Sharing Law and Policies (ABS) of Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR) ........................................................................................................218
   4.4.2 Research Findings regarding the Outcomes of Probit Regression that are related to Access and Benefit-Sharing Laws and Policies (ABS) of Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR) ........................................................................................................224
   4.4.3 Summary of Regression Analyses related to Access and Benefit-Sharing Regimes (ABS) by Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR) ..........................................................229

4.5 RECOMMENDATIONS AND SUGGESTIONS FOR THE CURRENT IMPLEMENTATION OF NATIONAL ACCESS AND BENEFIT-SHARING REGIMES (ABS)..................................................................................233
  4.5.1 Interactions regarding the Adoption of Access and Benefit-Sharing Regimes (ABS) and Plant Variety Protection (PVP) Applications ...........................................233
  4.5.2 Access Issues ........................................................................................................260
  4.5.3 Benefit-Sharing Issues ............................................................................................269
CHAPTER 5 - AN ANALYSIS OF THE “DRAFT OF THE GENETIC RESOURCES ACT OF TAIWAN”

5.1 OVERVIEW OF CURRENT ACCESS AND BENEFIT-SHARING LAWS AND POLICIES (ABS) IN TAIWAN

5.1.1 Laws related to the Conservation of Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs) .............................................

5.1.2 Intellectual Property Laws related to Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs) .............................................

5.1.3 Summary of Laws related to the Conservation of Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs) .............................................

5.2 OVERVIEW OF THE “DRAFT OF THE GENETIC RESOURCES ACT OF TAIWAN”

5.3 ANALYZING THE “DRAFT OF THE GENETIC RESOURCES ACT OF TAIWAN” FROM THE PERSPECTIVE OF OTHER PARTIES TO THE CONVENTION ON BIOLOGICAL DIVERSITY (CBD) OR THE INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE (ITPGR)

5.4 RECOMMENDATIONS AND SUGGESTIONS FOR FUTURE LEGISLATION REGARDING THE “DRAFT OF THE GENETIC RESOURCES ACT OF TAIWAN”

5.4.1 Intellectual Property Protection (Plant Variety Protection or Other Types of Protection) does not Conflict with the Conservation of Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs) .............................................

5.4.2 The Application of the “Compulsory License” Regulations in the Taiwanese Patent Act and Plant Variety and Plant Seed Act to the “Draft of the Genetic Resources Act of Taiwan” .............................................

5.4.3 The Application of the Concept – Special Law Takes Precedence over the General Law to the “Draft of the Genetic Resources Act of Taiwan” .............................................

5.4.4 Harmonization of Current Taiwanese Laws related to the Use of Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs) .............................................

5.4.5 The Enactment of the Taiwanese Genetic Resources Act should Protect the Developments of All Industries and Consider Different Perspectives in Taiwan .............................................

5.4.6 To Allow the Use of Genetic Resources without the Territory Limitation is Crucial in the “Draft of the Genetic Resources Act of Taiwan” .............................................
LIST OF TABLES AND FIGURES

Table 2.1 Historical Developments of the Ownership of Plant Genetic Resources (PGRs)....35
Table 2.2  The World's Top 10 Seed Companies – 2006 (Based on 2006 Seed Revenues). 44
Table 2.3  Difficulties Involved in Attempting to Resolve the Controversies regarding
the Use of Plant Genetic Resources (PGRs)........................................................................53
Table 2.4  Traditional Knowledge about the Use of Plant Genetic Resources (PGRs)........68
Table 2.5  The List of World’s Top 14 Owners of Plant Patents – 1995...............................82
Table 4.1  The Implementation of Access and Benefit-Sharing (ABS) Regimes of
Parties to the Convention on Biological Diversity (CBD) or the International Treaty on
Plant Genetic Resources for Food and Agriculture (ITPGR)..............................................131
Table 4.2  The Interpretations of Independent Variables related to the Regression
Analysis of the Implementation of Access and Benefit-Sharing (ABS) Laws and Policies
from Parties to the Convention on Biological Diversity (CBD) or the International Treaty on
Plant Genetic Resources for Food and Agriculture (ITPGR).............................................151
Table 4.3  The Correlation Coefficients of Numbers of PVP Applications in 2006 and
Other Variables related to Intellectual Property Protections.............................................157
Table 4.4  The Correlation Coefficients of Dependent and Independent Variables related
to the Regression Analysis of the Implementation of Access and Benefit-Sharing (ABS)
Laws and Policies from Parties to the Convention on Biological Diversity (CBD) or the
International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR)........160
Table 4.5  Model 1 – The Probit Regression between the Status of Access and Benefit-Sharing
Regime (ABS) and Numbers of PVP Applications – 2002~2006 Average.................163
Table 4.6  The Postestimation of Model 1 – The Probit Regression between the Status
of Access and Benefit-Sharing Regime (ABS) and Numbers of PVP Applications – 2002
~2006 Average................................................................................................................165
Table 4.7  Model 2 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, and GDP – per capita of 2008 (PPP)......................................................................................................................................................166

Table 4.8  The Postestimation of Model 2 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, and GDP – per capita of 2008 (PPP)......................................................................................................................................................168

Table 4.9  Model 3 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), and The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007.................................................................169

Table 4.10  The Postestimation of Model 3 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), and The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007.................................................................171

Table 4.11  Model 4 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, and Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?...............................................................................................................................................172

Table 4.12  The Postestimation of Model 4 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, and Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?...............................................................................................................................................175
Table 4.13  Model 5 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, and Enforcing Contracts Cost of 200% of income per capita.................................................................176

Table 4.14  The Postestimation of Model 5 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, and Enforcing Contracts Cost of 200% of income per capita.......................... ................................................... ........................178

Table 4.15  The Correlation Coefficients of Dependent and Independent Variables related to the Regression Analysis of the Implementation of Access and Benefit-Sharing (ABS) Laws and Policies from Developed Countries that are Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR)..................................................................180

Table 4.16  Model 1 – The Probit Regression between the Status of Access and Benefit-Sharing Regime (ABS) and Numbers of PVP Applications – 2002~2006 Average from Developed Countries................................ ................................................... ...........................183

Table 4.17  The Postestimation of Model 1 – The Probit Regression between the Status of Access and Benefit-Sharing Regime (ABS) and Numbers of PVP Applications – 2002~2006 Average from Developed Countries................................ ................................................... ............184

Table 4.18  Model 2 – The Probit Regression among the Status of Access and Benefit-
Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, and
Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)? from Developed Countries

Table 4.19  The Postestimation of Model 2 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, and Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?

Table 4.20  Model 3 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, and The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007 from Developed Countries

Table 4.21  The Postestimation of Model 3 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, and The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007 from Developed Countries

Table 4.22  Model 4 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, and GDP
per capita of 2008 (USD) from Developed Countries

Table 4.23  The Postestimation of Model 4 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, and GDP per capita of 2008 (USD) from Developed Countries

Table 4.24  Model 5 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, GDP per capita of 2008 (USD), and Enforcing Contracts Cost of 200% of income per capita from Developed Countries

Table 4.25  The Postestimation of Model 5 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, GDP per capita of 2008 (USD), and Enforcing Contracts Cost of 200% of income per capita from Developed Countries

Table 4.26  Model 6 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, GDP per capita of 2008 (USD), and Enforcing Contracts Cost of 200% of income per capita from Developed Countries
capita of 2008 (USD), Enforcing Contracts Cost of 200% of income per capita, and The Shares of Agriculture on GDP from Developed Countries..........................198

Table 4.27 The Postestimation of Model 6 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, GDP per capita of 2008 (USD), Enforcing Contracts Cost of 200% of income per capita, and The Shares of Agriculture on GDP from Developed Countries......201

Table 4.28 The Correlation Coefficient of Dependent and Independent Variables related to the Regression Analysis of the Implementation of Access and Benefit-Sharing (ABS) Laws and Policies from Developing Countries that are Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR).................................................................203

Table 4.29 Model 1 – The Probit Regression between the Status of Access and Benefit-Sharing Regime (ABS) and Numbers of PVP Applications – 2002~2006 Average from Developing Countries.................................................................206

Table 4.30 The Postestimation of Model 1 – The Probit Regression between the Status of Access and Benefit-Sharing Regime (ABS) and Numbers of PVP Applications – 2002~2006 Average from Developing Countries.................................................................207

Table 4.31 Model 2 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, and GDP per capita of 2008 (USD) from Developing Countries.................................................................208

Table 4.32 The Postestimation of Model 2 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, and GDP per capita of 2008 (USD) from Developing Countries.................210
Table 4.33  Model 3 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), and Enforcing Contracts Cost of 200% of income per capita from Developing Countries………………………………………………………………………………………………………211

Table 4.34  The Postestimation of Model 3 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), and Enforcing Contracts Cost of 200% of income per capita from Developing Countries……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………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accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, GDP per capita of 2008 (USD), Enforcing Contracts Cost of 200% of income per capita, and The Shares of Agriculture on GDP from Developed Countries.................................221

Table 4.39  The Probit Regression, Reporting Marginal Effects among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), Enforcing Contracts Cost of 200% of income per capita, and 2007/2008 Gini Index from Developing Countries..............................................223

Table 4.40  The Conclusion of Probit Regression about the Adoption of Access and Benefit-Sharing Regimes (ABS) under Changes of Different Variables.................................230


Table 4.42  Interactions among Numbers of PVP Application, Foreign Direct Investment (FDI), and Adoption of Access and Benefit-Sharing Regime (ABS)..................240

Figure 3.1  The Variations of Production Possibility Curves (PPC) for the Non-Monetary Sharing (Technology Transfer or Change)........................................................................114

Figure 3.2  The Variations of Production Possibility Curves (PPC) for Country A in Food Outputs and Benefits from the Trade Case of Absolute Specialization.................................116

Figure 3.3  The Variations of Production Possibility Curves (PPC) for Country B in Food Outputs and Benefits from the Trade Case of Absolute Specialization.................................117

Figure 4.1  The Status of ABS Regimes within the member countries of the United Nations and parties of the CBD........................................................................................................147

Figure 4.2  The Status of ABS Regimes that are parties to the ITPGR..................................147

Figure 4.3  Comparisons of Countries with ABS Regimes in the Developed and the Developing World..................................................................................................................149

Figure 4.4  Comparisons of Countries without ABS Regimes in the Developed and the Developing World..................................................................................................................149

Figure 4.5  Comparison of Plant Species in the Developed and the Developing World........150

Figure 4.6  The Scatter Plot of the Distributions for Hypothesis 1: Model 5 Probit Regression Variables from 194 Parties to the CBD or the ITPGR – Excerpt of the Dependent Variable: Status of Access and Benefit-Sharing Regime (ABS) and the Independent Variable: Numbers of PVP Applications – 2002~2006 Average........................................225

Figure 4.7  The Scatter Plot of the Distributions of the Hypothesis 2: Model 6 Probit Regression Variables from Developed Countries – Excerpt of the Dependent Variable: Status of Access and Benefit-Sharing Regime (ABS) and the Independent Variable: Numbers of PVP Applications – 2002~2006 Average........................................227

Figure 4.8  The Scatter Plot for Distributions for Hypothesis 3: Model 4 Probit Regression Variables from Developing Countries – Excerpt of the Dependent Variable: Status of Access and Benefit-Sharing Regime (ABS) and the Independent Variable: Numbers of PVP Applications – 2002~2006 Average........................................228
Figure 4.9  Changes of Numbers of PVP Applications of Countries that have
Adopted ABS Regimes prior to More PVP Application Filings between 2002 and 2007....253

Figure 4.10  Changes of Numbers of PVP Applications of Countries that have More
PVP Application Filings, which Enhance Them to Adopt ABS Regimes........................257
CHAPTER 1 - INTRODUCTION

1.1 WHY IS THE ISSUE OF PLANT GENETIC RESOURCES (PGRs) IMPORTANT?

Many developing and less-developed countries, including those located in the tropical regions, have Plant Genetic Resources (PGRs) within their territories. PGRs, some of which have been used for centuries by indigenous people in various countries for medicinal purposes, are now proving to be potentially valuable. The potential market for derivatives made from these plants has set off a controversy regarding who should share in the profits from the extraction and use of those resources. This dissertation will consider and evaluate the various alternatives that are available for bringing PGRs to market.

One example is the use of bark scratchings found in the Amazon. In the early 1800s a German explorer, Alexander von Humboldt, learned that Amazonian Indians scratched the barks of the Chondrodendron and Strychnos trees and put those scratchings into cold water in order to make poison arrows used for hunting. The poison made in this manner is known as Curare. Curare is an alkaloid that affects neuromuscular transmission and has valuable medical uses. For example, it is employed to relax skeletal muscles during surgery by controlling convulsions. Research has shown that Curare causes a weakening or paralysis of skeletal muscles by interfering with the transmission of nerve impulses between nerve axons and the contraction mechanism of muscle cells. Curare’s other medical uses include the treatment of muscle trauma or spasms, acute arthritis, and poliomyelitis, and the treatment of

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2 Hua-Ren Guo, Plant Genetic Resource and Its Legal Protection, available at http://seed.agron.ntu.edu.tw/cbdcourse/07%20%20%B4%20%B3%D3%A%20%B8%E%7%BD%A4%CE%A8%E4%AAk%20%EE%ABO%20C5@.pdf (last visited January 16, 2008).
4 The Mildred E. Mathias Botanical Garden, Botany Textbooks – Economy Botany: Curare, supra note 3.
5 The Mildred E. Mathias Botanical Garden, Botany Textbooks – Economy Botany: Curare, supra note 3.
patients who must be completely immobilized during surgery. Brazilians use curare as a diuretic for the treatment of edema, fever, and kidney stones.

Another example is Catharanthus Roseus, a plant native to the tropical island of Madagascar. The native inhabitants of Madagascar traditionally used Catharanthus Roseus to treat diabetes. In 1757, the French brought the plant back to France and used an extract to produce drugs that cured sore throat, pleurisy, and dysentery. During the 1950s and 1960s, the U.S. National Cancer Institute began to derive an anticancer drug from Catharanthus Roseus. Eli Lilly and Company used a component of the plant to make Oncovin, a drug used to treat a wide variety of cancers, including breast cancer, lung cancer, non-Hodgkin’s lymphoma (NHL), and leukaemia. The drug works by preventing the division of cancer cells. Eli Lilly also extracted an alkaloid from Catharanthus Roseus that was used to produce Velban, a drug used to treat testicular cancer. These two medicines were approved for use as anticancer medicines by the U.S. Food and Drug Administration (FDA) in 1961 and 1963.

Pharmaceuticals derived from PGRs have proven to be commercially valuable. The profits from Oncovin and Velban alone amounted to $100 million in 1985. A global estimate for 1995 indicated that the value of traditional medicines derived from the PGRs of indigenous people amounted to $43 billion. The U.S. National Cancer Institute pointed out that more than 25% of the active ingredients of known cancer medicines were initially discovered

8 Guo, supra note 2.
9 Guo, supra note 2.
10 Guo, supra note 2.
11 Guo, supra note 2.
12 Guo, supra note 2.
13 Department of Agronomy, National Taiwan University, Seed Wars: Plant Genetic Resources Right v. Intellectual Property Right, available at http://seed.agron.ntu.edu.tw/civilisation/SeedWar/seed%20war.pdf (last visited February 20, 2008).
15 Guo, supra note 2.
in rain forests (indigenous communities) or synthesized in laboratories using discoveries initially made in rain forests.\textsuperscript{16} The potential for profits and public benefits to be derived from turning PGRs into pharmaceuticals for worldwide use has attracted a great deal of public attention.

1.2 DEFINITION OF THE FAIR AND EFFICIENT USE OF PLANT GENETIC RESOURCES (PGRs)

As mentioned above, PGRs have made valuable contributions to human health, so the question of how to use PGRs fairly and efficiently is an important issue. The purpose of this dissertation is help to develop fair and efficient legal policies regarding PGRs and traditional knowledge involving the use of PGRs.

However, before proposing legal policies regarding the fair and efficient use of PGRs, it is necessary to first define the meanings of “fair” and “efficient.” The U.S. courts have long used dictionaries to assist their interpretive endeavors. The U.S. Supreme Court has referred to dictionaries in more than six hundred cases during a period of two hundred years.\textsuperscript{17} Although this dissertation is not a court case decision, this dissertation is a work of professional legal research, which is a part of jurisprudence. Therefore, this dissertation will initially use the dictionary definition of “fair.” The Oxford English Dictionary defines fair as being “equitably, honestly, impartially, justly; according to rule.”\textsuperscript{18}

As regards the efficient use of PGRs, this dissertation uses the “Pareto Efficiency”\textsuperscript{19} definition of “efficient.” “Pareto Efficiency” is an economic concept that makes it “impossible

\textsuperscript{17} See note 2 of Note, Looking It Up: Dictionaries and Statutory Interpretation, 107 Harv. L. Rev. 1437, 1437 (1994).
\textsuperscript{18} The original definition of “fair” is that “In a fair manner or degree…4. Equitably, honestly, impartially, justly; according to rule…” See Oxford English Dictionary – fair, available at http://dictionary.oed.com.proxy2.library.uiuc.edu/cgi/entry/50081753?query_type=word&queryword=fair&first=1&max_to_show=10&sort_type=alpha&result_place=4&search_id=b2ld-t7cq9M-5793&hilite=50081753.
\textsuperscript{19} Ching-Sheng Mao et al., Economics 215 (5th ed. 2007); Robert Cooter & Thomas Ulen, Law & Economics 17 (5th ed. 2007).
to make at least one person better off without making another person worse off.” 20 When the “Pareto Efficiency” principle is applied to the notion of sustainable development of the environment, it is usually known as “Pareto Sustainability,” 21 meaning that within the limitations of environmental resources, economic development should deploy natural resources to satisfy the needs of the current generation without ignoring the needs of the next generation. 22 In other words, economic development should increase for each generation, and natural resources should not be exhausted so rapidly that economic development for subsequent generations will be impacted.

If we interpret “fair” and “efficient” by applying the above definitions to the use of PGRs, the first meaning is to be derived that using PGRs involves not favoring one country or multinational corporation over another, and also accords with international law. 23 Of course, using PGRs without favoring one country or multinational corporation over another is an ethical ideology, so we need fair international rules regarding the use of PGRs. The current international rules regarding the fair use of PGRs include the Convention on Biological Diversity (CBD) in 1992 and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR) in 2001. However, the CBD and the ITPGR do not appear to have solved the disputes regarding the fair use of PGRs. As regards conflicts concerning the use of PGRs that exist between countries in the North (the Developed World) and the South (the Developing World) – “biopiracy” and “seed wars” are serious issues when seen from the viewpoint of the South. This dissertation will discuss the current regime concerning the use of PGRs.

20 Cooter & Ulen, supra note 19, at 17.
21 Mao et al., supra note 19, at 249.
22 Mao et al., supra note 19, at 249.
23 From the definition of “fair” in the Oxford English Dictionary, we know the meanings of “Equitably, honestly, impartially, and justly” are the same, so this dissertation choose the term of “impartially” to define fair, and impartially means that “In an impartial manner; without favouring one more than another…” See Oxford English Dictionary – impartially, available at http://dictionary.oed.com.proxy2.library.uiuc.edu/cgi/entry/50112734?single=1&query_type=word&queryword=impartially&first=1&max_to_show=10.
of PGRs established by the CBD and the ITPGR – Access and Benefit-Sharing (ABS)\textsuperscript{24} and proposes ways in which ABS regimes can be encouraged, and this is based on empirical evidence.

If we apply “Pareto Sustainability” to PGRs, PGRs should not be depleted and should be conserved for sustainable development purposes. The objectives of the CBD and the ITPGR state that PGRs are the private property of countries and sovereignties, and negotiation costs arise from what Wittman termed the combination of bilateral monopoly with numerous participants on both sides,\textsuperscript{25} such as negotiations among megadiverse countries and multinational biotechnology corporations. The costs include monitoring and enforcing agreements, and the costs incurred when one or both parties try to renge on agreements.\textsuperscript{26} For example, both Shaman Pharmaceuticals and Merck made “bioprospecting” agreements with INBio of Costa Rica.\textsuperscript{27} Shaman paid 20\% of the exploration budget to Costa Rica, in accordance with their

\textsuperscript{24}The articles of CBD regulate the “Access and Benefit-Sharing (ABS)” regime are Article 8(j) and Article 15, and Article 8(j) rules that “Each Contracting Party shall, as far as possible and as appropriate:…(j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices;… Article 15 rules that “…7. Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, and in accordance with Articles 16 and 19 and, where necessary, through the financial mechanism established by Articles 20 and 21 with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources. Such sharing shall be upon mutually agreed terms.” See Secretarial of the Convention on Biological Diversity, United Nations Environment Programme, Text of Convention, http://www.biodiv.org/convention/convention.shtml (last visited April 4, 2009). The article of ITPGR that regulates the ABS regime is Article 10, which rules that “10.1 In their relationships with other States, the Contracting Parties recognize the sovereign rights of States over their own plant genetic resources for food and agriculture, including that the authority to determine access to those resources rests with national governments and is subject to national legislation. 10.2 In the exercise of their sovereign rights, the Contracting Parties agree to establish a multilateral system, which is efficient, effective, and transparent, both to facilitate access to plant genetic resources for food and agriculture, and to share, in a fair and equitable way, the benefits arising from the utilization of these resources, on a complementary and mutually reinforcing basis.” In addition, Article 10 is regulated within the “Part IV: The Multilateral System of Access and Benefit-Sharing,” and this part also includes Articles 11-13 about multilateral system of access and benefit-sharing of using PGRs. See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, official versions of the treaty, http://www.fao.org/ag/cgrfa/itpgr.htm#text (last visited April 4, 2009).
\textsuperscript{26}Id.
agreement.28 Shaman raised money from venture capitalists and made a stock offering.29 However, Shaman’s partner, Eli Lilly, did not renew its research contract in 1994 due to doubts about Shaman’s ability to produce products on time and in an efficient manner.30 Shaman’s stock price fell, and the company retrenched and discontinued collecting and screening natural products.31 In this case, the “bioprospecting” agreement was disputed by both of the contracting parties and by the partners of the contracting parties. Bioprospecting agreements usually relate to obtaining benefits from PGRs. The “Coase Theorem”32 states that when transaction costs are zero (or very low), an efficient allocation of resources will result, regardless of law. In short, if we apply the “Coase Theorem” to the use of PGRs, it shows that the efficient use of PGRs depends on how property rights are assigned.33

This dissertation argues that when countries own PGRs as their national sovereignties, countries will use PGRs sustainably within their territories.34 This dissertation will establish the theory that regards PGRs as the property of sovereignties, and that this is an efficient method of using PGRs and extends to discussions of related issues.

1.3 THE STRUCTURE AND METHODOLOGY OF THE DISSERTATION

The purpose of this dissertation is to develop legal policies for the fair and efficient use of PGRs and to define the terms “fair” and “efficient.” We begin by introducing the structure and methodology of this dissertation. This dissertation will examine competing viewpoints

28 Id.
29 Lesser, supra note 27, at 33.
30 Id. at 34.
31 Lesser, supra note 27, at 34.
32 The “Coase Theorem” is that “If private parties can bargain without cost over the allocation of resources, then the private market will always solve the problem of externalities and allocate resources efficiently.” See N. Gregory Mankiw, Essentials of Economics 210 (4th ed. 2007).
33 Cooter & Ulen, supra note 19, at 89.
34 For example, Article 3 of the CBD rules that “States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.” PGRs are owned by countries themselves as their sovereignties, and PGRs are not the “Common Heritages.” See Secretarial of the Convention on Biological Diversity, supra note 24.
regarding “biopiracy,” “bioprospecting” and international regulations regarding “biopiracy” and “bioprospecting.” This dissertation will discuss the differing viewpoints regarding “biopiracy” and “bioprospecting” and present arguments regarding these issues. The focus of this dissertation will be empirical research about ABS regimes, a principle established by CBD and ITPGR to regulate the fair and equitable use of PGRs among 194 countries (excluding the European Community, but including the U.S. and Taiwan) that signed the CBD or the ITPGR. This dissertation makes recommendations about how to enhance the implementation of ABS regimes. This dissertation will specifically examine Taiwan’s “Draft of the Genetic Resources Act of Taiwan,” by analyzing the outcomes of empirical research from 194 countries, including the U.S. and Taiwan, that are parties to the CBD or the ITPGR.

Chapter 1 introduces the three parts of this dissertation. First, it examines why the issue of PGRs is important, and provides examples of useful medicines made from PGRs. Second, because this dissertation attempts to propose legal policies for the fair and efficient use of PGRs, this dissertation will use the “lexical definition” – a dictionary-style definition as well as the “law and economics definition,” to define “fair” and “efficient” later in this dissertation. The third part provides detailed descriptions of this dissertation’s structure and methodology.

Chapter 2 is “Conflicts regarding ‘Biopiracy’ and ‘Bioprospecting’ between the Developed and the Developing Worlds.” This chapter introduces competing theories about “biopiracy” and “bioprospecting” as well as international regulations regarding them. Disputes re-

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35 Actually, the CBD has 193 parties and the ITPGR has 120 parties, but the majority parties of both treaties are the same. See Secretarial of the Convention on Biological Diversity, supra note 24; Commission on Genetic Resources for Food and Agriculture, supra note 24. Moreover, the official reports of the CBD and the ITPGR show that the European Community is a party to the CBD and the ITPGR, but the European Community is not a country because it is a union, so we exclude the European Community as the object of empirical research related to the CBD and the ITPGR. Although the U.S. and Taiwan are not parties to the CBD and the ITPGR, they are worthwhile for this dissertation to study. As a result, we include the U.S. and Taiwan as objects of empirical research related to the CBD and the ITPGR in this dissertation.

36 The original definition of the “lexical definition” in the Black’s Law Dictionary is that “A dictionary-style definition of a word, purporting to give the full meaning of a term.” See Black’s Law Dictionary 435 (8th ed. 2004).
garding these issues are related to traditional intellectual property rights (patent or plant variety protection), and international laws of biological diversity, food, agriculture, human rights, and traditional knowledge. The international regulations introduced in this dissertation include the Trade-Related Aspects of Intellectual Property Rights Agreement (TRIPS), the Patent Cooperation Treaty (PCT) and the Patent Law Treaty (PLT), the International Convention for the Protection of New Varieties of Plants (UPOV), the Convention on Biological Diversity (CBD), the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR), the International Undertaking on Plant Genetic Resources (IUPGR), the Bonn Guidelines on Access to Genetic Resources and the Fair and Equitable Sharing of the Benefits Arising out of Their Utilization, the Universal Declaration of Human Rights, and the Declaration on the Rights of Indigenous Peoples. This dissertation also will describe two other international legal regimes that have been neglected by most of the existing research, the Manila Declaration and the Cancun Declaration of Like-minded Megadiverse Countries.

The former was an ethical declaration about how to conserve Asian biological resources and equitably share benefits that arise from these resources that was signed by 31 countries in 1992. The 2002 Manila Declaration was incorporated into the CBD, and was a declaration concerning the exchange of information and the harmonization of national laws concerning the protection of biological resources and the development of an international regime to pro-

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mote the just distribution of equitable benefits that arise from the uses of biological re-

Chapter 3 is “How to View the ‘Biopiracy’ and ‘Bioprospecting’ Debates in the Twenty-First Century.” This chapter argues that the controversies regarding the ownership of PGRs between the developed and the developing worlds remain unsolved. This chapter has four sections – First, conflicts between the conservation of biological diversity and intellectual property rights are needed to be examined by means of the new method in the twenty-first century. Second, the benefits of trade (technology transfer or change) based on the economic perspective. Third, the global recession has impacted R&D investments in the biotechnology industry. Fourth, an alternative method of analyzing legal issues conserving PGRs and traditional knowledge about the use of PGRs – empirical methods in law – to examine these controversies. We will use empirical research to examine how nations currently implement the fair and efficient use of their PGRs, and examine nations who are signatories to the CBD or the ITPGR. These countries have promised to implement ABS regimes using the regulations in the CBD and the ITPGR. This chapter introduces the following chapters concerning examinations of ABS regimes in the CBD or the ITPGR’s parties and the Taiwanese draft law related to the use of PGRs: “Draft of the Genetic Resources Act of Taiwan.”

Chapter 4 consists of empirical research regarding ABS regimes in 194 parties to the CBD and the ITPGR. This dissertation attempts to use an alternative method to examine this issue, depicts the developed and the developing worlds, and observes their adoption of ABS regimes with respect to different variables and comments on the research findings.

Chapter 5 examines Taiwan’s draft law regarding the use of PGRs, the Draft of the Genetic Resources Act of Taiwan. This dissertation uses the outcomes of regression analysis concerning 194 parties to the CBD or ITPGR regarding the implementation of the ABS re-

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41 See Vogel, supra note 38, at 130; Like-Minded Megadiverse Countries, Declaration/Action Plans – Cancun Declaration, supra note 38.
gime. I will evaluate the “Draft of the Genetic Resources Act of Taiwan” and determine whether or not it could fully protect Taiwan’s PGRs.

Chapter 6 concludes the dissertation, and includes concrete comments about how to establish legal policies regarding the fair and efficient use of PGRs.

This dissertation includes a description of the methodologies used. This dissertation makes use of three methodologies – “Citation Analysis,” “Induction,” and “Deduction” to reference and absorb a variety of legal theories from existing writings and empirical studies.

U.S. Supreme Court Justice Oliver Wendell Holmes, Jr. wrote in The Path of the Law: “For the rational study of the law the blackletter man may be the man of the present, but the man of the future is the man of statistics and the master of economics.” “Empirical Methods in Law” is a research method that makes use of statistics. Economics is a new method used to analyze law – “Law and Economics.” There are some “cross-disciplinary” legal studies regarding ABS regimes in the existing literature. This dissertation attempts to use alternative research methods – Law and Economics and Empirical Methods in Law – to analyze the issues of intellectual property with respect to plant innovation, technology transfers that involve ABS regimes, ownership of PGRs, and data from 194 countries regarding the implementation of ABS.

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42 The term of “blackletter” has three meanings: “1. Written or printed in black letter; as, a black-letter manuscript or book; 2. Given to the study of books in black letter; that is, of old books; out of date. Kemble, a black-letter man! - J. Boaden; 3. Of or pertaining to the days in the calendar not marked with red letters as saints’ days; - compare red-letter.” Thus, if we consider the contexts of the words from justice Oliver Wendell Holmes, Jr., “blackletter” should mean “out of date.” In other words, the “blackletter” man is a man who has “out of date” thoughts, and the “blackletter” man does not master modern types of professional knowledge, such as statistics or economics.

43 Oliver W. Holmes, The Path of the Law, 10 Harv. L. Rev. 457, 469 (1897).
CHAPTER 2 - CONFLICTS REGARDING “BIOPIRACY” AND “BIOPROSPECTING” BETWEEN THE DEVELOPED AND THE DEVELOPING WORLDS

This chapter begins by introducing issues related to “biopiracy” and “bioprospecting.” This chapter also adopts legal, economic, and historical methods of comparing different perspectives concerning the issues of PGRs and traditional knowledge about the use of PGRs.

This dissertation uses the perspectives of the process of establishing the ITPGR, corrective justice, and qualities of traditional knowledge in order to discuss disputes regarding “biopiracy” and “bioprospecting.” These disputes between the developed and the developing world are not easily solved, and this dissertation uses empirical research to analyze these disputes and controversies regarding the use of PGRs and traditional knowledge regarding the use of PGRs.

The disputes regarding “biopiracy” and “bioprospecting” are relevant to different perspectives (e.g. laws, economics, and environmental protections, etc), particularly the legal perspectives, so this chapter introduces the U.S. intellectual property regime for plant innovation, because the U.S. intellectual property law has a great impact on the world’s biotechnology industry. In addition, this chapter also introduces the international legal regimes related to “biopiracy” and “bioprospecting,” because these international regimes attempt to harmonize each national law for solving the current disputes of “biopiracy” and “bioprospecting.”

2.1 “BIOPIRACY” VERSUS “BIOPROSPECTING”

“Biopiracy” and “Bioprospecting” are “two sides of the same coin,” and two points of view regarding the exploitation of biological resources (including PGRs) of the developing world by the developed world’s multinational biotechnology corporations. The following sections will provide the definitions of “biopiracy” and “bioprospecting” and relevant issues
regarding these definitions.

2.1.1 The Definitions of “Biopiracy” and “Bioprospecting”

2.1.1.1 What is “Biopiracy”?

“Biopiracy” is a term coined by a Canadian activist, Pat Mooney\(^{44}\) and was first popularized in 1997 by the Indian writer and environmentalist, Vandana Shiva.\(^{45}\) Maggie Kohls cites the International Center for Technology Assessment, the ETC Group, and Vandana Shiva’s definitions of “biopiracy.”\(^{46}\) The International Center for Technology Assessment asserted that “biopiracy” occurs when powerful companies exploit the folk wisdom of indigenous peoples while providing little or nothing in return.\(^{47}\) The ETC Group defined “biopiracy” as the monopolization of genetic resources and knowledge taken from farming communities.\(^{48}\) According to the definition given by Philip Schuler, “biopiracy” means that patents are inappropriate and that patentees are “outright thieves.”\(^{49}\) Vandana Shiva defined “biopiracy” as the patenting of indigenous biodiversity-related knowledge.\(^{50}\) Graham Dutfield argued that “biopiracy” occurs when corporations from the developed world claim ownership of, take a free ride on, or take unfair advantage of, the genetic resources and traditional knowledge of the developing world. Dutfield states that “biopiracy” includes the biological, scientific, and cultural assets of the developing world being “pirated” by corporations.\(^{51}\)

\(^{45}\) The Note 1 on P.53 of Andrew Mushita and Carol B. Thompson’s book, Biopiracy of Biodiversity: Global Exchange as Enclosure clearly stated that, “The term was first popularized by Vandana Shiva (1997).” See Andrew Mushita & Carol B. Thompson, Biopiracy of Biodiversity: Global Exchange as Enclosure 53 (2007).
\(^{47}\) Id.
\(^{48}\) Kohls, supra note 46.
\(^{49}\) The Endnote 2 on P.178 of Philip Schuler’s article, Biopiracy and Commercialization of Ethnobotanical Knowledge, in Poor People’s Knowledge: Promoting Intellectual Property in Developing Countries clearly stated that RAFI/ETC coined the term biopiracy in 1994 as a spin on bioprospecting.
\(^{50}\) Kohls, supra note 46.
Andrew Mushita and Carol B. Thompson defined “biopiracy” as the removal of the organism, whether by literally taking the plant, animal, seed, or germplasm, and claiming ownership, or by destroying it.\textsuperscript{52} Mushita and Thompson state that “biopiracy” involves not compensating or acknowledging the original cultivators/custodians of bioresources.\textsuperscript{53} Ikechi Mgbeoji defined “biopiracy” as the unauthorized appropriation/theft of biological diversity and traditional knowledge through the use of intellectual property mechanisms, which fails to recognize and compensate indigenous peoples for the creations arising from their knowledge.\textsuperscript{54}

Jim Chen cited Heald, P.J.’s arguments about a fairly predictable and uniform script for “biopiracy:”

<Large corporation> <seeks/develops> a highly sophisticated <plant variety/pharmaceutical product> and sends researchers to <exotic place>. After company interviews local <farmers/foragers>, the company’s researchers identify a <species/variety/breed> of <life form>, which seems responsible for <desirable trait>. Researchers collect a few specimens and collate their interviews. The samples and local lore inspire a successful program of <cross-breeding/genetic engineering/pharmaceutical development> that saves the company thousands of hours and enables it to eclipse its competition. The company never shares its profits, but with the local community from which it derived genetic resources and traditional knowledge.\textsuperscript{55}

Critics of “biopiracy” have focused on theft, piratical actions, or the absence of benefit-sharing on the part of the developed world with respect to PGRs. The developing world’s perspective is that “biopiracy” involves the plunder of PGRs of the developing world by the developed world, and is related to the distribution of the benefits of intellectual property laws between the developed and the developing worlds. For example, the World Trade Organiza-

\textsuperscript{52} Mushita & Thompson, supra note 45, at 21.
\textsuperscript{53} See id.
\textsuperscript{54} Mgbeoji, supra note 44, at 12.
\textsuperscript{55} These statements are rephrased from Jim Chen’s original arguments. See J. Chen, Biodiversity and Biotechnology: A Misunderstood Relationship, in Agricultural Biotechnology and Intellectual Property: Seeds of Change 347, 349 (Jay Kesan ed., 2007).
tion (WTO)’s Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) plays an important role in harmonizing the world’s agricultural intellectual property laws. Article 27 of TRIPS stipulates that the members of the WTO should provide *sui generis* legal protection for new plant varieties\(^{56}\) although the patent laws of the WTO’s members could exclude patent protection for old types of plants or animals. Therefore, regardless of what developments may occur with respect to U.S. laws or TRIPS, plants can be protected by patents and plant variety protection, so new types of plants can be the private property of the issuers of plant patents or plant variety protection.

This trend conflicts with the interests of the developing world, because PGRs and the traditional knowledge of the use of PGRs from the developing world can be patented in the developed world. Plant variety protection requests can be filed by multinational biotechnology corporations in the developed world without permission and the payment of compensation to the developing world. “Biopiracy”\(^{57}\) occurs in such interactions.

### 2.1.1.2 The Definition of “Bioprospecting”

According to the definition given by Natalie Stoianoff, “bioprospecting” is defined as the systematic search for new sources of chemical compounds, genes, proteins, microorganisms, and other products which have potential economic value as biotic resources.\(^{58}\) Judith Jones defined “bioprospecting” as the search for, and sourcing of, organisms from the natural environment for the purpose of extracting of compounds in order to further investigate their potential for therapeutic development or industrial applications.\(^{59}\)

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\(^{57}\) The facts of “Biopiracy” as described in Jorge Pina’s article state that, “In the last 10 years, multinational chemical firms like the US-based DuPont, ‘world leader in biopiracy,’ have patented seeds and foodstuffs. This has been the key in launching an international race to control global food production.” See Jorge Pina, Greenpeace heads global campaign against “biopiracy,” http://www.twinside.org.sg/title/heads.htm (last visited Dec. 27, 2007).

\(^{58}\) See Stoianoff, supra note 39, at 38.

\(^{59}\) Judith S. Jones, *Regulating Access to Biological and Genetic Resources in Australia: A Case Study of Bio-
Farrier defined “bioprospecting” as a new area of research and development in which samples are collected from wild plants and animals and are screened for active compounds and genetic materials. These may have industrial, agricultural, or medicinal uses. Genes and living organisms also provide raw materials for genetic engineering or biotechnology.

“Bioprospecting” is defined by the World Resources Institute as “the exploration of commercially valuable genetic and biochemical resources.” The Philippines was the first nation to adopt specific ABS regulations. This was followed by the CBD in the form of an executive order in 1995. The Philippines Executive Order (PEO) and Implementing Regulations (PIRR) define “bioprospecting” as the research, collection, and utilization of biological and genetic resources for the purpose of applying the knowledge derived for scientific and commercial purposes.

2.1.2 Perspectives on “Biopiracy”

2.1.2.1 Which Factors Cause “Biopiracy”? 

Understanding “biopiracy” involves first examining “biopiracy” from the historical perspective. For example, Vandana Shiva argued that “biopiracy” is the “Second Coming of Columbus” because it developed after the era of Christopher Columbus. Since the time of the British “Industrial Revolution” up until the present day, western countries have used PGRs taken from developing and less-developed countries in Asia or South America.

61 Tucker & Farrier, supra note 60, at 168-69.
63 Lesser, supra note 27, at 56.
65 Shiva, supra note 62, at 1.
66 Guo, supra note 2.
Second, David Conforto indicated that the Non-Western (South) countries accuse Western (North) countries of “biopiracy,” a claim that results from unfair bilateral patent laws and international “agreements.” Non-Western (South) countries face trade sanctions set up by the Western (North) countries and succumb to international agreements influenced by the Western (North) countries, such as TRIPS, etc. In this manner, the Western (North) countries’ patent laws, especially the U.S. patent system, has spread throughout the world by means of international agreements. As a result, multinational biotechnology corporations have a firm legal foundation for conducting “biopiracy.”

To sum up, the arguments of Shiva and Conforto rest on two major theses: First, the plunder of the Western (North) countries has been going on since the time of Columbus, through the Industrial Revolution and continues to the present day. Second, the Western (North) countries’ patent laws, particularly the U.S. patent system, and assorted international agreements, such as the TRIPS, are the tools of the Western (North) countries for the expansion of the enforcement of their patents throughout the Non-Western (South) countries. Multinational corporations use these patent laws as the legal foundation for activities the developing world abhors.

2.1.2.2 The Perspective of “Biopiracy” in the Developed World

The perspective of the developed world is that the most effective means of developing PGRs is to allow multinational corporations in the developed world, particularly the U.S., to

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68 Jayashree Watal, *Intellectual Property Rights in the WTO and Developing Countries* 48 (2001). Jayashree Watal addressed that “it can be easily foreseen the realization of TRIPS will be monitored by major developed countries, such as by the U.S. because the U.S. will continue to use the Special 301 to against another WTO members, and even it will use the WTO dispute settlement mechanism to highlight the difficult areas of realization.” Furthermore, in footnote 1 of the same page, Watal cited the literature of Maskus (2000) to point out the other purpose that TRIPS is monitored by the U.S. that “the U.S. is by far the biggest beneficiary from TRIPS. In the table on estimated static transfers from TRIPS-induced strengthening of 1998 patents laws; in 1995 dollars, the U.S. will annually get net transfer about $6 billion; at the same time, France and Germany will only have about $6 billion. However, Japan will net deficit about half billions.”
assert ownership claims to PGRs and develop them for commercial use without obtaining prior permission or paying royalties to the developing world. The major arguments used to defend this perspective include the belief that PGRs are the “Common Heritage” of all mankind, and that the flows or exchanges of PGRs are “trade” that falls under the rubric of “Globalization.”

Although the CBD is an international regime regarding the fair use of PGRs and the regulation of “biopiracy,” the U.S. did not sign the CBD because the Bush administration thought that it did not offer adequate intellectual property protection. Some provisions of the CBD regarding compensation for biological resources are outside the purpose of conserving biological diversity, such as the “concessional terms for sharing intellectual property rights.” The latter view was based on the viewpoint of biotechnology industry representatives that the CBD should focus only on direct conservation biological diversity issues. Although the Clinton administration signed the CBD in 1993, Congress did not ratify it, using the same reasoning as did the Bush administration.

In addition, advocates of “bioprospecting” in the developed world include scholars and the developed world’s multinational biotechnology corporations, with divergent points of view. For instance, Ikechi Mgbeoji said “those who defend the structures, practices, and norms of the dominant models of intellectual property protection in the industrialized (developed) world argue that whatever injustices result from the operation of the major intellectual property systems (of the developed world) are mere aberrations rather than systemic predation on Third World (the developing world) biological resources and knowledge.” Victoria Sutton argued, “there is no international crime for “biopiracy,” but the CBD de-

70 Lesser, supra note 27, at 160.
72 Id. at 706.
73 See id.
74 Mgbeoji, supra note 44, at 11.
scribes the unethical practice of appropriating the property of others (other countries’ PGRs and traditional knowledge about using PGRs).”

Jim Chen argued that “There’s no such thing as ‘biopiracy,’ and it’s a good thing too.” His reasons include: first, the “biopiracy” narrative is that the South wants a large share of the world’s wealth. As matters stand, the North is rich, and the South is not, so the South (developing countries) will not soon cease clamoring for compensatory mechanisms that would reward their contributions to biological knowledge and applications within the global commons. Second, the international community is motivated by post-colonial theories of obligation to peoples in areas exploited by the North, and seeks ways to alleviate the distress of those living in the world’s bio-rich areas. Third, due to the deep antagonism generated by the perception of the appropriation of knowledge and germ plasm without permission from the South, the North does not compensate the South, while the North’s life sciences corporations become a target for the political grievances of the developing world. The South will stop at nothing short of a requirement under formal international law that inventors compensate possessors of traditional knowledge for sharing that knowledge. Chen asserted that “bioprospecting” helps collect millions of species from the developing world, and transnational corporations from the developed world can help translate ethnological knowledge into terms understood by the global scientific community. As a result, cooperative “bioprospecting” or North-to-South technology transfer for the enrichment of parataxonomy satisfies the CBD regulation that the international community should adopt “economically and socially sound measures…as incentives” to conserve biodiversity and contribute to the sustainable

76 Jim Chen, There’s No Such Thing as Biopiracy…and It’s a Good Thing Too, 37 McGeorge L. Rev. 1, 26 (2006).
77 See id.
78 Chen, supra note 76, at 26.
79 Chen, supra note 76, at 26.
80 Chen, supra note 76, at 26.
81 Chen, supra note 76, at 26.
82 Chen, supra note 76, at 30-31.
The multinational biotechnology corporations contend that the developing world wants to make money from something to which it did not contribute, and seeks a greater share of benefits. The developing world values its raw genetic resources and asks that multinational corporations do the same. Furthermore, it is difficult for corporations to pay more to the developing world for raw materials, or else natural product research would become uncompetitive, and corporations would not pay large access fees for raw materials. In particular, multinational corporations collect genetic resources from the developed world that are available for free, and there are many approaches to product development other than using genetic resources. The research and development process involved in converting genetic resources into products requires many years and millions of dollars. Moreover, corporations contend that their activities fuel economic development, and that they have no duty to conserve genetic resources or to correct historical injustices. In addition, patents on products developed from genetic resources require that companies recoup their investments in product development, and patents or plant variety protections (plant breeders’ rights) do not affect the developing world’s access to genetic resources or the development of new plant varieties.

### 2.1.2.3 The Perspective of “Biopiracy” in the Developing World

The developing world opposes “biopiracy,” and argues that the current manner in which the PGRs are discovered and brought to market is unjust and inefficient. In their view, the principal movers in the process are multinational biotechnology corporations in the devel-

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83 Chen, supra note 76, at 31.
84 Kate & Laird, supra note 64, at 6-9.
85 See id.
86 Kate & Laird, supra note 64, at 6-9.
87 Kate & Laird, supra note 64, at 6-9.
88 Kate & Laird, supra note 64, at 6-9.
89 Kate & Laird, supra note 64, at 6-9.
90 Kate & Laird, supra note 64, at 6-9.
91 Kate & Laird, supra note 64, at 6-9.
92 Kate & Laird, supra note 64, at 6-9.
oped world, particularly the U.S. Critics allege that these companies have no claims to the developing world’s PGRs, the traditional knowledge regarding the use of PGRs (including seed varieties), and have no right to register patents on them in the developed world without getting prior permission from developing countries. Critics contend that corporations have not given fair and adequate payment to the governments of developing countries for the resources they have extracted. For instance, northern hemisphere corporations do not pay royalties to developing countries for the use of their PGRs.

Michael Brown and other critics who believe that the current state of affairs is one of “biopiracy” call for action against the developed world’s multinational biotechnology corporations, particularly those in the U.S. For example, the developing world has begun to take legislative and executive action to correct the situation. The Indian government has set up an electronic database – “defensive publishing” – about the inventories of traditional healing methods and plant medicines of India, with a view towards preventing researchers or scientists in the developed world from filing patents that exploit indigenous Indian medical knowledge.93

After the “Industrial Revolution” began in Great Britain in 1789, the demand for rubber has increased. Brazil was the sole point of origin of rubber during the mid-19th century. In order to maintain economic development, the Brazilian government banned the exports of rubber in the 19th century.94 This was a very early form of national protective legislation.

This dissertation argues that “biopiracy” as conducted in the developing world has re-

94 Rubber was a crucial cog in the gears of “Industrial Revolution,” and rubber production boomed once the “Industrial Revolution” got into full swing in Europe and the U.S. Because Brazil monopolized 95% of the global supply of rubber, the British authorities aided Henry Wickham in 1876, who successfully smuggled out 70,000 rubber seeds in a boat even though Brazil government strictly banned the exports of rubber. Eventually, this boat reached British colonies in Asia, and it destroyed the Brazilian monopoly on rubber production. See Guo, supra note 2; Brazilmax.com, The Tree that Weeps: A History of Amazon Rubber, http://www.brazilmax.com/columnist.cfm/idcolumn/38 (last visited June 15, 2009); Southern Explorations | Amazon Rainforest Tours and Travel | Rubber, the Amazon’s Tree of Fortune, http://www.southernextplorations.com/article/AmazonRubberTreeFortune.htm (last visited June 15, 2009); Mgbeoji, supra note 44, at 104.
sulted in the phenomenon of “seed wars.” The term “seed wars” first appeared in a news report by Bill Paul in the Wall Street Journal in 1984, “Third world battles for fruit of its seed stocks.” Keith Aoki wrote that debates over the legal treatment of PGRs between “North” and “South” countries from 1982 to 2001 have been called the “seed wars,” but did not explain why the use of this term is limited to the period between 1982 and 2001. Aoki stated that the International Undertaking on Plant Genetic Resources (IUPGR) was signed in 1983, and took the position that “All PGRs are the ‘Common Heritage of Mankind,’ including ‘Commercial Plant Varieties.’” This resulted in opposition by the U.S. and other developed nations. Disputes about the legal treatment of PGRs did not end until 2001 when the ITPGR was adopted. It recognized germplasm as “Sovereign Property” and protected “Farmers’ Rights” and “Traditional Knowledge related to PGRs.”

“Legal” disputes about PGRs ended, but the “seed wars” between “North” and “South” countries did not end after 2001. The position of ITPGR is contrary to the position of the U.S. and Japan, which have large biotechnology industries, and neither country has ratified the ITPGR. Western countries need PGRs from developing and less-developed countries in Asia and South America to develop their industries and economies. The developing and less-developed countries have taken steps to prevent their genetic resources from being taken by western countries. For example, the Brazilian government prohibited the exports of rubber

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95 In Bill Paul’s report, he wrote that, “United Nations documents disclose that India isn’t giving out its prized black pepper seeds, while Malaysia, Thailand and Indonesia are restricting the availability of various fruit varieties. The documents also show that Ecuador is restricting cocoa, and that Taiwan is holding back on sugarcane varieties, among other examples. Especially, one of the sentences of his report even indicated that ‘You have heard of Star Wars, now there are Seed Wars.’” See Bill Paul, Third world battles for fruit of its seed stocks, Wall St. J., Jun. 15, 1984.


97 Aoki, supra note 96.

98 Aoki, supra note 96.

trees in the 19th century. According to Shiva and other critics, multinational corporations engage in “biopiracy,” so the “seed wars” have continued because “seed wars” are the result of “biopiracy.”

Critics (e.g. Vandana Shiva) argue that PGRs should not be patentable by multinational corporations and that “biopiracy” results in the loss of cultural diversity due to the disappearance of traditional knowledge of how to use PGRs, the loss of sustainable biodiversity and the overuse of PGRs and other natural resources by the developed world’s multinational corporations. In addition, “biopiracy” invades human rights – farmers’ rights, violates the principles of distributive justice regarding unequal royalties and unjust benefit sharing between the developed and developing worlds and invades the developing world’s sovereignties over PGRs and the traditional knowledge regarding the use of PGRs.

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100 Guo, supra note 2.
101 Vandana Shiva proposed that seeds or plants cannot be patented, and in her book, Protect or Plunder? – Understanding Intellectual Property Rights, she writes about several adverse results of allowing plant (seed) patents. Plant (seed) patent encourage western (U.S.) multinational corporations to monopolize control of plant resources; it will result in high prices of seeds due to the payment of royalties; economic changes result will from IPRs and lead small farmers into debt and destitution; patent protections for plant or seed will ignore food security because the patent regime is closely related to the demands of economic markets, but is less concerned about food security, etc. See Vandana Shiva, Protect or Plunder? – Understanding Intellectual Property Rights 78-80 (2001).
102 The Preface of Professor Ikechi Mgbeoji’s book, Global Biopiracy: Patents, Plants, and Indigenous Knowledge described the implications of the appropriation of plants and traditional knowledge of using PGRs, and they oppose “biopiracy” and “bioprospecting.” Mgbeoji, supra note 44, at ix.
103 Mgbeoji, supra note 44, at ix.
104 Mgbeoji, supra note 44, at ix.
105 Mgbeoji, supra note 44, at ix.
106 “Article 3. Principle” of the CBD rules that “States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction,” so the ownerships of plant genetic resources are owned by countries themselves as their sovereignties, and the PGRs are not the “Common Heritages.” As a result, it is a powerful argument to criticize “biopiracy” and “bioprospecting.” See Secretarial of the Convention on Biological Diversity, supra note 24.
2.1.3 The Perspective of “Bioprospecting”

2.1.3.1 The Positive Term to Describe “Biopiracy” from the Developed World – “Bioprospecting”

“Biopiracy” is a term used to describe the conflicts regarding the use of PGRs that occur between the developed and the developing worlds. In particular, “biopiracy” is a negative term applied to the developed world and their multinational biotechnology corporations by critics in the developing world because they “pirate” or “plunder” PGRs from the developing world for commercial use and file patents on the extracts or products of PGRs in the developed world, and undertake such actions without prior permission from the developing world.

On the other hand, “bioprospecting” is a positive term used to describe acts of “biopiracy” on the part of the developed world (i.e. the developed world’s multinational corporations who pirate or plunder PGRs from the developing world).\(^{107}\) “Bioprospecting” is research for the exploitation or development of new sources of chemical compounds, genes, proteins, microorganisms, and other products with high economic value (i.e. industrial or medical uses). The definition of “biopiracy” focuses attention on acts of “piracy” or “plunder” of PGRs of the developing world and the filing of patents for the extracts or products of PGRs for the benefit of multinational corporations’ commercial interests.

2.1.3.2 The Benefits of “Bioprospecting” for Plant Genetic Resources (PGRs) in the Developing World

According to Shiva, the developed world differentiates “biopiracy” from “bioprospecting” because “bioprospecting” has neutral overtones – “The exploration of commercially

\(^{107}\) “Bioprospecting” is jeopardized by activists from rich countries and government in some developing countries, who see it as “biopiracy.” See John R. Graham, Fraser Forum: Bioprospecting or Biopiracy?, http://www.fraserinstitute.org/Commerce.Web/product_files/Bioprospecting%20or%20Biopiracy-Graham.pdf.
valuable genetic and biochemical resources.”108 “Prior to prospecting, the resource lies buried, unknown, unused, and without value.”109 “Bioprospecting” provides these resources with opportunities for better utilization. Those who believe “biopiracy” is the most effective way of dealing with the ownership of the PGRs are those who will defend “bioprospecting.”

2.2 THE MAJOR DISPUTES CONCERNING “BIOPIRACY” AND “BIOPROSPECTING”

Questions about “biopiracy” or “bioprospecting” arise from conflicts about PGRs and traditional knowledge regarding the use of PGRs between the developed and developing worlds. Because these conflicts have two aspects: the access issue and the benefit-sharing issue, the following sections will discuss the access issues of PGRs and traditional knowledge regarding the use of PGRs and the benefit-sharing issues of PGRs and traditional knowledge regarding the use of PGRs.

2.2.1 Issues related to Plant Genetic Resources (PGRs)

Issues related to PGRs described in the following sections include: First, the access issue of PGRs examines various perspectives regarding the ownership of PGRs. Second, the benefit-sharing issue of PGRs describes from the perspectives of multinational biotechnology corporations that why these corporations have difficulties to share benefits (pay compensation or royalties) to the developing world. Third, arguments made in this dissertation concerning PGRs summary the existing issues concerning PGRs and examine difficulties involved in attempting to resolve the controversies regarding the use of PGRs.

108 Shiva, supra note 62, at 72.
109 Shiva, supra note 62, at 73.
2.2.1.1 The Access Issue of Plant Genetic Resources (PGRs)

As regards the access issue of PGRs, the most important question is “Who is the owner of PGRs?” This is controversial because there are two competing theories about the access (ownership) issue of PGRs in the international community and scholarly discussions. First, there is the viewpoint to the effect that PGRs are not “Communally” owned. Second, there is the viewpoint that sees PGRs as being the “Common Heritage” of Mankind. This dissertation attempts to analyze these two competing theories and discuss in this section.

2.2.1.1.1 The Viewpoint that Plant Genetic Resources (PGRs) are not “Communally” Owned

This section will begin to adopt the economic perspectives – theories and formulas – to describe why PGRs are not “communally” (private) owned, and then use the legal perspective – the ITPGR – to analyze why PGRs are not “communally” (private) owned.

2.2.1.1.1.1 The Private Property Theory

Who owns PGRs? The answer to this question decides who can make use of, and commercialize, PGRs. Deciding whether the PGRs are privately owned or communally owned thus also becomes the issue of who can most efficiently make use of them.

Keith Aoki cited the arguments of Elinor Ostrom,\textsuperscript{110} to the effect that Ostrom thought that a private property model is more efficient than an open-access (common) model.\textsuperscript{111} PGRs, like other global public goods, have suffered what property legal scholars term “the tragedy of the commons.”\textsuperscript{112} Garrett Hardin’s “Tragedy of the Commons” specifically stated

\textsuperscript{110} Keith Aoki, Seed Wars: Controversies and Cases on Plant Genetic Resources and Intellectual Property 99-100 (2008).

\textsuperscript{111} Id. at 99.

that a no-exclusive right to a resource results in the overuse and exhaustion of that resource.\textsuperscript{113} Carol Rose argued that the “Tragedy of the Commons” is that “the situation…with the consequence that entrants crowd onto these resources, over using them and underinvestment in their maintenance and improvement.”\textsuperscript{114} Ostrom’s “Prisoner’s Dilemma” indicated that decisions which maximize short-term interests are not beneficial for long-term interests.\textsuperscript{115} Mancur Olson’s “The Logic of Collective Action” showed that a collective resource creates “free riders” when access to benefits from such resources is free, and creates shortages of collective goods.\textsuperscript{116} After introducing these theories, a simple economic analysis in the next section will show that privately owned PGRs are an efficient way to make use of, and commercialize, PGRs.

2.2.1.1.1.2 The Economic Method of Analyzing the Ownership of PGRs in the Developing World

This section will analyze two competing theories about the ownership of PGRs in the developing world using the fundamental economic formula: $EP$ (Economic Profits) = $TR$ (Total Revenue) – $TC$ (Total Cost).

In this economic model, we assume that values of 100 mean $TR$ of biotechnology corporations are the highest, and $TC$ is the lowest (values of 0). When $TR$ of these corporations is high, values of $TR$ are high, but values of $TC$ are low. At this time, values of $EP$ are positive. On the contrary, when $TR$ of biotechnology corporations is decreased, values of $TR$ are decreased, but values of $TC$ are increased. Meanwhile, values of $EP$ are positive when values

\textsuperscript{113}Aoki, supra note 110, at 99.
\textsuperscript{114}Gulati, supra note 112, at 64-65 (quoting Carol M. Rose, The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades and Ecosystems, 83 Minn. L. Rev. 129, 129 (1998)).
\textsuperscript{115}Aoki, supra note 110, at 99.
\textsuperscript{116}Aoki, supra note 110, at 99-100.
of $TR$ are more than values of $TC$. Values of $EP$ are negative when values of $TR$ are fewer than values of $TC$. In short, we can compare the assumed values of “communal ownership” and “private ownership” of PGRs and decide which type of ownership is optimal through the following analyses.

2.2.1.1.2.1 Communal Ownership

$EP1 = TR1 - TC1$

If the U.S. biotechnology corporations’ $TR1$ is assumed to be 100 initially, the $TC1$ of the corporations is 0; therefore, the corporations’ $EP1$ is 100.

Developed countries (e.g., U.S.) have powerful biotechnology industries, and participate by using the ecological environments of developing countries. The U.S. biogenetic corporations’ $TR1$ is 80, and the $TC1$ of those corporations is 30. Therefore, the corporations’ $EP1$ is 50, because the ecological environment has been exhausted. Both $TR1$ and $TC1$ have declined.

These situations continue to exist. As a result, the $TR1$ of the U.S. or other developed countries’ biotechnology corporations becomes 50, and the $TC1$ of those corporations increases to 60. Therefore, the corporations’ $EP1$ is -10. Hence, the U.S. biotechnology corporations must pay to save the ecological environment.

Because the ecological environment has been destroyed, the U.S. or other developed countries’ corporations must pay extra costs to save the environment. The $TC1$ of those corporations becomes 80, but the $TR1$ drops to 20. In total, the corporations’ $EP1$ is -60. In this manner, the increasing speed of $TC1$ will become faster than that of the $TR1$.

2.2.1.1.2.2 Private Ownership

$EP2 = TR2 - TC2$
If developing countries retain ownership of plant patents rights, they also will attempt to maximize $TR$, if we assume the $TR_2$ of the local biotechnology corporations and farmers is 100 in the beginning, the $TC_2$ is 0. Therefore, their $EP_2$ is 100.

Although local biotechnology corporations and farmers still use natural resources, the corporations must obey the laws of local governments. Furthermore, their technologies are not as advanced as the developed countries’ biotechnology companies. Local farmers still use traditional methods of saving, improving, and breeding seed, which decreases the potential for harm to the ecological environment. Later, if we assume that the $TR_2$ of the local biotechnology corporations and farmers drops to 90, the $TC_2$ might increase to 10, but the $EP_2$ still will be at 80.

Thus, the increasing speed of $TC_2$ of local biotechnology corporations and farmers will become lower than that of the $TR_2$.

2.2.1.1.2.3 Conclusion

$EP_2 > EP_1$

$TR$ of biotechnology corporations is in inversely proportional to $TC$ of these corporations, and the economic analyses of assumed $EP$ indicate that PGRs from the developing world are not “Communally” owned; that they are not freely used by the developed world’s multinational biotechnology corporations without prior permission and that royalties are paid to the developing world, and that the resources are the developing world’s private properties of their sovereignties.
2.2.1.1.2 The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR) of 2001 Considers Plant Genetic Resources (PGRs) to Be “National Sovereignties”

The Food and Agriculture Organization of the United Nations (FAO) set up a “non-binding” undertaking in 1983 that is known as the International Undertaking on Plant Genetic Resources (IUPGR). Its legal treatment of the PGRs took the viewpoint that all PGRs are the “Common Heritage” of mankind, including commercial plant varieties, and are protected by Patent and Plant Variety Protection (PVP) regimes. Farmers are free to access such plant varieties. The U.S. did not participate in this undertaking.

After the CBD was signed in 1992, the FAO engaged in new negotiations to harmonize the CBD and to set up a binding international treaty regarding the exchange and conservation of PGRs. This ITPGR was signed in 2001. Unlike the “Common Heritage” of mankind term used in the IUPGR, the ITPGR deemed PGRs to be “National Sovereignties,” meaning that they are regarded as being owned by countries. Annex I of the ITPGR regulates 64 crops and forages which are conserved in the International Agricultural Centres (IARCs) or gene banks of the Consultative Group on International Agricultural Research (CGIAR) as being parts of these “Common Heritages.” “Common Heritages” are considered to be “Limited Commons” because recipients of germplasm for the listed 64 crops and forages “shall not claim any intellectual property or other rights” for them. Furthermore, access to these

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117 Aoki, supra note 110, at 70.
118 Aoki, supra note 96.
119 Aoki, supra note 110, at 71.
120 See the contents of section I. Introduction.
121 Aoki, supra note 110, at 86.
122 Aoki, supra note 96.
123 Aoki, supra note 110, at 88; Article 15.1(a) of the ITPGR rules that “(a) Plant genetic resources for food and agriculture listed in Annex I of this Treaty and held by the IARCs shall be available in accordance with the provisions set out in Part IV of this Treaty,” and the Annex I: List of Crops under the Multilateral System of ITPGR lists these 64 crops and forages. See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, official versions of the treaty, supra note 24.
124 Aoki, supra note 110, at 88-89; Article 12.3(d) of the ITPGR rules that “Such access (to plant genetic resources) shall be provided in accordance with the conditions below: (d) Recipients shall not claim any intellec-
PGRs (64 crops and forages) is limited because it must be “in the form received from the Multilateral System.”\textsuperscript{125}

One reason for setting up the ITPGR was to harmonize the CBD. If the “National Sovereignty” principle of CBD\textsuperscript{126} is applied here, PGRs which are not included on the list of 64 crops and forages on the Annex I of ITPGR are privately owned by countries as part of their national sovereignties.\textsuperscript{127} Those 64 crops and forages that are saved in the CGIAR gene bank are owned by the particular country where the gene bank is located.\textsuperscript{128}

2.2.1.1.3 The Viewpoint that Plant Genetic Resources (PGRs) are the “Common Heritage” of Mankind

This section will adopt four perspectives – First, the no self-sufficiency theory, Second, the limited commons theory, Third, the international undertaking on plant genetic resources (IUPGR) of 1983, and Forth, controversies regarding access to the use of plant genetic resources (PGRs) based on the historical perspective – to examine why PGRs are the “common heritage” of mankind.

2.2.1.1.3.1 The No Self-Sufficiency Theory

W. Lesser regarded “‘Genetic Resources’ as being the ‘Common Heritages’” and ar-
There is no doubt that genetic resources have been widely shared. In addition, the origins of many general food crops are traceable to the 12 Vavilov centres of origin and over time have been dispersed worldwide. Furthermore, no region is self-sufficient in terms of origin of stable food. Moreover, the objective statistics point out that even though the U.S. is a major food crop producer of the world, it still relies on foreign germplasm, such as Latin American, Central America, China, and Syria.\footnote{These statements are rephrased from W. Lesser’s original arguments. See Lesser, supra note 27, at 14.}

\subsection*{2.2.1.3.2 The Limited Commons Theory}

Aoki cited the arguments of Carol Rose that common ownership is generally found in cases of common pool resources, meaning cooperatively maintained resources such as beaches, roads, and navigable waterways, etc.\footnote{Aoki, supra note 110, at 101.} Similarly, systems of jointly-owned property in the U.S. property,\footnote{Aoki, supra note 110, at 102.} intellectual property\footnote{Aoki, supra note 110, at 102.} laws, and public-owned lands\footnote{Aoki also gave similar examples such as water, fire, business improvement, and school districts since they are limited purpose governances. See Aoki, supra note 110, at 102.} demonstrate that communally owned properties exist in our legal and social systems. Countries or local governments (communities) can also directly enact administrative regulations to manage communal resources or properties.\footnote{Aoki described, “the riparian and littoral rights are adumbrated through the doctrines of common law and modified by legislative and administrative regulations.” See Aoki, supra note 110, at 102. Therefore, except to the riparian and littoral rights, all other issues of ownership in the democracy society also should be ruled by legislative and administrative regulations, which are enacted by countries or local governments (communities) because it affords to the principle of democracy – “Rule of Law.”} Democratic means allow us to publicly elect representatives or legislators in local communities or countries who in turn set up management regimes which enact laws or establish public management organizations (agencies) to maintain...
and conserve resources or properties.\textsuperscript{135} Rose described this “Limited Commons” theory as being a “commons on the inside, property on the outside.”\textsuperscript{136} From the perspective of outsiders, such resources or properties are owned by local communities or countries. From the perspective of insiders, such resources or properties are publicly owned and managed by laws, administrative regulations, and public management organizations (agencies), and overseen by elected representatives or legislators.

This dissertation mentioned above that Annex I of the ITPGR specifies that 64 crops and forages are the “Common Heritage” of Mankind,\textsuperscript{137} but under the terms of the ITPGR, these PGRs are “Limited Commons” due to limitations on intellectual property rights or other rights protections.\textsuperscript{138} This dissertation argues that these PGRs are not “commons on the inside, property on the outside.” Regardless of whether these PGRs are seen from the perspective of insiders (meaning contracting countries of ITPGR) or the perspective of outsiders (meaning countries that are not contracting parties, multinational biotechnology corporations, and related parties), these PGRs are owned by the country where the CGIAR gene bank is located: they are “National Sovereignties.”

\textbf{2.2.1.1.3.3 The International Undertaking on Plant Genetic Resources (IUPGR) of 1983}

From the perspective of the developed world (U.S.) and its multinational biotechnology corporations, PGRs from the developed world offer economic profits. However, if these

\textsuperscript{135} Aoki stated, “Even private owned condominiums and homeowner’s associations must conform to requirements set by a publicly elected legislature.” See Aoki, \textit{supra} note 110, at 102. Of course, no matter private, public, or common owned properties, managing properties through a publicly elected legislature is the best way because these legislators or representatives are trusted by all owners of the properties to enact regulations or take suitable ways to manage properties, just like the positions of CBD and ITPGR put emphasis that those PGRs, which are located within countries are “National Sovereignties,” especially in democracy society, sovereignty is owned by people of the country, which is called “Popular Sovereignty,” so those PGRs should be owned by people of the country. Thus, people vote legislators or representatives through public elections to represent people in order to take effective and best ways to manage PGRs (national properties), and this “Representative democracy” is commonly adopted by many democracy countries in the world.

\textsuperscript{136} Aoki, \textit{supra} note 110, at 102.

\textsuperscript{137} Aoki, \textit{supra} note 110, at 88.

\textsuperscript{138} Aoki, \textit{supra} note 110, at 88-89.
PGRs were to be owned by the developing world (national sovereignties), the developed countries and their multinational corporations would experience losses because they would have to obtain prior permission and pay royalties for using those PGRs. On the other hand, from the standpoint of the developing world, those PGRs are valuable resources that are part of their national sovereignties. The developing world believes that it has the right to control and manage the flows or exchanges of PGRs.

The 1983 IUPGR is the starting point for debates about the legal treatment of the ownerships of PGRs. The IUPGR was controversial because it not only adopted the position that all PGRs are the “Common Heritage” of humanity, but also enlarged the scope of PGRs to include “Commercial Plant Varieties” that are protected by intellectual property regimes such as Patents and PVP certificates, and state that farmers are free to access these commercial plant varieties. Because “Common Heritage” of humanity here means ownership by the entire human race, and not by any one country, multinational biotechnology corporations could thus experience economic losses. The developed countries, including the U.S. and European countries, opposed this position.

2.2.1.1.4 Controversies regarding Access to the Use of Plant Genetic Resources (PGRs) based on the Historical Perspective

This section introduces controversies regarding the access issues with respect to the use of PGRs – the ownership of PGRs. “Who should own PGRs?” is the key question behind the controversies regarding PGRs. Keith Aoki argued that “the historical ‘baseline’ is that different regions of the earth have had dramatically different endowments of economically im-

139 Aoki, supra note 96.
140 Aoki, supra note 96.
141 Aoki, supra note 110, at 71.
142 Aoki, supra note 110, at 71.
portant plant species.”¹⁴³ He used the historical perspective to describe which plant species were economically important at certain times in different regions, but his arguments did not touch upon the key point “Who should own PGRs?”¹⁴⁴

Using the historical perspective to determine who should own PGRs produces different outcomes because ownership changes at different time in different regions. During the “Ice Age” (more than 10,000 years ago), most cultivated natural genetic resources were grown near the equator and the southern hemisphere due to the climate during that era.¹⁴⁵ At that time there was no concept of property, so we cannot judge who owned genetic resources at that time. The first known law in human history designed to protect property was the “Urukagina judicial code,” which freed the inhabitants of Lagash from seizures of their property from 2378 to 2371 B.C.¹⁴⁶ We can infer that although the protection of property rights was fragile at that time, the inhabitants of Lagash could own property without seizures and other interferences.¹⁴⁷ If the inhabitants of Lagash had private PGRs, they would have had ownership of those resources.¹⁴⁸ Two thousand years ago, the “Cropus Juris Civilis” (Roman Law) first defined property in the “statute” from 529 to 534 B.C. It ruled that “property is the right to use and abuse one’s own within the limits of the law.”¹⁴⁹ Under such definitions, PGRs can be the objects of “private property” within the limits of the law.

The colonial era began during the early 16th century.¹⁵⁰ European countries used military power to control the natural genetic resources of colonies. PGRs were owned by European countries and the British “East India Company.” PGRs were one part of the European

¹⁴³ Aoki, supra note 110, at 6.
¹⁴⁴ Aoki, supra note 110, at 5-7.
¹⁴⁵ Aoki, supra note 110, at 6.
¹⁴⁷ International World History Project, supra note 146.
¹⁴⁸ International World History Project, supra note 146.
¹⁵⁰ Aoki, supra note 110, at 6.
countries’ sovereignties at that time. During the late 19th century, conserving genetic diversity depended upon farmers and botanists working in state-owned botanical gardens. In this manner, PGRs were owned by countries.

In 1930, the U.S. became the first nation to provide patent protection to asexual plants by means of the Plant Patent Act (PPA). In 1970, the U.S. Congress enacted the Plant Variety Protection Act (PVPA) to provide certificate protection for sexual reproductions plants. In 1980, the U.S. Supreme Court held in the *Diamond v. Chakrabarty* case that microorganisms (life) can be the subject matter of section 101 of the Patent Act. In 1994, Congress amended the PVPA to limit the ability of farmers to save and sell seeds. In 2001, the Supreme Court further held in the *J.E.M. Ag-Supply, Inc. v. Pioneer Hi-Bred International, Inc.* case that plants could receive utility patents. PGRs can be owned by patent holders (people, companies, research institutes, and government agencies) and are not legally classified as “Common Heritage” in the U.S.

The CBD in 1992 and the ITPGR in 2001 recognized PGRs as “Sovereign Property.” The only exception is the IUPGR in 1983, whose position was that “All PGRs are the ‘Common Heritage of Mankind.’” Given the changes in ownership of PGRs over time, we can arrange historical developments with respect to the ownership of PGRs as Table 2.1 indicates.

| Table 2.1 Historical Developments of the Ownership of Plant Genetic Resources (PGRs) |
|---------------------------------------|---------------------------------|----------------------------------|-----------------|-------------------|
| Time | History Events | Common Heritage (Communal Owned) | Private Owned |                      |
|      |                  |                                 | Owned by Country (So-vereignties) | Owned by Patent Holders (Right Owners) |
| More than The Ice Age | N/A | N/A | N/A | N/A |

151 Aoki, supra note 110, at 6.
Table 2.1 (cont.)

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<th>Date Range</th>
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</tr>
<tr>
<td>2378 to 2371 B.C.</td>
<td>Urukagina’s judicial code</td>
<td>✓</td>
</tr>
<tr>
<td>529 to 534 B.C.</td>
<td>The Corpus Juris Civilis</td>
<td>✓</td>
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<tr>
<td>The beginning of</td>
<td>The Colonial Era</td>
<td>✓</td>
</tr>
<tr>
<td>16th century</td>
<td>The Conservations of Genetic Diversity by State Botanical Gardens</td>
<td>✓</td>
</tr>
<tr>
<td>The late 19th</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>century</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>1970</td>
<td>U.S. Congress enacted Plant Variety Protection Act (PVPA)</td>
<td>✓</td>
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<tr>
<td>1980</td>
<td>U.S. Supreme Court made the case: Diamond v. Chakrabarty</td>
<td>✓</td>
</tr>
<tr>
<td>1983</td>
<td>The International Undertaking on Plant Genetic Resources (IUPGR)</td>
<td>✓</td>
</tr>
<tr>
<td>1992</td>
<td>The Convention of Biological Diversity (CBD) opened for signature</td>
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</tr>
<tr>
<td>1994</td>
<td>U.S. Congress amended PVPA to limit farmers to save and sell seeds</td>
<td>✓</td>
</tr>
<tr>
<td>2001</td>
<td>U.S. Supreme Court made the case: J.E.M. Ag-Supply, Inc. v. Pioneer</td>
<td>✓</td>
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The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR) was adopted in 2001.


Notes: The symbols of N/A mean that there was no known concept of property during the “Ice Age,” so we cannot judge the ownerships of PGRs at that time.

The historical perspective offers an alternative approach for observing changes in the ownership of PGRs throughout history, but does not answer the key question: “Who should own PGRs?” This dissertation argues that this question is both difficult to answer and has no accurate answer because controversies regarding the ownership of PGRs imply that there are the conflicts of economic benefits with respect to the use of PGRs. The developed and the developing worlds have different positions regarding the ownership of PGRs based on how much economic profit or benefit that they could potentially earn or share. The developed world and its multinational biotechnology corporations would probably claim that PGRs are

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154 Aoki, supra note 110.
156 Proudhon, supra note 149.
158 Aoki, supra note 96.
the “Common Heritage” if they could freely use PGRs and obtain economic benefits from using PGRs. The developing world argues that PGRs are national sovereignties, and not a “Common Heritage.” The developed world and its multinational corporations can use PGRs from the developing world only when the developed world and its multinational corporations pay compensation or royalties and share benefits with the developing world.

International legal regimes (i.e. the CBD and the ITPGR and so forth) in the current international order have tried to solve controversies regarding the utilization of PGRs and set up corrective justice (the notion of fairness)\textsuperscript{159} to regulate who should own PGRs and the distribution of benefits arising from the use of PGRs. The perspective of law and economics has a fundamental theorem of welfare economics to the effect that efficiency and distribution are separable, and the tools of economics allow for normative statements about efficiency but not about distribution. Therefore, analyses using law and economics should focus on “efficiency” rather than the notion of fairness (corrective justice),\textsuperscript{160} because not only it is more philosophical than other topics in microeconomic theory, it cannot be evaluated by economists due to the lack of a metric. Louis Kaplow and Steven Shavell argued that “the notion of fairness (the corrective justice) should receive no independent weight in assessment of legal rules.”\textsuperscript{161}

Although the CBD, the ITPGR, and other international regimes concerning the utilization of PGRs have mechanisms for allocating the ownership of PGRs and benefits arising from the use of PGRs (i.e. the principle of PGRs that are countries’ sovereignties and the ABS regime about using PGRs), the implementation of CBD, ITPGR, and related interna-

\textsuperscript{159} The original arguments of Louis Kaplow and Steven Shavell state that “…This position implies that notions of fairness like corrective justice should receive no independent weight in assessment of legal rules…” See Louis Kaplow & Steven Shavell, Fairness versus Welfare 4 (2002).

\textsuperscript{160} For example, current legal and economics analyses of intellectual property laws examine TRIPS and the PCT using cost-benefit analysis (efficiency) to discuss optimal life of patent and copyright and how to decrease tracing and searching costs to copyright works’ users and products’ consumers. These analyses rarely use the notion of corrective justice to discuss intellectual property right as one kind of monopoly (e.g. patent) for authors or inventors because the more life of intellectual property right; the fewer authors or inventors will pay high royalty to use existing works and inventions in order to innovate them to create new works or inventions; thus, benefits created by the intellectual property laws solely fall on big corporations and a few inventors but not contribute to whole society, so social welfare cannot be equally allocated.

\textsuperscript{161} Kaplow & Shavell, supra note 159, at 4.
tional agreements are completely reliant on the contracting parties. Unfortunately, not all countries have ratified or become parties to these international agreements. It is difficult to find a creative solution to controversies regarding the access issue with respect to PGRs if we analyze these controversies using the notion of fairness (corrective justice). This dissertation attempts to develop legal policies which combine the “fair” and “efficient” use of PGRs. This dissertation uses “Empirical Methods in Law” to examine the current implementation of CBD or ITPGR (i.e. the ABS regime) in order to avoid the drawbacks of using the notion of fairness (corrective justice) for analysis.

2.2.1.1.5 Summary

This dissertation argues that no region of the world is completely self-sufficient, so countries need to trade or exchange with each other. Ownership of PGRs and trade are two separate issues. In reality, there is not necessarily any conflict between them. The only controversial issue is how to equally share benefits, transfer technology, and protect biodiversity when the U.S. multinational biotechnology corporations use PGRs from the developing world.

Although Rose’s “Limited Commons” theory can be used to describe property or resources owned in common that have existed in social and legal systems, this dissertation argues that the “Limited Commons” theory explains only the “interior” relationships concerning PGRs’ ownerships; it describes the relationships from B to H within the scope of A in Figure 2.1. However, the major debates about the ownership of PGRs go on between the developed and developing world; these are “global” conflicts, but not “interior” relationships, which means that we should pay attention to “exterior” relationships beyond the scope of A in Figure 2.1, such as the relationships of IA, IB, IC, or IE, etc. Therefore, if we consider only the “interior” relationships of the ownership of PGRs within the borders of the developing...
countries, the less-developed countries, the local governments, or the communities, we will neglect two important questions: 1. What is the fair and efficient international legal treatment of PGRs? 2. Are PRGs owned by “National Sovereignties” or are they the “Common Heritage” of humanity?

Figure 2.1  The flowchart of the Interior and Exterior Relationships of Plant Genetic Resources’ (PGRs) Ownerships

This dissertation will not adopt the “No Self-Sufficiency,” “Limited Commons,” and IUPGR theories because they do not clearly answer the question “What is the fair and efficient international legal treatment of PGRs?” By comparing the arguments of privately owned (national sovereignties) and communally owned PGRs, the arguments that PGRs are privately owned (national sovereignties) become persuasive. Because all types of resources in the world, including PGRs, are limited, corporations (people) will unduly use PGRs in pursuing short-term economic profits, which is not beneficial to long-term economic growth. If
PGRs are owned by countries, it not only follows that the rules of international laws operate with respect to national sovereignties, but is also an efficient use of PGRs, because countries and local governments (communities) will make good use of PGRs to improve their economies and protect biodiversity. The people of democratic countries and local governments (communities) elect representatives, legislators, and governments to establish management regimes: laws, administrative regulations, management organizations (agencies) to maintain and conserve valuable PGRs.

This dissertation takes the position that PGRs are owned by countries and are not the common heritage of all mankind, and conflicts about the access issue of PGRs remain the subject of disputes between the developed and the developing worlds.

2.2.1.2 The Benefit-Sharing Issue of Plant Genetic Resources (PGRs)

2.2.1.2.1 The Perspective that the Biotechnology Corporations from the Developed World Use Plant Genetic Resources (PGRs) Should Pay Compensation or Royalties to the Developing World

Since the colonial era, the European countries (“North” countries) used weapons to take their colonies’ (“South” countries) natural resources. For example, during the era of the “Industrial Revolution,” the European countries needed rubber and other natural resources from their colonies (“South” countries) to sustain their industrial development. In this way, PGRs were historically viewed as the common heritage of all mankind, and were freely used without paying royalties or compensations.

However, this situation changed after the CBD was signed in 1992. The CBD largely adopts the perspective of the developing countries regarding compensation for the use of PGRs. It mirrors Mgbeoji’s arguments that the ABS regime of the CBD is a jurisprudence, which provides for “South” countries to balance the “winner-take-all” situation which al-
“North” countries to freely appropriate and profit from “South” countries’ PGRs. The CBD is the regime for sharing the benefits derived from PGRs from “North” to “South” and tries to change this unfair situation.

2.2.1.2.2 The Perspective that Cost and Benefit Analysis of the Biotechnology Corporations from the Developed World, which Refuses to Pay Compensation or Royalties to the Developing World

2.2.1.2.2.1 The Difficulties for the U.S. Multinational Biotechnology Corporations to Decrease the Cost of “Research & Development (R&D)”

In economic discussions, it is assumed that corporations, including the U.S. multinational biotechnology corporations, pursue the goal of “profit maximization.” Profit equals revenue minus costs, so we can obtain a basic economic formula as follows:

$$EP (Economical Profits) = TR (Total Revenue) – TC (Total Cost)$$

When multinational corporations want to make more $EP$, they must decrease the $TC$. Furthermore, the short-term $TC$ is divided into two parts: one is “Total Fixed Cost (TFC)” and the other is “Total Variable Cost (TVC).” Therefore, we can obtain another economic formula as follows:

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162 Mgbeoji, supra note 44, at 83.
163 Mgbeoji, supra note 44, at 83.
164 Mao et al., supra note 19, at 86.
165 The definition of “Total Cost (TC)” is the total cost that firms pay for productive factors. “Total Fixed Cost (TFC)” means that the revenue of paying fixed factors and is a fixed value that is not related to productions. “Total Variable Cost (TVC)” is the revenue of paying variable factors. See Mao et al., supra note 19, at 95.
2.2.1.2.1.2 TC (Total Cost) = TFC (Total Fixed Cost) + TVC (Total Variable Cost): \(^{166}\)

\[ \text{TC} = \text{TFC} + \text{TVC} \]

(Figure 2.2) The Relationship of Total Cost (TC) and Total Variable Cost (TVC)\(^{167}\)

(Figure 2.3) The Relationship of Total Cost (TC) and Total Fixed Cost (TFC)\(^{168}\)

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\(^{166}\) This equation indicates the short-term cost analysis, and this section is referred to and revised by the contents of the Ching-Sheng Mao et al.'s book, Economics and Berkeley Hill’s book, An Introduction to Economics: Concepts for Students of Agriculture and the Rural Sector. See Mao et al., supra note 19, at 95-98; Berkeley Hill, An Introduction to Economics: Concepts for Students of Agriculture and the Rural Sector 120 (3rd ed. 2006).

\(^{167}\) Revised from Figure 5.5 (a), in Mao et al., supra note 19, at 98; Figure 5.21, in Hill, supra note 166, at 120.
Moreover, if we analyze this formula, we find that the \( TFC \) is fixed: it is not related to how many new GM seeds, or improved seeds that corporations produce. The examples of \( TFC \) include the cost of land, factories, and human resources, etc. In addition, given the changes from Figure 2.2 (a) to Figure 2.2 (b), we can determine that when \( TVC \) is reduced to \( TVC' \), \( TC \) is also decreased to \( TC' \). However, \( TFC \) remains unchanged.

Although the key element in deciding that \( TC \) is the \( TVC \), which is the cost of paying variable production factors,\(^\text{169}\) such as expensive infringement litigations, and renewing patent expenditures on innovations of agricultural biotechnology, etc., biotechnology corporations still must decrease their \( TFC \) if they want to reduce the \( TC \) (see the changes from Figure 2.3 (a) to Figure 2.3 (b)). The cost of R&D is a large proportion of the \( TFC \), because each biotechnology corporation must make regular large expenditures when developing new GM seeds, improved seeds, and new drugs. B. Wright described these as the high fixed costs (costs of R&D) and the low variable costs associated with commercializing agricultural technology.\(^\text{170}\) Under such circumstances, corporations can make large sales of biotechnology products in order to obtain high enough profits from those sales to cover their huge \( TFC \) arising from their expenditures on R&D.

### 2.2.1.2.1.3 Analysis of U.S. Multinational Biotechnology Corporations’ Research & Development (R&D) and Total Fixed Cost (TFC)

<table>
<thead>
<tr>
<th>Company</th>
<th>2006 seed sales US $ millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Monsanto (U.S.)</td>
<td>$4,028</td>
</tr>
<tr>
<td>2. Dupont (U.S.)</td>
<td>$2,781</td>
</tr>
<tr>
<td>3. Syngenta (Switzerland)</td>
<td>$1,743</td>
</tr>
</tbody>
</table>

\(^{166}\) Revised from Figure 5.5 (a), in Mao et al., supra note 19, at 98; Figure 5.21, in Hill, supra note 166, at 120.  
\(^{169}\) See the note 165 of this dissertation; Mao et al., supra note 19, at 95.  
Moreover, Wright indicated that Monsanto regularly spends more than 500 million dollars a year on R&D on agricultural biotechnology, and several other biotechnology firms have spent 250 million dollars a year on agricultural biotechnology R&D.\footnote{ETC Group – Publications: World’s Top 10 Seed Companies, available at http://www.etcgroup.org/en/materials/publications.html?pub_id=615 (last visited October 18, 2007).} Monsanto’s 500 million dollars for R&D expenditures of $TFC$ are about one-eighth of the 4,028 million dollars spent on seed sales revenues in 2006 (Table 2.2) and does not include other expenditures on $TVC$ and $TFC$. Therefore, $TC$ could be equal to or exceed the revenues – 4,028 million. Using this data, we cannot tell whether the real seed sales of Monsanto earned money or lost money in 2006. A corporation must achieve “profit maximization;” if Monsanto loses money or does not earn the expected rewards on seed sales, it will turn to other R&D investments in agricultural biotechnology to achieve “profit maximization.”

Monsanto will continuously take and use the PGRs from the developing world to create new agricultural biotechnology products in order to maximize its profits. In addition, multinational biotechnology corporations also will adopt the same strategy. In short, corporations will use PGRs taken from the developing world without paying compensation or royalties because they must decrease $TFC$, and especially, the cost of agricultural biotechnology R&D.

\footnote{Wright, \textit{supra} note 170, at 5.}
2.2.1.2.2 High Cost, Problematic, and Legal/Public Relations Uncertainties of Accessing Biological Resources (including PGRs) for Biotechnology (Pharmaceutical) Corporations

The pharmaceutical industry spent more than 55 billion dollars on R&D in 2006, and natural products are only small part of total.\(^{173}\) Currently, there are only four large pharmaceutical corporations that maintain natural products programs, and have the capacity to engage in all facets of drug discovery of natural products – Novartis, Wyeth, Merck, and Sanofi-Aventis.\(^{174}\)

In 1990s, many companies had natural product programs, with associated with conducting “bioprospecting” overseas, such as Bristol Myers Squibb, Pfizer, GlaxoSmithKline, and Monsanto, but they shut down their programs.\(^{175}\) A number of Japanese corporations maintain natural resources programs, but most of these corporations primarily collect microorganisms from Japan.\(^{176}\) During the 1990s, scientists thought the best way to generate compounds for the screens was through mass-produced combinatorial libraries.\(^{177}\) The main reasons behind these phenomenon was that “bioprospecting” natural products was slow, costly, and problematic from a scientific perspective,\(^{178}\) and the legal and public relations uncertainties associated with accessing genetic resources due to the CBD.\(^{179}\)

As a result, this dissertation argues that there was a problem with paying compensation or royalties (sharing benefits) before the 1990s because corporations had large “bioprospecting” natural products programs at that time, and most of these corporations stopped these


\(^{174}\) Id.

\(^{175}\) Laird & Wynberg, supra note 173.

\(^{176}\) Laird & Wynberg, supra note 173.

\(^{177}\) Laird & Wynberg, supra note 173.

\(^{178}\) Laird & Wynberg, supra note 173.

\(^{179}\) Laird & Wynberg, supra note 173.
programs currently. Even though corporations still maintain natural products programs, these corporations are not willing to pay compensation or royalties (benefit-sharing) due to the high cost and problems associated with accessing biological resources, and legal/public relations uncertainties related to accessing these resources as a result of the CBD.

2.2.1.2.2.3 The Discussions of Benefit-Sharing Issues concerning Plant Genetic Resources (PGRs) with the “Profit Maximization” Perspective

Agricultural Gross National Product (GNP)\textsuperscript{180} was estimated to be $1.2 trillion worldwide in 1990.\textsuperscript{181} If plants from native fields and forests account for 10% of the value of these products, this would be $120 billion a year.\textsuperscript{182} In the global pharmaceutical industry, judging from the fraction of revenues which is derived from natural plants and the magnitude of gross revenues, analysts stated that drugs hidden in tropical forests were probably worth $400 to $900 billion in 1993.\textsuperscript{183} Therefore, there are many potential economic benefits hidden in PGRs, and “how to fairly and equitably share these benefits arising from PGRs” is a controversial issue.

The solution to the controversial issue of benefit-sharing concerning the use of PGRs should be determined using the key question “Are PGRs the ‘Common Heritage’ of mankind?” Multinational biotechnology corporations from the developed world need not pay compensation or royalties to use PGRs from the developing world if the answer to this question is that “PGRs are the ‘Common Heritage’ of mankind.” The developing world will not share in the benefits enjoyed by these multinational corporations if “PGRs are not the ‘Com-

\begin{itemize}
  \item \textsuperscript{180} GNP is the nominal market value of the final products and services produced by people in certain areas within certain time periods, and it is an index to examine one country’s total productions in macroeconomics. See Mao et al., supra note 19, at 319-20.
  \item \textsuperscript{182} Id. at 121.
  \item \textsuperscript{183} Mendelsohn, supra note 181, at 121.
\end{itemize}
The discussions of 2.2.1.1 in this dissertation offered different perspectives on the issues regarding ownership of PGRs: first, the viewpoint that PGRs are not “Communally” owned – the “Private Property” theory and “National Sovereignties;” second, the viewpoint that PGRs are the “Common Heritage” of Mankind – the “No Self-Sufficiency” theory and the “Limited Commons” theory. This dissertation takes the viewpoint that PGRs are not “Communally” owned and are instead best regarded as “National Sovereignties,” because communally owned PGRs often result in overuse and exhaustion of those PGRs.

Although it is possible to maximize short-term interests from the use of PGRs, such use is not beneficial over the long run and violates the principle of “Pareto Sustainability.” Resources are subject to exhaustion and disappearance, and the next generation will not share in any benefits that arise from PGRs.

Issues regarding the ownership of PGRs cannot be solved by means of analysis based on law and economics, because arguments about issues regarding the ownership of PGRs are ultimately founded upon opinions about whether or not the developed and the developing worlds should own and share benefits arising from PGRs. For example, multinational biotechnology corporations in the developed world seek “profit maximization,” and are unwilling to share benefits with the developing world due to the R&D costs incurred by such corporations. The developing world believes that multinational corporations have no right to access or bioprospect their sovereign properties (PGRs) without paying compensation or royalties (sharing benefits). As a result, the developed and the developing worlds have conflicts concerning both access issues and benefit-sharing issues that concern PGRs, and these conflicts remain unresolved to date.

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184 See the discussions of 2.2.1.1.1 of this dissertation.
185 See the discussions of 2.2.1.1.1 of this dissertation.
186 See the discussions of 1.2 of this dissertation.
2.2.1.3 The Arguments Made in This Dissertation concerning Plant Genetic Resources (PGRs)

In addition to theoretical discussions of disputes concerning “biopiracy” and “bioprospecting,” this section uses two perspectives to summarize the theoretical discussions that concern “biopiracy” and “bioprospecting”: First, there has been no compromise regarding positions concerning PGRs between the developed and the developing worlds. Second, international regimes that regulate “biopiracy” and “bioprospecting” emphasize “corrective justice,” which fail to justify the conflicts of interest between the developed and the developing worlds.

2.2.1.3.1 No Compromise on Issues concerning Plant Genetic Resources (PGRs) between the Developed and the Developing Worlds

If we conduct an analysis using law and economics, the dispute regarding “Who owns PGRs?” is easily solved, and the answer is “PGRs should be the private properties of national sovereignties.” The reasons why “PGRs should be the private properties of national sovereignties” include: first, private property is more efficient than open-access property;\(^{187}\) second, non-exclusive ownership of resources results in overuse and exhaustion;\(^{188}\) third, freely accessing or obtaining benefits derived from resources creates the problem of “free riders.”\(^{189}\) This dissertation takes the position that “PGRs should be the private properties of national sovereignties,” but does not argue that this position is the perfect solution to the dispute over “Who owns PGRs?”

Attempts to resolve PGRs – related issues, including protective legislation, go back over one hundred years. Conflicts between Brazil and the U.K. over rubber plant export restric-

\(^{187}\) This argument is quoted from Elinor Ostrom. See the note 110 of this dissertation.
\(^{188}\) This argument is quoted from Garrett Hardin. See the note 113 of this dissertation.
\(^{189}\) This argument is quoted from Mancur Olson. See the note 116 of this dissertation.
tions erupted during the “Industrial Revolution”\textsuperscript{190} and “seed war” disputes were reported by Bill Paul in the \textit{Wall Street Journal} in 1984.\textsuperscript{191} PGRs became the subject of disputes between the developed and the developing worlds. Although the international community attempted to regulate the utilization of PGRs through the IUPGR, CBD, and ITPGR during the late 20th century, controversies about “biopiracy,” “bioprospecting,” and “seed wars” have continued because these controversies are tied to economics, politics and diplomacy. For example, the establishment of the International Board for Plant Genetic Resources (IBPGR) in 1974\textsuperscript{192} was grounded in political disputes. The CGIAR was created in 1971 by the Rockefeller and Ford Foundations and was a research institution prior to the IBPGR.\textsuperscript{193} The CGIAR opposed the FAO and the establishment of IBPGR.\textsuperscript{194} The IBPGR’s budget illustrates the conflicts between the developed and the developing worlds. The IBPGR budget does not come from the FAO, the United Nations Environment Programme, or developing countries, such as India and China\textsuperscript{195} but rather originates with members of CGIAR, which are developed countries.\textsuperscript{196} 69\% of the IBPGR’s budget in 1984 was provided by Canada, Japan, Netherland, the U.K., the U.S., and the World Bank.\textsuperscript{197} The IBPGR’s policies are not determined by debates among all of the members of the FAO but rather through internal decision-making processes conducted within the CGIAR.\textsuperscript{198} The IBPGR is formally an organization under the control of the FAO, but is actually a CGIAR institution.\textsuperscript{199}

The process of negotiations within the ITPGR included numerous debates between the

\textsuperscript{190} See the note 94 of this dissertation.
\textsuperscript{191} See the note 95 of this dissertation.
\textsuperscript{192} Jack Ralph Kloppenburg Jr., First the Seed: The Political Economy of Plant Biotechnology, 1492-2000 163-64 (2d ed. 2004).
\textsuperscript{193} Id. at 160, 163.
\textsuperscript{194} Kloppenburg, supra note 192, at 163.
\textsuperscript{195} Kloppenburg, supra note 192, at 164.
\textsuperscript{196} Kloppenburg, supra note 192, at 164.
\textsuperscript{197} Kloppenburg, supra note 192, at 164.
\textsuperscript{198} Kloppenburg, supra note 192, at 164.
\textsuperscript{199} Kloppenburg, supra note 192, at 164.
U.S. and the developing countries about the language of Article 12.3(d). The U.S. sought to eliminate Article 12.3(d) in order to limit the scope of PGRs, which sought to ban patents on PGRs, while developing countries sought to retain the language of “genetic parts or components.” When the U.S. was unable to strike this provision, the U.S. sought to retain the phrase “in the form received from the [MLS]” in the final version of the ITPGR. The above examples show that the utilization of PGRs is related to conflicts between economic value, politics, and diplomacy. The perspective of using the analytical viewpoint of law and economics is that “PGRs should be the private property of national sovereignties” is not the best solution to the controversies regarding the utilization of PGRs between the developed and the developing worlds. Although the IUPGR, CBD, and ITPGR attempt to regulate the use and conservation of PGRs, this dissertation argues that these international regimes have imperfectly amalgamated the interests of the developing and the developing worlds. Thus, it is difficult for them to justify the use and conservation of PGRs and solve the conflicts of interest concerning the use of PGRs between the developed and the developing worlds.

2.2.1.3.2 International Regimes Regulate “Biopiracy” and “Bioprospecting” as “Corrective Justice” and Fail to Justify the Conflicts of Interest between the Developed and the Developing Worlds

Disputes about “Who owns PGRs?” that make use of the analytical viewpoint of law and economics to the effect that “PGRs should be the private property of national sovereignties” are not the best solution to disputes about the utilization of PGRs in the real world.

200 Aoki, supra note 110, at 67 (quoting Cary Fowler, Unnatural Selection: Technology Politics, and Plant Evolution 184 (1994)).
201 Aoki, supra note 110, at 67.
202 Aoki, supra note 110, at 67.
203 Aoki, supra note 110, at 67.
204 Aoki, supra note 110, at 67.
Using the analytical approach of law and economics to analyze current international regimes involved in “biopiracy” and “bioprospecting” emphasizes corrective justice (notion of fairness) is the same as the objectives of CBD and ITPGR that attempt to promote “the fair and equitable sharing of benefits arising out of the utilization of genetic resources.” However, we cannot clearly judge “What constitutes ‘fair’ and ‘equitable’ benefit-sharing with respect to the use of PGRs for all countries, multinational biotechnology corporations, and other users of PGRs.” For instance, distributive method A of benefit-sharing is “fair” and “equitable” for the multinational corporation A’ but is not fair for corporation B’. Moreover, distributive method C of benefit-sharing is “fair” and “equitable” for the developing country, but C’ is not for country D’ and corporation E’. In other words, if we use the approach of law and economics to analyze the above objectives of the CBD and the ITPGR, international treaties will attempt to pursue corrective justice (the notion of fairness), and such objectives are philosophical concepts rather than analyses of economic efficiency.

This dissertation attempts to avoid the approach of corrective justice in analyzing the objectives of CBD and ITPGR to the effect that “the fair and equitable sharing of benefits arising out of the utilization of genetic resources,” and operate to promote the establishment of the ABS regime. This dissertation uses “Empirical Methods in Law” to analyze the current implementation of ABS regimes among the 194 member countries of the CBD or ITPGR. After understanding the current implementation of ABS regimes, we will attempt to

205 See the discussions of 2.2.1.1.4 of this dissertation.
206 The objectives of the CBD regulated in Article 1 are “The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources....” The objectives of the ITPGR are similar to the objectives of the CBD, and the objectives of the ITPGR ruled in Article 1 are that “1.1 The objectives of this Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity,...” In other words, the CBD and the ITPGR promote “the fair and equitable sharing of the benefits arising out of the utilization of PGRs” and enhance member countries to set up the ABS regimes. See Secretarial of the Convention on Biological Diversity, supra note 24; Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24.
207 Id.
208 See the note 206 of this dissertation.
propose a fair and efficient legal policy for the use of PGRs based on research findings regarding the implementation of ABS regimes.

2.2.1.3.3 Summary

This section examines the different perspectives regarding the ownership of PGRs, “seed wars,” and disputes regarding the establishment of the ITPGR and finds that there is little possibility of compromise over positions concerning PGRs between the developed and the developing worlds. In addition, the formation of international regimes – the CBD and the ITPGR – were attempts to solve the controversies regarding the use of PGRs. First, they recognize that PGRs are national sovereignties and not common heritage of mankind. Second, they emphasize the notion of corrective justice (notion of fairness) – the fair and equitable sharing of benefits arising out of the utilization of genetic resources.\(^{209}\) However, not all countries have ratified the CBD and the ITPGR, so the positions adopted by the CBD and the ITPGR are not accepted by all countries.\(^{210}\) Table 2.3 indicates the difficulties involved in attempting to resolve the controversies regarding the use of PGRs.

<table>
<thead>
<tr>
<th>Table 2.3 Difficulties Involved in Attempting to Resolve the Controversies regarding the Use of Plant Genetic Resources (PGRs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No compromise on positions concerning PGRs between the developed and the developing worlds</td>
</tr>
<tr>
<td>1. The divisions over whether or not PGRs are “common heritage of mankind;”</td>
</tr>
<tr>
<td>2. Cost and benefit (economic) analysis indicates</td>
</tr>
</tbody>
</table>

\(^{209}\) Article 1 of the CBD regulates that “The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.” Article 1.1 of the ITPGR regulates that “The objectives of this Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security.” Both of the objectives of the CBD and the ITPGR are pursued fair and equitable sharing of the benefits arising out of using PGRs, and these objectives are corrective justices regarding the use of PGRs. See Secretarial of the Convention on Biological Diversity, \textit{supra} note 24; Commission on Genetic Resources for Food and Agriculture, \textit{supra} note 24.

\(^{210}\) For example, the U.S. is not a contracting party of the CBD and the ITPGR and has not ratified these treaties. See Secretarial of the Convention on Biological Diversity, \textit{supra} note 24; Commission on Genetic Resources for Food and Agriculture, \textit{supra} note 24.
Table 2.3 (cont.)

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<table>
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<tbody>
<tr>
<td></td>
<td>that multinational corporations from the developed world are unable to pay compensation for the use of PGRs due to high R&amp;D costs; 3. The conflicts between the developed and the developing worlds during the process of establishing the ITPGR</td>
</tr>
<tr>
<td></td>
<td>1. The international regimes (e.g. the CBD or the ITPGR) emphasize corrective justice (notion of fairness); 2. The objectives of CBD or ITPGR are philosophical concepts rather than analyses of economic efficiency; 3. Empirical Methods in Law is an objective approach for analyzing the current implementation of ABS regimes (the objectives of CBD or ITPGR)</td>
</tr>
<tr>
<td>The international regimes regulate “biopiracy” and “bioprospecting” as “corrective justice” and fail to justify the conflicts of interest between the developed and the developing worlds</td>
<td></td>
</tr>
</tbody>
</table>

This dissertation does not give up on the possibility of solving controversies regarding the use of PGRs, but the method of traditional review is not a good way to do so. As a result, this dissertation proposes that empirical methods in law is an objective approach for examining the controversies regarding the use of PGRs between the developed and the developing worlds and analyzing the current implementation of the ABS regime (the objectives of CBD or ITPGR) of the contracting parties to the CBD or the ITPGR.

2.2.2 Issues related to Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs)

Issues related to traditional knowledge regarding the use of PGRs discussed in the following sections include: First, access issues related to traditional knowledge regarding the use of PGRs examines the example of the “Neem Tree” and legal perspectives on traditional knowledge. Second, benefit-sharing issues related to traditional knowledge regarding the use of PGRs describe whether or not traditional knowledge is the “Common Heritage” of man-
kind? Third, arguments made in this dissertation concerning traditional knowledge regarding the use of PGRs summary the existing literatures to examine the definition, legal quality (property or abstract idea), and stewardship of traditional knowledge regarding the use of PGRs.

2.2.2.1 Access Issues related to Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs)

Another issue related to the issue of PGRs is traditional knowledge concerning the use of PGRs. Traditional knowledge regarding the use of PGRs can be defined as the understanding or skills possessed by indigenous peoples pertaining to their use of native plants for medicinal purposes.\(^{211}\) Traditional knowledge regarding the use of PGRs is one type of understanding or skill, meaning that such understanding or skill is only an “abstract idea” and therefore is not patentable if a medicine or plant product is developed from this “abstract idea.”\(^{212}\) Traditional knowledge regarding the use of PGRs in and of itself has no economic value for multinational biotechnology corporations because such knowledge is not patentable.

This does not mean that issues concerning traditional knowledge regarding the use of PGRs are not important. There have been several cases which concern conflicts regarding the use of traditional knowledge regarding the use of PGRs between the developed and the developing worlds. The most famous is the “Neem Tree” case. W.R. Grace, a chemical specialties corporation, obtained the patents which involved a stable extract made from neem seeds that could be used to control fungi on plants.\(^{213}\) The patents awarded were “European patent

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\(^{212}\) The U.S. Supreme Court ruled in the case decision *Rubber-Tip Pencil Co. v. Howard*, 87 U.S. (20 Wall.) 498 (1874) that “an idea of itself is not patentable, but a new device by which it may be made practically useful is.” See Merges et al., *supra* note 1, at 139.

Indians have used neem products for centuries, and W.R. Grace’s extraction process did not differ from their traditional method. There were public demonstrations against W.R. Grace’s joint venture in India as early as 1993. Advocacy groups challenged W.R. Grace’s European and U.S. patents in 1995. W.R. Grace responded that its process to extract azadiracthin (the pesticidal agent in the neem) allows for longer storage than is the case for the traditional method, extending it from a few days to at least two years. The company argued that its U.S. patent did not prohibit farmers in India from producing and distributing their own extracts.

The example of the “Neem Tree” shows that traditional knowledge regarding the use of PGRs is both worthy of attention, and propertied (i.e. given intellectual property protection) by multinational biotechnology corporations to help them market products made through the use of this knowledge. Multinational corporations have attempted to become propertied using traditional knowledge regarding the use of PGRs. The opposing voices express the view that traditional knowledge regarding the use of PGRs is property, because those who hold of this knowledge are eligible to fairly and equitably share in the benefits that arise from the use of their knowledge. Both perspectives try to make property out of traditional knowledge regarding the use of PGRs. Aristotle held that the property rights are ap-

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214 See id. at 161.
215 See Schuler, supra note 213, at 162.
216 See Schuler, supra note 213, at 162.
217 This dissertation argues that the developed world and its multinational biotechnology corporations still think the traditional knowledge about the use of PGRs as the “Common Heritage” of Mankind because this argument provides a strong legal foundation for the developed world and its multinational corporations to freely use traditional knowledge of the use of PGRs in order to be propertied (intellectual property protection). The position of “Common Heritage” of mankind is a strong argument for the developed world and its multinational corporations to become propertied using traditional knowledge about the use of PGRs by means of intellectual property rights. See Munzer & Raustiala, supra note 211.
218 See Munzer & Raustiala, supra note 211.
219 This argument is cited in note 2 of Stephen R. Munzer & Kal Raustiala’s article, and it arises from Vandana Shiva, because “to denounce ‘biopiracy’ and the plunder of traditional knowledge assumes that what was pirated or plundered is property” See Munzer & Raustiala, supra note 211.
220 This argument is cited in note 3 of Stephen R. Munzer & Kal Raustiala’s article, and it references the report of the World Intellectual Property Organization (WIPO): Intellectual Property and Traditional Knowledge, Booklet No.2. See Munzer & Raustiala, supra note 211.
proaches for achieving distributive justice. Applying property rights to this knowledge allows for the pursuit of distributive justice regarding the use of this knowledge through the eventual application of property rights that get set up. However, there are different types of property rights that can become set up (e.g. intellectual property rights, the mechanisms of CBD and so on). The developed and the developing worlds choose different forms of property rights for the achievement of distributive justice. For instance, the developed world and its multinational corporations try to apply intellectual property rights (especially patents) to traditional knowledge regarding the use of PGRs in order to pursue their notion of distributive justice – the monopoly of economic value. On the other hand, the developing world attempts to apply the mechanisms of the CBD (i.e. ABS regimes) to this knowledge in order to pursue their notion of distributive justice – fair and equitable benefit-sharing arising from the utilization of PGRs by the developed world and its multinational corporations.

This dissertation argues that traditional knowledge regarding the use of PGRs is not the subject matter of patents because it is an abstract idea when seen from the perspective that such knowledge is propertied. The controversies over access issues regarding traditional knowledge regarding the use of PGRs between the developed and the developing worlds remain unresolved.

2.2.2.2 Benefit-Sharing Issues related to Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs)

The traditional knowledge regarding the use of PGRs also presents problems with respect to benefit-sharing. The “neem tree” is an example of the traditional knowledge about the use of PGRs. Indian farmers used neem seeds to produce natural pesticides. They traditionally soaked neem seeds in water and alcohol and then sprayed the emulsion on plants.222

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221 See Cooter & Ulen, supra note 19, at 116.
222 See Schuler, supra note 213, at 161.
The W.R. Grace company improved this traditional process of extracting neem seeds for controlling fungi on plants (biopesticides) and was awarded U.S. and European patents.\textsuperscript{223} Advocacy groups thought that the W.R. Grace’s extraction process was not radically different from the traditional process and challenged the Grace’s U.S. and the European patents.\textsuperscript{224}

Grace’s European patent was revoked due to prior art (the traditional India farmers’ extraction process of neem seeds) in May 2000.\textsuperscript{225} The USPTO’s database listed more than 400 U.S. patents related to “neem tree” as of September 2002.\textsuperscript{226} The European Patent Office (EPO)’s database also contains several hundred patents concerning the “neem tree.”\textsuperscript{227} U.S. patents granted in 1980 included toothpastes containing neem, among other ingredients,\textsuperscript{228} so these patents (including the W.R. Grace patent) represent economic value for biotechnology corporations. Traditional knowledge regarding the use of PGRs includes hidden economic value, although traditional knowledge (which is an abstract idea) cannot be patented.\textsuperscript{229}

“How to fairly and equitably share benefits derived from traditional knowledge regarding the use of PGRs” is a controversial issue. The key question with respect to benefit-sharing issues is “Whether traditional knowledge regarding the use of PGRs is the ‘Common Heritage’ of Mankind?” The developed and the developing worlds have different perspectives on this question. Chika Onwuekwe argued that the developed world believes that traditional knowledge regarding the use of PGRs is the “Common Heritage” of Mankind\textsuperscript{230} because this position appears to provide a firm theoretical foundation for multinational biotechnology corporations in the developed world to make property out of this knowledge (intellectual

\begin{footnotes}
\item[223] See Schuler, \textit{supra} note 213, at 161.
\item[224] See Schuler, \textit{supra} note 213, at 162.
\item[225] See Schuler, \textit{supra} note 213, at 162.
\item[226] See Schuler, \textit{supra} note 213, at 162.
\item[227] See Schuler, \textit{supra} note 213, at 162.
\item[228] See Schuler, \textit{supra} note 213, at 162.
\item[229] See the note 212 of this dissertation.
\end{footnotes}
The developed world and its multinational corporations do not need to share benefits with the developing world arising from the use of traditional knowledge regarding the use of PGRs. The developing world thinks that their traditional knowledge regarding the use of PGRs is their property and is not the “Common Heritage” of Mankind, just as with PGRs. Thus, the developed world and its multinational corporations cannot use this knowledge unless they share the benefits that arise from the use of this knowledge with the developing world.

To sum up, controversies regarding benefit-sharing issues with respect to traditional knowledge about the use of PGRs between the developed and the developing worlds remain unresolved, along with controversies regarding benefit-sharing issues about the use of PGRs.

2.2.2.3 The Arguments Made in This Dissertation concerning Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs)

The literature focuses on issues concerning the utilization of PGRs, as opposed to issues related to traditional knowledge regarding the use of PGRs. The key point is that intellectual property rights (especially patents) regarding PGRs are related to disputes between the developed and the developing worlds.

The example of the “neem tree” shows that traditional knowledge regarding the use of PGRs may have value beyond the PGRs themselves, so traditional knowledge about the use of PGRs both attracts international regimes (e.g. CBD) for protection, and is worthy of

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To sum up, controversies regarding benefit-sharing issues with respect to traditional knowledge about the use of PGRs between the developed and the developing worlds remain unresolved, along with controversies regarding benefit-sharing issues about the use of PGRs.
further study. However, before we analyze the importance of protecting traditional knowledge regarding the use of PGRs, it is important to clarify issues such as “Whether or not any certain definition of traditional knowledge exists at present,” “Is traditional knowledge about the use of PGRs ‘property’ or an ‘abstract idea’?” and “Is traditional knowledge about the use of PGRs the ‘Common Heritage’ of Mankind?”

2.2.2.3.1 Whether or not Any Certain Definition of Traditional Knowledge Exists at Present

Section 2.2.2.1 of this dissertation defined “traditional knowledge regarding the use of PGRs” as “the understanding or skill, which is possessed by indigenous peoples pertaining to their use of native plants for medicinal purposes.” Existing definitions of “traditional knowledge about the use of PGRs” are found in the literature, but this term is rarely defined by international regimes or in reports. The only international report which has defined “traditional knowledge” is the World Intellectual Property Organization (WIPO) Report. Its ambiguous definition of “traditional knowledge” states that “traditional knowledge embraces a wide range of individuals, communities, and cultures living in a largely non-urbanized setup.” The Convention on Biological Diversity (Article 8(j)) characterizes it as involving living ‘traditional lifestyles.’ Article 8(j) of the CBD does not define “traditional knowledge,” and its language concerning “traditional knowledge” is similar to the WIPO Report. In other words, there is no certain or generally-accepted definition of traditional knowledge at present.

There are a variety of definitions of “indigenous peoples” used by international regimes

235 See the note 211 of this dissertation.
236 See Mgbeoji, supra note 44, at 10.
237 See Mgbeoji, supra note 44, at 10.
238 The language of Article 8(j) of the CBD concerning “traditional knowledge” states that “…knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles…,” and it is like the language of WIPO Report, which does not provide the certain definition of “traditional knowledge.” See Secretarial of the Convention on Biological Diversity, supra note 24; Mgbeoji, supra note 44, at 10.
or used in reports. For example, the UN Martinez Cobo Report defined indigenous peoples, countries, and communities as “those which, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the society now...” The UN International Labour Organization (ILO), Convention 169, specified on June 27, 1989 that “indigenous peoples” are “those who have descended from populations that... retain some or all of their own social, economic, cultural, and political institutions.” The draft UN Declaration on the Rights of Indigenous Peoples of 1994 did not define “indigenous peoples.” The formal UN Declaration on the Rights of Indigenous Peoples, which was adopted in September, 2007, did not define “indigenous peoples,” and did not define “indigenous knowledge.”

If we assume “indigenous knowledge” to be a practice or knowledge of “indigenous peoples” and attempt to apply this definition to “traditional knowledge,” it is not appropriate to define “traditional knowledge” in this manner. “Indigenous knowledge” could be a practice or knowledge of “indigenous peoples,” but the WIPO Report stated that “‘traditional knowledge’ is not necessarily ‘indigenous.’” Therefore, it is impossible to expand the definition of “indigenous peoples” or “indigenous knowledge” to include “traditional knowledge” or define “traditional knowledge with respect to PGRs” because they have different meanings. To sum up, there is no certain or widely-accepted definition of traditional knowledge currently in use at the international level (e.g. international regimes or reports).

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239 See Mgbeoji, supra note 44, at 9.
240 See Mgbeoji, supra note 44, at 9-10.
241 This argument is cited in note 25 of Stephen R. Munzer & Kal Raustiala’s article. See Munzer & Raustiala, supra note 211.
244 See Mgbeoji, supra note 44, at 10.
2.2.2.3.2 Is Traditional Knowledge regarding the Use of PGRs “Property” or an “Abstract Idea”?

Disputes regarding the W.R. Grace patents on extracts of “neem tree” seeds\(^\text{245}\) show that traditional knowledge regarding the use of PGRs is worthy of examination. In fact, traditional knowledge regarding the use of PGRs differs from PGRs themselves. PGRs have been described as property regardless of whether they are owned by countries (sovereignties) or humanity (common heritage of mankind). PGRs are plants that exist as physical objects, and are not abstract ideas.

However, there is a problem involved in applying the term “ownership” to traditional knowledge, because the definition of traditional knowledge regarding the use of PGRs is “the understanding or skill, which is possessed by indigenous peoples pertaining to their use of native plants for medicinal purposes,”\(^\text{246}\) so such traditional knowledge should be described as one type of practice, knowledge, abstract idea, or known process or method.

If a practice, knowledge, abstract idea, or known process or method (i.e. traditional knowledge about the use of PGRs) does not include the use of new knowledge, processes, or methods, such traditional knowledge is not eligible to be patented\(^\text{247}\). For example, the traditional method or process of extracting “neem tree” seeds has been used in India for thousands of years. The W.R. Grace company filed a patent application for this known extraction process or method and could not obtain a patent for this extraction process or method without any new elements being present. U.S. patent 5,124,349 is a patent for a “Storage stable aza-

\(^\text{245}\) See the discussions of 2.2.2.1 and 2.2.2.2 of this dissertation.
\(^\text{246}\) See the note 211 of this dissertation.
\(^\text{247}\) 35 U.S.C. §§100-01 (1952) (Although the U.S. Patent Act §101 rules that “Whoever invents or discovers any new and useful ‘process,’ machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title,” the U.S. Patent Act §100(b) regulates that “When used in this title unless the context otherwise indicates—(b) The term ‘process’ means process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material…” In other words, the known process without any new use is not eligible to be patentable).
dirachtin formulation,” which emphasizes that “Storage stable pesticide compositions”\textsuperscript{248} is better than traditional processes,\textsuperscript{249} so this patent does not include the extraction method or the process that involves “neem tree” seeds.

This dissertation argues that patents are intended to protect devices or physical instrumentalities in the “useful arts” but does not protect “esoteric matters.”\textsuperscript{250} Traditional knowledge regarding the use of PGRs is an abstract idea (meaning a known method or process), which is not eligible to be patented. We cannot use the term “ownership” to explain “Who owns traditional knowledge regarding the use of PGRs?” because such traditional knowledge cannot be made into property by the use of intellectual property right laws (especially patents). Kristen A. Garpenter, Sonia K. Katyal, and Angela R. Riley have proposed the concept of “stewardship,”\textsuperscript{251} which may be a more appropriate concept than “ownership,” for describing “traditional knowledge regarding the use of PGRs with respect to whom it belongs.”

As mentioned above, patents are not a proper form of intellectual property law for the protection of traditional knowledge, because traditional knowledge is a practice, knowledge, abstract idea, or known process or method that can be viewed as “prior art,”\textsuperscript{252} which means

\begin{itemize}
\item \textsuperscript{249} See Schuler, supra note 213, at 162.
\item \textsuperscript{250} “Esoteric matters” are described from the perspective of outsiders unfamiliar with the actual composition of “esoteric matters.” In addition, when multinational biotechnology corporations first acquire traditional knowledge about the use of PGRs, they see traditional knowledge as “esoteric matters.” However, multinational corporations can use scientific methods to analyze the compositions of PGRs and invent new processes or methods of using PGRs that are distinct from traditional knowledge. Thus, such new processes or methods of using PGRs are eligible for patents. See Merges et al., supra note 1, at 139.
\item \textsuperscript{251} “Stewardship” is quoted from the essay, \textit{In Defense of Property}, written by Kristen A. Garpenter, Sonia K. Katyal & Angela R. Riley in Yale Law Journal Vol. 118 (forthcoming 2009). See Munzer & Raustiala, supra note 211.
\item \textsuperscript{252} If “traditional knowledge” is documented in a “printed publication,” it is considered as a “prior art” under § 102 (b) of the U.S. Patent Act. However, “traditional knowledge,” which is discoursed or shown by means of oral or Internet databases, is not “prior art,” which is a bar to obtaining U.S. patents. For example, the Indian government set up an electronic database that provides comprehensive inventories of traditional Indian healing methods and plant medicines. This type of database of “defensive publishing” attempts to make it difficult for researchers in the developed world, such as U.S., to register patent claims that exploit traditional Indian medical knowledge. However, these materials, which are posted on the database located on the Internet, do not fulfill the element of “printed publication” in § 102 (b) of the U.S. Patent Act. In addition, the U.S. courts held that a “prior art” is limited to disclosure by “printed publications,” such as Federal Circuit’s case of \textit{In re Klopfenstein},
\end{itemize}
that traditional knowledge is not eligible for patent protection. Trade secret protection may be
an appropriate form of intellectual property protection for traditional knowledge.253 The U.S.
Uniform Trade Secret Act rules that “‘Trade secret’ means information, including a formula,
pattern, compilation, program device, method, technique, or process…,”254 and traditional
knowledge falls within the subject matter of trade secret. However, the Uniform Trade Secret
Act also regulates that “‘Trade secret’ means…. that: (i) [it] derives independent economic
value, actual or potential, from not being generally known to, and not being readily ascer-
tainable by proper means by, other persons who can obtain economic value from its disclo-
sure or use…. “255 The Uniform Trade Secret Act both regulates the subject matter, and the
requirements of trade secrets. Furthermore, this dissertation argues that it is open to question
whether traditional knowledge can be protected by trade secret laws, because traditional
knowledge has usually been known, used for thousand of years, and has been communicated
by means of oral disclosures,256 as was the case for the extraction process for “neem tree”
seeds, which has been known and used for thousand of years in India. This is also the case for

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253 Chen, supra note 70, at 21 (quoting Gelvina Rodriguez Stevenson, Note, Trade
254 Uniform Trade Secret Act, with 1985 Amendments: “§1. Definitions – As used in this Act, unless the context
requires otherwise:… (4) “Trade secret” means information, including a formula, pattern, compilation, program
device, method, technique, or process, that: (i) derives independent economic value, actual or potential, from no
being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain
economic value from its disclosure or use, and (ii) is the subject of efforts that are reasonable under the cir-
cumstances to maintain its secrecy.”
255 Section 1(4) of the Uniform Trade Secret Act.
256 See Mgbeoji, supra note 44, at 132.
traditional knowledge of Chinese herbal medicines and other types of subject matter. Although traditional knowledge might fall within the subject matter of trade secret protection, it is hard for it to fit the requirement of “not being generally known” in order to qualify for trade secret protection. In other words, trade secrets are a valid form of intellectual property protection for traditional knowledge, but there are unanswered questions about how to apply the legal requirements regarding trade secrets to traditional knowledge.

This dissertation argues that trade secret protection is not an appropriate form of intellectual property protection for PGRs, because the current intellectual property regimes have protected PGRs themselves (e.g. seeds or plants, and so on), such as the U.S. PPA of 1930\(^{257}\) and related case law.\(^{258}\) As a result, it is not practical and useful to propose trade secret protection as a better way to protect PGRs other than by means of patents, even though voices from the developing world oppose patent protection for PGRs (i.e. Vandana Shiva\(^{259}\)).

2.2.2.3 Is Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs) the “Common Heritage” of Mankind?

Article 8(j) of the CBD regulates that traditional knowledge regarding the use of PGRs is treated in a manner similar to PGRs,\(^ {260}\) and using traditional knowledge should involve the sharing of fair and equitable sharing of benefits with the “stewards” of traditional know-

\(^{258}\) For example, *J.E.M. Ag-Supply, Inc. v. Pioneer Hi-Bred International, Inc.*, 534 U.S. 124 (2001) (plant innovations can be patentable through utility patents without the limitations by the rules of PPA and PVPA).
\(^{259}\) See the note 101 of this dissertation.
\(^{260}\) Article 8(j) of the CBD rules that “Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices:…” See Secretarial of the Convention on Biological Diversity, *supra* note 24. As a result, respecting, preserving and maintaining knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles is “relevant” for the conservation and sustainable use of biological diversity. Thus, protecting traditional knowledge is as important as the *In-situ* conservation of biological diversity (PGRs), and traditional knowledge is one part of biological diversity.
Germplasm resources (PGRs) of the Third World have historically been considered a free good, and germplasm resources (PGRs) are openly accessible under the principle that they are the “Common Heritage” of Mankind. As mentioned above, Article 8(j) of the CBD treats traditional knowledge regarding the use of PGRs in a manner similar to PGRs. Thus, it can be inferred that traditional knowledge regarding the use of PGRs is not the “Common Heritage” of Mankind when seen from this point of view.

Chika Onwuekwe questioned, and argued about, this notion that traditional knowledge regarding the uses of PGRs being the “Common Heritage” of Mankind held in most advanced countries as being in error. Onwuekwe argued that there is no legal reason for designating the uses and utility of traditional knowledge regarding the use of PGRs as being part of the commons. Moreover, this works against the notion that the interests of farmers (or indigenous communities) of the developing countries and makes access less certain for farmers (or indigenous communities) in the developing countries.

This dissertation argues that Onwuekwe’s perspective focuses solely on the interests of developing countries. If traditional knowledge regarding the use of PGRs is not the “Common Heritage” of Mankind, such a notion would work against the interests of multinational biotechnology corporations in the developed countries and make access to traditional knowl-

261 See the note 260 of this dissertation.
262 The term “germplasm resources” indicates plant resources such as seeds, roots, and other plant tissues containing genetic materials. On the contrary, the term “plant genetic resources (PGRs)” is used in this dissertation in a broad sense, including anything which contributes to the development of new or existing plant varieties, so PGRs include germplasm resources. Although some literature uses terms such as “germplasm,” “seed germplasm,” or “germplasm resources,” this dissertation argues that using the term “plant genetic resources (PGRs)” is more appropriate than the terms such as “germplasm,” “seed germplasm,” or “germplasm resources.” These arguments are cited from note 1 of the introduction in Keith Aoki, Seed Wars: Controversies and Cases on Plant Genetic Resources and Intellectual Property xiii. See Aoki, supra note 110, at xiii.
263 See Aoki, supra note 110, at 5.
264 Kloppenburg, supra note 192, at 15.
265 See Phillips & Onwuekwe, supra note 230, at 15.
266 See Phillips & Onwuekwe, supra note 230, at 15.
267 See Phillips & Onwuekwe, supra note 230, at 15.
knowledge less certain for these corporations, because corporations would have to pay high trans-
action costs in order to negotiate with farmers (or indigenous peoples) in the developing
countries and reach agreements about the utilization and sharing of benefits derived from tra-
ditional knowledge regarding the use of PGRs.

This dissertation takes the position that traditional knowledge regarding the use of PGRs,
which is similar to PGRs, is not the “Common Heritage” of Mankind. The developed and the
developing worlds have different perspectives on the controversies concerning traditional
knowledge regarding the use of PGRs, and these perspectives are based on conflicts of inter-
est. As a result, the conflict between the developed and the developing worlds concerning
“Whether or not traditional knowledge regarding the use of PGRs is the ‘Common Heritage’
of Mankind?” remains unresolved. This dissertation proposes that we can escape these con-
flicts by using an alternative method – Empirical Methods in Law – to examine legal issues
related to the utilization and implications of PGRs and traditional knowledge regarding the
use of PGRs.

2.2.2.3.4 Summary

Given the definition, type, quality, and legal protection of traditional knowledge regarding
the use of PGRs, we can understand that traditional knowledge regarding the use of PGRs
is not given more attention than PGRs. It has no fixed definition at the international level (e.g.
regimes or reports), while also having significant protection in international regimes, unlike
PGRs.

Traditional knowledge regarding the use of PGRs is also no more controversial than
PGRs with respect to legal protection, because it consists of abstract ideas and is not the sub-

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268 Multinational corporations from the developed world have to spend high “bargaining cost” in order to nego-
tiate with farmers or indigenous peoples from the developing world, and the “bargaining cost” is one of the
transaction cost. See Cooter & Ulen, supra note 19, at 91-92.
ject matter of patents. Unlike the PGRs, PGRs can be the subject matters of patents.

This dissertation does not state that traditional knowledge about the use of PGRs is unimportant and unworthy of study, because there have been disputes between the developed and the developing worlds concerning the stewardship of traditional knowledge regarding the use of PGRs, specifically concerning whether traditional knowledge regarding the use of PGRs are national sovereignties or common heritages of mankind? Table 2.4 outlines issues related to traditional knowledge regarding the use of PGRs.

<table>
<thead>
<tr>
<th>Definition of Traditional Knowledge regarding the Use of PGRs</th>
<th>Types of Traditional Knowledge</th>
<th>Is Traditional Knowledge a Property/Abstract Idea?</th>
<th>Legal Protection of Traditional Knowledge</th>
<th>Is Traditional Knowledge the Common Heritage of Mankind?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The understanding or skill, which is possessed by indigenous peoples pertaining to their use of native plants for medicinal purposes; 2. Traditional Knowledge regarding the use of PGRs is rarely defined by international</td>
<td>Comounds Extracted from PGRs</td>
<td>Traditional Knowledge is an Abstract Idea</td>
<td>1. Trade Secret is not a practical and useful way to protect Traditional Knowledge; 2. Currently not provided by any legal system</td>
<td>Traditional Knowledge is not the Common Heritage of Mankind</td>
</tr>
<tr>
<td>Uses of PGRs</td>
<td>Traditional Knowledge is an Abstract Idea</td>
<td>1. Trade Secret is not a practical and useful way to protect Traditional Knowledge; 2. Currently not provided by any</td>
<td></td>
<td>Traditional Knowledge is not the Common Heritage of Mankind</td>
</tr>
</tbody>
</table>

See the discussions of 2.2.2.3.2 of this dissertation.

See the discussions of 2.2.2.3.2 of this dissertation.

See the discussions of 2.2.2.3.3 of this dissertation.
The key point concerning traditional knowledge regarding the use of PGRs is that traditional knowledge is used to make, or uses products related to PGRs, or PGRs, and only PGRs can be the subject matters of patents. If we could find a solution to the controversies between the developed and the developing world regarding the use of PGRs, the solution would represent a better way to solve the controversies regarding the traditional knowledge regarding the use of PGRs between the developed and the developing world. This dissertation argues that we can use empirical methods to examine legal issues related to the utilization and implications of PGRs and traditional knowledge regarding the use of PGRs and propose tangible recommendations or suggestions to help solve these controversies that are based on the outcomes of the empirical study.

2.3 THE INFLUENCE OF THE U.S. INTELLECTUAL PROPERTY REGIME FOR PLANT INNOVATION ON GLOBAL “BIOPIRACY” AND “BIOPROSPECTING”

This section will describe the U.S. intellectual property regime for plant innovation, the development of the world’s biotechnology industry, and the phenomena of global “biopiracy” and “bioprospecting.”

This section discusses the U.S. intellectual property regime for plant innovation because: First, the TRIPS Agreement is an approximation of U.S. jurisprudence and ideology and is a product of the political clout of the U.S. biotechnology industry. Second, controversial patents which raise concerns about “biopiracy” have been issued by the U.S. Patent and Trademark Office (USPTO). Third, the U.S. Patent System accounts for almost half of all

Table 2.4 (cont.)

<table>
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<tr>
<th>regimes or in reports</th>
<th>legal system</th>
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272 Mgbeoji, supra note 44, at 14.
273 Id. at 14.
274 Mgbeoji, supra note 44, at 14.
of the patents issued in the world, and U.S. court decisions about patent law have immense international influence. Fourth, the U.S. also leads the world in the commercialization of biotechnology.

Because the U.S. intellectual property regime for plant innovation (patent law in particular) has a great impact on developments concerning the world’s intellectual property laws for plant innovation, and has great influence on the global biotechnology industry, the following sections will introduce the sources of the U.S. intellectual property regime for plant innovation, including case laws and statutes (e.g. the Utility Patent, Plant Patent Act, and Plant Variety Protection Act) and discuss relationships relevant to the U.S. intellectual property regime with respect to plant innovation, global “biopiracy,” and “bioprospecting.”

2.3.1 The Utility Patent

The U.S. Supreme Court decided the case of *Diamond v. Chakrabarty* in 1980, which made genetically altered bacteria patentable. In other words, “anything under the sun made by man” can be patentable.

However, this landmark case decision did not change the United States Patent and Trademark Office (USPTO)’s mind about allowing plants to be patentable until 1985. In the case of *Ex Parte Hibberd*, the Patent and Trademark Office’s Board of Appeals decided that plants modified by both traditional breeding and molecular transformation are pro-

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ected by utility patents.283 This was an administrative decision made by a government agency, the USPTO, and was not a case decision made by a court. Although the USPTO began to issue utility patents for plants in 1985, this issue had no legal foundation until 2001, when the U.S. Supreme Court decided the case of J.E.M. Ag-Supply, Inc. v. Pioneer Hi-Bred International, Inc.,284 which held that plants can be protected by utility patents.285

The requirements for utility patents for plants are stricter than for other types of intellectual property regimes for plant innovations (e.g. Plant Patent Act and Plant Variety Protection Act). Plants can be issued utility patents only when they fit the elements of patentability: “novelty,”286 “utility,”287 “non-obviousness,”288 and “enablement.”289 On the other hand, util-

283 Kjeldgaard & Marsh, supra note 279.
285 J.E.M. Ag-Supply, Inc. v. Pioneer Hi-Bred International, Inc., 534 U.S. 124 (2001) (The actual language in this case decision states that “…We hold that utility patents may be issued for plants.”).
286 Section 102 of the U.S. Patent Act regulates that “A person shall be entitled to a patent unless-
(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or
(c) he has abandoned the invention, or
(d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by
the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for
patent in this country on an application for patent or inventor's certificate filed more than twelve months before
the filing of the application in the United States, or
(e) the invention was described in a patent granted on an application for patent by another filed in the United
States before the invention thereof by the applicant for patent, or on an international application by another who
has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371 (c) of this title before the invention
thereof by the applicant for patent, or
(f) he did not himself invent the subject matter sought to be patented, or
(g) before the applicant's invention thereof the invention was made in this country by another who had not
abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only
the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of
one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.” See
287 Section 101 of the U.S. Patent Act regulates that “Whoever invents or discovers any new and useful process,
machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a pa-
tent therefor, subject to the conditions and requirements of this title.” See 35 U.S.C. § 101 (1952).
288 Section 103 of the U.S. Patent Act regulates that “A patent may not be obtained though the invention is not
identically disclosed or described as set forth in section 102 of this title, if the differences between the subject
matter sought to be patented and the prior art are such that the subject matter as a whole would have been ob-
vious at the time the invention was made to a person having ordinary skill in the art to which said subject matter
pertains. Patentability shall not be negatived by the manner in which the invention was made.
Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of sec-
tion 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed
invention were, at the time the invention was made, owned by the same person or subject to an obligation of
ity patents provide plants with broader legal protection. The Plant Patent Act (PPA) protects only plants that are reproduced asexually,\textsuperscript{290} while the Plant Variety Protection Act (PVPA) protects that are reproduced sexually.\textsuperscript{291}

2.3.2 The 1930 Plant Patent Act (PPA)

The U.S. Congress enacted the Townsend-Purcell Plant Patent Act (PPA) on May 23, 1930,\textsuperscript{292} but only asexually-propagated plants are covered by the PPA, meaning asexually-propagated plants that reproduce by means other than seeds, such as rootings of cuttings, layering, budding, grafting, inarching, and so on.\textsuperscript{293} On the other hand, tuber-propagated

\textsuperscript{289} Section 112 of the U.S. Patent Act regulates that “The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention. The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention. A claim may be written in independent or, if the nature of the case admits, in dependent or multiple dependent form. Subject to the following paragraph, a claim in dependent form shall contain a reference to a claim previously set forth and then specify a further limitation of the subject matter claimed. A claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers. A claim in multiple dependent form shall contain a reference, in the alternative only, to more than one claim previously set forth and then specify a further limitation of the subject matter claimed. A multiple dependent claim shall not serve as a basis for any other multiple dependent claim. A multiple claim shall be construed to incorporate by reference all the limitations of the particular claim in relation to which it is being considered. An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.” See 35 U.S.C. § 112 (1952).

\textsuperscript{290} Section 161 of the U.S. Plant Patent Act regulates that “Whoever invents or discovers and asexually reproduces any distinct and new variety of plant, including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state, may obtain a patent therefor, subject to the conditions and requirements of this title. The provisions of this title relating to patents for inventions shall apply to patents for plants, except as otherwise provided.” See 35 U.S.C. § 161 (1930).

\textsuperscript{291} Section 2402(a) of the U.S. Plant Variety Protection Act regulates that “The breeder of any sexually reproduced or tuber propagated plant variety (other than fungi or bacteria) who has so reproduced the variety, or the successor in interest of the breeder, shall be entitled to plant variety protection for the variety, subject to the conditions and requirements of this chapter, if the variety is—…” See 7 U.S.C. § 2402 (1994).

\textsuperscript{292} See Adelman et al., supra note 252, at 24.

plants, meaning plants such as the Irish potato and the Jerusalem artichoke, are not protected by the PPA.  

The elements of patentability for utility patents are stricter than for those of the PPA. The patentability elements of utility patents are “novelty,” “utility,” “non-obviousness,” and “enablement (specification),” but the patentability element of PPA includes only the specification which shall be in formal terms for the plant shown and described. This dissertation argues that the PPA has had less impact than the PVPA, because major plants sexually reproduce through seeds are protected by the PVPA, while the PVPA provides only patent-like protection, but not patent protection.

2.3.3 The 1994 U.S. Plant Variety Protection Act (PVPA)

In the J.E.M. Ag-Supply, Inc. case, Justice Thomas delivered the opinion of the Supreme Court and stated that “By passing the PVPA in 1970, Congress specifically authorized limited patent-like protection for certain sexually reproduced plants.” Although the PVPA offers patent-like protection and provides Plant Variety Protection (PVP) certificates, Justice
Thomas argued in the *J.E.M. Ag-Supply, Inc.* case that “Since the 1994 amendments, the PVPA also protects ‘any variety that is essentially derived from a protected variety,’ § 2541(c)(1), and ‘any variety whose protection requires the repeated use of a protected variety,’ § 2541(c)(3).”

The PVPA provides only certificate protection, but § 2541(c)(1) and § 2541(c)(3) of the PVPA indicate that the scope of PVPA protection is broader than the PPA, which protects only asexually reproduced plants. The PVPA is worthy of further study, and the following sections describe the PVPA from different perspectives.

### 2.3.3.1 The History of the 1970 U.S. Plant Variety Protection Act (PVPA)

The creation of UPOV in 1961 pushed the U.S. to enact Plant Breeders’ Right (PBR) or Plant Variety Protection (PVP) legislation. The American Seed Trade Association (ASTA) formed a study group to examine European PBR or PVP legislation to determine whether or not they could apply such legislation to the U.S. In 1962, the U.S. Department of Agriculture (“USDA”) was under pressure to amend the existing Federal Seed Act. The American seed industry objected to an amendment regarding compulsory registration.

During the 1960s, U.S. private and public breeders engaged in negotiations and debates about the future of PBR or PVP legislation. The private seed industry (private breeders) opposed the creation of an institutional mechanism for ensuring that new plant varieties were in fact improvements. The seed industry thought that PBR or PVP was less about research and more about marketing legislation. Public breeders proposed the right of industry to a “fair profit.” PBR or PVP legislation enhanced public investment, not the expansion of prop-
erty rights, which requires justification.\textsuperscript{307} Public breeders who opposed PBR or PVP legislation were tempered by the ascendancy of agribusiness.\textsuperscript{308} The two different perspectives concerned whether or not to provide a profit motive for private enterprise or to leave future development to governmental or quasi-governmental institutions.\textsuperscript{309}

In 1968, the ASTA drafted a bill that would have amended the 1930 PPA by adding the term “or sexually” in appropriate places for the purpose of bringing all crops under this statute.\textsuperscript{310} This proposed addition evoked substantial opposition from the USDA and public breeders.\textsuperscript{311} The result of was a series of meetings involving several institutions. The ASTA drafted a second bill known as the Plant Variety Protection Act (PVPA).\textsuperscript{312} The seed industry sought the conditions of “novelty,” “uniformity,” and “stability” as part and parcel of the proprietary rights to new plant varieties in this draft bill.\textsuperscript{313} Public agencies introduced the idea that farmers could save and replant seeds without infringement, and that protected varieties could be used for purposes of research.\textsuperscript{314} The compromise bill was sent to the Congress, and became law on December 24, 1970.\textsuperscript{315}

\textbf{2.3.3.2 The Conditions of Protected Rights and Limitations on Plant Breeders’ Rights in the U.S. Plant Variety Protection Act (PVPA)}

The PVPA protects new plant varieties that “sexually” reproduce by seeds. Grants of PBRs or PVPs are awarded not by patents, but rather by use of “Certificates of Plant Variety Protection”\textsuperscript{316} (patent-like protection\textsuperscript{317}) under the PVPA. The certificates of PVPA are

\begin{itemize}
\item[307] Kloppenburg, \textit{supra} note 192, at 138.
\item[308] Kloppenburg, \textit{supra} note 192, at 138.
\item[309] Kloppenburg, \textit{supra} note 192, at 138.
\item[310] Kloppenburg, \textit{supra} note 192, at 139.
\item[311] Kloppenburg, \textit{supra} note 192, at 139.
\item[312] Kloppenburg, \textit{supra} note 192, at 139.
\item[313] Kloppenburg, \textit{supra} note 192, at 139.
\item[314] Kloppenburg, \textit{supra} note 192, at 139-40.
\item[315] Kloppenburg, \textit{supra} note 192, at 140.
\item[316] Merges et al., \textit{supra} note 1, at 378.
\end{itemize}
awarded to breeders who invent new plant varieties that are “of any novel variety of sexually reproduced plant,” and exhibit “distinctness,” “uniformity,” and “stability.” The PVPA denies this protection to fungi, bacteria, or first-generation hybrid plants.

Three restrictions on breeders enforce their PBR or PVP in the PVPA: First, the “Right to save seed; crop exemption” – it shall not infringe on PBR or PVP when a person saves seeds produced from seeds obtained, or descended, from seeds obtained, by authority of the variety owner for seeding purposes and use such saved seed to produce a crop for use on the farm of the person, or for sale, as provided in § 2543 of the PVPA. Second, there is a “Research exemption” – it shall not infringe on PBR or PVP to use and reproduce a protected variety for plant breeding or other bona fide research. Third, there is an “Intermediary ex-

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318 7 U.S.C. § 2402 (1994) (This section is the “Right to plant variety protection; plant varieties protectable” and describes that “(a) In general The breeder of any sexually reproduced or tuber propagated plant variety (other than fungi or bacteria) who has so reproduced the variety, or the successor in interest of the breeder, shall be entitled to plant variety protection for the variety, subject to the conditions and requirements of this chapter, if the variety is— (1) new, in the sense that, on the date of filing of the application for plant variety protection, propagating or harvested material of the variety has not been sold or otherwise disposed of to other persons, by or with the consent of the breeder, or the successor in interest of the breeder, for purposes of exploitation of the variety— (A) in the United States, more than 1 year prior to the date of filing; or (B) in any area outside of the United States— (i) more than 4 years prior to the date of filing, except that in the case of a tuber propagated plant variety the Secretary may waive the 4-year limitation for a period ending 1 year after April 4, 1996; or (ii) in the case of a tree or vine, more than 6 years prior to the date of filing; (2) distinct, in the sense that the variety is clearly distinguishable from any other variety the existence of which is publicly known or a matter of common knowledge at the time of the filing of the application; (3) uniform, in the sense that any variations are describable, predictable, and commercially acceptable; and (4) stable, in the sense that the variety, when reproduced, will remain unchanged with regard to the essential and distinctive characteristics of the variety with a reasonable degree of reliability commensurate with that of varieties of the same category in which the same breeding method is employed.”) See Merges et al., supra note 1, at 378.

319 Merges et al., supra note 1, at 378.

320 7 U.S.C. § 2543 (1994) (The actual language of this section is that “Except to the extent that such action may constitute an infringement under subsections (3) and (4) of section 2541 of this title, it shall not infringe any right hereunder for a person to save seed produced by the person from seed obtained, or descended from seed obtained, by authority of the owner of the variety for seeding purposes and use such saved seed in the production of a crop for use on the farm of the person, or for sale as provided in this section. 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. A purchaser who diverts seed from such channels to seeding purposes shall be deemed to have notice under section 2567 of this title that the actions of the purchaser constitute an infringement”).

321 7 U.S.C. § 2544 (1994) (The actual language of this provision is that “The use and reproduction of a protected variety for plant breeding or other bona fide research shall not constitute an infringement of the protection provided under this chapter”).
emption” – it shall not constitute an infringement of the PBR or PVP for transportation or delivery by a carrier in the ordinary course of its business as a carrier, or advertising by a person in the advertising business in the ordinary course of that business.\textsuperscript{322}

Debates about the PVPA between private breeders (biological corporations) and public breeders (governmental or quasi-governmental institutions) focused on the profits of protected plant varieties arising from PVPA protection. There is a framework for exemptions regarding PBR or PVP in the regulations of PVPA, specifically regarding the right to save seed. Crop exemptions (farmer-saved seed exemptions) in the PVPA are closely related to the profits of protected varieties (seeds) of biological corporations, because farmers would not buy new seeds from corporations for planting during the next season if farmers could save seeds or exchange seeds using the protection of PVPA.

The issue of farmer-saved seed exemptions occurs not only in the U.S., but also in many other countries, particularly developing countries that are highly reliant on agriculture and have numerous farmers. These farmers traditionally save or exchange seeds from their lands for the next season. The UPOV Conventions 1978 and 1991 also paid attention to such issues, and had such exemptions for PBR or PVP for member nations. The U.S. has the biggest seed industry in the world, and the U.S. PVPA exerts great influence over other countries’ PBR or PVP legislation, particularly farmer-saved seed exemptions. The following section introduces the developments regarding farmer-saved seed exemptions in the U.S. PVPA.

\section*{2.3.3.3 The Farmer-Saved Seed Exemption in the U.S. Plant Variety Protection Act (PVPA)}

Farmers have saved seeds for thousands of years. Haley Stein argued that “Farmers

\footnote{322 7 U.S.C. § 2545 (1994) (The actual language of this provision is that “Transportation or delivery by a carrier in the ordinary course of its business as a carrier, or advertising by a person in the advertising business in the ordinary course of that business, shall not constitute an infringement of the protection provided under this chapter”).}
saved seeds with the most beneficial characteristics to replant for the next harvest for thousands of years. Until recently, the USDA not only freely developed and distributed seeds, but encouraged seed saving by farmers. In addition, a nation’s sufficiency depends on its ability to provide its own labor and food; the U.S. is no exception.\textsuperscript{323}

However, even within the U.S., farmers remain limited in their ability to sell (exchange) seeds. The Supreme Court held in the \textit{Asgrow Seed Co. v. Winterboer}\textsuperscript{324} case that a farmer may only sell PVPA – protected, for reproductive purposes, seed, the seeds that the farmers saved for replanting their own acreage. Farmers need to establish a “reproductive purposes” intent in order to sell (exchange) seeds,\textsuperscript{325} according to the rules of § 2543\textsuperscript{326} and § 2541 (3)\textsuperscript{327} of the U.S. PVPA.

After the \textit{J.E.M. Ag-Supply}\textsuperscript{328} case, the U.S. Supreme Court held that plant innovations can be patentable through utility patents without the limitations by the rules of PPA and PVPA. Plant breeders (e.g. biotechnology corporations) might decrease to seek PVP certificates in favor of utility patents for their commercially important inventions, because utility patents provide more robust rights than PVP certificates.\textsuperscript{329} In short, utility patents are beneficial to commercial plant breeders rather than farmers, because the farmer-saved seed exemption is only regulated in the PVPA, but such exemption is not regulated in the “experimental use” exception of patent infringement of § 271 of the U.S. Patent Act.\textsuperscript{330}

\textsuperscript{324} \textit{Asgrow Seed Co. v. Winterboer}, 513 U.S. 179 (1995).
\textsuperscript{325} \textit{Id.}
\textsuperscript{327} 7 U.S.C. § 2541(3) (1994).
\textsuperscript{329} See Adelman et al., supra note 252, at 119.
\textsuperscript{330} Section 271(e)(1) of the U.S. Patent Act regulates that “It shall not be an act of infringement to make, use, or sell a patented invention (other than a new animal drug or veterinary biological product (as those terms are used in the Federal Food, Drug, and Cosmetic Act and the Act of March 4, 1913) which is primarily manufactured using recombinant DNA, recombinant RNA, hybridoma technology, or other processes involving site specific genetic manipulation techniques) solely for uses reasonably related to the development and submission of information under a Federal law which regulates the manufacture, use, or sale of drugs or veterinary biological
2.3.4 The U.S. Intellectual Property Regime for Plant Innovation Played an Important Role in the Development of the World’s Biotechnology Industry

The world’s patent system changed after 1980. In 1980, the revolutionary U.S. Supreme Court’s case, *Diamond v. Chakrabarty*, 331 held that “micro-organism or life (biotechnology)” was patentable. In 2001, another landmark case, *J.E.M. Ag-Supply, Inc. v. Pioneer Hi-Bred International, Inc.*, 332 held that “utility patents may be issued for plants.”

These cases expanded the scope of patentable subject matter to include plants, micro-organisms and other life forms. In 1930, the U.S. Congress enacted the “Plant Patent Act (PPA)” to allow asexually-propagated plants to enjoy patents. In 1970, the Congress enacted the “Plant Variety Protection Act (PVPA)” to allow sexually-propagated plants to have patent-like protection. In practice, prior to the *J.E.M. Ag-Supply* 333 case, the U.S. Patent and Trademark Office (USPTO) began issuing utility patents for plants in 1985. 334 The *Chakrabarty* 335 and *J.E.M. Ag-Supply* 336 cases thus were only extensions of previously existing forms of legal protection for the U.S. biotechnology industry.

The U.S. biotechnology industry (multinational biotechnology corporations) has expanded into global markets to increase profits. Patents are a legal weapon for them to use to assert exclusive rights over PGRs in the developing world and to enforce their patents outside the U.S. through bilateral international agreements. For instance, the TRIPS Agreement came into effect January 1, 1995, 337 and the Indian environmentalist, Vandana Shiva argued that

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the TRIPS Agreement globalized US-style patent laws\textsuperscript{338} and is weighted in favor of transnational corporations.\textsuperscript{339} Shiva cited a Monsanto representative’s opinions when the TRIPS Agreement was being negotiated which said that it was “…absolutely unprecedented in the General Agreement on Tariffs and Trade (GATT).\textsuperscript{340} Industry has identified a major problem in international trade…”\textsuperscript{341} Having drafted the TRIPS Agreement, global corporations are determined to use the TRIPS Agreement\textsuperscript{342} in order to reduce the trade barriers that some developing countries (i.e. India)\textsuperscript{343} with insufficiency intellectual property laws to protect corporations’ products in these countries.

This dissertation argues that these arguments reflect that there exist different understandings of intellectual property laws between the developed and the developing world. The developed world believes that the TRIPS Agreement, and other international intellectual property treaties, attempt to reduce trade barriers, enhance free trade, and protect multinational corporation’s products by applying intellectual property laws in the developing world. On the other hand, the developing world fears that PGRs and traditional knowledge regarding the use of PGRs could be patented by foreign multinational corporations. The developing world might be prohibited from using these PGRs and traditional knowledge and might even have to pay user fees to multinational corporations from the developed world.

Multinational corporations continue to commercialize products made from PGRs and traditional knowledge regarding the use of PGRs from the developing world using the protec-

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\textsuperscript{338} Shiva, supra note 101, at 3.
\textsuperscript{339} Shiva, supra note 62, at 10.
\textsuperscript{340} The GATT is a predecessor organization of the WTO. Because the WTO was established in 1995, the GATT was existed when the TRIPS Agreement was being negotiated. See WTO | What is the WTO? – About the WTO – a statement by the Director-General, http://www.wto.org/english/thewto_e/whatis_e/wto_dg_stat_e.htm (last visited June 28, 2009); Vandana Shiva, Stolen Harvest: The Hijacking of the Global Food Supply 89 (2000).
\textsuperscript{341} Id. at 89.
\textsuperscript{342} Shiva, supra note 340, at 89.
\textsuperscript{343} At the beginning, the Indian government did not want to implement the TRIPS Agreement, and the U.S. government initiated a WTO dispute against India, but India was fail under the ruling of WTO in 1998. Therefore, this ruling forced India to recognize US-style patent laws, and Shiva argued that this ruling is in essence a decision against Indian democracy. See Shiva, supra note 340, at 89.
tion of intellectual property rights (especially patents). The developing world claims that such actions on the part of corporations is “biopiracy,” which causes ecological and economic losses to the developing world. As a result, debates about the ownership of these resources continue.

An increasing number of books and articles have begun to pay attention to “biopiracy” and “bioprospecting.” Lakshmi Sarma cited Vandana Date’s arguments in stating that Northern countries (the developed world) assume that intellectual property is not a matter of national public policy or sovereign jurisdiction, but rather that technology is viewed as private property. On the other hand, Southern countries (the developing world) attempt to regulate technology transfers, because they believe that technology is a common asset which should be freely shared. Sarma quoted Vandana Shiva’s perspective in stating that Southern countries (the developing world) believe that patents only build on prior knowledge and the use of biological systems for food and medicine. The Southern view is that intellectual property rights stifle creativity because patents limit the ability to explore and create for a limited number of years.

Sarma argued that the developed countries have been criticized for their narrow definition of knowledge, creativity, and their unwillingness to accredit the creativity of knowledge systems in less developed countries (the developing world). Instead of rewarding knowledge and innovation, the present Northern-based Intellectual Property Rights system stifles

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345 Id. at 108.
346 Sarma, supra note 344, at 108 (quoting Vandana Shiva, Farmers’ Rights, Biodiversity and International Treaties, 28 Econ. & Pol. Wkly. 557, 557 (Apr. 3, 1993)).
347 Sarma, supra note 344, at 108-09.
348 Sarma, supra note 344, at 109.
Table 2.5 shows that the world’s top 14 countries control of plant patents in 1995. The table reflects the fact that western countries both monopolize the world’s plant patents.

<table>
<thead>
<tr>
<th>Company</th>
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</tr>
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<td>11</td>
</tr>
<tr>
<td>Mycogen</td>
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</tr>
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2.4 THE INTERNATIONAL LEGAL REGIMES RELATED TO “BIOPIRACY” AND “BIOPROSPECTING”

Sections 2.1 to 2.3 described in detail the issues of “biopiracy” and “bioprospecting,” but offer no tangible solutions to disputes regarding “biopiracy” and “bioprospecting.” International regimes (such as the CBD and the ITPGR) regulate “biopiracy” and “bioprospecting” using “corrective justice” (the notion of fairness), and they actually do not justify the conflicts of interest between the developed and the developing worlds. These international regimes are transnational standards or solutions, which attempt to solve disputes regarding

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349 Sarma, supra note 344, at 109.
351 See the discussions of 2.2.1.3.2 of this dissertation.
“biopiracy” and “bioprospecting” between the developed and the developing worlds. As a result, these regimes are worth discussing and further studying.

The goal of this dissertation is to develop fair and efficient legal policies regarding PGRs. This dissertation has defined the fair and efficient use of PGRs as being the case in situations which do not favor one country or multinational corporation over another and which accords with international law. Thus, international laws are standards for the fair and efficient use of PGRs by countries or corporations, and the purpose of international laws is to decrease the occurrence of “biopiracy” and “bioprospecting” in order to protect biodiversity.

The issues of “biopiracy” and “bioprospecting” are related to intellectual property rights for plant innovation or biotechnology (especially patents), and are also associated with biodiversity and traditional knowledge protection. Therefore, such international laws are related to “biopiracy” and “bioprospecting” and cross the fields of agriculture, biodiversity, intellectual property laws (including plant variety protection), human rights, and traditional knowledge, etc. This dissertation will introduce eleven international laws: (1) Trade-Related Aspects of Intellectual Property Rights Agreement (TRIPS); (2) the Patent Cooperation Treaty (PCT) and the Patent Law Treaty (PLT); (3) the International Convention for the Protection of New Varieties of Plants (UPOV Convention); (4) the Manila Declaration; (5) the Convention on Biological Diversity (CBD); (6) the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR); (7) the International Undertaking on Plant Genetic Resources (IUPGR); (8) the Bonn Guidelines on Access to Genetic Resources and the Fair and Equitable Sharing of the Benefits Arising out of Their Utilization; (9) the Cancun Declaration of Like-minded Megadiverse Countries; (10) the Universal Declaration of Human Rights (UDHR); and (11) Declaration on the Rights of Indigenous Peoples, which are closely related to “biopiracy” and “bioprospecting” and their current implementation.
2.4.1 Trade-Related Aspects of Intellectual Property Rights Agreement (TRIPS)

From 1986 to 1994, the Uruguay Round negotiated the WTO’s TRIPS, which is an attempt to narrow intellectual property rights gaps, and bring these rights under common international rules.\(^{352}\) In other words, TRIPS is an international regime within the multilateral trading system\(^{353}\) which tries to set up a minimum standard of intellectual property rights for 153 WTO members.\(^{354}\)

The TRIPS Agreement came into effect on January 1, 1995, and the text consists of three major parts: Standards, Enforcement, and Dispute Settlement.\(^{355}\) The TRIPS Agreement has 73 articles,\(^{356}\) and the different types of intellectual property rights covered by the TRIPS include the Paris Convention for the Protection of Industrial Property (patents and industrial designs, and so on) and the Berne Convention for the Protection of Literacy and Artistic Works (copyright).\(^{357}\)

Article 27.3(b)\(^{358}\) of the TRIPS Agreement is a provision related to “biopiracy” and “bioprospecting.” This provision sets up the requirement for new plant varieties protection by means of patents, a *sui generis* system, or combination thereof for members of the WTO. 153 WTO member countries require this provision for the enactment of patents, *sui generis* systems, or any combination thereof to protect new plant varieties. Multinational biotechnology

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\(^{357}\) WTO | intellectual property – overview of the TRIPS Agreement, *supra* note 355.

\(^{358}\) Article 27.3(b) of the TRIPS Agreement states that “Article 27 Patentable Subject Matter…3. 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.” See WTO | intellectual property (TRIPS) – agreement text – standards, http://www.wto.org/english/tratop_e/trips_e/t_agm3_e.htm (last visited May 30, 2009).
corporations can file patents, *sui generis*, or combinations of different types of legal protection to protect their new plant innovations, regardless of the sources of the raw genetic materials, which means that it does not matter whether they were bio-pirated or bio-prospected from the developing world (“South” countries) or not.

However, the developing world thinks that Article 27.3(b) of the TRIPS Agreement provides international legal protection for multinational corporations to protect their plant innovations, regardless of whether these plants are bio-pirated or bio-prospected from the developing world. In this manner, Article 27.3(b) of the TRIPS Agreement conflicts with the CBD, because one of the objectives of the CBD is “the fair and equitable sharing of the benefits arising out of the utilization of genetic resources,”\(^{359}\) while the TRIPS Agreement has no provision for the fair and equal sharing of benefits derived from genetic resources.

The Fourth Doha Ministerial Conference on November, 2001 attempted to coordinate the TRIPS and the CBD. Paragraph 19 of the Ministerial Declaration\(^{360}\) authorizes the Council for TRIPS to review Article 27.3(b) of the TRIPS and examine “inter alia”\(^{361}\) the relationship between the TRIPS and the CBD. The Ministerial Declaration provides only the mandate for new grounds of negotiation on a range of topics, so this was not the final decision. Although the ABS regulations of the CBD are the focal points for a harmonization initiative during the Doha ground negotiations, it is unlikely that the ongoing negotiations gave rise to

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\(^{359}\) The objectives of the CBD are regulated in Article 1, which describes that “The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.” See Secretariat of the Convention on Biological Diversity, *supra* note 24.

\(^{360}\) The paragraph 19 of the Ministerial Declaration states that “We instruct the Council for TRIPS, in pursuing its work programme including under the review of Article 27.3(b), the review of the implementation of the TRIPS Agreement under Article 71.1 and the work foreseen pursuant to paragraph 12 of this declaration, to examine, inter alia, the relationship between the TRIPS Agreement and the Convention on Biological Diversity, the protection of traditional knowledge and folklore, and other relevant new developments raised by members pursuant to Article 71.1. In undertaking this work, the TRIPS Council shall be guided by the objectives and principles set out in Articles 7 and 8 of the TRIPS Agreement and shall take fully into account the development dimension.” See WTO | Doha 4th Ministerial – Ministerial declaration, http://www.wto.org/english/tratop_e/minist_e/min01_e/mindecl_e.htm (last visited May 30, 2009).

\(^{361}\) The meaning of “inter alia” is “Among other things.” See Black’s Law Dictionary 827 (8th ed. 2007).
the amendment of the TRIPS (i.e. adding traditional knowledge as patentable subject matter, and allowing developing countries to file patents to protect their traditional knowledge from use by multinational corporations). Because any changes would alter fundamental assumptions about intellectual property right definitions regarding what qualifies for patent protection and jeopardize the determination of patentable subject matter, the developed world and its multinational corporations object to any amendments to the TRIPS (current international intellectual property law system). In short, it is difficult to solve disputes regarding the use of genetic resources between the developed and the developing world as well as the conflicts between the TRIPS and the CBD including the Doha ground negotiations in the near future.

2.4.2 The Patent Cooperation Treaty (PCT) and the Patent Law Treaty (PLT)

In addition to the TRIPS Agreement, which harmonizes world intellectual property laws, there are also two international treaties that harmonize world patent laws – the Patent Cooperation Treaty (PCT) and the Patent Law Treaty (PLT). The TRIPS Agreement emphasizes “substantial” intellectual property requirements and protections, while the PCT and the PLT focus on “procedural” patent applications, processes, and protection. The PCT makes it possible to seek patent protection for an invention in each contracting state simultaneously by filing an “international patent application.” In other words, one may file a patent applica-

363 Id. at 201-02.
364 Onwuekwe & Phillips, supra note 362, at 201.
365 The PCT was formed in 1970 by representatives of patent offices and is open to any country which has joined the Paris Convention. See Adelman et al., supra note 252, at 17.
366 The PLT was adopted in Geneva on June 1, 2000 and is open to member states of WIPO and/or states parties to the Paris Convention for the Protection of Industrial Property. It is also open to certain intergovernmental organizations, and instruments of ratification or accession must be deposited with the Director General of WIPO. The PLT entered into force on April 28, 2005. See World Intellectual Property Organization, About WIPO, Treaties and Contracting Parties: Summary of the Patent Law Treaty (2000), http://www.wipo.int/treaties/en/ip/plt/summary_plt.html (last visited June 26, 2009).
tion in one’s home country’s patent office without also filing patent applications in numerous foreign offices, deferring the huge costs of filing patent applications across countries that include expensive translations.\textsuperscript{368} The intent of the PLT is to harmonize and streamline formal procedures with respect to national and regional patent applications and patents,\textsuperscript{369} such as requirements for obtaining a filing date, formal requirements for national and regional applications, standardized model international forms, simplified procedures before the patent offices, procedures for the avoidance of unintentional loss of substantive rights, and the implementation of electronic filing.\textsuperscript{370}

Both the PCT and the PLT harmonize the procedural regulations of world patent laws and simplify the complicated process of filing patent applications, so applicants (e.g. inventors, researchers, or multinational biotechnology corporations) can reduce their expenses and file patent applications more easily.

Each nation’s laws specify different requirements for patent applications. The patent laws of some nations require applicants to disclose the origin of genetic resources (e.g. the Swedish Patent Legislation)\textsuperscript{371} if the inventions were made using genetic sources. Article 27(1)\textsuperscript{372} of the PCT rules that national laws shall not require the use of different forms other

\textsuperscript{368} Adelman et al., \textit{supra} note 252, at 733-34.


\textsuperscript{371} The Swedish Patent legislation requires that the origin of the genetic resources used in an invention shall be disclosed in patent applications. If the origin is unknown, it should be indicated. The failure to provide this information does not affect the handling of the patent application by the rights conferred by a patent. However, this requirement has any material effects on the validity of granted patents. \textit{See} Convention on Biological Diversity, Information, National Information, Country Profiles: Sweden – Details, http://www.cbd.int/countries/profile.shtml?country=se (last visited Nov. 27, 2009).

than those provided for in the PCT and the Regulations, but Article 27(2) to (7)\textsuperscript{373} of the PCT does not specify any requirement for the disclosure of the origin of genetic resources. Article 27(8)\textsuperscript{374} of the PCT is an exceptional provision of Article 27(1) relating to national security or general economic interests and the disclosure of the origin of genetic resources appears to have no significant relationship to national security or general economic interests.

The PLT also has provisions similar to the PCT. Article 6(1)\textsuperscript{375} of the PLT rules that contracting parties shall not require compliance, or the use of different forms, in addition to the requirements regulated by the PCT, or beyond what is prescribed in the Regulations. Article 3(1)\textsuperscript{376} of the PLT regulates that the provisions of PLT and the Regulations shall apply to national, regional, and international applications for patents on inventions and for patents of addition filed in accordance with the regulations of PCT. The provisions of formal re-


\textsuperscript{374} Article 27(8) of the PCT rules that “Nothing in this Treaty and the Regulations is intended to be construed as limiting the freedom of any Contracting State to apply measures deemed necessary for the preservation of its national security or to limit, for the protection of the general economic interests of that State, the right of its own residents or nationals to file international applications.” \textit{See} World Intellectual Property Organization, IP Services, PATENTSCOPE®, PCT Resources, Legal Texts, Treaty – Patent Cooperation Treaty (PCT): Article 27 National Requirements, \textit{supra} note 372.

\textsuperscript{375} Article 6(1) of the PLT regulates that “[Form or Contents of Application] Except where otherwise provided for by this Treaty, no Contracting Party shall require compliance with any requirement relating to the form or contents of an application different from or additional to:

(i) the requirements relating to form or contents which are provided for in respect of international applications under the Patent Cooperation Treaty;

(ii) the requirements relating to form or contents compliance with which, under the Patent Cooperation Treaty, may be required by the Office of, or acting for, any State party to that Treaty once the processing or examination of an international application, as referred to in Article 23 or 40 of the said Treaty, has started;


\textsuperscript{376} Article 3(1) of the PLT regulates that “(1) [Applications] (a) The provisions of this Treaty and the Regulations shall apply to national and regional applications for patents for invention and for patents of addition, which are filed with or for the Office of a Contracting Party, and which are:

(i) types of applications permitted to be filed as international applications under the Patent Cooperation Treaty;

(ii) divisional applications of the types of applications referred to in item (i), for patents for invention or for patents of addition, as referred to in Article 4G(1) or (2) of the Paris Convention.

(b) Subject to the provisions of the Patent Cooperation Treaty, the provisions of this Treaty and the Regulations shall apply to international applications, for patents for invention and for patents of addition, under the Patent Cooperation Treaty:

(i) in respect of the time limits applicable under Articles 22 and 39(1) of the Patent Cooperation Treaty in the Office of a Contracting Party;

(ii) in respect of any procedure commenced on or after the date on which processing or examination of the international application may start under Article 23 or 40 of that Treaty.” \textit{See} World Intellectual Property Organization, About WIPO, Treaties and Contracting Parties: Patent Law Treaty, \textit{supra} note 375.
quirements: Article 6(1), (2), (4), (5), and Article 8(1) to (4)\textsuperscript{377} of the PLT do not regulate that the contracting party set the requirement for the disclosure of the origin of genetic resources. Article 10(1)\textsuperscript{378} of the PLT regulates that non-compliance with one or more formal patent requirements referred to in Article 6(1), (2), (4), (5), and Article 8(1) to (4) with respect to a patent application may not be a reason for the revocation or invalidation of a patent. Article 10(1) of the PLT provides contracting countries with an optional choice for formal patent requirements, and non-compliance with certain formal patent requirements does not affect the validity of patent.

To sum up, if we adopt the perspective of inventors, researchers, and multinational biotechnology corporations from the developed world, the PCT and the PLT could actually reduce the costs of filing patent applications. If we take the position of the developing world, the PCT and the PLT offer the developing world a new method of applying for patents, because the developing world could file patent applications in the developed world (e.g. U.S., European, or Japan) for inventions made using PGRs and traditional knowledge regarding the use of PGRs. This dissertation argues that the developing world could use such patents to protect economic interests related to PGRs and traditional knowledge concerning PGRs, and this may be a positive approach for the developing world to use to resist “biopiracy” and “bioprospecting.”


\textsuperscript{378} Article 10(1) of the PLT regulates that “[Validity of Patent Not Affected by Non-Compliance with Certain Formal Requirements] Non-compliance with one or more of the formal requirements referred to in Articles 6(1), (2), (4) and (5) and 8(1) to (4) with respect to an application may not be a ground for revocation or invalidation of a patent, either totally or in part, except where the non-compliance with the formal requirement occurred as a result of a fraudulent intention.” See World Intellectual Property Organization, About WIPO, Treaties and Contracting Parties: Patent Law Treaty, \textit{supra} note 375.
2.4.3 The International Convention for the Protection of New Varieties of Plants (UPOV Convention)

Article 27.3(b)\textsuperscript{379} of the 1995 TRIPS Agreement sets up the requirement for the protection of new plant varieties by patents, \textit{sui generis} systems, or combinations thereof for WTO members. The \textit{sui generis} system is the legal regime for Plant Breeders’ Rights (PBR) or Plant Variety Protection (PVP). Article 27.3(b) of the TRIPS Agreement provides a legal foundation that the international community can use to develop an international regime of PBR or PVP. The International Union for the Protection of New Varieties of Plants (UPOV) was established by a number of European countries in 1961.\textsuperscript{380} The International Convention for the Protection of New Varieties of Plants (UPOV Convention) was also adopted in Paris during in 1961.\textsuperscript{381}

UPOV Convention was revised in 1972, 1978, and 1991.\textsuperscript{382} This dissertation will discuss amendments to the UPOV Conventions that were made during 1978 and 1991, because they offer different treatments of “farmers’ exemption (farmers’ rights),” and examine the question of whether or not the unlawful collection of PGRs for the purpose of developing new plant varieties annuls or cancels plant variety certificates issued by UPOV members given the amendments of UPOV Convention 1978 and 1991.\textsuperscript{383} The creation of the UPOV was a catalyst that revived the PBR issue in the U.S.\textsuperscript{384} The PVPA was enacted by Congress

\textsuperscript{379} Article 27.3(b) of the TRIPS Agreement states that “Article 27 Patentable Subject Matter…3. 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 \textit{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.” See WTO | intellectual property (TRIPS) – agreement text – standards, http://www.wto.org/english/tratop_e/trips_e/t_agm3_e.htm (last visited May 30, 2009).


\textsuperscript{382} UPOV – Welcome to the International Union for the Protection of New Varieties of Plants, \textit{supra} note 381.

\textsuperscript{383} See Carvalho, \textit{supra} note 372, at 253-54.

\textsuperscript{384} Kloppenburg, \textit{supra} note 192, at 137.
in 1970 following negotiations between public and private breeders.\footnote{Kloppenburg, \textit{supra} note 192, at 137-39.} As a result, the UPOV Convention and the U.S. PVPA are closely related, and the U.S. PVPA and its legal development has had a serious influence on global PBR and PVP legislation.

\subsection*{2.4.3.1 The International Convention for the Protection of New Varieties of Plants (UPOV Convention) 1978}

The major issue during the UPOV Convention in 1978 was the issue that the UPOV Convention of 1978 indirectly allows “farmers’ exemption (farmers’ rights),”\footnote{Aoki, \textit{supra} note 110, at 65.} which means that farmers have the right to save seeds in order to replant those seeds during the next season on their land without paying royalties. Article 5(1) of the UPOV Convention 1978 states that the PBR is limited and prevents the commercial marketing, offering for sale, and marketing of reproductive material.\footnote{Article 5(1) of the UPOV Convention 1978 regulates that “(1) The effect of the right granted to the breeder is that his prior authorization shall be required for - the production for purposes of commercial marketing - the offering for sale - the marketing of the reproductive or vegetative propagating material, as such, of the variety.” \textit{See} UPOV – Publications: UPOV Convention, http://www.upov.int/en/publications/conventions/ (last visited June 4, 2009). As a result, PBR is limited and only avoid from the above three conditions under the regulations of Article 5(1) of the UPOV Convention 1978.} “Farmers’ exemption (farmers’ rights)” does not include clauses which require prior breeder authorization. In other words, the rules of Article 5(1) of the UPOV Convention 1978 state that farmers are allowed to save seeds for non-commercial purposes.\footnote{From note 218, the regulations of Article 5(1) of the UPOV Convention 1978 express that only three conditions are needed to authorize by breeders: the commercial marketing, offering for sale, and marketing of the reproductive. As a result, farmer-saved seeds are not limited within the regulations of the Article 5(1); thus, farmers are allowed to save seeds for non-commercial purposes.}

On the other hand, multinational biotechnology corporations and researchers in the developed world get blamed for “biopiracy” when they develop new plant varieties after they unlawfully collect PGRs from the developing world or violate the developing world’s nation-
al laws concerning access to PGRs (i.e. the India Biological Diversity Bill, 2002). UPOV members may not expand the grounds for annulling or cancelling plant variety certificates under Article 10(4) of the UPOV Convention 1978, so breeders (e.g. multinational biotechnology corporations and researchers) who develop new plant varieties based on PGRs that were unlawfully collected previously shall not respectively annul or cancel certificates acquired by any UPOV member because breeders failed to follow national laws concerning limitations on access to PGRs.

In short, the UPOV Convention 1978 focuses on “uniformity” and “stability” requirements for the protection of new varieties of plants, such as local varieties which are grown by farmers are considered to be available for open access, because they lack the “uniformity” and “stability” requirements needed for protection.

389 Article 3(1) of the India Biological Diversity Bill, 2002 regulates that “No person referred to in sub-section (2) shall without previous approval of the National Biodiversity Authority obtain any biological resource occurring in India or knowledge associated thereto for research or for commercial utilisation or for bio-survey and bio-utilisation.” See GRAIN, Resources, Biodiversity Rights Legislation (BRL), Biological Diversity Act, http://www.grain.org/brl/?docid=322&lawid=1378 (last visited Nov. 27, 2009).

390 Article 10(4) of the UPOV Convention 1978 states that “…(4) The right of the breeder may not be annulled or become forfeit except on the grounds set out in this Article.” In addition, Article 10(1)-(3) state that the right of the breeder may be annulled or forfeit only if the breeders’ new plant varieties are not eligible for protection; the breeder is longer in a position to provide the competent authority with reproductive or propagating material capable of producing the variety with its characteristics as defined when the protection was granted; breeder does not provide the competent authority with the reproductive or propagating material or does not allow inspection of the measures which have been taken for the maintenance of the variety; breeder has failed to pay within the prescribed period such fees as may be payable to keep his rights in force. Otherwise, if breeder does not violate any conditions, listed in Article 10(1)-(3), the right of the breeder may not be annulled or become forfeit. See UPOV – Publications: UPOV Convention, supra note 387; Carvalho, supra note 372, at 253.

391 See the note 389 of this dissertation.

392 From note 221, we cannot see that breeders have failed to follow the national laws concerning access to PGRs as a condition in Article 10(1)-(3) of the UPOV Convention 1978, which allows for the annulment or cancellation breeders’ plant variety certificates.

393 Article 10(1) regulates “conditions required for plant variety protection” as a condition to annul or forfeit the breeders’ plant variety certificates, except to Article 10(1), Article 6 detail regulates the “conditions required for plant variety protection,” and it shows that an eligible plant variety right is the sources of the right of the breeder. Of course, the breeder cannot enjoy the breeders’ right if his/her plant varieties do not fit the “conditions required for plant variety protection.” See Carvalho, supra note 372, at 253.

394 Aoki, supra note 110, at 65.
2.4.3.2 The International Convention for the Protection of New Varieties of Plants (UPOV Convention) 1991

The primary issue during the UPOV Convention 1991 was the issue of “farmers’ exemption (farmers’ rights).” The UPOV Convention 1991 made “farmers’ exemption (farmers’ rights)” optional for UPOV members\(^{395}\) and curtails “farmers’ exemption (farmers’ rights)”\(^{396}\) because Article 15(2)\(^{397}\) of the UPOV Convention 1991 makes the “farmers’ exemption (farmers’ rights)” optional and allows UPOV members to decide whether or not to expand this exemption (right). Therefore, Article 15(2) of the UPOV Convention 1991 largely limits the rights of farmers to save seeds.

In addition to the amendments concerning “farmers’ exemption (farmers’ rights),” plant breeders’ exemptions were narrowed in Articles 14\(^{398}\) and 15(1)\(^{399}\) of the UPOV Convention

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\(^{395}\) Aoki, supra note 110, at 65.

\(^{396}\) Aoki, supra note 110, at 65.

\(^{397}\) Article 15(2) of the UPOV Convention 1991 states that “…(2) [Optional exception] Notwithstanding Article 14, each Contracting Party may, within reasonable limits and subject to the safeguarding of the legitimate interests of the breeder, restrict the breeder’s right in relation to any variety in order to permit farmers to use for propagating purposes, on their own holdings, the product of the harvest which they have obtained by planting, on their own holdings, the protected variety or a variety covered by Article 14(5)(a)(i) or (ii).” Because this provision is an “Optional Exception,” the UPOV member countries do not make it mandatory to “restrict the breeder’s right in relation to any variety in order to permit farmers to use for propagating purposes.” See UPOV – Publications: UPOV Convention, supra note 387.

\(^{398}\) Article 14(1) of the UPOV Convention 1991 regulates that “…(1) [Acts in respect of the propagating material] (a) Subject to Articles 15 and 16, the following acts in respect of the propagating material of the protected variety shall require the authorization of the breeder:

(i) production or reproduction (multiplication),
(ii) conditioning for the purpose of propagation,
(iii) offering for sale,
(iv) selling or other marketing,
(v) exporting,
(vi) importing,
(vii) stocking for any of the purposes mentioned in (i) to (vi), above.

(b) The breeder may make his authorization subject to conditions and limitations.” Thus, if we compare with Article 5(1) of the UPOV Convention 1978, we can find that it only regulates three conditions that shall require the authorization of the breeder: the commercial marketing, offering for sale, and marketing of the reproductive. However, Article 14(1) of the UPOV Convention 1991 adds another five conditions that require the authorization of the breeder, so plant breeders’ exemptions are narrowed in this provision. Moreover, the rest of the provisions of Article 14 define what constitutes “the protected varieties,” and the scope of “the protected varieties” are broader than the scope defined in Article 5(1) of the UPOV Convention 1978. See UPOV – Publications: UPOV Convention, supra note 387.

\(^{399}\) Article 15(1) of the UPOV Convention 1991 rules that “…(1) [Compulsory exceptions] The breeder’s right shall not extend to

(i) acts done privately and for non-commercial purposes,
1991. “Essentially Derived” varieties cannot be marketed without the original plant breeders’ authorizations.\(^{400}\) Article 35(2)\(^{401}\) of the UPOV Convention 1991 allows members to grant the protection of industrial property, which is contrary to the UPOV Convention 1978.\(^{402}\) In comparison with the UPOV Convention 1978, the UPOV Convention 1991 expands protection for plant breeders and extends industrial property protection to plant varieties.

Does the unlawful collection of PGRs for the purpose of developing new plant varieties constitute a valid reason under the UPOV Convention 1991 for UPOV members to annul or cancel plant variety certificates? Just as with the UPOV Convention 1978, UPOV members may not expand the grounds for annulling or cancelling plant variety certificates under Articles 21(2)\(^{403}\) and 22(2)\(^{404}\) of the UPOV Convention 1991.\(^{405}\) Member nations shall not re-
spectively annul or cancel certificates because breeders fail to follow national genetic laws concerning access to PGRs.406

The UPOV Convention 1991 restricts “farmers’ exemption (farmers’ rights),” expands protection for plant breeders, and extends industrial property protection to plant varieties. As a result, the UPOV Convention 1991 is beneficial for the seed industry, and the seed industry lobbied governments and pressured developing countries to adopt the UPOV Convention 1991 because it offers stronger monopoly rights to breeders and watered-down “farmers’ exemptions (farmers’ rights).”407

2.4.4 The Manila Declaration

Unlike the TRIPS Agreement, the PCT, the PLT, and the UPOV Convention, all of which focus on global intellectual property rights and plant variety protection, the Manila Declaration concerns the ethical utilization of Asian biological resources, and included a Code of Ethics for foreign collectors of biological samples and a “Contract Guideline.”408 The text of the Manila Declaration included three primary principles: first, Asia’s biological resources must be conserved;409 second, local scientists should be involved in flora and fauna research;410 third, any commercial benefits derived from the regional resources must be equitably shared with the Asian region.411

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404 Article 22(2) of the UPOV Convention 1991 regulates that “[Exclusion of other reasons] No breeder’s right shall be cancelled for reasons other than those referred to in paragraph (1).” See UPOV – Publications: UPOV Convention, supra note 387. In short, breeders’ right shall be cancelled for the following reasons: plant varieties are no longer fulfilled the conditions of ‘uniformity’ and ‘stability;’ the breeder does not provide the authority with the information, documents or material deemed necessary for verifying the maintenance of the variety; the breeder fails to pay such fees to keep his right in force; the breeder does not propose, where the denomination of the variety is cancelled after the grant of the right, another suitable denomination.

405 Carvalho, supra note 372, at 253.

406 See Articles 21(2) and 22(2) of the UPOV Convention 1991; Carvalho, supra note 372, at 253-54.

407 Aoki, supra note 110, at 65.

408 See Garson, supra note 37, at 28.

409 See Garson, supra note 37, at 28.

410 See Garson, supra note 37, at 28.

411 See Garson, supra note 37, at 28.
A 1990 meeting of the Asian Coordinating Group for Chemistry stated concerns about the number of Asian plant samples that had been taken overseas. The Seventh Asian Symposium on Medicinal Plants, Spices and Other Natural Products (ASOMPS VII) was held in Manila on February, 1992, and resulted in the Manila Declaration. The Manila Declaration was endorsed by the Bukit Tinggi Declaration on October, 1992, and the principles of the Manila Declaration were incorporated into the CBD. The Manila Declaration was an important initial keystone prior to the CBD, even though the Manila Declaration was a regional, and not a global, declaration.

2.4.5 The Convention on Biological Diversity (CBD)

Just as was the case with the Manila Declaration, the CBD emphasizes the conservation of biological resources rather than intellectual property and plant variety protection. However, the CBD is the first global convention to focus on biodiversity protection, and its influence extends further than the regionally-focused Manila Declaration.

After the “Convention on International Trade in Endangered Species of Wild Fauna and Flora” (CITES) was signed in 1973 for the purpose of protecting global animal species, the CBD was another international agreement which also sought to protect global flora and fauna. The CBD opened to potential signatories during the “Earth Summit” held by the United Nations in Rio de Janeiro in Brazil, and had 193 parties (including the European Community) as of December 2009.

Article 1 of the CBD stated the objectives of CBD as follows: “The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of

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412 See Garson, supra note 37, at 28.
413 See Stoianoff, supra note 40, at 34.
414 See Stoianoff, supra note 40, at 34.
416 Jang, supra note 415.
biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.”

The objectives of the CBD are three-fold: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising out of the utilization of genetic resources. Furthermore, it differs from traditional ideas about biological conservation, which take the humanistic perspective of protecting endangered wild animals by restricting trade, such as the CITES, which does not emphasize the sustainable use of biological components.419

However, most countries that possess abundant genetic resources fail to actively protect their genetic resources.420 If these countries share genetic resources found within their territories with developed countries, receiving benefits for doing so can help them protect their genetic resources.421 The CBD emphasizes the fair and equitable sharing of benefits that arise from the utilization of genetic resources.422 The CBD formally came into effect in 1993. Proposals for mechanisms for obtaining other countries’ genetic resources and the fair and equitable sharing of the benefits arising from the utilization of genetic resources began in 1999.423 The CBD emphasizes three important issues: first, “Material Transfer Agreements” (MTAs); second, enforcement agencies of the CBD; third, inadequate rules regarding patent protection under the CBD.424

Article 16 (2) of the CBD states that “Access to and transfer of technology referred to in

419 Jang, supra note 415.
420 Jang, supra note 415.
421 Jang, supra note 415.
422 Jang, supra note 415.
423 Jang, supra note 415.
424 R. Pistorius argued that “Convention in Rio, citing inadequate protection of IPR.” See Lesser, supra note 27, at 160.
paragraph 1 above to developing countries shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed, and, where necessary, in accordance with the financial mechanism established by Articles 20 and 21.\textsuperscript{425} Such concessional and preferential terms, where mutually agreed upon, are known as MTAs, and MTAs have great influence on the transfer of technology and the allocation and utilization of PGRs between the developed and the developing world. Article 16, Access to, and Transfer of, Technology offers insufficient rules regarding the sharing of benefits with farmers and aborigines. Most of the original owners of PGRs or indigenous knowledge were farmers and aborigines in developing or developed countries. The CBD includes regulations regarding MTAs, but does not offer detailed rules regarding whether the two parties to a particular MTA are “biogenetic corporations from the developed countries” v. “governments of developing or less developed countries” or “biogenetic corporations” v. “those aborigines and farmers” and who actually owns those PGRs? However, if the two parties to an agreement are “biogenetic corporations” v. “governments,” the question is how to transfer the benefits from the governments to the true owners of the PGRs – the aborigines and farmers?

There are three ways of settling disputes regarding the CBD: Negotiations, Meditations, and Arbitrations by the International Court of Justice (ICJ). These rules have no enforcement mechanisms and the CBD has not set up a enforcement agency to deal with such disputes.\textsuperscript{426} The question remains, how will disputes involving the CBD be resolved? If the parties to such disputes do not come under the jurisdiction of the ICJ, how will the ICJ deal with such disputes? If this problem cannot be resolved, how can the CBD administer the world’s PGRs and traditional knowledge regarding the use of PGRs? The CBD focuses on protecting PGRs and traditional knowledge regarding the use of PGRs found in the developing or less devel-

\textsuperscript{425} See Secretarial of the Convention on Biological Diversity, supra note 24.
oped countries. The CBD has not set up a unitary intellectual property law system concerning the world’s PGRs and traditional knowledge regarding the use of PGRs.

### 2.4.6 The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR)

The 2001 ITPGR is another international treaty concerning the utilization of PGRs, and involves regulations concerning ABS regimes regarding the use of PGRs,\(^{427}\) farmers’ rights, the protection of traditional knowledge and farmer know-how concerning PGRs,\(^{428}\) and related issues.

The United Nations Food and Agriculture Organization (FAO) initiated an international round of negotiations in 1994 intended to revise the 1983 IUPGR\(^ {429}\) and to develop another international treaty. Major points include any making this future treaty a legally binding treaty,\(^ {430}\) and harmonizing its provisions with the CBD to the effect that PGRs are national sovereignties.\(^ {431}\) The CBD is significantly at odds with the IUPGR position that PGRs are the common heritage of mankind.\(^ {432}\) 120 countries are parties to the ITPGR.\(^ {433}\)

The regulations of the ITPGR adopt the CBD’s position. PGRs belong to sovereignties. PGRs listed in the Annex I of this treaty are considered to be “Limited Commons.”\(^ {434}\) Two important issues are addressed in the regulations of the ITPGR. First, farmers’ rights: the ITPGR states that “farmers’ rights” involve the right to use, exchange, and sell saved seeds.

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\(^{427}\) The regulations of the ABS regime of using PGRs in the ITPGR include Articles 10-13 (The Multilateral System of ABS). See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24.

\(^{428}\) Aoki, supra note 110, at 86.

\(^{429}\) Aoki, supra note 110, at 86.

\(^{430}\) Aoki, supra note 110, at 86.

\(^{431}\) Aoki, supra note 110, at 86.

\(^{432}\) Aoki, supra note 110, at 86.


\(^{434}\) Aoki, supra note 110, at 89.
both traditional as well as improved varieties, but these rights are subject to national legislation. Although the ITPGR is comprehensive in the treatment of “farmers’ rights,” it has not provided individual farmers and breeders with much to help them implement intellectual property protection. According to the perspective presented by Aoki, the ITPGR does not recognize any rights in the labor by individual farmers and breeders who develop new plant varieties through systemic practices, but institutional public and private breeders enjoy intellectual property protection for their new created plant varieties. Because Article 12.3(d) only limits intellectual property rights applied to PGRs that are in the original “form received from the Multilateral System” on Annex I of the ITPGR, intellectual property rights can be applied to PGRs that are not in the original “form received from the Multilateral System” and are not listed in the Multilateral System on Annex I of the ITPGR. In other words, only institutional public and private breeders have capability to develop new plant varieties that are not in the original “form received from the Multilateral System” and are not listed in the Multilateral System on Annex I of the ITPGR, such as plant varieties, which are modified by individual genes, advance lines, cells, and particular DNA sequences, etc, are eligible for intellectual property protections. However, individual farmers and breeders, who develop new plant varieties through traditional ways (systemic practices), have no capability to develop new plant varieties that are not in the original “form received from the Multilateral System” and are not listed in the Multilateral System on Annex I of the ITPGR.

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435 Aoki, supra note 110, at 86.
436 Aoki, supra note 110, at 86.
437 Aoki, supra note 110, at 90.
438 Aoki, supra note 110, at 90.
439 Aoki, supra note 110, at 89.
440 Aoki, supra note 110, at 89.
441 Article 12.3(d) of the ITPGR regulates that “…d) Recipients shall not claim any intellectual property or other rights that limit the facilitated access to the plant genetic resources for food and agriculture, or their genetic parts or components, in the form received from the Multilateral System;...” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24.
442 Aoki, supra note 110, at 89.
443 Aoki, supra note 110, at 89.
444 Aoki, supra note 110, at 89.
445 Because Article 11.1 of the ITPGR regulates that “In furtherance of the objectives of conservation and sus-
Although the regulations of Article 9 in the ITPGR recognize "farmers’ rights," the regulations of Article 12.3(d) restrict "farmers’ rights" in practice, because individual farmers and breeders have difficulties with intellectual property rights for their new plant varieties produced through traditional ways (systemic practices). As a result, Aoki cited the arguments of Kirit Patel to the effect that “…the ‘in the form received’ language is in tension with the ‘farmers’ rights’ provisions of the ITPGR.”

Second, there is the multilateral system of ABS. The ITPGR set up a multilateral system that facilitates access to PGRs for food and agriculture and the sharing of benefits that arise from the use of these resources in a fair and equitable manner. The multilateral system allows ITPGR parties to receive limited access to PGRs by means of MTAs. This system will include all PGRs for food and agriculture listed in Annex I of the ITPGR. Because the

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446 Article 9 of the ITPGR is “Farmers’ Rights.” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24; Aoki, supra note 110, at 89.

447 See the note 445 of this dissertation.


449 Article 10.2 of the ITPGR regulates that “In the exercise of their sovereign rights, the Contracting Parties agree to establish a multilateral system, which is efficient, effective, and transparent, both to facilitate access to plant genetic resources for food and agriculture, and to share, in a fair and equitable way, the benefits arising from the utilization of these resources, on a complementary and mutually reinforcing basis.” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24. Thus, the ABS regime in the ITPGR is in the multilateral system.

450 Article 12.4 of the ITPGR states that “To this effect, facilitated access, in accordance with Articles 12.2 and 12.3 above, shall be provided pursuant to a standard material transfer agreement (MTA), which shall be adopted by the Governing Body and contain the provisions of Articles 12.3a, d and g, as well as the benefit-sharing provisions set forth in Article 13.2d(ii) and other relevant provisions of this Treaty, and the provision that the recipient of the plant genetic resources for food and agriculture shall require that the conditions of the MTA shall apply to the transfer of plant genetic resources for food and agriculture to another person or entity, as well as to any subsequent transfers of those plant genetic resources for food and agriculture.” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24. In this way, the ITPGR parties will receive limited access to PGRs by the MTAs under the multilateral system.

451 Article 11.2 of the ITPGR states that “The Multilateral System, as identified in Article 11.1, shall include all plant genetic resources for food and agriculture listed in Annex I that are under the management and control of
issues of access and the sharing of benefits related to the use of PGRs under the ITPGR exist in the multilateral system, multinational biological corporations and researchers obtain limited access and must share benefits by means of MTAs if they use the 64 crops and forages listed in Annex I. Another problem with the multilateral system is that the germplasm of crops and forages on Annex I in the original form may not be protected by intellectual property rights, though individual genes, DNA sequences and compounds derived from this germplasm may be eligible for intellectual property rights protection.

The 2001 ITPGR attempts to coordinate the guiding principles of the CBD that PGRs are national sovereignties, protect farmers’ rights, and enhance ABS regimes in the multilateral system. The debates and compromises between the developed and the developing worlds are reflected in the final text of the ITPGR. The ITPGR does not effectively implement the CBD’s principles, farmers’ rights, and ABS regimes. The following section introduces the outcome of these debates and compromises between the developed and the developing worlds – the International “Undertaking” on Plant Genetic Resources (IUPGR) prior to the establishment of the ITPGR.

the Contracting Parties and in the public domain. With a view to achieving the fullest possible coverage of the Multilateral System, the Contracting Parties invite all other holders of the plant genetic resources for food and agriculture listed in Annex I to include these plant genetic resources for food and agriculture in the Multilateral System.” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24. As a result, under the rules of this provision, the multilateral system shall include all plant genetic resources for food and agriculture listed in the Annex I of ITPGR.


Aoki, supra note 110, at 89.

For example, Article 12.3(d) shows why there were debates and compromises in the process of forming the ITPGR. Keith Aoki cites Laurence Helfer’s arguments that the U.S. wanted to strike Article 12.3(d) completely, but developing nations wanted to retain the language of “genetic parts or components.” The U.S. failed to strike this provision and wanted to keep the language of “in the form received” in this provision. Because the U.S. wanted to limit the scope of crops and forages, which recipients from the developed world (multinational corporations or researchers) could apply crops and forages into intellectual property protections are broad, the U.S. wanted to limit the applications of intellectual property protection “in the form received” for 64 crops and forages in the Annex I. On the other hand, developing nations wanted to apply more restrictions to intellectual property rights to 64 crops and forages, so they wanted to extend the limitations to “genetic parts or components” of 64 crops and forages in the Annex I. The final provision kept both languages. See Aoki, supra note 110, at 89.
2.4.7 The International Undertaking on Plant Genetic Resources (IUPGR)

The FAO was a flashpoint for debates between the developed and the developing worlds concerning the exploitation of PGRs during the early 1980s.\(^\text{455}\) We can analyze the debates by examining the development of the 1983 IUPGR. The introduction of FAO Resolution 8/83, the IUPGR, decreased the level of debate among representatives at the FAO 22nd biennial conference in November, 1983.\(^\text{456}\) The final draft adopted was a voluntary “Understanding,” unlike the ITPGR, which was a legally binding “Treaty (Convention).”\(^\text{457}\)

The process of developing the IUPGR involved serious debates between the developed and the developing worlds concerning the notion of what constitutes PGRs – whether or not the concept of PGRs as the common heritage of mankind should expand to include the commodity-form?\(^\text{458}\) The developed and the developing worlds have also debated the International Board for Plant Genetic Resources (IBPGR),\(^\text{459}\) an institution of genetic conservation that was established in 1974.\(^\text{460}\) The IBPGR has an unusual relationship with the FAO.\(^\text{461}\) The IBPGR’s headquarters are located at the FAO’s Rome offices, and the FAO pays the IBPGR’s staff salaries, but the IBPGR has autonomy in setting its own programmatic agenda,\(^\text{462}\) because the IBPGR is an institution of CGIAR,\(^\text{463}\) which was created by the Rockefeller and Ford foundations.\(^\text{464}\) Critics of the IBPGR noted that the IBPGR during the late 1980s had a “distinctly northern flavor,”\(^\text{465}\) and “[o]nly 15 percent of the [germplasm] samples collected [were] designed for storage in Third World collection…[f]ully 85 percent [have] been

\[^\text{455}\] Aoki, supra note 110, at 69.
\[^\text{456}\] Kloppenburg, supra note 192, at 172.
\[^\text{457}\] Kloppenburg, supra note 192, at 172.
\[^\text{458}\] Kloppenburg, supra note 192, at 173.
\[^\text{459}\] Kloppenburg, supra note 192, at 172-73.
\[^\text{460}\] Kloppenburg, supra note 192, at 163.
\[^\text{461}\] Aoki, supra note 110, at 67.
\[^\text{462}\] Aoki, supra note 110, at 67.
\[^\text{463}\] Kloppenburg, supra note 192, at 164.
\[^\text{464}\] Kloppenburg, supra note 192, at 160.
\[^\text{465}\] Aoki, supra note 110, at 67 (quoting Cary Fowler, Unnatural Selection: Technology Politics, and Plant Evolution 184 (1994)).
stored in industrialized countries…”466 Aoki indicated that “delegates from developing countries meet at the 1981 FAO Conference to express their growing discontent with the IBPGR’s tilt toward the U.S. and other countries of the global North and what they saw as a generally unilateral, Northward flow of PGRs.”467 Due to this status quo at the IBPGR, the developing and the developed worlds had debates about the IBPGR’s juridical personality and whether or not the IBPGR should be under the legal auspices of the FAO.468 Three days of heated debate at the 1983 FAO biennial conference failed to narrow these differences of opinion, and the developing world forced, and won, the vote which carried the IUPGR.469

The final IUPGR position was that PGRs (including commodity-form varieties) are the common heritage of mankind, and they came out in favor of free exchange, so the IUPGR was deemed unacceptable to countries with highly developed seed industries, which engage in breeding proprietary crops for commercial sale.470 Ten developed countries, including the U.S., Denmark, Finland, Germany, Netherlands, Norway, Sweden, United Kingdom, and New Zealand, officially indicated that they cannot support the IUPGR, or can do so only with restrictions.471 Virtually all of the non-aligned and developing countries provided an official response expressing “support without restriction” for the adoption of the IUPGR.472 Given that the IUPGR is a non-binding “Understanding,” it has only a limited impact on the regulation of exchange and conservation of PGRs among the FAO member countries, particularly countries in the developed world.

Although the IUPGR position confirms the principle that “germplasm (PGRs) is the common heritage of mankind,” this position is subject to the CBD and the ITPGR, which re-

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466 Aoki, supra note 110, at 67 (quoting Id. at 184).
467 Aoki, supra note 110, at 69.
468 Kloppenburg, supra note 192, at 172-73.
469 Kloppenburg, supra note 192, at 173.
470 Kloppenburg, supra note 192, at 173.
471 Kloppenburg, supra note 192, at 174.
472 Kloppenburg, supra note 192, at 174.
473 Aoki, supra note 110, at 70.
recognizes “national sovereignty” over genetic resources. In fact, the IUPGR is only a voluntarily non-binding “undertaking,” so countries which participate in the IUPGR have no responsibility to adhere to the IUPGR. However, both the CBD and the ITPGR are formal international “treaties,” so contracting parties to the CBD and the ITPGR have the responsibility of enforcing the CBD and the ITPGR. In other words, the current position regarding PGRs in international laws, such as the CBD and ITPGR is that “PGRs are properties of national sovereignties,” but how to effectively conserve PGRs and better implement ABS regimes as regulated in the CBD and the ITPGR is a challenge that each country must face.

2.4.8 The Bonn Guidelines on Access to Genetic Resources and the Fair and Equitable Sharing of the Benefits Arising out of Their Utilization

The Bonn Guidelines on Access to Genetic Resources and the Fair and Equitable Sharing of the Benefits Arising out of Their Utilization was adopted in Decision VI/24 of the Sixth Conference of the Parties (COP VI) in April, 2002. The stated purposes of the Bonn Guidelines are to help contracting parties, governments, and other stakeholders set up domestic statutes, mechanisms, and measures to create ABS regimes as specified Articles 8(j), 10(c),

475 Article 3 of the CBD states that “States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.” In addition, Preamble of the ITPGR states that “…Recognizing that, in the exercise of their sovereign rights over their plant genetic resources for food and agriculture, states may mutually benefit from the creation of an effective multilateral system for facilitated access to a negotiated selection of these resources and for the fair and equitable sharing of the benefits arising from their use; and…” See Secretarial of the Convention on Biological Diversity, supra note 24; Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24. In other words, both the CBD and the ITPGR confirm the position about PGRs that “PGRs are properties of national sovereignty.”
of the CBD and identify the steps involved in setting up ABS regimes regarding the use of genetic resources.479

There are 61 articles in the Bonn Guidelines, and these are divided into five sections and two appendixes.480 These five parts include the “General Provisions,” “Roles and Responsibilities in Access and Benefit-Sharing Pursuant to Article 15 of the Convention on Biological Diversity,” “Participation of Stakeholders,” “Steps in the Access and Benefit-Sharing Process,” “Other Provisions.”481 The two appendixes consist of the “Suggested Elements for Material Transfer Agreements” and “Monetary and Non-Monetary Benefits.”482

Users can obtain genetic resources from providers by obtaining prior informed consent.483 Benefits arising from the use of genetic resources are shared according to MTAs.484 The Bonn Guidelines are voluntary485 for signatories of the CBD. These Guidelines are the same as for the CBD, which cannot force contracting parties to adopt them. In practice, the Conference of the Parties (COP) at its seventh meeting recognized that “the Guidelines are making a useful contribution to the development of national regimes and contractual arrangements for access and benefit-sharing and to the implementation of the objectives of the Convention.”486 Contracting parties to the CBD are encouraged to share their experiences and lessons learned from their implementation of ABS measures, and this is a principle which was recognized in Decision VIII/4 B of the COP during its eighth meeting. These shared ex-

478 Jang, supra note 415.
483 Jang, supra note 415.
484 Jang, supra note 415.
periences and lessons are provided to the Secretariat of the CBD.\footnote{Convention on Biological Diversity, Programmes & Issues, ABS, Implementation: Bonn Guidelines, supra note 476.}

2.4.9 The Cancun Declaration of Like-minded Megadiverse Countries

The Group of Like-Minded Biodiverse Countries (i.e. Brazil, China, Costa Rica, Colombia, Ecuador, India, Indonesia, Kenya, Mexico, Peru, South Africa, and Venezuela) issued the Cancun Declaration of Like-minded Megadiverse Countries on 18 February, 2002 through their Environment Ministers and representatives of the above 12 countries.\footnote{Vogel, supra note 38, at 130.}

The Cancun Declaration of Like-minded Megadiverse Countries related to ABS issues concerning the use of genetic resources – restricting “biopiracy” and “bioprospecting.” There are two parts: first, the exchange of information and harmonization of national laws concerning the protection of biological diversity, and the improvement of access to genetic resources and the distribution of benefits derived from the use of genetic resources.\footnote{Vogel, supra note 38, at 130.}

Second, driving the development of an international regime to promote and safeguard the just and equitable distribution of benefits arising from the use of biological diversity and its components.\footnote{Vogel, supra note 38, at 130.}

\textit{Inter alia}\footnote{See the note 361 of this dissertation.} should be considered under this regime using the following elements – certification of the legal status of biological materials, prior informed consent and mutually agreed upon terms for the transfer of genetic materials as prerequisites for patent applications and issuances, in strict adherence to the “access” conditions granted by the countries of origin of genetic materials.\footnote{Vogel, supra note 38, at 130.}
2.4.10 The Universal Declaration of Human Rights (UDHR)

The primary purpose of the “Universal Declaration of Human Rights (UDHR)” is the protection of human beings. However, the UDHR also regulates the issues of the ownership of PGRs (property rights) and farmer-saved seeds (right to food).

The Article 17 of the UDHR rules that everyone has the right to own property, and that no one shall be deprived of their property.\textsuperscript{493} Property rights are a fundamental human right. A large degree of protection of traditional knowledge concerning the use of PGRs found in the developing world is owned by farmers and indigenous people, and multinational biotechnology corporations cannot use that knowledge without the permission of the owners.

The UDHR also emphasizes the right to food.\textsuperscript{494} If farmers do not have the right to save seeds, farmers could not continue subsistence farming, which would reduce the ability of farmers to provide adequate food for themselves and those who rely on them.\textsuperscript{495} Respecting the ability of farmers to save or sell (exchange) seeds helps protect the universal right to food. The WTO dispute settlement understanding (DSU) can enforce decisions.\textsuperscript{496} The UDHR is similar to the CBD in that it is difficult to enforce.\textsuperscript{497} The UDHR protects property rights and right of farmers to food and indigenous people in the developing world to food. It is simply a ethical declaration for member states of the United Nations (UN) and is not backed up by an enforcement mechanism.

\textsuperscript{493} The Article 17 of the UDHR states that “(1) Everyone has the right to own property alone as well as in association with others. (2) No one shall be arbitrarily deprived of his property.” See United Nations, Documents: The Universal Declaration of Human Rights, http://www.un.org/en/documents/udhr/ (last visited June 6, 2009).
\textsuperscript{495} Id. at 307.
\textsuperscript{496} See Ho, supra note 494, at 309.
\textsuperscript{497} See Ho, supra note 494, at 309.
2.4.11 Declaration on the Rights of Indigenous Peoples

The discussions in section 2.2.2.3.1 showed that traditional knowledge regarding the use of PGRs does not have a fixed certain definition and is not given a great deal of attention on the international level (e.g. regimes or reports).

Article 8(j) of the CBD regulates that “Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices…”

The Declaration on the Rights of Indigenous Peoples has a preface with a similar principle, and states that “Recognizing that respect for indigenous knowledge, cultures and traditional practices contributes to sustainable and equitable development and proper management of the environment…”

The Declaration on the Rights of Indigenous Peoples represent the views and interests of the indigenous peoples of the world. Therefore, the Declaration protects traditional knowledge, and the protection of traditional knowledge does focuses on exclusively the use of PGRs. The Declaration on the Rights of Indigenous Peoples is a formal international regime for indigenous peoples’ rights that also protects traditional knowledge.

500 These are quoted from the Chair of the International Indigenous Peoples’ Caucus, Les Malezer’s words, welcomed the adoption of the Declaration in a statement to the General Assembly. See International Work Group for Indigenous Affairs: Declaration on the Rights of Indigenous Peoples, supra note 242.
CHAPTER 3 - HOW TO VIEW THE “BIOPIRACY” AND “BIOPROSPECTING”
DEBATES IN THE TWENTY-FIRST CENTURY?

The above introduction to theoretical discussions of “biopiracy,” “bioprospecting,” and international legal regimes aids our understanding of issues regarding conflicts between the conservation of biological diversity\(^\text{501}\) and intellectual property rights (the commercial use of biological diversity).\(^\text{502}\) Conflicts about issues concerning PGRs and traditional knowledge about the use of PGRs are trans-national and important in the 21st century.

This chapter has four parts – First, conflicts regarding the conservation of biological diversity and intellectual property rights need to be examined using the new method in the twenty-first century. Second, the benefits of trade (technology transfer or change) are based on the economic perspective. Third, the global recession impacts R&D investments in the biotechnology industry. Fourth, an alternative method of analyzing legal issues conserving PGRs and traditional knowledge about the use of PGRs using the empirical methods in law method to analyze issues concerning PGRs and traditional knowledge regarding the use of PGRs and propose new solutions to these controversies. This chapter explains how the empirical methods in law method can be used to resolve the controversies concerning PGRs and traditional knowledge regarding the use of PGRs.

\(^{501}\) For example, the main purpose of the CBD is the conservation of biological diversity, but the CBD rarely emphasizes commercial profits arising from intellectual property rights.

\(^{502}\) Article 27.3(b) of the WTO TRIPS Agreement attempts to provide a legal foundation for global \textit{sui generis} protection (PBR or PVP) of new plant varieties for members of the WTO. Although the legal effect of PBR or PVP is not stronger than the legal effect of Plant Patent, this provision of the TRIPS Agreement actually provides a legal foundation for multinational biotechnology corporations to enforce the PBR or PVP of their new plant varieties. In short, the objectives of the TRIPS or other international intellectual property conventions conflict with the objectives of the CBD.
3.1 ANALYZING THE CONFLICTS REGARDING THE CONSERVATION OF BIOLOGICAL DIVERSITY AND INTELLECTUAL PROPERTY RIGHTS USING A NEW METHOD

Chapter 15 of Agenda 21\textsuperscript{503} is an action plan for the 21st century adopted by the United Nations Earth Summit that resulted in the creation of the CBD in 1992.\textsuperscript{504} It concerns the conservation of biological diversity and the sustainable use of biological resources (including PGRs).\textsuperscript{505} Agenda 21 noted that the world’s biological diversity has continued to be lost and destroyed, and that biological resources constitute a capital asset that yield sustainable benefits.\textsuperscript{506} Urgent national and international actions are needed to conserve and protect biological diversity and the sustainable use of biological resources.\textsuperscript{507}

On the other hand, the action plan in Chapter 15 of Agenda 21 has been challenged by the development of biotechnology industry. The current era is the “Biotech Century”\textsuperscript{508} in which the genetic engineering industrial revolution allows for the manipulation and engineering of life forms on the genetic level.\textsuperscript{509} The developing world accuses the developed world and its multinational biotechnology corporations of plundering biological resources (including PGRs) along with related traditional knowledge and filing various forms of intellectual property protection (especially patents) on these resources and knowledge.\textsuperscript{510} The developed world and its multinational corporations believe that they are making proper use of those resources and knowledge, which thereby allows more people to use them.\textsuperscript{511} Filing for
intellectual property protection (especially patents) on biological resources and related traditional knowledge from the developed world and its multinational corporations has resulted in the additions to the economic value of resources and knowledge.\textsuperscript{512}

Corporations, including multinational biotechnology corporations in the developed world, pursue the goal of “profit maximization.”\textsuperscript{513} Intellectual property protection both relates to the economic value of biological resources and traditional knowledge and also concerns global trade. The WTO Uruguay Round Negotiation from 1986 to 1994 created the TRIPS Agreement, which extended intellectual property protection and enforced corporate intellectual property rights around the world.\textsuperscript{514} The extension of intellectual property rights in global trade through the TRIPS Agreement potentially conflicts with the objectives\textsuperscript{515} of the CBD and Chapter 15 of Agenda 21 – the sustainable use of biological resources (including related traditional knowledge\textsuperscript{516}) and the equitable sharing of benefits derived from the utilization of these resources. The former agreement emphasizes the economic value arising from intellectual property protection related to the use of biological resources and related traditional knowledge, while the latter convention focuses on the sustainable use of biological resources, rather than commercial benefits. These agreements have the potential to be harmonized, but the process will be difficult, and has the potential for conflict.

Conflicts between the developed and the developing worlds concerning the use of PGRs

\textsuperscript{513} Mao et al., \textit{supra} note 19, at 86.
\textsuperscript{514} WTO | Understanding the WTO – Intellectual property: protection and enforcement, \textit{supra} note 352.
\textsuperscript{515} The three objectives of the CBD include: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising out of the utilization of genetic resources. \textit{See} Secretarial of the Convention on Biological Diversity, \textit{supra} note 24.
\textsuperscript{516} Article 8(j) of the CBD regulates that “Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices;...” \textit{See} Secretarial of the Convention on Biological Diversity, \textit{supra} note 24. As a result, the CBD parties’ national legislation should respect, preserve, and maintain traditional knowledge, which is relevant to the conservation and sustainable use of biological diversity.
began in the twentieth century and continue to the present day. These conflicts become serious when intellectual property rights were used to protect PGRs, and these conflicts enlarged as a result of the controversies regarding the conservation of biological diversity and intellectual property rights (the commercial use of biological diversity). Theoretical discussions have not helped to resolve the conflicts concerning the issues of “biopiracy” and “bioprospecting.” This dissertation will not oversimplify these issues and uses empirical studies to analyze controversies related to “biopiracy” and “bioprospecting.”

3.2 ANALYZING THE BENEFITS OF TRADE (TECHNOLOGY TRANSFER OR CHANGE) USING THE ECONOMIC PERSPECTIVE

The issue of the sharing of benefits derived from PGRs remains controversial. The developing world accuses corporations of not paying compensation (benefit-sharing) for the use of their PGRs and traditional knowledge regarding the use of PGRs. The discussions in section 2.2.1.2.2 showed that multinational corporations are unwilling to share benefits with the developing world because their cost and benefit analyses showed that doing so was not profitable. Benefit-sharing includes monetary benefit-sharing and non-monetary bene-

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517 For example, Brazil restricted the exports of rubber since the “Industrial Revolution” began in 1789, which resulted in the increased use of rubber. In addition, Malaysia, Thailand, and Indonesia restricted the availability of fruit varieties. Ecuador restricted cocoa, and Taiwan held back on sugarcane varieties, and these phenomena were called “seed wars,” which were written by the Bill Paul’s report in the Wall Street Journal in 1984. See the notes 94-95 of this dissertation.

518 In 1930, the U.S. enacted the Plant Patent Act (PPA), which protects asexually reproduced plants. Then, the U.S. enacted the Plant Variety Protection Act (PVPA) in 1970, which protects sexually reproduced plants. The U.S. Supreme Court held that living things can be protected by utility patents. In particular, intellectual property for plants has been expanded through the Trade Related Aspects of Intellectual Property Rights Agreement (TRIPS) since 1995 and the International Convention for the Protection of New Varieties of Plants (UPOV) since 1968. See the discussions of 2.2.2.1.4 of this dissertation; WTO | intellectual property – overview of the TRIPS Agreement, supra note 355; UPOV – Welcome to the International Union for the Protection of New Varieties of Plants, supra note 381.

519 Professor Keith Aoki from the University of California, Davis King Hall School of Law wrote and published the book: “Seed Wars” on January, 2008, and its texts not only discuss current cases on PGRs and intellectual property, but also study the controversies between the developed and the developing world. As a result, we can understand why the book is called “Seed Wars” based on the discussions about the controversies of using PGRs between the developed and the developing world in the texts. See the note 110 of this dissertation.
Multinational corporations are unwilling to share non-monetary benefits, such as jointly owned intellectual property rights, and are similarly unwilling to provide technology equipment, or new plant varieties to the developing world.

Is non-monetary benefit-sharing good policy? Using Lesser’s method – “Production Possibility Curves (PPC)” – to analyze the non-monetary sharing (technology transfer or change) initially requires understanding the definition of technology. Peterson and Hayami defined technology as “the phenomena of input quality improvements or an increase in knowledge leading to an increase in output per unit of input…”. This means more output while using the same level of inputs, and this can be represented as the outward shift of the PPC, because a PPC for two products indicates the maximum production of the two prod-

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520 46 of the “Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization” regulates that “Examples of monetary and non-monetary benefits are provided in appendix II to these Guidelines.” Convention on Biological Diversity, Programmes & Issues, ABS, Implementation: Bonn Guidelines: download the brochure, supra note 480.

521 Kate & Laird, supra note 64, at 215-16.

522 Revised from Figure 8.1, in Lesser, supra note 27, at 141.

523 See Lesser, supra note 27, at 140-46.

524 See Lesser, supra note 27, at 140-41.

525 See Lesser, supra note 27, at 141.

526 See Lesser, supra note 27, at 141.
Technology transfer or change is represented by the outward shift from A1 to A2 in Figure 3.1. As a result, non-monetary benefit-sharing (technology transfer or change) is beneficial for both countries.

Technology transfer or change is a kind of trade based on trade theories of comparative advantage, which help to explain why technologies are needed from abroad as opposed to being locally developed. It is necessary to consider two other economic factors: the national indifference curve and the international commodity terms of trade (ITT) when analyzing the PPC concerning non-monetary sharing (technology transfer or change). Figure 3.2 (a) shows that without trade (technology transfer or change), country A’s citizens must be satisfied with the combinations of products along the PPC, because point C is the point of tangency for the national indifference curve, II, for food output/benefits, technology, and country A is more efficient at food output/benefits, so one unit of food output/benefits would have to be sacrificed to change a unit of technology, because its ITT, SS, is placid.

In Figure 3.3 (a), without trade (technology transfer or change), country B’s citizens must be satisfied with the combinations of products along the PPC. Point D is the point of tangency for the national indifference curve, I’I’, for food output/benefits and technology. However, country B is more efficient at sacrifices in order to change one unit of food output/benefits than at producing one unit of technology, food output/benefits, because its ITT, S’S’, is steep.

Moreover, if country A begins to trade (technology transfer or change), its ITT will become the model of country B’s ITT, S’S’, as shown in Figure 3.2 (b). The PPC will become S’S’ so that the indifference curve is tangent at C’. As C’ indicates more technology will

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527 See Lesser, supra note 27, at 141.
528 See Lesser, supra note 27, at 141.
529 See Lesser, supra note 27, at 143.
530 See Lesser, supra note 27, at 143.
531 See Lesser, supra note 27, at 144.
532 See Lesser, supra note 27, at 144.
transfer or change, and there will also be more food output. Therefore, benefits will increase in comparison to C. Country A typically benefits from trade (technology transfer or change). On the other hand, if country B increases its trade (technology transfer or change) and thus enhances its food production and benefits, its ITT will become the model for country A’s ITT, SS, as shown in Figure 3.3 (b). The PPC will change to S’S’ that such the indifference curve is tangent at D’. This indicates that, in comparison with D, trade increases the technology transfer or change, and the amount of food output and benefits. As a result, country B also benefits from trade (technology transfer or change).

Figure 3.2  The Variations of Production Possibility Curves (PPC) for Country A in Food Outputs and Benefits from the Trade Case of Absolute Specialization

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533 See Lesser, supra note 27, at 141.
534 See Lesser, supra note 27, at 141.
535 Revised from Figure 8.2-4, in Lesser, supra note 27, at 143-144.
If we see country A as a developed country, the effects of trade (technology transfer or change) decrease the risks of selling products in its market and increases its food productions and benefits.\textsuperscript{537} In addition, if we see country B as a developing country, through the regime of trade (technology transfer or change), its food outputs and benefits will increase through exchange technology transfer.\textsuperscript{538}

Thus, the trade (technology transfer or change) of the developed and the developing worlds are beneficial for their food outputs and monetary-benefits. Using the analytical method of economic “PPC” shows that multinational corporations from the developed world should be willing to transfer technology. This dissertation seeks to pursue fair and efficient legal policies for the use of PGRs and traditional knowledge regarding the use of PGRs, and the analysis of “PPC” indicates that the non-monetary benefit-sharing (technology transfer or change) fits the definition of “Pareto Efficiency,” which makes it “impossible to make at least

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure3.3.png}
\caption{The Variations of Production Possibility Curves (PPC) for Country B in Food Outputs and Benefits from the Trade Case of Absolute Specialization\textsuperscript{536}}
\end{figure}

\textsuperscript{536} Id.
\textsuperscript{537} See Lesser, supra note 27, at 141.
\textsuperscript{538} See Lesser, supra note 27, at 141.
one person better off without making another person worse off.” Therefore, adopting non-monetary benefit-sharing is an efficient policy-making (legal practice) for developed and developing countries even though we cannot assure that adopting the non-monetary benefit-sharing is a fair policy-making (legal practice) for developed and developing countries. In addition to the analysis of “PPC” for the technology transfer or change (non-monetary benefit-sharing), Chapter 4 will provide the empirical research that will help prove and interpret the advantages of non-monetary benefit-sharing.

3.3 THE IMPACT OF THE GLOBAL RECESSION ON BIOTECHNOLOGY INDUSTRY RESEARCH AND DEVELOPMENT (R&D) INVESTMENTS

A global recession began in 2008, and many areas of business have been influenced by this, including R&D investments in the biotechnology industry. R&D investments influence the development of new medicines by global biotechnology corporations, GM seeds and other plant products, and the spending of corporations involved in “bioprospecting” or the exploitation of PGRs outside of their home countries. As a result, the challenges presented by the current global recession that relate to biotechnology corporations involved in “bioprospecting” are worthy of examination.

The report of EurActiv indicated that the current global credit crunch could reduce investment in biotechnology research and delay new medical discoveries. R&D investments by European businesses have grown and surpassed those of the U.S. during 2007, but drug development by pharmaceutical corporations has been “hit by the credit crunch.” Large corporations have laid off research staff and shut down research units.

539 Cooter & Ulen, supra note 19, at 17.
541 EurActiv.com, Financial crisis expected to slow R&D investment, supra note 540.
542 EurActiv.com, Financial crisis expected to slow R&D investment, supra note 540.
543 EurActiv.com, Financial crisis expected to slow R&D investment, supra note 540.
The U.S. biotechnology industry has been severely impacted by the recession. A *Wall Street Journal* report by Jeanne Whalen and Ron Winslow stated that the financial crunch has shaken the global biotechnology industry, and cash-poor U.S. corporations have cut research on new medicines, reduced the number of high-technology jobs, and sought protection from creditors. Venture capitalists scaled back their investments in biotechnology corporations, and public stock offerings and bank loans dried up during the economic recession. The biotechnology industry is heavily reliant on functioning capital markets for the financing of R&D, particularly small U.S. biotechnology corporations. Due to the lack of funding, such corporations have insufficient funds to carry out human trials of new medicines and have even given up research on new medicines.

In the near future, the economic recession will both result in the shrinkage of R&D investment in the biotechnology industry, and force biotechnology corporations to cut, or give up on, plans for “bioprospecting” for new varieties of PGRs outside their home countries to help them develop new medicines. The controversies regarding “biopiracy” and “bioprospecting” are likely to be solved during the 21st century due to the impact of the global recession on biotechnology corporations. This dissertation argues that this trend will impact future research regarding the utilization of PGRs.

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545 WSJ.com, Cash-Poor Biotech Firms Cut Research, Seek Aid, *supra* note 544.
546 WSJ.com, Cash-Poor Biotech Firms Cut Research, Seek Aid, *supra* note 544.
547 This opinion is from Jim Greenwood, the president and chief executive officer of Biotechnology Industry Organization (BIO). See WSJ.com, Cash-Poor Biotech Firms Cut Research, Seek Aid, *supra* note 544.
548 WSJ.com, Cash-Poor Biotech Firms Cut Research, Seek Aid, *supra* note 544.
549 This report took the Oramed Pharmaceuticals Inc., which is based in Jerusalem as an example. Oramed Pharmaceuticals Inc. needs $25 million to carry out human trials of an oral form of insulin. It sold stock and asked large drug corporations and other foreign investors for cash in exchange for some eventual revenue in markets should the drug gain regulatory approval for sale. Furthermore, the Cytokinetics Ins. of South San Francisco gave up on some types of research. It cut its work force by 29% and jettisoned cancer research to focus on a drug for heart failure. See WSJ.com, Cash-Poor Biotech Firms Cut Research, Seek Aid, *supra* note 544.
3.4 USING EMPIRICAL METHODS IN LAW TO ANALYZE LEGAL ISSUES CONCERNING PLANT GENETIC RESOURCES (PGRs) AND TRADITIONAL KNOWLEDGE ABOUT THE USE OF PLANT GENETIC RESOURCES (PGRs)

This dissertation proposes an alternative method of analyzing PGRs – related issues – Empirical Methods in Law. Empirical Research includes “Quantitative Research” and “Qualitative Research.” On the other hand, “Qualitative Research” concerns the collection and analysis of information in non-numerical data formats. It focuses on exploring, in as much detail as possible, small numbers of examples which are of interest and aims to achieve “depth” rather than “breadth.”

During the 1960s, the traditional dominance of “Quantitative Research” began to face challenges. This was accompanied by substantial growth in the use of “Qualitative Research,” which produced a split among researchers and engendered debates about “Quantitative Research” vs. “Qualitative Research.”

This dissertation does not attempt to discuss challenges to “Quantitative Research” or analyze debates about the relative merits of “Quantitative Research” vs. “Qualitative Research.” It simply adopts “Quantitative Research” for use in “Empirical Methods.” This dissertation is a global study regarding how to develop fair and efficient legal guidelines about the use of PGRs (and traditional knowledge regarding PGRs). It will examine various kinds of numerical data from member countries of the CBD or the ITPGR (i.e. the variables of ma-
croeconomic, intellectual property laws, or agriculture, etc). This dissertation will use regression analysis in order to understand certain phenomena: first, which variables influence the adoption of ABS regimes (e.g. law or policy) by member countries of the CBD and the ITPGR; second, the relationships between the adoption of ABS regimes by member countries and other variables; third, the current implementation of ABS regimes by member countries under the CBD or the ITPGR. This dissertation will propose tangible recommendations regarding how to enhance the adoption of ABS regimes. This dissertation will examine the “Draft of the Genetic Resources Act of Taiwan” to determine whether the provisions could help conserve biological resources and enhance the fair and equitable sharing of benefits that arises from the utilization of PGRs (and traditional knowledge regarding the use of PGRs) in Taiwan.

This dissertation does not use “Qualitative Research,” because the scope of research is so broad (193 countries) that it is not possible to interview or make observations due to restrictions on time and money. This dissertation argues that using “Quantitative Research” for “Empirical Method” regression analysis is a persuasive way to uncover new research findings that superior to traditional discussions that utilize “citation analysis” with respect to issues such as “biopiracy,” “bioprospecting,” and the utilization of PGRs (and traditional knowledge regarding the use of PGRs).
CHAPTER 4 - AN EMPIRICAL STUDY OF ACCESS AND BENEFIT-SHARING
LAWS AND POLICIES CONCERNING PLANT GENETIC RESOURCES (PGRs)
AND TRADITIONAL KNOWLEDGE REGARDING THE USE OF PLANT GENETIC
RESOURCES BY SELECTED PARTIES TO THE CONVENTION ON BIOLOGICAL
DIVERSITY (CBD) AND THE INTERNATIONAL TREATY ON PLANT GENETIC
RESOURCES FOR FOOD AND AGRICULTURE (ITPGR)

“Quantitative Research” is an “Empirical Method” that is used as the primary research
method in this dissertation for the purpose of analyzing legal issues regarding the fair and ef-
cient use of PGRs – Access and Benefit-Sharing Regimes (ABS).

This Chapter has five sections concerning empirical studies of this topic. The first sec-
tion is “Literature Review of the Access and Benefit-Sharing Laws and Policies of Plant Ge-
etic Resources (PGRs),” which is an overview of existing research literature about ABS re-
gimes. The second section is “An Examination of the Current Access and Benefit-Sharing
Laws and Policies (ABS) of the World,” which examines the current implementation of ABS
regimes by parties to the CBD or the ITPGR and each country’s participation in the CBD or
the ITPGR. The third section is “Empirical Research on the Current Access and Benefit-
Sharing (ABS) Laws and Policies of the World,” which consists of regression analyses
about data (variables) related to the adoption of ABS regimes by 194 parties to the CBD or
the ITPGR (e.g. intellectual property laws, macroeconomic, or agriculture, etc). This disserta-
tion will compare different regression analysis outcomes for 194 countries in the developed
and the developing worlds. This dissertation will use the results of regression analyses to
present research findings and propose recommendations and suggestions regarding the cur-
rent implementation of national ABS regimes.
4.1 LITERATURE REVIEW REGARDING ACCESS AND BENEFIT-SHARING LAWS AND POLICIES OF PLANT GENETIC RESOURCES (PGRs) AND TRADITIONAL KNOWLEDGE REGARDING THE USE OF PLANT GENETIC RESOURCES (PGRs)

The existing literature has primarily focused on theoretical discussions and case studies rather than on conducting empirical research. The literature review in this section will first introduce the current literature concerning theoretical discussions and case studies related to ABS regimes and will then discuss the existing literature regarding empirical research about ABS regimes.

Ikechi Mgbeoji argued that the ABS regime of the CBD is a jurisprudence, which allows “South” countries to balance the *ancien regime* “winner-take-all” situation. The present situation is that “North” countries are free to appropriate and profit from the PGRs of “South” countries, while “South” countries often derive no benefit from their own PGRs. CBD is thus the regime that attempts to allow for the sharing of benefits derived from PGRs transferred from “North” to “South.” Lesser introduced the notion of benefit-sharing into the scope of “Access Legislation” under the Article 15(1) of the CBD, and compares the legislation of eight countries and the Andean Community. Lesser discussed

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557 The author does not define “jurisprudence” in the book, and the meanings of “jurisprudence” include: 1. a. Knowledge of or skill in law; b. The science which treats of human laws (written or unwritten) in general; the philosophy of law; 2. A system or body of law; a legal system if we look up the Oxford English Dictionary. However, the original language in author’s book is that “The CBD has also contributed to jurisprudence of plant life forms by creating a regime for fair and equitable sharing of the benefits of plants,” so “jurisprudence” should be “a system or body of law; a legal system.” See Oxford English Dictionary – jurisprudence, available at: http://dictionary.oed.com.proxy2.library.uiuc.edu/cgi/entry/50124819?single=1&query_type=word&queryword=jurisprudence&first=1&max_to_show=10; Mgbeoji, supra note 44, at 83.

558 The author does not define “*ancien regime*” in the book, and the Oxford English Dictionary defines “*ancien, or old, regime* (tr. F. *l’ancien régime*)” as “the system of government in France before the Revolution of 1789. Also transf., the old system or style of things.” As a result, “*ancien regime*” is “the old system or style of things.” See Oxford English Dictionary – régime, regime, available at: http://dictionary.oed.com.proxy2.library.uiuc.edu/cgi/entry/50201208; Mgbeoji, supra note 44, at 83.

559 See Mgbeoji, supra note 44, at 83.

560 See Mgbeoji, supra note 44, at 83.

561 See Lesser, supra note 27, at 47.
the protection of traditional knowledge, but did not discuss which issues related to traditional knowledge under Article 8(j) of the CBD.\textsuperscript{562}

David Castle and Richard Gold introduced the idea that ABS is related to traditional knowledge, and argued that benefit sharing is a mechanism not for compensatory justice, but rather for the achievement of distributive justice or the satisfaction of international human rights law based on the theories of Rawls, Beitz, and Pogge\textsuperscript{563} and two international conventions – the \textit{Universal Declaration of Human Rights} and the \textit{International Covenant on Economic, Social and Cultural Rights}.\textsuperscript{564} They also argued that multilateral organizations are a useful framework for conducting distributive justice, and that the WTO is a potential useful organization for negotiating distributive justice.\textsuperscript{565} Nuno Pires de Carvalho argued that the “unclean hands” doctrine promotes benefit sharing because patent owners presently use the courts’ authority to collect revenues from infringers and maintain their position as exclusive users of inventions in the markets by means of injunctions.\textsuperscript{566} Because courts refuse to file injunctions until patent owners clean their hands,\textsuperscript{567} patent owners had no choice but to seek settlements with the suppliers of genetic resources and licensors associated with traditional knowledge.\textsuperscript{568}

Joseph Henry Vogel used economic theories to analyze ABS issues concerning the use

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{562} See Lesser, \textit{supra} note 27, at 113-35.
\item \textsuperscript{563} David Castle & E. Richard Gold, \textit{Traditional Knowledge and Benefit Sharing: From Compensation to Transaction, in Accessing and Sharing the Benefits of the Genomics Revolution} 65, 75 (Peter W.B. Phillips & Chika B. Onwuekwe eds., 2007).
\item \textsuperscript{564} Id. at 75.
\item \textsuperscript{565} See Castle & Gold, \textit{supra} note 563, at 77.
\item \textsuperscript{566} See Carvalho, \textit{supra} note 372, at 256.
\item \textsuperscript{567} The doctrine that is applied to “patent owners to the effect that they ‘clean their hands’” is the “unclean hand doctrine.” The “unclean hand doctrine” is “the principle that a party cannot seek equitable relief or assert an equitable defense if that party has violated an equitable principle, such as good faith.” Furthermore, patent owners (multinational biotechnology corporations) cannot use court authority to collect revenue from an infringer and/or to maintain its position as exclusive user of the invention in the market by means of an injunction. For example, multinational biotechnology corporations cannot use the courts to protect inventions derived from PGRs or traditional knowledge about the use of PGRs if these corporations bio-pirate or plunder PGRs or traditional knowledge or do not share benefits with the source countries of PGRs or traditional knowledge from the developing world. If this situation happens, patent owners had no choice but to seek settlements with the suppliers of genetic resources and licensors associated with traditional knowledge. See Black’s Law Dictionary 268 (8th ed. 2007); Carvalho, \textit{supra} note 372, at 256.
\item \textsuperscript{568} See Carvalho, \textit{supra} note 372, at 256.
\end{itemize}
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of PGRs and traditional knowledge regarding the use of PGRs. Vogel argued that competition will drive prices down to the marginal cost, a concept that is the central idea of neoclassical economics, so biodiverse countries face problems similar to those that the music industry faced with respect to piracy as a result of the low cost of sample collection. The sovereignty granted each country over its genetic resources through the CBD has morphed “biopiracy” – free access, the biofraud of MTAs – down to the level of cheap access. Vogel argued that with so much genetic information and so many species diffused across species and international boundaries, “competition to capture an MTA is fierce.” He indicated that biotechnology industry spokespersons respond that only those who create information, which is “novel, non-obvious, and useful” are rewarded, and the great bulk of artificial information is free. This response seems to be saying that “we will only reward natural information that is ‘novel, non-obvious, and useful’” through the lens of economic theory. After solving the environmental problem of survival in its ecological niche, the metabolites and genes of any species are “useful and non-obvious,” but this same evolutionary reasoning means that they are not “novel – every living thing has been evolving as long as everything else.” Novelty makes sense and it lacks of diffusion of information. Vogel indicated that endemic species and those threatened with extinction would be novel information worthy of an oligopoly, while pandemic species and those not facing extinction would be non-novel.

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569 See Vogel, supra note 38, at 115.
570 Id. at 124.
571 Id. at 124.
572 Id. at 124.
573 Id. at 124.
574 Id. at 124.
575 Id. at 124.
576 Id. at 124.
577 Id. at 124.
578 The author does not define “endemic” in his article, and “endemic” is “a plant native to a certain limited area” if we see the contexts of original article and check the Oxford English Dictionary. See Oxford English Dictionary – endemic, available at http://dictionary.oed.com.proxy2.library.uiuc.edu/cgi/entry/50074929?single=1&query_type=word&queryword=endemic&first=1&max_to_show=10; Vogel, supra note 38, at 124.
579 See Vogel, supra note 38, at 124.
580 The author does not define “pandemic” in his article, and “pandemic” is “gen. Freq. depreciative. General, universal, widespread” if we check the Oxford English Dictionary. As a result, pandemic species are universal or widespread species, and the author indicates here are plant species if we see the context of his article. See Ox-
public-domain knowledge, and should be free.\textsuperscript{579} This tacit analogy has emerged “in the negotiation of all MTAs where one meager royalty rate is scheduled for pandemics and another, much higher rate is scheduled, for endemics.”\textsuperscript{580} He also applied the economic theory of “excess burden” to the ABS regime and economic decisions regarding R&D for the biotechnology industry.\textsuperscript{581} If a tax instrument applies to genetic resources in the biotechnology industry, this would entail distortions and excess burdens.\textsuperscript{582} He thought that the solution is “lump sum taxes.”\textsuperscript{583} In this manner, governments can raise needed funds, without distorting economic decisions regarding investments in R&D.\textsuperscript{584} Vogel criticized the existing literature as promoting “bioprospecting” in order to increase capital-building, which ignores the opportunity costs of highly qualified individuals.\textsuperscript{585} He criticized that the existing literature because it neglects the brain drain problem. Multinational industries will identify a hard-working, but poor, natural product chemistry professor in the developing world\textsuperscript{586} and entice that professor to lobby Ministries of the Environment and obtain the “prior informed consent” required for MTAs.\textsuperscript{578} He also criticized the “win-win strategies”\textsuperscript{588} in the current ABS literature because the developing world gets only outdated lab equipment in return (benefit-sharing) from the developed world.\textsuperscript{589}

Jorge Cabrera Medaglia examined the implications of ABS in Costa Rica.\textsuperscript{590} Anil Gupta examined the ABS regime in India and wrote that there are four types of benefits mediated in

\footnotesize{\textit{ford English Dictionary – pandemic, available at}
http://dictionary.oed.com.proxy2.library.uiuc.edu/cgi/entry/50170215?single=1&query_type=word&queryword=pandemic&first=1&max_to_show=10; Vogel, \textit{supra} note 38, at 124.}

\textsuperscript{579} Id. at 124.
\textsuperscript{580} Id. at 125.
\textsuperscript{581} Id. at 125.
\textsuperscript{582} Id. at 125.
\textsuperscript{583} Id. at 125.
\textsuperscript{584} Id. at 125.
\textsuperscript{585} Id. at 125.
\textsuperscript{586} Id. at 126.
\textsuperscript{587} Id. at 126.
\textsuperscript{588} Id. at 126.
\textsuperscript{589} Id. at 126.
\textsuperscript{590} Jorge Cabrera Medaglia, \textit{Bioprocessing Partnerships in Practice: A Decade of Experiences at INBio in Costa Rica, in Accessing and Sharing the Benefits of the Genomics Revolution} 183, 188-90 (Peter W.B. Phillips & Chika B. Onwuekwe eds., 2007).}
the National Innovation Foundation (NIF) of India: monetary-individual (MI), monetary-collective (MC), non-monetary-individual (NMI), and non-monetary-collective (NMC).\(^{591}\) Gupta introduced two categories of benefit-sharing arrangements: Monetary benefits and Non-monetary benefits\(^{592}\) and analyzed their requirements and implications. Joshua Rosenthal examined the process of negotiating agreements about benefit sharing in the MAYA ICBG.\(^{593}\) Susan Perkoff Bass and Manuel Ruiz Muller’s book, *Protecting Biodiversity: National Laws Regulating Access to Genetic Resources in the Americas*, and compared the biodiversity legislation of seven countries in the Americas, including the ABS legislation.\(^{594}\) Andrew Mushita and Carol Thompson’s book, *Biopiracy of Biodiversity: Global Exchange as Enclosure*, introduced ABS regimes related to the CBD,\(^{595}\) the ITPGR,\(^{596}\) the International Commission on Plant Genetic Resources,\(^{597}\) the United Nations Conference on the Law of the Sea (UNCLOS),\(^{598}\) and the practical benefit-sharing cases of the U.K. Royal Botanic Gardens\(^{599}\) and Merck & Co. in Costa Rica.\(^{600}\)

The above literature concerns ABS regimes with respect to the use of PGRs and traditional knowledge regarding the use of PGRs. They focus on doctrinal discussions, not empirical research. One empirical study concerning this issue focuses on statistics regarding countries with ABS regimes. The book, *Accessing Biodiversity and Sharing the Benefits: Lessons from Implementing the Convention on Biological Diversity*, which was edited by Santiago


\(^{592}\) Id. at 352.


\(^{595}\) See Mushita & Thompson, *supra* note 45, at 172-73, 223-24.

\(^{596}\) Id. at 223.

\(^{597}\) Id. at 37.

\(^{598}\) Id. at 224.

\(^{599}\) Id. at 223.

\(^{600}\) Id. at 224.
Carrizosa, Stephen Brush, Brian Wright, and Patrick McGuire, examined statistics regarding ABS regimes in forty-one Pacific Rim countries. Additional empirical research concerning ABS regimes can be found in the book, *The Commercial Use of Biodiversity: Access to Genetic Resources and Benefit-Sharing*, edited by Kerry ten Kate and Sarah A. Laird. This book offered empirical research concerning the development of the biotechnology industry and the response of multinational biotechnology corporations to critics. This empirical research did not focus on the implementation of ABS regimes by member countries of the CBD. The data collected in this book is out of date (1999). This dissertation will collect the most recent data and conduct new empirical research concerning the implementation of ABS regimes by member countries of the CBD or the ITPGR.

The existing empirical research concerning the implementation of ABS regimes does not explain why member countries of the CBD or the ITPGR have chosen to adopt ABS regimes and does not explain the relationships between the dependent variable (The status of ABS regimes) and the independent variables (e.g. the status of plant patent and plant variety protection, macroeconomics factors, and developments of agriculture).

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602 See Kate & Laird, *supra* note 64.

603 The empirical research regarding the development of the biotechnology industry in this book is introduced in Chapter 3: Natural Products and the Pharmaceutical Industry, Chapter 4: The Botanical Medicine Industry, Chapter 5: The Development of Major Crops by the Seed Industry, and Chapter 9: The Natural Personal Care and Cosmetics Industry. See Kate & Laird, *supra* note 64, at iii-vii.

604 Empirical research regarding the response of multinational biotechnology corporations in this book is introduced in Chapter 10: Industry and the CBD. See Kate & Laird, *supra* note 64, at vii, 295.

605 Although the research subject of this dissertation includes the ITPGR, this book was published in 1999. Because the ITPGR was not signed until 2001, the content of this book focused on discussing the CBD. See Kate & Laird, *supra* note 64, at ii, iii, vii-viii.

606 See Kate & Laird, *supra* note 64, at ii.
4.2 AN EXAMINATION OF CURRENT ACCESS AND BENEFIT-SHARING LAWS AND POLICIES (ABS) OF THE WORLD

This section examines quantitative data regarding current ABS policies. Although this particular section does not involve regression analysis regarding the implementation of ABS regimes, the preliminary quantitative data provided in this section constitutes the foundation for regression analysis concerning the implementation of the ABS regime of the world later on in this dissertation.

4.2.1 Overview of the Implementation of Access and Benefit-Sharing Regimes (ABS) among 194 Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resource (ITPGR)

This section details the current implementation of ABS regimes among 194 CBD or ITPGR parties. There are 67 parties to the CBD or the ITPGR, and they are obligated by both treaties to enact and adopt ABS regimes regarding the utilization of PGRs and traditional knowledge regarding the use of PGRs. This dissertation emphasizes that these national ABS regimes are currently in force. Even the U.S. has adopted an ABS regime regarding the utilization of PGRs in U.S. national parks, but the U.S. is not a party to either the CBD

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607 Member states of the CBD or the ITPGR are called “Parties,” so this dissertation uses the term “Parties” to refer to “Member States.” In addition, the 194 parties to the CBD or the ITPGR calculated in this dissertation excludes the “European Community,” although it is a party to the CBD and the ITPGR. However, the “European Community” is not a country. Taiwan and the U.S. are included in the 194 parties examined in this dissertation, although they are not parties to the CBD or the ITPGR, but both countries are worthy of study. See note 35 of this dissertation; Secretarial of the Convention on Biological Diversity, supra note 24; Commission on Genetic Resources for Food and Agriculture, supra note 24.

608 This dissertation attempts to distinguish between parties which have enacted and adopted ABS regimes and parties that are developing the ABS regime. The former parties are obligated by the CBD and the ITPGR to enact and adopt ABS regimes, but the later parties are not obligated by the CBD and the ITPGR, because they currently have no ABS regimes in force. The book, the Commercial Use of Biodiversity: Access to Genetic Resources and Benefit-Sharing edited by Kerry Kate & Sarah Laird indicated that there were 42 countries, which had concluded or had under development ABS regimes in 1999, and these 42 countries were mixed with the countries that have adopted or had under development ABS regimes. This dissertation divides these countries into two categories. See Kate & Laird, supra note 64, at 16.

609 Carrizosa, supra note 601, at 14, 22.
For instance, “Title 36 of the U.S. Code of Federal Regulation” rules that all specimens collected in a national park for research (or access), belong to the park, and the park is part of the U.S. federal government. “National Park Service (NPS)” regulations specify that bioprospectors can access genetic resources in national parks only through a collection permit process which has been in effect since 1983. Researchers must apply for a permit on the “National Park Service’s Research Permit and Reporting System Website.”

101 parties (excluding Taiwan) to the CBD or the ITPGR are not obligated by treaties to enact and adopt ABS regimes. These 101 parties can be divided into three groups: first, parties that are in the process of developing, or have not developed, access and benefit-sharing (ABS) regimes; second, parties that have adopted only “Access” regimes; third, parties that have adopted only “Benefit-Sharing” regimes. 63 parties are in the process of developing or have not yet fully developed ABS regimes. 34 parties have adopted only “Access” regimes, and only 4 parties have adopted “Benefit-Sharing” regimes.

In addition, there are 24 parties for which we do not have sufficient information or documents to judge whether or not these parties have adopted ABS regimes. Table 4.1 lists the implementation of ABS regimes by CBD or ITPGR parties and includes detailed sources of data.

606 See the note 607 of this dissertation.
611 See the “National Park Service’s Research Permit and Reporting System Website” is a website for applying for scientific research and collecting permits in the U.S. national parks, and this website includes NPS procedures and requirements, online submission applications for research permits and investigator annual reports, and related search study materials, etc. See National Park Service, Research Permit and Reporting System, https://science.nature.nps.gov/research/ac/ResearchIndex (last visited Aug. 18, 2009); Carrizosa, supra note 601, at 14, 22.
612 Taiwan is not a party to the CBD and the ITPGR, so it is not included within the total of 101 parties. Taiwan has drafted the “Draft of the Genetic Resources Act of Taiwan,” but it has only adopted the “access” laws or policies, and it has not adopted any “benefit-sharing” laws or policies. Detail introductions of Taiwan’s ABS laws or policies are described in section 5.1 of this dissertation. See the note 607 of this dissertation; Department of Agronomy, SEED LAB., National Taiwan University, Genetic Resources Laws, available at http://seed.agron.ntu.edu.tw/agra.htm (last visited Dec. 29, 2008).
Table 4.1  The Implementation of Access and Benefit-Sharing Regimes (ABS) of Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR)

<table>
<thead>
<tr>
<th>Parties that currently have Access and Benefit-Sharing (ABS) Regimes in force</th>
<th>1. Australia 613</th>
</tr>
</thead>
<tbody>
<tr>
<td>(67 Parties)</td>
<td>2. Azerbaijan 614</td>
</tr>
<tr>
<td></td>
<td>3. Bolivia 615</td>
</tr>
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<td></td>
<td>4. Belgium 616</td>
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<tr>
<td></td>
<td>5. Belize 617</td>
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<td></td>
<td>6. Botswana 618</td>
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<td></td>
<td>7. Brazil 619</td>
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<td></td>
<td>8. Bulgaria 620</td>
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<td></td>
<td>9. Bhutan 621</td>
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<td></td>
<td>10. Cameroon 622</td>
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<td></td>
<td>11. Canada 623</td>
</tr>
<tr>
<td></td>
<td>12. Chile 624</td>
</tr>
</tbody>
</table>

613 Australia has adopted several ABS regimes, such as the Nationally consistent approach for access to and the utilisation of, Australia's native genetic and biochemical resources and the Environment Protection and Biodiversity Conservation Regulations 2000, and so on. See Convention on Biological Diversity, Programmes & Issues, ABS, Implementation: Databases on ABS Measures, http://www.cbd.int/abs/measures.shtml (last visited Dec. 28, 2008).


616 Belgium has both “access” measures (e.g. National Botanic Garden of Belgium and International Network for the Improvement of Banana and Plantain) for the exchange or conservation of genetic resources and “benefit-sharing” measures (e.g. the MTA of Belgian Coordinated Collections of Micro-organisms and National Botanic Garden of Belgium), which followed the Bonn Guideline on the exchange of living plant specimens. See Convention on Biological Diversity, Information, National Information, Country Profiles, Overview, Belgium: Third National Report, http://www.cbd.int/countries/?country=be (last visited Dec. 28, 2008).


618 Brazil has adopted several ABS regimes, such as Amapá State Law on Access to Genetic Resources and Provisional measure concerning access to genetic resources and traditional knowledge, and so on. GRAIN, Resources: Biodiversity Rights Legislation (BRL) – Access and benefit sharing, supra note 615.


<table>
<thead>
<tr>
<th>No.</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>China</td>
</tr>
<tr>
<td>14.</td>
<td>Costa Rica</td>
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<td>15.</td>
<td>Cuba</td>
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<td>16.</td>
<td>Cyprus</td>
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<td>17.</td>
<td>Czech Republic</td>
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<td>18.</td>
<td>Democratic People's Republic of Korea</td>
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<td>19.</td>
<td>Egypt</td>
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<td>20.</td>
<td>Estonia</td>
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<td>21.</td>
<td>Ethiopia</td>
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<td>22.</td>
<td>Finland</td>
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<td>23.</td>
<td>France</td>
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<td>24.</td>
<td>Gabon</td>
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<td>25.</td>
<td>Gambia</td>
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<td>26.</td>
<td>Germany</td>
</tr>
<tr>
<td>27.</td>
<td>Greece</td>
</tr>
<tr>
<td>28.</td>
<td>Guatemala</td>
</tr>
</tbody>
</table>

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626 Carrizosa, supra note 601, at 43.
640 Convention on Biological Diversity, The Convention, Parties, List of Parties: Guatemala, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008); Convention on Biological Diversity, Pro-
Table 4.1 (cont.)

<table>
<thead>
<tr>
<th></th>
<th>29. Guinea 641</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.</td>
<td>Guyana 642</td>
</tr>
<tr>
<td>31.</td>
<td>India 643</td>
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<td>32.</td>
<td>Ireland 644</td>
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<td>33.</td>
<td>Israel 645</td>
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<td>34.</td>
<td>Japan 646</td>
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<td>35.</td>
<td>Kenya 647</td>
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<td>36.</td>
<td>Malawi 648</td>
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<td>37.</td>
<td>Maldives 649</td>
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<td>38.</td>
<td>Mauritania 650</td>
</tr>
<tr>
<td>39.</td>
<td>Mexico 651</td>
</tr>
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<td>40.</td>
<td>Myanmar 652</td>
</tr>
<tr>
<td>41.</td>
<td>Netherlands 653</td>
</tr>
</tbody>
</table>


651 For example, Mexico’s Constitution, Ecological Equilibrium and Environmental Protection General Act (ELEEPGA), Wildlife General Act (WGA), Sustainable Forestry Development General Act (SFDGA), and Criminal Code have regulated the “Access” issues. In addition, Ecological Equilibrium and Environmental Protection General Act (ELEEPGA) has regulated “Benefit-Sharing” issues. See Jorge Larson-Guerra, Christian Lopez-Silva, Francisco Chapela, Jose Carlos Fernandez-Ugalde and Jorge Soberon, Mexico: Between Legality and Legitimacy, in 54 IUCN Environmental Policy and Law Paper, Accessing Biodiversity and Sharing the Benefits: Lessons from Implementing the Convention on Biological Diversity 123, 128 (Santiago Carrizosa, Stephen B. Brush, Brian D. Wright, and Patrick E. McGuire ed., 2004).


653 Convention on Biological Diversity, Information, National Information, Country Profiles, Overview, Nether-
<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>42. Niue</td>
<td>454</td>
</tr>
<tr>
<td>43. Norway</td>
<td>455</td>
</tr>
<tr>
<td>44. Panama</td>
<td>456</td>
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<tr>
<td>45. Peru</td>
<td>457</td>
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<tr>
<td>46. Philippines</td>
<td>458</td>
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<tr>
<td>47. Portugal</td>
<td>459</td>
</tr>
<tr>
<td>48. Qatar</td>
<td>460</td>
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<tr>
<td>49. Republic of Korea</td>
<td>461</td>
</tr>
<tr>
<td>50. Russian Federation</td>
<td>462</td>
</tr>
<tr>
<td>51. Rwanda</td>
<td>463</td>
</tr>
<tr>
<td>52. Saint Vincent and the Grenadines</td>
<td>464</td>
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<tr>
<td>53. Samoa</td>
<td>465</td>
</tr>
<tr>
<td>54. Saudi Arabia</td>
<td>466</td>
</tr>
</tbody>
</table>

Table 4.1 (cont.)


657 Peru has adopted the ABS regime, such as the “Law introducing a protection regime for the collective knowledge of indigenous peoples derived from biological resources.” GRAIN, supra note 615.


Table 4.1 (cont.)

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<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>55. Senegal</td>
<td>667</td>
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<tr>
<td>56. South Africa</td>
<td>668</td>
</tr>
<tr>
<td>57. Sweden</td>
<td>669</td>
</tr>
<tr>
<td>58. Switzerland</td>
<td>670</td>
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<tr>
<td>59. Thailand</td>
<td>671</td>
</tr>
<tr>
<td>60. Turkey</td>
<td>672</td>
</tr>
<tr>
<td>61. Uganda</td>
<td>673</td>
</tr>
<tr>
<td>62. Ukraine</td>
<td>674</td>
</tr>
</tbody>
</table>


669 There is an ABS regime regarding the use of genetic resources, approved by the government, and MTAs have been established which involve genetic resources. The Swedish International Cooperation Agency supports gene banks of other nations with respect to ABS strategies. For example, the Nordic Gene Bank is a good example, and Nordic Council Ministers suggest that access genetic resources in the Nordic Gene Bank is free (limited commons), but these resources are managed by Nordic nations. In addition, private collections are collectors’ properties. Sweden’s patent legislation requires the disclosure of origin in patent applications, but applicant failure to disclose such information does not influence the validity of the patent. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Sweden, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

670 Switzerland has ABS regimes and policies and has followed the Bonn Guidelines in setting up an ABS regime. There are four aspects to Swiss implementation of an ABS regime. First, academic research on ABS: The “Access and Benefit Sharing – Good practice for academic research on genetic resources,” developed by the Swiss Academy of Sciences (SCNAT), which is supported by the Switzerland Federal Office for the Environment (FOEN). This ABS-tool of SCNAT is set up to inform the national academic community about the procedures of ABS and is distributed in international workshops and conferences. Second, the government supported Botanical Gardens integrates the International Plant Exchange Network (IPEN) for tracking transfers of genetic resources in accordance with the rules of the CBD. Third, private sector: Switzerland supports the BioTrade Facilitation Programme (BTFP) of UNCTAP that combines sustainable use and economic profit from genetic resources, so indigenous communities should receive benefits from the international trade in genetic resources, such as the Pilot Program carried out among Bolivia, Colombia, Vietnam, and so on. The Fourth part surveys the situations of other sectors regarding the use of genetic resources, such as horticulture. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Switzerland, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008); Convention on Biological Diversity, Information, National Information, Search National Reports and NBSAPs, http://www.cbd.int/reports/search/?type.nr-abs (last visited Dec. 28, 2008).


<table>
<thead>
<tr>
<th>Country that is not a party to the CBD or the ITPGR, but currently has an Access and Benefit-Sharing (ABS) Regime in force (1 Country)</th>
<th>United Kingdom of Great Britain and Northern Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parties currently have no Access and Benefit-Sharing (ABS) Regimes in force (101 Parties)</td>
<td>1. United States of America</td>
</tr>
<tr>
<td>The Access and Benefit-Sharing (ABS) Regime is being developing but development remains in-</td>
<td>1. Cambodia</td>
</tr>
<tr>
<td></td>
<td>2. Colombia</td>
</tr>
<tr>
<td></td>
<td>3. Ecuador</td>
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<td></td>
<td>4. Eritrea</td>
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<td></td>
<td>5. Fiji</td>
</tr>
</tbody>
</table>

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680 “Title 36 of the U.S. Code of Federal Regulation” also rules that all specimens, collected in national parks for research (or access), belong to the park. Under the “NPS” regulations, bioprospectors can access the genetic resources only through the collection permit processes in effect since 1983. Researchers must apply for a permit from the “National Park Service’s Research Permit and Reporting System Website.” In addition, the Cooperative Research and Development Agreements (CRADAS) deals with issues of benefit-sharing, and the CRADA is regulated by the Federal Technology Transfer Act of 1986. See Carrizosa, supra note 601, at 43.
681 Cambodia is working with ASEAN countries towards developing an ABS regime and is planning to develop a sub-decree about equitable benefit-sharing. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Cambodia, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).
682 Colombia has no ABS regime, and Colombia currently facilitates Decision 391 (ABS regime) at the national level. See Carrizosa, supra note 601, at 43, 89.
685 The Draft of Sustainable Development Bill of Fiji regulates the ABS principles of using natural resources including: (1) Biological research and exploitation should produce no harm to ecology, society, and the economy; (2) Taking samples from natural resources should produce no harm to Fiji’s biodiversity; (3) Ensuring a fair return from the exploitation of Fiji’s natural resources; (4) Inform and get permission before collecting and bioprospecting; and (5) Bioprospecting is not allowed if concerned parties have not been previously informed and

Although federal laws regarding an ABS have been enacted, the provinces of Sabah and Sarawak have enacted local laws concerning an ABS, such as the Sabah Biodiversity Enactment 2000 and Sarawak Biodiversity Centre Ordinance 1997. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Malaysia, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

The draft Access and Benefit Sharing Law has been circulated to all stakeholders and comments are being received. This law also includes the Prior Informed Consent (PIC), Material Transfer Agreement (MTA), and Mutually Agreed Terms (MTA). See Convention on Biological Diversity, The Convention, Parties, List of Parties: Pakistan, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

Papua New Guinea is working towards developing ABS regimes. See Carrizosa, supra note 601, at 46.


There is an “access” regime involving a programme which enhances the genetic resources of forests in Austria, but a “benefit-sharing” regime (the Standard MTA) has yet to be adopted. See Convention on Biological Diversity, Information, National Information, Country Profiles, Overview, Austria: Third National Report, http://www.cbd.int/countries/?country=at (last visited Dec. 28, 2008).

Table 4.1 (cont.)

<table>
<thead>
<tr>
<th>6. Lao People’s Democratic Republic</th>
<th>686</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Malaysia</td>
<td>687</td>
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<td>8. Namibia</td>
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<td>9. Pakistan</td>
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<td>10. Papua New Guinea</td>
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<td>11. Solomon Islands</td>
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<td>12. Afghanistan</td>
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<td>13. Albania</td>
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<td>14. Algeria</td>
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<td>15. Angola</td>
<td>695</td>
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<tr>
<td>16. Antigua and Barbuda</td>
<td>696</td>
</tr>
<tr>
<td>17. Armenia</td>
<td>697</td>
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<tr>
<td>18. Austria</td>
<td>698</td>
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<td></td>
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<tr>
<td>20. Bahrain</td>
<td>700</td>
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<td>21. Bangladesh</td>
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<td>22. Barbados</td>
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<td>23. Belarus</td>
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</tr>
<tr>
<td>24. Bosnia and Herzegovina</td>
<td>704</td>
</tr>
<tr>
<td>25. Burundi</td>
<td>705</td>
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<tr>
<td>26. Cape Verde</td>
<td>706</td>
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<td>27. Chad</td>
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<td>28. Comoros</td>
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<td>29. Cook Islands</td>
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<td>30. Croatia</td>
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<td>31. Democratic Republic of the Congo</td>
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<tr>
<td>32. Denmark</td>
<td>712</td>
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<tr>
<td>33. Ghana</td>
<td>713</td>
</tr>
</tbody>
</table>


Cook Islands is developing a national ABS regime (e.g. Proposed National Environmental Act), and the island and municipal councils may adopt by-laws. See Carrizosa, supra note 601, at 44.


Table 4.1 (cont.)

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>34. Grenada</td>
<td>714</td>
</tr>
<tr>
<td>35. Haiti</td>
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<td>36. Hungary</td>
<td>716</td>
</tr>
<tr>
<td>37. Iceland</td>
<td>717</td>
</tr>
<tr>
<td>38. Iran (Islamic Republic of)</td>
<td>718</td>
</tr>
<tr>
<td>39. Lebanon</td>
<td>719</td>
</tr>
<tr>
<td>40. Lesotho</td>
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</tr>
<tr>
<td>41. Liberia</td>
<td>721</td>
</tr>
<tr>
<td>42. Marshall Islands</td>
<td>722</td>
</tr>
<tr>
<td>43. Micronesia (Federated States of)</td>
<td>723</td>
</tr>
<tr>
<td>44. Morocco</td>
<td>724</td>
</tr>
<tr>
<td>45. Mozambique</td>
<td>725</td>
</tr>
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<td>46. Nepal</td>
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</table>


Table 4.1 (cont.)

<table>
<thead>
<tr>
<th>Country</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Palau</td>
<td>Carrizosa, supra note 601, at 46.</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>The Policy and Act regarding Access to genetic resources and the fair and equitable sharing of benefits has been drafted, and MTAs have also been drafted. See Convention on Biological Diversity, Information, National Information, Search National Reports and NBSAPs, <a href="http://www.cbd.int/reports/search/?type=nr-abs">http://www.cbd.int/reports/search/?type=nr-abs</a> (last visited Dec. 28, 2008).</td>
</tr>
<tr>
<td>Suriname</td>
<td>Whether there exists protection of access (use) of genetic resources that are part of Tonga’s biodiversity is not clearly stated, and there is no mechanism for enhancing fair and equitable benefit-sharing. See Convention on Biological Diversity, Information, National Information, Country Profiles, Overview, Tonga: First National Report, <a href="http://www.cbd.int/countries/?country=to">http://www.cbd.int/countries/?country=to</a> (last visited Dec. 28, 2008).</td>
</tr>
<tr>
<td>The former Yugoslav Republic of Macedonia</td>
<td>Carrizosa, supra note 601, at 47.</td>
</tr>
</tbody>
</table>

729 Carrizosa, supra note 601, at 46.
731 The Policy and Act regarding Access to genetic resources and the fair and equitable sharing of benefits has been drafted, and MTAs have also been drafted. See Convention on Biological Diversity, Information, National Information, Search National Reports and NBSAPs, http://www.cbd.int/reports/search/?type=nr-abs (last visited Dec. 28, 2008).
735 Whether there exists protection of access (use) of genetic resources that are part of Tonga’s biodiversity is not clearly stated, and there is no mechanism for enhancing fair and equitable benefit-sharing. See Convention on Biological Diversity, Information, National Information, Country Profiles, Overview, Tonga: First National Report, http://www.cbd.int/countries/?country=to (last visited Dec. 28, 2008).
737 Carrizosa, supra note 601, at 47.
Table 4.1 (cont.)

<table>
<thead>
<tr>
<th>Parties currently have no Access and Benefit-Sharing (ABS) Regime in force (101 Parties)</th>
<th>Parties only adopt Access Regime (34 Parties)</th>
<th>62. Yemen</th>
<th>63. Zambia</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>14. Kyrgyzstan</th>
<th>15. Latvia</th>
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<tr>
<td>16. Lithuania</td>
<td>17. Madagascar</td>
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<td>18. Mali</td>
<td>19. Mauritius</td>
</tr>
<tr>
<td>22. Poland</td>
<td></td>
</tr>
<tr>
<td>23. Republic of Moldova</td>
<td>24. Romania</td>
</tr>
<tr>
<td>25. Saint Lucia</td>
<td>26. Singapore</td>
</tr>
<tr>
<td>27. Slovakia</td>
<td>28. Slovenia</td>
</tr>
<tr>
<td>29. Syrian Arab Republic</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.1 (cont.)

765 The Republic of Moldova has “access” regimes (e.g. international agreements and special authorisation), but potential measures concerning “benefit-sharing” remain under review. See Convention on Biological Diversity, Information, National Information, Country Profiles, Overview, Republic of Moldova: Third National Report, http://www.cbd.int/countries/?country=md (last visited Jan. 3, 2009).
772
Table 4.1 (cont.)

| Country that is not a party to the CBD or the ITPGR and has adopted only Access Regime (1 Country) | 30. Tajikistan\(^{773}\)  
31. Togo\(^{774}\)  
32. Trinidad and Tobago\(^{775}\)  
33. Turkmenistan\(^{776}\)  
34. Viet Nam\(^{777}\) |
|-------------------------------------------------|
| Parties that currently have no Access and Benefit-Sharing (ABS) Regime in force (101 Parties) | 1. Taiwan (The Republic of China, R.O.C.)\(^{778}\)  
2. Dominica\(^{780}\)  
3. Indonesia\(^{781}\)  
4. Kiribati\(^{782}\) |
| Parties that have adopted only Benefit-Sharing Regime (4 Parties) | 1. Argentina\(^{779}\)  
2. Dominica\(^{780}\)  
3. Indonesia\(^{781}\)  
4. Kiribati\(^{782}\) |
| N/A (24 Parties) | 1. Brunei Darussalam\(^{783}\)  
2. Burkina Faso\(^{784}\)  
3. Equatorial Guinea\(^{785}\) |


\(^{778}\) Taiwan (The Republic of China, R.O.C.) has started to draft an ABS law known as the “Draft of the Genetic Resources Act of Taiwan.” Taiwan has adopted “access” laws or policies, but it has not adopted any “benefit-sharing” laws or policies. Detail introductions of Taiwan’s ABS laws or policies are described in section 5.1 of this dissertation. See Department of Agronomy, SEED LAB., National Taiwan University, Genetic Resources Laws, supra note 612.


\(^{780}\) Dominica has adopted the Memorandum of Understanding (MOU) regarding fisheries for the sharing of benefits (25% of benefits). In addition, although there are American and British universities which endeavor to facilitate “access” to genetic resources, there is no known evidence of actual projects or conduct. See Convention on Biological Diversity, Information, National Information, Country Profiles, Overview, Dominica: Third National Report, http://www.cbd.int/countries/?country=dm (last visited Jan. 2, 2009).


\(^{783}\) There is no country profile information on which to base a determination as to whether Brunei Darussalam has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Brunei Darussalam, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

\(^{784}\) There is insufficient country profile information on which to base a determination as to whether Burkina Faso has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Burkina Faso, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

\(^{785}\) There is insufficient country profile information on which to base a determination as to whether Equatorial
Table 4.1 (cont.)

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<tr>
<th>Country</th>
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<tr>
<td>Georgia</td>
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<td>Iraq</td>
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<td>Kuwait</td>
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<td>Libyan Arab Jamahiriya</td>
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<td>Liechtenstein</td>
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<td>Luxembourg</td>
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<td>Malta</td>
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<td>Monaco</td>
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<td>Montenegro</td>
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<td>Nauru</td>
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<td>Oman</td>
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<tr>
<td>Saint Kitts and Nevis</td>
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<tr>
<td>San Marino</td>
<td>798</td>
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</table>


786 There is insufficient country profile information on which to base a determination as to whether Georgia has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Georgia, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

787 There is insufficient country profile information on which to base a determination as to whether Kuwait has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Kuwait, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

788 There is insufficient country profile information on which to base a determination as to whether Libyan Arab Jamahiriya has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Libyan Arab Jamahiriya, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

789 There is insufficient country profile information on which to base a determination as to whether Liechtenstein has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Liechtenstein, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

790 There is insufficient country profile information on which to base a determination as to whether Luxembourg has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Luxembourg, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

791 There is insufficient country profile information on which to base a determination as to whether Malta has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Malta, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

792 There is insufficient country profile information on which to base a determination as to whether Montenegro has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Montenegro, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

793 There is insufficient country profile information on which to base a determination as to whether Nauru has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Nauru, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

794 There is insufficient country profile information on which to base a determination as to whether Oman has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Oman, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

795 There is insufficient country profile information on which to base a determination as to whether Saint Kitts and Nevis has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Saint Kitts and Nevis, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

796 There is insufficient country profile information on which to base a determination as to whether San Marino has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of
Table 4.1 (cont.)

<p>| | |</p>
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|   | 17. Sao Tome and Principe<sup>799</sup>  
|   | 18. Serbia<sup>800</sup>  
|   | 19. Seychelles<sup>801</sup>  
|   | 20. Somalia<sup>802</sup>  
|   | 21. Spain<sup>803</sup>  
|   | 22. Swaziland<sup>804</sup>  
|   | 23. Timor-Leste<sup>805</sup>  
|   | 24. United Arab Emirates<sup>806</sup> |


<sup>799</sup> Sao Tome and Principe has “access” laws concerning the management and conservation of its biodiversity, but there is no information available regarding whether or not Sao Tome and Principe has a “benefit-sharing” regime. See Convention on Biological Diversity, Information, National Information, Search National Reports and NBSAPs, http://www.cbd.int/reports/search/?type=nr-abs (last visited Jan. 5, 2009).

<sup>800</sup> There is insufficient country profile information on which to base a determination as to whether Serbia has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Serbia, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

<sup>801</sup> There is insufficient country profile information on which to base a determination as to whether Seychelles has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Seychelles, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).


<sup>804</sup> There is insufficient country profile information on which to base a determination as to whether Swaziland has adopted an ABS regime or not. See Convention on Biological Diversity, Information, National Information, Search National Reports and NBSAPs, http://www.cbd.int/reports/search/?type=nr-abs (last visited Jan. 5, 2009).

<sup>805</sup> There is insufficient country profile information on which to base a determination as to whether Timor-Leste has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: Timor-Leste, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).

<sup>806</sup> There is insufficient country profile information on which to base a determination as to whether United Arab Emirates has adopted an ABS regime or not. See Convention on Biological Diversity, The Convention, Parties, List of Parties: United Arab Emirates, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008).
4.2.2 Comparison of the Adoption of the Convention on Biological Diversity (CBD), the International Treaty on Plant Genetic Resources (ITPGR), and Access and Benefit-Sharing Regimes (ABS) of the Developed and the Developing Worlds

This dissertation will analyze statistics concerning the CBD, the ITPGR and ABS regimes. 192 “countries” are “parties” to the CBD,\(^807\) which is 100% of the total number of 192 member countries of the United Nations.\(^808\) The protection of global biodiversity is accepted by nearly all of the countries of the world. The ITPGR is similar to the CBD in that it is an international convention of the United Nations. It regulates biodiversity (PGRs) and encourages the creation of ABS regimes in order to utilize PGRs to a greater extent than does the CBD. The ITPGR has 120 “parties,”\(^809\) or 62.5% of the total number of member countries of the United Nations.\(^810\) The above empirical data shows that the controversies regarding PGRs with respect to the CBD, the ITPGR, ABS, and related issues concerning the developed and

\(^{807}\) Convention on Biological Diversity, The Convention, Parties, List of Parties, http://www.cbd.int/convention/parties/list/ (last visited July 14, 2008). Although the actual number of parties to the CBD should be 193, the list includes the “European Community,” which is not a country. As a result, the numbers of “countries” in the CBD is 191.


\(^{810}\) The ITPGR is an international treaty under the “Food and Agriculture Organization of the United Nations (UNFAO),” and parties to the ITPGR are the member countries of the United Nations, this research includes empirical research based on the member countries of the United Nations.
the developing worlds continue to exist.

As regards ABS regimes with respect to the use of PGRs and traditional knowledge regarding the use of PGRs, the empirical data shows that only 68 countries currently have ABS regimes in force. This is 35.4% of the total number of 192 member countries of the United Nations. This is 35.2% of the total number of 193 parties to the CBD. Moreover, 47 parties to

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811 Convention on Biological Diversity, The Convention, Parties, List of Parties, supra note 807; Carrizosa, supra note 601; International Development Research Centre, supra note 594; GRAIN, Resources: Biodiversity Rights Legislation (BRL) – Access and benefit sharing, supra note 615; Department of Agronomy, SEED LAB., National Taiwan University, Genetic Resources Laws, supra note 612.
the ITPGR have adopted ABS regimes,\textsuperscript{812} which is 39.1\% of the total number of 120 parties to the ITPGR. Therefore, we can compare the data about the relationships between the adoption of the ABS and the parties to the CBD and the ITPGR in Figures 4.1 and 4.2. To sum up, the establishment of ABS regimes is not the primary task for parties to the CBD and the ITPGR. The empirical evidence indicates that the CBD and the ITPGR are ethical international obligations of countries that are parties to both international agreements.

Comparing the differences between the ABS regimes between the developed and the developing world shows that 19 countries in the developed world currently have ABS regimes in force.\textsuperscript{813} On the other hand, 49 countries in the developing world have ABS regimes in force at present.\textsuperscript{814} Furthermore, the majority of countries all around the world do not have ABS regimes, meaning a total of 102 countries.\textsuperscript{815} Within this group are 8 countries in the developed world, and 94 countries in the developing world.\textsuperscript{816} Therefore, Figures 4.3 and 4.4 are comparison graphs regarding the adoption of ABS regimes among countries in the developed and developing worlds.

\textsuperscript{812} Convention on Biological Diversity, The Convention, Parties, List of Parties, \textit{supra} note 807; Food and Agriculture Organization of the United Nation, Legal Office – treaties: International Treaty on Plant Genetic Resources for Food and Agriculture, \textit{supra} note 809; Carrizosa, \textit{supra} note 601; International Development Research Centre, \textit{supra} note 594; GRAIN, Resources: Biodiversity Rights Legislation (BRL) – Access and benefit sharing, \textit{supra} note 615; Department of Agronomy, SEED LAB., National Taiwan University, Genetic Resources Laws, \textit{supra} note 612.


\textsuperscript{814} Id.

\textsuperscript{815} Id.

\textsuperscript{816} Id.
Comparing the numbers of PGR species found in the developed and the developing worlds might reveal why more countries in the developing world have adopted ABS regimes than is the case in the developed world. Figure 4.5 indicates that countries in the developing world have 842,108 plant species, a number greater than the number in the developed world (including the U.S. and Japan) – 267,656 plant species.\footnote{Convention on Biological Diversity, The Convention, Parties, List of Parties, supra note 807; World Resources Institute, EarthTrends: Environmental Information, Biodiversity and Protected Areas: Country Profiles, http://earthtrends.wri.org/country_profiles/index.php?theme=7 (last visited Sept. 11, 2008). Even though the U.S. and Japan are not treaty states of "ratification," they have agricultural biotechnology industries, and are worthy of further research. In addition, this research defines the plant species as including alga, fungus, and}
Developing countries should establish ABS regimes to protect and share benefits derived from the utilization of PGRs. But why have more countries in the developing world adopted ABS regimes than is the case in the developed world? There are many factors (independent variables) that can influence the adoption of ABS regimes (dependent variable) in different countries. The following section will interpret the dependent variable (the status of adoption of ABS regime from each party to the CBD or the ITPGR) and the independent variables that are run by the probit regression and propose a research hypothesis for regression analysis. This dissertation will use regression analysis to examine this hypothesis and analyze the relationships between the dependent variable and the independent variables.

4.3 EMPIRICAL RESEARCH REGARDING CURRENT ACCESS AND BENEFIT-SHARING (ABS) LAWS AND POLICIES OF THE WORLD

This section will begin by describing the regression analysis with respect to ABS regimes, and will include the interpretation of collected data related to current ABS laws and policies and the proposed research hypothesis. This section presents an overview of the dependent and the independent variables used in the probit regression of this dissertation. I
propose one research hypothesis as the subject of the regression analysis, and the remainder of this section consists of the examinations of the research hypothesis by means of probit regression.

4.3.1 The Interpretation of Collected Data related to Current Access and Benefit-Sharing (ABS) Laws and Policies and the Proposed Research Hypothesis

4.3.1.1 The Interpretation of Dependent and Independent Variables in the Probit Regression concerning Access and Benefit-Sharing (ABS) Laws and Policies

This research defines “Status of Access and Benefit-Sharing Regime” as a dependent variable, and that dependent variable will be dichotomous. The country that adopts an ABS regime will be given a value of 1, and the country that does not adopt an ABS regime will be given a value of 0. The following variables – “Numbers of PVP Applications – 2002~2006 Average,” “Numbers of Patent Application in 2006,” “Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?,” “Enforcing Contract Costs of 200% of income per capita (%),” “GDP – per capita of 2008 (purchasing-power-parity (PPP)),” “GDP per capita of 2008 (USD),” “The Share of Agriculture as a Percent of GDP (%),” “The Share of Gross Domestic Expenditures on R&D Accounted for by Industry of GDP (purchasing-power-parity (PPP)) in 2007 (%),” and “2007/2008 Gini Index (%)” – are independent variables. Interpretations of the independent variables appear in Table 4.2.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Meanings</th>
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<tbody>
<tr>
<td>Number of PVP Applications –</td>
<td>The average number of Plant Variety Protection appli-</td>
</tr>
<tr>
<td>2002~2006 Average</td>
<td>cations from 2002 to 2006 made by parties to the CBD or the ITPGR</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?</td>
<td>This is a “Dummy” variable. Variables are 1 if countries accept the compulsory jurisdiction of the ICJ, so countries can settle disputes concerning the CBD and the ITPGR. Variables are 0 if countries do not accept the compulsory jurisdiction of the ICJ, so countries cannot settle disputes arising from the CBD and the ITPGR.</td>
</tr>
<tr>
<td>Enforcing Contract Costs of 200% of income per capita (%)</td>
<td>Enforcing contract costs in court fees and attorney fees, where the use of attorneys is mandatory or common, expressed as a percentage of the debt value among parties to the CBD or the ITPGR.</td>
</tr>
<tr>
<td>GDP – per capita of 2008 (purchasing-power-parity (PPP))</td>
<td>This variable is “Gross domestic product based on purchasing-power-parity (PPP) per capita.” It shows</td>
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820 Article 27.3 of the CBD regulates that “When ratifying, accepting, approving or acceding to this Convention, or at any time thereafter, a State or regional economic integration organization may declare in writing to the Depositary that for a dispute not resolved in accordance with paragraph 1 or paragraph 2 above, it accepts one or both of the following means of dispute settlement as compulsory: (a) Arbitration in accordance with the procedure laid down in Part 1 of Annex II; (b) Submission of the dispute to the International Court of Justice.” In addition, Article 22.3 of the ITPGR regulates that “When ratifying, accepting, approving or acceding to this Treaty, or at any time thereafter, a Contracting Party may declare in writing to the Depositary that for a dispute not resolved in accordance with Article 22.1 or Article 22.2 above, it accepts one or both of the following means of dispute settlement as compulsory: (a) Arbitration in accordance with the procedure laid down in Part 1 of Annex II to this Treaty; (b) Submission of the dispute to the International Court of Justice.” See Secretarial of the Convention on Biological Diversity, supra note 24; Commission on Genetic Resources for Food and Agriculture, supra note 24. In addition to negotiation and mediation, submission of disputes to the International Court of Justice (ICJ) is a way that contracting parties to the CBD or the ITPGR can settle disputes. This dissertation argues that disputes related to the CBD or the ITPGR are complicated and that it is difficult to reach agreements by negotiations or mediations, because they concern the utilization and benefit-sharing of biological resources, countries’ sovereignties, and legal issues, particularly intellectual property law issues. As a result, the submission of disputes to the ICJ is a better way for contracting parties to the CBD or the ITPGR to settle disputes. In addition, the ways in which disputes are settled by negotiations or mediations cannot be shown by quantitative data, but the ways in which disputes are settled by the submission of disputes to the ICJ can be shown by quantitative data (dummy variables), which is why this dissertation chooses the route of dispute settlement by submitting disputes to the ICJ as an independent variable for regression.
821 See the note 820 of this dissertation.
824 The data is drawn from the website of the World Economic Outlook Database of International Monetary Fund. See International Monetary Fund, Data and Statistics: World Economic Outlook Database October 2008,
| **GDP per capita of 2008 (USD)** | This variable is “Gross domestic product per capita, current price,” and the unit is the U.S. dollar. However, the GDP per capita (USD) cannot compare relative prices and living conditions across countries in 2008, just as with the GDP – per capita (purchasing-power-parity (PPP)). |
| **The Share of Agriculture as a Percent of GDP (%)** | This variable gives the percentage contribution of agriculture to total GDP from parties to the CBD or the ITPGR |
| **The Shares of Gross Domestic Expenditure on R&D accounted for by Industry of GDP (purchasing-power-parity (PPP)) in 2007 (%)** | This variable gives the percentage of Gross Domestic Expenditure on R&D accounted for by Industry relating to total GDP (purchasing-power-parity (PPP)) in 2007 from parties to the CBD or the ITPGR |
| **2007/2008 Gini Index (%)** | The Gini index measures the extent to which the distribution of income among individuals or households differ within a country or economy. |
distribution of income (in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly normal distribution.\footnote{International Labour Organization, Key Indicators of the Labour Market (KILM): 2001-2002 (2002).}

This Chapter will focus on regression analysis, so all of the collected data is listed in the Appendix of this dissertation. Because the dependent variable (Status of Access and Benefit-Sharing Regime) is a “dummy” variable, the regression used in this dissertation is a

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\footnote{International Labour Organization, Key Indicators of the Labour Market (KILM): 2001-2002 704 (2002).}
non-linear regression – probit regression. Moreover, the independent variables that are run using this probit regression include variables concerning agriculture, macroeconomics, and intellectual property laws. This dissertation attempts to understand the relationships between the dependent variable (Status of Access and Benefit-Sharing Regime) and the independent variables (the above nine variables). In particular, this dissertation also attempts to determine through probit regression which variables influence parties to the CBD or the ITPGR to adopt ABS laws and policies, and examines the current implementation of ABS laws and policies used by parties to the CBD or the ITPGR.

4.3.1.2 The Research Hypothesis

The research hypothesis proposed in this dissertation is that “The more Plant Variety Protection (PVP) applications that are filed in one contracting party to the CBD or the ITPGR, the lower probability that this contracting party will adopt an ABS regime.”

The reasons why this research hypothesis focuses on discussing the numbers of PVP application made by each contracting party to the CBD or the ITPGR file uses include: First, the fundamental theoretical principle of “biopiracy” is that multinational biotechnology corporations in the developed world use the intellectual property laws of the developed world to acquire PGRs from the developing world and make those PGRs into their property. Multi-national corporations engage in such practices in order to monopolize commercial markets throughout the world. In addition, the advocates of anti-biopiracy believe that the TRIPS

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837 This argument is drawn from Vandana Shiva’s book, Biopiracy: The Plunder of Nature and Knowledge. Shiva described “biopiracy” as “Piracy through Patents – The Second Coming of Columbus.” She further argued that “Five hundred years after Columbus, a more secular version of the same project of colonization continues through patents and intellectual property rights (IPRs)...The principle of effective occupation by Christian princes has been replaced by effective occupation by modern-day rulers. The vacancy of targeted lands has been replaced by the vacancy of targeted life forms and species manipulated by the new biotechnologies...” See Shiva, supra note 62, at 1-2.

838 This argument is drawn from Vandana Shiva, who argued that “The duty to incorporate savages into Christianity has been replaced by the duty to incorporate local and national economies into the global marketplace, and to incorporate non-Western systems of knowledge into the reductionism of commercialized Western science and technology...” See Shiva, supra note 62, at 2.
Agreement and other bilateral international agreements are tools used by multinational corporations in the developed world for the purpose of enforcing corporate intellectual property protection throughout the world.\textsuperscript{839} Moreover, biodiverse countries in the developing world are unlikely to have complete bodies of intellectual property laws and will adopt ABS regimes to protect themselves from “biopiracy” originating in the developed world.

Second, article 27.3(b) of the TRIPS Agreement requires only that member states of the WTO enact effective \textit{sui generis} protection – PVP laws for the purpose of protecting new plant varieties, so enacting patent laws to protect new plant varieties is optional for member states of the WTO.\textsuperscript{840} In addition, the question of whether PGRs can be the subject matter of patents remains a controversial issue.\textsuperscript{841} Therefore, discussing PVP issues in relationship to ABS regimes through the use of regression analysis is more practical than discussing it in terms of patent issues.

Third, the requirements for granting patents for PGRs are stricter than the requirements for granting PVPs for PGRs.\textsuperscript{842} Moreover, the majority of PGRs propagate sexually instead of asexually. Thus, the “protectability” of PVPs, which are a form of intellectual property

\textsuperscript{839} This argument is drawn from Vandana Shiva, who argued that “The freedom that transnational corporations are claiming through intellectual property rights protection in the GATT agreement on Trade Related Intellectual Property Rights (TRIPs) is the freedom that European colonizers have claimed since 1492…” See Shiva, \textit{supra} note 62, at 2.

\textsuperscript{840} Article 27.3(b) of the TRIPS Agreement states that “Article 27 Patentable Subject Matter…3. 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 \textit{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.” See WTO | intellectual property (TRIPS) – agreement text – standards, http://www.wto.org/english/tratop_e/trips_e/t_agm3_e.htm (last visited May 30, 2009); the note 358 of this dissertation.

\textsuperscript{841} See the note 101 of this dissertation.

\textsuperscript{842} The requirements for Utility Patents include “Utility,” “Novelty,” “Non-obviousness,” and “Specification (Enablement and Writing Description).” The requirements for Plant Patents include being “Distinct,” “New,” and having a “Description,” but “No plant patent shall be declared invalid for noncompliance with written description if the description is as complete as is reasonably possible.” In addition, the requirements of Plant Variety Protection (PVP) include “New,” “Distinctness,” “Uniformity,” and “Stability.” See 35 U.S.C. §§ 101-103, 112 (1952); 35 U.S.C. §§ 161-164 (1988); 7 U.S.C. § 2402; Article 5 of UPOV Convention: 1991 Act. To sum up, the requirements for PVPs are not like Utility Patents and Plant Patents, whose requirements include “Specification (Enablement and Writing Description)” and “Description.” The U.S. Plant Variety Protection Act (PVPA) may be relegated to being a secondary, “petty patent” regime, employed for inventions with less marketplace significance or inventions which do not meet the rigorous standards required for utility patents. See Adelman et al., \textit{supra} note 252, at 119.
protection for plants that propagate sexually, is broader than the “protectability” of plant patents, which are a form of intellectual property protection for plants that propagate asexually.

Fourth, Gasser and Fraley observed that prior to the passage of the “Plant Variety Protection Act (PVPA)” of 1970, only three companies sold commercial soybean seeds, while afterwards more than forty companies sold commercial soybean seeds. Lesser and Masson also argued that the passage of the PVPA was positive. PVPs opened a new window for inducing innovations in biotechnology (e.g., new plant varieties or genetic-modified seeds or crops, etc), and correlates with the development of biotechnology. In short, discussions of PVP issues with respect to ABS regimes allow for general observations about the development of the biotechnology industry.

Table 4.3 The Correlation Coefficients of the Numbers of PVP Applications in 2006 and Other Variables in Relationship to Intellectual Property Protections

|-----------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------|------------------------------------------------|-------------------------------------------------|

843 Article 2402 of the U.S. PVPA regulates that “The breeder of any sexually reproduced or tuber propagated plant variety (other than fungi or bacteria) who has so reproduced the variety, or the successor in interest of the breeder, shall be entitled to plant variety protection for the variety…” See 7 U.S.C. § 2402.
844 Article 161 of the U.S. Plant Patent Act (PPA) rules that “Whoever invents or discovers and asexually reproduces any distinct and new variety of plant, including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state, may obtain a patent therefore…” See 35 U.S.C. § 161 (1988).
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<tr>
<td>Numbers of Patent Applications in 2006</td>
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<tr>
<td>Numbers of Patent Grants in 2006</td>
<td>0.9602</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbers of Chemistry Patent Applications (including plant and other biotechnology patents) – 2001<del>2005 Average (numbers</del>sofc~t)</td>
<td>0.9340</td>
<td>0.8694</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbers of PVP Applications – 2002<del>2006 Average (numbers</del>2002 200)</td>
<td>0.6463</td>
<td>0.5845</td>
<td>0.5787</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>Numbers of PVP Grants – 2002~2006 Average</td>
<td>0.6570</td>
<td>0.6163</td>
<td>0.6866</td>
<td>0.9069</td>
<td>1.0000</td>
</tr>
</tbody>
</table>
Fifth, when we measure the correlation coefficient\(^\text{847}\) of the “Numbers of PVP Applications – 2002~2006 Average” and other independent variables regarding intellectual property protections (e.g., Numbers of Patent Applications in 2006 and Numbers of Patent Grants in 2006, etc) there exists “Multicollinearity,” and we observe multicollinearity in Table 4.3. Multicollinearity refers to very high intercorrelations among independent variables, and is a type of disturbance in the data.\(^\text{848}\) If multicollinearity is present in the data, the statistical inferences made about the data may not be reliable.\(^\text{849}\) This dissertation has no choice but to select only one independent variable – Numbers of PVP Applications – 2002~2006 Average and drop the other variables. As a result, this dissertation proposes the research hypothesis that “The more Plant Variety Protection (PVP) applications that are filed in one contracting party to the CBD or the ITPGR, the higher probability that this contracting party will adopt an ABS regime.”

4.3.2 Hypothesis 1: The More Plant Variety Protection (PVP) Applications that are Filed in the 194 Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resource (ITPGR), the Lower Probability that These Parties will Adopt Access and Benefit-Sharing Regimes (ABS)

4.3.2.1 Using Regression Models to Test the Hypothesis

Regression analysis is used in this dissertation both to determine which variable is statis-

---

\(^\text{847}\) The “Correlation Coefficient” is also called the “Pearson Correlation Coefficient,” and is defined as being “A number between -1.0 and +1.0 that describes the strength and direction of the linear relationship between two variables. A Pearson Correlation Coefficient (PCC) of -1.0 indicates a perfect negative relationship, while +1.0 indicates a perfect positive relationship. See David Cope, Fundamentals of Statistical Analysis 98 (2005).


\(^\text{849}\) Statistics Solutions, Inc., Data Entry, Cleaning, and Coding: Multicollinearity, supra note 848.
tically significant, and to find a better model of regression which can completely determine the dependent variable – Status of Access and Benefit-Sharing Regime. Therefore, this dissertation will not use “Numbers of PVP Applications – 2002~2006 Average” as the sole independent variable when running probit regressions in order to determine whether it is statistically significant, and will use the methods of “P-value,” “Sensitivity,” and “Specificity” to test the null-hypothesis. In particular, this dissertation will set up several regression models rank-ordered by correlation coefficients with the dependent variable from high to low and use the methods of “P-value,” “Pseudo $R^2$,” “Positive Predictive Value,” and “Correctly Classified Rate” to judge each regression model and examine whether the latter model regression is better than the former one. In other words, the latter regression model should be better than the first model for purposes of determining the dependent variable.

In addition, the difficulty with regression analysis in this dissertation involves multicollinearity. In order to solve the problem of multicollinearity, this dissertation will measure correlation coefficients in Table 4.4 and drop highly correlated variables, so the final independent variables that run are in this regression have been discussed in section 4.3.1. As mentioned above, the rank of these correlation coefficients with respect to the dependent variable also provides a guideline for establishing regression models.

<table>
<thead>
<tr>
<th>Table 4.4  The Correlation Coefficients of Dependent and Independent Variables related to the Regression Analysis of the Implementation of Access and Benefit-Sharing (ABS) Laws and Policies from Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR)</th>
<th>Status of Access and Benefit-Sharing Regime – In Force (status~r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status of Access and Benefit-Sharing Regime – In Force (statusfac~r)</td>
<td>1.0000</td>
</tr>
<tr>
<td>Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of</td>
<td>0.1942</td>
</tr>
<tr>
<td></td>
<td>170</td>
</tr>
</tbody>
</table>
### Table 4.4 (cont.)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Correlation Coefficient</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Justice (ICJ)? (enforcement)</td>
<td>0.2694</td>
<td>170</td>
</tr>
<tr>
<td>Developed/Developing (developed)</td>
<td>0.0314</td>
<td>46</td>
</tr>
<tr>
<td>Status of Plant Patent Laws (statusofpl)</td>
<td></td>
<td>.</td>
</tr>
<tr>
<td>Status of PVP Laws (statusofpv)</td>
<td>0.0314</td>
<td>68</td>
</tr>
<tr>
<td>The Patentability of Novelty of Patent Laws – Is the Prior Art included “Oral Disclosure” and “Distributed Publication”? (v11)</td>
<td>-0.1333</td>
<td>52</td>
</tr>
<tr>
<td>Numbers of Patent Applications in 2006 (numbers-n200)</td>
<td>0.2344</td>
<td>75</td>
</tr>
<tr>
<td>Numbers of Patent Grants in 2006 (numbers-2006)</td>
<td>0.2458</td>
<td>64</td>
</tr>
<tr>
<td>Numbers of Chemistry Patent Applications (including plant and other biotechnology patents) – 2001~2005 Average (numbersofc-t)</td>
<td>0.2505</td>
<td>28</td>
</tr>
<tr>
<td>Numbers of PVP Applications – 2002~2006 Average (numb-2002200)</td>
<td>0.4002</td>
<td>59</td>
</tr>
<tr>
<td>Numbers of PVP Grants – 2002~2006 Average (numbersofp-a)</td>
<td>0.3644</td>
<td>59</td>
</tr>
<tr>
<td>Enforcing Contracts Cost of 200% of income per capita (%) (enforcingc-c)</td>
<td>-0.1792</td>
<td>159</td>
</tr>
<tr>
<td>Rule of Law – Governance Score of 2007 (-2.5~+2.5) (ruleof-20072)</td>
<td>0.2346</td>
<td>169</td>
</tr>
<tr>
<td>Control of Corruption – Governance Score of 2007 (-2.5~+2.5) (controlofc-c)</td>
<td>0.2128</td>
<td>168</td>
</tr>
<tr>
<td>Government Effectiveness – Governance Score of 2007 (-2.5~+2.5) (government-n)</td>
<td>0.2709</td>
<td>170</td>
</tr>
<tr>
<td>GDP of 2008 (billion $)</td>
<td>0.2544</td>
<td>157</td>
</tr>
<tr>
<td>(gdpof2008b-n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP (PPP) of 2008 (billion $)</td>
<td>0.2610</td>
<td>161</td>
</tr>
<tr>
<td>(gdppppof20-n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP per capita of 2008 (USD)</td>
<td>0.3022</td>
<td></td>
</tr>
<tr>
<td>Metric</td>
<td>Value</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>(gdppercapi-d)</td>
<td>161</td>
<td></td>
</tr>
<tr>
<td>GDP – per capita of 2008 (PPP)</td>
<td>0.2960</td>
<td></td>
</tr>
<tr>
<td>(gdppvercap-p)</td>
<td>158</td>
<td></td>
</tr>
<tr>
<td>The Shares of Agriculture on GDP (%) (theshareso-p)</td>
<td>-0.1900</td>
<td></td>
</tr>
<tr>
<td>The Shares of R&amp;D Expenditures on GDP in 2000 ~ 2005 (%) (theshareso-so-n)</td>
<td>0.3262</td>
<td></td>
</tr>
<tr>
<td>Researchers in R&amp;D in 1990 ~ 2005 (per million people) (researcher~l)</td>
<td>0.2523</td>
<td></td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure on R&amp;D of GDP in 2005 (%)</td>
<td>0.1599</td>
<td></td>
</tr>
<tr>
<td>(theshareso~t)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure on R&amp;D Performed by Industry of GDP (PPP) in 2007 (%) (v31)</td>
<td>0.2453</td>
<td></td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure on R&amp;D Performed by Higher Education and Government of GDP (PPP) in 2007 (%) (v32)</td>
<td>0.0124</td>
<td></td>
</tr>
<tr>
<td>GNI per capita of 2007 – Atlas method (USD) (gnipercaip-s)</td>
<td>0.2835</td>
<td></td>
</tr>
<tr>
<td>2007/2008 Gini Index (%) (v34)</td>
<td>-0.0448</td>
<td></td>
</tr>
<tr>
<td>2007/2008 Gini Index (%) (v34)</td>
<td>117</td>
<td></td>
</tr>
<tr>
<td>Human Development Index of 2005 (humande~2005)</td>
<td>0.2268</td>
<td></td>
</tr>
<tr>
<td>Population of 2008 (million) (population~n)</td>
<td>0.1798</td>
<td></td>
</tr>
<tr>
<td>The Percentage of Total Researchers, which occupies total population in 2006 (%) (thepercen~w)</td>
<td>0.0212</td>
<td></td>
</tr>
<tr>
<td>1995- 2005 Literacy Rate (%) (v38)</td>
<td>0.2007</td>
<td></td>
</tr>
<tr>
<td>The Percentage of Economically Active Labor Force on Agriculture, which occupies total population in 2005 (%) (thepercen~v)</td>
<td>-0.0967</td>
<td></td>
</tr>
<tr>
<td>The Percentage of Population in Urban</td>
<td>0.2038</td>
<td></td>
</tr>
</tbody>
</table>
### 4.3.2.2 Model 1 Regression

Model 1 is the probit regression run using the “Status of Access and Benefit-Sharing Regime” as the dependent variable and “Numbers of PVP Applications – 2002–2006 Average” as the independent variable that exhibits the greatest degree of correlation with the dependent variable. The outputs of the regression appear in Table 4.5.

| Status of Access and Benefit-Sharing Regime – In Force (statusofac-r) | Coefficient | Standard Error | z-statistic | P > |z| | 95% Conf. Interval |
|---|---|---|---|---|---|---|
| Numbers of Patent Applications in 2006 (numb–2002200) | .0048839 | .0018111 | 2.70 | 0.007 | .0013342 | .0084336 |
| _cons | -.4241909 | .2195464 | -1.93 | 0.053 | -.8544939 | .0061121 |

### 4.3.2.2.1 Null-Hypothesis Test

In addition to running a regression, testing the null-hypothesis should be conducted after regression analysis. In this model, the null-hypothesis is that “the 194 contracting parties to the CBD or the ITPGR adopt the ABS regime, which does not correlate with the numbers of PVP applications filed in these parties.” Therefore, if we use the P-value to test the
null-hypothesis, the null-hypothesis is rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.007) is statistically significant (P-value < .05).  

The following Table 4.6 points out that the specificity of Model 1 is high, so the “Type I error” probability is low. In other words, the probability of “rejecting the true null-hypothesis” is low. On the other hand, the sensitivity of Model 1 is low, so the “Type II error” probability is high. This means that the probability of “failing to reject the false null-hypothesis” is high. However, the null-hypothesis in this regression is rejected, which means that it is impossible that a “Type II error” exists in this regression. Because the “Type I error” probability (rejecting the true null-hypothesis) is low, the probability that this rejected null-hypothesis is true is low.

4.3.2.2.2 Model Test

In addition to testing the null-hypothesis, determining whether or not a good regression model can completely determine the dependent variable is important. This section will use different methods to test Model 1. If the P-value of Model 1 is (.0001) in Table 4.5, Model 1 is statistically significant (P-value < .05), and therefore Model 1 is a good model according

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850 See Cope, supra note 847, at 40.
851 The significance level, $\alpha$, has been called the error of the first kind, Type I error and the alpha error. Because it is the probability of rejecting a true null hypothesis, it should be taken as a relatively small value. On the other hand, specificity (the probability that it is true negative), which indicates that the null-hypothesis is in fact true, and the test outcome shows that this null-hypothesis is false, should be high. As a result, when specificity is high, Type I error is low. However, when specificity is low, Type I error is high. See Jacob Cohen, Statistical Power Analysis for the Behavioral Sciences 4 (2d ed. 1988); Emory University, CancerQuest, Diagnosis & Detection, Introduction: Cancer Detection – Sensitivity and Specificity of Medical Tests, http://www.cancerquest.org/index.cfm?page=3305 (last visited July 31, 2009).
852 “Type I error” is “the rejection of the null hypothesis when it is in fact true.” See Cope, supra note 847, at 103.
853 “Type II error” is symbolized as $b$ and is known as beta error, and Type II error is the error rate of failing to reject a false null-hypothesis, so this error rate should be low. On the other hand, power values are also called sensitivity (the probability of true positive), which indicates that for the testing null-hypothesis is in fact false, and the test outcome shows that this null-hypothesis is also false, should be high. See Cohen, supra note 851, at 5; Emory University, CancerQuest, Diagnosis & Detection, Introduction: Cancer Detection – Sensitivity and Specificity of Medical Tests, supra note 851.
854 “Type II error” is “failure to reject the null hypothesis when it is in fact false.” See Cope, supra note 847, at 103.
855 See Cope, supra note 847, at 40.
to the P-value of this model. However, the methods of testing this regression model are not limited to the P-value, so this section will use the “Positive Predictive Value Rate” as another method for testing Model 1. The outputs of postestimation produced by the STATA software show the outcomes of “Positive Predictive Value Rate” in Table 4.6.

Table 4.6  The Postestimation of Model 1 – The Probit Regression between the Status of Access and Benefit-Sharing Regime (ABS) and the Numbers of PVP Applications – 2002~2006 Average

<table>
<thead>
<tr>
<th>True</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>16</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td>-</td>
<td>15</td>
<td>23</td>
<td>38</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>28</td>
<td>59</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .5
True D defined as statusofaccessandbenefitsharingr != 0

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Pr(+</td>
<td>D)</td>
</tr>
<tr>
<td>Specificity</td>
<td>Pr(-</td>
<td>~D)</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>Pr( D</td>
<td>+)</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>Pr(~D</td>
<td>-)</td>
</tr>
<tr>
<td>False + rate for true ~D</td>
<td>Pr( +</td>
<td>~D)</td>
</tr>
<tr>
<td>False - rate for true D</td>
<td>Pr( +</td>
<td>D)</td>
</tr>
<tr>
<td>False + rate for classified +</td>
<td>Pr(~D</td>
<td>+)</td>
</tr>
<tr>
<td>False - rate for classified -</td>
<td>Pr( D</td>
<td>-)</td>
</tr>
<tr>
<td>Correctly classified</td>
<td></td>
<td>66.10%</td>
</tr>
</tbody>
</table>

Furthermore, if we examine the “Positive Predictive Value” in Table 9, we see that the random prediction for dependent variable = 1 (contracting parties to the CBD or the ITPGR have adopted ABS regimes) has a 40% chance (68/170) of being right, but the positive predictive value (76.19%) in Model 1 is even greater. According to the positive predictive value, Model 1 is a good regression model for determining the dependent variable. This dissertation uses the Model 2 regression in order to determine whether Model 2 is better than Model 1 for determining the dependent variable.
4.3.2.3 Model 2 Regression

This regression adds the second highly correlated independent variable – “GDP – per capita of 2008 (PPP)” in the former Model 1 regression to the Model 2 regression in Table 4.7:

<table>
<thead>
<tr>
<th>Status of Access and Benefit-Sharing Regime – In Force (statusofac~r)</th>
<th>Number of obs</th>
<th>LR chi²(2)</th>
<th>Prob &gt; chi²</th>
<th>Pseudo R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of Patent Applications in 2006 (numb~2002200)</td>
<td>59</td>
<td>17.60</td>
<td>0.0002</td>
<td>0.2155</td>
</tr>
<tr>
<td>GDP – per capita of 2008 (PPP) (gdpvper~p)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_cons</td>
<td>-0.8791405</td>
<td>0.3471363</td>
<td>-2.53</td>
<td>0.011</td>
</tr>
</tbody>
</table>

Table 4.7  Model 2 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, and GDP – per capita of 2008 (PPP)

| Status of Access and Benefit-Sharing Regime – In Force (statusofac~r) | Coefficient | Standard Error | z-statistic | P > |z| | [95% Conf. Interval] |
|---------------------------------------------------------------|-------------|----------------|-------------|-----|---|---------------------|
| Numbers of Patent Applications in 2006 (numb~2002200)        | 0.0046899   | 0.0018344      | 2.56        | 0.011 |   | 0.0010946    .0082852 |
| GDP – per capita of 2008 (PPP) (gdpvper~p)                    | 0.000224    | 0.000129       | 1.74        | 0.082 |   | -2.85e-06    .0000477 |
| _cons                                                         | -.8791405   | .3471363       | -2.53       | 0.011 |   | -1.559515   -.198766  |

4.3.2.3.1 Null-Hypothesis Test

In Model 2, the null-hypothesis states that “194 contracting parties to the CBD or the ITPGR have adopted ABS regimes, which does not correlate with the number of PVP application filed in these parties.” Therefore, if we use the P-value to test this null-hypothesis, this null-hypothesis is rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.011) is statistically significant (P-value < .05). Although the P-value of “GDP – per capita of 2008 (PPP)” (.082 > .05) is not statistically significant, “GDP – per capita of 2008 (PPP)” is not covered by this null-hypothesis, and the variable “Numbers of
PVP Applications – 2002~2006 Average” is statistically significant, so this null-hypothesis is rejected.

Furthermore, the ideal case for “Sensitivity” and “Specificity” when testing the null-hypothesis is that both sensitivity and specificity are high, because the rates of “Type I error” (rejecting the true null-hypothesis) and “Type II error” (failing to reject the false null-hypothesis) are low. Compared with the sensitivity and specificity of Model 1, the sensitivity of Model 2 is higher than that of Model 1. In other words, the probability of “Type II error” in Model 2 is lower than in Model 1. However, the specificity of Model 2 is lower than that of Model 1, so the probability of “Type I error” of Model 2 is higher than in Model 1. In other words, the rejected null-hypothesis in Model 2 may be true, and the probability of such a situation occurring in Model 2 is higher than for Model 1.

4.3.2.3.2 Model Test

If we use the P-value of Model 2 (.0002) in Table 4.7, Model 2 is shown to be statistically significant (P-value < .05) and is a good model for determining the dependent variable. However, this dissertation will not conclude that Model 2 is a good model for determining the dependent variable only by means of the P-value. The “Pseudo R$^2$” is a good method for comparing which model best fits the outcome data for the same dataset, and the higher “Pseudo R$^2$” indicates which model best predicts the outcome. In this situation, the “Pseudo R$^2$” of Model 2 increases and exceeds that of Model 1, and this is additional evidence that Model 2 is better than Model 1 for determining the dependent variable.

Table 4.8  The Postestimation of Model 2 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, and GDP – per capita of 2008 (PPP)

<table>
<thead>
<tr>
<th>Classified</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>20</td>
<td>7</td>
<td>27</td>
</tr>
<tr>
<td>-</td>
<td>11</td>
<td>21</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>28</td>
<td>59</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .5

True D defined as statusofaccessandbenefitsharingr != 0

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Pr( +</td>
<td>D)</td>
</tr>
<tr>
<td>Specificity</td>
<td>Pr( -</td>
<td>~D)</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>Pr( D</td>
<td>+)</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>Pr(~D</td>
<td>-)</td>
</tr>
<tr>
<td>False + rate for true ~D</td>
<td>Pr( +</td>
<td>~D)</td>
</tr>
<tr>
<td>False - rate for true D</td>
<td>Pr( -</td>
<td>D)</td>
</tr>
<tr>
<td>False + rate for classified +</td>
<td>Pr(~D</td>
<td>+)</td>
</tr>
<tr>
<td>False - rate for classified -</td>
<td>Pr( D</td>
<td>-)</td>
</tr>
<tr>
<td>Correctly classified</td>
<td></td>
<td>69.49%</td>
</tr>
</tbody>
</table>

In addition, if we take the method of “Positive Predictive Value” for testing Model 2, we find that the random prediction for dependent variable = 1 (contracting parties to the CBD or the ITPGR have adopted the ABS regimes) has a 40% chance (68/170) of being right, but the positive predictive value (74.07%) in Model 2 is better (40%). However, compared with the positive predictive value of Model 1, the positive predictive value (74.07%) of Model 2 is lower (76.19%) than in Model 1, so Model 2 is not better than Model 1 for determining the dependent variable.

The “Correctly Classified Rate” (69.49%) in Model 2 is higher than that (66.10%) in Model 1. In other words, the 41 variables (59*69.49%) in Model 2 exceed the 39 variables (59*66.10%) in Model 1, which are correctly classified as not having “Type I” and “Type II” errors. Based on the correctly classified rate, Model 2 is better than Model 1 for determining the dependent variable. In conclusion, Model 2 still has room for improvement and is not
better than Model 1 for determining the dependent variable, so the next section will run another model regression.

4.3.2.4 Model 3 Regression

The outcomes of the Model 2 regression show that Model 2 is not a good model for determining the dependent variable (Status of Access and Benefit-Sharing Regime), so we will add the third highly correlated independent variable – “The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007” from the former Model 2 regression to the new Model 3 regression in Table 4.9:

Number of obs   =         34  
LR chi²(3)      =      12.96  
Prob > chi² =     0.0047  
Pseudo R²  =     0.2935

Table 4.9  Model 3 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), and The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007

| Status of Access and Benefit-Sharing Regime – In Force (statusofac~r) | Coefficient | Standard Error | z-statistic | P>|z| | [95% Conf. Interval] |
|---|---|---|---|---|---|
| Numbers of PVP Applications – 2002~2006 Average (numb~2002200) | .0050265 | .0025215 | 1.99 | 0.046 | .0000844    .0099686 |
| GDP – per capita of 2008 (PPP) (gdpvper~cap~p) | .0000156 | .0000274 | 0.57 | 0.569 | -.0000381    .0000694 |
| The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007 (%) (v31) | .6524533 | .4800228 | 1.36 | 0.174 | -.2883742    1.593281 |

169
4.3.2.4.1 Null-Hypothesis Test

In Model 3, the null-hypothesis is stated as “194 contracting parties to the CBD or the ITPGR adopt ABS regimes, which is not correlated with the numbers of PVP applications filed in these parties.” The P-value shows that this null-hypothesis is rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.046) is statistically significant (P-value < .05). Although the P-values of “GDP – per capita of 2008 (PPP)” (.569 > .05) and “The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007” (.174 > .05) are not statistically significant, “GDP – per capita of 2008 (PPP)” and “The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007” are not discussed with respect to this null-hypothesis, and the variable “Numbers of PVP Applications – 2002~2006 Average” is statistically significant, so this null-hypothesis is still rejected.

Compared with the sensitivity and specificity of the Model 2, the sensitivity of Model 3 exceeds that of Model 2. In other words, the probability of a “Type II error” occurring in Model 3 is lower than for Model 2. However, the specificity of Model 3 is lower than for Model 2, which means that the probability of having a “Type I error” occur in Model 3 is greater than for Model 2. As a result, the rejected null-hypothesis in Model 3 may be true, and the probability of such a situation occurring in Model 3 is higher than is the case for Model 2.

4.3.2.4.2 Model Test

If we use the P-value of Model 3 (.0047) in Table 4.9, Model 3 is statistically significant (P-value < .05) and is a good model for determining the dependent variable. However, this
In addition, we cannot determine whether Model 3 is better than Model 2 for determining the dependent variable, because the number of observations de-
creased from 59 to 34.

Finally, the “Correctly Classified Rate” (64.71%) of Model 3 is lower (69.49%) than for Model 2. In other words, the 22 variables (34*64.71%) in Model 3 do not exceed the 41 variables (59*69.49%) in Model 2, which are correctly classified as not having “Type I” and “Type II” errors. In other words, the variables in Model 2, which are correctly classified as not having “Type I” and “Type II” errors, do not exceed the variables in Model 3. However, we still cannot conclude that Model 2 is better than Model 3 for determining the dependent variable, and the reason is that Model 3 has the same positive predictive value even though the number of observations decreased from 59 to 34. Although the “Pseudo R2” shows that Model 3 better than Model 2, it has room for improvement. Therefore the next section will run another model regression.

4.3.2.5 Model 4 Regression

The outcomes of the Model 3 regression show that Model 3 is not a good model for determining the dependent variable (Status of Access and Benefit-Sharing Regime). Therefore, we will add the fourth highly correlated independent variable – “Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?” to the former Model 3 regression, which yields the new Model 4 regression in Table 4.11:

<table>
<thead>
<tr>
<th>Number of obs</th>
<th>34</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR chi²(4)</td>
<td>13.49</td>
</tr>
<tr>
<td>Prob &gt; chi²</td>
<td>0.0091</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.3055</td>
</tr>
</tbody>
</table>

Table 4.11  Model 4 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002–2006 Average, GDP – per capita of 2008 (PPP), The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, and Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?
Table 4.11 (cont.)

<table>
<thead>
<tr>
<th>Status of Access and Benefit-Sharing Regime – In Force (statusofac=r)</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>z-statistic</th>
<th>P&gt;</th>
<th>z</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of PVP Applications – 2002–2006 Average (numb~2002200)</td>
<td>.0052389</td>
<td>.0025595</td>
<td>2.05</td>
<td>0.041</td>
<td>.0002224</td>
<td>.0102554</td>
</tr>
<tr>
<td>GDP – per capita of 2008 (PPP) (gdpvper-cap~p)</td>
<td>.0000149</td>
<td>.000028</td>
<td>0.53</td>
<td>0.595</td>
<td>-.0000399</td>
<td>.0000697</td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure on R&amp;D Performed by Industry of GDP (PPP) in 2007 (%) (v31)</td>
<td>.6783656</td>
<td>.4811682</td>
<td>1.41</td>
<td>0.159</td>
<td>-.2647066</td>
<td>1.621438</td>
</tr>
<tr>
<td>Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)? (enforcemen~e)</td>
<td>.3886003</td>
<td>.5384083</td>
<td>0.72</td>
<td>0.470</td>
<td>-.6666606</td>
<td>1.443861</td>
</tr>
<tr>
<td>_cons</td>
<td>-1.639233</td>
<td>.9449407</td>
<td>-1.73</td>
<td>0.083</td>
<td>-3.491282</td>
<td>.2128171</td>
</tr>
</tbody>
</table>

Note: 0 failures and 1 success completely determined.

4.3.2.5.1 Null-Hypothesis Test

In Model 4, the null-hypothesis is stated as “194 contracting parties to the CBD or the ITPGR adopt ABS regimes, which does not correlate with the numbers of PVP applications that these parties file.” Therefore, if we use the P-value to test this null-hypothesis, this null-hypothesis is rejected, because the P-value of “Numbers of PVP Applications – 2002–2006 Average” (.041) is statistically significant (P-value < .05). Although the other
three variables in this regression are not statistically significant, they are not discussed with respect to this null-hypothesis, and the variable “Numbers of PVP Applications – 2002~2006 Average” is statistically significant, so this null-hypothesis is still rejected.

In comparison with the sensitivity and specificity of Model 3, both the sensitivity and specificity of Model 4 are better than Model 3. In other words, the probabilities of “Type I error” and “Type II error” in Model 4 are lower than in Model 3. As a result, we do not need to worry about the probability of “Type I error” (the probability of rejecting the true null-hypothesis) in Model 4, because the probability of “Type I error” in Model 4 is low, and is even lower than in Model 3.

4.3.2.5.2 Model Test

If we use the P-value of Model 4 (.0091) in Table 4.11, Model 4 is statistically significant (P-value < .05) and is a good model for determining the dependent variable. However, this dissertation will not conclude that Model 4 is a good model for determining the dependent variable only by means of P-value. In addition, the “Pseudo R²” of Model 4 increases and is greater than in Model 3, which is evidence that Model 4 is a better than Model 3 for determining the dependent variable.

In addition, if we use the method of “Positive Predictive Value” to test Model 4, we find that the random prediction for dependent variable = 1 (contracting parties to the CBD or the ITPGR that have adopted ABS regimes) has a 40% chance (68/170) of being right, but the positive predictive value (78.26%) of Model 4 is better (40%). However, compared with the positive predictive value of Model 3, the positive predictive value (78.26%) of Model 4 is higher (70.83%) than for Model 3, so Model 4 is better than Model 3 for determining the dependent variable.
Table 4.12  The Postestimation of Model 4 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, and Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?

<table>
<thead>
<tr>
<th>Classified</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>18</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>-</td>
<td>4</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>12</td>
<td>34</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .5

True D defined as statusofaccessandbenefitsharingr != 0

|                      | Pr( +| D)  | 81.82% |
|----------------------|---------|--------|
| Sensitivity          |         |        |
| Specificity          | Pr( -|~D)  | 58.33% |
| Positive predictive value | Pr( D| +)  | 78.26% |
| Negative predictive value | Pr(-D| -)  | 63.64% |
| False + rate for true ~D | Pr( +|~D)  | 41.67% |
| False - rate for true D  | Pr( -| D)  | 18.18% |
| False + rate for classified + | Pr(-D| +)  | 21.74% |
| False - rate for classified - | Pr( D| -)  | 36.36% |
| Correctly classified  |         | 73.53% |

As regards the “Correctly Classified Rate” for Model 4 (73.53%) is greater than for Model 3 (64.71%). In other words, the 25 variables (34*73.53%) in Model 4 exceed the 22 variables (34*64.71%) in Model 3, which are correctly classified as not having “Type I” and “Type II” errors. Based on the correctly classified rate, Model 4 is better than Model 3 for determining the dependent variable. To sum up, Model 4 is much better than Model 3 for determining the dependent variable, but there remains a need for a better regression model, so the next section will run another model regression.

4.3.2.6 Model 5 Regression

Although Model 4 is helpful for determining the dependent variable (Status of Access and Benefit-Sharing Regime), we will add the fifth highly correlated independent variable –
“Enforcing Contracts Costs of 200% of income per capita” to the former Model 4 regression to create the new Model 5 regression in Table 4.13:

| Status of Access and Benefit-Sharing Regime – In Force (statusofac~r) | Coefficient | Standard Error | z-statistic | P>|z| | [95% Conf. Interval] |
|---------------------------------------------------------------|-------------|----------------|-------------|----------------|----------------|
| Numbers of PVP Applications – 2002~2006 Average (numb~2002200) | .0061762    | .0027007       | 2.29        | 0.022          | .0008829 .0114694 |
| GDP – per capita of 2008 (PPP) (gdpvpercap~p)                | .0000239    | .0000297       | 0.81        | 0.421          | -.0000343 .000082 |
| The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007 (%) (v31) | .6965865    | .5018339       | 1.39        | 0.165          | -.2869899 1.680163 |
| Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice | .6114814    | .6017117       | 1.02        | 0.310          | -.5678518 1.790815 |

Table 4.13  Model 5 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, and Enforcing Contracts Cost of 200% of income per capita

Number of obs = 34
LR chi²(5) = 15.59
Prob > chi² = 0.0081
Pseudo R² = 0.3531
Table 4.13 (cont.)

<table>
<thead>
<tr>
<th>(ICJ)? (enforcement–e)</th>
<th>Enforcing Contracts</th>
<th>Cost of 200% of income per capita (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.0555177</td>
<td>.0399693</td>
</tr>
<tr>
<td></td>
<td>1.39</td>
<td>0.165</td>
</tr>
<tr>
<td></td>
<td>-.0228206</td>
<td>.1338561</td>
</tr>
</tbody>
</table>

| (enforcingc–c)        | _cons               | 1.602733                             |
|                       | -3.290369           | -2.05                                |
|                       | 0.040               | -6.431668                            |
|                       | -.149069            |                                     |

Note: 0 failures and 1 success completely determined.

4.3.2.6.1 Null-Hypothesis Test

In Model 5, the null-hypothesis is stated as “194 contracting parties to the CBD or the ITPGR adopt ABS regimes, which does not correlate with the numbers of PVP applications filed in these parties.” Therefore, if we use the P-value to test this null-hypothesis, this null-hypothesis is rejected, because the P-value of “Numbers of PVP Applications – 2002–2006 Average” (.022) is statistically significant (P-value < .05). Although the P-values of “GDP – per capita of 2008 (PPP)” (.421 > .05), “The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007” (.165 > .05), “Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?” (.310 > .05), and “Enforcing Contracts Cost of 200% of income per capita” (.165 > .05) are not statistically significant, these variables are not discussed in the context of this null-hypothesis, and the variable “Numbers of PVP Applications – 2002–2006 Average” is statistically significant, so this null-hypothesis is still rejected.

Comparing Model 5 with the sensitivity and specificity of Model 4 shows that both the sensitivity and the specificity of Model 5 are identical with Model 4. The probabilities of “Type I” and “Type II” errors in Model 5 are identical with those found in Model 4. In other words, we need not worry about the probability of “Type I error” (the probability of rejecting the true null-hypothesis) in Model 5, because the probability of such errors in Model 5 is low and identical with the probability found in Model 4.
4.3.2.6.2 Model Test

If we use the P-value of Model 5 (.0081) in Table 4.14, Model 5 is statistically significant (P-value < .05) and is a good model for determining the dependent variable. However, this dissertation will not conclude that Model 5 is a good model for determining the dependent variable only by means of the P-value. In addition, the “Pseudo $R^2$” of Model 5 increases and exceeds that of Model 4, which shows that Model 5 is better than Model 4 for determining the dependent variable.

Table 4.14  The Postestimation of Model 5 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, and Enforcing Contracts Cost of 200% of income per capita

<table>
<thead>
<tr>
<th>Classified</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>18</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>-</td>
<td>4</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>12</td>
<td>34</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .5

True D defined as status of access and benefit sharing ≠ 0

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Pr(+</td>
<td>D)</td>
<td>81.82%</td>
</tr>
<tr>
<td>Specificity</td>
<td>Pr(−</td>
<td>D)</td>
<td>58.33%</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>Pr(D</td>
<td>+)</td>
<td>78.26%</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>Pr(D</td>
<td>−)</td>
<td>63.64%</td>
</tr>
<tr>
<td>False + rate for true ~D</td>
<td>Pr(+</td>
<td>~D)</td>
<td>41.67%</td>
</tr>
<tr>
<td>False - rate for true D</td>
<td>Pr(−</td>
<td>D)</td>
<td>18.18%</td>
</tr>
<tr>
<td>False + rate for classified +</td>
<td>Pr(D</td>
<td>+)</td>
<td>21.74%</td>
</tr>
<tr>
<td>False - rate for classified -</td>
<td>Pr(D</td>
<td>−)</td>
<td>36.36%</td>
</tr>
<tr>
<td>Correctly classified</td>
<td></td>
<td>73.53%</td>
<td></td>
</tr>
</tbody>
</table>

Using the method of “Positive Predictive Value” to test Model 5 shows that the random prediction for dependent variable = 1 (contracting parties to the CBD or the ITPGR have
adopted the ABS regimes) has a 40% chance (68/170) of being right, but the positive predictive value (78.26%) of Model 5 is greater (40%). However, compared with the positive predictive value of Model 4, the positive predictive value (78.26%) of Model 5 is identical (78.26%) with Model 4, so both Model 4 and Model 5 are better regression models for determining the dependent variable in terms of “Positive Predictive Value.”

The “Correctly Classified Rate” (73.53%) of Model 5 is identical with Model 4 (73.53%). In other words, the 25 variables (34*73.53%) in Model 5 are the same as the 25 variables (34*73.53%) in Model 4, which are correctly classified as not having “Type I” and “Type II” errors. To sum up, in comparison with Model 4, Model 5 is a better model for determining the dependent variable based on the increased “Pseudo R2.”

4.3.2.7 Summary

A review of the Model 1 through Model 5 regressions shows that the “Numbers of PVP Applications – 2002~2006 Average” is a statistically significant independent variable and is significantly correlated with whether or not the 194 parties to the CBD or the ITPGR adopt ABS regimes. This dissertation uses different methods for testing the Model 1 through Model 5 regressions, and Model 5 is a better regression model than the other models for determining the dependent variable.

4.3.3 Hypothesis 2: The More Plant Variety Protection (PVP) Applications that are Filed in Developed Countries, the Lower Probability that They will Adopt Access and Benefit-Sharing Regimes (ABS)

4.3.3.1 The Establishment of Regression Models for Testing the Hypothesis

Regression analysis is used both to determine which variable is statistically significant, and to find a better regression model which can completely determine the dependent variable.
(Status of Access and Benefit-Sharing Regime). This dissertation will not use the “Numbers of PVP Applications – 2002~2006 Average” as the sole independent variable in running a probit regression in order to examine whether or not the “Numbers of PVP Applications – 2002~2006 Average” is statistically significant, and will use the “P-value,” “Sensitivity,” and “Specificity” to test the null-hypothesis. This dissertation will set up several regression models rank-ordered by “Correlation Coefficients” with the dependent variable from high to low and use the methods of “P-value,” “Pseudo R\(^2\),” “Positive Predictive Value,” and “Correctly Classified Rate” to judge each regression model and to determine whether each subsequent regression model is better than the previous regression. In other words, each subsequent regression model should be better than the previous regression model for determining the dependent variable.

Moreover, the problem with this regression analysis is “Multicollinearity.” In order to solve the problem of multicollinearity, this section will measure correlation coefficients in Table 4.15 and drop highly correlated variables, and the final independent variables used in this regression have been discussed in section 4.3.1. The ranking of these correlation coefficients with respect to the dependent variable also provides a guideline for the establishment of regression models.

<table>
<thead>
<tr>
<th>Status of Access and Benefit-Sharing Regime – In Force (status~r)</th>
<th>1.0000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International</td>
<td>0.2874</td>
</tr>
</tbody>
</table>

Table 4.15  The Correlation Coefficients of Dependent and Independent Variables related to the Regression Analysis of the Implementation of Access and Benefit-Sharing (ABS) Laws and Policies from Developed Countries that are Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR)
<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Court of Justice (ICJ)? (enforcement)</td>
<td>0.1336</td>
</tr>
<tr>
<td>Status of Plant Patent Laws (statusofpl-s)</td>
<td>15</td>
</tr>
<tr>
<td>Status of PVP Laws (statusofpv-s)</td>
<td>.</td>
</tr>
<tr>
<td>The Patentability of Novelty of Patent Laws – Is the Prior Art included “Oral Disclosure” and “Distributed Publication”? (v10)</td>
<td>0.1070</td>
</tr>
<tr>
<td>Numbers of Patent Applications in 2006 (numbers-n200)</td>
<td>0.1932</td>
</tr>
<tr>
<td>Numbers of Patent Grants in 2006 (numbers-2006)</td>
<td>0.2470</td>
</tr>
<tr>
<td>Numbers of Chemistry Patent Applications (including plant and other biotechnology patents) – 2001~2005 Average (numbersofct)</td>
<td>0.2795</td>
</tr>
<tr>
<td>Numbers of PVP Applications – 2002~2006 Average (numbersofp-a)</td>
<td>0.3798</td>
</tr>
<tr>
<td>Enforcing Contracts Cost of 200% of income per capita (%) (enforcingc-c)</td>
<td>-0.0995</td>
</tr>
<tr>
<td>Rule of Law – Governance Score of 2007 (-2.5→+2.5) (ruleof-20072)</td>
<td>0.0591</td>
</tr>
<tr>
<td>Control of Corruption – Governance Score of 2007 (-2.5→+2.5) (controlofc-c)</td>
<td>-0.0995</td>
</tr>
<tr>
<td>Government Effectiveness – Governance Score of 2007 (-2.5→+2.5) (government-n)</td>
<td>-0.0080</td>
</tr>
<tr>
<td>GDP of 2008 (billion $) (gdpo2008b-n)</td>
<td>0.2331</td>
</tr>
<tr>
<td>GDP (PPP) of 2008 (billion $) (gdpppof20-n)</td>
<td>0.2128</td>
</tr>
<tr>
<td>GDP per capita of 2008 (USD) (gdppercaip-d)</td>
<td>0.1372</td>
</tr>
<tr>
<td>GDP – per capita of 2008 (PPP) (gdpvperc-cap-p)</td>
<td>0.0301</td>
</tr>
<tr>
<td>The Shares of Agriculture on GDP (%) (the-shareso-p)</td>
<td>0.0785</td>
</tr>
<tr>
<td>The Shares of R&amp;D Expenditures on GDP in</td>
<td>0.0511</td>
</tr>
<tr>
<td>Variable</td>
<td>Value</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Researchers in R&amp;D in 1990 ~ 2005 (per million people) (researcher~l)</td>
<td>-0.0987</td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure on R&amp;D of GDP in 2005 (%) (theshareso~t)</td>
<td>0.0759</td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure on R&amp;D Performed by Industry of GDP (PPP) in 2007 (%) (v30)</td>
<td>0.1593</td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure on R&amp;D Performed by Higher Education and Government of GDP (PPP) in 2007 (%) (v31)</td>
<td>-0.1758</td>
</tr>
<tr>
<td>GNI per capita of 2007 – Atlas method (USD) (gnipercapi~s)</td>
<td>0.1446</td>
</tr>
<tr>
<td>2007/2008 Gini Index (%) (v33)</td>
<td>-0.0695</td>
</tr>
<tr>
<td>Human Development Index of 2005 (humanede~2005)</td>
<td>0.0899</td>
</tr>
<tr>
<td>Population of 2008 (million) (population~n)</td>
<td>0.2269</td>
</tr>
<tr>
<td>The Percentage of Total Researchers, which occupies total population in 2006 (%) (thepercent~w)</td>
<td>-0.2204</td>
</tr>
<tr>
<td>1995- 2005 Literacy Rate (%) (v37)</td>
<td>0.1000</td>
</tr>
<tr>
<td>The Percentage of Economically Active Labor Force on Agriculture, which occupies total population in 2005 (%) (thepercent~v)</td>
<td>0.0457</td>
</tr>
<tr>
<td>The Percentage of Population in Urban Areas, which occupies total population in 2006 (%) (thepercent~n)</td>
<td>-0.0734</td>
</tr>
<tr>
<td>The Percentage of total Arable Land, which occupies total area (%) (thepercent~h)</td>
<td>-0.0399</td>
</tr>
</tbody>
</table>

### 4.3.3.2 Model 1 Regression

Model 1 is the probit regression run by using the “Status of Access and Benefit-Sharing Regime” (the dependent variable) and “Numbers of PVP Applications – 2002~2006 Average...”
age” (this is the highest correlation independent variable with the dependent variable). The outputs of the regression appear in Table 4.16.

| Status of Access and Benefit-Sharing Regime – In Force (statusofac~r) | Coefficient | Standard Error | z-statistic | P > |z| | 95% Conf. Interval |
|---|---|---|---|---|---|
| Numbers of PVP Applications – 2002~2006 Average (numb~2002200) | .007288 | .0043404 | 1.68 | 0.093 | -.001219 | .0157949 |
| _cons | -.1153045 | .381936 | -0.30 | 0.763 | -.8638853 | .6332762 |

Note: 0 failures and 1 success completely determined.

### 4.3.3.2.1 Null-Hypothesis Test

In Model 1, the null-hypothesis is stated as “Developed countries who are parties to the CBD or the ITPGR, adopt ABS regimes, and this does not correlate with the numbers of PVP applications filed in these countries.” Therefore, if we use the P-value to test this null-hypothesis, this null-hypothesis is not rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.093) is statistically significant (P-value > .05). In other words, “Numbers of PVP Applications – 2002~2006 Average” is not statistically significant in this model, so we will continue to conduct the Model 2 regression in section 4.3.3.4.

The sensitivity of Model 1 is high, so the probability of “Type II error” is low. Thus, the probability of “failing to reject the false null-hypothesis” is low. On the other hand, the specificity of Model 1 is low, so the probability of “Type I error” is high. This means that the
probability of “rejecting the true null-hypothesis” is high. Because the null-hypothesis for Model 1 has not been rejected, we must examine the probability of “Type II error.” However, the probability of “Type II error” is low, so the probability that this non-rejected null-hypothesis may be false is low.

4.3.3.2.2 Model Test

In addition to testing the null-hypothesis, this section will also test Model 1 using different methods. If we use the P-value of Model 1 (.0061) in Table 19, Model 1 is statistically significant (P-value < .05) and is a good model for determining the dependent variable. However, this dissertation will not conclude that Model 1 is a good model for determining the dependent variable using only the P-value.

<table>
<thead>
<tr>
<th>Classified</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>13</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>-</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>7</td>
<td>24</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .5
True D defined as statusofaccessandbenefitsharingr != 0

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Pr( +</td>
<td>D)</td>
</tr>
<tr>
<td>Specificity</td>
<td>Pr( -</td>
<td>~D)</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>Pr( D</td>
<td>+)</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>Pr(~D</td>
<td>-)</td>
</tr>
<tr>
<td>False + rate for true ~D</td>
<td>Pr( +</td>
<td>~D)</td>
</tr>
<tr>
<td>False - rate for true D</td>
<td>Pr( -</td>
<td>D)</td>
</tr>
<tr>
<td>False + rate for classified +</td>
<td>Pr(~D</td>
<td>+)</td>
</tr>
<tr>
<td>False - rate for classified -</td>
<td>Pr( D</td>
<td>-)</td>
</tr>
<tr>
<td>Correctly classified</td>
<td>70.83%</td>
<td></td>
</tr>
</tbody>
</table>
Furthermore, the methods of testing a regression model are not limited to using the P-value, so this section uses the “Positive Predictive Value Rate” and “Correctly Classified Rate” to test Model 1. Using the method of “Positive Predictive Value” to test Model 1 shows that the random prediction for the dependent variable = 1 (developed countries have adopted ABS regimes) has a 70.37% chance (19/27) of being right, but the positive predictive value (81.25%) of Model 1 is better (70.37%).

Finally, the “Correctly Classified Rate” for Model 1 is 70.83%, and there are 17 variables (24*70.83%) in Model 1, which are correctly classified as not having “Type I” and “Type II” errors. Using the correctly classified rate shows that Model 1 is a good model for determining the dependent variable. To sum up, Model 1 is a good model for predicting the dependent variable, but we still use the Model 2 regression in order to determine whether or not Model 2 is better than Model 1 for predicting the dependent variable.

4.3.3.3 Model 2 Regression

<table>
<thead>
<tr>
<th>Number of obs</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR chi²(2)</td>
<td>8.58</td>
</tr>
<tr>
<td>Prob &gt; chi²</td>
<td>0.0137</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.2961</td>
</tr>
</tbody>
</table>

Table 4.18 Model 2 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002–2006 Average, and Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)? from Developed Countries

| Status of Access and Benefit-Sharing Regime – In Force (statusofac=r) | Coefficient | Standard Error | z-statistic | P>|z| | [95% Conf. Interval] |
|---|---|---|---|---|---|
| Numbers of PVP Applications – 2002–2006 Average (numb~2002200) | .0074534 | .0040145 | 1.86 | 0.063 | -.000415 .0153217 |
| Enforcement of the | .667825 | .653188 | 1.02 | 0.307 | -.6124 1.94805 |
CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?

<table>
<thead>
<tr>
<th></th>
<th>_cons</th>
<th>.5210495</th>
<th>.564319</th>
<th>-0.92</th>
<th>0.356</th>
<th>-1.627094</th>
<th>.5849955</th>
</tr>
</thead>
</table>

Note: 0 failures and 1 success completely determined.

This regression involves adding the second highly correlated independent variable – “Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?” to the former Model 1 regression in order to make Model 1 into the Model 2 regression shown in Table 4.18.

4.3.3.3.1 Null-Hypothesis Test

In Model 2, the null-hypothesis is stated as “Developed countries, who are parties to the CBD or the ITPGR, adopt ABS regimes, and this does not correlate with the numbers of PVP applications filed in these countries.” Therefore, if we use the P-value to test this null-hypothesis, this null-hypothesis is not rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.063) is not statistically significant (P-value > .05).

The best case for “Sensitivity” and “Specificity” with respect to testing the null-hypothesis is that both the sensitivity and specificity are high, because the probability of “Type I error” (rejecting the true null-hypothesis) and “Type II error” (failing to reject the false null-hypothesis) are both low. Compared with the sensitivity and specificity of Model 1, the sensitivity of Model 2 exceeds the sensitivity of Model 1. In other words, the probability of “Type II error” occurring in Model 2 is lower than for Model 1. However, the specificity (57.14%) of Model 2 is the same (57.14%) as for Model 1, which means that the probability of “Type I error” occurring in Model 2 is the same as in Model 1. Although the probability of
“Type I error” occurring in Model 2 is high, just as with Model 1, the null-hypothesis for Model 2 is not rejected, so we must pay attention to the probability of “Type II error.” Because the probability of “Type II error” occurring in Model 2 is low, the probability that the non-rejected null-hypothesis may be false is low.

4.3.3.3.2 Model Test

As regards the model test, the P-value of Model 2 (.0137) in Table 4.18 indicates that Model 2 is statistically significant (P-value < .05) and is a good model for determining the dependent variable. However, this dissertation will not conclude that Model 2 is a good model for determining the dependent variable only by means of the P-value. In addition, the “Pseudo $R^2$” of Model 2 increases and exceeds the “Pseudo $R^2$” of Model 1. As a result, Model 2 is better than Model 1 for determining the dependent variable under the “Pseudo $R^2$.”

As regards the method of “Positive Predictive Value” in Model 2, we find that the random prediction for dependent variable = 1 (developed countries have adopted ABS regimes) has a 70.37% chance (19/27) of being right, but the positive predictive value (84.21%) in Model 2 is greater (70.37%). However, compared with the positive predictive value of Model 1, the positive predictive value (84.21%) in Model 2 exceeds the positive predictive value of Model 1 (81.25%). As a result, Model 2 is better than Model 1 for determining the dependent variable according to the positive predictive value.

Table 4.19  The Postestimation of Model 2 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002–2006 Average, and Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)? from Developed Countries

<table>
<thead>
<tr>
<th></th>
<th>Classified</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>16</td>
<td></td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 4.19 (cont.)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>17</td>
<td>7</td>
<td>24</td>
</tr>
<tr>
<td>Classified + if predicted $Pr(D) \geq .5$</td>
<td>94.12%</td>
<td>57.14%</td>
<td>84.21%</td>
</tr>
<tr>
<td>True $D$ defined as statusofaccessandbenefitsharingr != 0</td>
<td>80.00%</td>
<td>42.86%</td>
<td>83.33%</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>$Pr( +</td>
<td>D)$</td>
<td>94.12%</td>
</tr>
<tr>
<td>Specificity</td>
<td>$Pr( ~D</td>
<td>-)$</td>
<td>57.14%</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>$Pr(D</td>
<td>+)$</td>
<td>84.21%</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>$Pr(~D</td>
<td>-)$</td>
<td>80.00%</td>
</tr>
<tr>
<td>False + rate for true $~D$</td>
<td>$Pr( +</td>
<td>~D)$</td>
<td>42.86%</td>
</tr>
<tr>
<td>False - rate for true $D$</td>
<td>$Pr( ~D</td>
<td>D)$</td>
<td>5.88%</td>
</tr>
<tr>
<td>False + rate for classified +</td>
<td>$Pr(~D</td>
<td>+)$</td>
<td>15.79%</td>
</tr>
<tr>
<td>False - rate for classified -</td>
<td>$Pr(D</td>
<td>-)$</td>
<td>20.00%</td>
</tr>
<tr>
<td>Correctly classified</td>
<td>83.33%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The “Correctly Classified Rate” (83.33%) for Model 2 is higher than for Model 1 (70.83%). The 20 variables (24*83.33%) in Model 2 exceed the 17 variables (24*70.83%) in Model 1, which are correctly classified as not having “Type I” and “Type II” errors. Using the correctly classified rate shows that Model 2 is better than Model 1 for determining the dependent variable. An examination of the model testing shows that Model 2 is much better than Model 1 for determining the dependent variable, but we still must run the Model 3 regression to determine whether or not Model 3 is better than Model 2 for determining the dependent variable.

### 4.3.3.4 Model 3 Regression

Although the outcomes of the Model 2 regression show that Model 2 is a better model than Model 1 for determining the dependent variable (Status of Access and Benefit-Sharing Regime), Model 2 does not have an independent variable, which is statistically significant, so Model 2 has room for improvement. Therefore, we add the third most highly correlated independent variable – “The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007” to the former Model 2 regression in order to create the new
Model 3 regression shown in Table 4.20:

| Coefficient | Standard Error | z-statistic | P>|z| | [95% Conf. Interval] |
|-------------|----------------|-------------|-------|------------------|
| Status of Access and Benefit-Sharing Regime – In Force (statusofac-r) | 0.0073829 | 0.004178 | 1.77 | 0.077 | -.0008058 | .0155717 |
| Numbers of PVP Applications – 2002–2006 Average (numb~2002200) | .7149268 | .678689 | 1.05 | 0.292 | -.6152792 | 2.045133 |
| Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)? (enforcement) | .4870565 | .469043 | 1.04 | 0.299 | -.432251 | 1.406364 |
| The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007 (v30) | -1.159232 | .829825 | -1.40 | 0.162 | -2.785659 | .4671954 |

Note: 0 failures and 1 success completely determined.
4.3.3.4.1 Null-Hypothesis Test

In Model 3, the null-hypothesis is stated as “Developed countries who are parties to the CBD or the ITPGR, adopt ABS regimes, and this does not correlate with the numbers of PVP applications filed in these countries.” Therefore, if we use the P-value to test this null-hypothesis, this null-hypothesis is not rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.077) is not statistically significant (P-value > .05).

In comparison with the sensitivity and specificity of Model 2, the sensitivity (88.24%) of Model 3 is lower than in Model 2 (94.12%). The probability of “Type II error” occurring in Model 3 is higher than for Model 2. However, the specificity (57.14%) of Model 3 is the same as in Model 2 (57.14%). This means that the probability of “Type I error” in Model 3 is the same as in Model 2. When compared with the probability of “Type I error,” the probability of “Type II error” (failing to reject the false null-hypothesis) in Model 3 is higher than in Model 2, and the probability of “Type II error” in Model 3 (11.76%) is lower than the probability of “Type I error” (42.86%) in Model 3. The null-hypothesis for Model 3 is not rejected, so “Type I error” has not occurred in Model 3.

4.3.3.4.2 Model Test

The P-value of Model 3 (.0202) in Table 4.20 shows that Model 3 is statistically significant (P-value < .05) and is a good model for determining the dependent variable. However, this dissertation will not conclude that Model 3 is a good model for determining the dependent variable only by means of the P-value. In addition, the “Pseudo R²” of Model 3 increases and is greater than for Model 2, which means that Model 3 is better than Model 2 for determining the dependent variable.
Table 4.21  The Postestimation of Model 3 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, and The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007 from Developed Countries

<table>
<thead>
<tr>
<th>True</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>15</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>-</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>7</td>
<td>24</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .5
True D defined as statusofaccessandbenefitsharingr != 0

|       | Pr( +| D)      | 88.24% |
|-------|-------------|--------|
| Sensitivity | Pr( +| D)      | 88.24% |
| Specificity | Pr( +| D)      | 88.24% |
| Positive predictive value | Pr( +| D)      | 88.24% |
| Negative predictive value | Pr( +| D)      | 88.24% |
| False + rate for true ~D | Pr( +| D)      | 88.24% |
| False - rate for true D | Pr( +| D)      | 88.24% |
| False + rate for classified + | Pr( +| D)      | 88.24% |
| False - rate for classified - | Pr( +| D)      | 88.24% |
| Correctly classified | 79.17% |

If we use “Positive Predictive Value” for testing Model 3, we find that the random prediction for the dependent variable = 1 (developed countries that have adopted the ABS regimes) has a 70.37% chance (19/27) of being right, but the positive predictive value (83.33%) of Model 3 is greater in current (70.37%). However, compared with the positive predictive value of Model 2, the positive predictive value (83.33%) of Model 3 is lower than for Model 2 (84.21%), so Model 3 is not better than Model 2 for determining the dependent variable.

Moreover, the “Correctly Classified Rate” (79.17%) in Model 3 is lower than in Model 2 (83.33%). The total of 19 variables (24*79.17%) in Model 3 does not exceed the 20 variables (24*83.33%) found in Model 2, which are correctly classified as not exhibiting “Type I” and “Type II” errors. When the correctly classified rate is used Model 3 is no better than Model 2 for determining the dependent variable. In summary, Model 3 still has room for improvement.
and is not a better model than Model 2 for determining the dependent variable, so the next section will conduct a Model 4 regression.

### 4.3.3.5 Model 4 Regression

The outcomes of Model 3 regression show that Model 3 is not a sufficiently good model for determining the dependent variable. Therefore, we add the fourth highly correlated independent variable – “GDP per capita of 2008 (USD)” to the former Model 3 regression as shown in the Model 4 regression in Table 4.22:

| Status of Access and Benefit-Sharing Regime – In Force (statusofac=r) | Coefficient | Standard Error | z-statistic | P>|z| | 95% Conf. Interval |
|---|---|---|---|---|---|
| Numbers of PVP Applications – 2002~2006 Average (numb~2002200) | .0079324 | .0043953 | 1.80 | 0.071 | -.0006823 to .016547 |
| Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, and GDP per capita of 2008 (USD) from Developed Countries | .6227175 | .698048 | 0.89 | 0.372 | -.7454316 to 1.990866 |

Table 4.22  Model 4 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, and GDP per capita of 2008 (USD) from Developed Countries.
Table 4.22 (cont.)

<table>
<thead>
<tr>
<th>(ICJ)? (enforcement)</th>
<th>The Shares of Gross Domestic Expenditure on R&amp;D Performed by Industry of GDP (PPP) in 2007 (v28)</th>
<th>GDP per capita of 2008 (USD) (gdppercapita–d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.4494955 .4505922</td>
<td>1.00 0.318 -.4336489 1.33264</td>
<td>-.0000165 .0000196 0.84 0.401 -.000022 0.0000549</td>
</tr>
<tr>
<td>-1.917258 1.231574  -1.56 0.120 -4.331098 .4965833</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 0 failures and 1 success completely determined.

4.3.3.5.1 Null-Hypothesis Test

In Model 4, the null-hypothesis is stated as “Developed countries, who are parties to the CBD or the ITPGR, adopt ABS regimes, and this does not correlate with the numbers of PVP applications filed in these countries.” Therefore, if we use the P-value to test this null-hypothesis, this null-hypothesis is still not rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.071) is not statistically significant (P-value > .05).

In comparison with the sensitivity and specificity of Model 3, both the sensitivity and specificity of Model 4 are the same as in Model 3. In other words, the probabilities of “Type II” and “Type I” errors in Model 4 are identical with those exhibited by Model 3. The specificity of Model 4 is still low, so the probability of “Type I error” (the probability of “rejecting the true null-hypothesis”) is high in Model 4. The null-hypothesis for Model 4 is not rejected, so “Type I error” has not occurred in Model 4.

4.3.3.5.2 Model Test

If we use the P-value to test Model 4, Model 4 is statistically significant (.0318 < .05)
and is a good model for determining the dependent variable. However, this dissertation will not conclude that Model 4 is a good model for determining the dependent variable only by using the P-value. In addition, the “Pseudo $R^2$” of Model 4 increases and exceeds that of Model 3, and is evidence that Model 4 is better than Model 3 for determining the dependent variable.

Table 4.23  The Postestimation of Model 4 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, and GDP per capita of 2008 (USD) from Developed Countries

<table>
<thead>
<tr>
<th>Classified</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>15</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>-</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>7</td>
<td>24</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) $\geq .5$

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Pr( +</td>
<td>D)</td>
</tr>
<tr>
<td>Specificity</td>
<td>Pr( -</td>
<td>D)</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>Pr( D</td>
<td>+)</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>Pr(~D</td>
<td>-)</td>
</tr>
<tr>
<td>False + rate for true ~D</td>
<td>Pr( +</td>
<td>~D)</td>
</tr>
<tr>
<td>False - rate for true D</td>
<td>Pr( -</td>
<td>D)</td>
</tr>
<tr>
<td>False + rate for classified +</td>
<td>Pr(~D</td>
<td>+)</td>
</tr>
<tr>
<td>False - rate for classified -</td>
<td>Pr( D</td>
<td>-)</td>
</tr>
<tr>
<td>Correctly classified</td>
<td></td>
<td>79.17%</td>
</tr>
</tbody>
</table>

If we use the method of “Positive Predictive Value” for testing Model 4, we find that the random prediction for the dependent variable = 1 (developed countries have adopted the ABS regimes) has a 70.37% chance (19/27) of being right, but the positive predictive value (83.33%) for Model 4 is greater in current (70.37%). Compared with the positive predictive value of Model 3, the positive predictive value (83.33%) of Model 4 is identical with Model 3.
(83.33%). As a result, Model 4 is not better than Model 3 for determining the dependent variable.

The “Correctly Classified Rate” (79.17%) in Model 4 is the same (79.17%) as in Model 3. In other words, both Model 4 and Model 3 each have 19 variables, which are correctly classified as not having “Type I” and “Type II” errors. Using the correctly classified rate shows that we can understand how Model 4 is better than Model 3 for determining the dependent variable. Using the P-value and Pseudo $R^2$ shows that Model 4 is a better model than Model 3 for determining the dependent variable. Finally, we will run the Model 5 regression to determine whether or not Model 5 is better than Model 4 for predicting the dependent variable.

4.3.3.6 Model 5 Regression

This regression will add the fifth highly correlated independent variable – “Enforcing Contracts Cost of 200% of income per capita” used in the former Model 4 regression and used it as the new Model 5 regression in Table 4.24:

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Standard Error</th>
<th>z-statistic</th>
<th>P &gt;</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of obs = 24</td>
<td>LR chi$^2$(5) = 10.68</td>
<td>Prob &gt; chi$^2$ = 0.0582</td>
<td>Pseudo $R^2$ = 0.3684</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.24 Model 5 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, GDP per capita of 2008 (USD), and Enforcing Contracts Cost of 200% of income per capita from Developed Countries
### 4.3.3.6.1 Null-Hypothesis Test

In Model 5, the null-hypothesis is stated as “Developed countries who are parties to the CBD or the ITPGR, adopt ABS regimes, and this does not correlate with the numbers of PVP applications filed in these countries.” Therefore, if we use the P-value to test this null-hypothesis, the null-hypothesis is not rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.081) is not statistically significant (P-value > .05).

In comparison with the sensitivity and specificity of Model 4, both the sensitivity and
specificity of Model 5 are the same as in Model 4. In other words, the probability of “Type II error” and “Type I error” is the same in Model 5 and Model 4. Just as is the case for Model 4, the probability of “Type I error” in Model 5 is high. As a result, we need not worry about there being a high probability of “Type I error” in Model 5, because the null-hypothesis for Model 5 has not been rejected, and “Type I error” has not occurred in Model 5.

4.3.3.6.2 Model Test

<table>
<thead>
<tr>
<th>Classified</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>15</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>-</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>7</td>
<td>24</td>
</tr>
</tbody>
</table>

Classified + if predicted $Pr(D) \geq .5$

True $D$ defined as $\text{statusofaccessandbenefitsharingr} \neq 0$

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>$Pr(+</td>
<td>D)$</td>
</tr>
<tr>
<td>Specificity</td>
<td>$Pr(-</td>
<td>\neg D)$</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>$Pr(D</td>
<td>+)$.</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>$Pr(\neg D</td>
<td>-)$.</td>
</tr>
<tr>
<td>False + rate for true ~D</td>
<td>$Pr(+</td>
<td>\neg D)$</td>
</tr>
<tr>
<td>False - rate for true D</td>
<td>$Pr(-</td>
<td>D)$</td>
</tr>
<tr>
<td>False + rate for classified +</td>
<td>$Pr(D</td>
<td>+)$</td>
</tr>
<tr>
<td>False - rate for classified -</td>
<td>$Pr(D</td>
<td>\neg)$</td>
</tr>
<tr>
<td>Correctly classified</td>
<td></td>
<td>79.17%</td>
</tr>
</tbody>
</table>

If we examine the P-value of Model 5 (.0582) in Table 4.24, Model 5 is not statistically significant (P-value $> .05$) and is not a good model for determining the dependent variable, so this dissertation will not conclude that Model 5 is not a good model for determining the de-
dependent variable only by using the P-value. However, the “Pseudo R\(^2\)” of Model 5 increases and is greater than in Model 4, which shows that Model 5 is better than Model 4 for determining the dependent variable.

If we use the method of “Positive Predictive Value” for testing Model 5, we find that the random prediction for the dependent variable = 1 (developed countries that have adopted ABS regimes) has a 70.37% chance (19/27) of being right, but the positive predictive value (83.33%) of Model 5 is greater in current (70.37%). Furthermore, in comparison with the positive predictive value of Model 4, both Model 5 and Model 4 have the same positive predictive value (83.33%). In brief, we cannot compare Model 5 and Model 4 and determine which one is better with respect to sensitivity and specificity.

The “Correctly Classified Rate” (79.17%) in Model 5 is the same as in Model 4 (79.17%). In other words, the 19 variables (24*79.17%) in Model 5 are the same as the 19 variables (24*79.17%) in Model 4, which are correctly classified as not having “Type I” and “Type II” errors. By using the correctly classified rate, we cannot determine whether Model 5 or Model 4 is a better regression model for determining the dependent variable, so the next section will run another regression model.

### 4.3.3.7 Model 6 Regression

The outcomes of the Model 5 regression show that it needs improvement, so we add the sixth highly correlated independent variable – “The Shares of Agriculture on GDP” to the former Model 5 regression and change it into the new Model 6 regression in Table 4.26:

| Number of obs | = | 24 |
| LR chi\(^2\)(6) | = | 12.85 |
| Prob > chi\(^2\) | = | 0.0455 |
| Pseudo R\(^2\) | = | 0.4435 |

**Table 4.26** Model 6 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, Enforcement of the CBD and the ITPGR:
### Table 4.26 (cont.)

<table>
<thead>
<tr>
<th>Status of Access and Benefit-Sharing Regime – In Force (statusofac~r)</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>z-statistic</th>
<th>P &gt;</th>
<th>z</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of PVP Applications – 2002–2006 Average (numb~2002200)</td>
<td>.0102978</td>
<td>.0051224</td>
<td>2.01</td>
<td>0.044</td>
<td>.0002581</td>
<td>.0203375</td>
</tr>
<tr>
<td>Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)? (enforce<del>men</del>e)</td>
<td>.7492752</td>
<td>.7989772</td>
<td>0.94</td>
<td>0.348</td>
<td>-.8166914</td>
<td>2.315242</td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure on R&amp;D Performed by Industry of GDP (PPP) in 2007 (v28)</td>
<td>.8372359</td>
<td>.6186342</td>
<td>1.35</td>
<td>0.176</td>
<td>-.3752649</td>
<td>2.049737</td>
</tr>
<tr>
<td>GDP per capita of 2008 (USD) (gdppercapi~d)</td>
<td>.0000306</td>
<td>.0000252</td>
<td>1.22</td>
<td>0.224</td>
<td>-.0000187</td>
<td>.000008</td>
</tr>
<tr>
<td>Enforcing Contracts Cost of 200% of income per capita (%) (enforcingc~c)</td>
<td>.0164308</td>
<td>.0585183</td>
<td>0.28</td>
<td>0.779</td>
<td>-.098263</td>
<td>.1311246</td>
</tr>
<tr>
<td>The Shares of Agriculture on GDP (%) (thesharesco~p)</td>
<td>.316781</td>
<td>.2298666</td>
<td>1.38</td>
<td>0.168</td>
<td>-.1337492</td>
<td>.7673111</td>
</tr>
</tbody>
</table>
4.3.3.7.1 Null-Hypothesis Test

In Model 6, null-hypothesis was stated as “Developed countries, who are parties to the CBD or the ITPGR, adopt ABS regimes, and this does not correlate with the numbers of PVP applications filed in these countries.” Therefore, if we use the P-value to test this null-hypothesis, the null-hypothesis is rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.044) is statistically significant (P-value < .05). Although the P-values of the other five variables are not statistically significant, these variables are not discussed within the confines of this null-hypothesis. Because the variable “Numbers of PVP Applications – 2002~2006 Average” is statistically significant, this null-hypothesis is rejected.

In comparison with the sensitivity and specificity of Model 5, the sensitivity of Model 6 is greater than for Model 5. In other words, the probability of “Type II error” occurring in Model 6 is less than is the case for Model 5. However, the specificity of Model 6 is lower than for Model 5, which means that the probability of “Type I error” occurring in Model 6 is greater than for Model 5. In other words, the rejected null-hypothesis for Model 6 may be true, and the probability of such a situation occurring in Model 6 is greater than is the case for Model 5.

4.3.3.7.2 Model Test

As regards the P-value of Model 6 (.0455) in Table 4.26, Model 6 is statistically significant (P-value < .05) and is a good model for determining the dependent variable. However, this dissertation will not conclude that Model 6 is a good model for determining the dependent variable using only the P-value. In addition, the “Pseudo R^2” of Model 6 increases and is
greater than for Model 5, which shows that Model 6 is better than Model 5 for determining
the dependent variable.

Using the method of “Positive Predictive Value” to test Model 6 shows that the random
prediction for dependent variable = 1 (developed countries have adopted the ABS regimes)
has a 70.37% chance (19/27) of being right, but the positive predictive value (80.00%) of
Model 6 is greater in current (70.37%). Comparing this with the positive predictive value of
Model 5 shows that the positive predictive value (80.00%) of Model 6 is less than in Model 5
(83.33%). Using the positive predictive value shows that Model 2 is not better than Model 1
for determining the dependent variable.

Using the method of “Positive Predictive Value” to test Model 6 shows that the random
prediction for dependent variable = 1 (developed countries have adopted the ABS regimes)
has a 70.37% chance (19/27) of being right, but the positive predictive value (80.00%) of
Model 6 is greater in current (70.37%). Comparing this with the positive predictive value of
Model 5 shows that the positive predictive value (80.00%) of Model 6 is less than in Model 5
(83.33%). Using the positive predictive value shows that Model 2 is not better than Model 1
for determining the dependent variable.
As regards the “Correctly Classified Rate,” the correctly classified rate for Model 6 (79.17%) is the same as in Model 5 (79.17%). Both Model 6 and Model 5 have 19 variables (24*79.17%), which are correctly classified as not having “Type I” and “Type II” errors. When we use the correctly classified rate, we cannot determine which model is better for predicting the dependent variable. Comparing Model 6 and Model 5 reveals that Model 6 is a better regression model than Model 5 for determining the dependent variable in terms of the “Correctly Classified Rate.”

4.3.3.8 Summary

Testing hypothesis 2 using regression analysis shows that the “Numbers of PVP Application – 2002~2006 Average” is a statistically significant independent variable and is significantly correlated with whether or not developed countries who are parties to the CBD or the ITPGR adopt ABS regimes.

Using regression analysis on Model 1 through Model 6 shows that the Model 6 regression model is better than the other models for determining the dependent variable.

4.3.4 Hypothesis 3: The More Plant Variety Protection (PVP) Applications that are Filed in Developing Countries, the Lower Probability that These Countries will Adopt Access and Benefit-Sharing Regimes (ABS)

4.3.4.1 The Establishment of Regression Models for Testing the Hypothesis

Just as is the case with regression analysis of hypotheses 1 and 2, the purpose of using regression analysis to test hypothesis 3 is both to determine which variable is statistically significant, and to find a better regression model which can completely determine the dependent variable – Status of Access and Benefit-Sharing Regime. Therefore, this section also will not select “Numbers of PVP Applications – 2002~2006 Average” as the sole independent varia-
ble for running probit regression in order to determine whether or not the “Numbers of PVP Applications – 2002~2006 Average” is statistically significant and will use the methods of “P-value,” “Sensitivity,” and “Specificity” to test the null-hypothesis. This section will set up several regression models rank-ordered by “Correlation Coefficient” with the dependent variable running from high to low, and use the methods of “P-value,” “Pseudo R\(^2\),” “Positive Predictive Value,” and “Correctly Classified Rate” to judge each regression model and determine whether the latter regression model is better than the former models. In other words, later regression models should be better than the earlier regression models for the purpose of determining the dependent variable.

<table>
<thead>
<tr>
<th>Table 4.28 The Correlation Coefficient of Dependent and Independent Variables related to the Regression Analysis of the Implementation of Access and Benefit-Sharing (ABS) Laws and Policies from Developing Countries that are Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR)</th>
<th>Status of Access and Benefit-Sharing Regime – In Force (status~r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status of Access and Benefit-Sharing Regime – In Force (statusofac~r)</td>
<td>1.0000</td>
</tr>
<tr>
<td>Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)? (enforcement~e)</td>
<td>0.1081</td>
</tr>
<tr>
<td>Status of Plant Patent Laws (statusofpl~s)</td>
<td>-0.0085</td>
</tr>
<tr>
<td>Status of PVP Laws (statusofpv~s)</td>
<td>.</td>
</tr>
<tr>
<td>The Patentability of Novelty of Patent Laws – Is the Prior Art included “Oral Disclosure” and “Distributed Publication”? (v10)</td>
<td>-0.2100</td>
</tr>
<tr>
<td>Numbers of Patent Applications in 2006 (numbers~n200)</td>
<td>0.2334</td>
</tr>
<tr>
<td></td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>49</td>
</tr>
<tr>
<td>Metric</td>
<td>Value</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Numbers of Patent Grants in 2006 (numbers~2006)</td>
<td>0.2759</td>
</tr>
<tr>
<td>Numbers of Chemistry Patent Applications (including plant and other biotechnology patents) – 2001<del>2005 Average (numbersofc</del>t)</td>
<td>0.3063</td>
</tr>
<tr>
<td>Numbers of PVP Applications – 2002~2006 Average (numberspvp2002200)</td>
<td>0.3782</td>
</tr>
<tr>
<td>Numbers of PVP Grants – 2002<del>2006 Average (numbersofp</del>a)</td>
<td>0.2989</td>
</tr>
<tr>
<td>Enforcing Contracts Cost of 200% of income per capita (%) (enforcingc~c)</td>
<td>-0.1260</td>
</tr>
<tr>
<td>Rule of Law – Governance Score of 2007 (-2.5~+2.5) (ruleof~20072)</td>
<td>0.0656</td>
</tr>
<tr>
<td>Control of Corruption – Governance Score of 2007 (-2.5~+2.5) (controlofc~c)</td>
<td>0.0337</td>
</tr>
<tr>
<td>Government Effectiveness – Governance Score of 2007 (-2.5~+2.5) (government~n)</td>
<td>0.1282</td>
</tr>
<tr>
<td>GDP of 2008 (billion $) (gdpof2008b~n)</td>
<td>0.2692</td>
</tr>
<tr>
<td>GDP (PPP) of 2008 (billion $) (gdppppof20~n)</td>
<td>0.2475</td>
</tr>
<tr>
<td>GDP per capita of 2008 (USD) (gdpperca-pi~d)</td>
<td>0.1419</td>
</tr>
<tr>
<td>GDP – per capita of 2008 (PPP) (gdpvper-cap~p)</td>
<td>0.1465</td>
</tr>
<tr>
<td>The Shares of Agriculture on GDP (%) (theshireso~p)</td>
<td>-0.1024</td>
</tr>
<tr>
<td>The Shares of R&amp;D Expenditures on GDP in 2000 ~ 2005 (%) (theshireso~n)</td>
<td>0.3164</td>
</tr>
<tr>
<td>Researchers in R&amp;D in 1990 ~ 2005 (per million people) (researcher~l)</td>
<td>0.1134</td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure on R&amp;D of GDP in 2005 (%) (theshireso~t)</td>
<td>0.4896</td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure on R&amp;D Performed by Industry of GDP (PPP) in 2007 (%) (v30)</td>
<td>0.5813</td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure</td>
<td>0.1328</td>
</tr>
</tbody>
</table>
Table 4.28 (cont.)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>on R&amp;D Performed by Higher Education and Government of GDP (PPP) in 2007 (%) (v31)</td>
<td>11</td>
</tr>
<tr>
<td>GNI per capita of 2007 – Atlas method (USD) (gnipercaqi-s)</td>
<td>0.0756</td>
</tr>
<tr>
<td>2007/2008 Gini Index (%) (v33)</td>
<td>0.1022</td>
</tr>
<tr>
<td>Human Development Index of 2005 (humanede~2005)</td>
<td>0.0967</td>
</tr>
<tr>
<td>Population of 2008 (million) (population~n)</td>
<td>0.1959</td>
</tr>
<tr>
<td>The Percentage of Total Researchers, which occupies total population in 2006 (%) (thepercen~t)</td>
<td>-0.0763</td>
</tr>
<tr>
<td>1995- 2005 Literacy Rate (%) (v37)</td>
<td>0.1198</td>
</tr>
<tr>
<td>The Percentage of Economically Active Labor Force on Agriculture, which occupies total population in 2005 (%) (thepercen~v)</td>
<td>0.0221</td>
</tr>
<tr>
<td>The Percentage of Population in Urban Areas, which occupies total population in 2006 (%) (thepercen~n)</td>
<td>0.1108</td>
</tr>
<tr>
<td>The Percentage of total Arable Land, which occupies total area (%) (thepercen~h)</td>
<td>-0.0430</td>
</tr>
</tbody>
</table>

In addition, the difficulty with regression analysis in this section is “Multicollinearity.” In order to solve the problem of multicollinearity, this section will first measure correlation coefficients in Table 4.28 and then will drop highly correlated variables. The final independent variables run in this regression have been discussed in section 4.3.1. As mentioned above, the rank-order of these correlation coefficients with respect to the dependent variable also provides a guideline for establishing regression models.

4.3.4.2 Model 1 Regression

Mode 1 is the probit regression run between the “Status of Access and Benefit-Sharing
Regime” (the dependent variable) and “Numbers of PVP Applications – 2002~2006 Average” (this is the independent variable that is most highly correlated with the dependent variable), and the outputs of the regression appear in Table 4.29.

| Status of Access and Benefit-Sharing Regime – In Force (statusofac-r) | Coefficient | Standard Error | z-statistic | P > |z| | [95% Conf. Interval] |
|---|---|---|---|---|---|---|
| Numbers of PVP Applications – 2002~2006 Average (numb~2002200) | .0037467 | .0020018 | 1.87 | 0.061 | -.0001767 | .0076701 |
| _cons | -.6032065 | .2716542 | -2.22 | 0.026 | -1.135639 | -.070774 |

4.3.4.2.1 Null-Hypothesis Test

In Model 1, the null-hypothesis is stated as “Developing countries, who are parties to the CBD or the ITPGR, adopt ABS regimes, and this does not correlate with the numbers of PVP applications filed in these parties.” Therefore, if we use the P-value to test this null-hypothesis, this null-hypothesis is not rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.061) is not statistically significant (P-value > .05).

In addition, the ideal case for “Sensitivity” and “Specificity” when testing the null-hypothesis is that both sensitivity and specificity are high, because the probabilities of “Type I error” (rejecting the true null-hypothesis) and “Type II error” (failing to reject the false null-hypothesis) are low. The sensitivity of Model 1 is low, so the probability of “Type II error” occurring in Model 1 is high. However, the specificity of Model 1 is high, which
means that the probability of “Type I error” occurring in Model 1 is low. In brief, the non-rejected null-hypothesis in Model 1 may be false due to the high probability of “Type II error” – meaning the high probability of “failing to reject the false null-hypothesis” in Model 1.

4.3.4.2.2 Model Test

If we use the P-value (.0183) to test Model 1 regression, Model 1 has a statistically significant (P-value < .05) and is a good model for determining the dependent variable. However, we cannot conclude that Model 1 is a good model for determining the dependent variable using only the P-value.

<table>
<thead>
<tr>
<th>Classified</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>-</td>
<td>10</td>
<td>19</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>21</td>
<td>35</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .5
True D defined as statusofaccessandbenefitsharingr != 0

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Pr(+</td>
<td>D)</td>
</tr>
<tr>
<td>Specificity</td>
<td>Pr(~D</td>
<td>-)</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>Pr(D</td>
<td>+)</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>Pr(~D</td>
<td>-)</td>
</tr>
<tr>
<td>False + rate for true ~D</td>
<td>Pr(+</td>
<td>~D)</td>
</tr>
<tr>
<td>False - rate for true D</td>
<td>Pr(-</td>
<td>D)</td>
</tr>
<tr>
<td>False + rate for classified +</td>
<td>Pr(~D</td>
<td>+)</td>
</tr>
<tr>
<td>False - rate for classified -</td>
<td>Pr(D</td>
<td>-)</td>
</tr>
<tr>
<td>Correctly classified</td>
<td></td>
<td>65.71%</td>
</tr>
</tbody>
</table>

If we use the method of “Positive Predictive Value” to test Model 1, we find that the
random prediction for dependent variable = 1 (developing countries that have adopted ABS regimes) has a 34.27% chance (49/143) of being right, but the positive predictive value (66.67%) for Model 1 is greater (34.27%).

Using the above methods for testing Model 1 regressions shows that Model 1 is good for determining the dependent variable, but we will use the Model 2 regression to determine whether or not Model 2 is better than Model 1 for determining the dependent variable.

### 4.3.4.3 Model 2 Regression

This regression will take the second highly correlated independent variable – “GDP per capita of 2008 (USD)” from the former Model 1 regression and use it in the new Model 2 regression in Table 4.31:

| Status of Access and Benefit-Sharing Regime – In Force (statusofac-r) | Coefficient | Standard Error | z-statistic | P>|z| | [95% Conf. Interval] |
|---|---|---|---|---|---|
| Numbers of PVP Applications – 2002–2006 Average (numb=2002200) | .0037474 | .0020042 | 1.87 | 0.062 | -.0001808    .0076755 |
| GDP per capita of 2008 (USD) (gdpper-capì-d) | -2.87e-07 | .0000368 | -0.01 | 0.994 | -.0000724    .0000719 |
| _cons | -.6008631 | .4054675 | -1.48 | 0.138 | -1.395565    .1938386 |

**Table 4.31** Model 2 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002–2006 Average, and GDP per capita of 2008 (USD) from Developing Countries

Number of obs = 35
LR chi$^2$(2) = 5.59
Prob > chi$^2$ = 0.0611
Pseudo R$^2$ = 0.1187
4.3.4.3.1 Null-Hypothesis Test

In Model 2, null-hypothesis is stated as “Developing countries, who are parties to the CBD or the ITPGR, adopt ABS regimes, and this does not correlate with the numbers of PVP applications filed in these parties.” Therefore, if we use the P-value to test this null-hypothesis, this null-hypothesis will not be rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.062) is not statistically significant (P-value > .05).

In comparison with the sensitivity and specificity of Model 1, the sensitivity and specificity of Model 2 are the same as in Model 1. In other words, the non-rejected null-hypothesis in Model 2 may be false, because the probability of “Type II error” occurring in Model 2 is also high (high rate of “failing to reject the false null-hypothesis”).

4.3.4.3.2 Model Test

The P-value of Model 2 (.0617) in Table 4.31 shows that Model 2 is not statistically significant (P-value > .05) and is not a good model for determining the dependent variable, but this section will not conclude that Model 2 is not a good model for determining the dependent variable using only the P-value. Moreover, the “Pseudo R$^2$” (.1182) of Model 2 is the same (.1182) as for of Model 1, which shows that Model 2 is not better than Model 1 for determining the dependent variable.

If we use the method of “Positive Predictive Value” to test Model 2, we find that the random prediction for dependent variable = 1 (developing countries have adopted ABS regimes) has a 34.27% chance (49/143) of being right, but the positive predictive value (66.67%) of Model 2 is greater (34.27%). However, compared with the positive predictive value exhibited in Model 1, the positive predictive value (66.67%) of Model 2 is identical with Model 1 (66.67%), so Model 2 is no better than Model 1 for predicting the dependent
variable.

Table 4.32  The Postestimation of Model 2 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002–2006 Average, and GDP per capita of 2008 (USD) from Developing Countries

<table>
<thead>
<tr>
<th></th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classified +</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Classified -</td>
<td>10</td>
<td>19</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>21</td>
<td>35</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .5
True D defined as statusofaccessandbenefitsharingr != 0

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Pr( +</td>
<td>D)</td>
</tr>
<tr>
<td>Specificity</td>
<td>Pr( -</td>
<td>~D)</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>Pr( D</td>
<td>+)</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>Pr( ~D</td>
<td>-)</td>
</tr>
<tr>
<td>False + rate for true ~D</td>
<td>Pr( +</td>
<td>~D)</td>
</tr>
<tr>
<td>False - rate for true D</td>
<td>Pr( -</td>
<td>D)</td>
</tr>
<tr>
<td>False + rate for classified +</td>
<td>Pr( ~D</td>
<td>+)</td>
</tr>
<tr>
<td>False - rate for classified -</td>
<td>Pr( D</td>
<td>-)</td>
</tr>
<tr>
<td>Correctly classified</td>
<td></td>
<td>65.71%</td>
</tr>
</tbody>
</table>

The “Correctly Classified Rate” (65.71%) in Model 2 is the same as in Model 1 (65.71%). Therefore, both Model 2 and Model 1 have 23 variables (35*65.71%), which are correctly classified as not having “Type I” and “Type II” errors. Using the correctly classified rate shows that Model 2 is not better than Model 1 for determining the dependent variable. To sum up, Model 2 is no better than Model 1 for determining the dependent variable, so the next section will conduct Model 3 regression.

4.3.4.4 Model 3 Regression

The outcomes of Model 2 regression show that Model 2 is not a good model for determining the dependent variable – Status of Access and Benefit-Sharing Regime. As a result,
we use the third highly correlated independent variable – “Enforcing Contracts Cost of 200% of income per capita” from the Model 2 regression in the new Model 3 regression in Table 4.33:

\[
\begin{align*}
\text{Number of obs} & = 34 \\
\text{LR chi}^2(3) & = 7.72 \\
\text{Prob > chi}^2 & = 0.0522 \\
\text{Pseudo R}^2 & = 0.1675
\end{align*}
\]

Table 4.33 Model 3 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), and Enforcing Contracts Cost of 200% of income per capita from Developing Countries

| Status of Access and Benefit-Sharing Regime – In Force (statusofac-raw) | Coefficient | Standard Error | z-statistic | P > |z| [95% Conf. Interval] |
|-------------------------------------------------|-------------|---------------|-------------|------|-------------------|
| Numbers of PVP Applications – 2002~2006 Average (numb~2002200) | .004207 | .0020698 | 2.03 | 0.042 | .0001502 .0082638 |
| GDP per capita of 2008 (USD) (gdppercapi-d) | 9.68e-06 | .0000391 | 0.25 | 0.804 | -.0000669 .0000862 |
| Enforcing Contracts Cost of 200% of income per capita (%) (enforcingc-c) | .0394496 | .025442 | 1.55 | 0.121 | -.0104158 .0893149 |
| _cons | -1.72661 | .8858418 | -1.95 | 0.051 | -3.462828 .0096084 |

4.3.4.4.1 Null-Hypothesis Test

In Model 3, the null-hypothesis is stated as “Developing countries, who are parties to the CBD or the ITPGR, adopt ABS regimes, and this does not correlate with the numbers of PVP applications filed in these parties.” Therefore, if we use the P-value to test this null-hypothesis, this null-hypothesis is rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.042) is statistically significant (P-value < .05). Al-
though the P-values “GDP – per capita of 2008 (PPP)” (.806 > .05) and “Enforcing Contracts Cost of 200% of income per capita” (.122 > .05) are not statistically significant, they are discussed in the context of this null-hypothesis, and the variable “Numbers of PVP Applications – 2002~2006 Average” is statistically significant, so this null-hypothesis is still rejected.

In comparison with the sensitivity and specificity of Model 2, both the sensitivity and specificity of Model 3 are greater than in Model 2. However, like Model 2, the specificity is still higher than the sensitivity, so the probability of “Type II error” in Model 3 is high. Thus, the probability of “failing to reject the false null-hypothesis” is high for Model 3. Because the null-hypothesis in Model 3 is rejected, “failing to reject the false null-hypothesis” has not occurred.

4.3.4.4.2 Model Test

The P-value of Model 3 (.0529) in Table 4.33 shows that Model 3 is not statistically significant (P-value > .05) and is not a good model for determining the dependent variable. However, we cannot conclude that Model 3 is not a good model for determining the dependent variable using only the P-value. Moreover, the “Pseudo R²” of Model 3 increases and is greater than in Model 2, which shows that Model 3 is better than Model 2 for determining the dependent variable.

<table>
<thead>
<tr>
<th>Table 4.34</th>
<th>The Postestimation of Model 3 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), and Enforcing Contracts Cost of 200% of income per capita from Developing Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Classified</td>
<td>D</td>
</tr>
<tr>
<td>+</td>
<td>6</td>
</tr>
<tr>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .5
Using the “Positive Predictive Value” of Model 3 allows us to determine the probability that the random prediction for dependent variable = 1 (developing countries have adopted the ABS regimes) has a 34.27% chance (49/143) of being right, but the positive predictive value of Model 3 (85.71%) is greater. However, in comparison with the positive predictive value of Model 2, the positive predictive value (85.71%) of Model 3 exceeds Model 2 (66.67%), so Model 3 is better than Model 2 for determining the dependent variable.

The “Correctly Classified Rate” (73.53%) for Model 3 is greater than in Model 2 (65.71%). In other words, the 25 variables (34*73.53%) in Model 3 are greater in number than the 23 variables (25*65.71%) in Model 2, which are correctly classified as not having “Type I” and “Type II” errors. Using the correctly classified rate shows that Model 3 is better than Model 2 for determining the dependent variable. To sum up, Model 3 is better than Model 2 for determining the dependent variable. However, we will conduct Model 4 regression in the next section to determine whether or not Model 4 is better than Model 3 for determining the dependent variable.

### 4.3.4.5 Model 4 Regression

Although Model 3 is better than Model 2 for determining the dependent variable (Status of Access and Benefit-Sharing Regime), we will attempt to find a better regression model in
this section. We will add the fourth highly correlated independent variable – “2007/2008 Gini Index” to the former Model 3 regression in order to create the new Model 4 regression in Table 4.35:

<table>
<thead>
<tr>
<th>Status of Access and Benefit-Sharing Regime – In Force (statusofac-r)</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>z-statistic</th>
<th>P &gt;</th>
<th>z</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of PVP Applications – 2002<del>2006 Average (numb</del>2002200)</td>
<td>0.0042559</td>
<td>0.002039</td>
<td>2.09</td>
<td>0.037</td>
<td>.0002596</td>
<td>.0082523</td>
</tr>
<tr>
<td>GDP per capita of 2008 (USD) (gdpper-capi-d)</td>
<td>0.0000428</td>
<td>0.0000475</td>
<td>0.90</td>
<td>0.367</td>
<td>-.0000503</td>
<td>.0001359</td>
</tr>
<tr>
<td>Enforcing Contracts Cost of 200% of income per capita (%) (enforcingc-c)</td>
<td>0.0376247</td>
<td>0.0276532</td>
<td>1.36</td>
<td>0.174</td>
<td>-.0165747</td>
<td>.091824</td>
</tr>
<tr>
<td>2007/2008 Gini Index (%) (v33)</td>
<td>0.0243863</td>
<td>0.0270001</td>
<td>0.90</td>
<td>0.366</td>
<td>-.028533</td>
<td>.0773055</td>
</tr>
<tr>
<td>_cons</td>
<td>-3.072976</td>
<td>1.439646</td>
<td>-2.13</td>
<td>0.033</td>
<td>-5.894631</td>
<td>-.2513215</td>
</tr>
</tbody>
</table>

4.3.4.5.1 Null-Hypothesis Test

In Model 4, the null-hypothesis is stated as “Developing countries, who are parties to the CBD or the ITPGR, adopt ABS regimes, which does not correlate with the numbers of PVP applications filed in these parties.” Therefore, if we use the P-value to test this
null-hypothesis, this null-hypothesis is rejected, because the P-value of “Numbers of PVP Applications – 2002~2006 Average” (.037) is statistically significant (P-value < .05). Although the P-values of the other three variables are not statistically significant (P-value > .05), these variables are not discussed because they are not a part of this null-hypothesis. Because the variable “Numbers of PVP Applications – 2002~2006 Average” is statistically significant, this null-hypothesis is rejected.

In comparison with the sensitivity and specificity of Model 3, the sensitivity (46.15%) of Model 4 is greater than in Model 3 (42.86%). In other words, the probability of “Type II error” occurring in Model 4 is less than in Model 3. However, the specificity (89.47%) of Model 4 is less than in Model 3 (95.00%), which means that the probability of “Type I error” occurring in Model 4 is greater than in Model 3. Furthermore, compared with the sensitivity and specificity of Model 3, the specificity is greater than sensitivity, so the probability of “Type II error” occurring (the rate of failing to reject the false null-hypothesis) is high. Fortunately, the null-hypothesis in Model 4 has been rejected, so “Type II error” did not occur in Model 4.

4.3.4.5.2 Model Test

If we use the P-value (.0455) to test Model 4, Model 4 is statistically significant (P-value < .05), and is a good model for determining the dependent variable. However, we cannot conclude that Model 4 is a good model for determining the dependent variable using only the P-value. In addition, the “Pseudo R²” of Model 4 increases and is greater than in Model 3, which is evidence that Model 4 is better than Model 3 for determining the dependent variable.

If we use the method of “Positive Predictive Value” for testing Model 4, we find that the random prediction for dependent variable = 1 (developing countries have adopted the ABS regimes) has a 34.27% chance (49/143) of being right, but the positive predictive value of
Model 4 (75.00%) is greater. However, in comparison with the positive predictive value of Model 3, the positive predictive value (75.00%) of Model 4 is less than Model 3 (85.71%), so Model 4 is not better than Model 3 for determining the dependent variable.

Table 4.36  The Postestimation of Model 4 – The Probit Regression among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), Enforcing Contracts Cost of 200% of income per capita, and 2007/2008 Gini Index from Developing Countries

<table>
<thead>
<tr>
<th>Classified</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>6</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>-</td>
<td>7</td>
<td>17</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>19</td>
<td>32</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .5

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>True D defined as statusofaccessandbenefitsharingr != 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Pr( +</td>
<td>D)</td>
</tr>
<tr>
<td>Specificity</td>
<td>Pr( -</td>
<td>~D)</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>Pr( D</td>
<td>+)</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>Pr(~D</td>
<td>-)</td>
</tr>
<tr>
<td>False + rate for true ~D</td>
<td>Pr( +</td>
<td>~D)</td>
</tr>
<tr>
<td>False - rate for true D</td>
<td>Pr( -</td>
<td>D)</td>
</tr>
<tr>
<td>False + rate for classified +</td>
<td>Pr(~D</td>
<td>+)</td>
</tr>
<tr>
<td>False - rate for classified -</td>
<td>Pr( D</td>
<td>-)</td>
</tr>
<tr>
<td>Correctly classified</td>
<td></td>
<td>71.88%</td>
</tr>
</tbody>
</table>

Finally, the “Correctly Classified Rate” (71.88%) in Model 4 is less than Model 3 (73.53%). In other words, the 23 variables (32*71.88%) in Model 4 are fewer in number than the 25 variables (34*73.53%) in Model 3, which are correctly classified as not having “Type I error” and “Type II error.” If we use the correctly classified probability to test Model 4, it is not better than Model 3 for determining the dependent variable. However, after testing Model 3 using the P-value and Pseudo R², Model 4 is still better than Model 3 for determining the dependent variable.
4.3.4.6 Summary

Testing hypothesis 3 using regression analysis shows that “Numbers of PVP Applications – 2002~2006 Average” is a statistically significant independent variable and is significantly correlated with whether or not developing countries who are parties to the CBD or the ITPGR adopt ABS regimes.

The regression analysis from Model 1 through Model 4 shows that Model 4 is a better regression model for determining the dependent variable.

4.4 FURTHER ANALYSES AND RESEARCH FINDINGS REGARDING THE OUTCOMES OF PROBIT REGRESSION RELATED TO THE ACCESS AND BENEFIT-SHARING LAWS AND POLICIES (ABS) OF PARTIES TO THE CONVENTION ON BIOLOGICAL DIVERSITY (CBD) OR THE INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE (ITPGR)

The previous section showed that the outcomes of probit regression are related to ABS regimes of parties to the CBD or the ITPGR, tested three null-hypotheses, and judged which regression model is better for determining the dependent variable – Status of Access and Benefit-Sharing Regime by using different methods.

Because there was no analysis of the outcomes of regression in the previous section, this section will introduce the “dprobit” – Infinitesimal Changes Extrapolated From Independent Variables with respect to the Changes of Probability regarding the Dependent Variable, and will arrange the outcomes of regressions and the dprobit to test whether or not hypotheses 1 through 3 are true.
4.4.1 Further Analyses of the Probit Regression concerning the Access and Benefit-Sharing Law and Policies (ABS) of Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR)

This dissertation attempts to run regression analyses related to ABS regimes, so this section will use the same variables that were used in the regression analyses in sections 4.3.2 to 4.3.4 in order to obtain the outcomes of the “dprobit” for each hypothesis. We can observe the infinitesimal changes extrapolated from independent variables with respect to the changes of probability regarding the dependent variable in this section.

4.4.1.1 Hypothesis 1: The More Plant Variety Protection (PVP) Applications that are Filed in the 194 Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resource (ITPGR), the Lower Probability that These Parties will Adopt Access and Benefit-Sharing Regimes (ABS)

If we use the outputs of the probit regression in Model 5 of hypothesis 1 for the following variables: the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, and Enforcing Contracts Cost of 200% of income per capita from 194 parties to the CBD or the ITPGR, we can use the following equation:

\[
\Pr (ABS = 0|1) = \Phi \left(0.0061762\text{numb~20022006} + 0.0000239\text{gdpvpercap~p} + 0.6965865\text{the share of gross domestic expenditure on R&D performed by industry of GDP in 2007 (v27)} + 0.6114814\text{enforcement~e} + 0.0555177\text{enforcement~e} - 3.290369\right) \tag{1}
\]
We can observe the standard deviation of the probit index using one-unit changes of each independent variable based on the above equation (coefficient), but we still cannot determine whether an infinitesimal change was extrapolated out.\textsuperscript{858} As a result, we also put the Model 5 variables into the dprobit of the probit regression using STATA software, and the “dF/dx” in Table 4.37 are the outputs of the infinitesimal changes extrapolated from the independent variables with respect to the changes of probability regarding the dependent variable.\textsuperscript{859}

<table>
<thead>
<tr>
<th>Status of Access and Benefit-Sharing Regime – In Force (status~r)</th>
<th>dF/dx</th>
<th>Standard Error</th>
<th>z-statistic</th>
<th>P&gt;</th>
<th>z</th>
<th>x-bar</th>
<th>95% Conf. Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of PVP Applications – 2002-2006 Average (num~2200)</td>
<td>.0016127</td>
<td>.0005093</td>
<td>2.29</td>
<td>0.022</td>
<td>207.118</td>
<td>.000614 , .002611</td>
<td></td>
</tr>
<tr>
<td>GDP – per capita of 2008 (PPP) (gdpvpe~p)</td>
<td>6.24e-06</td>
<td>7.81e-06</td>
<td>0.81</td>
<td>0.421</td>
<td>30841.7</td>
<td>-9.1e-06 , .000022</td>
<td></td>
</tr>
<tr>
<td>The Shares of Gross Domestic Expenditure on R&amp;D Performed by Industry of GDP (PPP) in 2007</td>
<td>.1818922</td>
<td>.1343986</td>
<td>1.39</td>
<td>0.165</td>
<td>1.09941</td>
<td>-.081524 , .445309</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.37  The Probit Regression, Reporting Marginal Effects the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002–2006 Average, GDP – per capita of 2008 (PPP), The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, and Enforcing Contracts Cost of 200% of income per capita from 194 Parties to the CBD or the ITPGR


\textsuperscript{859} Id. at 621.
Table 4.37 (cont.)

<table>
<thead>
<tr>
<th>GDP (PPP) in 2007</th>
<th>Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)? (enforc-e)*</th>
<th>Enforcing Contracts Cost of 200% of income per capita (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(%) (v31)</td>
<td>.161827 .1613992 1.02 0.310 .529412 -.154496 .47815</td>
<td>.0144968 .0108891 1.39 0.165 19.9176 -.006846 .035839</td>
</tr>
<tr>
<td>obs. P</td>
<td>.6470588</td>
<td>.821395 (at x-bar)</td>
</tr>
<tr>
<td>pred. P</td>
<td>.821395</td>
<td></td>
</tr>
</tbody>
</table>

(*) dF/dx is for discrete change of dummy variable from 0 to 1. 

z and P> |z| correspond to the test of the underlying coefficient being 0.

4.4.1.2 Hypothesis 2: The More Plant Variety Protection (PVP) Applications that are Filed in Developed Countries, the Lower Probability that These Countries will Adopt Access and Benefit-Sharing Regimes (ABS)

If we use the outputs of the probit regression in Model 6 of hypothesis 2 for the following variables: the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002–2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, GDP per capita of 2008 (USD), Enforcing Contracts Cost of 200% of income per capita, and The Shares of Agriculture on GDP from developed countries, we can use the following equation:
Pr (ABS = 0/1) = \Phi (.0102978 numb-2002200 + .7492752 enforcing\text{enforcer\text{industry}\text{gdppppin2007}} (v26) + .000306 gdppercapi-d - .0161116 enforcing\text{enforcinge} + .316781 theshareofgdp\text{ppp\text{2007}} - 4.558899) \ (2)

We can observe the standard deviation of the probit index using one-unit changes of each independent variable using the above equation (coefficient), but we still cannot determine whether an infinitesimal change was extrapolated out. We put the Model 6 variables into the dprobit of probit regression using the STATA software, and the outputs of “dF/dx” in Table 4.38 are the infinitesimal changes extrapolated from the independent variables with respect to the changes of probability regarding the dependent variable.

Table 4.38  The Probit Regression, Reporting Marginal Effects among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002–2006 Average, Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International Court of Justice (ICJ)?, The Shares of Gross Domestic Expenditure on R&D Performed by Industry of GDP (PPP) in 2007, GDP per capita of 2008 (USD), Enforcing Contracts Cost of 200% of income per capita, and The Shares of Agriculture on GDP from Developed Countries

| Status of Access and Benefit-Sharing Regime – In Force (status-r) | dF/dx     | Standard Error | z-statistic | P>|z| | x-bar | [95% Conf. Interval] |
|--------------------|-----------|----------------|-------------|---------|--------|---------------------|
| Numbers of PVP Applications – 2002–2006 Average (num-2200) | .0010658  | .000916        | 2.01        | 0.044  | 196.833 | -.000729 .002861   |
| Enforcement of the CBD and the ITPGR: Settlement Disputes – Do countries accept the compulsory jurisdiction of the International | .0886837  | .1440976       | 0.94        | 0.348  | .583333 | -.193742 .37111    |
Table 4.38 (cont.)

<table>
<thead>
<tr>
<th>Court of Justice (ICJ)? (enforce~e)*</th>
<th>The Shares of Gross Domestic Expenditure on R&amp;D Performed by Industry of GDP (PPP) in 2007 (v30)</th>
<th>GDP per capita of 2008 (USD) (gdpper~d)</th>
<th>Enforcing Contracts Cost of 200% of income per capita (%) (enforc~c)</th>
<th>The Shares of Agriculture on GDP (%) (thesha~p)</th>
<th>obs. P</th>
<th>pred. P</th>
</tr>
</thead>
<tbody>
<tr>
<td>.0866549 .1107406 1.35 0.176 1.37958 -.130393 .303702</td>
<td>3.17e-06 4.29e-06 1.22 0.224 48444.9 -5.2e-06 .000012</td>
<td>.0017006 .0063259 0.28 0.779 19.475 -.010698 .014099</td>
<td>.0327872 .0416518 1.38 0.168 2.45833 -.048849 .114423</td>
<td>.7083333</td>
<td>.9497777 (at x-bar)</td>
<td></td>
</tr>
</tbody>
</table>

(*) dF/dx is for discrete change of dummy variable from 0 to 1. z and P>|z| correspond to the test of the underlying coefficient being 0.

4.4.1.3 Hypothesis 3: The More Plant Variety Protection (PVP) Applications that are Filed in Developing Countries, the Lower Probability that These Countries will Adopt Access and Benefit-Sharing Regimes (ABS)

If we use the output of the probit regression in Model 4 of hypothesis 3 for the following variables: the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002-2006 Average, GDP – per capita of 2008 (PPP), Enforcing Contracts Cost of 200% of income per capita, and 2007/2008 Gini Index from developing countries, we can use the following equation:

\[
Pr \ (ABS = 0/1) = \Phi (.0042583numb~2002200 + .0000428gdppercapi~d + .0376327enforcingc~c + .02437782007\/2008gniindex (v29) - 3.073103) 
\] (3)
We can observe the standard deviation of the probit index using one-unit changes of each independent variable based on the above equation (coefficient), but we still cannot determine whether an infinitesimal change was extrapolated out. As a result, we put the Model 4 variables into the dprobit of probit regression produced by the STATA software, and the outputs of “dF/dx” in Table 4.39 are the infinitesimal changes extrapolated from the independent variables with respect to the changes of probability regarding the dependent variable.

Table 4.39  The Probit Regression, Reporting Marginal Effects among the Status of Access and Benefit-Sharing Regime (ABS), Numbers of PVP Applications – 2002~2006 Average, GDP – per capita of 2008 (PPP), Enforcing Contracts Cost of 200% of income per capita, and 2007/2008 Gini Index from Developing Countries

| Status of Access and Benefit-Sharing Regime – In Force (status~r) | dF/dx | Standard Error | z-statistic | P>|z| | x-bar | [95% Conf. Interval] |
|---------------------------------------------------------------|-------|---------------|-------------|---------|--------|---------------------|
| Numbers of PVP Applications – 2002~2006 Average (num~2200)   | .0016453 | .0008142       | 2.09        | 0.037   | 112.469 | .000049 .003241     |
| GDP per capita of 2008 (USD) (gdpper~d)                      | .0000165 | .0000183       | 0.90        | 0.367   | 8861.33 | -.000019 .000052    |
| Enforcing Contracts Cost of 200% of income per capita (%) (enforc~c) | .0145454 | .010704        | 1.36        | 0.174   | 25.4344 | -.006434 .035525    |
| 2007/2008 Gini Index (%) (v33) obs. P                        | .0094275 | .0103708       | 0.90        | 0.366   | 41.3063 | -.010899 .029754    |
| pred. P                                                      | .40625 |               |             |         |        |                     |
| Pred. P                                                      | .4009862 |               |             |         |        |                     |

z and P>|z| correspond to the test of the underlying coefficient being 0.
4.4.2 Research Findings regarding the Outcomes of Probit Regression that are related to Access and Benefit-Sharing Laws and Policies (ABS) of Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR)

The previous section obtained the outcomes for the “dprobit” of probit regression in sections 4.3.2 through 4.3.4. This section will further analyze the outcomes of “dprobit” from the previous section, and determine whether or not hypotheses 1 to 3 were true according to the outcomes of the regression analyses in sections 4.3.2 through 4.3.4.

4.4.2.1 Hypothesis 1: The More Plant Variety Protection (PVP) Applications that are Filed in the 194 Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resource (ITPGR), the Lower the Probability that These Parties will Adopt Access and Benefit-Sharing Regimes (ABS)

The first step in judging whether or not this hypothesis is true is to determine whether or not PVP applications are correlated with the adoption of ABS regimes. As mentioned in section 4.3.2, the “Numbers of PVP Applications – 2002~2006 Average” is statistically significant and is correlated with the adoption of ABS regimes.

In examining the distributions for the Hypothesis 1: Model 5 probit regression variables for 194 parties to the CBD or the ITPGR – excerpt of the dependent variable: status of access and benefit-sharing regime (ABS) and the independent variable: numbers of PVP applications – 2002~2006 average in Figure 4.6, it appears that contracting parties (member countries) to the CBD or the ITPGR, who adopt ABS regimes, have more PVP application filings. Moreover, the outputs of “dF/dx” in Table 4.37 indicated that “infinitesimal changes” can be extrapolated from the independent variables with respect to the “changes of probability” re-
The “Numbers of PVP Applications – 2002~2006 Average” is statistically significant with respect to the adoption of ABS regimes in the probit regression for Hypothesis 1, each PVP application that is filed increases that party’s likelihood adopting an ABS regime by 0.16%. Each PVP application that is not filed decreases that party’s likelihood of adopting an ABS regime by 0.16%. Each ten additional applications increases that party’s likelihood of adopting an ABS regime by 1.6%, and each one hundred additional applications increases that party’s likelihood of adopting an ABS regime by 16%.

Figure 4.6  The Scatter Plot of the Distributions for Hypothesis 1: Model 5 Probit Regression Variables from 194 Parties to the CBD or the ITPGR – Excerpt of the Dependent Variable: Status of Access and Benefit-Sharing Regime (ABS) and the Independent Variable: Numbers of PVP Applications – 2002~2006 Average

In sum, the more PVP applications that are filed in the 194 parties to the CBD or the ITPGR, the greater the probability that they will adopt ABS regimes. By contrast, the fewer

\[^{860}\text{Stata Press, supra note 858, at 621.}\]
PVP applications that are filed in the 194 parties to the CBD or the ITPGR, the lower the probability that they will adopt ABS regimes. Therefore, we know that the proposed hypothesis 1 is not true.

4.4.2.2 Hypothesis 2: The More Plant Variety Protection (PVP) Applications that are Filed in Developed Countries, the Lower the Probability that These Countries will Adopt Access and Benefit-Sharing Regimes (ABS)

As mentioned in section 4.3.3, the “Numbers of PVP Applications – 2002~2006 Average” is statistically significant with respect to the adoption of ABS regimes. The distributions for the “Hypothesis 2: Model 6 probit regression variables for developing countries – excerpt of the dependent variable: status of access and benefit-sharing regime (ABS) and the independent variable: numbers of PVP applications – 2002~2006 average” in Figure 4.7 show that developing countries who are parties to the CBD or the ITPGR, adopt ABS regimes as the numbers of PVP applications that these countries file increases.

The outputs of “dF/dx” in Table 4.38 indicated that the “infinitesimal changes” that are extrapolated from the independent variables show the “changes of probability” for the dependent variable. Because the “Numbers of PVP Applications – 2002~2006 Average” is statistically significant with respect to the adoption of ABS regimes in the probit regression for Hypothesis 2, each PVP application that is filed increases that party’s likelihood of adopting an ABS regime by 0.11%. Each PVP application that is not filed decreases that party’s likelihood of adopting an ABS regime by 0.11%. Each ten additional applications increases that party’s likelihood of adopting an ABS regime by 1.1%, and each one hundred additional applications increases that party’s likelihood of adopting an ABS regime by 11%.
To sum up, the more PVP applications that are filed in developed countries that are parties to the CBD and the ITPGR, the greater the probability that they will adopt ABS regimes. By contrast, the fewer PVP applications that are filed in developed countries who are parties to the CBD and the ITPGR, the lower the probability that they will adopt ABS regimes. As a result, the proposed hypothesis 2 is not true.

4.4.2.3 Hypothesis 3: The More Plant Variety Protection (PVP) Applications that are Filed in Developing Countries, the Lower Probability that These Countries will Adopt Access and Benefit-Sharing Regimes (ABS)

As mentioned in section 4.3.4, the “Numbers of PVP Applications – 2002~2006 Average...
“Hypothesis 3: Model 5 probit regression variables from developing countries – excerpt of the dependent variable: status of access and benefit-sharing regime (ABS) and the independent variable: numbers of PVP applications – 2002~2006 average” in Figure 4.8 show that developing countries that are parties to the CBD or the ITPGR and adopt ABS regimes, experience more PVP application filings.

Moreover, the outputs for “dF/dx” in Table 4.39 indicated the “infinitesimal changes” extrapolated from the independent variables for the “changes of probability” regarding the dependent variable. Because the “Numbers of PVP Applications – 2002~2006 Average” is statistically significant with respect to the adoption of ABS regimes in the probit regression
for Hypothesis 3, each PVP application that is filed increases that party’s likelihood of adopting an ABS regime by 0.16%. Each PVP application that is not filed decreases that party’s likelihood of adopting an ABS regime by 0.16%. Each ten additional applications increases that party’s likelihood of adopting an ABS regime by 1.6%, and each one hundred additional applications increases that party’s likelihood of adopting an ABS regime by 16%.

To sum up, the more PVP applications that are filed in developing countries that are parties to the CBD and the ITPGR, the greater the probability that they will adopt ABS regimes. On the other hand, the less the numbers of PVP applications that are filed in developing countries that are parties to the CBD and the ITPGR, the lower the probability that they will adopt ABS regimes. As a result, the proposed hypothesis 3 is not true.

### 4.4.3 Summary of Regression Analyses related to Access and Benefit-Sharing Regimes (ABS) by Parties to the Convention on Biological Diversity (CBD) or the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR)

The probit regression for the adoption of ABS regimes and other independent variables related to the adoption of ABS regimes by 194 parties to the CBD or the ITPGR shows that it is possible to use an objective method to understand issues concerning ABS regimes. The literature produced by advocates of anti-biopiracy and anti-bioprospecting, has focused on criticizing “biopiracy” and “bioprospecting” promulgated by the developed world. This literature rarely makes use of economic or empirical studies to determine the actual causes of “biopiracy,” “bioprospecting,” and the reasons why countries, regardless of whether they are contracting parties to the CBD or the ITPGR, adopt ABS regimes for the purpose of conserving their PGRs or traditional knowledge regarding the use of PGRs.

For example, three research hypotheses are based on the existing literature and conven-

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861 The criticisms that “biopiracy” and “bioprospecting” are caused by the developed countries can be seen in the arguments of Chapter 2 of this dissertation.
tional arguments concerning the adoption of ABS regimes. These three hypotheses show that, regardless of whether a country is developed or developing, the more PVP applications that are filed in a country, the lower the probability that this country will adopt an ABS regime. If a country establishes an ABS regime based on the CBD and the ITPGR which emphasizes conservation, the fair and equitable use of PGRs or traditional knowledge regarding the use of PGRs, and which balances the intellectual property regimes that overtly and commercially use PGRs or traditional knowledge regarding the use of PGRs, then the development of an intellectual property regime will not promote the adoption of an ABS regime. However, it is the case that the three hypotheses are not true after conducting regression analyses. Therefore, the development of intellectual property regimes (PVP application) is closely related to the adoption of ABS regimes. As a result, the outcomes of regression analysis take priority over the existing literature and conventional arguments, because they are based on empirical evidence.

Although the three research hypotheses support the contention that increased PVP application filings result in the increased probability that contracting parties to the CBD or the ITPGR will adopt ABS regimes, regardless of whether those parties are developed or developing countries, the research scope of the three research hypotheses are quite different. The research scope of hypothesis 1 focuses on analyzing the 194 contracting parties to the CBD or the ITPGR. The research scope of hypothesis 2 examines the 31 developed countries that are parties to the CBD or the ITPGR. The research scope of hypothesis 3 concerns the 163 developing countries that are parties to the CBD or the ITPGR.

<table>
<thead>
<tr>
<th>Table 4.40 The Conclusion of Probit Regression about the Adoption of Access and Benefit-Sharing Regimes (ABS) under Changes of Different Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracting Parties to the CBD or the ITPGR</td>
</tr>
<tr>
<td>Conclusion</td>
</tr>
<tr>
<td>Contracting Parties</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>All Contracting</td>
</tr>
<tr>
<td>Parties (194</td>
</tr>
<tr>
<td>countries)</td>
</tr>
<tr>
<td>Contracting Parties</td>
</tr>
<tr>
<td>that are Developed</td>
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<tr>
<td>Countries (31</td>
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<tr>
<td>(31 countries)</td>
</tr>
<tr>
<td>Contracting Parties</td>
</tr>
<tr>
<td>that are Developing</td>
</tr>
<tr>
<td>Countries (163</td>
</tr>
<tr>
<td>(163 countries)</td>
</tr>
</tbody>
</table>
The P-values produced by the better regression model for the three hypotheses (0.022, 0.044, and 0.037) show that “Numbers of PVP Applications – 2002~2006 Average” is statistically significant, given that those CBD or ITPGR contracting parties adopt ABS regimes. The values of “dF/dx” for “Numbers of PVP Applications – 2002~2006 Average” in Table 4.37 through Table 4.39 were positive, which means that PVP applications correlate positively with the adoption of ABS regimes even though the “dF/dx” for the better regression models for the three hypotheses (.0016, .0011, and .0016) are small. In short, we can arrange the probit regression regarding the adoption of ABS regimes using different variables in Table 4.40.

This dissertation concludes that the CBD and the ITPGR, which emphasize the conservation of PGRs and traditional knowledge regarding the use of PGRs and the fair and equitable use of those resources, do not conflict with the TRIPS or other bilateral international intellectual property agreements that seek to harmonize global intellectual property laws. Countries adopt ABS regimes in order to conserve PGRs and traditional knowledge regarding the use of PGRs and the fair and equitable use of those resources when those countries encourage plant breeders to innovate new plant varieties and file more PVP applications, regardless of whether these countries are developed countries, developing countries, or contracting parties to the CBD or the ITPGR. The next section will further interpret these findings and make recommendations and suggestions regarding these phenomena.
4.5 RECOMMENDATIONS AND SUGGESTIONS FOR THE CURRENT IMPLEMENTATION OF NATIONAL ACCESS AND BENEFIT-SHARING REGIMES (ABS)

4.5.1 Interactions regarding the Adoption of Access and Benefit-Sharing Regimes (ABS) and Plant Variety Protection (PVP) Applications

Making recommendations and suggestions regarding the current implementation of national ABS regimes using the outcomes of regression analyses requires understanding the interactions regarding the adoption of ABS regimes and PVP applications. This section will use the theoretical development and regression analysis to further examine the interactions between the adoption of ABS regimes and PVP applications.

4.5.1.1 Theoretical Developments regarding the Interactions between the Adoption of Access and Benefit-Sharing Regimes (ABS) and Plant Variety Protection (PVP) Applications

The outcomes of probit regression show that the adoption of ABS regimes is statistically significant with respect to PVP applications. PVP is a form of intellectual property protection that is available in many countries (including both developed and developing countries), because Article 27.3(b) of the TRIPS Agreement of the WTO set up an obligation for the 153 members of the WTO to enact *sui generis* systems for the protection of new plant varieties. The UPOV Convention is an international agreement regarding the harmonization of PVP or PBR laws that has only has 67 contracting parties. The UPOV Convention is an important

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step in the implementation of Article 27.3(b) of the TRIPS Agreement, and is the only international agreement concerning the establishment of PVP or PBR. Therefore, the establishment of PVP or PBR is necessary in the era of genetic engineering,\textsuperscript{865} and is an issue that has captured the attention of the international community.

PVP laws exert different types of influences in different countries. W. Lesser and R. Masson have argued that positive influences influenced the passage of the U.S. PVPA.\textsuperscript{866} Gasser and Fraley observed that prior to the passage of the U.S. PVPA, only three corporations were selling commercial soybean seeds, while more than forty corporations were selling commercial soybean seeds after the passage of the PVPA.\textsuperscript{867} These arguments are applicable only to the U.S. biotechnology industry, and we cannot conclude that the enactment of PVP laws is the only reason for the stimulation of the development of biotechnology industry in different countries.

The purpose behind enacting intellectual property laws (including PVP laws) is to provide legal protection in order to encourage new works or inventions (e.g. machines, new plant varieties, or genetic-modified seeds, etc).\textsuperscript{868} PVP laws may not be the one and only factor involved in the birth or development of a country’s biotechnology industry, but it is important for stimulating new plant innovations and promoting the development of a biotechnology industry in a given country. In other words, if one country possesses a large number of plant innovations and has a well-developed biotechnology industry, there should be substantial R&D investments and numerous R&D inventors, researchers, and scientists in the public and private sectors in that country.

\textsuperscript{865} See Stoianoff, supra note 508, at 1.


\textsuperscript{867} C.S. Gasser & R.T. Fraley, Genetically Engineering Plants for Crop Improvement, 244 Sci. 1293 (1989).

\textsuperscript{868} For example, the Article I, Section 8, Clause 8 of the U.S. Constitution of 1789 rules that “Congress shall......; To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries;......”. See U.S. Const. art. I, § 8, cl. 8. Therefore, this article not only is the foundation of the first U.S. Patent Law of 1790, but also tells us that intellectual property laws (including Patent, Copyright, or PVP laws, etc) promote the progress of science and useful Arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.
As regards the pharmaceutical and seed industries, the R&D expenditures of the Eli Lilly company were 3.49 billion dollars in 2007, and the R&D expenditures of Wyeth were 3.27 billion dollars during the same year. The R&D expenditures of Monsanto, the world’s largest seed company, were 700 million dollars in 2006. Intellectual property laws are tools that corporations use to protect their innovations. For example, between 1976 and 1999, Monsanto ranked first in the number of U.S. utility patents and PVP certificates granted (749). R&D expenditures, and the numbers of inventors, researchers, and scientists are positively associated with the development of various forms of intellectual property protection (including PVP) in many countries. An empirical study shows that agricultural biotechnology research processes lead to the filing of increased numbers of PVP applications. As mentioned above, when the numbers of PVP applications and PVP grants are put into regression, the regression will exhibit “Multicollinearity,” meaning that two variables are highly correlated with each other. Therefore, the existence of additional PVP applicants indicates that there are probably additional PVP grants, and discussing PVP grants is the same as discussing PVP applications.

Biotechnology corporations use PGRs or traditional knowledge regarding the use of PGRs that may originate in developing countries or domestically. For instance, the 1994 report of the Rural Advancement Foundation International (RAFI), which is now known as ETC Group, stated that “At least 7,000 medical compounds used in Western medicine are

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874 Statistics Solutions, Inc., Data Entry, Cleaning, and Coding: Multicollinearity, supra note 848.
The Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI) said that “…as much as 74 percent of plant derived human drugs are used for the same purpose for which native people discovered their use.” As a result, issues regarding Access and Benefit-Sharing (ABS) concerning the use of PGRs or traditional knowledge regarding the use of PGRs are consolidated with the use of these resources or traditional knowledge. This dissertation cited Vogel’s arguments that the existing literature neglects the brain drain problem because multinational industries engage in practices such as identifying a hard-working, but poor, natural product chemistry professor in the developing world and enticing that professor to lobby the Ministry of the Environment and thereby fulfill the “prior informed consent” requirement for MTAs.

Therefore, Vogel’s arguments confirm the statements in this dissertation that if a given country possesses numerous plant innovations, and has a highly developed biotechnology industry, there should be substantial R&D investments and numerous R&D inventors, researchers, and scientists in the public and private sectors in that country. Multinational industries seek to ensure that they can use PGRs or traditional knowledge regarding the use of PGRs without limitations, so they hire numerous researchers or experts on ABS issues regardless of whether these researchers or experts come from developed or developing countries. As a result, the adoption of ABS regimes is closely related to both the number of application filings for intellectual property protection (PVP applications), and the brain drain problem.

Vogel’s arguments indicate that only multinational industries in the developed world can afford to hire large numbers of “hard-working but poor natural product chemistry professor[s]” and have large numbers of experts specializing in ABS issues. However, this disserta-

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875 See Schuler, supra note 213, at 160.
876 See Schuler, supra note 213, at 160.
877 See Vogel, supra note 38, at 126.
878 See Vogel, supra note 38, at 126.
tion will not state that the differences between developed and developing countries are the one and only reason for discussing the interactions between the adoption of ABS regimes and PVP applications.

4.5.1.2 Regression Analysis concerning the Interactions between the Adoption of Access and Benefit-Sharing Regimes (ABS) and Plant Variety Protection (PVP) Applications

The above section argues that having a highly developed biotechnology industry (including substantial R&D investments and large numbers of scientists or researchers in the public and private sectors) induces the filing of increased numbers of PVP applications in a contracting party (member country) to the CBD or the ITPGR. The filing of PVP applications in a member country is one outcome of the existence of a highly developed biotechnology industry. If a member country experiences increased PVP application filings, scientists and researchers in the public and private sectors use PGRs or traditional knowledge regarding the use of PGRs to develop new plant innovations and then go on to file more PVP applications in order to protect their innovations. However, these arguments do not indicate that there are advantages to be derived from the adoption of ABS regimes by biotechnology corporations and countries, so this section will use regression analysis to further examine the interactions between the adoption of ABS regimes and PVP applications. The outcomes of regression analyses in sections 4.3 and 4.4 showed that the more PVP applications that are filed in a member country of the CBD or the ITPGR, the higher the probability that the member country will adopt an ABS regime, and such outcomes focus on the legal perspective.

On the other hand, the independent variables used in the regression analysis in this section include “Numbers of PVP Applications – 2002~2006 Average” (law), “Enforcing Contracts Cost of 200% of income per capita” (law), “Transnational Corporations: Foreign direct
investment, net inflows in 2006” (economic), “The Numbers of Vascular Plant Species in 2004” (biodiversity), “The Percentage of total Arable Land, which occupies total area” (agriculture), and “The Percentage of Population in Urban Areas, which occupies total population in 2006” (urbanization), because ABS issues concerning the use of PGRs and traditional knowledge regarding the use of PGRs relate to different perspectives (e.g. law, economic, biodiversity, agriculture, and so on). Table 4.41 shows the outcomes of regression analysis.


<table>
<thead>
<tr>
<th>Status of Access and Benefit-Sharing Regime – In Force (statusofac-r)</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>z-statistic</th>
<th>P &gt;</th>
<th>z</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of PVP Applications – 2002<del>2006 Average (numb</del>2002200)</td>
<td>.004665</td>
<td>.0020803</td>
<td>2.24</td>
<td>0.025</td>
<td>.005878</td>
<td>.0087422</td>
</tr>
<tr>
<td>Transnational Corporations: Foreign direct investment, net inflows in 2006 (million $) (transnation)</td>
<td>.0000364</td>
<td>.0000182</td>
<td>2.00</td>
<td>0.046</td>
<td>6.77e-07</td>
<td>.0000721</td>
</tr>
<tr>
<td>Enforcing Contracts Cost of 200% of income per capita (%) (enforcingc-c)</td>
<td>.0225737</td>
<td>.0229693</td>
<td>0.98</td>
<td>0.326</td>
<td>-.0224453</td>
<td>.0675926</td>
</tr>
<tr>
<td>The Numbers of Vascular Plant Species in 2004 (numb~2004)</td>
<td>-9.69e-06</td>
<td>.0000193</td>
<td>-0.50</td>
<td>0.616</td>
<td>.0000475</td>
<td>.0000281</td>
</tr>
</tbody>
</table>

Number of obs = 56  
LR chi²(6) = 22.25  
Prob > chi² = 0.0011  
Pseudo R² = 0.2876
Table 4.41 (cont.)

<table>
<thead>
<tr>
<th>2004 (thenumbers~s)</th>
<th>The Percentage of Population in Urban Areas, which occupies total population in 2006 (%) (thepercent~n)</th>
<th>The Percentage of total Arable Land, which occupies total area (%) (thepercent~h)</th>
<th>_cons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-0.0117975 .0133068 -0.89 0.375 -.0378783 .0142833</td>
<td>-0.0272088 .0178956 -1.52 0.128 -.0622836 .007866</td>
<td>.0171588 1.124719 0.02 0.998 -2.18725 2.221568</td>
</tr>
</tbody>
</table>

Note: 0 failures and 1 success completely determined.

This regression analysis points out that both “Numbers of PVP Applications – 2002~2006 Average” and “Transnational Corporations: Foreign direct investment, net inflows in 2006” are statistically significant with respect to “Status of Access and Benefit-Sharing Regime.” In other words, the more net inflows of foreign direct investments from transnational corporations among the 194 contracting parties (member countries) to the CBD or the ITPGR, the higher probability that these countries will adopt ABS regimes. Not only will there be increased PVP application filings, but there will also be more net inflows of foreign direct investments from transnational corporations in each member country, which will increase the probability of the adoption of ABS regimes by these countries.

When a member country of the CBD or the ITPGR adopts laws or policies (e.g., complete frameworks for intellectual property protection) that attract increased foreign direct investments from transnational corporations, such laws or policies will benefit the economic development of that country, and will promote the fair and efficient use of PGRs and traditional knowledge regarding the use of PGRs in that country. Transnational corporations often invest large amounts of money in a country in the hope of obtaining greater profits from their investments in that country. In this manner, corporations need to file additional PVP applica-
In order to protect the potential commercial benefits of their plant innovations, because developing innovations requires substantial initial R&D expenditures. Substantial R&D investments and PVP applications filings by transnational corporations lead to increased demand for PGRs (raw materials) and promote the development of benefit-sharing agreements arising from the use of PGRs (raw materials).

<table>
<thead>
<tr>
<th>Table 4.42</th>
<th>Interactions among the Numbers of PVP Application, Foreign Direct Investment (FDI), and the Adoption of Access and Benefit-Sharing Regimes (ABS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistically Significant Variables</td>
<td></td>
</tr>
<tr>
<td>Numbers of PVP Application (P-value: 0.022)</td>
<td></td>
</tr>
<tr>
<td>Developing Countries</td>
<td>Developed Countries</td>
</tr>
<tr>
<td>A. To attract more FDI (foreign bioprospecting projects);</td>
<td></td>
</tr>
<tr>
<td>B. Increased PVP applications mean increased agricultural biotechnology research processes.</td>
<td></td>
</tr>
<tr>
<td>Monsanto ranked first in the number of U.S. utility patents and PVP certificates granted (749) between 1976-1999, and had R&amp;D expenditures of 500 million dollars a year on agriculture.</td>
<td></td>
</tr>
<tr>
<td>Increased demand for raw materials from biotechnology industry – access (e.g. Biotechnology in fields other than health care and agriculture, crop protection, horticulture, the development of major crops by the seed industry, botanical medicine industry)</td>
<td></td>
</tr>
<tr>
<td>Increased probability of the sharing of monetary and non-monetary benefits arising from the use of raw materials</td>
<td></td>
</tr>
</tbody>
</table>

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879 Plants can be protected by utility patents or plant patent laws (sexually propagated plants) in a few countries of the world, such as the U.S. However, plants can be protected through Plant Variety Protections (PVPs) or Plant Breeders’ Rights (PBRs) which are recognized by two international agreements – TRIPS Agreement and UPOV Convention. See the discussions of 2.4.1 and 2.4.3 of this dissertation.


883 Wright, *supra* note 170, at 5.

884 *See* Kate & Laird, *supra* note 64, at 99-100, 139-140, 172-76, 211-12, 242-45.
Foreign Direct Investment (FDI) (P-value: 0.047)

<table>
<thead>
<tr>
<th>In Decision V/26 on Access to Genetic Resources, the Conference of the Parties of CBD recognised that the key capacity building needs of ABS regimes include:</th>
<th>FDI in developed countries is greater than in developing countries, and developed countries have more money and resources than developing countries for capacity building concerning ABS regimes and establishing ABS regimes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. assessment and inventory of biological resources as well as information management;</td>
<td>Developed countries have formalized legal frameworks, including intellectual property, investment, or benefit-sharing laws that induce increased FDI and benefit-sharing</td>
</tr>
<tr>
<td>b. contract negotiation skills;</td>
<td></td>
</tr>
<tr>
<td>c. legal drafting skills;</td>
<td></td>
</tr>
<tr>
<td>d. means of protecting traditional knowledge associated with genetic resources</td>
<td></td>
</tr>
</tbody>
</table>

FDI is the dominant mechanism for technology transfer (non-monetary benefit-sharing) to developing countries. Technology disseminated through FDI generally includes the entire package including experts and their skills, and also contributes to technology transfer through on-the-job training and various forms of interaction among local and foreign firms.

887 Secretariat of the Convention on Biological Diversity, Notification: Ad Hoc Technical Expert Group on
In addition, setting up ABS regimes requires capacity building. Foreign direct investments (FDI) play important roles in the establishment of ABS regimes in developing countries, such as technology transfers (non-monetary benefit-sharing).^{880} Developed countries already have formalized legal frameworks (i.e., intellectual property, investment, or benefit-sharing law, etc) that help them attract more FDI than developing countries. Developed countries have more money and resources than developing countries for developing the capabilities necessary to establish ABS regimes. Table 4.42 shows the interactions among the numbers of PVP application, FDI, and the adoption of ABS regimes.

Table 4.42

| Status of Access and Benefit-Sharing Regime – In Force (statusofac=r) | Coefficient | Standard Error | z-statistic | P > |z| | [95% Conf. Interval] |
|---|---|---|---|---|---|---|
| Numbers of PVP Applications by Residents – 2002–2006 Average | .0085324 | .0041208 | 2.07 | 0.038 | .0004558 | .0166091 |


Number of obs = 55
LR chi²(6) = 22.58
Prob > chi² = 0.0009
Pseudo R² = 0.2979

^{880} The dominant mechanism for technology transfer to developing countries is foreign direct investment (FDI), which accounts for more than 60% of the flow of technology into these countries. Multinational corporations (the main drivers of FDI) are powerful and effective means of disseminating technology from developed to developing countries, and are often the only source of new technologies that are usually not available through the market. See Conference of the Parties to the Convention on Biological Diversity, Technology Transfer and Scientific and Technology Cooperation, Compilation and synthesis of information on institutional, administrative, legislative and policy frameworks that facilitate access to and adaptation of technologies: Note by the Executive Secretary, https://www.cbd.int/doc/meetings/cop/cop-08/information/cop-08-inf-09-en.pdf (last visited on Mar. 2, 2010).
If we use the independent variable: “Numbers of PVP Applications by Residents – 2002~2006 Average” instead of the original independent variable: “Numbers of PVP Applications – 2002~2006 Average,” we can find that both “Numbers of PVP Applications by Residents – 2002~2006 Average” and “Transnational Corporations: Foreign direct investment, net inflows in 2006” are statistically significant with respect to the adoption of ABS regimes. Table 4.43 shows the outcomes of regression analysis.

If we use the independent variable: “Numbers of PVP Applications by Non-resident – 2002~2006 Average” instead of the original independent variable: “Numbers of PVP Appli-
cations by Residents – 2002~2006 Average,” we can find that both “Numbers of PVP Applications by Non-resident – 2002~2006 Average” and “Transnational Corporations: Foreign direct investment, net inflows in 2006” are statistically significant with respect to the adoption of ABS regimes. Table 4.44 points out the outcomes of regression analysis.


| Status of Access and Benefit-Sharing Regime – In Force (statusofac=r) | Coefficient | Standard Error | z-statistic | P>|z| | [95% Conf. Interval] |
|---|---|---|---|---|---|
| Numbers of PVP Applications by Non-resident – 2002~2006 Average (numbsofp~s) | .0077793 | .003883 | 2.00 | 0.045 | .0001688 , .0153898 |
| Transnational Corporations: Foreign direct investment, net inflows in 2006 (million $) (transnatio~n) | .000039 | .0000169 | 2.31 | 0.021 | 5.91e-06 , .0000721 |
| Enforcing Contracts Cost of 200% of income per capita (%) (enforcingc~c) | .0166718 | .0217661 | 0.77 | 0.444 | -.025989 , .0593325 |
| The Numbers of Vascular Plant Species in 2004 (thenumbers~s) | -9.16e-06 | .0000188 | -0.49 | 0.627 | -.0000461 , .0000278 |
| The Percentage of | -.0106294 | .0128107 | -0.83 | 0.407 | -.0357379 , .0144791 |
Table 4.44 (cont.)

<table>
<thead>
<tr>
<th>Population in Urban Areas, which occupies total population in 2006 (%) (thepercent-n)</th>
<th>The Percentage of total Arable Land, which occupies total area (%) (thepercent-h)</th>
<th>_cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.0189934</td>
<td>0.0154044</td>
<td>-1.23</td>
</tr>
<tr>
<td>0.218</td>
<td>-0.0491853</td>
<td>0.0111986</td>
</tr>
<tr>
<td>0.0425149</td>
<td>1.081428</td>
<td>0.04</td>
</tr>
<tr>
<td>0.969</td>
<td>-2.077044</td>
<td>2.162074</td>
</tr>
</tbody>
</table>

Note: 0 failures and 1 success completely determined.

When a member country of the CBD or the ITPGR adopts a complete framework of intellectual property laws (e.g., PVP laws), increased levels of FDI will flow to that country, and transnational corporations are more willing to file for additional intellectual property protection (e.g., PVPs) for their creations, such as plant innovations. Meanwhile, when an increased number of inventions is created in a given country that means that transnational corporations become more likely to increase their R&D expenditures and demand more PGRs (raw materials), which arise from benefit-sharing agreements regarding the use of these resources or materials. As a result, legal predictability and written records of legal frameworks of property rights are crucial for investors. The Convention of the International Union for the Protection of New Varieties of Plants (UPOV Convention) is a good example, and stresses that “...many States rightly attach importance [to the protection of new varieties of plants], [and this] should be resolved by each of them in accordance with uniform and defined principles.”

In other words, the UPOV Convention promotes “an effective system of plant variety protection” (PVP laws) for member states of the Convention, and plant breeders (e.g., transnational corporations or investors) seek PVP laws that are “predictable” or used for

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“prediction”\textsuperscript{890} for the protection of their new plant varieties and commercial benefits in member states of the UPOV Convention.

Overemphasizing ABS regimes apparently makes it difficult for transnational corporations to access PGRs and traditional knowledge regarding the use of PGRs, because it reduces corporate profits while requiring companies to pay compensation to the sources of PGRs and traditional knowledge regarding the use of PGRs (e.g. countries, tribes, intermediaries,\textsuperscript{891} or culture collections\textsuperscript{892}). Countries seek to improve their PVP laws in order to obtain increased filings of PVP application, and transnational corporations seek firm legal protection for their innovations (commercial benefits). In addition, the outcome of this regression analysis inferred that countries will seek to enhance laws and adopt policies in order to obtain increased foreign direct investments from transnational corporations in order to improve their economic development, and induce foreign investors and that country to adopt ABS regimes (fair and efficient use of PGRs and traditional knowledge regarding the use of PGRs).

4.5.1.3 Further Analyses and Research regarding the Interactions between the Adoption of Access and Benefit-Sharing Regimes (ABS) and Plant Variety Protection (PVP) Applications

Regression analyses and theoretical developments in sections 4.3, 4.5.1.1, and 4.5.1.2 have indicated that increased PVP applications (an independent variable) are statistically sig-

\textsuperscript{890} The definition of “predictability” in the Oxford English Dictionary is “The fact or condition of being predictable; the extent to which something can be predicted or used for prediction.” See Oxford English Dictionary – predictability, available at http://dictionary.oed.com.proxy2.library.uiuc.edu/cgi/entry/30007703?single=1&query_type=word&queryword=predictability&first=1&max_to_show=10.

\textsuperscript{891} In practice, the transaction costs of accessing PGRs or samples by public and private sectors of biotechnology industry are high due to access limitations in national laws, so they access PGRs or samples through “intermediaries” or “culture collections.” In other words, “intermediaries” or “culture collections” are alternative sources of PGRs or samples. Although the access fees for “intermediaries” or “culture collections” are cheaper than the transaction costs of directly negotiating with source countries, biotechnology corporations are still required to pay substantial access fees if they need to access numerous PGRs or samples. See Kate & Laird, supra note 64, at 5-6, 244, 322.

\textsuperscript{892} See Kate & Laird, supra note 64, at 5-6, 244, 322.
significant with respect to the adoption of ABS regimes (the dependent variable) and explained why increased numbers of PVP application filings in a given country induces the adoption of an ABS regime in that country. However, there is a lack of alternative explanations regarding whether or not the adoption of an ABS regime (an independent variable) in a given country is statistically significant with respect to the numbers of PVP application (the dependent variable) filings in that country.

In addition, the outcomes of regression analyses and theoretical examinations in sections 4.3, 4.5.1.1, and 4.5.1.2 might not reflect that some countries adopted ABS regimes prior to experiencing increased numbers of PVP application filings in those countries, because the adoption of ABS regimes is one reason that might increase the numbers of PVP application filings in those countries. We will discuss this in section 4.5.1.3.2. On the other hand, regression analyses and theoretical developments in sections 4.3, 4.5.1.1, and 4.5.1.2 reflected that the numbers of PVP application filings in a given country impact the adoption of an ABS regime in that country. We will discuss this in section 4.5.1.3.3.

4.5.1.3.1 Linear Regression of the Interactions between Plant Variety Protection (PVP) Applications and the Adoption of Access and Benefit-Sharing Regimes (ABS) that Numbers of Plant Variety Protection (PVP) Applications as the Dependent Variable

Determining whether or not the adoption of ABS regimes in a given country is statistically significant with respect to numbers of PVP application filings in that country requires that we run a linear regression regarding the interactions between PVP applications and the adoption of ABS regimes using the numbers of PVP applications as the dependent variable. The outcome of this regression analysis will prove that some countries that have adopted ABS regimes prior have experienced increased numbers of PVP application filings, and
comparing them with countries that already have more PVP application filings shows how this enhances their adoption of ABS regimes.

In addition to “Numbers of PVP Applications – 2002~2006 Average” as the dependent variable and “Status of Access and Benefit-Sharing Regime – In Force” as an independent variable in this regression, “Enforcing Contracts Cost of 200% of income per capita,” “The Percentage of Population in Urban Areas, which occupies total population in 2006,” “The Percentage of total Arable Land, which occupies total area,” “The Numbers of Vascular Plant Species in 2004,” and “Transnational Corporations: Foreign direct investment, net inflows in 2006” are independent variables run in this regression. Table 4.45 indicates the regression outcomes concerning the Numbers of PVP Applications – 2002~2006 Average, Status of ABS Regime, Enforcing Contracts Cost of 200% of income per capita, The Percentage of Population in Urban Areas, which is the total population in 2006, The Percentage of total Arable Land, which is the total area, The Numbers of Vascular Plant Species in 2004, and Transnational Corporations: Foreign direct investment, net inflows in 2006.

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>t-statistic</th>
<th>P &gt;</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of PVP Applications – 2002<del>2006 Average (numb</del>2002200)</td>
<td>Status of Access and Benefit-Sharing Regime (ABS)</td>
<td>171.9298</td>
<td>63.77975</td>
<td>2.70</td>
<td>0.010</td>
</tr>
</tbody>
</table>

Table 4.45 (cont.)

<table>
<thead>
<tr>
<th>Benefit-Sharing Regime – In Force (statusofac-r)</th>
<th>Enforcing Contracts Cost of 200% of income per capita (%) (enforcing-c)</th>
<th>The Percentage of Population in Urban Areas, which occupies total population in 2006 (%) (thepercen-t-n)</th>
<th>The Percentage of total Arable Land, which occupies total area (%) (thepercen-t-h)</th>
<th>The Numbers of Vascular Plant Species in 2004 (thenumbers-s)</th>
<th>Transnational Corporations: Foreign direct investment, net inflows in 2006 (million $) (transnatio-n)</th>
<th>_cons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-4.621569</td>
<td>3.52047</td>
<td>-1.31</td>
<td>0.195</td>
<td>-11.69622</td>
<td>2.45308</td>
</tr>
<tr>
<td></td>
<td>The Percentage of Population in Urban Areas, which occupies total population in 2006 (%) (thepercen-t-n)</td>
<td>2465296</td>
<td>1.839182</td>
<td>0.13</td>
<td>0.894</td>
<td>-3.449446</td>
</tr>
<tr>
<td></td>
<td>1.165694</td>
<td>2.274998</td>
<td>0.51</td>
<td>0.611</td>
<td>-3.406086</td>
<td>5.737474</td>
</tr>
<tr>
<td></td>
<td>The Numbers of Vascular Plant Species in 2004 (thenumbers-s)</td>
<td>.0034984</td>
<td>.0029215</td>
<td>1.20</td>
<td>0.237</td>
<td>-.0023725</td>
</tr>
<tr>
<td></td>
<td>Transnational Corporations: Foreign direct investment, net inflows in 2006 (million $) (transnatio-n)</td>
<td>.000274</td>
<td>.0010197</td>
<td>0.27</td>
<td>0.789</td>
<td>-.0017752</td>
</tr>
<tr>
<td></td>
<td>_cons</td>
<td>92.18794</td>
<td>166.1099</td>
<td>0.55</td>
<td>0.581</td>
<td>-241.6224</td>
</tr>
</tbody>
</table>

In this regression, “Status of Access and Benefit-Sharing Regime – In Force” is statistically significant (P-value < .05) with respect to “Numbers of PVP Applications – 2002~2006 Average.” The outcome of this regression is much different than in the previous regression models, because the previous regression models indicate that “Numbers of PVP Applications – 2002~2006 Average” is a factor that induces a given country to adopt an ABS regime. However, the linear regression in this section points out that “Status of Access and Bene-

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^893 If “Numbers of PVP Applications by Residents – 2002~2006 Average” is the dependent variable in a new regression analysis, “Status of Access and Benefit-Sharing Regime – In Force” is also statistically significant (P-value < .05) with respect to “Numbers of PVP Applications by Residents – 2002~2006 Average.”
“Access and Benefit-Sharing Regime – In Force” is a factor that causes increased PVP application filings in a given country.

In other words, various countries adopt different strategies based on their individual situations. Some countries have paid attention to the sustainable use and fair and equitable sharing of benefits arising from the use of PGRs and have adopted ABS regimes. The strategies of countries that have adopted ABS regimes prior to experiencing increased PVP application filings is that such strategies promote increases in PVP application filings in these countries. On the other hand, some countries have already experienced increased PVP application filings, which enhanced the adoption of ABS regimes, because more raw materials are needed for research and development of new plant innovations that result in the sharing of benefits (compensations or royalties) that arise from the use of raw materials. We will compare two different groups of countries in the following sections.

4.5.1.3.2 Countries which Adopted Access and Benefit-Sharing Regimes (ABS) prior to Experiencing Increased Plant Variety Protection (PVP) Application Filings

This section will examine 21 countries, which are contracting parties to the CBD or the ITPGR and have adopted ABS regimes (laws or policies). In particular, the year that these countries adopted ABS regimes was prior to the year in which greater numbers of PVP applications were filed in these countries (2002). Table 4.46 shows detailed statistics about countries that adopted ABS regimes prior to experiencing increased PVP application filings.

Table 4.46 compares “Numbers of PVP Applications” of 21 countries from 2002 to 2007. There are 10 countries for which there is no data regarding the numbers of PVP ap-

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applications between 2002 and 2007. The numbers of PVP applications filed in 9 countries (Australia, Bolivia, Brazil, China, Estonia, Finland, Mexico, Russian Federation, and United States of America) are increased. The average rate of increased of PVP application filings for these 9 countries between 2002 and 2007 is 40.26%. In other words, as regards the 9 countries that adopted ABS regimes before 2002, doing so increased PVP application filings between 2002 and 2007.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>2000</td>
<td>329</td>
<td>378</td>
<td>337</td>
<td>356</td>
<td>363</td>
<td>336</td>
<td>+2.08%</td>
</tr>
<tr>
<td>Bolivia</td>
<td>1997</td>
<td>2</td>
<td>14</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>10</td>
<td>+80%</td>
</tr>
<tr>
<td>Brazil</td>
<td>1997</td>
<td>93</td>
<td>122</td>
<td>211</td>
<td>178</td>
<td>187</td>
<td>219</td>
<td>+57.53%</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Before 2002</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>China</td>
<td>1998</td>
<td>307</td>
<td>616</td>
<td>770</td>
<td>1023</td>
<td>934</td>
<td>877</td>
<td>+64.99%</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>1998</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Estonia</td>
<td>1997</td>
<td>10</td>
<td>9</td>
<td>2</td>
<td>14</td>
<td>8</td>
<td>11</td>
<td>+9.09%</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td></td>
<td>8</td>
<td>2</td>
<td>12</td>
<td>17</td>
<td>N/A</td>
<td>10</td>
<td>+20%</td>
</tr>
<tr>
<td>Germany</td>
<td>2001</td>
<td>217</td>
<td>282</td>
<td>213</td>
<td>181</td>
<td>204</td>
<td>185</td>
<td>-17.30%</td>
</tr>
<tr>
<td>Guatemala</td>
<td>1999</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>India</td>
<td>2001</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Malawi</td>
<td>1996</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Mexico</td>
<td>1996</td>
<td>45</td>
<td>34</td>
<td>46</td>
<td>39</td>
<td>87</td>
<td>112</td>
<td>+59.82%</td>
</tr>
<tr>
<td>Niue</td>
<td>2001</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Panama</td>
<td>1998</td>
<td>4</td>
<td>1</td>
<td>7</td>
<td>N/A</td>
<td>2</td>
<td>1</td>
<td>-300%</td>
</tr>
<tr>
<td>Philippines</td>
<td>1995</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>2001</td>
<td>578</td>
<td>534</td>
<td>576</td>
<td>570</td>
<td>686</td>
<td>885</td>
<td>+34.69%</td>
</tr>
<tr>
<td>Saint Vincent and the Grenadas</td>
<td>1955</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Samoa</td>
<td>2000</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Thailand</td>
<td>1999</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>United States of America</td>
<td>1983</td>
<td>287</td>
<td>342</td>
<td>327</td>
<td>347</td>
<td>331</td>
<td>436</td>
<td>+34.17%</td>
</tr>
</tbody>
</table>

Using a line graph (Figure 4.9) to represent the changes of numbers of PVP applications from 11 countries (Australia, Bolivia, Brazil, China, Estonia, Finland, Germany, Mexico, Panama, Russian Federation, and United States of America), which adopted ABS regimes prior to experiencing increased PVP application filings between 2002 and 2007 shows that the number of PVP applications filed in large developing countries (e.g., China, Russian Federation, and Brazil, etc) exceed the number of PVP applications filed in certain developed countries (e.g., U.S., Australia, and Germany, etc) between 2002 and 2007. Of course, we cannot say that developing countries pay more attention to the adoption of ABS regimes and the development of plant innovations – increased PVP application filings than developed
countries. However, the effects of the adoption of ABS regimes to increase PVP application filings are more obvious among major developing countries than among developed countries.

4.5.1.3.3 Countries that Experience Increased Plant Variety Protection (PVP) Application Filings Become More Likely to Adopt Access and Benefit-Sharing Regimes (ABS)

This section will examine 17 countries which are contracting parties to the CBD or the ITPGR and adopted ABS regimes (laws or policies). In particular, the year that these countries adopted ABS regimes was after the year in which increased numbers of PVP applications were filed in these countries (2001). These countries already experienced increased PVP application filings, which induced them to adopt ABS regimes. Table 4.47 provides statistics about countries which experienced increased PVP application filings, which promoted their adoption of ABS regimes.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Azerbaycan</td>
<td>2002</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

897 Convention on Biological Diversity, Information, National Information, Country Profiles, Overview, supra note 894; Convention on Biological Diversity, Programmes & Issues, ABS, Implementation: Databases on ABS Measures, supra note 894; Convention on Biological Diversity, Information, National Information, Search National Reports and NBSAPs, supra note 894.
<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
<th>Value 5</th>
<th>Value 6</th>
<th>Change % (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>2002</td>
<td>N/A</td>
<td>193</td>
<td>44</td>
<td>68</td>
<td>29</td>
<td>26</td>
<td>-642.31 % (1997~2001)</td>
</tr>
<tr>
<td>Bhutan</td>
<td>2003</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>2003</td>
<td>85</td>
<td>111</td>
<td>96</td>
<td>108</td>
<td>73</td>
<td>151</td>
<td>+43.71 %</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>2006</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Guyana</td>
<td>2008</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Japan</td>
<td>2005</td>
<td>939</td>
<td>1054</td>
<td>1034</td>
<td>767</td>
<td>927</td>
<td>1142</td>
<td>+17.78 %</td>
</tr>
<tr>
<td>Kenya</td>
<td>2006</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>61</td>
<td>69</td>
<td>197</td>
<td>+69.04 % (1999~2001)</td>
</tr>
<tr>
<td>Peru</td>
<td>2002</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>5</td>
<td>4</td>
<td>N/A</td>
<td>-25 % (1999~2000)</td>
</tr>
<tr>
<td>Portugal</td>
<td>2002</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>N/A</td>
<td>8</td>
<td>N/A</td>
<td>+12.5 % (1996~2000)</td>
</tr>
<tr>
<td>South Africa</td>
<td>2004</td>
<td>208</td>
<td>217</td>
<td>270</td>
<td>206</td>
<td>218</td>
<td>223</td>
<td>+6.73 %</td>
</tr>
<tr>
<td>Sweden</td>
<td>2003</td>
<td>44</td>
<td>68</td>
<td>43</td>
<td>48</td>
<td>43</td>
<td>37</td>
<td>-18.92 %</td>
</tr>
<tr>
<td>Switzerland</td>
<td>2005</td>
<td>113</td>
<td>79</td>
<td>73</td>
<td>101</td>
<td>104</td>
<td>122</td>
<td>+7.38 %</td>
</tr>
<tr>
<td>Uganda</td>
<td>2005</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Vanuatu</td>
<td>2002</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Table 4.47 (cont.)
Table 4.47 (cont.)

<table>
<thead>
<tr>
<th>Country</th>
<th>2002</th>
<th>N/A</th>
<th>N/A</th>
<th>N/A</th>
<th>N/A</th>
<th>N/A</th>
<th>N/A</th>
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<tbody>
<tr>
<td>Zimbabwe</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>


Notes: The symbols of N/A mean that the data of “Numbers of PVP Applications” of a given country are not available.

Table 4.47 compares the “Numbers of PVP Applications” of 17 countries from 1996 to 2001. In addition to 7 countries for which there is no data regarding the numbers of PVP applications between 1996 and 2001, the numbers of PVP applications filed in 6 countries (Czech Republic, Japan, Kenya, Portugal, South Africa, and Switzerland) increased. The average rate of increase of PVP application filings for these 6 countries between 1996 and 2001 was 26.19%. As a result, these 6 countries experienced more PVP application filings from 1996 to 2001 which promoted their adoption of ABS regimes.

Using a line graph (Figure 4.10) to represent the changes of numbers of PVP applications from 10 countries (Bulgaria, Czech Republic, Japan, Kenya, Peru, Portugal, South Africa, Sweden, Switzerland, and United Kingdom of Great Britain and Northern Ireland) shows that the more PVP application filings that these countries experience, the more likely they adopt ABS regimes between 1996 and 2001. Japan is the only country which had high levels of PVP application filings between 1996 and 2001, prior to Japan’s adoption of an

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ABS regime. The numbers of PVP applications for the remaining 9 countries between 1996 and 2001 ranged from 0 to 350.

In other words, changes in the numbers of PVP applications for these 9 countries are minor, but it does not mean that numbers of PVP applications for these 9 countries decreased between 1996 and 2001. PVP application filings in the Czech Republic, Portugal, South Africa, and Switzerland increased from 1996 to 2001. As a result, a given country which has a complete body of PVP laws and more developments of plant innovations that induce increased numbers of PVP application filings in that country. The biotechnology industries of
that country can protect and reward benefits that are derived from plant innovations through the use of PVP laws and other types of intellectual property laws. In particular, such a country’s strategy will provide utilitarian/economic incentives\textsuperscript{900} for biotechnology industries to follow national access regulations and share benefits with the providers of PGRs. We can prove this argument through the regression analysis where “Transnational Corporations: Foreign direct investment, net inflows in 2006” (FDI) is the dependent variable and “Numbers of Patent Applications in 2006” is an independent variable.\textsuperscript{901} The outcome of this regression analysis shows that “Numbers of Patent Applications in 2006” is statistically significant (P-value < .05) with respect to the FDI.\textsuperscript{902} In other words, if a given country has a complete framework of intellectual property protection (e.g., Patents, PVPs, or other intellectual property rights), these forms of intellectual property protections will promote increased FDI in that country. Foreign investors will obtain potential benefits from intellectual property protection, which provides these investors with utilitarian/economic incentives\textsuperscript{903} to share monetary or non-monetary benefits with the providers of PGRs.

\textsuperscript{900} Although the “utilitarian/economic incentive theory” is used to describe intellectual property law as involving the promotion of new and improved works, this dissertation argues that if countries can improve their intellectual property laws (e.g. PVP laws), doing so would provide utilitarian/economic incentives for biotechnology corporations to follow “access” regulations and share benefits with providers regarding the use of PGRs or samples, after which these corporations could obtain commercial benefits eligible for protection by intellectual property laws. See Merges et al., supra note 1, at 11.

\textsuperscript{901} In addition to “Transnational Corporations: Foreign direct investment, net inflows in 2006” (FDI) as the dependent variable and “Numbers of Patent Applications in 2006” as an independent variable, “Status of Access and Benefit-Sharing Regime – In Force,” “Enforcing Contracts Cost of 200% of income per capita,” “The Percentage of Population in Urban Areas, which occupies total population in 2006,” “The Percentage of total Arable Land, which occupies total area,” and “The Numbers of Vascular Plant Species in 2004” are independent variables in this new regression.

\textsuperscript{902} In addition to “Numbers of Patent Applications in 2006,” which is statistically significant (P-value=.001 < .05) with respect to “Transnational Corporations: Foreign direct investment, net inflows in 2006” (FDI), “The Percentage of Population in Urban Areas, which occupies total population in 2006” is also statistically significant (P-value=.009 < .05) with respect to the FDI.

\textsuperscript{903} See the note 900 of this dissertation.
4.5.1.4 Summary of Interactions regarding the Adoption of Access and Benefit-Sharing Regimes (ABS) and Plant Variety Protection (PVP) Applications

Different countries adopt different strategies based on their particular situations. Some major developing countries (i.e., China, Russian Federation, and Brazil, etc) and developed countries (i.e., U.S., Australia, and Germany, etc) adopted ABS regimes prior to experiencing increased numbers of PVP application filings. The strategies of these countries resulted in increased numbers of PVP applications being filed in these countries. Such statements fit with the outcomes of the regression analyses in section 4.5.1.3.1 such that “Numbers of PVP Applications – 2002~2006 Average” was the dependent variable and the regression analysis indicated that “Status of Access and Benefit-Sharing Regime – In Force” is statistically significant with respect to “Numbers of PVP Applications – 2002~2006 Average.”

On the other hand, some countries already had complete frameworks of PVP laws that promoted increases in the numbers of PVP application filings from the public and the private sectors of the biotechnology industry. Such strategies promote the development of biotechnology industry, protect the potential commercial benefits of the biotechnology industry, and provide utilitarian/economic incentives\(^\text{904}\) for the biotechnology industry to follow access regulations and share benefits with providers. These arguments are proven by the outcomes of regression analyses in sections 4.3, 4.5.1.1, and 4.5.1.2, which indicated that “Numbers of PVP Applications – 2002~2006 Average” is statistically significant with respect to “Status of Access and Benefit-Sharing Regime – In Force.”

Different countries have different reasons for adopting ABS regimes. We can determine from this section’s analyses that the sustainable use, fair, and equitable sharing of benefits arising from the use of PGRs (the adoption of ABS regimes) does not conflict with the development of intellectual property rights (PVP laws or other types of intellectual property

\(^{904}\) See the note 900 of this dissertation.
laws). The issues involve balancing the adoption of ABS regimes and the development of intellectual property rights (i.e., PVP laws) and determining how “access” and “benefit-sharing” issues that are currently encountered by the public and private sectors of biotechnology industries in order to propose tangible ways to solve them. The next three sections attempt to examine current “access” and “benefit-sharing” issues regarding the use of PGRs by the public and the private sectors of biotechnology industries and to provide some possible recommendations concerning current national ABS laws.

4.5.2 Access Issues

Countries adopt ABS regimes in order to conserve PGRs or traditional knowledge regarding the use of PGRs and their fair and equitable use. We cannot clearly determine whether or not ABS regimes are a usefully valid legal system or policy for the public sector (universities or research institutions, etc) and the private sector (multinational biotechnology corporations, etc) of the biotechnology industry. The outcome of regression analysis in the previous section indicated that adopting ABS regimes is beneficial to countries for economic development purposes, the promotion of the development of plant innovations, and the fair and efficient use of PGRs and traditional knowledge regarding the use of PGRs. Countries improve their PVP laws in order to give legal protection to transnational corporations’ plant innovations. There remain issues that are worthy of study through the use of the outcomes of regression analyses in the previous sections – “Numbers of PVP Applications – 2002~2006 Average” and “Transnational Corporations: Foreign direct investment, net inflows in 2006” are statistically significant with respect to “Status of Access and Benefit-Sharing Regime.” If the independent variable – “Numbers of PVP Applications – 2002~2006 Average” is used instead of “Numbers of PVP Applications by Residents – 2002~2006 Average” and “Num-

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905 See outcomes of the regression analyses in sections 4.3 and 4.5.1.2 of this dissertation.

This section has two parts – one, access and benefit-sharing issues that state why increasing the numbers of PVP applications significantly correlates with the adoption of ABS regimes and why the adoption of ABS regimes also significantly correlates with the numbers of PVP applications, and, two, recommendations about which roles the public and private sectors of the biotechnology industries and countries should play in order to enhance the development of biotechnology industries, intellectual property protection (PVP applications), and the adoption of ABS regimes based on empirical studies and case studies.

4.5.2.1 The Challenges to the Private and Public Sectors of the Biotechnology Industry concerning Access to PGRs and Traditional Knowledge regarding the Use of PGRs

The costs involved when multinational corporations invent new types of seeds are substantial, including the costs of accessing PGRs or samples that corporations need – “Mass Selection” and “Base Broadening.” For example, consider the example of the Wheat, Veery, that was released by Centro Internactional de Mejoramiento de Maiz y Trigo (CIMMYT). CIMMYT used plant progenitors whose genealogy can be traced back to about

906 See outcomes of the regression analyses in section 4.5.1.2 of this dissertation.
907 See outcomes of the regression analyses in section 4.5.1.3.1 of this dissertation.
908 Kate & Laird, supra note 64, at 127-28.
3,170 different crosses made by breeders around the world and 51 individual lines from 26 nations. The costs of these processes is estimated to be 31 to 52.5 million dollars per seed variety.

As a result, the increased costs of accessing PGRs or samples that corporations or research institutions need are serious issues for both the public sector (universities or research institutions, etc.) and the private sector (multinational biotechnology corporations, etc.) of the biotechnology industry, both of which find it difficult to directly negotiate with provider countries in order to access the PGRs or samples that they seek. They access PGRs or needed samples through “intermediaries” (e.g. botanical gardens, universities, research institutions, gene banks, libraries, or companies and so on) or “culture collections.” The costs of accessing PGRs or samples in this manner are lower than the costs of directly accessing them through governments. For example, the Belgian Coordinated Collections of Microorganisms (BCCM) charges 50 dollars for universities and non-profit organizations for access to plasmids and charges commercial corporations 160 dollars for access to cDNA libraries. The American Type Culture Collection (ATCC) charges from 60 to 275 dollars per strain, and ATCC offers discounts to non-profit organizations for access to some items.

“Intermediaries” and “culture collections” are important issues with respect to developing the access laws or policies for each country as well as for discussions of the CBD and the

909 Kate & Laird, supra note 64, at 127.
910 Kate & Laird, supra note 64, at 127.
911 Diversity magazine described the “intermediary” as “Many refer to these intermediary institutions as ‘leaky,’ since they allow access to genetic resources without dealing directly with source countries, which might require prior informed consent or the sharing of benefits for access to their genetic resources.” Kate & Laird’s research argued that “Many (corporations) are anxious for intermediaries to shoulder the responsibility of satisfying legal and requirements for access, and in particular are unwilling to become involved in direct negotiations with governments or local stakeholders, such as local authorities, institutions, and communities.” As regards the “culture collection,” Kate & Laird’s research described that that “The heavy reliance by the biotechnology sector on ‘culture collections’ for access to genetic resources is significant from the perspective of benefit-sharing…collections continue, in most cases, to be supplied to companies and other researchers without any restrictions on commercialization or requirement to share benefits with source countries.” See Kate & Laird, supra note 64, at 5-6, 244, 322.
912 Kate & Laird, supra note 64, at 5.
913 Kate & Laird, supra note 64, at 139.
914 Kate & Laird, supra note 64, at 139.
ITPGR. The CBD and the ITPGR regulate only access issues that are related to relationships between users (multinational corporations or research institutions) and provider countries. However, the CBD or the ITPGR do not include the relationships between users (multinational corporations or research institutions) and “intermediaries” or “culture collections.” In this manner, the public and private sectors of the biotechnology industry play “passive” roles in obeying the access regulations of each country, the CBD, and the ITPGR, which do not fit in with their practical operations. Countries should play more “proactive” roles by enacting practical national access regulations which fit with the operations of the public and private sectors of the biotechnology industry, because the biotechnology industry largely accesses countries’ PGRs or samples through “intermediaries” or “culture collections” and avoids directly accessing countries’ PGRs or samples. These regulations are helpful for countries that seek to create investment-friendly environments and appeal for more net inflows of foreign direct investments on the part of transnational corporations.

915 For example, Article 8(j) of the CBD regulates that “Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.” Article 15(5) of the CBD rules that “Access to genetic resources shall be subject to prior informed consent of the Contracting Party providing such resources, unless otherwise determined by that Party.” Article 15(7) of the CBD rules that “Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, and in accordance with Articles 16 and 19 and, where necessary, through the financial mechanism established by Articles 20 and 21 with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources. Such sharing shall be upon mutually agreed terms.” In addition, Article 10.1 of the ITPGR rules that “In the exercise of their sovereign rights, the Contracting Parties agree to establish a multilateral system, which is efficient, effective, and transparent, both to facilitate access to plant genetic resources for food and agriculture, and to share, in a fair and equitable way, the benefits arising from the utilization of these resources, on a complementary and mutually reinforcing basis.” Article 11.3 of the ITPGR regulates that “Contracting Parties also agree to take appropriate measures to encourage natural and legal persons within their jurisdiction who hold plant genetic resources for food and agriculture listed in Annex I to include such plant genetic resources for food and agriculture in the Multilateral System.” See Secretarial of the Convention on Biological Diversity, supra note 24; Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24. Given these articles of the CBD and the ITPGR, we understand that the CBD and the ITPGR authorize contracting parties (countries) to enact national laws or legislations concerning ABS issues and promote the fair and equitable sharing of benefits with holders of PGRs and traditional knowledge (countries and local communities). As a result, we cannot find any regulations in the CBD and the ITPGR that regulate ABS issues related to “intermediaries” or “culture collections.”

4.5.2.2 The Roles of Countries in Enhancing Access Laws and Policies

Although the public and private sectors of the biotechnology industries can go through “intermediaries” or “culture collections” in seeking to solve the problems of the protracted and costly procedures involved in accessing PGRs or samples they require (e.g. seeds), the current access regulations of the CBD require prior informed consent from provider countries.917 Multinational biotechnology corporations or research institutions seek to reduce access costs by accessing PGRs or samples through “intermediaries” or “culture collections,” so the access provisions regarding the use of PGRs or samples in the CBD or the ITPGR are not applicable with respect to the practical operations of multinational corporations or research institutions in this regard.

Section 3.3 of this dissertation mentioned that the current recession has reduced R&D investments by the biotechnology industries, so corporations or research institutions or research institutions will continue to seek access to PGRs or samples through “intermediaries” or “culture collections” in order to decrease access (R&D) costs. 103 parties to the CBD or the ITPGR, or 53.1% of the 194 parties, have adopted national access laws or policies.918 Most of these national access laws or policies confirm the purposes of the CBD or the ITPGR to the effect that PGRs are national sovereignties and require users to obtain prior informed consent, and also require long and complicated administrative procedures as a prerequisite for accessing PGRs or samples.

Thailand and Philippines have national access laws, policies, and procedures that regulate access to natural, biological, and genetic resources in Thailand. Foreign bioprospectors

917 For instance, Article 15(5) of the CBD rules that “Access to genetic resources shall be subject to prior informed consent of the Contracting Party providing such resources, unless otherwise determined by that Party.” See Secretarial of the Convention on Biological Diversity, supra note 24.
918 There are 103 parties to the CBD or the ITPGR that have adopted national access laws or policies. These parties include 68 parties who have both adopted access and benefit-sharing laws or policies, and 35 parties, who have adopted access laws or policies but not benefit-sharing laws or policies. See discussions in 4.2.1 in this dissertation.
must apply to the “National Research Council (NRCT)” for permission to conduct research in Thailand before entering the country.\textsuperscript{919}

According to regulation “B.E. 2525 of NRCT,” bioprospectors must fill out form “NRCT-01” and submit it to the “NRCT” no less than 90 days before entering the country, together with an application to the “NRCT.” Applicants must also submit two letters of endorsement from domestic researchers.\textsuperscript{920} A letter from the “NRCT” is required to obtain a visa at the “Royal Thai Embassy or Consulate.” Within 7 days of entering the country, the applicant must report to the “NRCT” to pay a processing fee of $200 Baht per researcher and obtain an identification card.\textsuperscript{921}

Applicants can apply to access the genetic resources, the Plant Variety Protection Act (PVPA) or Regulation on Forestry Studying and Research Conducting within Forested Areas (RFSRCFA). According to the PVPA, local and foreign commercial bioprospectors must file applications with the “Department of Agriculture” and obtain “Prior Informed Consents (PICs)” from the owners of local genetic resources.\textsuperscript{922} When wild plant varieties are used, researchers must set up benefit-sharing agreements with the government and sometimes the owners of the resources\textsuperscript{923} as well.

As regards the procedures for accessing biological resources in the Philippines, the “EO 247” states that local and foreign bioprospectors must apply for access to genetic resources that have commercial and noncommercial purposes.\textsuperscript{924} Applications for “Academic Research Agreements (ARA)” or “Commercial Research Agreements (CRA)” must be submitted to the “Technical Secretariat” for initial evaluation.\textsuperscript{925} Applications are then passed along to the “Inter-Agency Committee on Biological and Genetic Resources (IACBGR), which makes a

\textsuperscript{919} Carrizosa, supra note 601, at 14, 21, 22.
\textsuperscript{920} Carrizosa, supra note 601, at 14, 21, 22.
\textsuperscript{921} Carrizosa, supra note 601, at 14, 21, 22.
\textsuperscript{922} Carrizosa, supra note 601, at 14, 21, 22.
\textsuperscript{923} Carrizosa, supra note 601, at 14, 21, 22.
\textsuperscript{924} Carrizosa, supra note 601, at 13, 14, 21.
\textsuperscript{925} Carrizosa, supra note 601, at 13, 14, 21.
“Recommendation” to the pertinent agency.  

Foreign applicants must engage a local institution in the research process. On the other hand, the “Wildlife Act” modified the “EO 247” and ruled that the collection and use of biological resources for academic or scientific purposes can be undertaken with free permission. Moreover, the “Department of Environment and Natural Resources (DENR),” the “Department of Agriculture,” and the “Palawan Council for Sustainable Development (PCSD)” are responsible for implementing the “Wildlife Act.”

This dissertation argues that although PGRs belong to national sovereignties, countries should attempt to make the long and complicated procedures involved in accessing PGRs easier. Countries should encourage the establishment of additional “intermediaries” or “culture collections” in order to decrease the high access costs for corporations and research institutions, and also to conserve PGRs, because the long and complicated administrative procedures involved in accessing PGRs are not necessarily the best ways to conserve countries’ PGRs. Shorter and more efficient administrative procedures can also help conserve PGRs.

As mentioned above, the access provisions of the CBD and the ITPGR do not mention “intermediaries” or “culture collections,” and multinational corporations or research institutions need only pay royalties for access to PGRs or samples that they actually need. These PGRs or samples do not originate with “intermediaries” or “culture collections,” who are only brokers between users and providers. In theory, corporations or research institutions should pay royalties to first-hand providers (e.g. farmers), because doing so fits the access requirements of the CBD and the ITPGR. The CBD and the ITPGR do not regulate access issues related to “intermediaries” or “culture collections,” so countries (contracting parties) should enact laws and policies regulating “intermediaries” or “culture collections” in order to

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926 Carrizosa, supra note 601, at 13, 14, 21.
927 Carrizosa, supra note 601, at 13, 14, 21.
928 Carrizosa, supra note 601, at 13, 14, 21.
929 Carrizosa, supra note 601, at 13, 14, 21.
930 Kate & Laird, supra note 64, at 322.
ensure that the original providers receive royalties.

In addition, countries all over the world compete to attract foreign direct investments, because investments by multinational corporations bring new technologies, management skills, and marketing know-how. Therefore, efficient access laws or policies are necessary for countries that seek to create investor-friendly environments for foreign direct investments by multinational corporations. The regression analysis in section 4.5.1.2 indicated that net inflows of foreign direct investments from transnational corporations are statistically significant with respect to the adoption of ABS regimes. Increased net inflows of direct foreign investments by transnational corporations result in the increased probability of the adoption of ABS regimes. If one country adopts efficient laws and policies regarding accessing PGRs, such laws and policies make it convenient for multinational corporations to collect PGRs or samples in order to develop plant innovations and file more PVP applications, and are also beneficial for attracting direct foreign investments by multinational corporations in that country.

The previous section mentioned that the costs of “Mass Selection” and “Base Broadening” (accessing seeds) in the seed industry are high, and corporations or research institutions may require thousands of PGRs or samples from several countries in order to develop new seeds or new plant varieties. As a result, large-scale access to PGRs or samples is an important issue for today’s mergers and acquisitions that have led to a few giant multinational corporations. An empirical study showed that PVPs (or PBRs) systems have been the older breeding firms have been consolidated within multinational corporations. Only a few multinational corporations have filed more PVP applications and obtained PVP grants, which

931 Javorcik, supra note 916, at 159.
932 Kate & Laird, supra note 64, at 127.
helps them control commercial markets.\textsuperscript{934}

The regression analyses in this dissertation showed that increasing numbers of PVP applications are statistically significant with respect to the adoption of ABS regimes, mergers, while the consolidation of old firms and PVP applications (or grants) into a decreasing number of companies is unhealthy for a country’s economy.\textsuperscript{935} This dissertation suggests that countries should simplify the long and complicated administrative procedures required for access to PGRs or samples that corporations or research institutions need in order to decrease the costs associated with accessing PGRs or samples. This does not mean that countries should give up “access” control regarding the use of PGRs or samples, but rather that they should adopt more efficient ways to regulate “access” to PGRs or samples. Biotechnology industries are beneficial to the development of countries’ intellectual property rights (e.g. PVP laws) in the form of the adoption of ABS regimes, and the outcome of regression analysis in section 4.5.1.3.1 showed that the adoption of ABS regimes is statistically significant with respect to increased numbers of PVP applications. This also would help small or old biotechnology corporations avoid being merged or consolidated into big biotechnology corporations, and help prevent the numerical near-monopolization of PVP applications (or grants) by a small number of corporations. Meanwhile, small corporations could file more PVP applications or obtain more PVP grants, which would enhance the adoption of an ABS regime within a given country. Furthermore, efficient access laws and policies are beneficial for countries that seek direct foreign investments from multinational corporations (i.e. R&D investments), and these corporations file increased numbers of PVP applications to protect their legal rights. To sum up, such laws and policies promote the implementation of ABS regimes, economic development, and the development of plant innovations.

\textsuperscript{934} Rangnekar, supra note 933.
\textsuperscript{935} Rangnekar, supra note 933.
4.5.3 Benefit-Sharing Issues

This section has two parts: the challenges to the private and public sectors presented by the biotechnology industry, and the role that countries play in enhancing laws regarding the sharing of benefits or policies that provide tangible recommendations or suggestions regarding these issues.

4.5.3.1 The Challenges to the Private and Public Sectors of the Biotechnology Industry concerning the Sharing of Benefits Derived from Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs)

The sharing of benefits derived from the use of PGRs or traditional knowledge regarding the use of PGRs is controversial for the private and public sectors of the biotechnology industry. The profits of multinational corporations that derive from the commercialization of PGRs or traditional knowledge regarding the use of PGRs are not high, while the R&D costs are high.

Consider the examples of the Horticulture and Seed industries. Interviews conducted by Kate and Laird indicated that the profit margins of horticulture are shrinking, and the overall budgets for purchases of plant materials are being squeezed by shipping costs, so horticultural companies are less willing to pay benefits to their suppliers. In addition, the costs of applying for seed certificates (PVP applications) exceed 1,500 million dollars, and the costs of GMOs are 1-7 million dollars per “event” for approval of a transgene. Biotechnology corporations get little money from commercializing PGRs or derivative products after benefits are shared, so they are unwilling to share their limited monetary benefits with suppliers.

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936 Kate & Laird, supra note 64, at 178.
937 Kate & Laird, supra note 64, at 178.
938 Kate & Laird, supra note 64, at 127.
As mentioned above, biotechnology corporations face financial limitations and are unwilling to share monetary benefits due to profit concerns, R&D costs and the costs of benefit sharing. In comparison with the sharing of monetary benefits, sharing non-monetary benefits is a better policy for the public sector (universities or research institutions) and the private sector (multinational corporations). Consider the examples of the Crop Protection and Seed industries. Interviews with crop protection corporations conducted by Kate and Laird showed that collaborative research programs with universities and public research bodies both help them secure public funding, and also prepare them to cover the costs of seeking intellectual property rights (IPRs) protection in cases where IPRs are jointly owned by corporations and their collaborators (local communities or developing countries). Another method of non-monetary benefit-sharing in crop protection includes public organizations (e.g. universities or research institutions) that conduct crop protection research sharing or which provide information. Corporations send equipment to developing countries and permit doctoral students to use laboratories, which helps with the analysis of results, in return for copies of the students’ dissertations.

As regards the seed industry, Kate and Laird interviewed Dr. Susan McCouch of Cornell University, who indicated that “We don’t have the cash to pay up front, but we will work on the basis of reciprocity, and give back what we receive…If new or important varieties are developed, they are quickly offered to the country of origin.” The private sector (here meaning multinational corporations) of the seed industry uses this approach for non-monetary benefit-sharing. For example, Novartis Seeds provided Bt-maize germplasm to Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT) and Bt-rice germplasm to Interna-

939 Kate & Laird, supra note 64, at 215.
940 Kate & Laird, supra note 64, at 215.
941 Kate & Laird, supra note 64, at 216.
942 Kate & Laird, supra note 64, at 216.
943 Kate & Laird, supra note 64, at 216.
944 Kate & Laird, supra note 64, at 147.
tional Rice Research Institute (IRRI), because the subsistence farmers served by these institutions would not otherwise benefit from these corporations’ efforts.\footnote{Kate & Laird, supra note 64, at 147.}

Adopting non-monetary benefit-sharing is a better policy for the public and private sectors than monetary benefit-sharing. Whether or not benefit-sharing laws and policies can be properly implemented will be determined by interactions between the public and the private sectors of the biotechnology industry and countries. The outcome of linear regression in section 4.5.1.3.1 indicated that the adoption of ABS regimes is statistically significant with respect to increased numbers of PVP applications. This dissertation argues that the adoption of benefit-sharing regimes is crucial for the promotion of the development of plant innovations (increased PVP application filings), which are beneficial to the public and the private sectors of biotechnology industries for the protection of their potential commercial benefits. Governments play active roles in enacting practical and useful benefit-sharing laws and policies, but should also consider different aspects of the biotechnology industry (e.g. profits or R&D costs, etc.) and economic development (direct foreign investments by multinational corporations) when enacting benefit-sharing laws and policies.

4.5.3.2 The Roles of Countries in Enhancing Laws and Policies regarding the Sharing of Benefits

The sharing of benefits derived from the use of PGRs or traditional knowledge regarding the use of PGRs remains a controversial issue. Table 2.2 showed that 4 of the top 10 of the world’s largest seed corporations are U.S. seed corporations. Their total revenues exceed the revenues of the other 6 largest seed corporations combined.\footnote{See discussions in 2.2.1.2.1.3 in this dissertation.} These U.S. corporations also make profits that add to the U.S. GDP (Gross Domestic Product).

The example of the U.S. indicates that developed countries, which have flourishing bio-
technology industries, enact laws and policies that favor the development of their biotechnology industries, and every country does this for their own industries. On the other hand, the perception of the “appropriation of knowledge and germ plasm without...permission and without compensation, the life sciences companies of the North will continue to make a big target for the developing world’s political grievances.”\footnote{Chen, supra note 76, at 26.} As a result, developing countries face domestic political pressures to enact strict laws and policies that regulate access to PGRs and traditional knowledge regarding the use of PGRs and the sharing of benefits derived from PGRs and traditional knowledge. In brief, the different positions of the developed and developing countries have resulted in benefit-sharing issues being seen as complicated and controversial.

Market economies are not always perfect, so countries (governments) should intervene in market economies in order to enhance economic efficiency, fairness, and societal stability.\footnote{Mao et al., supra note 19, at 247-48.} No matter what position countries take, they do not want market failure to occur, and their objectives include the pursuit of economic efficiency, fairness, and stability.\footnote{Mao et al., supra note 19, at 247-48.} For example, developing countries do not want multinational corporations from the developed world to use Patents or PVPs to create barriers against domestic biotechnology corporations or plant breeders that seek to enter markets. Markets are not perfectly competitive. In brief, developing countries believe that they must interfere with market economies and adopt ABS laws or policies in order to protect the national ownership of PGRs and local communities’ stewardships of traditional knowledge regarding the use of PGRs and the fair and equitable sharing of benefits derived by corporations with local communities.

On the other hand, developed countries do not want plant innovations (e.g. GM seeds or other new plant varieties) invented by their multinational corporations to become public goods (due to the free riders problem), and farmers do not want to pay money to purchase

\footnote{Chen, supra note 76, at 26.}
\footnote{Mao et al., supra note 19, at 247-48.}
\footnote{Mao et al., supra note 19, at 247-48.}
seeds, so demand in market economies is low. As a result, developed countries enact complete bodies of IPR laws in their countries, and push developing countries to obey the obligations of bilateral international intellectual agreements (i.e. TRIPS Agreement or UPOV Convention) by enacting IPR laws to protect the legal rights of multinational corporations from the developed world.

Although the actions engaged in by developed and developing countries differ, their objective is to avoid market failure and enhance economic efficiency, fairness and stability in their respective societies. In this manner, an ideal country would promote the development of all sectors of industry. Therefore, an ideal country should adopt an ABS regime – the protection of ownership and stewardship of PGRs and traditional knowledge regarding the use of PGRs and the fair and equitable sharing of benefits from multinational corporations with local communities, and promote the development of the biotechnology industry and IPRs for the benefit of inventors and plant breeders.

The regression analysis in this dissertation showed that the development of IPRs (PVP applications) does not conflict with the fair and equitable use of PGRs or traditional knowledge regarding the use of PGRs (ABS regime). Kloppenburg argued that “the PVPA is more a marketing act, rather than an act promoting research.” Corporations pursue the goal of profit maximization, and the PVPA offers legal protection for corporations seeking to efficiently commercialize products derived from PGRs and traditional knowledge regarding the use of PGRs. Corporations must spend large amounts of money, and require long periods of time, to obtain the legal protection of the PVPA. Corporations are not willing to share monetary benefits with local communities or developing countries due to cost and benefit analysis.

The previous section mentioned that the sharing of non-monetary benefits is beneficial for the public/private sectors of the biotechnology industry and countries. Corporate colla-

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950 Kloppenburg, supra note 192, at 137.
951 Mao et al., supra note 19, at 86.
borative research programs with local communities or developing countries (public organizations) allow local communities to participate in the joint ownership of IPRs while developing countries obtain technology transfers (i.e. equipments or education). Of course, these non-monetary benefits (technology transfers) are initiatives for countries (especially developing countries) to promote the development of the biotechnology industry. These successful examples of the sharing of non-monetary benefits teach us that local communities or developing countries do not necessarily claim ownership of PGRs and can become involved in jointly-owned IPRs in order to exploit such resources. Corporations obtain benefits by sharing non-monetary benefits with local communities or developing countries, because they seek to exchange raw materials (PGRs or samples that corporations or research institutions need). In addition, multinational biotechnology corporations promote their interest in profit maximization, so benefit-sharing laws and policies in a given country can help determine whether or not multinational corporations will invest in that country.

This dissertation suggests that benefit-sharing laws and policies should emphasize the sharing of non-monetary benefits rather than the sharing of monetary benefits. “Intermediaries” and “culture collections” play important roles for the majority of biotechnology corporations that need to access PGRs or samples and relate to benefit-sharing relationships due to existing ABS laws and policies that have required complicated procedures and restrictions regarding access to, and the sharing of, benefits derived from PGRs. Countries should enact provisions or regulations to regulate “intermediaries” and “culture collections” with respect to the sharing of benefits (especially the non-monetary benefit-sharing). In brief, establishing a non-monetary benefit-sharing regime as part of a country’s benefit-sharing laws and policies provides commercial benefits to biotechnology corporations, is beneficial for the conservation of PGRs and attracts increased foreign direct investments from transnational cor-

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Kate & Laird, supra note 64, at 5.
4.5.4 Summary

This dissertation makes the following recommendations and suggestions concerning the current implementation of ABS regimes based on the outcomes of the regression analyses:

4.5.4.1 The Development of Intellectual Property Right (IPR) Protection does not Conflict with the Adoption of Access and Benefit-Sharing Regime (ABS)

The regression analyses showed that PVP applications are statistically significant with respect to the adoption of ABS regimes, and the adoption of ABS regimes is also statistically significant with respect to PVP applications. In other words, various countries choose to implement ABS regimes in different ways. The more PVP applications that are filed in contracting parties (member countries) to the CBD or the ITPGR, the greater the probability that they will adopt ABS regimes. On the other hand, if a given country adopts an ABS regime, doing so will promote the filing of additional PVP applications in that country.

PVP laws are beneficial to the development of the biotechnology industry in the developed world. The R&D departments of biotechnology corporations need PGRs or traditional knowledge regarding the use of PGRs in order to produce new drugs, new GM seeds, and new plant varieties, but face ABS issues, and require experts in order to deal with ABS issues. Biotechnology corporations will need to file more PVP applications in order to protect their new drugs, GM seeds, and plant varieties. The development of PVP (or IPRs) does not conflict with the adoption of ABS regimes, which is contrary to the anti-biopiracy perspective of the developing world.

953 See outcomes of the regression analyses in section 4.3 of this dissertation.
954 See outcomes of the regression analyses in section 4.5.1.3.1 of this dissertation.
4.5.4.2 Eliminating Long and Complicated Administrative Procedures regarding Access to PGRs and Traditional Knowledge regarding the Use of PGRs

This section takes two countries – Thailand and Philippines – as examples of the administrative procedures that their national access laws or policies allow regarding the use of PGRs or traditional knowledge regarding the use of PGRs. Other countries have also adopted strict national access laws or policies, such as the Commonwealth of Austria, Nicaragua, Colombia, Ecuador, and Peru (Decision 391) etc.

This dissertation argues that long and complicated administrative procedures do not necessarily result in better conservation of PGRs or traditional knowledge regarding the use of PGRs. Such access restrictions will result in the loss of foreign “bioprospecting” programs (foreign direct investments) that are beneficial. For example, “biopiracy” claims that poorly defined ownership claims over genetic resources, the patenting of life forms, the protection of traditional knowledge, and equity issues have contributed to the cancellation of “biopros-

955 Within the territory of the Commonwealth of Austria, the Commonwealth owns the biological resources of the land; this ownership is based on common law principles. Furthermore, natural things growing on the land or in it are owned by the Commonwealth. In order to maintain the sustainable use of biological resources in the land, based on the draft regulations, commercial and non-commercial bioprospectors must obtain permission to access biological resources within the Commonwealth, and most important of all, must establish benefit-sharing agreements with the providers of those resources. As a result, the Commonwealth of Austria is a good legislative example of a developed country with an ABS regime. See Carrizosa, supra note 601, at 13, 18.

956 The draft of “Law of Biodiversity” specifies that the wildlife, genetic, and biochemical resources are seen as being in the public domain. Hence, these resources are owned by the State, which regulates access to them. In addition, the processes for accessing these resources have been defined by the draft of the “Law of Biodiversity.” It rules that all domestic and foreign bioprospectors must obtain the authorization of the National Biodiversity Institute in order to get permission to access genetic and biochemical resources. Most important of all, the following authorizations must be included: the Prior Informed Consent (PIC) of the supplier of these resources and the indigenous knowledge and a description of the intent to sign accessory contracts with local or foreign institutions, or descriptions of accessory contracts signed with these parties, before the law comes into force. See Carrizosa, supra note 601, at 13, 20, 21.

957 According to “Decision 391,” genetic resources and their derivatives which are discovered in the Andean Community are viewed as the goods or patrimony of the State, and the implementation of “Decision 391” relies on the countries’ legislation. The process of accessing genetic resources is very complicated. The “Decision 391” proposes that the “access contract” be negotiable between the bioprospector and the “Competent National Authority (CNA)” in the member country where the resources are found. Furthermore, prior to the negotiation of the contract, the bioprospector must file an application to access the relevant CNA. The application must include the information about the applicant, the identity of the supplier of genetic or biology resources, the identity of public or private institutes’ support, the identity of the project leader and groups, the identity of the nature of accessing conducts being requested, and the area in which the access will be made. See Carrizosa, supra note 601, at 13, 18, 19.
pecting” projects in countries such as Mexico.

4.5.4.3 Regulating “Intermediaries” or “Culture Collections” with respect to the Relationships of Access and Benefit-Sharing (ABS) in Current National Access and Benefit-Sharing (ABS) Regimes

Due to the restrictions on access to PGRs or traditional knowledge regarding the use of PGRs, many biotechnology corporations use PGRs or samples provided by “intermediaries” and “culture collections.”

There are two reasons for this: first, access fees required for the acquisition of the PGRs or samples that corporations need through “intermediaries” or “culture collections” are low for corporations; second, corporations can avoid high transaction costs (time and money) when accessing PGRs or samples. In addition, a number of “intermediaries” or “culture collections” may be involved between the initial collection and ultimate commercialization, so “intermediaries” or “culture collections” play important roles in determining the relationships intrinsic to the sharing of benefits. 958

To sum up, “intermediaries” or “culture collections” are important brokers that deal with ABS issues concerning the use of PGRs and samples that corporations need. This dissertation argues that each country should regulate relevant provisions or regulations regarding “intermediaries” and “culture collections” as part of their national ABS regimes.

4.5.4.4 Countries (Governments) should Emphasize Non-Monetary Benefit-Sharing rather than Monetary Benefit-Sharing in Current National Access and Benefit-Sharing (ABS) Regimes

The profits earned by biotechnology corporations differ by sectors. For example, the

958 Kate & Laird, supra note 64, at 322.
profit margin of the horticulture industry is decreasing. The costs of accessing PGRs or needed samples and applying for seed certificates (PVP applications or grants and other forms of IPR protection) are high for biotechnology corporations. Cost and benefit analysis shows that corporations are more willing to share non-monetary benefits than monetary benefits with local communities and developing countries.

Vogel criticized the “win-win strategies”\(^{959}\) that are common in the current ABS literature. The developing world gets access to outdated lab equipment (benefit-sharing) from the developed world,\(^ {960}\) and non-monetary benefits include providing equipment and other types of non-monetary benefits (e.g. providing new seeds to developing countries, jointly owned IPRs by corporations and local communities, education, or other technology transfers, etc). These non-monetary benefits are more practical and useful to countries (especially developing countries) than monetary benefits. Countries can use these non-monetary benefits as initiatives to promote the development of their biotechnology industries and IPRs, and should emphasize non-monetary benefit-sharing rather than monetary benefit-sharing.

\(^{959}\) See Vogel, \textit{supra} note 38, at 126.  
\(^{960}\) See Vogel, \textit{supra} note 38, at 126.
CHAPTER 5 - AN ANALYSIS OF THE “DRAFT OF THE GENETIC RESOURCES ACT OF TAIWAN”

“Thinking Globally, Acting Locally”\(^{961}\) is a good guideline for the future development of Taiwan’s biotechnology industry, intellectual property protection for agricultural biotechnology, and the conservation of PGRs and traditional knowledge regarding the use of PGRs.

The biotechnology industry began to attract the attention of the Taiwanese government during the 1980s.\(^{962}\) The Taiwanese government enacted the plan of “Development Program of Science and Technology” in 1982,\(^{963}\) and ruled that biotechnology was one of the eight important technologies.\(^{964}\) The Executive Yuan of Taiwan enacted “Challenge 2008: Important National Development Plan” in May, 2002 and adopted measures to accelerate the development of Taiwan’s biotechnology industry.\(^{965}\) Taiwan has highly developed agricultural technology, and offers a good environment for the development of an agricultural biotechnology industry.\(^{966}\) Combining the “National Technology Program of Agricultural Biotechnology Industry” and the “Forum of Commercialization of Agricultural Biotechnology Innovations,” made by the “Bio-Technology Committee (BTC)” of Taiwan’s Executive Yuan, the

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\(^{961}\) These words are quoted from Part IV of the book – *Biodiversity and The Law: Intellectual Property, Biotechnology and Traditional Knowledge* edited by Charles McManis. This topic reflects the contents of Part IV regarding the experiences of Peru and Southern Africa with the ethics and practices in ethnobiology and negotiations with indigenous groups. The contents of Part IV describe how Public Interest Intellectual Property Advisors (PIIPA) improves the ability of developing countries to manage, protect, or challenge intellectual property in the public interest. The contents of Part IV describe the operations of the Intellectual Property and Business Formation Legal Clinic at Washington University in St. Louis. This clinic provides professional services and research tools to help determine the effects of early-stage access to affordable legal services on the innovative process. The former parts “think globally,” and the latter parts “act locally.” This dissertation argues that although Taiwan already has a good environment for the development of an agricultural biotechnology industry, intellectual property protection, and conservation of PGRs or traditional knowledge about the use of PGRs, Taiwan can still benefit from the examples of additional ideas, experiences, and examples from other countries.

\(^{962}\) Julie C. L. Sun, *Innovation Strategies of Taiwan’s Biotechnology Industry*, http://www.biotaiwan.org.tw/download/aboutchief2/%E5%8F%B0%E7%81%A3%E7%94%A2%E6%A5%AD%E7%95%A5.pdf.

\(^{963}\) Sun, *supra* note 962.

\(^{964}\) Sun, *supra* note 962.


“Technology Consulting Group” of Executive Yuan held the first committee meeting on March 6, 2008 and passed the “Development of Industrialization Program for Agricultural Biotechnology.” The purposes of this program include enhancing the commercialization of innovations. R&D for agricultural investments, and the establishment of multinational agricultural biotechnology corporations.

These measures indicate that the government is making a serious effort to provide a good environment for the development of the agricultural biotechnology industry. Intellectual property protection is an initiative for the commercialization of agricultural biotechnology innovations, and Taiwan offers many types of intellectual property protection. For example, the Global Competitiveness Report 2008-2009 from the World Economic Forum showed that utility patent grants per million population in Taiwan between January 1 and December 31, 2007 ranked first in the world. There were 250 patents granted in the USPTO between 2004 to 2006 that were related to agriculture, and Taiwan ranked tenth in the world during that period.

Taiwan provides a good environment for intellectual property protection for the commercialization of agricultural biotechnology innovations. However, does this mean that emphasizing the developments of the agricultural biotechnology industry and intellectual property protection necessarily conflicts with the conservation of Taiwan’s PGRs and traditional knowledge regarding the use of PGRs? The answer appears to be “No.” Taiwan’s efforts to conserve PGRs and traditional knowledge regarding the use of PGRs may be proceeding...
more slowly than in other countries, but “access” laws and polices have nevertheless been adopted that conserve Taiwan’s PGRs and traditional knowledge regarding the use of PGRs. The “Draft of the Genetic Resources Act of Taiwan,”971 clearly regulates the Taiwanese ABS regime and the conservation of Taiwanese genetic resources.

The arguments in this chapter reflect the concept of acting locally, meaning the introduction and examination of current laws and policies regarding the conservation of PGRs or traditional knowledge regarding the use of PGRs, and also reflect the concept of thinking globally, meaning making use of other countries’ experiences. The outcomes of regression analyses for the 194 contracting parties to the CBD or the ITPGR of the world: PVP application (intellectual property protection) describes and suggests possible directions for the future development of Taiwanese ABS laws and policies.

5.1 OVERVIEW OF CURRENT ACCESS AND BENEFIT-SHARING LAWS AND POLICIES (ABS) IN TAIWAN

This section has two parts – Laws related to the Conservation of Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs), and Intellectual Property Laws related to the Conservation of Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs) that introduce the current ABS laws or policies in effect in Taiwan.

971 Department of Agronomy, SEED LAB., National Taiwan University, Genetic Resources Laws, supra note 612.
5.1.1 Laws related to the Conservation of Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs)\footnote{Laws introduced over here are only related to the conservation of PGRs and traditional knowledge regarding the use of PGRs but include those conservation of animal or other genetic resources and relevant traditional knowledge in Taiwan.}

5.1.1.1 Constitution of the Republic of China (Taiwan)

A Constitution is the fundamental law of a country, so the Constitution of the Republic of China (Taiwan) is the fundamental law of Taiwan. Although the Constitution of the Republic of China (Taiwan) does not directly regulate ABS issues regarding the use of PGRs and traditional knowledge regarding the use of PGRs, it does embody key principles regarding the ownership of mineral deposits and natural powers, which include PGRs.\footnote{Minguo Xianfa art. 143, § 2 (1947).} For example, Article 143, Section 2 of the Constitution of the Republic of China (Taiwan) regulates that “Mineral deposits which are embedded in the land, and natural power which may, for economic purposes, be utilized for public benefit shall belong to the State, regardless of the fact that private individuals may have acquired ownership over such land.”\footnote{Minguo Xianfa art. 143, § 2 (1947).}

Of course, the concept of natural power in this article of the constitution may not be the same as the concept of PGRs, but the discussions in section 4.5 in this dissertation explained that PGRs are economically significant for medicine, agriculture, food, etc, so PGRs are one part of the natural power of the state. In particular, the spirit of this article shows that natural resources (i.e. mineral deposits, natural power, or PGRs, and so on) within Taiwan’s national jurisdiction shall be regarded as part of the country’s sovereignty regardless of whether these resources are called mineral deposits, natural power, or PGRs. Thus, the regulations of this article implement the spirit of the CBD\footnote{Article 3 of the CBD regulates that “States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.” See Secretarial} and the ITPGR\footnote{See Secretarial} to the effect that PGRs are
owned by countries and are the property of national sovereignties.

As regards issues related to traditional knowledge regarding the use of PGRs, Additional Article 10, Section 11 of the Constitution of the Republic of China (Taiwan) regulates that “...The State shall also guarantee and provide assistance and encouragement for aboriginal education, culture, transportation, water conservation, health and medical care, economic activity, land, and social welfare, measures for which shall be established by law...”\(^\text{977}\) Although this article of the constitution regulates only the rights of indigenous people (aborigines), this article also authorizes the Legislative Yuan to enact “The Indigenous Peoples Basic Law”\(^\text{978}\) and “Protection Act for the Traditional Intellectual Creations of Indigenous Peoples.”\(^\text{979}\) The Protection Act for the Traditional Intellectual Creations of Indigenous Peoples is a \textit{sui generis} act intended to protect intellectual property rights related to traditional knowledge not only regarding the use of PGRs, but also other forms of cultural expression (i.e. religious ceremonies, music, dance, clothes, skills, etc.).\(^\text{980}\)

\(^\text{976}\) Article 10.1 of the ITPGR regulates that “In their relationships with other States, the Contracting Parties recognize the sovereign rights of States over their own plant genetic resources for food and agriculture, including that the authority to determine access to those resources rests with national governments and is subject to national legislation.” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, \textit{supra} note 24. As a result, this article of the ITPGR shows that countries have sovereign rights over their PGRs, and PGRs are owned by countries.

\(^\text{977}\) Minguo Xianfa add. art. 10, § 11 (2005).

\(^\text{978}\) Article 1 of the “Indigenous Peoples Basic Law” regulates that “This Law is enacted for the purposes of protecting the fundamental rights of indigenous peoples, promoting their subsistence and development and building inter-ethnic relations based on co-existence and prosperity,” and this article implements the regulations in the Additional Article 10, Section 11 of the Constitution that “…The State shall also guarantee and provide assistance and encouragement for aboriginal education, culture, transportation, water conservation, health and medical care, economic activity, land, and social welfare, measures for which shall be established by law…” See Faigui Huibian art. 1, [The Indigenous Peoples Basic Law of 2005] (ROC); Minguo Xianfa add. art. 10, § 11 (2005).


\(^\text{980}\) Article 3 of the “Protection Act for the Traditional Intellectual Creations of Indigenous Peoples” regulates that “The intellectual creations referred to in this Act shall mean traditional religious ceremonies, music, dance, songs, sculptures, weaving, patterns, clothing, folk crafts or any other expression of the cultural achievements of indigenous peoples.” See Faigui Huibian art. 3, [Protection Act for the Traditional Intellectual Creations of Indigenous Peoples, 2005] (ROC).
To sum up, although the Taiwanese constitution does not regulate the concept of ABS concerning the use of PGRs and traditional knowledge regarding the use of PGRs, the constitution authorizes the Legislative Yuan to enact laws in order to conserve PGRs and to protect traditional knowledge regarding the use of PGRs.

5.1.1.2 National Park Law

The reasons for the enactment of the National Park Law include the preservation of the nation’s unique natural scenery, wild fauna and flora, historic sites and providing public recreation and areas for scientific research. The introduction to the National Park Law discusses the preservation of animal or plant genetic resources in Taiwan’s national parks. The Ministry of the Interior is the authority that is responsible for national parks and the local headquarters that exist in each national park. Therefore, these two agencies are in charge of managing, investing in, and surveying national parks and are responsible for the approval of activities and research within the recreational, cultural, historic, scenic, and ecologically protected areas in Taiwan’s national parks.

digenous Peoples of 2007] (ROC). In other words, the intellectual commons within the protection of this law not only are related to traditional knowledge about the use of PGRs, but also are related to various forms of the cultural achievements of indigenous peoples.

981 Article 1 of the “National Park Law” regulates that “Be it enacted for the purpose of preserving the nation’s unique natural scenery, wild fauna and flora, and historic sites and providing public recreation and areas for scientific research, that is hereby created the National Park Law.” See Faigui Huibian art. 1, [National Park Law of 1972] (amended 1998) (ROC).

982 In addition to Article 1 of the “National Park Law” which states the preservation of wild fauna and flora in the National Park Law, Article 8 of this law also regulates that “Major terms in this law are defined as follows: 1. ’Wildlife’ refers to the fauna and flora naturally growing in an area without any artificial feeding, raising or cultivation and which constitute a major component of the natural scenery…” See Faigui Huibian art. 1, 8, [National Park Law of 1972] (amended 1998) (ROC).

983 Article 3 of the “National Park Law” regulates that “The Ministry of Interior is the responsible authority for national parks,” and Article 5 of this law regulates that “Headquarters shall be established at each national park. General rules of administration shall be enacted for all national parks.” See Faigui Huibian art. 3, 5, [National Park Law of 1972] (amended 1998) (ROC).

984 Article 10, § 1 of the “National Park Law” regulates that “The Ministry of Interior or its designated agency, for the purpose of investigating the national park area or altering the national park plan, may assign qualified individuals to enter private and public land to conduct studies and survey,” and Article 11, § 3 of this law regulates that “When necessary, the concessions may be invested in and operated by the local government, quasi-public corporation or other public or private group after the approval of the national park authority and under the supervision of the national park headquarters.” See Faigui Huibian art. 10, § 1 & 11, § 3, [National Park Law of 1972] (amended 1998) (ROC).
For example, Article 10 of the National Park Law regulates that the Ministry of Interior, or its designated agency, may assign qualified individuals to enter public and private lands in order to conduct studies and surveys, and prior notification of intended entry must be given to the landowner.\textsuperscript{985} Article 14 regulates which types of activities can be conducted within the existing recreational areas, and when permission must be obtained from the national park headquarters.\textsuperscript{986} Articles 15,\textsuperscript{987} 16,\textsuperscript{988} 17,\textsuperscript{989} and 19\textsuperscript{990} are regulations concerning activities which are conducted within cultural, historic, scenic, and ecological areas, and such activities shall be approved by the Ministry of Interior and the national park headquarters. Article 21 controls scientific research within the national, and prospective researchers must send proposals to the national park headquarters for approval.\textsuperscript{991}

\textsuperscript{986} Article 14 of the “National Park Law” regulates that “Within existing use areas or recreation areas, the following activities may be allowed after obtaining permission from the national park headquarters:
1. Building or demolishing public or private structures, roads, or bridges;
2. Filling, draining, altering or expanding the water surface or waterway;
3. Prospecting or exploring for minerals, earth or gravel;
4. Land clearing and farming;
5. Fishing or livestock grazing;
6. Constructing aerial cable systems;
7. Making use of water and hot springs;
8. Advertising or erecting signboards or similar objects;
9. Expanding, increasing or altering equipment in existing factories;
10. Any permission given under the above sections which effects a large area or is of particular importance shall be submitted by the National Park Headquarters to the Ministry of Interior for approval. The Ministry of Interior shall deliberate and make decisions together with other authorities concerned.” See Faigui Huibian art. 14, [National Park Law of 1972] (amended 1998) (ROC).
\textsuperscript{987} Article 15 of the “National Park Law” regulates that “Within cultural/historic areas, the following activities shall be subject to prior permission from the Ministry of Interior:
1. Repairing artifacts or historic monument;
2. Repairing or reconstructing buildings;
\textsuperscript{988} Article 16 of the “National Park Law” regulates that “Within cultural/historic areas, scenic areas, ecological protected areas, the following activities shall be permitted to meet specific needs after approval by the National Park Headquarters.” See Faigui Huibian art. 16, [National Park Law of 1972] (amended 1998) (ROC).
\textsuperscript{989} Article 17 of the “National Park Law” regulates that “Within scenic areas and ecological protection areas, the following activities shall be permitted to meet specific needs after approval by the National Park Headquarters:
1. Introducing exotic animals or plants;
2. Collecting specimens;
\textsuperscript{990} Article 19 of the “National Park Law” regulates that “Entrance to ecological protection areas may be allowed only after obtaining a permit from the national park headquarters.” See Faigui Huibian art. 19, [National Park Law of 1972] (amended 1998) (ROC).
\textsuperscript{991} Article 21 of the “National Park Law” regulates that “Academic institutes may engage in scientific research
As regards punishment for violating Articles 14, 16, 16, and 17, any person who violates the above articles shall be punished with a fine not to exceed 1,000 yuan or with imprisonment of not more than 1 year. As a result, the above discussions regarding the statutes of the National Park Law show that the National Park Law implements the spirit of the CBD and the ITPGR to the effect that genetic resources (including PGRs) shall be owned by countries and are part of their national sovereignties. The National Park Law has strict “access” regulations (as regards obtaining permission or approval from the Ministry of Interior and national park headquarters) and has regulations concerning punishment for violations of these “access” regulations. However, the National Park Law does not have a complete body of ABS regulations concerning the use of PGRs, because there is no regulation in the National Park Law regarding benefit-sharing issues with respect to the use of PGRs.

5.1.1.3 The Forestry Act

The purposes behind the enactment of the Forestry Act include preserving forest resources, the natural functions of forests, and their economic viability. Just as in the case of the National Park Law, the Forestry Act emphasizes the preservation of genetic resources (PGRs – forestry resources). The central government agencies that manage forests are the Council of Agriculture of the Executive Yuan and the county (city) government within the local government.

Although Taiwan’s forests are considered to be national public and private forests, Tai-
wan’s forests ultimately belong to the nation.\textsuperscript{997} Therefore, national forest management plans are regulated by the relevant administrative agencies and receive approval from the central government agency. Article 45, Section 1 regulates that all forest products must be given permits and inspected by the government agency prior to transportation for distribution.\textsuperscript{998}

Articles 50 through 56-4 are penalty provisions regarding people who steal, set fires, or engage in forbidden activities in forests.\textsuperscript{999} The ownership and punishment provisions in the Forestry Act show that the Forestry Act has strict “access” and punishment provisions but lacks “benefit-sharing” regulations, the same situation as is the case with the National Park Law.

5.1.1.4 The Law regarding the Exclusive Economic Zone and the Continental Shelf of the Republic of China (Taiwan)

The purposes behind the enactment of the Law on the Exclusive Economic Zone and the Continental Shelf of the Republic of China (Taiwan) include preserving and exercising rights in the exclusive economic zone and on the continental shelf of the Republic of China.\textsuperscript{1000}

Although this law does not specify which government agency manages the exclusive economic zone and on the continental shelf, Article 5, Section 1, Clause 1 declares that the Republic of China (Taiwan) enjoys sovereign rights for the purposes of exploring, exploiting, conserving, and managing resources (living or non-living) in the waters superadjacent to the

\textsuperscript{997} Article 3, § 2 of the “Forestry Act” regulates that “…According to the delineation of ownership, forest(s) shall be distinguished as national forest(s), public forest(s), and private forest(s); forests principally belong to the nation.” See Faigui Huibian art. 3, § 2, [Forestry Act of 1932] (amended 2004) (ROC).
\textsuperscript{998} Article 45, § 1 of the “Forestry Act” regulates that “All forest products are subject to permitting and inspection by the government agency prior to transport for distribution. The terms of logging and harvesting permits, application procedures, and due compliance requirements and inspection regulations shall be decreed by the central government agency.” See Faigui Huibian art. 45, § 1, [Forestry Act of 1932] (amended 2004) (ROC).
\textsuperscript{1000} Article 1, § 1 of the “Law on the Exclusive Economic Zone and the Continental Shelf of the Republic of China” regulates that “This law is enacted to preserve and exercise the rights in the exclusive economic zone and on the continental shelf of the Republic of China.” See Faigui Huibian art. 1, § 1, [Law on the Exclusive Economic Zone and the Continental Shelf of the Republic of China of 1998] (ROC).
seabed, on the seafloor and in the seabed subsoil.\textsuperscript{1001} Articles 6 through 9 and 15 rule that undertaking the exploration, exploitation, conservation, or management of resources (living or non-living), utilizing energy from water, currents, winds, or other activities, and delineating the course of laying, maintaining, or modifying submarine cables or pipelines within the exclusive economic zone, and on the continental shelf, shall be permitted by the Government of the Republic of China.\textsuperscript{1002}

In order to enforce Taiwan’s sovereign rights over the exclusive economic zone and on the continental shelf, Articles 17 through 23 regulate that dumping, discharging, or disposing waste, damaging or harming natural resources or ecological system, constructing, using artificial islands or structures, conducting exploration or exploitation, producing energy from the water, currents, and winds, undertaking marine scientific research, and laying, maintaining, or modifying submarine cables and pipelines in the exclusive economic zone and on the continental shelf without permission from the Government of the Republic of China shall be punished with fines or with imprisonment.\textsuperscript{1003} These provisions fall short of regulating the sharing of benefits derived from resources found within the exclusive economic zone and on the continental shelf.

\subsection*{5.1.1.5 The Indigenous Peoples Basic Law}

The discussions in 5.1.1.1 through 5.1.1.4 analyzed the four laws that focus on regulating “access” issues and stipulating punishments for violations of the “access” provisions. These laws do not regulate issues such as the sharing of benefits and traditional knowledge

\textsuperscript{1001} Article 5, § 1, cl. 1 of the “Law on the Exclusive Economic Zone and the Continental Shelf of the Republic of China” regulates that “The Republic of China shall, in its exclusive economic zone or on its continental shelf, enjoy and exercise the following rights: 1. Sovereign rights for the purpose of exploring, exploiting, conserving, and managing the resources, living or non-living, of the waters superjacent to the seabed and of the seabed and its subsoil;...” See Faigui Huibian art. 5, § 1, cl. 1, [Law on the Exclusive Economic Zone and the Continental Shelf of the Republic of China of 1998] (ROC).

\textsuperscript{1002} See Faigui Huibian art. 6, 7, 8, 9, 15, [Law on the Exclusive Economic Zone and the Continental Shelf of the Republic of China of 1998] (ROC).

obtained from local indigenous tribes. This section will discuss the Indigenous Peoples Basic Law, which was enacted for the purpose of protecting the fundamental rights of indigenous peoples.\textsuperscript{1004}

In comparison with the above four laws, the Indigenous Peoples Basic Law is a complete law regarding the regulation of ABS issues and intellectual property protection for traditional knowledge. For example, Article 13 regulates that the government shall protect indigenous peoples’ traditional biological diversity knowledge and intellectual creations, and that these issues shall be provided for by intellectual property laws.\textsuperscript{1005} This provision both protects the traditional knowledge of indigenous peoples, and authorizes the Legislative Yuan to enact the “Protection Act for the Traditional Intellectual Creations of Indigenous Peoples,”\textsuperscript{1006} a special law intended to protect the intellectual property rights of traditional knowledge.

As regards ABS issues in the Indigenous Peoples Basic Law, Article 20, Section 1 rules that the government recognizes the indigenous peoples’ rights to land and natural resources,\textsuperscript{1007} and Section 3 of the same article regulates that the restoration, acquisition, planning, and utilization of the areas of the land and sea that are owned by indigenous peoples should be regulated by laws.\textsuperscript{1008} Sections 1 and 3 of Article 20 indicate that access to indi-

\textsuperscript{1004} Article 1 of the “Indigenous Peoples Basic Law” regulates that “This Law is enacted for the purposes of protecting the fundamental rights of indigenous peoples, promoting their subsistence and development and building inter-ethnic relations based on co-existence and prosperity.” \textit{See} Faigui Huibian art. 1, [Indigenous Peoples Basic Law of 2005] (ROC).

\textsuperscript{1005} Article 13 of the “Indigenous Peoples Basic Law” regulates that “The government shall protect indigenous peoples’ traditional biological diversity knowledge and intellectual creations, and promote the development thereof. The related issues shall be provided for by the laws.” \textit{See} Faigui Huibian art. 13, [Indigenous Peoples Basic Law of 2005] (ROC).

\textsuperscript{1006} \textit{See} the note 1005 of this dissertation.

\textsuperscript{1007} Article 20, § 1 of the “Indigenous Peoples Basic Law” regulates that “The government recognizes indigenous peoples’ rights to land and natural resources.” \textit{See} Faigui Huibian art. 20, § 1, [Indigenous Peoples Basic Law of 2005] (ROC).

\textsuperscript{1008} \textit{See} the note 1005 of this dissertation.

\textsuperscript{1005} Article 13 of the “Indigenous Peoples Basic Law” regulates that “The government shall protect indigenous peoples’ traditional biological diversity knowledge and intellectual creations, and promote the development thereof. The related issues shall be provided for by the laws.” \textit{See} Faigui Huibian art. 13, [Indigenous Peoples Basic Law of 2005] (ROC).

\textsuperscript{1006} \textit{See} the note 1005 of this dissertation.

\textsuperscript{1007} Article 20, § 1 of the “Indigenous Peoples Basic Law” regulates that “The government recognizes indigenous peoples’ rights to land and natural resources.” \textit{See} Faigui Huibian art. 20, § 1, [Indigenous Peoples Basic Law of 2005] (ROC).

\textsuperscript{1008} Article 20, § 3 of the “Indigenous Peoples Basic Law” regulates that “The restoration, acquisition, disposal, plan, management and utilization of the land and sea area owned or occupied by indigenous peoples or indigenous persons shall be regulated by laws.” \textit{See} Faigui Huibian art. 20, § 3, [Indigenous Peoples Basic Law of 2005] (ROC).
genous peoples’ lands and resources is strictly regulated by laws.\textsuperscript{1009} Article 21, Section 1 regulates “benefit-sharing” issues, and rules that the government and private parties shall consult indigenous peoples, obtain their consent and share with the indigenous peoples whatever benefits are generated from land development, resource utilization, ecology conservation, and academic research in the indigenous peoples’ regions.\textsuperscript{1010}

The Indigenous Peoples Basic Law has more complete and detailed regulations related to ABS issues and intellectual property protection for traditional knowledge than is found in the Constitution, the National Park Law, the Forestry Act, and the Law on the Exclusive Economic Zone and the Continental Shelf of the Republic of China (Taiwan).

\textbf{5.1.1.6 Cultural Heritage Preservation Law}

The purpose of the Cultural Heritage Preservation Law include conserving and making proper use of Taiwan’s cultural heritage, and the scope of cultural heritage covered by this law includes natural scenery – natural areas, geography, plants, and minerals that have conservation value.\textsuperscript{1011} In other words, certain parts of the regulations in this law can be used to conserve PGRs.

Article 83 regulates that natural memorials (e.g. rare plants and minerals) are prohibited from being removed, cut, dug up or otherwise destroyed, and their ecological environment shall be protected.\textsuperscript{1012} However, in exceptional cases, interested parties should apply to the Council of Agriculture of the Executive Yuan and obtain permission.\textsuperscript{1013} In other words, this article is the restricted provision regarding access to PGRs (i.e. rare plants).

\textsuperscript{1009} See the note 1007, 1008 of this dissertation.
\textsuperscript{1010} Article 21, § 1 of the “Indigenous Peoples Basic Law” regulates that “The government or private party shall consult indigenous peoples and obtain their consent or participation, and share with indigenous peoples benefits generated from land development, resource utilization, ecology conservation and academic researches in indigenous people’s regions.” See Faigui Huibian art. 21, § 1, [Indigenous Peoples Basic Law of 2005] (ROC).
\textsuperscript{1011} See Faigui Huibian art. 1, 3, [Cultural Heritage Preservation Law of 2005] (ROC).
\textsuperscript{1012} See Faigui Huibian art. 83, [Cultural Heritage Preservation Law of 2005] (ROC).
\textsuperscript{1013} See Faigui Huibian art. 4, § 2, [Cultural Heritage Preservation Law of 2005] (ROC).
Article 94, Section 1, Clause 6 is the punishment regulation for violations of the rules of Article 83.\textsuperscript{1014} It specifies that any person, who removes, cuts, digs up, or takes other actions to destroy natural memorials or ecology environments, shall be punished with imprisonment of not more than 5 years or fined between 200 thousand and 1 million New Taiwan Dollars.\textsuperscript{1015} Taiwan’s Cultural Heritage Preservation Law focuses on regulating the “access” and punishment provisions but falls short of regulating issues regarding the sharing of benefits, and also covers removing, cutting, digging, or other actions that involve misusing natural memorials (i.e., PGRs – rare plants).

\textbf{5.1.2 Intellectual Property Laws related to Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs)}

This section introduces Taiwanese intellectual property laws concerning PGRs and traditional knowledge regarding the use of PGRs. This section has three parts: the Patent Act, the Plant Variety and Plant Seed Act, and the Protection Act for the Traditional Intellectual Creations of Indigenous Peoples. This section introduces the laws and analyzes legal issues that influenced the establishment of ABS laws and policies in Taiwan.

\textbf{5.1.2.1 Patent Act}

The Taiwanese Patent Act was promulgated on May 29, 1944, and took effect on January 1, 1949.\textsuperscript{1016} This law has been amended eight times. The current law was promulgated February 6, 2003 and took effect on July 1, 2004.\textsuperscript{1017} The current law has five chapters and

\textsuperscript{1014} See Faigui Huibian art. 94, § 1, cl. 6, [Cultural Heritage Preservation Law of 2005] (ROC).
\textsuperscript{1015} See the note 1014 of this dissertation.
Due to the increase in knowledge-based economies, intellectual property rights have become increasingly important resources for business and national development. The Taiwanese government supports intellectual property protection, particularly patents, and encourages innovation. Patents are legal mechanisms that promote societal progress and industrial competition and can influence technological development and national competitiveness. Patents reflect a country’s progress. Biotechnology is important for Taiwan’s industrial development, and the Taiwanese government continues to amend the current Patent Act in order to harmonize Taiwan with the trends of globalization and international intellectual property laws.

The key points of the draft of the 2008 Patent Amendment Act include allowing patents on animals and plants in Taiwan. According to Clause 1 of Article 24 of the current Patent Act, domestic and foreign biotechnology corporations have no incentive to innovate, because their innovations in Taiwan do not currently have patent protection. Therefore, ABS issues are not major issues that these corporations dwell on, because corporations do not know how many “free riders” and “competitors” might use and duplicate their innovations and products. Thus, corporations would have no initiative to invent or develop new innovations or products. If corporations cannot determine how much profit they could earn or what

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return they would get on R&D expenditures, they will attempt to reduce their access fees, and will not share benefits with the providers of animal or plant genetic resources.

The Taiwanese government seeks to encourage the development of the biotechnology industry. Clause 1 of Article 24 of the Patent Act was eliminated by the 2008 Patent Amendment Act. This clause currently prohibits the patenting of “new varieties of animals and plants,” but “new varieties of animals and plants” may be patentable in the future in Taiwan. The new Taiwanese Patent Act seeks to reduce the number of “free riders” and “duplicate” problems for corporations, and thereby give corporations an incentive to invent or innovate new products, particularly plants (i.e. GM seeds, drugs, etc). The new Taiwanese Patent Act seeks to provide more patent protection for biotechnology corporations than does the current Taiwanese Patent Act, but no definite date has been set for these upcoming changes.

Broad patent protection for animal or plant innovations enhances the development of the biotechnology industry in Taiwan, and such legislation will result in greater implementation of ABS issues regarding the utilization of genetic resources (animals or plants). Corporations need to access genetic resources (animals or plants) from intermediaries, culture collections, and indigenous peoples. How to share benefits that may arise from the commercialization of innovations or products derived from patented resources is an important issue. The new Taiwanese Patent Act will allow new varieties of animals and plants to be patented and has enhanced the implementation of an ABS regime in Taiwan.

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1029 See the discussions of 4.4.3 and 4.5.4.1 of this dissertation.
5.1.2.2 The Plant Variety and Plant Seed Act

The Plant Seed Act took effect in 1988. The name of this act was changed to the Plant Variety and Plant Seed Act in 2004, and was amended as a result of the UPOV Convention in 1991.

Taiwan has traditionally been an agricultural country, so the Taiwanese government enacted simple laws, such as “The Registration and Denomination Regulations on Taiwan Provincial New Agricultural Animal, Plant Varieties, and Microorganisms,” “The Management Regulations on Seeding Industry of the Taiwan Area,” and “The Exporting Management Regulations on Academic Agricultural and Forestry Seeds of the Taiwan Area.” However, these regulations did not provide protection for breeders and avoided punishing companies that sold poor-quality seeds that fail to sprout. As a result, poor-quality seeds were exchanged without restrictions, which resulted in the degradation of crops. Crops were harmed by diseases and pets, and the productivity of crops decreased significantly, e.g., the “Papaya Ringspot Disease.”

The Taiwanese government promulgated and enforced the Plant Seed Act in order to protect new plant varieties. In order to harmonize Taiwan’s laws with the international PVP regimes, Taiwanese government referenced U.S., Japanese, the European Union Laws, and 1991 UPOV Convention by amending the Plant Seed Act and changing the name to the

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1032 Id. at 82.
1033 Cheng, supra note 1031, at 82.
1034 Cheng, supra note 1031, at 82.
1035 Cheng, supra note 1031, at 82.
1036 Cheng, supra note 1031, at 82.
1037 Cheng, supra note 1031, at 82.
1038 Cheng, supra note 1031, at 82.
1039 Cheng, supra note 1031, at 82-83.
Plant Variety and Plant Seed Act. The scope of the PVP in the current Plant Variety and Plant Seed Act is broader than in the Plant Seed Act. For example, protection in the previous Plant Seed Act focused only on plant varieties. The current Plant Variety and Plant Seed Act protects plant variety rights-holders who hold the exclusive rights to plant seeds for propagation, conditioning for the purpose of propagation, offered for sale, sales or marketing, importing or exporting, or for any of the above purposes.

Although the scope of plant breeders’ rights in the Plant Variety and Plant Seed Act is broader than in the Plant Seed Act, the Plant Variety and Plant Seed Act did not receive more attention than was the case for other types of intellectual property laws. For example, there were 2263 administrative case decisions related to the Patent Act in the Taipei High Administrative Court between January 1, 2005 and September 1, 2009, but only 1 administrative case decision related to the Plant Variety and Plant Seed Act during that period. There were 145 civil case decisions concerning the Patent Act in the Taiwan High Court Taichung Branch Court between January 1, 2005 and September 1, 2009, but only 1 civil case decision concerning the Plant Variety and Plant Seed Act during that period. There were 128 civil case decisions about the Patent Act in the Taiwan Taichung District Court between January 1, 2005 and September 1, 2009, but only 1 civil case decision regarding the Plant Variety and Plant Seed Act during that period. The Plant Seed Act was promulgated in 1988, and the Agriculture and Food Agency of the Council of Agriculture in the Execu-

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1040 Cheng, supra note 1031, at 83.
1041 Cheng, supra note 1031, at 87-88.
1048 Laws and Regulations Database of The Republic of China, The Plant Variety and Plant Seed Act, supra note 1050.
tive Yuan issued 880 PVPs from 1988 until 2009.\textsuperscript{1049} However, the Intellectual Property Office, Ministry of Economic Affairs, R.O.C. issued 673,671 patents from 1988 to 2008.\textsuperscript{1050} The case decisions, patent issues, PVP issues, and the Patent Act have offered increasingly greater protection than was the case for the Plant Variety and Plant Seed Act.

This phenomena is similar to what happened in the U.S. The U.S. Supreme Court case, \textit{J.E.M. v. Pioneer},\textsuperscript{1051} had a great impact on the PVPA, because it allowed utility patents to be issued for plants,\textsuperscript{1052} and gave a firm legal foundation afterwards to the principle of the patentability of plants. Utility patents offer more robust rights than PVP certificates, and plant breeders might decline to seek PVP certificates in favor of utility patents for plant innovations.\textsuperscript{1053} In brief, the PVPA may be relegated to secondary or “petty patent” status.\textsuperscript{1054}

Taiwan implemented Article 27.3(b) of the TRIPS Agreement by enacting the \textit{sui generis} system (PVP law) for the protection of new plant varieties.\textsuperscript{1055} The regression analysis in this dissertation indicates that the more PVP applications that are filed in a country, the lower the probability that the country will adopt an ABS regime, so the key issue for the Taiwanese government is how to promote the filing of more PVP applications in order to enhance their ABS regime.

\begin{thebibliography}{9}
\bibitem{1053} Adelman et al., supra note 252, at 119.
\bibitem{1054} Adelman et al., supra note 252, at 119.
\bibitem{1055} The \textit{sui generis} system (PVP law) for protecting new plant varieties in Taiwan is the Plant Variety and Plant Seed Act. \textit{See} the discussions of 5.1.2.2 of this dissertation.
\end{thebibliography}
5.1.2.3 Protection Act regarding the Traditional Intellectual Creations of Indigenous Peoples

The previous section of this dissertation introduced the Indigenous Peoples Basic Law, which protects the basic rights of indigenous peoples in Taiwan, including intellectual property protection for traditional knowledge found among indigenous peoples in Taiwan. Article 13 of the Indigenous Peoples Basic Law authorizes the Legislative Yuan to enact the “Protection Act for the Traditional Intellectual Creations of Indigenous Peoples.”\textsuperscript{1056} This law is not only a \textit{sui generis} legal system for the protection of traditional knowledge of the indigenous peoples in Taiwan, but also implements Article 31 of the UN Declaration on the Rights of Indigenous Peoples to the effect that “1. Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge, and traditional cultural expressions. 2. In conjunction with indigenous peoples, States shall take effective measures to recognize and protect the exercise of these rights.”\textsuperscript{1057} Although Taiwan is not a member state of the United Nations, it follows the Declaration.

Section 2.2.2.3.2 of this dissertation discussed the notion that traditional knowledge cannot be the subject matter of patents, because traditional knowledge is an abstract idea. Therefore, traditional knowledge is not protected or regulated within patent law. Enacting the \textit{sui generis} law – Protection Act for the Traditional Intellectual Creations of Indigenous Peoples.

\textsuperscript{1056} See the note 1006 of this dissertation.

Peoples for the protection of traditional knowledge is a better option for Taiwan.

The Protection Act for the Traditional Intellectual Creations of Indigenous Peoples offers broader protection for traditional knowledge (intellectual creations) than does the Patent Act. For example, Article 15, Section 1 of the Protection Act for the Traditional Intellectual Creations of Indigenous Peoples states that “The exclusive right to use intellectual creations shall be protected permanently.” However, Article 50, Section 3 of the Taiwanese Patent Act rules that “An invention patent right shall endure for a term of twenty (20) years from the filing date of the patent application.” Article 100, Section 3 of the Patent Act regulates that “A new utility model patent right shall endure for a term of twelve (12) years from the filing date of the patent application.” In addition, Article 109, Section 3 of the Patent Act rules that “A new design patent right shall expire twelve (12) years from the filing date of the patent application…” In other words, the periods of protection for traditional knowledge (intellectual creations) offered in the Protection Act for the Traditional Intellectual Creations of Indigenous Peoples are longer than those offered for inventions in the Patent Act.

Article 14 of the Protection Act for the Traditional Intellectual Creations of Indigenous Peoples regulates that income derived from exclusive rights shall be put into a fund for the benefit of aboriginal groups or tribes. On the other hand, there is no similar regulation in the Patent Act, which sets up a fund for the purposes of benefiting the inventors or promoting innovations. This statute in the Protection Act for the Traditional Intellectual Creations of Ind-

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1058 See Faigui Huibian art. 15, § 1, [Protection Act for the Traditional Intellectual Creations of Indigenous Peoples of 2007] (ROC).
1062 Article 14 of the “Protection Act for the Traditional Intellectual Creations of Indigenous Peoples” regulates that “If the exclusive right to use any intellectual property is obtained by an aboriginal group or tribe according to the provisions in Article 7, subparagraph 1 or subparagraph 2 herein, the income derived there from shall be used to set up a mutual fund benefiting the relevant aboriginal groups or tribes; the income, expenses, method of custody and utilization in connection thereto shall be determined separately by the competent authority. If the exclusive right to use intellectual creations is obtained by the indigenous peoples in their entirety, the income derived there from shall be included in the consolidated development fund of the indigenous peoples and be utilized for the purpose of promoting the cultural development of aboriginal groups or tribes.” See Faigui Huibian art. 14, [Protection Act for the Traditional Intellectual Creations of Indigenous Peoples of 2007] (ROC).
indigenous Peoples is a typical example of the promotion of the sharing of benefits. The purpose of this statute is to use intellectual property protection to protect traditional knowledge (intellectual creations) among the indigenous peoples in Taiwan, and also sets up a fund derived from the use of this knowledge in order to share these benefits with aboriginal tribes.

5.1.3 Summary of Laws related to the Conservation of Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs)

Taiwanese laws related to the conservation of PGRs and traditional knowledge regarding the use of PGRs are disorderly and complicated, and multiple government agencies are responsible for enforcing these laws. These laws are similar to ABS regulations, and there is a single enforceable law regarding the conservation of PGRs and traditional knowledge regarding the use of PGRs and ABS issues.

This section has three parts that summarize laws related to the conservation of PGRs and traditional knowledge regarding the use of PGRs: first, Laws that lack “Access” and “Benefit-Sharing” Regulations, second, Laws that have only “Access” Regulations, and third, Laws that have both “Access” and “Benefit-Sharing” Regulations.

5.1.3.1 Laws that lack “Access” and “Benefit-Sharing” Regulations

The Constitution regulates the principle that mineral deposits and natural powers (PGRs) are owned by the State, but there are no detailed ABS regulations in the Constitution. Given this principle, the Constitution authorizes the Legislative Yuan to enact detailed laws concerning the Conservation of PGRs and traditional knowledge regarding the use of PGRs and ABS issues.
5.1.3.2 Laws that have only “Access” Regulations

The previous section showed that the National Park Law, the Forestry Law, the Law on the Exclusive Economic Zone and the Continental Shelf of the Republic of China (Taiwan), and the Cultural Heritage Preservation Law have regulations regarding “access” issues, which concern issues such as how to conserve and protect plant and animal resources within these laws, and the penalties (fines) that will be imposed on violators of “access” regulations. However, these laws are also “benefit-sharing” regulations regarding how to deal with the problem of the sharing of benefits derived from these protected plant and animal resources.

The Patent Act and the Plant Variety and Plant Seed Act are intellectual property laws that regulate the intellectual property protection given to inventors and plant breeders. The current Patent Act and the Plant Variety and Plant Seed Act have regulations regarding “access” with respect to inventors and plant breeders and offer limited “access” to parties other than inventors and plant breeders.

For example, inventors and plant breeders have the exclusive right to exclude other parties from manufacturing, selling, using, or importing the patented articles and from producing or propagating, conditioning for the purpose of propagation, offering for sale, selling or otherwise marketing, importing or exporting without the prior consent of patent and PVP holders. Parties other than inventors and plant breeders can use patented inventions and PVP

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1063 Article 56, §§ 1-2 of the “Patent Act” regulates that “Unless otherwise provided for in this Law, the patentee of a patented article shall have the exclusive right to exclude other persons from manufacturing, selling, using, or importing for above purposes the patented article without his prior consent. Unless otherwise provided for in this Law, the patentee of a patented process shall have the exclusive right to preclude others from using such process and using, selling or importing for above purposes the articles made through direct use of the said manufacturing process without his prior consent.” Article 24, § 1 of the “Plant Variety and Plant Seed Act” regulates that “The holder of a plant variety right shall have the exclusive right to preclude others from engaging, without the consent of the holder, in the following acts with respect to plant seeds to which the holder has the plant variety right:

1. production or propagation,
2. conditioning for the purpose of propagation,
3. offering for sale,
4. selling or otherwise marketing,
5. importing or exporting, or
6. holding for any of the purposes in the preceding five Subparagraphs.” See Faigui Huibian art. 56, §§ 1-2, [Pa-
protected plant innovations only for non-profit, experimental or research purposes, and farmers are allowed to save seeds. The “access” regulations in the Patent Act and the Plant Variety and Plant Seed Act favor protection for patent and PVP owners rather than other parties. There is no regulation regarding the sharing of benefits arising from the commercialization of patented inventions or PVP protected plant innovations.

5.1.3.3 Laws with both “Access” and “Benefit-Sharing” Regulations

Sections 5.1.1.5 and 5.1.2.3 of this dissertation showed that the Indigenous Peoples Basic Law and the Protection Act for the Traditional Intellectual Creations of Indigenous Peoples regulate “access” and “benefit-sharing” issues. These are laws concerning the protection of the basic rights of indigenous peoples and intellectual property rights arising from the traditional knowledge (intellectual creations) of indigenous peoples.

From the perspective of promoting ABS regimes, indigenous peoples appear to obtain
more legal protection from the Indigenous Peoples Basic Law and the Protection Act for the Traditional Intellectual Creations of Indigenous Peoples than from the other laws that are related to the conservation of PGRs and traditional knowledge regarding the use of PGRs discussed above. Table 5.1 summarizes laws related to the conservation of PGRs and traditional knowledge regarding the use of PGRs.

<table>
<thead>
<tr>
<th>Law</th>
<th>Authority Government Agency</th>
<th>Access Regulation</th>
<th>Benefit-Sharing Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Access Statute</td>
<td>Violation Punishment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Articles Contents</td>
<td>Articles Contents</td>
</tr>
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<td></td>
<td>(Fines &amp; Criminal Penalties)</td>
</tr>
<tr>
<td>Constitution of the Republic of China</td>
<td>N/A</td>
<td>Art. 143, § 2</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Additional Art. 10, §11 statute protecting indigenous peoples’ rights</td>
<td>N/A</td>
</tr>
<tr>
<td>National Park Law</td>
<td>Ministry of Interior</td>
<td>Art. 14, 15, 17, 19, and 21 obtaining permission requirements</td>
<td>Art. 14, 16, and 17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Art. 45, §1 obtaining permission and inspections requirements</td>
<td>Art. 50 ~ 56-4</td>
</tr>
<tr>
<td>The Forestry Act</td>
<td>Council of Agriculture</td>
<td>Art. 14, 15, 17, 19, and 21 obtaining permission requirements</td>
<td>Art. 14, 16, and 17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Art. 50 ~ 56-4</td>
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<tr>
<td>Law on the Exclusive Economic Zone and the Continental Shelf of the Republic of China</td>
<td>N/A</td>
<td>Art. 5, §§ 1, 6, 7, 8, 9, and 15</td>
<td>obtaining permissions requirements</td>
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<tr>
<td>The Indigenous Peoples Basic Law</td>
<td>Council of Indigenous Peoples</td>
<td>Art. 20, §§ 1 and 3</td>
<td>restoration, acquisition, plan, and use of indigenous peoples’ land and sea area</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Cultural Heritage Preservation Law</td>
<td>Council for Cultural Affairs and Council of Agriculture</td>
<td>Art. 83</td>
<td>rare plant and mineral protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patent Act</td>
<td>Art. 56 exclusive rights of patentees</td>
<td>Art. 125, 126, 128, and 129</td>
<td>N/A</td>
</tr>
<tr>
<td>Intellectural Property Office, Ministry of Economic Affairs</td>
<td>Art. 57 and 118 exemptions of people other than patentees who can use patented inventions</td>
<td>NT$ 15,000 ~ 150,000</td>
<td>&lt; 2 years imprisonment</td>
</tr>
<tr>
<td>The Plant Variety and Plant Seed Act</td>
<td>Art. 24 exclusive rights of PVP holders</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Council of Agriculture</td>
<td>Art. 26 exemptions of people other than plant breeders who can use PVP plants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection Act for the Traditional Indigenous Creations of</td>
<td>Art. 10 owners of exclusive rights to use intellectual creations</td>
<td>Art. 18 and 19 jointly and severally liable – NT$ 50,000 ~ 3,000,000</td>
<td>Art. 14 setting up a mutual fund benefiting the aboriginal groups or tribes</td>
</tr>
<tr>
<td>Council of Indigenous Peoples</td>
<td>Art. 16 exemptions of people</td>
<td></td>
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</tbody>
</table>
Table 5.1 (cont.)

<table>
<thead>
<tr>
<th>Indigenous Peoples</th>
<th>other than owners of exclusive rights who can use intellectual creations</th>
</tr>
</thead>
</table>

Notes: The symbols of N/A mean that there are no access statutes, access violation punishments, and benefit-sharing regulations in the 9 listed laws. In addition, the symbols of < mean that the criminal penalties are “no more than” and “not exceed” certain imprisonments, and the symbols of ≤ mean that the criminal penalties are “by up to” certain imprisonments.

5.2 OVERVIEW OF THE “DRAFT OF THE GENETIC RESOURCES ACT OF TAIWAN”

Taiwan has enacted numerous laws related to the conservation of PGRs and traditional knowledge regarding the use of PGRs, but there has not been a particular professional law regarding access and the sharing of benefits that arise from genetic resources in Taiwan. Taiwan has abundant genetic resources, so conserving biodiversity is an important task. On August 15, 2001, the Cabinet Conference No. 2747 of the Executive Yuan passed the “Biodiversity Promotion Plan,” which ensured that Taiwan would enact the “Genetic Resources Act.” The reasons why Taiwan should enact the Genetic Resources Act include the lack of “bioprospecting” regulations imposed on foreign bioprospectors who want to bio-

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1065 “Catalogue of Life in Taiwan” indicates that there are more than 50,000 life species in Taiwan, which occupy 2.5% of the world’s life species. See Shu-Min Yang, Catalogue of Life in Taiwan shows more than 50,000 life species which occupy 2.5% of the world’s life species, Jul. 16, 2009, available at http://tw.news.yahoo.com/article/url/d/a/090716/5/1n702.html.
1067 Seed Lab., National Taiwan University, Genetic Resources Act: The Statements of the Draft of the Genetic Resources Act of Taiwan, supra note 1066.
prospect for genetic resources in Taiwan, and there is no benefit-sharing regulation which ensures that benefits derived from the commercialization of genetic resources will be returned to Taiwan.\textsuperscript{1068} Enacting the Genetic Resources Act is thus a better approach for resolving these disadvantages.

The Agriculture Research Institute, Council of Agriculture, Executive Yuan entrusted the “Drafting Group of Genetic Resources Act,” which was hosted by Professor Hua-Ren Guo, Department of Agronomy, National Taiwan University, to draft the Genetic Resources Act in October, 2004.\textsuperscript{1069} During eleven meetings and one symposium, the Group heard various opinions and finished two drafts of the “Genetic Resources Act of Taiwan”\textsuperscript{1070} (hereafter called the “Draft of the Genetic Resources Act of Taiwan”).

The “Draft of the Genetic Resources Act of Taiwan” has eight Chapters and fifty-five Articles. Article 1 regulates that the purposes behind the enactment of this law are to promote conservation, the sustainable use of genetic resources, and the fair and equitable sharing of benefits derived from the use of genetic resources.\textsuperscript{1071} Although Taiwan is not a contracting party to the CBD and the Bonn Guidelines, the stated purposes of Article 1 show that this Draft Law meshes smoothly with the principles in the CBD and the Guidelines.\textsuperscript{1072}

There are several different government agencies responsible for the assortment of laws related to the conservation of PGRs and traditional knowledge regarding the use of PGRs. Foreign bioprospectors encounter have difficulty figuring out which particular government agency to contact regarding “bioprospecting” applications. Articles 3 and 8 of the “Draft of the Genetic Resources Act of Taiwan” regulate that the Council of Agriculture, Executive...
Yuan is the government agency that administrates this law along with “bioprospecting” applications, public applications and other materials concerning genetic resources “bioprospecting.”

The most important part of this Draft Law is “Chapter 2: Permission for Bioprospecting.” 76% of the articles in Chapter 2 (Article 8 ~ Article 29) concern the procedures for submitting bioprospecting applications to obtain access to genetic resources, but only 10% of the articles in Chapter 2 (Article 30 ~ Article 32) concern the regulation of “benefit-sharing.” The remaining 14% of the articles in Chapter 2 (Article 33 ~ Article 36) are “monitor mechanisms.” Although the “Draft of the Genetic Resources Act of Taiwan” consists of both “access” and “benefit-sharing” regulations, this Draft Law has substantially more detailed “access” regulations than “benefit-sharing” regulations.

As regards “benefit-sharing” regulations, this Draft Law references the Bonn Guidelines and Brazil law by setting up regulations concerning the sharing of “monetary” and “non-monetary” benefits in Article 31. The regulations regarding “monetary” benefit-sharing in this Draft Law are more detailed than those regarding “non-monetary” benefit-sharing. Articles 32, 45, and 46 set up a “Biodiversity Fund,” which consists of deposits of “monetary” commercial benefits arising from the use of genetic resources.

Intellectual property rights are closely related to ABS issues regarding the use of genetic resources. Chapter 5 concerns “Relationships between the Use of Genetic Resources and Intellectual Property Rights,” but only two articles (Articles 43 and 44 in the “Draft of the Genetic Resources Act of Taiwan”) related to intellectual property protection for genetic re-

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1073 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1074 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1075 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1076 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1077 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
sources. Article 43 states that intellectual property protection of genetic resources shall not conflict with the purpose of the Genetic Resources Act of Taiwan.\textsuperscript{1078} Article 44 regulates that intellectual property applications (patent and PVP) of genetic resources shall indicate the origins of these resources.\textsuperscript{1079} The “Draft of the Genetic Resources Act of Taiwan” focuses on regulating ABS issues regarding the use of genetic resources, specifically whether or not intellectual property statutes shall be excluded in the Genetic Resources Act. This is an important issue that is related to both the conservation of genetic resources and the development of the biotechnology industry, so this issue will be discussed in the next section.

Successful enforcement of the Genetic Resources Act of Taiwan and achieving the goal of this law includes penalties. Chapter 7 concerns “Punishment,” which consists of Articles 47 through 52.\textsuperscript{1080} The penalties in this Draft Law do not include criminal penalties – imprisonment, but do include civil penalties – fines, particularly Article 50, which stipulates punitive sanctions for violation of “benefit-sharing” regulations – three times commercial benefits.\textsuperscript{1081} Article 52 of this Draft Law concerns punishment for violating export regulations regarding genetic resources.\textsuperscript{1082} How to harmonize this article with similar regulations in other laws related to the conservation of PGRs and traditional knowledge regarding the use of PGRs is an important issue prior to the promulgation of a new version of the Genetic Resources Act of Taiwan.

\textsuperscript{1078} Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.  
\textsuperscript{1079} Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.  
\textsuperscript{1080} Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.  
\textsuperscript{1081} Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.  
\textsuperscript{1082} Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.
5.3 ANALYZING THE “DRAFT OF THE GENETIC RESOURCES ACT OF TAIWAN” FROM THE PERSPECTIVE OF OTHER PARTIES TO THE CONVENTION ON BIOLOGICAL DIVERSITY (CBD) OR THE INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE (ITPGR)

The previous section introduced the notion that the “Drafting Group of Genetic Resources Act” has referenced the CBD, the Bonn Guidelines, and the legislation of other countries while drafting the “Draft of the Genetic Resources Act of Taiwan,” so statutes based on this Draft Law mesh with legislative trends concerning ABS regimes around the world, particularly with respect to the purposes and ABS statutes of this Draft Law, which implements the CBD and the Bonn Guidelines regulations.

The introduction in section 2.4.6 of this dissertation showed that the ITPGR is another binding treaty regarding the utilization and ABS regime for PGRs, but the protected subjects concern PGRs for food and agriculture, which differ from the protected subjects of the CBD – biodiversity (plant and animal genetic resources). The ITPGR protects PGRs for food and agriculture, while the ITPGR sets up the “multilateral system” regarding access and benefit-sharing. The “multilateral system” is where the ITPGR lists 64 crops and forages on Annex I, and contracting parties take legal or other measures to facilitate access and bene-

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1083 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1084 The “multilateral system” is regulated in Article 10.2 of the ITPGR that “In the exercise of their sovereign rights, the Contracting Parties agree to establish a multilateral system, which is efficient, effective, and transparent, both to facilitate access to plant genetic resources for food and agriculture, and to share, in a fair and equitable way, the benefits arising from the utilization of these resources, on a complementary and mutually reinforcing basis.” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24.
1085 Article 11.1 of the ITPGR regulates that “In furtherance of the objectives of 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, as stated in Article 1, the Multilateral System shall cover the plant genetic resources for food and agriculture listed in Annex I, established according to criteria of food security and interdependence.” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24.
fit-sharing regarding PGRs for food and agriculture included in the “multilateral system.”\textsuperscript{1086}

On the other hand, Article 5, Section 1, Clause 3 of the “Draft of the Genetic Resources Act of Taiwan” excludes crops and forages listed on the ITPGR, Annex I within the scope of this Draft Law.\textsuperscript{1087} The reasons for excluding these crops and forages listed on the ITPGR, Annex I regarding protection by this Draft Law are that many listed crops and forages are not grown in Taiwan, and are imported from other countries.\textsuperscript{1088} If Taiwan restricts other countries who are contracting parties to the ITPGR, with respect to access to these crops and forages, other countries (contracting parties to the ITPGR) will be reluctant to export these crops and forages to Taiwan and might boycott Taiwan.\textsuperscript{1089} Obviously, such reasons for the enactment of Article 5, Section 1, Clause 3 of the Draft Law are misdirected, because the “multilateral system” regulated in Article 12 of the ITPGR is intended to facilitate access to PGRs for food and agriculture,\textsuperscript{1090} but does not limit international trade (or exchange).\textsuperscript{1091} As

\textsuperscript{1086} See the note 1085 of this dissertation.

\textsuperscript{1087} See Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.

\textsuperscript{1088} See Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.

\textsuperscript{1089} See Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.

\textsuperscript{1090} Article 12.1 of the ITPGR regulates that “The Contracting Parties agree that facilitated access to plant genetic resources for food and agriculture under the Multilateral System, as defined in Article 11, shall be in accordance with the provisions of this Treaty.” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, \textit{supra} note 24.

\textsuperscript{1091} Restrictions of accessing PGRs for food and agriculture regulated in Articles 12.3~12.6 of the ITPGR include that “12.3 Such access shall be provided in accordance with the conditions below: a) Access shall be provided solely for the purpose of utilization and conservation for research, breeding and training for food and agriculture, provided that such purpose does not include chemical, pharmaceutical and/or other non-food/feed industrial uses. In the case of multiple-use crops (food and non-food), their importance for food security should be the determinant for their inclusion in the Multilateral System and availability for facilitated access. b) Access shall be accorded expeditiously, without the need to track individual accessions and free of charge, or, when a fee is charged, it shall not exceed the minimal cost involved; c) All available passport data and, subject to applicable law, any other associated available non-confidential descriptive information, shall be made available with the plant genetic resources for food and agriculture provided; d) Recipients shall not claim any intellectual property or other rights that limit the facilitated access to the plant genetic resources for food and agriculture, or their genetic parts or components, in the form received from the Multilateral System; e) Access to plant genetic resources for food and agriculture under development, including material being developed by farmers, shall be at the discretion of its developer, during the period of its development; f) Access to plant genetic resources for food and agriculture protected by intellectual and other property rights shall be consistent with relevant international agreements, and with relevant national laws; g) Plant genetic resources for food and agriculture accessed under the Multilateral System and conserved shall
a result, the drafting group cannot use the reason that other countries will be reluctant to export the crops and forages listed on the ITPGR, Annex I to Taiwan to exclude them within the scope of the Draft Law.

This dissertation argues that although Taiwan is not a contracting party to the ITPGR and has no duty to comply with the ITPGR, Article 5, Section 1, Clause 3 of the Draft Law violates the purpose of this Draft Law – sustainable use of genetic resources, the fair and equitable sharing of benefits after the commercialization of genetic resources. The lists of crops and forages indicate that they are important for food security, but the ITPGR only attempts to facilitate the ability of contracting parties to regulate ABS concerning the use of those important crops and forages. Article 5, Section 1, Clause 3 of the “Draft of the Genetic Resources Act of Taiwan” violates the purpose behind setting up the “multilateral system” and ABS regulations in the ITPGR. Section 2 of Article 5 of the “Draft of the Genetic

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continue to be made available to the Multilateral System by the recipients of those plant genetic resources for food and agriculture, under the terms of this Treaty; and

h) Without prejudice to the other provisions under this Article, the Contracting Parties agree that access to plant genetic resources for food and agriculture found in situ conditions will be provided according to national legislation or, in the absence of such legislation, in accordance with such standards as may be set by the Governing Body.

12.4 To this effect, facilitated access, in accordance with Articles 12.2 and 12.3 above, shall be provided pursuant to a standard material transfer agreement (MTA), which shall be adopted by the Governing Body and contain the provisions of Articles 12.3a, d and g, as well as the benefit-sharing provisions set forth in Article 13.2d(ii) and other relevant provisions of this Treaty, and the provision that the recipient of the plant genetic resources for food and agriculture shall require that the conditions of the MTA shall apply to the transfer of plant genetic resources for food and agriculture to another person or entity, as well as to any subsequent transfers of those plant genetic resources for food and agriculture.

12.5 Contracting Parties shall ensure that an opportunity to seek recourse is available, consistent with applicable jurisdictional requirements, under their legal systems, in case of contractual disputes arising under such MTAs, recognizing that obligations arising under such MTAs rest exclusively with the parties to those MTAs.

12.6 In emergency disaster situations, the Contracting Parties agree to provide facilitated access to appropriate plant genetic resources for food and agriculture in the Multilateral System for the purpose of contributing to the re-establishment of agricultural systems, in cooperation with disaster relief co-ordinators.” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24. However, there is no limitations of international trade (or exchange) regarding PGRs for food and agriculture in the regulations of Articles 12.3~12.6 of the ITPGR.

The ITPGR facilitates the ability of contracting parties to regulate ABS concerning the use of those important crops and forages, which are regulated by Articles 12.1 and 13.1. Article 12.1 of the ITPGR regulates that “The Contracting Parties agree that facilitated access to plant genetic resources for food and agriculture under the Multilateral System, as defined in Article 11, shall be in accordance with the provisions of this Treaty.” Article 13.1 of the ITPGR regulate that “The Contracting Parties recognize that facilitated access to plant genetic resources for food and agriculture which are included in the Multilateral System constitutes itself a major benefit of the Multilateral System and agree that benefits accruing therefrom shall be shared fairly and equitably in accordance with the provisions of this Article.” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24.
Resources Act of Taiwan” regulates that the “National Plant Genetic Resources Center, Taiwan Agricultural Research Institute” shall enact additional regulations regarding the exchanges of crops and forages listed on the ITPGR, Annex I. It is uncertain whether or not this regulation has an ABS regime and punishment statutes similar to the “Draft of the Genetic Resources Act of Taiwan,” that ensure that this regulation will be effectively enforced. In addition, the exclusionary regulations regarding the ITPGR, Annex I are not beneficial to Taiwan with respect to future participation in the ITPGR and international cooperation with other countries, regardless of whether they are contracting parties to the ITPGR, with respect to conservation and ABS issues concerning PGRs used for food and agriculture.

As regards the adoption of an ABS regime from other contracting parties to the CBD or the ITPGR, Taiwan will select pertinent and useful notion from other contracting parties’ (countries’) ABS legislation and insert them into the “Draft of the Genetic Resources Act of Taiwan.” Taiwan will enact a fair and efficient ABS law based on Taiwanese interests, because a fair and efficient law should promote the implementation of an ABS regime regarding the use of PGRs, and enhance the development of the agricultural biotechnology industry and IPRs in Taiwan.

The regression outcomes in this dissertation show that implementing ABS regimes concerning the use of PGRs does not conflict with the development of IPRs (i.e. PVP) in different countries. On the other hand, the adoption of ABS regimes is statistically significant with respect to PVP (or other forms of IPRs) applications in each country. When governments enact laws related to the conservation of PGRs, traditional knowledge regarding the

1093 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1094 The regression in this dissertation showed that the numbers of PVP applications have the highest correlation coefficient with the adoption of the ABS regime than other types of IPRs (i.e. numbers of plant and chemical patent application or grant), so the regression outcomes in this dissertation indicated that numbers of PVP application correlate statistically with the adoption of ABS regimes. In fact, the regression outcomes in this dissertation also indicated that numbers of PVP applications exhibit “multicollinearity” with respect to other types of IPRs (i.e. numbers of plant and chemical patent applications or grants). In other words, other types of IPRs also are statistically correlate with the adoption of the ABS regime. See the discussions of 4.4.3 and 4.5.4.1 of this dissertation.
use of PGRs, and ABS issues, governments should pay attention to the development of IPRs and harmonize laws related to the conservation of PGRs, traditional knowledge regarding the use of PGRs, and ABS issues concerning intellectual property laws.

Unfortunately, the purpose behind the enactment of the “Draft of the Genetic Resources Act of Taiwan” is to promote the conservation and sustainable use of genetic resources and the fair and equitable sharing of benefits arising from the use of genetic resources. Only two articles (4%)\textsuperscript{1095} in this Draft Law regulate relationships between the use of genetic resources and IPRs, including Articles 43 and 44, which regulate intellectual property protection related to genetic resources, and intellectual property protection regarding genetic resources should fit the purposes behind the enactment of this law.\textsuperscript{1096} If PVP or Patent applications regarding genetic resources (e.g. PGRs) violate the principles of conservation and sustainable use of genetic resources and the fair and equitable sharing of benefits arising from the use of genetic resources, the Agriculture and Food Agency, Council of Agriculture or the Intellectual Property Office, Ministry of Economic Affair will not allow filings of PVP or Patent applications related to genetic resources. Otherwise, the Agriculture and Food Agency or the Intellectual Property Office will allow such filings of PVP or Patent applications.

The legal issue arising from such legislation is that the principle of special laws take precedence over general laws. The special laws here are the Draft of the Genetic Resources Act of Taiwan, which are special laws that take precedence over general laws – the Patent Act and the Plant Variety and Plant Seed Act. The conflicts between the Draft of the Genetic Resources Act of Taiwan and the Patent Act and the Plant Variety and Plant Seed Act indicate the overlap of regulatory agencies related to the examinations of PVP or Patent applications regarding genetic resources – the Agriculture and Food Agency or the Intellectual

\textsuperscript{1095} Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.

\textsuperscript{1096} Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.
Property Office. PVP or Patent applications filed by biotechnology corporations should meet the requirements of the Patent Act or the Plant Variety and Plant Seed Act and also meet the requirements of the Draft of the Genetic Resources Act of Taiwan. As mentioned above, the draft of the 2008 Patent Amendment Act allows plants to be the subjects of patents, but Article 43 of the Draft of the Genetic Resources Act of Taiwan does not clearly regulate the scope of permissible PVPs or Patents regarding genetic resources (e.g. plants). In other words, if a new Patent Act and Genetic Resources Act were to be passed by the Legislative Yuan and enforced, the Agriculture and Food Agency or the Intellectual Property Office would have no standards for determining whether or not PVP or Patent applications violate the purposes of the Draft of the Genetic Resources Act of Taiwan. Article 55 authorizes the regulatory agency – the Council of Agriculture to enact enforcement rules for the Draft of the Genetic Resources Act of Taiwan, including Article 43. Only PVP applications are examined and issued by the Council of Agriculture. Patent applications are examined and issued by the Intellectual Property Office. The Intellectual Property Office enacts enforcement rules for Article 43 of the Draft of the Genetic Resources Act of Taiwan for use by the Council of Agriculture, and should also enact enforcement rules regarding Article 43 of this Draft Law.

The Drafting Group for the Genetic Resources Act should enact clearer statutes concerning IPRs related to genetic resources and define the scope of permissible PVP or Patent applications prior to completing the promulgation of the Genetic Resources Act. Both the Agriculture and Food Agency and the Intellectual Property Office should enact enforcement rules and set up more precise PVP and Patent examination standards for Article 43 of the Draft of the Genetic Resources Act of Taiwan.

1097 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1098 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
5.4 RECOMMENDATIONS AND SUGGESTIONS FOR FUTURE LEGISLATION REGARDING THE “DRAFT OF THE GENETIC RESOURCES ACT OF TAIWAN”

The “Drafting Group of the Genetic Resources Act” began to draft the Taiwanese Genetic Resources Act in October, 2004, and the conservation of Taiwanese genetic resources (biodiversity) entered a new era. This law is the first sui generis legal regime, and the successful outcome of the legalization of the conservation of Taiwanese genetic resources.

This dissertation examined current Taiwanese laws related to the conservation of PGRs, traditional knowledge regarding the use of PGRs and the Draft of the Genetic Resources Act of Taiwan. This dissertation will propose some tangible recommendations and suggestions prior to the future promulgation of the Taiwanese Genetic Resources Act.

5.4.1 Intellectual Property Protection (Plant Variety Protection or Other Types of Protection) does not Conflict with the Conservation of Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs)

Chapter 2 showed that it is possible to use different perspectives to understand the issues of “biopiracy” and “bioprospecting.” It is also possible to understand why the developing world views the development of IPRs (e.g. PVPs or other types of protection) as trends that are likely to result in “biopiracy” and “bioprospecting,” and why this perspective influences the CBD and the ITPGR.

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1099 Seed Lab., National Taiwan University, Genetic Resources Act: Latest News, supra note 1069.
1100 See the “Research Hypothesis” in section 4.3.1.2 and discussions of the Chapter 2 in this dissertation.
1101 Article 3 of the CBD states that “States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.” See Secretarial of the Convention on Biological Diversity, supra note 24. As a result, states have the sovereign right to manage their genetic resources and prevent multinational corporations from the developed world from conducting “biopiracy” or “bioprospecting” of their genetic resources.
1102 Article 10.1 of the ITPGR states that “In their relationships with other States, the Contracting Parties recognize the sovereign rights of States over their own plant genetic resources for food and agriculture, including that the authority to determine access to those resources rests with national governments and is subject to national legislation.” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Ge-
Article 16.2 of the CBD regulates that access to, and the transfer of, technology shall be provided on terms which recognize, and are consistent with, the adequate and effective protection of intellectual property rights.\textsuperscript{1103} Article 16.5 of the CBD rules that patents and other intellectual property rights shall not contradict CBD objectives.\textsuperscript{1104} Article 12.3(d) of the ITPGR regulates that recipients of PGRs shall not claim any intellectual property rights, or other rights, that shall operate to limit access to PGRs for food and agricultural purposes, or their genetic parts or components in the Multilateral System.\textsuperscript{1105} These regulations in the CBD and the ITPGR indicate that the development of ABS regimes regarding the use of PGRs take precedence over the development of IPRs, and this position favors the developing world.

However, is this position “right”? Answering this question requires the use of an objective method. This dissertation uses regression analysis to examine relationships and interactions between IPRs (e.g. PVPs or other types of IPRs) and the adoption of ABS regimes. The regression analysis used in this dissertation showed that PVP applications have higher correlation coefficients with respect to the adoption of ABS regimes than do other types of IPRs, patents or plant patent applications, and are actually multicollinear with respect to PVP applications for Food and Agriculture, supra note 24. As a result, states also have the sovereign right to manage their PGRs for food and agriculture and prevent multinational corporations from the developed world from conducting “biopiracy” or “bioprospecting” of their resources.

\textsuperscript{1103} Article 16.2 of the CBD regulates that “Access to and transfer of technology referred to in paragraph 1 above to developing countries shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed, and, where necessary, in accordance with the financial mechanism established by Articles 20 and 21. In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights. The application of this paragraph shall be consistent with paragraphs 3, 4 and 5 below.” See Secretarial of the Convention on Biological Diversity, supra note 24.

\textsuperscript{1104} Article 16.5 of the CBD regulates that “The Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of this Convention, shall cooperate in this regard subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to its objectives.” See Secretarial of the Convention on Biological Diversity, supra note 24.

\textsuperscript{1105} Article 12.3 of the ITPGR regulates that “Such access shall be provided in accordance with the conditions below:….d) Recipients shall not claim any intellectual property or other rights that limit the facilitated access to the plant genetic resources for food and agriculture, or their genetic parts or components, in the form received from the Multilateral System:…” See Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, supra note 24.
Therefore, the more PVPs (or other types of IPRs) applications that are filed in contracting parties to the CBD or the ITPGR, the greater the probability that those parties will adopt ABS regimes. The regression analysis in section 4.5.1.2 pointed out that net inflows of foreign direct investments from transnational corporations are statistically significant with respect to the adoption of ABS regimes, which means that increased net inflows of foreign direct investments by transnational corporations result in the increased probability of the adoption of ABS regimes. In addition, the regression analysis in section 4.5.1.3.1 showed that the adoption of ABS regimes is statistically significant with respect to more PVP application filings, which means that the adoption of ABS regimes results in the increased numbers of PVP applications.

By using the outcomes of regression analyses to examine Article 43 of the Draft of the Genetic Resources Act of Taiwan, this article attempts to unnecessary, because IPRs are not contrary to the purposes of the Taiwanese Genetic Resources Act – meaning the sustainable use (access) and the fair and equitable sharing of benefits. The more plant breeders or biotechnology corporations that file PVPs, patents, or plant patent applications, the greater the extent of the implementation or operation of an ABS regime in Taiwan, and countries, plant breeders, or biotechnology corporations implement ABS regimes that is a reason to cause more PVP application filings. The enactment of Article 43 of the Draft of the Genetic Resources Act of Taiwan was followed by Article 16.5 of the CBD, such legislation is not the best approach to policy-making, because weakening the protection of intellectual property discourages foreign investors from undertaking local production. The ambiguity of Article 43 will deter potential PVPs, patents, and plant patent applications, and decrease utilita-

1106 See the note 1094 of this dissertation.
1107 See the note 1094 of this dissertation.
1108 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1109 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1110 Javorcik, supra note 916, at 159.
rian/economic incentives for the implementation and operation of an ABS regime in Taiwan. In addition, Article 43 of the Draft Law will also have negative influences on foreign direct investments from multinational corporations and economic development in Taiwan.

5.4.2 The Application of the “Compulsory License” Regulations in the Taiwanese Patent Act and Plant Variety and Plant Seed Act to the “Draft of the Genetic Resources Act of Taiwan”

The previous section mentioned that the conservation of PGRs and traditional knowledge regarding the use of PGRs (the adoption of ABS regimes) is not contrary to the development of intellectual property protection. However, Article 43 of the Draft of the Genetic Resources Act of Taiwan regulates that intellectual property protection regarding genetic resources should mesh with the purposes behind the enactment of the law – to promote conservation, the sustainable use of genetic resources, and the fair and equitable sharing of benefits arising from the use of genetic resources.\(^{1111}\) This dissertation argues that such legislation would reduce foreign investors’ willingness to seek intellectual property protection for their commercial benefits and reduce direct investments in Taiwan.

On the other hand, if the Draft of the Genetic Resources Act of Taiwan were to include the “Compulsory License” regulations, these problems could be solved. For example, Article 76, Section 1 of the Taiwanese Patent Act and Article 30, Section 1 of the Plant Variety and Plant Seed Act regulate that “In order to cope with the national emergencies and substantial national situations, or to make non-profit-seeking use for the enhancement of the public welfare and interest, or in the case of an applicant’s failure to reach a licensing agreement with the patentee and the holder of a plant variety right under reasonable commercial terms within a considerable period of time, the Patent Authority and the central competent authority may

\(^{1111}\) Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.
grant a compulsory license to the applicant to put patented inventions into practice and to exercise such plant variety rights upon request…”

If we apply the former “compulsory license” regulations in the Patent Act and Plant Variety and Plant Seed Act to the Draft of the Genetic Resources Act of Taiwan, there are no “national emergencies,” no “substantial national situations,” and there is “a licensing agreement with the patentee and the holder of a plant variety right under reasonable commercial terms” in the case of the use of genetic resources. However, the concepts of “public welfare and public interest” (conservation, sustainable use of genetic resources, and equal and fair benefit-sharing arising from the use of genetic resources) and “agreement” (benefit-sharing agreement) within the “Compulsory License” regulations of the Patent Act and the Plant Variety and Plant Seed Act are relevant to the use of genetic resources.

Future amendments to the Draft of the Genetic Resources Act of Taiwan should include similar regulations concerning “Compulsory License,” because Article 17 of the Draft Law regulates that benefit-sharing is based on “mutually agreed terms.” In other words, the “equal” and “fair” conditions of benefit-sharing agreements are achieved through negotiations among bioprospecting applicants, landowners, and regulatory agencies.

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1112 Article 76, Section 1 of the Taiwanese Patent Act regulates that “In order to cope with the national emergencies, or to make non-profit-seeking use of a patent for enhancement of public welfare, or in the case of an applicant’s failure to reach a licensing agreement with the patentee concerned under reasonable commercial terms and conditions within a considerable period of time, the Patent Authority may, upon an application, grant a right of compulsory licensing to the applicant to put the patented invention into practice; provided that such practicing shall be restricted mainly to the purpose of satisfying the requirements of the domestic market. However, if the application for compulsory licensing of a patent right covers semiconductor technology, such application may be allowed only if the proposed practicing is purpose for a non-profit-seeking use contemplated to enhance the public welfare.” Article 30, Section 1 of the Taiwanese Plant Variety and Plant Seed Act regulates that “In order to cope with substantial national situations, or to make non-profit use for the enhancement of the public interest, or in the case of an applicant’s failure to reach a licensing agreement with the holder of a plant variety right under reasonable commercial terms within a considerable period of time, the central competent authority may grant a compulsory license to exercise such plant variety right upon request, provided that such license shall be exercised mainly for the purposes of satisfying domestic market demand.” See Laws and Regulations Database of The Republic of China, Patent Act, supra note 1016; Laws and Regulations Database of The Republic of China, The Plant Variety and Plant Seed Act, supra note 1030.

1113 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.

1114 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
agencies have no exclusive power to enforce the public welfare and the public interest (conservation, sustainable use of genetic resources, and the fair and equitable sharing of benefits arising from the use of genetic resources). In particular, we cannot determine exactly when bioprospecting applicants, landowners, and regulatory agencies will achieve “equal” and “fair” conditions in benefit-sharing agreements. If the Draft Law includes the “Compulsory” regulations, as do the Patent Act and the Plant Variety and Plant Seed Act, they would authorize regulatory agencies to automatically seek to achieve public welfare or public interest within a “considerable” period of time.

The benefits of applying the “Compulsory” regulations to the Draft of the Genetic Resources Act of Taiwan include avoiding pending bioprospecting applications from domestic or foreign investors for a “considerable” period of time. Chapter 2 of the Draft of the Genetic Resources Act of Taiwan contains a great deal of abstract and complicated regulations concerning the filing of bioprospecting applications, and the “Compulsory” regulations would be a mechanism for domestic or foreign investors to balance such uncertainty. Just as

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1115 See the note 1112 of this dissertation.

1116 For example, Article 9, Section 1 of the Draft of the Genetic Resources Act of Taiwan regulates that the procedures of bioprospecting applications and their examinations regarding academic research shall be simple, and regulatory agencies shall consider the “public interests,” “impacts of ecosystem,” and other relevant factors to examine these bioprospecting applications. However, there are no definitive definitions regarding “public interests,” “impacts of ecosystem,” and other relevant factors in any regulation of the Chapter. See Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071. If applicants of bioprospecting applications concerning academic research file their applications, they do not know what “public interests,” “impacts of ecosystem,” and other relevant factors are and do not know whether or not the regulatory agency will allow their applications.

1117 For example, Article 11, Section 4 of the Draft of the Genetic Resources Act of Taiwan regulates that in addition to application materials listed in Section 1, the second type of bioprospecting program shall attach the statements of commercial use of bioprospecting, and the statements shall include assessments of commercial use regarding bioprospected resources and their expected economic benefits. Article 13, Section 1 of the Draft Law regulates that after applicants submit all application materials, the regulatory agency shall conduct a preliminary examination of these materials and could consult opinions from regulatory agencies involved in environmental protection, national defense, animal and plant conservation, indigenous peoples or other relevant affairs. The regulatory agency (Council of Agriculture) may create a committee to examine bioprospecting applications. See Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071. In other words, bioprospecting applicants need to clarify the type of application: first or second type and prepare all materials. It is hard for applicants to prepare the statements of commercial use of bioprospecting, because applicants do not know how much economic benefit that may arise from genetic resources they will bioprospect. In particular, applicants do not know when they will get permission for bioprospecting if the regulatory agency (Council of Agriculture) may consult relevant regulatory agencies and form a committee to examine applications.
with the recommendations regarding national ABS laws in section 4.5.4.2 of this dissertation, countries should eliminate long and complicated administrative procedures regarding access to PGRs and traditional knowledge regarding the use of PGRs, so that foreign biotechnology corporations can more easily obtain raw materials. In this manner, these countries could attract more foreign direct investments from transnational corporations (FDI) or foreign bioprospecting programs. As a result, inserting “Compulsory” regulations into the Draft of the Genetic Resources Act of Taiwan is one possible way to create a friendly investment environment in Taiwan.

5.4.3 The Application of the Concept – Special Law Takes Precedence over the General Law to the “Draft of the Genetic Resources Act of Taiwan”

Section 5.3 of this dissertation showed that as regards the application of the Taiwanese Genetic Resources Act, the authorizing agency (enforcement agency) for this law, the Council of Agriculture, faces an important legal issue – the Special Law takes precedence over the General Law. The Taiwanese Genetic Resources Act is a *sui generis* (special law) regarding the conservation of genetic resources and ABS issues regarding the use of genetic resources in Taiwan. On the other hand, the other laws related to the Taiwanese Genetic Resources Act are general laws.

For example, if disputes regarding the conservation of genetic resources and ABS issues that are regulated by the Taiwanese Genetic Resources Act and other general laws occur, and such regulations conflict with each other, the Council of Agriculture shall apply the regulations found in the Taiwanese Genetic Resources Act. Just as the regulation in Article 43 of  

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1118 See the discussions of 4.5.4.2 of this dissertation.
1119 The concept of “Special Law Takes Precedence over the General Law” is regulated in Article 16 of the “Central Regulation Standard Act” of the Republic of China (Taiwan), and it regulates that “While a regulation stipulated otherwise for the same object from other regulations, the regulation shall govern, notwithstanding other regulations have been amended and the regulation remained as it was.” See Laws and Regulations Database of The Republic of China, Central Regulation Standard Act, http://law.moj.gov.tw/Eng/Fnews/FnewsContent.asp?msgid=2205&msgType=en (last visited Oct. 5, 2009).
the Draft of the Genetic Resources Act of Taiwan states that intellectual property protection concerning genetic resources shall conform with the purposes stated in the Taiwanese Genetic Resources Act, meaning the sustainable use of genetic resources and the fair and equitable sharing of benefits arising from the use of genetic resources, the Intellectual Property Office shall not issue patents derived from genetic resources to inventors or biotechnology corporations if such patents are contrary to the intent and purposes of the Taiwanese Genetic Resources Act, according to Article 43. However, the question remains: why should the Intellectual Property Office obey regulations found in the Taiwanese Genetic Resources Act? The Intellectual Property Office is not actually the governing agency with respect to the Taiwanese Genetic Resources Act, and must follow the requirements specified by the Taiwanese Patent Act when examining patent applications. Patent applications that meet the requirements of the Patent Act, but violate the regulations in Article 43 of the Taiwanese Genetic Resources Act, give the Intellectual Property Office an excuse to refuse to issue patents involving genetic resources to inventors and biotechnology corporations.

Article 44 of the Draft of the Genetic Resources Act of Taiwan states that patent or PVP applications concerning genetic resources or their genetic parts or components granted under this law must indicate the origins of these resources or their genetic parts or components and must include approval certificates from the Council of Agriculture as regulated in Article 25 of this law. This article will create some legal issues regardless of what is stated in Article 26 of the current Patent Act, or the draft of 2008 Patent Amendment Act. The specification

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1120 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1121 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1122 Article 3 of the “Patent Act” regulates that “The government authority in charge of patent affairs (hereinafter referred to as the “Competent Authority”) under this Act shall be the Ministry of Economic Affairs (the “MOEA”). The patent affairs shall be handled by a sole authority (hereinafter referred to as the “Patent Authority”) to be appointed by the MOEA.” See Laws and Regulations Database of The Republic of China, Patent Act, supra note 1016. The “Patent Authority” that handles the said patent affairs, which is regulated in this article, is the “Intellectual Property Office.”
1123 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
(written requirement) for patent applications in this article consists of the “title of invention,” “description of invention,” “abstract of invention,” and “scope of claims.” The specifications in this article do not include “origin of invention,” which is the same as the regulation in Article 44 in the Draft of the Genetic Resources Act of Taiwan. The question remains: why can the Intellectual Property Office refuse to issue patents regarding genetic resources to inventors or biotechnology corporations if their patent applications regarding genetic resources do in fact meet the specification requirements of Article 26 in the current Patent Act or the draft of 2008 Patent Amendment Act?

Applying the concept that “Special Law takes precedence over General Law” to answer questions regarding Articles 43 and 44 makes these questions easy to answer. The Intellectual Property Office has the right to refuse the applications of inventors or biotechnology corporations if such applications violate Articles 43 and 44 of the Draft of the Genetic Resources Act of Taiwan. The reason for enacting Articles 43 and 44 was to offer some possible solutions to these questions. The purposes stated in Articles 43 and 44 state that when the Intellectual Property Office examines patents, copyrights, trademarks, trade secrets, or other intellectual property applications regarding the use of Taiwanese genetic resources, the Intellectual Property Office shall first consult with the Council of Agriculture.

The question remains as to which regulatory agency is actually responsible for examining intellectual property applications regarding genetic resources – the Intellectual Property Office or the Council of Agriculture? The answer remains ambiguous. The efficiency of the Intellectual Property Office will be low if numerous intellectual property applications regarding genetic resources and particular patents require initial consolidations with the Coun-

\footnote{Article 26, § 1 of the “Patent Act” regulates that “The specification referred to in the preceding Article shall contain the title of invention, description of invention, abstract of invention, and scope of claims.” Although Article 26 of the “2008 Patent Amendment Act” has deleted § 1 of this article, other sections in this article still have not regulated that the specification (writing requirement) of patent application needs to disclose “origin of invention.” See Laws and Regulations Database of The Republic of China, Patent Act, supra note 1016; Intellectual Property Office, Ministry of Economic Affairs, R.O.C., The Comparison Chart of the Statutes of 2008 Patent Amendment Act and Current Patent Act, supra note 1025.}
cil of Agriculture. Intellectual property applications that concern genetic resources are likely to remain pending for extended periods of time, and many valuable potential intellectual property applications that might be beneficial to the development of the Taiwanese biotechnology industry might be deferred. This sort of situation is contrary to the current policy of the Taiwanese government, which supports intellectual property protection and encourages innovation, with particular emphasis on the promotion of the biotechnology industry in Taiwan. Foreign biotechnology investments are likely to be withdrawn from Taiwan if biotechnology products cannot obtain proper intellectual property protection in Taiwan.

5.4.4 Harmonization of Current Taiwanese Laws related to the Use of Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs)

Section 5.1 examined complicated legal systems regarding the conservation of PGRs and the protection of traditional knowledge regarding the use of PGRs, various enforcement agencies and the complicated administrative procedures that enforce different laws in Taiwan.

Section 5.4.2 showed that the Council of Agriculture is the governing agency with respect to the Taiwanese Genetic Resources Act. Articles 43 and 44 of the Draft of the Genetic Resources Act of Taiwan regulate intellectual property protection regarding genetic resources, but the examination of intellectual property applications (i.e. patent, copyright, or trademark, etc) is managed by the Intellectual Property Office, so which major agency

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1125 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
1126 Article 3 of the “Patent Act” regulates that “The government authority in charge of patent affairs (hereinafter referred to as the “Competent Authority”) under this Act shall be the Ministry of Economic Affairs (the “MOEA”). The patent affairs shall be handled by a sole authority (hereinafter referred to as the “Patent Authority”) to be appointed by the MOEA...” Article 2 of the “Copyright Act” states that “The competent authority under this Act is the Ministry of Economic Affairs. The Ministry of Economic Affairs shall appoint a specialized agency in charge of copyright matters.” Article 7 of the “Trademark Act” regulates that “The term, competent authority, as referred to in this Act is the Ministry of Economic Affairs (hereinafter as the MOEA). Trademarks
ultimately makes the final decision regarding the issuance of IPRs (e.g. patents) concerning genetic resources to inventors or biotechnology corporations?

Answering this question requires initially answering some preliminary questions regarding the enactment of complicated laws related to the conservation of PGRs and traditional knowledge regarding the use of PGRs in order to ensure that the government conserves PGRs in an efficient manner, protects traditional knowledge regarding the use of PGRs, and promotes the establishment of an ABS regime in Taiwan. If the government had not decided to enact the Taiwanese Genetic Resources Act, does that mean that the conservation of PGRs, the protection of traditional knowledge regarding the use of PGRs, and the promotion of the establishment of an ABS regime in Taiwan will not be successfully and efficiently enforced? The answers to both questions are “No.” The promotion of the establishment of an ABS regime in Taiwan will be successfully and efficiently enforced, and this relies on a single, efficient, powerful governing agency and simple administrative procedures, but should not depend on complicated legal systems and inefficient regulatory (enforcement) agencies.

The enactment of the Taiwanese Genetic Resources Act meshes with the international trend toward the conservation of PGRs, the protection of traditional knowledge regarding the use of PGRs, and the promotion of the establishment of ABS regimes. The government will again face the question “Which major regulatory agency makes the final decision about the issuance of IPRs (e.g. patents) concerning genetic resources to inventors and biotechnology corporations?” following the promulgation of the Taiwanese Genetic Resources Act. This dissertation argues that in addition to the enactment of the Taiwanese Genetic Resources Act,

the government must also take action to harmonize current Taiwanese laws related to the use of PGRs and traditional knowledge regarding the use of PGRs.

5.4.5 The Enactment of the Taiwanese Genetic Resources Act should Protect the Developments of All Industries and Consider Different Perspectives in Taiwan

Taiwan is a mountainous island, and more than two-thirds of Taiwan’s surface area is mountainous.1127 Residents have no choice but to build houses, cultivate fruits and vegetables on open ground in mountainous areas. Over-exploitation has resulted in the disappearance of valuable PGRs (e.g. forest resources) and produced unwanted outcomes, such as the destruction of soil and water and the loss of life and property.

Although the government has emphasized economic development in Taiwan, the Taiwanese government has paid little attention to these issues. However, after “Typhoon Morakot” struck Taiwan in August, 2009 and produced serious damage, leaving 619 people dead and nearly 600 people missing,1128 particularly in mountainous areas, the government began to pay more attention to the problems of soil and water conservation and the destruction of PGRs in mountainous areas (i.e. forest resources).

Although the passage of the “Draft of the Genetic Resources Act of Taiwan” can enforce the conservation of PGRs, the enforced legalization of the conservation of Taiwanese PGRs might push administrative agencies to enact enforcement regulations and improve interagency collaboration in order to ensure the enforcement of any future versions of the Taiwanese Genetic Resources Act.

For example, Articles 43 and 44 of the Draft of the Genetic Resources Act of Taiwan regulate relationships between IPRs and genetic resources. The sections above mentioned that the agencies that are responsible for examining the applications of intellectual property protection (i.e. patent, copyright, trademark, and trade secret) and conserving genetic resources (i.e. plant or animal genetic resources) are different agencies. The former is managed by the Intellectual Property Office,\textsuperscript{1129} which is responsible to the Council of Agriculture.\textsuperscript{1130} In order to balance the conservation of genetic resources and the development of intellectual property protection, the two agencies need to enact enforcement regulations. The Intellectual Property Office shall enact regulations that clearly regulate the examination standards for applications for intellectual property protection regarding genetic resources in order to properly mesh with the requirements of Article 43 and 44 of the Draft of the Genetic Resources Act of Taiwan. In addition, Article 44 indicates that the Intellectual Property Office should consult with the Council of Agriculture when it examines applications for intellectual property protection regarding genetic resources.\textsuperscript{1131} This article requires two agencies – the Intellectual Property Office and the Council of Agriculture to collaborate on examinations of intellectual property protection applications that concern genetic resources.

The Draft of the Genetic Resources Act of Taiwan requires related agencies to enact enforcement regulations in order to effectively enforce future versions of the Taiwanese Genetic Resources Act, and also to protect all of the industries in Taiwan. For instance, Articles 22 and 23 of the Draft of the Genetic Resources Act of Taiwan regulate “bioprospecting” examination factors and principles and dismissal factors concerning “bioprospecting” applications.\textsuperscript{1132} Clause 2 of both articles regulates that the Council of Agriculture shall consider the

\textsuperscript{1129} See the note 1126 of this dissertation.
\textsuperscript{1130} Article 3, § 1 of the “Draft of the Genetic Resources Act of Taiwan” regulates that the Council of Agriculture is the competent authority of this law. See Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.
\textsuperscript{1131} Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.
\textsuperscript{1132} Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, \textit{supra} note 1071.
impact of “bioprospecting” applications on national defense, economics, intellectual property protection, environmental protection, and other national policies in order to decide whether or not to allow or dismiss such applications. These two articles show that “bioprospecting” applications can relate to developments in other sectors of industry besides the agricultural biotechnology industry. The Council of Agriculture must consider the potential impact of “bioprospecting” applications on national development with respect to economics, intellectual property protection, and other areas.

Articles 22 and 23 of the Draft of the Genetic Resources Act of Taiwan take into account the impact of “bioprospecting” applications on different industries, but the regulations in these two articles are ambiguous. For example, what are the other national policies? Do these policies include competitive or antitrust policy for intellectual property protection regarding genetic resources? The truth is that competition or antitrust law differs from genetic resources and intellectual property laws. The competition or antitrust policy that underlies intellectual property protection regarding genetic resources will probably be regulated in future enforcement regulations of the Taiwanese Genetic Resources Act. Biotechnology corporations can obtain permission to engage in “bioprospecting” and obtain patents or PVPs for genetic resources derived from “bioprospecting.” They can refuse to license their patents or PVPs to other corporations or inventors, and thus take advantage of their dominant positions with respect to patents or PVPs, and create barriers to future innovations.

In order to solve the problems of ambiguous and insufficient regulations in Articles 22 and 23 of the Draft of the Genetic Resources Act of Taiwan, the Council of Agriculture needs to enact enforcement regulations that clearly regulate the scope of national defense, economics, intellectual property protection, environmental protection, and other national policies after the Legislative Yuan passed the Draft of the Genetic Resources Act of Taiwan. In the

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1133 Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
process of drafting the Draft of the Genetic Resources Act of Taiwan, there is no opposite perspective, meaning the opposition sponsored by biotechnology corporations.\(^{1134}\) For example, two symposiums of the Draft of the Genetic Resources Act of Taiwan in 2005 only had one representative of a Taiwanese biotechnology corporation, participating in the discussions.\(^{1135}\) The primary participants were legal, biology, and biodiversity scholars,\(^{1136}\) who focused on legal terms or regulations in the Draft Law.\(^{1137}\) Of course, this representative paid attention to the scope of ABS regime in the Draft Law, because the ABS regime in the Draft Law is closely related to corporate interests.\(^{1138}\) However, he also mentioned that it is necessary to regulate access to Taiwanese genetic resources, because some specific species of genetic resources have been taken to Mainland China.\(^{1139}\) Although the perspectives of this representative could not represent all corporate interests in Taiwan, biotechnology corporations paid attention to the influence of an ABS regime in the Draft Law.

Furthermore, if we further discuss the perspectives expressed in the symposium on the Draft of the Genetic Resources Act of Taiwan, these perspectives reflect the “social justice”\(^{1140}\) ideas of anti-biopiracy advocates in developing countries, which emphasize the im-
importance of the conservation of PGRs and traditional knowledge regarding the use of PGRs. The sharing of benefits arising from the use of PGRs and traditional knowledge regarding the use of PGRs is “distributional justice,” and Rawls’ “notions of justice” involves the distribution of such foundational goods as health and food. The perspectives of the “social justice” viewpoint also indicate that developed countries and their multinational biotechnology corporations “unfairly and improperly administer intellectual property laws” that make PGRs and traditional knowledge regarding the use of PGRs into private property.

On the other hand, the conclusion of the probit regression of this dissertation showed the “social justice” that the adoption of ABS regimes (conservation and sustainable use of PGRs) conflicts with the development of IPRs is invalid. The “utilitarian/economic incentive theory” regarding intellectual property points out that intellectual property rights are necessary for providing creators with “incentives” to engage in creative activity, such as plant in-

See the note 1140 of this dissertation.

See Castle & Gold, supra note 563, at 74.

The definition of “justice” in the Black’s Law Dictionary is that “The fair and proper administration of laws.” See Black’s Law Dictionary 881 (8th ed. 2004). If we apply this definition to describe the perspectives of anti-biopiracy advocates or developing countries, their perspective is that the unfair and improper administration of intellectual property laws from developed countries and their multinational biotechnology corporation make PGRs and traditional knowledge regarding the use of PGRs into private property for a limited time.

The issue that PGRs and traditional knowledge regarding the use of PGRs can be private property is closely related to the conflicts between the CBD and the TRIPS Agreement. For example, Mitchell Simith argued that “Article 27 of TRIPs, the most disputed provision with respect to the TRIPs-CBD conflict, provides a broad scope for protection, allowing for the patenting of ‘any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application.’ This contrasts with the more restrictive objectives of the CBD. Article 15.1 of the CBD recognises the sovereignty of source nations and allows nations to determine access to their genetic resources. In addition, Articles 15.6, 15.7, 16, 19.1 and 19.2 provide for fair and equitable benefit-sharing between the providers of resources and relevant users. The CBD thus takes genetic resources out of the public domain by recognising a source country’s right to benefits and technologies coming from them… While developed nations continue to push for broad IPRs, developing nations look for ways of controlling the property rights granted and prohibiting the majority of profits coming from biogenetic resources obtained within their country from going to foreign companies and institutions….” See Mitchell Simith, The Relationship between TRIPs and the CBD: A Way Forward? (May 11, 2009), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1403000. In other words, the conflicts between developed and developing countries are that developed countries want to extend intellectual property rights, particularly patents on biological resources from developing countries and obtain commercial benefits from them. However, developing countries want to strictly control their biological resources from flowing to other countries and promote the sharing of benefits arising from the use of biological resources with developing countries.

See the discussions of 4.5.4.1 of this dissertation.
novations, so additional new plant varieties would be created through the incentives of intellectual property protection (e.g., Plant Patents or PVPs). Thus, the PGRs (raw materials) of developing (source) countries would add commercial value rather than remain inefficiently conserved within national territories (borders). The Draft of the Genetic Resources Act of Taiwan adopted the perspective of “social justice,” and provides for stricter access or conservation regulations concerning the use of Taiwanese genetic resources. This dissertation proposes that future amendments to the Draft Law should consider different perspectives other than “social justice,” because future amendments should add more regulations concerning how to efficiently use genetic resources in Taiwan.

Therefore, the above different perspectives concerning the Draft Law are simply the opinions of certain parties, and we can imagine that regulations in the Draft Law would face more challenges from different perspectives (i.e. corporate interests) when the Draft Law eventually gets sent to the Legislative Yuan in the future. The “Lobbying Act” was promulgated on August 8, 2007, so biotechnology corporations can lobby legislators to impact the enactment of future versions of the Taiwanese Genetic Resources Act. This disserta-

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1146 The principal objective of intellectual property law is the promotion of new and improved works. The U.S. Constitution, Article I, Section 8, Clause 8 regulates that “To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries…” See Merges et al., supra note 1, at 11.

1147 See Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071. 76% of the articles (Articles 8 ~ 29) in Chapter 2 of the Genetic Resources Act of Taiwan concern the procedures for submitting bioprospecting applications to obtain access to genetic resources, and they occupy 49% of all of the articles in the Draft Law. As a result, regulations of the Genetic Resources Act of Taiwan focus on using long and complicated administrative procedures to decrease the number of applicants who seek to bioprospect Taiwanese genetic resources.


1149 Article 2, Section 1 of the Lobbying Act regulates that “The term lobbying mentioned in this Act refers to the behavior that lobbyist intends to affect the lobbied party or its agency about the formulation, enactment, modification or annulment of laws, government policies or legislation by any oral or written communication direction directly to the lobbied party or its designee.” Article 2, Section 2, Clause 1 of the Lobbying Act states that “The term “lobbyist” used in this Act is as follows: 1. Individual, legal person, organization permitted to establishment or file for record or group constituted by special purpose with representative…” See Ministry of the Interior, The Information Website of Lobbying Act, Regulations: English Edition of the Lobbying Act, http://www.moi.gov.tw/lobby/law1.asp?did=7 (last visited Jan. 2, 2010). As a result, biotechnology corporations are legal persons, which are qualified within the definitions of Article 2, and can impact the lobbied agency (Legislative Yuan) about the enactment of laws (Taiwanese Genetic Resources Act).
tion argues that considering different perspectives on the enactment of the Taiwanese Genetic Resources Act are beneficial for the harmonization and protection of interests of all of the industries in Taiwan, but there exist different opinions regarding the Taiwanese Genetic Resources Act.

Unfortunately, on August 15, 2006, the draft of the second edition of the Draft of the Genetic Resources Act of Taiwan was completed, and there has been no further legislative progress to date. This dissertation argues that passage of the Draft of the Genetic Resources Act of Taiwan was a good way to encourage the conservation of Taiwanese genetic resources (e.g. plant and animal genetic resources). Any future versions of the Taiwanese Genetic Resources Act should focus related agencies’ attention on the conservation of genetic resources and inter-agency collaboration.

5.4.6 To Allow the Use of Genetic Resources without the Territory Limitation is Crucial in the “Draft of the Genetic Resources Act of Taiwan”

Section 5.4.5 of this dissertation mentioned the perspective of a representative who attended the symposium of the Draft of the Genetic Resources Act of Taiwan in 2005 who said that it is necessary to regulate access to Taiwanese genetic resources, because some species of genetic resources have been taken to Mainland China. Issues concerning Taiwanese genetic resources flowing out of Taiwan involve Mainland China and other countries, which indicate that there currently exists a loophole concerning access to genetic resources in Taiwan, because the Draft of the Genetic Resources Act of Taiwan has not been fully en-

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The report of “Taiwan is disadvantageous, because plant seeds flow to Mainland China” as reported in the Liberty Times in 2007, which indicated that Taiwanese fruit varieties have been exported and grown in Mainland China. Government officials of the Agriculture and Food Agency, Council of Agriculture pointed out that 11 types of plant seeds are restricted. These 11 plant seeds could flow out of Taiwan after the Council of Agriculture’s permission. In addition to these 11 plant seeds, exporting plant seeds to other countries does not require permission from the Council of Agriculture. Although there have been punishment regulations in the Plant Variety and Plant Seed Act regarding exporting these 11 plant seeds to other countries, plant seeds are so small that people can easily illegally take them out of Taiwan. Therefore, it is difficult to punish people, who take plant seeds out of Taiwan by using the Plant Variety and Plant Seed Act. This report also indicated that Taiwan is at a
forced. In particular, genetic resources are protected by the Taiwanese Plant Variety and Plant Seed Act, and, Taiwanese biotechnology corporations and breeders harm the flow of commercial genetic resources out of Taiwan.

The purpose of this dissertation is to develop fair and efficient legal policies concerning the use of PGRs and traditional knowledge regarding the use of PGRs.\textsuperscript{1151} Adopting ABS regimes can help achieve the “fair” use of PGRs and traditional knowledge regarding the use of PGRs, but the “efficient” use of PGRs and traditional knowledge regarding the use of PGRs is also crucial. However, the Draft of the Genetic Resources Act of Taiwan focuses on regulating ABS issues concerning the use of PGRs, particularly access to genetic resources, and the question of how to efficiently use Taiwanese genetic resources is rarely mentioned in the Draft Law though intellectual property protection regarding genetic resources is mentioned in Articles 43 and 44.\textsuperscript{1152} It goes without saying that the efficient use of genetic resources is not limited to seeking to develop intellectual property protection regarding genetic resources. This dissertation proposes that using genetic resources should not be restricted within Taiwan, although this dissertation argues that PGRs (genetic resources) belong to national sovereigncies. In other words, enforcing national sovereigncies is not limited to national territories,\textsuperscript{1153}

\begin{itemize}
\item See the discussions of 1.2 of this dissertation.
\item Intellectual property regulations in the Draft of the Genetic Resources Act of Taiwan are in the Chapter 5: Relationships between the Use of Genetic Resources and Intellectual Property Rights, but they constitute 4% of the articles of the Draft Law. See Seed Lab., National Taiwan University, Genetic Resources Act: Second Edition of the Draft of the Genetic Resources Act, supra note 1071.
\item Article 4 of the CBD regulates that “Subject to the rights of other States, and except as otherwise expressly provided in this Convention, the provisions of this Convention apply, in relation to each Contracting Party: (a) In the case of components of biological diversity, in areas within the limits of its national jurisdiction; and (b) In the case of processes and activities, regardless of where their effects occur, carried out under its jurisdiction or control, within the area of its national jurisdiction or beyond the limits of national jurisdiction.” See Secretarial of the Convention on Biological Diversity, supra note 24. In other words, it is possible for countries to
\end{itemize}
and future versions of the Taiwanese Genetic Resources Act should avoid limiting the use of genetic resources to remain within territorial boundaries and allow businessmen and investors to take genetic resources out of Taiwan. In particular, benefits arising from the use of genetic resources (including monetary and non-monetary benefit-sharing) should eventually flow back to Taiwan.

Such uses of Taiwanese genetic resources are more efficient than the current uses of these resources as regulated in the Draft of the Genetic Resources Act of Taiwan, because the former makes foreign interests, domestic biotechnology corporations and investors, and the Taiwanese developing biotechnology industry all better off. On the other hand, the latter makes the state of conservation, the sustainable use of genetic resources, and the fair and equitable sharing of benefits arising from the use of genetic resources in Taiwan better off, while making foreign, and domestic biotechnology corporations and investors worse off.

This argument is made by the “Pareto Efficiency,” which means that “it is impossible to make at least one person better off without making another person worse off.” See Cooter & Ulen, supra note 19, at 17. If regulations of the Genetic Resources Act of Taiwan will not be amended, the conservation, sustainable use of genetic resources, and equal and fair benefit-sharing arising from the use of genetic resources in Taiwan are better off, but foreign, domestic biotechnology corporations or investors are worse off. Such use of genetic resources is not “Pareto Efficiency.”
5.4.7 Enhancing International Cooperation and Participation to Help Taiwan Conserve Plant Genetic Resources (PGRs) and Traditional Knowledge regarding the Use of Plant Genetic Resources (PGRs)

Lesser argued that genetic resources are widely shared, and no region of the world is completely self-sufficient with respect to food crops,\textsuperscript{1156} so genetic resources (i.e. food crops) are exchanged or traded among countries. The issues of genetic resources – plant and animal genetic resources – are international issues without national border limitations.

The protection of traditional knowledge is a global issue. The UN Declaration on the Rights of Indigenous Peoples stated the principle of respecting indigenous (traditional) knowledge\textsuperscript{1157} and the CBD regulates indigenous (traditional) knowledge regarding biodiversity (i.e. PGRs).\textsuperscript{1158} PGRs and traditional knowledge are international issues, so we should act locally, and think globally with respect to the conservation of PGRs and the protection of traditional knowledge regarding the use of PGRs.

The second edition of the “Draft of the Genetic Resources Act of Taiwan” has been completed, but this Draft Law has not yet become an enforceable law. The “Indigenous Peoples Basic Law”\textsuperscript{1159} and the “Protection Act regarding the Traditional Intellectual Creations of Indigenous Peoples”\textsuperscript{1160} protect traditional knowledge and IPRs concerning traditional knowledge. However, Taiwan is still far from achieving the target of effectively conserv-

\textsuperscript{1156} See Lesser, supra note 27, at 14.
\textsuperscript{1157} Preamble of the UN Declaration on the Rights of Indigenous Peoples states that “…Recognizing that respect for indigenous knowledge, cultures and traditional practices contributes to sustainable and equitable development and proper management of the environment,…” See International Work Group for Indigenous Affairs, Declaration on the Rights of Indigenous Peoples: UN Declaration on the Rights of Indigenous Peoples, supra note 242.
\textsuperscript{1158} Article 8(j) of the CBD regulates that “Each Contracting Party shall, as far as possible and as appropriate:…(j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices:…” See Secretarial of the Convention on Biological Diversity, supra note 24.
\textsuperscript{1159} See the discussions of 5.1.1.5 of this dissertation.
\textsuperscript{1160} See the discussions of 5.1.2.3 of this dissertation.
ing all PGRs and protecting traditional knowledge regarding the use of PGRs. The Taiwanese government has paid insufficient attention to the conservation of PGRs and the protection of traditional knowledge regarding the use of PGRs. This dissertation argues that Taiwan has lacked international participation and cooperation regarding PGRs and traditional knowledge regarding the use of PGRs, and the result has been that conserving PGRs and protecting traditional knowledge regarding the use of PGRs have become marginal issues in Taiwan.

Taiwan has not effectively and extensively participated in international organizations (i.e. UNFAO) and treaties (i.e. CBD or ITPGR) or cooperated with other countries on issues such as sharing information related to the conservation of PGRs and the protection of traditional knowledge regarding the use of PGRs. The Taiwanese government has adopted a pragmatic method of participating in international organizations and enhancing Taiwan’s international cooperation. This pragmatic method has produced some successful outcomes and enhanced Taiwan’s international activities. The Taiwanese government needs to adopt more effective strategies to conserve PGRs and protect traditional knowledge regarding the use of PGRs on the local level.

For example, the discussions in section 5.3 mentioned that Article 5, Section 1, Clause 3 of the “Draft of the Genetic Resources Act of Taiwan” excludes crops and forages listed on the ITPGR, Annex I from protection by this Draft Law, and this article violates the purposes of setting up the “multilateral system” and ABS regulations in the ITPGR. Taiwan has not been a contractual party to the ITPGR and has no duty to comply with the ITPGR. The legislation found in Article 5, Section 1, Clause 3 in the “Draft of the Genetic Resources Act of

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1161 After President of the Republic of China (Taiwan) – Ying-Jeou Ma was elected on March, 2008, He gave up diplomatic policy of the former government and adopted the “modus vivendi” or “diplomatic truce” way to enhance Taiwan’s international participations. See Ministry of Foreign Affairs, Republic of China (Taiwan), Foreign Policy Report, 7th Congress of the Legislative Yuan, 2nd Session (Sept. 25, 2008), http://www.mofa.gov.tw/webapp/ct.asp?xItem=33802&ctNode=1877&mp=6 (last visited Oct. 5, 2009).

1162 The typical outcome of the pragmatic way to participate international organizations is that Taiwan uses the name – Chinese Taipei to participate the observer of World Health Assembly (WHA) from May 18 ~ 27, 2009. See Taiwan Uses the Name “Chinese Taipei” to be the WHA Observer, Sina.com, Apr. 28, 2009, available at http://dailynews.sina.com/bg/tw/twpolitics/bcc/20090428/22223204317.html (last visited Oct. 5, 2009).
Taiwan” blocks future Taiwanese participation in the ITPGR. The Drafting Group of the Genetic Resources Act will have to list crops and forages on the ITPGR, Annex I in order to give them protection in future versions of the “Draft of the Genetic Resources Act of Taiwan.”

This dissertation argues that Taiwan should effectively participate in international agricultural organizations of which Taiwan is a member, such as the “Afro-Asian Rural Development Organization,” “Food and Fertilizer Technology Center for the Asian and Pacific Region,” “AVRDC – The World Vegetable Center,” and “Asia-Pacific Association of Agricultural Research Institutions.” These international organizations share information and conduct research in order to increase agricultural productivity and incomes, but at present do not promote research on agriculture, the conservation of PGRs for food and agriculture, and traditional knowledge regarding the use of PGRs. This dissertation argues that this is a good starting point for the Taiwanese government to use its current organizational affiliations and information from organizations in which it participates to promote agricultural productivity and incomes, the conservation of PGRs, and the protection of traditional knowledge regarding the use of PGRs. Participating in these organizations also will help lay a better foundation for future Taiwanese participation in international organizations such as the UNFAO and treaties, such as the CBD and ITPGR.

CHAPTER 6 - CONCLUSIONS

The goal of this dissertation is to develop fair and efficient legal practices for the treatment of PGRs and traditional knowledge regarding the use of PGRs. There are two current international treaties that concern biological diversity and agriculture – the CBD and the ITPGR, which regulate access and benefit-sharing regimes (ABS), which is a mechanism for the treatment of PGRs and traditional knowledge regarding the use of PGRs in a fair and efficient manner. Although this dissertation argues that ABS regimes are good general legal mechanisms for handling PGRs and traditional knowledge regarding the use of PGRs, not every country takes the same position in practice. The developed and the developing worlds have different perspectives. As a result, this dissertation emphasizes ABS regimes, and uses regression analysis to examine conflicts between ABS regimes and intellectual property rights (IPRs) in order to propose concrete ways to implement ABS regimes.

Chapters 1 through 4 showed that there are different perspectives in the developed and the developing worlds regarding the issues of “biopiracy” and “bioprospecting.” The advocates of anti-biopiracy or anti-bioprospecting, particularly in the developing world, believe that the ownership and stewardship of PGRs and traditional knowledge regarding the use of PGRs are part of national sovereignties, and that no party has the right to remove or use PGRs and traditional knowledge regarding the use of PGRs from any given country without that country’s permission. The opposite perspective is that there is no such thing as “biopiracy.” “Biopiracy” should instead be referred to as “bioprospecting,” and undiscovered PGRs and traditional knowledge regarding the use of PGRs remain to be discovered through “bioprospecting.” Therefore, “bioprospecting” is beneficial to countries, particularly in the developing world, where PGRs are abundant as is traditional knowledge regarding the use of PGRs. These different perspectives on “biopiracy” or “bioprospecting” reflect the controversies regarding the issues of ABS and IPRs related to PGRs and traditional knowledge regard-
ing the use of PGRs.

These controversies concerning the issues of ABS and IPRs related to PGRs and traditional knowledge regarding the use of PGRs in the developed and the developing worlds cannot be readily solved through theoretical discussions. Wolfe and Brown argued that “romantic criticism…simply fails to persuade a large public audience.”[^1164] Heald argued that “the current rhetoric of ‘biopiracy’ may gratify our ‘sense of moral worth but can offer only utopian longings that ultimately have no critical edge.’ This essay suggests engaging multinational corporations on pragmatic terms, using language that is less threatening to their interests and more likely to achieve concrete results.”[^1165] This dissertation uses an alternative method – Probit Regression – to uncover interactions between ABS regimes and IPRs regarding PGRs and traditional knowledge regarding the use of PGRs. Regression analysis was used in this dissertation to show that the more PVP applications that are filed in a given country, the higher the probability that the country will adopt an ABS regime (e.g. laws or policies). PVPs and other types of IPRs are “multicollinear.” Adopting ABS regimes does not conflict with the application of IPRs. This conclusion is contrary to the positions found in the current literature.

This dissertation discusses the interactions between the PVP applications and the adoption of ABS regimes and uses regression analysis to find that net inflows of foreign direct investments from transnational corporations are statistically significant with respect to the adoption of ABS regimes. This means that countries should promote PVP laws (or other types of intellectual property laws) to encourage multinational corporations to file more PVP applications for their commercial benefit. Countries thus enact PVP laws (or other types of intellectual property laws) to attract increased foreign direct investments from transnational


[^1165]: *Id.*
corporations. If the numbers of PVP applications is the dependent variable in regressions, the adoption of ABS regimes is statistically significant with respect to the increased numbers of PVP applications, which means that countries shall not negatively adopt ABS regimes and shall positively adopt efficient ABS regimes. In other words, the interactions between the numbers of PVP applications and the adoption of ABS regimes are harmonized, and are not in conflict, countries can fairly and efficiently use PGRs and traditional knowledge regarding the use of PGRs, and can also promote plant innovations and greater economic development. This dissertation described the interactions between the numbers of PVP applications and the adoption of ABS regimes, and attempted to make tangible recommendations and suggestions regarding the current implementation of national ABS regimes. The recommendations and suggestions made in this dissertation include the notion that countries should enact pragmatic national access regulations, including “intermediaries” and “culture collections,” because such regulations mesh smoothly with the existing operations of the public and private sectors of the biotechnology industry. The biotechnology industry accesses countries’ PGRs or samples primarily through “intermediaries” and “culture collections.” Countries should streamline the long and complicated procedures involved in accessing PGRs by encouraging the establishment of “intermediaries” and “culture collections” whose operation will decrease the high access costs incurred by the public and private sectors of the biotechnology industry. In addition, adopting non-monetary benefit-sharing policies is a preferable policy for the public and private sectors of biotechnology industry as opposed to monetary benefit-sharing, because the anticipated profits of biotechnology corporations are not substantial, though their R&D costs are substantial. In brief, non-monetary benefit-sharing is beneficial for developing countries, and includes jointly owned IPRs, research and information sharing concerning crop protection, the provision of equipment, and so on.

1166 See the discussions of 4.5.3.1 of this dissertation.
“Biopiracy” and “bioprospecting” are global issues, and ABS issues concerning PGRs and traditional knowledge about the use of PGRs are transnational issues. In considering these issues, it is best to “Think Globally, Act Locally.” This dissertation examines the interactions between ABS regimes and IPRs of 194 contracting parties (countries) to the CBD or the ITPGR through regression analysis, examines the current Taiwanese ABS, examines intellectual property regimes and proposes concrete recommendations and suggestions for future Taiwanese ABS regimes based on the outcomes of regression analysis drawn from 194 contracting parties (countries) to the CBD or the ITPGR.

Taiwan has a complete body of laws concerning the conservation of PGRs and traditional knowledge regarding the use of PGRs, such as the Constitution, the National Park Law, the Forestry Act, the Law on the Exclusive Economic Zone and the Continental Shelf, the Indigenous Peoples Law, and the Cultural Heritage Preservation Law. Taiwan also has a body of intellectual property laws concerning PGRs and traditional knowledge, such as the Patent Act, the Plant Variety and Plant Seed Act, and Protection Act for the Traditional Intellectual Creations of Indigenous Peoples. However, Taiwan does not currently have an enforceable ABS regime (i.e. law or policy) even though the Drafting of the Taiwanese Genetic Resources Act began in October, 2004.

Taiwan has room for improvement regarding the implementation of an ABS regime. This dissertation makes several recommendations and suggestions: first, the regression analyses in this dissertation show that intellectual property protection (PVPs or other types of protection) does not conflict with the conservation of PGRs and traditional knowledge regarding the use of PGRs. Therefore, regulations in future versions of the Taiwanese Genetic Resources Act, and other relevant laws, should not prohibit the application of intellectual property protection to PGRs and traditional knowledge in order to conserve PGRs and traditional knowledge regarding the use of PGRs. The other side of the coin is that future versions of the Taiwanese Genetic Resources Act and other relevant laws should attempt to promote
an increase in the number of applications for intellectual property protection, because increased numbers of applications can enhance the adoption of an ABS regime. Second, the application of the “Compulsory License” regulations in the Taiwanese Patent Act and Plant Seed Act to the “Draft of the Genetic Resources Act of Taiwan.” Article 17 of the Draft Law regulates that benefit-sharing is based on “mutually agreed terms,” and the “equal” and “fair” conditions of benefit-sharing agreements are achieved through negotiations among bioprospecting applicants, land owners, and regulatory agencies. The application of the “Compulsory” regulations to the draft law could prevent pending bioprospecting applications from domestic or foreign investors for a “considerable” period of time. Third, the application of “Special Law Takes Precedence over General Law” remains ambiguous regarding which agency ultimately controls intellectual property applications regarding genetic resources (i.e. PGRs). The Intellectual Property Office should consult the opinions of the Council of Agriculture regarding Patent or PVP applications to ensure that they conform with Article 44 of the Taiwanese Genetic Resources Act. The Drafting Group of the Taiwanese Genetic Resources Act should focus on this problem. The efficiency of the Intellectual Property Office will be low if it is required to examine numerous Patent or PVP applications for genetic resources while also being required to consult with the Council of Agriculture. Fourth, Taiwan currently has a variety of laws and agencies involved in the conservation of PGRs and traditional knowledge, so the government must take action to harmonize current Taiwanese laws and agencies whose responsibilities include PGRs or traditional knowledge with the Taiwanese Genetic Resources Act. Fifth, the regulations currently in the Draft of the Genetic Resources Act of Taiwan are ambiguous and insufficient. The Council of Agriculture should enact enforcement regulations to protect Taiwanese industries other than the agricultural biotechnology industry after the Legislative Yuan passes the Draft of the Genetic Resources Act of Taiwan. Sixth, allowing the use of genetic resources without territorial limitations will be crucial in the “Draft of the Genetic Resources Act of Taiwan.” This dissertation proposes that
the future versions of the Taiwanese Genetic Resources Act shall allow the use of genetic resources without territorial limitations and allow businessmen and investors to take genetic resources out of Taiwan and use foreign advanced technologies. Furthermore, benefits arising from the use of genetic resources (including monetary and non-monetary benefit-sharing) should eventually flow back to Taiwan. Seventh, the Taiwanese government should effectively participate in international organizations in which Taiwan holds membership, and should also effectively participate in international organizations and treaties, such as the UNFAO, CBD, and ITPGR, because enhanced international cooperation and participation can help Taiwan conserve PGRs and traditional knowledge regarding the use of PGRs.

The current global recession has damaged the global economy, including the biotechnology industry, and R&D investments by the biotechnology industry have declined. The traditional perspective of criticizing biotechnology corporations based in the developed world, which some parties believe engage in “biopiracy” or “bioprospecting,” requires modification. There is a need for an alternative method of examining conflicts between the developed and the developing worlds that involves the use of PGRs and traditional knowledge regarding the use of PGRs. This alternative method should balance the perspectives of the developed and developing worlds. This dissertation used regression analysis to arrive at the conclusion that the numbers of PVP applications in any one country are statistically correlated with the adoption of an ABS regime in that country. Regression analysis is an objective research method that balances the perspectives of the developed and the developing worlds, and is a new method for examining conflicts that involve different approaches to the use of PGRs and traditional knowledge regarding the use of PGRs in the developed and developing worlds.

There are two possible directions for future research on regression analysis and theoretical developments that involve examining interactions between the adoption of ABS regimes and intellectual property rights (e.g. PVP applications). This dissertation uses regression analyses to examine the relationships between foreign direct investments from transnational
corporations, PVP applications, and the adoption of ABS regimes, and uses theoretical discussions to analyze access and benefit-sharing issues concerning the use of PGRs and traditional knowledge regarding the use of PGRs. However, there remains a need for additional future research, particularly future research that focuses on finding more pragmatic ways to harmonize intellectual property rights and ABS regimes.

The status of the adoption of ABS regimes, the numbers of PVP applications, the shares of R&D expenditures on GDP, the numbers of researchers in R&D, the shares of Gross Domestic Expenditure on R&D of GDP, the shares of Gross Domestic Expenditure on R&D performed by industry of GDP (PPP), the shares of Gross Domestic Expenditure on R&D performed by higher education and government of GDP (PPP), the government effectiveness index, the rule of law index, and all of the other variables that are related to the development of the biotechnology industry and the attraction of FDI could be independent variables, but net inflows of foreign direct investments from transnational corporations (FDI) could be the dependent variable in possible future regression analyses intended to examine which variable is statistically significant with respect to the FDI. Future research should further examine the interactions between the adoption of ABS regimes and intellectual property rights and analyze additional national ABS laws and policies in order to determine how ABS laws and policies promote the fair and efficient use of PGRs and traditional knowledge regarding the use of PGRs.
REFERENCES

Books


Martin A. Girsberger. *Biodiversity and the Concept of Farmers’ Rights in International Law: Factual Background and Legal Analysis* (Berne: Peter Lang AG, 1999).


**Collections**


Articles from Journals and Newspapers


GianCarlo Moschini and Oleg Yerokhin, Patents, Research Exemption, and the Incentive for Sequential Innovation (Iowa State University, Department of Economics Research, Working Paper No. 06019).


Oliver W. Holmes, The Path of the Law, 10 Harv. L. Rev. 457 (1897).


Dissertations


Case Decisions


In re Bergstrom, 427 F.2d 1394 (C.C.P.A. 1970).


Statutes


Minguo Xianfa (1947).


**Internet Sources**


Cancer Medicine, Section 11: Chemotherapy, Preclinical and Early Clinical Development of New Anticancer Agents – Table 45-1. FDA-Approved Anticancer Agents and Their Indica-


Conference of the Parties to the Convention on Biological Diversity, Technology Transfer and Scientific and Technology Cooperation, Compilation and synthesis of information on institutional, administrative, legislative and policy frameworks that facilitate access to and adaptation of technologies: Note by the Executive Secretary. <https://www.cbd.int/doc/meetings/cop/cop-08/information/cop-08-inf-09-en.pdf>.


Convention on Biological Diversity, Programmes & Issues, ABS, Implementation: Databases


Department of Agronomy, SEED LAB., National Taiwan University, Genetic Resources Act. <http://seed.agron.ntu.edu.tw/agra.htm>.


Hua-Ren Guo. “Plant Genetic Resource and Its Legal Protection.” <http://seed.agron.ntu.edu.tw/cbdcourse/07%20%20%B4%D3%AA%AB%B8%EA%B7%BD%A4%CE%A8%E4%AAk%A8%EE%ABO%C5@.pdf>.


355


Julie C. L. Sun. “Innovation Strategies of Taiwan’s Biotechnology Industry.” [http://www.biotaibin.org.tw/download/aboutchief2/%E5%8F%B0%E7%81%A3%E7%94%9F%E6%8A%80%E7%94%A2%E6%A5%AD%E7%8F%BE%E6%B3%81%E8%88%87%E5%89%B5%E6%96%B0%E7%AD%96%E7%95%A5.pdf].

<http://web2.westlaw.com/search/default.wl?tf=0&method=WIN&fn=_top&tc=0&mt=LawSchoolPractitioner&rs=WLW8.01&sskey=CLID_SSSA81018171&query=keith+aoki+40+uc+davis+l+rev+717&db=jlr&action=Search&vr=2.0&sv=Split&cnt=DOC&origin=Search&service=Search&effdate=1%2f1%2f0001+12%3a00%3a00+AM&rp=%2fdefault.wl&rlti=1&eq=search>.


Ministry of Foreign Affairs, Republic of China (Taiwan), Foreign Policy Report, 7th Con-


<http://dictionary.oed.com.proxy2.library.uiuc.edu/cgi/entry/50124819?single=1&query_type=word&queryword=jurisprudence&first=1&max_to_show=10>

<http://dictionary.oed.com.proxy2.library.uiuc.edu/cgi/entry/50170215?single=1&query_type=word&queryword=pandemic&first=1&max_to_show=10>

<http://dictionary.oed.com.proxy2.library.uiuc.edu/cgi/entry/30007703?single=1&query_type=word&queryword=predictability&first=1&max_to_show=10>

<http://dictionary.oed.com.proxy2.library.uiuc.edu/cgi/entry/50201208>

<http://www.marxists.org/reference/subject/economics/proudhon/property/ch02.htm>


Shu-Min Yang. “Catalogue of Life in Taiwan shows more than 50,000 life species which occupy 2.5% of the world’s life species, Jul. 16, 2009.” <http://tw.news.yahoo.com/article/url/d/a/090716/5/1n702.html>.


Southern Explorations | Amazon Rainforest Tours and Travel | Rubber, the Amazon’s Tree of Fortune. <http://www.southernexplorations.com/articleAmazonRubberTreeFortune.htm>.


The Seed Laboratory of National Taiwan University. <http://seed.agron.ntu.edu.tw/civilisation/SeedWar/seed%20war.pdf>.


World Resources Institute, EarthTrends: Environmental Information, Biodiversity and Pro-
tected Areas: Country Profiles.


WSJ.com. “Cash-Poor Biotech Firms Cut Research, Seek Aid.”

WTO | Doha 4th Ministerial – Ministerial declaration.

WTO | intellectual property – overview of the TRIPS Agreement.

WTO | intellectual property (TRIPS) – agreement text – contents.
<http://www.wto.org/english/tratop_e/trips_e/t_agm0_e.htm>.

WTO | intellectual property (TRIPS) – agreement text – standards.
<http://www.wto.org/english/tratop_e/trips_e/t_agm3_e.htm>.

WTO | Understanding the WTO – Intellectual property: protection and enforcement.

WTO | Understanding the WTO – members.

WTO | What is the WTO? – About the WTO – a statement by the Director-General.

Yi-Ying Li. “Discussions of the Technology Development Trend from Taiwan’s Transactional Agriculture, The Science & Technology Policy Research and Information Center (2008).”
<http://www.biotaiwan.org.tw/download/structure4/Yi-Yang%20Lee/%E6%8E%A2%E8%A8%8E%E5%8F%B0%E7%81%A3%E8%BE%B2%E6%A5%AD%E8%BD%89%E5%9E%B4%E4%B9%8B%E7%A7%91%E6%8A%80%E7%99%BC%E5%B1%95%E8%B6%A8%E5%8B%A2200809.pdf>.

United Nations Agencies’ Documents

APPENDIX A: THE DATA FOR REGRESSION ANALYSES

The data used to conduct regression analyses, which are included 194, developed, and developing countries that are contracting parties to the CBD or the ITPGR. This material may be found in the supplemental appendix file labeled Appendix A – The Data for Regression Analyses.pdf.
APPENDIX B: THE OUTCOMES OF REGRESSION ANALYSES

The outcomes of regression analyses that are included correlate coefficients and probit regressions. This material may be found in the supplemental appendix file labeled Appendix B – The Outcomes of Regression Analyses.pdf.