INTRODUCTION

Research Problem Identification, Scope and Significance of the Study

Biodiversity has gained much attention during the past few decades and halting the extinction of biodiversity is a major challenge before humankind. The Convention on Biological Diversity is a landmark Convention that addresses issues relating to conservation and sustainable use of biodiversity and genetic resources. Biodiversity is a resource also, and the importance of genetic resources is too obvious to be emphasized. But biodiversity is much more than a natural phenomenon. Since humans had changed ecosystems and continue to change or modify or destroy ecosystems conservation of biodiversity and use of biodiversity is closely related to understanding the actions of humans, the causes and consequences of the same. Although there may be consensus on the need to protect biodiversity there are divergent and contradictory views on the solutions for the biodiversity crisis. This is partly due to the differences in perceptions and perspectives of various stakeholders. On the other hand ever since time immemorial the genetic resources, particularly the plant genetic resources have traveled beyond the places where they originated. Human intervention is so many ways, has enhanced the original diversity found in Nature. At the same time the ownership and transfer of plant genetic resources has been a contentious issue. The colonial expansion and the Columbian Exchange resulted in massive transfer of plant genetic resources across the continents by all means, fair and foul.[i] Often new germplasm was used in agriculture and industry as a resource and as a base for further development. A good portion of this germplasm has been stored in gene banks. This resource, the plant genetic resources, was considered by developed nations to be part of the Common Human Heritage till few decades ago, and hence, was used a resource that could be used freely and without any corresponding obligation to those who developed it or from

regions/countries such transfers were made. The idea of Common Heritage of Mankind could be traced Hugo Grotius and it was articulated by the then Ambassador of Malta, Arvid Pardo in 1967 in the context of the deep sea bed.[ii] Pardo articulated the points about the deep seabed as the "common heritage of mankind": (1) the seabed and the ocean floor, underlying the seas beyond the limits of national jurisdiction as defined in the treaty are not subject to national appropriation in any manner whatsoever; (2) the seabed and the ocean floor beyond the limits of national jurisdiction shall be reserved exclusively for peaceful purpose; (3) scientific research with regard to the deep seas and ocean floor not directly connected with defense, shall be freely permissible and its result available to all; (4) the resources of the seabed and ocean floor beyond the limit of national jurisdiction shall be exploited primarily in the interest of mankind with particular regard to the needs of poor countries; and (5) the exploration and exploitation of the seabed and ocean floor beyond the limits of national jurisdiction shall be conducted in a manner consistent with the principles and purposes of the UN Charter and in a manner not causing obstruction of the high seas or serious impairment of the marine environment.

This resulted in a North-South divide as developing nations objected to the appropriation of global commons and asserted their national sovereignty over natural resources. Permanent National Sovereignty over Natural Resources was accepted by the U.N.

The unauthorized transfer of plant genetic resources was seen as a challenge to the sovereignty. The Convention on Biological Diversity (CBD) which was agreed upon by most countries in the world is a Treaty that recognizes national sovereignty over genetic resources. The objective of the CBD is conservation, and sustainable use of biodiversity. Thus the North-South divide has been bridged by CBD to a great extent, by recognizing the sovereign rights and by providing mechanism for access and benefit sharing with regard to genetic resources.

On the other hand ever since the first decades of the last century attempts were made to extend Intellectual Property Rights to plants and plant varieties and later the International Union for Protection of New Varieties was established. In USA due to changes in the law and judicial interpretations the scope of the Intellectual Property Rights on plants, plant varieties and seeds expanded rapidly. But many developing countries did not have any law to offer such protection. They are in the process of doing so. With the formation of WTO and signing of TRIPS in 1994 the Intellectual Property Protection for plants has become a mandatory requirement although what exactly should be the subject matter and the scope of the protection to be offered are hotly debated. But countries cannot avoid offering protection on plants and plant varieties. Due to developments in biotechnology it has become possible to analyze the genetic components and produce genetically modified organisms and plants. Biotechnology thus has enabled many developments, the implications of which are controversial. Thanks to the changing legal landscape and judicial pronouncements biotechnology patents have been issued since 1981 and with the patenting of gene sequences the subject matter for patents has expanded. With increased use of biotechnology in agriculture, patents on plants, plant varieties, components and biological processes were granted. Thus genetic resources although technically cannot be patented per se, the rapid expansion of Intellectual Property Rights on them has resulted in privatization of genetic resources. This has serious implications for agricultural research, plant breeding, farmer's rights and production and distribution of seeds. With development of Genetic Use Restriction Technologies (GURTs) , the capacity of seeds to regenerate has been curtailed and this has been covered by patents.

The implications of the expanding scope of IPRS have been debated. Many scholars argue that TRIPS gives too much protection and the long term impacts of stronger intellectual property rights will be disastrous for the public domain and the tendency to restrict

fair use and experimental use will stifle research and innovation. Moreover the scope of protection is too vast and this has been done at the expense of strict criteria for granting IPRs. On the other hand some innovative attempts have been made to question the ever expanding scope of the IPR system and to develop alternatives which are workable and which can be used to create and distribute goods and services.

Instead of taking biodiversity as a whole the scope of the study is limited to plant genetic resources and the issues related to them. Biodiversity is considered as a natural phenomenon only. Instead the social and cultural dimensions of biodiversity are very important and in this thesis biodiversity is viewed in a broad context meaning bio-cultural diversity. It is argued that in case of plant genetic resources this is all the more true.

Thus the research problem is formulated as 'what are the impacts and implications of the current IP regime, particularly TRIPS for plant genetic resources, taking in to account the bio-cultural diversity and the international treaties relating to IPRs and biodiversity and whether any alternatives are needed to obviate the negative impacts (if any) of current IP regime'.

Scope of the Study

The scope of the study is to identify the research problem, develop the research questions relevant for the study and to investigate whether these can be addressed and, answers can be found. The scope of the study is not limited to law and wherever necessary ideas, concepts and research done in other disciplines also have been drawn upon. Since the primary subject of the research is plant genetic resources marine biodiversity has been excluded, issues relating to medicinal plants have not been addressed except where relevant, and animal biodiversity, biodiversity aspects related to microbes, human genome, genes and genetics of other animals/living beings have not been taken up for research in this dissertation.

This has been done not only for practical reasons but also for conceptual clarity and to address closely related issues. Moreover some of the topics that have been excluded (e.g. human genome) are more suitable for researching on biotechnology and IPRs than biodiversity. Thus the research theme is limited to one particular aspect of biodiversity although the understanding of biodiversity is in a broader context and importance is given to bio-cultural diversity. This exclusion helps in approaching the research questions in appropriate clusters and to examine the linkages between them in a holistic manner. For example bioprospecting and indigenous knowledge are closely related but there are some issues that are unique to indigenous knowledge and they need a detailed examination of their own. Similarly the question of Farmers' Rights is closely associated with the rights of farmers over seeds but Farmers' Rights as a political idea and a right enshrined in law is much more than rights over seeds. In case of seeds the technological developments have influenced the IPR regime and vice versa. But the technological determinism is insufficient to understand the transformation relating to seeds and the commodification process. Since this thesis is not an inquiry on the history of technology or history of IPRs issues relating to the history or economics of technological development are not addressed, but an attempt has been made to understand the developments in a broader context without conflating one in to another or adopting a deterministic framework. But this not being a dissertation in Science and Technology Studies the discussion is limited as much as possible to the IPR issues and their contexts. The research problem as identified can be approached from various disciplines and with different perspectives.[iii] Hence while this researcher has adopted a particular line of enquiry that need not be the only one line of enquiry and that is not the only one.

The research questions that have been identified are very interesting and offer much scope for extensive research. For example the idea of biodiversity itself can be a subject of more than one dissertation or the question of sovereignty over genetic resources can be a

research topic for a dissertation in international law. However a dissertation is not an ever expanding exercise on interesting questions. This is a focused attempt to address some questions and to formulate some perspectives on them and to discuss them in the context of the literature relating to these questions and to examine their relevance as solutions or as ideas. Hence the issues have been analyzed at length and an alternative model which can be used to formulate solutions and to rethink some of the issues from a different perspective has been suggested.

For reasons of space and as the focus of the study is on trends and developments globally detailed analyses, critiques and reviews of national level laws or guidelines have been avoided as much as possible. Similarly some topics have not been dealt with in this dissertation (e.g. history of TRIPS, legal history of patents and IPRs, political economy of IPRs, theories about various forms of IPRs) for reasons of space and to confine the study to selected issues. As most of research for this dissertation was done in USA and USA being a very important country in terms of IPR issues, the literature and case laws from USA have been used to highlight some important trends and to study the development of IP rights in some areas (e.g. seeds) and to address issues relating to broad patents and patents on software etc. The researcher is well aware of the extensive and ever increasing literature available on the topics of research. An attempt has been made to use relevant literature available in other disciplines as much as possible and hence while important articles, cases and books etc have been cited not every book on the subject nor all articles published in law reviews/journals and else where on the issues discussed in the dissertation have been cited. Finally the scope of the analysis is mentioned in each chapter and at the appropriate places throughout the dissertation.

Significance of the Study

The significance of the study lies in the fact that it goes beyond critiquing the current IP regime and it also proposes clear cut ideas that can form the basis for solutions and strategies. A new framework to develop workable solutions that are grounded in practice and backed by a theoretical perspective is suggested. In the dissertation the available literature is analyzed and some new ideas which are based on our original insights on the questions are put forth. While a great deal of literature is available on these issues, perhaps this is the first attempt to address the issues in a holistic manner drawing out the linkages between issues and the often unnoticed aspects of biodiversity and IPRs. For example the critique given in this dissertation, of some of the ideas currently debated in international fora go beyond the critiques available in the literature and an attempt has been made to raise questions that have not been asked before. The objective has been to go beyond piece meal approaches and to look at the interface between biodiversity and IPRs in different contexts and to suggest an alternative framework not only to reframe the debate but also to underscore the need to look for a new perspective that can be relevant and useful for theory and praxis.

This new framework is placed in a broader context and some important issues for further examination are indicated. It is not claimed that a panacea has been found, nor it is claimed that the framework suggested is the ultimate solution. Far from these, rather all that is claimed is that new framework can be a starting point and this new framework is not a utopian one. Thus this study tries to go beyond the analysis available in the existing literature in many areas even as it tries to break a new ground by suggesting an alternative framework on biodiversity and IPRs.

Hypothesis

Biodiversity and bio-cultural diversity are inseparable and hence any solution that is inimical to the bio-cultural diversity will be inimical to biodiversity as well. The true

nature and significance of biodiversity can be understood only if biodiversity is viewed in a broader context than as a part of nature or as an outcome of natural processes over eons. Since most issues related to biodiversity and bio-cultural diversity are also issues relating to human rights, cultural rights, sovereign rights and responsibilities etc discussions on biodiversity conservation and sustainable development have to be sensitive to these aspects, to be meaningful and relevant.

The relationship between biodiversity and IPRs is not self evident. It has to be understood analyzed in the different contexts in which IPRs are used to appropriate genetic resources and associated bio-cultural diversity. The current expansion of IPRs creates more problems than it solves, and hence the possibility of developing an alternative paradigm has to be studied.

The current discourse on biodiversity and IPRs has reached an important stage. There is a need for more light than heat in debates and analyses and a thorough analysis grounded in reality can be of great help in clarifying issues and in identifying new avenues of intellectual enquiry. There is an urgent need to develop new frameworks and models that can function as an alternative to IP regime as envisaged by TRIPS. In short the need of the hour is to reframe the issues and go beyond the limitations of the current debate on the issues related to biodiversity and IPRs, and, to suggest new frameworks for evolving solutions.

Research Questions Cluster

The following are research questions be addressed by the dissertation

1) **Characterization of Biodiversity**

Although biodiversity is often perceived as something natural, given the fact that nature it self is a contested terrain and the very idea biodiversity is a recent origin the case to look beyond the commonly held assumption to understand the real issues in biodiversity and intellectual property rights is strong. Biodiversity, particularly genetic resources

for agriculture cannot be viewed in isolation of the historical developments or technological developments or the interventions of the actors like governments. Thus while plant genetic resources may appear to be products of evolution and human intervention the discursive framework in which the plant genetic resources are collected, stored, transferred, appropriated and distributed are very important. The formation of botanical gardens and the global movement of germplasm cannot be understood except in the context of colonial expansion, the industrial revolution and application of science and technology in agriculture. So biodiversity and IPR issues have to addressed in a broader context taking into account the various historical developments, colonial expansion, the role of the state etc.

The research questions

What exactly in the biodiversity issue in the context of biodiversity and intellectual property rights? Is biodiversity is just a natural resource that can be privatized or is it more than a natural resource? If so how do we identify the other aspects of biodiversity and what are their relevance for application or non-application of intellectual property rights on genetic resources.

2) The Convention of Biodiversity: A Review

The Convention on Biological Diversity has been hailed as a landmark convention that has for the first time focused on biodiversity in a holistic manner, beyond species and protected areas and ecosystems. Yet even after a decade the Convention has not resulted in dramatic improvements and the biodiversity crisis still looms large. The Convention has focused its attention on some aspects (e.g. traditional knowledge, technology transfer, access and benefit sharing) which for the first time have been given the attention they deserve. But there is a long way to go in fulfilling the stated objectives and at times CBD does not seem to be the most important forum for issues which have direct bearing on biodiversity and WTO, WIPO and other fora are emerging as very important fora for many CBD related issues.

A realistic assessment of CBD reveals that while it has galvanized the international community on biodiversity issues it has not been able to achieve even reasonable success in actualizing the stated objectives.

The research questions

How to characterize CBD - a framework convention or a treaty? What factors resulted in the CBD and whether it is still suffering from the birth pangs. Whether the North-South compromise reflected in CBD is still evident, and whether the North has chosen to give more importance to other fora vis-a-vis CBD. What factors inhibit the CBD from achieving the objectives? What is the scope for CBD to succeed in future and is it too early to write off CBD as a spent force. In the context of IPRs what exactly in the CBD's position on IPRS on genetic resources and whether the North has found CBD less suited for the purpose of IPRs than TRIPS. What is the relationship between CBD and other conventions and treaties?

3) Farmers' Rights: Theory and Praxis

Farmers' Rights has been discussed since the early 1980s. It was suggested that farmers' contributions to conservation and sustainable use of germplasm should be recognized and rewarded and just as plant breeders' are entitled to rights, farmers too should be entitled to some rights and these rights should be legally enforceable. But despite all the rhetoric the international community has finally left it to the national governments to initiate appropriate steps regarding Farmers' Rights while under TRIPS, IPRS on plant varieties have been made binding and compulsory. Various countries have passed laws relating Farmers Rights.

The research questions

1) What are the implications of the decision of the international community? 2) What exactly is Farmers' Rights both as an idea and in practice? 3) Are the current initiatives are adequate to implement Farmers' Rights in toto particularly in the

context of new biotechnologies and the tendency to apply and receive patents on seeds and plant varieties? 4) Should we re-conceptualise Farmers' Rights and if so how? 5) What are the technologies that are not inimical to Farmers' Rights? 6) Whether passing laws is adequate to safeguard Farmers' Rights?

4) The IUPGR: Scope and Relationship with CBD and TRIPS

The International Undertaking on Plant Genetic Resources was finally adopted in 2001 after protracted negotiations. It is coming in to force in June 2004. It is the first international treaty that focuses on plant genetic resources for agriculture, their conservation, and sustainable use on a global scale. Although it does not all crops and all plant genetic resources it establishes a Multilateral System to regulate transfer on germplasm and related genetic resources. It also stipulates conditions regarding IPRs on material received under the Undertaking.

The research question

The research question is whether the Undertaking will be effective and what is the relationship between TRIPS and IUPGR. Another important issue is whether IUPGR is sufficient even for the crops covered by it and whether it can prevent misappropriation of genetic resources.

5) Bioprospecting, Bio-Piracy

Bioprospecting has been touted as a win-win solution to save biodiversity and to effectively use indigenous knowledge associated with biodiversity. But it has failed to live up to the expectations. CBD recognized access and benefit sharing and pointed out the need for policies that facilitate this while fulfilling the objectives of CBD. Despite the expectations access and benefit sharing mechanisms have not been successful and even in countries where laws are in place due to many problems access and benefit sharing has become controversial. Thus while Bonn guidelines are in place under CBD at the national level a lot remains

to be done. The commercial viability of bioprospecting model has been questioned, and so, have been the access and benefit sharing regimes. Critical interventions from civil society and indigenous communities have forced a rethink on these issues.

Biopiracy is unauthorized appropriation of traditional knowledge/indigenous knowledge and plant genetic resources and the knowledge associated with that using IPRs for such misappropriation. The irony is that the IPR regimes are used to get patents or to create monopoly rights even when there is no real invention or innovation. There are many case studies which highlight the problem with current IP regimes, particularly the law and practice in USA. Due to opposition from developing nations this issue has got the attention of the international community although there is no consensus on the solutions. On the other hand this has created an interest in using IP rights to protect the IK/TK as well as the knowledge associated with plant genetic resources and in particular using Geographical Indications as a means of protection.

Research Questions

1) What are the pros and cons of bioprospecting? 2) How countries have tried to regulate the access and benefit sharing and what has been the impacts of laws and regional level initiatives in this particularly in the context of IPRs? 3) Can the access regimes be used to conserve biodiversity and promote sustainable use of biodiversity? 4) Why biopiracy continues and what are the problems with IPR regimes? 5) How successful have been the attempts to combat and prevent biopiracy? 6) What solutions will be needed to prevent biopiracy at the national and international levels?

6) CBD and TRIPS: Conflict or Harmony

The relationship between CBD and TRIPS is a much debated one. While it is claimed that both are in conflict in many areas, for some there is no conflict between both. The issues are more than linkages between institutions. If both are in conflict is there a way to

reconcile both and if no reconciliation is possible what are the options.

The research questions

1) Are TRIPS and CBD are in conflict or not, if they are in conflict what is to be done to minimize the conflict or to eliminate them? 2) What are the positions taken by different countries on the relationship between TRIPS and CBD and how these positions are linked to the positions taken in other issues relating to biodiversity? 3) What is the importance of the relationship between CBD and TRIPS for biodiversity related issues? 4) Is there any scope for synergy between both and if there is one what needs to be done to utilize that synergy.

7) IPRs, Seeds and Plant Varieties

Intellectual Property rights on seeds and plant varieties were virtually unknown in many countries even now yet all countries that are parties to TRIPS have to grant IPRs on seeds and plant varieties sooner or later. But the issue of interpreting the relevant Article of TRIPS hinges on interpreting what is meant by effective system and what are the elements of a sui generis system. More over with the availability of double protection for seeds and plant varieties in many countries the preference for patents is becoming clear. The expansion of IPRS on seeds has resulted in farmers losing many rights (e.g. right to sell seed, right to exchange seeds) which were available as late as 1980s. Besides this the technological trends also favor stronger IPRs on seeds and plant varieties and the development of technologies like GURTs, the appropriability question becomes all the more important. Seeds are considered as embodiments of information owned by seed developers and farmers are treated as users of information who have no rights over the information except the ones mentioned in the contracts. What are the implications of these and judgments that have affirmed dual protection on seeds? What are the options available to developing nations with regards to granting IPRS on seeds – is UPOV the only option? . The expansion of IPRs on seeds and the consolidation in seeds sector are resulting in monopolies and oligopolies in seed sector.

This has serious implications for farmers everywhere as these monopolies and oligopolies also hold crucial patents in agricultural biotechnology and hence are in dominant position to determine the future technological options. Apart from this as many countries are trying to use biotechnology in agriculture the question of appropriate IPR for seeds becomes very important. With the decline in public sector R&D and increasing involvement of private sector in seeds development, production and distribution the question of IPRs becomes very important and whether IPRs would impede or encourage innovation in seeds sector is an important question. The impact of GMOs in biodiversity is another important issue which however is beyond the scope of the thesis.

The research questions

1) How does one understand the technological developments, changes in laws and the question of IPRs on seeds and plant varieties? 2) What are the implications of the technological developments, judicial pronouncements and changes in law? 3) What are the implications of commodification of germplasm and seeds? 4) What are the options available under TRIPS for developing nations? 5) Whether the UPOV model can adequately meet the requirements of developing nations. 6) Whether Plant Breeders Rights are still relevant in the context of patents on seeds and if not what are the options other than patents. 7) How countries have tried to interpret Article 27.3(b) and what is the significance of the interpretations?

8) Indigenous Knowledge/Traditional Knowledge and IPRs

Misappropriation of IK/TK using IPRs and the need for protecting IK/TK is a much debated issue. The importance of IK/TK is being increasingly recognized and there are many initiatives to document IK/TK and to protect them through legal measures. However the issues are more complex than what they appear prima facie. An important issue is how to characterize/define IK/TK and what is the relationship between IK/TK and western

scientific knowledge. Should IK/TK be valued only because it has some utility for developmental purposes. The bio-cultural dimension of IK/TK and the nexus between biodiversity, IK/TK and linguistic diversity are very important. As IK issues are closely related to human rights, cultural rights and other rights related to indigenous communities many scholars have examined IK and these rights in the context of the problems faced by indigenous communities and their struggles. And whether IPRs are the right means to protect TK/IK is a much debated issue.

Many solutions have been offered to protect IK/TK and these range from sui generis systems to trade secrets. But many are skeptical about using IPRs as a means of protection and whether IPRs can protect indigenous interests is a question that is often raised. On the other hand some new proposals like digital databases, trade secrets, registries are being tried in many countries. The IGC of WIPO has come out with various studies and it has been suggested that IPRs can really serve the interests of indigenous communities. But some scholars have suggested that an international treaty is needed to protect IK/TK. Thus the discussion on IK/TK and IPRs has gone beyond the extreme viewpoints and has entered an important stage.

Research questions

1) How to characterize IK/TK and differentiate between them? 2) What is the nexus between IK/TK and bio-cultural diversity? 3) What are the concerns expressed by indigenous communities on using IPRS and what are their major concerns about using IK by others. 4) What is the state of the art on the issue of IK/TK and IPRs and what are the significant solutions and their pros and cons? 5) What will be the impact of the various initiatives relating to IPRs and TK/IK? 6) Are IPRs alone sufficient to protect IK/TK and if not what are the options?

The above research questions were in respect of various issues identified for further

research. The dissertation proposes some new ideas and tries to address the above mentioned issues in the context of the new ideas. The research has two objectives: to identify and analyze the questions as mentioned above and to discuss them, and, to identify a new framework to put forth some solutions.

The discussion above on research questions is related to the first objective. Regarding the second objective the dissertation provides a detailed analysis and discussion in the third part.

Research Methodology

The methodology used in this dissertation is analytical, comparative and doctrinal. In undertaking this research the challenge is to address the research questions and to suggest an alternative framework. The research was done mostly on the basis of an extensive analysis of literature on these issues, study of cases, study of various documents including the ones prepared by international agencies or submitted to them and the laws and regimes relating to biodiversity and IPRs.

As most of research for this dissertation was done in USA and USA being a very important country in terms of IPR issues, the literature and case laws from USA have been used to highlight some important trends and to study the development of IP rights in some areas (e.g. seeds) and to address issues relating to broad patents and patents on software etc

It is futuristic as an attempt has been made to explore new options and suggest solutions which can be used for developing workable models. The objective is to provide a blue print that would be relevant in finding solutions to issues related to biodiversity and IPRs. An analytical framework has been used to examine the various issues and wherever necessary a comparative analysis has been given.

Research Design

The dissertation is divided into three parts. Based on the research done the outcome is organized in different chapters with each chapter focusing on a single issue. The first two parts provide a survey of the issues and in each chapter an extensive analysis is given. In the third part the theoretical and practical aspects of the suggested new model is provided. This dissertation has been organized this way so that there is a coherent approach and the discussion flows smoothly from one issue to another. Although there are many cross cutting themes and issues at the appropriate places the linkage is explained or the relevant chapter is referred to or cited for reasons of space and to avoid duplication.

In the first chapter in the first part the idea of biodiversity is examined and various issues related to biodiversity and its global dimensions are analyzed and it is concluded that a better understanding is possible only if both the social and natural dimension of the biodiversity issue is taken in to account. The next chapter gives an extensive analysis of the CBD and examines the origins of CBD, its various features, and its functioning. These two chapters provide the basis for the subsequent discussions in the other chapters.

In the second part, the first chapter deals with Farmers' Rights and the evolution of this idea is traced and the chapter examines Farmers' Rights both as a concept and as a practice. In the next chapter the International Treaty on Plant Genetic Resources is examined and its various provisions are also discussed. This is followed by a chapter on bioprospecting, and biopiracy wherein the bioprospecting and access and benefit sharing issues are discussed threadbare .The discussion on biopiracy focuses on case studies and analyzes the legal provisions and examines why biopiracy continues. The various solutions are also examined in this chapter.

The relationship between CBD and TRIPS is the focus of the following chapter, in which the interface between CBD and TRIPS is discussed, taking into account the

positions taken by countries on this and the major points of disagreement. In the next chapter IPR issues relating seeds and plant varieties are analyzed. The developments in USA are used to illustrate the development of IP regime on seeds and the interplay between various factors is highlighted. The various interpretations of TRIPS article 27.3(b) are also discussed and the evolution of IP rights for seeds and plant varieties and the question of 'sui generis system' and 'effective' protection as envisaged under TRIPS are examined, besides the legal responses to that provision of TRIPS. In the next chapter, the final chapter in Part II the discussion is on Traditional Knowledge/Indigenous Knowledge and IPRs. In this chapter the discussion begins with explorations on IK/TK and its relationship with bio-cultural diversity. The various issues relating to IPRs and IK/TK are examined and important suggestions are analyzed for their merits and demerits. Some new suggestions like digital databases are examined at length and their relevance is also explored. This chapter also gives some suggestions including the outline for an international treaty on IK/TK. This chapter thus tries to provide an in-depth discussion of the various issues relating to IK/TK.

The first two parts thus give an extensive analysis of the issues, problems and the suggested solutions. In each chapter an attempt has been made to provide a coherent discussion, pinpointing the linkages and crosscutting issues. Thus the two parts can be considered as a comprehensive state of the art review with suggestions and informed views on these issues. These are necessary but not sufficient for they do not provide an alternative framework nor they suggest an alternative model which can be used to develop solutions and strategies.

This task is taken up in the final part – Part III. The first chapter provides an extensive overview of Open Source and IP issues related to Open Source and the use of Open Source models. It points out the relevance of Open Source as an alternative paradigm and examines issues relating to commons and anticommons in research, role of IPRs in

biotech patents and the impact of judicial pronouncements and laws in USA on IPRs and the Freedom to Operate in agricultural research is discussed in the context of recent developments. . In the second chapter the use of Open Source and Open Source models as a strategy to prevent anticommons in biotechnology and genomics is explained and the use of Open Source models in other sectors is also pointed out citing relevant examples. In the following section the applicability of Open Source model to the various issues discussed in the previous two parts is explored and some suggestions are made. In the next part a case study is given and the suggested solutions are examined in that context. The dissertation ends with a Conclusion chapter, followed by bibliography of references cited in various chapters, listed in Chicago 14A style. The web resources, URLs, cases, newspaper articles etc. are given in the end notes of the chapters and are not listed in the bibliography.

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[i]. Cosby, Alfred W., 1972, The Columbian Exchange: Biological and Cultural Consequences of 1492, Westport, CT: The Greenwood Press.

[ii]. Pardo articulated the points about the deep seabed as the "common heritage of mankind" in a comprehensive manner.

Available at http://www.foreign.gov.mt/stockholm/doc/CommonHeritageOfMankind.htm; see also Susan J. Buck, The Global Commons: An Introduction, London: Earthscan (1998), Chemillier-Gendreau, Monique. "The Idea of the Common Heritage of Humankind and its Political Use." *Constellations* 9, no. 3 (2002): 375-89.

[iii]. For example scholars with grounding in economics would approach them differently and economics is well suited to analyze IP Law e.g. Landes, William M., Posner, Richard A. The Economic Structure of Intellectual Property Law The Belknap Press of Harvard University Press 2003.