BIODIVERSITY AND GLOBALISATION: A GEOPOLITICAL ANALYSIS OF PATENTS RIGHT

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DECLARATION

I declare that the dissertation entitled "***Biodiversity and Globalisation: A Geopolitical Analysis of Patents Right***" submitted by me for the degree of **Master of Philosophy** of Jawaharlal Nehru University is my own work. The dissertation has not been submitted for any other degree of this university or any other university.

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CERTIFICATE

We recommend that this dissertation be placed before the examiners for evaluation.

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For the drawback in this dissertation if any, I am alone responsible for it.

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ACRONYMS

ARVs	:-	Anti Retroviral Drugs
ASEAN	:-	Association of South-East Nations
ATCC	:-	American Type Culture Collection
BGs	:-	Botanical Gardens
CBD	:-	Convention on Biological Diversity
CGIAR	:-	Consultative Group on International Agricultural Research
CI	:-	Conservation International
CIEL	:-	Centre for International Environmental Law
CSIR	:-	Council of Scientific and Industrial Research
EBAs	:-	Endemic Bird Areas
EFTA	:-	European Free Trade Agreement
EPC	:-	European Patent Convention
EPO	:-	European Patent Office
ETC	:-	Action Group on Erosion, Technology and Concentration group
EU	:-	European Union
FR	:-	Farmers' Rights
GATT	:-	General Agreement on Tariffs and Trade
GBs	:-	Germ Plasm Banks
GR	:-	Genetic Resources
GRAIN	:-	Genetic Resources Action International
IARC	:-	International Agricultural Research Centers
IMF	:-	International Monetary Fund
IPC	:-	International Patent Classification
IPGRI	:-	International Plant Genetic Resources Institute
IP	:-	Intellectual Property
IPRs	:-	Intellectual Property Rights
IUCN	:-	The World Conservation Union – International Union for Nature
JPO	:-	Japanese Patent office

LMMC	:-	Like-Minded Megadiverse Countries
MNCs	:-	Multi National Corporations
NGOs	:-	Non Governmental Organisations
OECD	:-	Organization for Economic Cooperation and Development
PBRs	:-	Plant Breeder's Rights
PCT	:-	Patent Cooperation Treaty
PGR	:-	Plant Genetic Resources
PVRs	:-	Plant Varieties Rights
R & D	:-	Research and Development
RAFI	:-	Rural Advancement Foundation International
SACSIR	:-	South African Council for Scientific and Industrial Research
TK	:-	Traditional Knowledge
TNCs	:-	Transnational Corporations
TRIPS	:-	Trade Related Aspects of Intellectual Property Rights
TWN	:-	Third World Network
UNCED	:-	United Nations Conference on Environment and Development
UNCTAD	:-	United Nations Conference on Trade and Development
UNDP	:-	United Nations Development Programme
UNEP	:-	United Nations Environment Programme
UNESCO	:-	United Nation Educational, Scientific and Cultural Organisation
UPOV	:-	Union for the Protection of New Varieties of Plants
USPTO	:-	United States Patent and Trademark office
WCMC	:-	World Conservation and Monitoring Centre
WIPO	:-	World Intellectual Property Rights Organisation
WTO	:-	World Trade Organisation

Chapter 1

Introduction

Chapter 1

INTRODUCTION

Since the end of Cold War many developments have taken place in social, economic and political arena. In the post-Cold War period there has been a continuous intensification of the globalisation process. The term globalisation which has become popular mainly after 1990 simply refers to the widening, deepening, and speeding up of worldwide interconnectedness (McGrew 2008: 16). In economic sense, it implies a system in which there is a free flow of goods & services, intellectual property and financial transactions across international borders. However, in spite of the intensification of the globalisation process, many of its implications (majority of which are indirect) have not been clearly understood.

The intense globalisation process and the emergence of the Third World as a major group on the world platform has led to the development of the North-South debate on various global issues and local problems which have global implications. In the post-Cold War period efforts were made towards the introduction and establishment of intellectual property rights (IPRs) protection regime on global scale. Intellectual property rights of which patent are a major form, has been a major part of North-South debate. The debate between developing and developed nations in this globalised era has been further intensified by the expansion in the scope of patents to certain life forms. World Intellectual Property Organization (WIPO) describe a patent as the right granted for limited time by the state to an inventor to exclude others from commercially exploiting the invention for a limited period, in return for the disclosure of the invention. Patent as a major type of Intellectual property rights is an important instrument of globalization which has been regarded as a new colonial force working in favour of developed countries at the expense of the developing countries.

Globalisation has intensified interdependence and competition among the different nations of the world. This competition and interdependence is quite obvious in relation to the trading in goods and services and in movement of capital, labour,

biological resources and intellectual property. This has resulted into a situation where, domestic economic developments of developing countries are not determined entirely by domestic policies and market conditions rather, they are influenced by both domestic and global policies set up by the world community. Globalisation might bring new opportunities to developing countries such as greater access to global markets; increased technology transfer from developed countries to developing countries etc. However, globalisation has also thrown up new challenges to developing countries like environmental degradations, misappropriation of biological resources etc. Thus, in the last two decades, Globalisation and its associated issues has become a matter of intense debate between developed and developing nations.

In recent years the increasing globalisation of problems and issues related to biodiversity and environment and its impacts on developed and developing nations has become a major part of North-south debate and has become a major area of interest for the political geographers particularly the geopoliticians. The increasing globalisation of environmental problems and related issues in the post-cold war period has been enhancing the interest in the study of geopolitics surrounding the north-south debate on environment and biodiversity.

Geopolitics which is a subfield of political geography focus on providing rational explanation of the global geopolitical order from a geographical (spatial) perspective (Dikshit 2005). Today in the era of globalisation, the renewed attention being paid to the global scale has reawakened the interest of political geographers in geopolitics. At the global scale, the emergence of patent regime and continuous expansion of its scope to new subject areas related to biodiversity has also led to the renewal of interest in geopolitics surrounding the north-south debate.

Biodiversity describes the total availability of life on earth i.e. all living organisms, their genetic composition and the communities to which they belong. It is the vast array of all the species of plants, animals, and the micro-organism inhabiting on the earth. However, biodiversity is not distributed evenly on Earth. It is mainly found in the tropics and in other specific regions. Most of the tropical countries which are the major repository of biological and genetic resources are in their developing stage. These countries and their communities have been involved in the conservation

of biodiversity for centuries. Today, they are also the major holder of traditional knowledge associated with the use of biological resources.

The spread of patent system to the biological arena at global level has become a significant debatable issue for both developed and developing nations because of its wide social, economic and geopolitical implications. The emergence and the expansion of the scope of intellectual property rights system particularly of the patents to certain life forms has led to many controversies and debates. This debate has partly emerged due to the unequal distribution of biodiversity and scientific technological capability among the different nations of the world. The developing countries has the major share of the global biodiversity while the technological capability that is required to make scientific use of these biological resources is mainly available with the developed countries.

Developed nations which are the main proponents of present patent system claims that the introduction of the patent mechanism has many benefits in terms of increasing innovation & technology transfer, reducing North-south gap and enhancing the economic values of biodiversity and thereby encouraging conservation of biodiversity. However developing nations, most of which have suffered exploitation at the hands of the developed nations during colonial period has criticized the present patent regime as an instrument functioning towards establishing a neo-colonial relationship. To developing nations the present patent regime seems to be an attempt to grab them of their biodiversity and associated knowledge. Thus biodiversity has emerged as an important topic with a high degree of socio-economic prominence and consequently of political & geopolitical significance.

In the last couple of decades, major efforts both direct and indirect, have been made by developed nations to spread the intellectual property protection at the global scale. The developed nations particularly the United States attributed their worsening balance of trade partly to the absence or low standards of Intellectual Property Rights (IPRs) laws prevailing in many developing nations. This perspective of the developed nations that establishes link between IPRs and trade led to the introduction of Trade-Related Aspects of Intellectual Property Rights (TRIPs) agreement in GATT (now WTO).

The developed nations and their business corporations have been the major force behind the formulation and the introduction of TRIPs agreement. TRIPS in essence is the outcome of the international regulatory capture of the WTO process by concentrated producer interests in the form of pharmaceutical, film and software TNCs all holding large intellectual property portfolios and therefore with much to gain from government intervention. TRIPs agreement has become a major instrument for the harmonization of the IPRs all over the world which imposes the developed north countries' minimum standards of patents, copyrights, trade mark, trade secret, etc on the south countries. The involvement of developed, and developing countries and other non-state actors like NGOs and TNCs has made the issue of biological patents more important and demands greater attention to the geopolitics involved in it.

However, the TRIPs agreement which facilitate the spread of higher standards of patents has not gone without criticism. There has been criticism mainly from biodiversity rich developing south regarding the TRIPs agreement which they found as unsuitable to their national interests. They, therefore, favour low standards of patent law. They see the whole concept of TRIPs as shaped by the trade objectives of Transnational Corporations (TNCs). Through the instrument of TRIPs and the appropriation and privatisation of community knowledge that TRIPs facilitates, TNCs have posed a potent potential threat to the biological and intellectual heritage of the traditional communities of developing nations.

The patent system in its present form is not favoured by the developing nations which seems to them as biased towards western culture and values. The new IP regimes will have wide ranging socio-economic, technological and political impact. Under the Trade Related Aspects of Intellectual Property Rights (TRIPS), all the members of World Trade Organization (WTO) are supposed to implement national systems of intellectual property rights following an agreed set of minimum standards. However, there is an increasing feeling that harmonisation is demanded from those that are not equal, either economically or institutionally.

The most common perception regarding the functioning of the present patent system is that it is working in a unidirectional manner with most of the benefits reaped by developed countries and developing nations are at the receiving end and are exploited due to lack of capital and the 'wanted' technology. This view is strongly supported by Shiva (1999) and also by Chauhan (2001). However the issue related to patents and biodiversity and the geopolitics involve in this whole debate is highly complex as it has many actors associated with it. These issues are not the matter of contention only between developed and developing nations. This debate also includes multinational corporations, international research institutions which are engaged in the scientific utilisation of biological resources on the one hand, and confronting them are the traditional communities group, international non-governmental organisations particularly environmental & human rights group, civil society groups etc. which are engaged in the protection of traditional communities right on the biological resources and associated knowledge on the other hand.

A major theme running through the present policy development agenda is the empowerment of the poor. However, the globalization of intellectual property is an example of the way in which the deeds of globalization do not match this policy aspiration. Drahos (2002) argues this point by revealing the fact that when TRIPs was being negotiated no African country was a player in any of the key negotiating groups that shaped its final contents. The reality of standard-setting is that they operate within an intellectual property paradigm dominated by the US and EU and international business.

TRIPs which is both a creation and agent of globalisation process has, thus, become major instrument for establishing a patent regime which works in favour of developed countries. The TRIPs Agreement prohibits the national governments to apply their patent laws which provide little exclusivity or very short period of exercising rights to the patent holders. These provisions of the TRIPs seems to work against the interest of the developing countries as majority of the them are technological backward and therefore, would not be able to make effective use of the TRIPs Agreement.

This patent regime has also failed to address the concern of developing countries regarding the misappropriation of traditional knowledge and genetic resources. Genetic resources which constitute important part of research in biotechnology sector are of prime importance to agriculture, pharmaceutical and chemical industries. Several biotechnological inventions are build on biological resources like medicinal plants that originate in the south – as well as on traditional knowledge related to the use of these biological resources. There have been already many cases of biopiracy i.e. the misappropriations of genetic resources and associated knowledge, reported from developing countries and there are apprehensions that the present patent regime will further encourage this trend.

The growing health concerns about the adverse impact of synthetic materials has led to the increased attraction for natural products which in turn led to the encouragement of research in biological sciences particularly in biotechnology and pharmaceuticals. The increased research in biological sciences led to the advancement of technological capabilities in the biotechnogical and pharmaceuticals sectors. Thus the development of modern technologies in biological field coincided with increased research in agricultural and pharmaceutical sector which brought about an economic incentive to introduce patent protection. Coinciding with this, biotechnology also made it possible to fulfil the legal patent criteria for inventions involving biological material. It has proved difficult to provide similar legal protection of the traditional knowledge about these resources.

Developing countries, thus, claim that their genetic capital is still considered a common heritage of mankind, which is freely accessed by all. At the same time, they fear that they must pay an increasing price for the patented products and medicines which are in actuality derived from their own biological and genetic resources. With the increasing number of genetic patent-based agricultural and medical research, the developing countries of the South are now demanding that the value of indigenous knowledge and the properties of genetic materials used in biotechnological inventions in industrialised North be acknowledged properly.

However, the appropriation of biological and genetic resources is not at all a new phenomenon. Rather, it has been an important constituent of the colonial world order. For a hundred years, plant material has been collected free of charge under the veil of the concept 'Common Heritage of Mankind' and stored in international gene banks. Recently, a mechanism of bioprospecting has been generated to facilitate the appropriation of biological and genetic resources, which, if left unregulated, could lead to the establishment of a neo-colonial relationship between developed and developing nations. The bioprospecting mechanism is used by the Multinational companies to access the biological and genetic resources so as to utilise these resources and related traditional knowledge for production of commercially beneficial items. This mechanism is advocated by the developed countries and their business corporations to share the benefits accrued from these items with the communities which are in possession of this resources and knowledge. The advocates of bioprospecting influence the bioresource rich-South to collaborate with the TNCs to add value to their natural resources and thus raise their income and provide incentives to the indigenous people for the conservation of biodiversity. But apart from a few extraordinary biodiversity hot-spots there is no hard theoretical or empirical support to the myth that bioprospecting adds sufficient value to tropical ecosystem.

The persistent poverty in bio-rich regions is due to the meagre value paid by the various national and international organisations to the grass-root people who protect local biodiversity. These indigenous people are poor because they have shared their rich resources and knowledge so generously. Today in this globalised era, the threat to the traditional knowledge holders and misappropriation of this knowledge has increased due to biopiracy. IPR laws are generally inappropriate and inadequate for defending the rights and resources of local communities. Due to the improper and unstandardised documentation of traditional knowledge, patents are often granted to parties who are traditionally not the owners of this knowledge, thereby, leading to conflict in trade interests of the parties involved. Moreover, a part of the profits made by the patent holders also does not flow back to the holders of traditional knowledge, thus leading to discontent amongst the latter.

Today it is widely recognized that a uniform global intellectual property (IP) system advocating higher standards of protection, is inherently unjust to developing countries which are at lower level of technological and economic development. It is no longer possible to maintain a uniform intellectual property protection system at the international level without grave economic and social losses to, in particular, developing countries. Therefore, there is urgent need to replace this IP protection system with a more flexible framework which makes it possible for each country to adapt it to its national level of economic, technological and social development.

Thus, it could be said that the adoption of TRIPS Agreement; the functioning of patent system in Post-TRIPs Period; the emergence of various debates and controversies of biopiracy or bioprospecting & their impact on the relations between the developed north and developing south or third world and the involvement of various non-state actors like MNCs, NGOs, indigenous communities group etc. has provided a geopolitical angle to the whole issue of biodiversity related patents in this era of globalisation which needs to carefully studied and analysed.

1.1 JUSTIFICATION AND SCOPE OF THE STUDY

On the basis of the above study, it has been found that the issue of functioning of patent regime and the appropriation of patent in relation to the biodiversity has not been dealt in through manner and is to be studied. Distribution of biodiversity shows that it is mainly concentrated in the developing centuries which are lacking in the adequate resources and technology required for availing the benefits of the patents system. Developing countries also failed to get the requisite technology transfer from the developed countries.

On the other hand, the developed countries have vast resources in terms of capital and skilled manpower, and also advanced technology but relatively less fortunate in terms of availability of biological resources i.e. flora, fauna, microorganisms etc. Most of the traditional knowledge is also concentrated in the developing countries. All this facts make the study of patents in relation to the biodiversity very much important. This also brings the geopolitics into this issue.

The present functioning of the patents is not satisfactory and is criticised for working in favour of developed countries. There are allegations of biopiracy and misappropriations of traditional knowledge by the MNC's and governments of developed nations. There is a fear that the current patent system, if not revised, would rob the developing countries of their geological resource and traditional knowledge. There are also criticisms of irregularities in the benefit sharing with the original traditional knowledge holders and their marginalization in the process of appropriation of patent. All this provides the rationale for this study.

The scope of the study is mainly determined by the literature gap found relating to the issue and the rationale of the study. The study will focus on the trends and pattern of patent activity related to biodiversity, current status of biodiversity and the implication of patents on biodiversity. The temporal and spatial analysis of appropriation of patent will be done to show the distribution of patents and share of developed countries vis-a-vis developing countries. The study will also try to analyze the patent policies of developed countries and their effect on the patent activity and developing countries. It will also study the implication on developing countries and the traditional knowledge holders of the current patent regime

1.2 STATEMENT OF THE PROBLEM

The issues pertaining to the field of the patents and biodiversity are a major part of North-South debate which has become a major factor in determining the relationship between the developed and developing nations. However the debate surrounding this area has become very complex because of the increased involvement of various non-state actors. Thus the involvement of non-state actors like MNC's, NGO's, civil society, indigenous people besides the developed and developing nations, which has also increased due to intense globalisation process has made the geopolitics involved in this field significantly complex. Thus there arise many questions which need to be answered such as:

(i) What is the geopolitics involved in the issue surrounding patent and biodiversity ?

(ii) What are the views and perceptions of the North and South regarding biopiracy or Bioprospecting?

(iii) What are the implications of biodiversity related patent policies of the developed countries on the developing countries ?

(iv) What are the implications of the present patent system particularly on the developing countries ?

1.3 RESEARCH HYPOTHESES

(i) The established patent system favours the developed countries at the expense of the developing countries.

(ii) The patent regime is working towards the establishment of the neo-colonial relationship.

1.4 DATA BASE

For the present study data has been collected from various sources like

(i) World Intellectual Property Organization (WIPO), World Patent Report: A Statistical Review (2008)

(ii) International NGOs like Canada-based Action Group on Erosion, Technology and Concentration group (ETC) and Europe based NGO-Genetic Resources Action International (GRAIN)

(iii) Map of Ecoregions collected from World Wildlife Fund (2001)

(iv) Map of Biodiversity Hotspots collected from Conservation International

1.5 RESEARCH METHODOLOGY

The proposed study will be based on historical, descriptive, comparative and analytical review of the data collected both from primary and secondary sources. Apart from the available source materials like books, periodicals, journals, newspapers etc, primary sources like official documents, reports and statistical analysis will be take care of. Proposed study will make use of various cartographic and statistical techniques to provide a visual analysis and scientific base to the study. This will give a more accurate view of the subject. The cartographic and statistical techniques like bar diagram, line graph, pie-charts, etc. would be used as per the requirement. Maps would be used to show the biodiversity distribution and different biodiverse areas.

1.6 FRAMEWORK OF THE STUDY

This research work consists of five chapters. The first chapter provides a general introduction about the status of biodiversity vis-a-vis the functioning of present system in a globalised world. It provides a general view of the debates surrounding the issue of patents and biodiversity. This chapter talks about the justification and scope of the study, statement of the problem, research hypotheses, data base and research Methodology.

The second chapter "Biodiversity and Patents: A Geopolitical Analysis" is an effort to provide an insight into the geopolitics involved in the whole issue of biodiversity and patent. This chapter consists of eight subsections besides the first subsection as introction and final subsection as conclusion. The prominent subsection of this chapter are related to distribution of biodiversity and its classification, Geopolitics of Patent Related to Biodiversity, statistical analysis of the trends and patterns in the patent activity related to biodiversity.

The third chapter "Biodiversity Related Patent Policies of Developed Countries" analyse the patent policies of developed countries in terms of their implications on biodiversity and socio-economic development of developing

countries. The first subsection looks into the historical development of the patent system and its present functioning. The second subsection looks into the TRIPs Agreement related to biodiversity and patent. The next subsection looks into the patent policies of USA and its implications on developing countries and traditional communities. The next subsection analyse the patent policies development of European Union countries in relation to the present debate surrounding patents and biodiversity. Likewise, the last subsection analyse the patent policies of Japan.

The fourth chapter "Patents and Biopiracy: Causes and Implications" provides a comprehensive review of the patent activity of the developed countries in the field of biodiversity. The first subsection provides critical insight into the evolution of the concept of biopiracy and its temporal development. The next subsection analyse the conflicting perspective of developing and developed countries. It provides an introduction to the issues involved with "global biopiracy." The next subsection looks into the various forms of biopiracy. The fourth subsection looks into the causes of biopiracy. The fifth subsection looks into the various cases of biopiracy done by the developed countries and MNCs of developed countries. The next part analyse the implications of biopiracy and patents on the developing countries and their traditional communities. The next subsection looks into the various options and alternatives available to the developing countries and presents a case for the reforming of the way the present system functions. The final part looks into the responses of the developing countries to biopiracy.

The final chapter provides the conclusion drawn out of this research work which is followed by references and appendices.

Chapter 2

Biodiversity and Patents: A Geopolitical Analysis

CHAPTER 2

BIODIVERSITY AND PATENTS: A GEOPOLITICAL ANALYSIS

2.1 INTRODUCTION

The developing countries are the major holder of the biological and genetic resources whereas the technologies that could make use of these resources lies mainly with the developed countries. This asymmetric distribution of biodiversity and technological capabilities to make use of it, between the developed and developing countries makes the issue of biodiversity and patents, a geopolitically significant subject of study. In this background, this chapter deals with the different aspects of this issue from a geopolitical angle and studies the North-South debate in relation to this subject. The major issues surrounding the patent system, both in general and in relation to biodiversity, like the role played by developed and developing countries in its establishment, efforts made to strengthen & harmonise this system and concern raised by various geopolitical actors regarding its structural construct and its implications, its expansion to certain life-forms etc. are of great significance for this study and thus would be discussed. This chapter also provides an analysis of the spatial distribution of the biological diversity and patent activity associated with it, so as to understand the geopolitical significance of this issue.

2.2 DEFINITION OF BIODIVERSITY

The term 'Biodiversity' refers to the vast array of all the species of animals, plants, insects and the micro-organism inhabiting on our planet either in the terrestrial or the aquatic habitats. It includes the variety of genetically different species of plants, animals and micro-organism and the various ecosystems in which they function. The conservation and use of biological diversity is one of the most debated areas in the field of environmental law. Biodiversity has acquired a special importance due to the

developments that has taken place in the area of technology, economy, international trade and politics.

The notion of Biodiversity has expanded in last two decades. Biodiversity is a term which has gained enormous currency in the past few years. The more widely it is used, the less precisely it is defined and the less well it is understood. The Convention On Biological Diversity defines 'biological diversity' as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (CBD). This constitutes a eapansion of the scope of environment protection from previous stages which used to focus on the management and protection of species to later stages of habitats protection and further on ecosystem protection.

The concept of biodiversity includes the variability of: (a) Ecosystem diversity which refers to the diversity of communities and ecological processes that occur at this level. It is also known as ecological diversity or functional diversity. (b) Species diversity which refers to the number of species in all taxonomic groups and also known as species richness. (c) Genetic diversity which includes the genetic variability within individuals. Genetic diversity exists within and between populations, as well as within species.

2.3 CLASSIFICATION OF LIVING-ORGANISMS

Classification is a way of organising information by grouping similar taxa. Classification of living-organism is important for understanding of ecosystems and of biodiversity in general. In the classification system proposed by Linnaeus, each level of the hierarchy corresponds to the name of a taxon. Naturalists around the world use the same system of general nomenclature-the binomial system- to designate and identify the species. This system consists of a genus name followed by a species name. The superior categories (genus, family, order, division, class, phylum, etc.) indicate the degree of relationship between taxa. Today, classifications are based upon

the genetic similarity between individuals, and organisms are grouped according to their phylogenetic relationship.

2.4 BIODIVERSITY ON EARTH

The biodiversity of living-organism is evident at all levels of organization, from genes to ecosystem. But the term usually refers to the diversity of species on earth. Since life began 3.5 billion years ago, there are as many as 500 million myriad of species of plants, animals and micro-organism inhabited this earth. In the mid-18th century, Carl Linnaeus enumerated 9000 species of plants and animals. Since then over 1.7 million species have been described but still our ignorance in this area is vast, especially in tropical regions.

Table: 2.1 Estimated Numbers of Describes Species, and Possible Global Total

Domain	Eukaryote Kingdoms	No. of Described Species	Estimated Total
Arcahea		**175**	**?**
Bacteria		**10000**	**?**
Eukarya			
	Animalia		**1320000**
	Craniata(vertebrates),total	**52500**	**55000**
	Mammals	**4630**	
	Birds	**9750**	
	Reptiles	**8002**	
	Amphibians	**4950**	
	Fishes	**25000**	
	Mandibulata (insects and myriapods)	**963000**	**8000000**
	Chelicerata (arachnids, etc.	**75000**	**750000**
	Mollusca		**200000**
	Crustacea	**70000**	**150000**
	Nematoda	**40000**	**400000**
		25000	
	Fungi	**72000**	**1500000**
	Plantae	**270000**	**320000**
	Protoctista	**80000**	**600000**
Total		**1750000**	**14000000**

Source: World Atlas of Biodiversity, UNEP-WCMC, 2002.

Nobody really knows how many different species live on earth, but there number is estimated at somewhere between 7 to 100 million (Leveque and Mounolou, 2004: 22). There may be anything between 5 to 50 million species of plants and animals (Chauhan, 2001:19). So far only about 1.5 million species have been identified and described and over millions still remain unclassified. Out of the total known species the majority about 259,000 are green plants and about 41, 0000 vertebrates. The remainder are invertebrates, fungi and micro-organism (*ibid*).

2.5 DISTRIBUTION OF BIODIVERSITY

Biological diversity is not evenly distributed over the surface of the planet. Naturalists have attempted to determine large-scale patterns in the spatial distribution of biodiversity. Large biomes have been identified by assessing relationship between climate and vegetation. Alternatively, delineation of bio geographic areas has been done by assessing the degree of relationship between flora and fauna.

However, the most important identifiable areas of biodiversity are those ecosystems and habitats that contain many species and those that contain species that occurs nowhere else (i.e. endemic species), as well as ecosystems and habitats that are taken to be representative samples of major or rare ecosystems or which contain large number of genetic lineages of economic values (World Conservation Monitoring Centre, WCMC).

Species richness and diversity increase from poles towards the equator i.e. from the temperate towards the tropical zones of the earth. There is an intimate relationship of 'latitude' and 'altitude' on distribution of plants and animal species and genetic diversity among them. At lower altitude and latitude the conditions are warmer and tropical and hence vegetation is richer in biodiversity. There is a shift to cooler temperate condition with poor biodiversity with Increasing latitude and altitude. Thus, species diversity reaches a maximum in tropical forests and the coral reefs.

2.5.1 Distribution of Biodiversity at Country Level

The major holders of the global biodiversity are the tropical countries which have large areas of well-preserved equatorial and tropical forest. Tropical forests are highly rich in biodiversity and cover 2,998 million hectares of the earth's surface. They are very unevenly distributed among the developing countries. Just three developing countries- brazil, Indonesia, Zaire holds 48 percent or nearly half of the world's tropical closed forests rich in biodiversity (Chauhan, 2001: 24). Peru, Angola, Bolivia and India each have about 3 percent of world's tropical closed forests. The rest is distributed among 120 other developing countries and colonies of the world. Hence developing countries have nearly all the world's tropical biodiversity. Together they contain nearly half of the world's species of plants and animals (*ibid*).

World Conservation and Monitoring Centre (WCMC) on the basis of its available data on species richness and endemism provides list of 50 countries with the highest estimated totals of plant species (Table 2.2), bird species (Table 2.3), and mammal species (Table 2.4).

Table: 2.2 Estimated Number of Plant Species in the 50 Most Plant Rich Countries (data missing for Cambodia, Laos and Vietnam, which would otherwise be expected to be included).

Serial No.	Country	Species	Serial	Country	Species
1	Brazil	55,000	26	Philippines	8,000
2	Colombia	50,000	27	Guatemala	8,000
3	China	30,000	28	Paraguay	7,500
4	Mexico	25,000	29	Myanmar	7,000
5	South Africa	23,000	30	Nicaragua	7,000
6	Indonesia	22,500	31	Nepal	6,500
7	[ex-USSR]	22,000	32	Gabon	6,500
8	Venezuela	20,000	33	Ethiopia	6,500
9	United States	19,000	34	Iran	6,500
10	Ecuador	18,250	35	Kenya	6,000
11	Peru	17,000	36	Guyana	6,000
12	Bolivia	16,500	37	Cuba	5,996
13	Australia	15,500	38	Mozambique	5,500
14	India	15,000	39	Italy	5,463
15	Malaysia	15,000	40	Bhutan	5,446
16	Thailand	12,000	41	[ex-Yugoslavia]	5,250

Contd...

17	Zaire	11,000	42	Chile	5,100
18	Costa Rica	11,000	43	Angola	5,000
19	Papua New Guinea	10,000	44	French Guiana	5,000
20	Tanzania	10,000	45	Honduras	5,000
21	Madagascar	9,000	46	Uganda	5,000
22	Panama	9,000	47	Dom. Republic	5,000
23	Argentina	9,000	48	Bangladesh	5,000
24	Turkey	8,500	49	Pakistan	4,917
25	Cameroon	8,000	50	Spain	4,916

Source: WCMC Biodiversity Series No. 3, 1994

Table 2.2 shows that majority of the plant species occur in tropical countries. Among the top 50 countries that holds the estimated plant species almost all are developing countries except United States, ex-USSR, Australia and Argentina. Similarly the table 2.3 shows the dominance of developing countries in the bird species found all over the world. Here the developing countries prominence is obvious with only two developed countries viz. US and Australia appearing in the list of the top 50 holders of bird species. All the top 20 countries in terms of bird species are developing countries with US at 30th position and Australia far behind the US.

Table: 2.3 Estimated Number of Bird Species in the 50 Most Species-Rich Countries (bird data are not completely consistent as for some countries some non-resident species have been included).

Serial no.	Country	Species	Serial no.	Country	Species
1	Colombia	1721	26	Côte d'Ivoire	683
2	Peru	1705	27	Rwanda	669
3	Brazil	1573	28	Central African Rep.	668
4	Indonesia	1519	29	Mozambique	666
5	Ecuador	1435	30	United States	650
6	Venezuela	1308	31	Paraguay	650
7	Bolivia	1257	32	Mali	647
8	China	1100	33	Namibia	640
9	Zaire	1086	34	Somalia	639
10	Kenya	1067	35	Viet Nam	638
11	Tanzania	1016	36	Zimbabwe	635
12	Uganda	989	37	Burundi	633
13	India	969	38	Malawi	630
14	Mexico	961	39	Benin	630
15	Sudan	938	40	Togo	630
16	Panama	922	41	Nepal	629

Contd.....

17	Angola	872	42	Senegal	625
18	Myanmar	867	43	Gabon	617
19	Cameroon	848	44	Thailand	616
20	Costa Rica	848	45	Sierra Leone	614
21	Ethiopia	836	46	Liberia	590
22	Nigeria	831	47	Papua New Guinea	578
23	South Africa	774	48	Australia	571
24	Zambia	732	49	Botswana	569
25	Ghana	721	50	Guinea	529

Source: WCMC Biodiversity Series No. 3, 1994

Table 2.4 which provide the list of the 50 richest countries in terms of the mammal species also substantiate the fact that the majority of the world's biodiversity occur in the tropical developing countries. Among the top 50 countries harbouring the mammal species almost all are located within the tropical region and are in their developing stage.

Table: 2.4 Estimated Number of Mammal Species in the 50 Most Species-Rich Countries

Serial no.	Country	Species	Serial no.	Country	Species
1	Indonesia	515	26	Ethiopia	255
2	Mexico	439	27	Thailand	251
3	Zaire	415	28	South Africa	247
4	China	394	29	Papua New Guinea	242
5	Brazil	394	30	Côte d'Ivoire	230
6	Colombia	359	31	Zambia	229
7	United States	346	32	Ghana	222
8	Peru	344	33	Panama	218
9	India	317	34	Central African Rep.	209
10	Uganda	315	35	Costa Rica	205
11	Kenya	309	36	Congo	200
12	Tanzania	306	37	Togo	196
13	Myanmar	300	38	Zimbabwe	196
14	Cameroon	297	39	Malawi	195
15	Venezuela	288	40	Liberia	193
16	Australia	282	41	Guyana	193
17	Bolivia	280	42	Guinea	190
18	[ex-USSR]	276	43	Gabon	190
19	Angola	276	44	Benin	188
20	Nigeria	274	45	Suriname	187

Contd.....

21	**Viet Nam**	**273**	**46**	**Equatorial Guinea**	**184**
22	**Ecuador**	**271**	**47**	**Mozambique**	**179**
23	**Sudan**	**267**	**48**	**Honduras**	**173**
24	**Malaysia**	**264**	**49**	**Laos**	**173**
25	**Argentina**	**258**	**50**	**Somalia**	**171**

Source: WCMC Biodiversity Series No. 3, 1994

Thus all the three tables prove the dominance of developing countries in terms of biodiversity. Most of the tropical countries, presently at their initial stage of economic development have well preserved their rich biodiversity. On the other hand, the developed countries have failed to protect their biodiversity while going through the process of economic development.

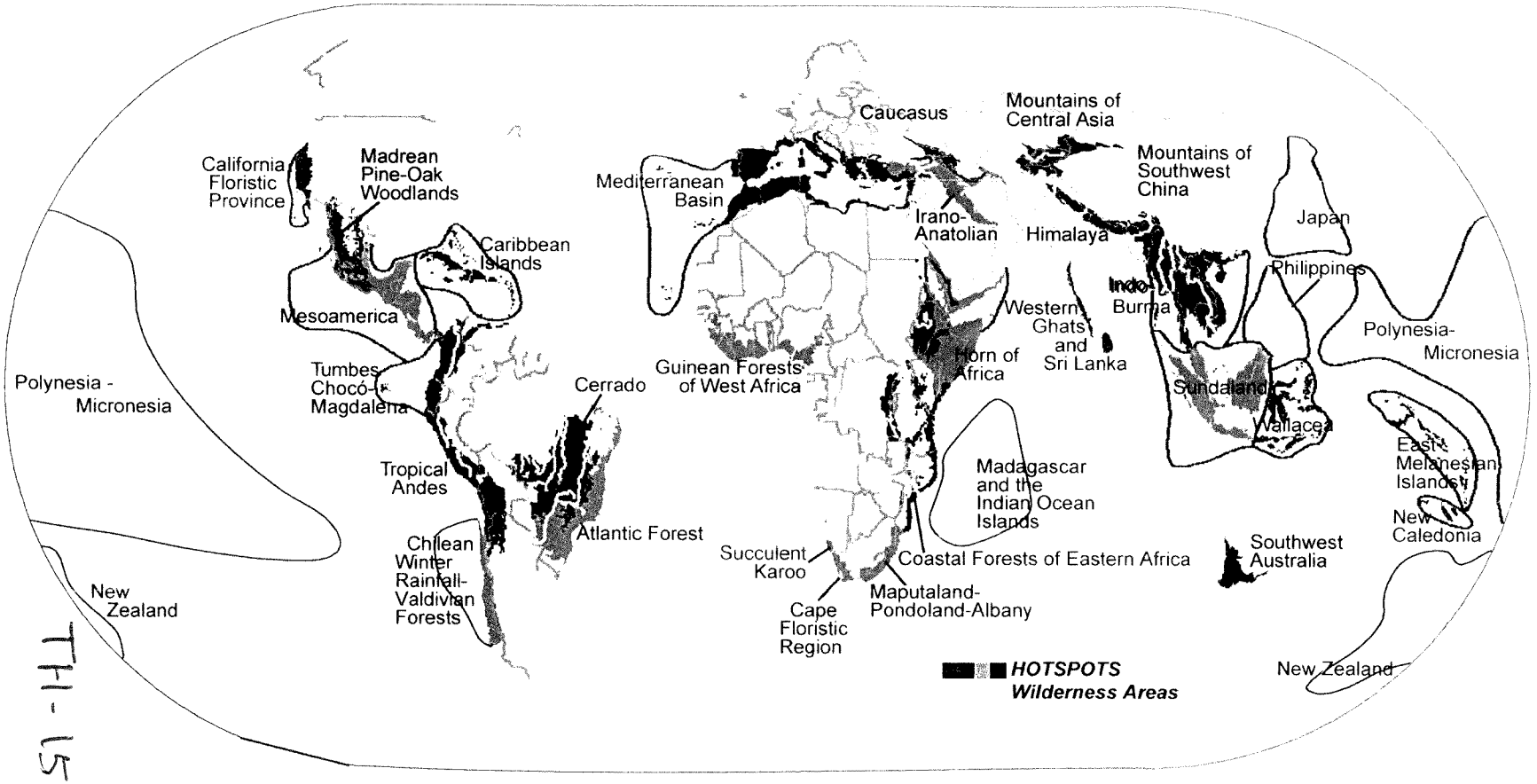
Further, World Conservation and Monitoring Centre (WCMC) suggest 50 countries or territories possessing maximum species richness and endemism.

Group 1 (the 25 most biodiverse countries): Argentina, Australia, Bolivia, Brazil, Cameroon, China, Colombia, Costa Rica, Ecuador, Ethiopia, India, Indonesia, Madagascar, Malaysia, México, Papua New Guinea, Peru, the Philippines, South Africa, Tanzania, the USA, [ex-USSR], Venezuela, Viet Nam and Zaire; and

Group 2 (the 25 next most biodiverse countries): Angola, Botswana, Cambodia, Central African Republic, Chile, Congo, Côte d'Ivoire, Cuba, Gabon, Ghana, Guatemala, Guyana, Iran, Kenya, Laos, Myanmar, Nigeria, Panama, Paraguay, Sudan, Suriname, Thailand, Turkey, Uganda and Zambia

Another group of countries which comprises of 20 islands or group of islands having fewer total species, but with a large proportion of native species that occur nowhere else are as follows;

Comoros, Dominican Republic, Federated States of Micronesia, Fiji, French Polynesia, Haiti, Jamaica, Japan, Mauritius, New Caledonia, New Zealand, Palau, Puerto Rico, São Tomé and Príncipe, Seychelles, Solomon Islands, Sri Lanka, Taiwan, Vanuatu and Western Samoa.



BIODIVERSITY HOTSPOTS OF THE WORLD

Source: Conservation International (http://www.conservation.org/explore/priority_areas/hotspots/pages/hotspots_mains.as_

Thus it is found that more than 60 countries out of total 70 countries in these three groups are developing countries which suggest the biodiversity richness of developing countries (WCMC).

Apart from assessment of biodiversity at national scale biodiversity is also assessed in terms of hotspots[1], based principally on their high plant endemism and significant human impact. A seminal paper by Norman Myers in 1988 first identified ten tropical forest "hotspots" characterized both by exceptional levels of plant endemism and by serious levels of habitat loss. In 1990 Myers added a further eight hotspots which include four Mediterranean-type ecosystems. Further in 1999 analysis, published in the book, "Hotspots: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregion", and a year later in the scientific journal Nature 25 biodiversity hotspots were identified (Myers, *et al.* 2000).

Recently conservation international, an organisation working in field of biodiversity conservation following Myers hotspots definition identified 34 hotspots, which contain 50 percent of the total endemic plant species, and 42 percent of total endemic terrestrial vertebrate species accounting for 77 percent of the world's total terrestrial vertebrate species.

Thus it could be said that this 34 hotspots contain extremely high amount of biodiversity. The importance these hotspots increase further from the fact that they occupy only 2.3% of the world's total land surface. However these 34 hotspots once covered 15.7% of the world's total land surface but have now lost about 86% of its original habitat. Thus these biodiversity rich hotspots need large scale conservation efforts.

But hotspots are not the only system devised for assessing global biodiversity rich areas and conservation priorities. Birdlife international, for instances, has identified 218 "Endemic Bird Areas" (EBAs) each of which hold two or more bird species found nowhere else.The world wild life fund has devised a system called the

[1] Hotspots are those locations which hold at least 1,500 endemic plant species and have lost at least 70% of its original habitat extent.

- Tropical & Subtropical Moist Broadleaf Forests
- Tropical & Subtropical Dry Broadleaf Forests
- Tropical & Subtropical Coniferous Forests
- Temperate Broadleaf & Mixed Forests
- Temperate Conifer Forests
- Boreal Forests/Taiga
- Tropical & Subtropical Grasslands, Savannas & Shrublands
- Temperate Grasslands, Savannas & Shrublands
- Flooded Grasslands & Savannas
- Montane Grasslands & Shrublands
- Tundra
- Mediterranean Forests, Woodlands & Scrub
- Deserts & Xeric Shrublands
- Mangroves
- Freshwater
- Marine

Source: World Wildlife Fund, 2001

"Global 200 Ecoregions", the aim of which is to select priority Ecoregions for conservation within each of 14 terrestrial, 3 freshwater and 4 marine habitat types.

They are chosen on the basis of their species richness, endemism, taxonomic uniqueness, unusual ecological or evolutionary phenomena, and global rarity. About 60% of global 200 terrestrial Ecoregions and 78% of EBAs overlap with hotspots. (Conservation International, CI)

2.6 GEOPOLITICS OF BIODIVERSITY RELATED PATENTS

2.6.1 Geopolitics: Evolution and Historical Development

Geopolitics is a product of its times and its definitions has evolved accordingly (Cohen 2003: 11). Rudolf Kjellen, who coined the term in 1899, described geopolitics as "the theory of the state as a geographical organism or phenomenon in space. Geopolitics is one of the fields of study in political geography which is concerned basically with the application of geographic information and geographic perspective to the development of state's foreign policies (Glassner and Blij 1980). Geopolitics developed towards the end of nineteenth century mainly because of the new development that took place in the science and technology provided people with a broader view of the world. The renewed attention being paid to the global scale has made the study of geopolitics interesting to the political geographers. Heffernan (1998) defines Geopolitics as a branch of political geography which argues that understanding the dynamics of space is essential for proper understanding of international relations. Today geopolitics is an important and long established area of geographical inquiry, which regards spatial relationship to be of central importance in the constitution of international politics.

Geopolitics is characterized with great dynamism which is linked with continuous technological developments taking place in various fields. A State's existing geopolitics outlook will be rendered obsolete with each marked technological developing in various fields. Mahan postulated geopolitics in an era of naval supremacy; later, Mackinder's geopolitics assessed the growing importance of land

force and heartland as vital decisive military factors due to technological development; Seversky developed geopolitics realising the predominance of air forces in power struggle.

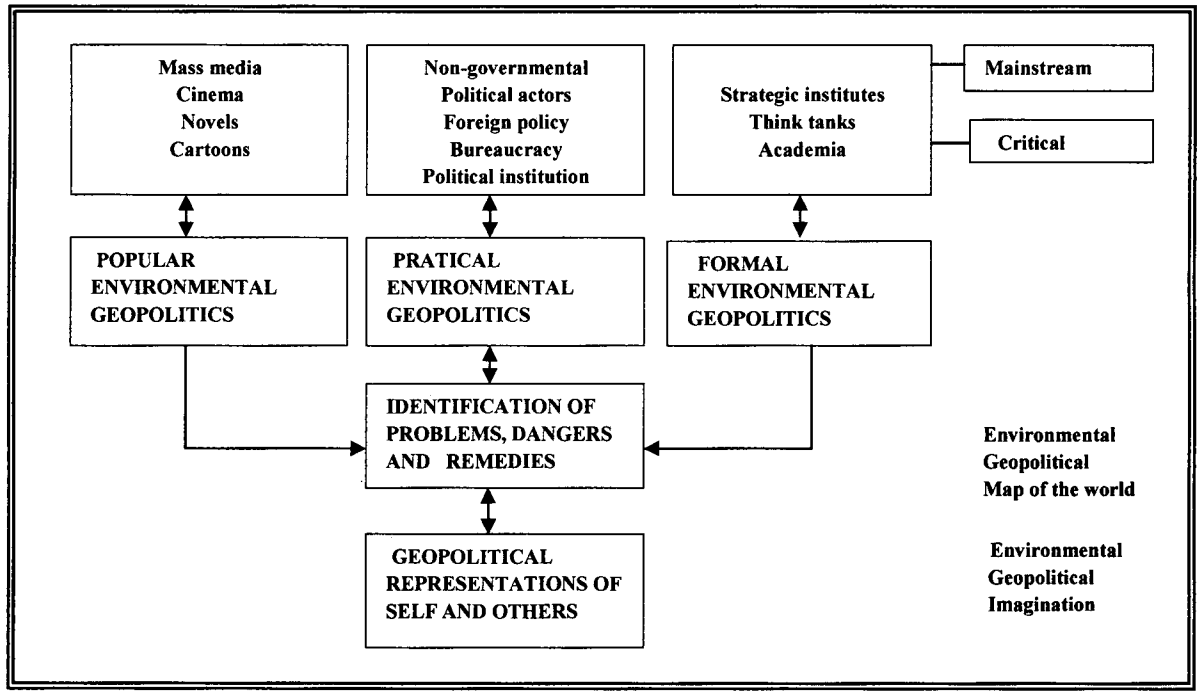
Thus geopolitics discourses are multiple and contingent. Since the term was coined by Swedish political scientist Rudolph Kjellen in 1899, geopolitics has been reworked in its various historical-geographical contexts of knowledge and practice. A century ago, the term was related with the imperialist's power politics of countries such as Germany and Great Britain. The geopolitical discourse was further developed by key intellectual such as Karl Haushofer, Halford Mackinder and Alfred Mahan whose imperialist geopolitical imagination focussed on controlling, containing or limiting access to what were seen as strategically important spaces(land, sea or resources). Then, after the Second World War, the Cold War geopolitics involving ideologically conflicting block emerged. However the imperialist and geopolitics shared the same modern world view which saw interstate relation as a contest between sovereign entities whose power rested on control of resources, land or sea (Castree, 2003: 426).

2.6.2 Geopolitics in Post-Cold War Period

But after the end of cold war and increasing globalisation of environmental problems – along with the globalisation production, trade and telecommunication- the modern geopolitics imagination has been brought into a state of crisis (O' Tuathail 1998). The functioning of globalisation process in relation to the environment has posed a major challenge to modern geopolitical discourses and practices. Castree (2003) discusses few of the effects of globalisation on modern geopolitical discourse such as: [1] erosion of the national boundaries; [2] it compelled states to cede some of their sovereignty to trans-national quasi-governmental actors; [3] led states to participate in a large number of environmental agreements and actions; [4] increased importance of certain local events and decisions at global level; and [5] brought non-state actors in world politics, such as the major environmental NGOs, transnational companies.

Thus in the recent years with the increase in the globalisation process, deterioration of environment, commodification of biodiversity , and emergence of new geopolitical actors like MNCs, NGOs, civil society, research institutions, traditional communities etc, the geopolitical discourse has expanded (see figure: 2.1).

Figure: 2.1 A Framework for Analysis of Environmental Geopolitics as Suggested by Castree, N. (2003)



The emergence of the new geopolitical order in the Post-Cold War World, where the ecological interdependence of the state is more obvious and acute than at any other time in modern history has been termed as environmental geopolitics. Several politicians, diplomats and strategic analysts relate the emergence of this new geopolitical order with the convening of United Nations "Earth Summit" in 1992 at Rio de Janeiro. However, in another sense, global environmental geopolitics has a very long history. It stretches back to the period of European colonialism, when colonisers appropriated land, created large mines, turned forested lands into agricultural plantations, and transported plants and animals around the world (Juma 1989). This new order of environmental geopolitics shows the emergence of "Third World" which replaces the old global drama of Cold War involving two opposite

world- the West and the Communist Bloc. In this new geopolitical order, Governments of the "Third World" are only able to accomplish their goals in the environmental arena with the full or partial support of an array of the non-governmental actors (Castree 2003).

The present study which focus on the geopolitics surrounding biodiversity and patents in this globalised world have features similar to the new geopolitical order. Thus, the geopolitics surrounding the whole debate related to biodiversity and patents particularly the phenomena of biopiracy can certainly be considered as a part of environmental geopolitics discourse and practice.

2.6.3 Biodiversity and Patents

In recent years there has been increasing public interest in the subject of Intellectual Property Rights (IPRs) particularly patent and its relationship with sustainable development, including the environment and human development. The issue of granting of patents which are related to biological or genetic resources has been the subject of rather intense debate all over the world. The issue of biodiversity and patents is geopolitically highly significant mainly because of the asymmetric distribution pattern of biological and genetic resources and of patents. As noted before, the majority of biodiversity is found in developing countries. On the other hand, developed countries hold the major share of patents because of their high technology know-how and capabilities in research and development. Thus this unequal distribution of biodiversity and technologically capabilities between developed and developing countries has led to an interdependent relationship between these two groups of countries.

Also this relationship has developed not only between developed and developing countries but also between MNCs, research institutions (majority of originate in developed countries) on the one hand, and traditional communities mainly residing in developing nations, on the other hand. The modern technology to manipulate genetic material belongs in great part of the multinational corporations (MNCs) and research institutions in the developed world. However, the raw materials

for this MNCs and research institutions still come from biological resources which are mainly held by the developing countries.

Traditionally, there has been open access to the bulk of world's biodiversity, which is mainly harboured by developing countries. As a result, the common-pool biological and genetic resources have been used freely by researchers of developed countries, while the products which are derived from these resources have been protected through the mechanism of the patents. Thus these corporations and institutions in developed countries have sometimes accrued great profits from IPRs over derivatives of resources obtained from developed countries. However the benefits accrued by this companies and institutions have not been adequately shared with developing countries and indigenous people (Davalos et *al.* 2003).

Thus the geopolitics of biodiversity related patents also involves non-state actors like MNCs, NGOs, civil society groups, research institutions, and traditional people besides the states. The major issue related to this debate is that the developed nations, and their business corporations utilise the biological resources and the traditional knowledge associated to it, without proper sharing of the benefits with the developing nations and the traditional communities residing there. They are also accused by developing nations for misappropriating the traditional knowledge acquired by the indigenous people over the years.

2.6.4 North-South Debate Associated with Biodiversity and Patents

Biological and genetic resources have acquired great significance in recent years mainly because of the technological advancement in the field of pharmaceuticals, biotechnology and genetic engineering. Therefore, despite having general agreement over the importance of biodiversity conservation, significant differences have emerged between the North (developed nations) and the south (developing nations) over the utilisation of biodiversity and the sharing of benefits accruing from it. There are two major issues over which differences persists between developed and developing nations which are:

2.6.4.1 Differences over Access to and Control of Genetic Resources

North –South differences over the question of access to and control of genetic resources mainly concerned with the plant genetic resources. Traditionally there was a wide acceptance of the principle 'common heritage of mankind' under which biological resources of countries were freely accessed by foreign entities and no compensation was paid to them for this resources. However, towards the end of the 1970s, a general feeling of suspicion began to develop in the southern developing countries about the 'common heritage' principle (Chauhan 2001). Developing countries found themselves being robbed of their genetic resources by the North.

Debate over the Common Heritage Principle:

There are two important debates that have emerged between the North –South nations regarding the question of access to and control of plant genetic resources. The first debate is in relation to the fairness of a common heritage system that allowed research institutions from the developed countries to collect germplasm from the developing countries without providing them any compensation (Chauhan 2001). This concept of free access was increasingly questioned by developing countries. The developing countries as the major holder of biological and genetic resources rejected the concept of common heritage because they found it contradictory in the sense that though they provide free access to their biological resources but still they are made to pay high prices for products which are derived out of their biological and genetic resources. Therefore, the 1992 convention in Rio de Janeiro to protect the biodiversity dropped the term the common heritage of mankind. This convention was signed by 160 states and aims at the 'countries of origin' owning of rights of disposal of biodiversity (Davalos *et.al.* 2003). However, it regards the protection of biodiversity as the common concern of humankind. This convention talks about the right of the countries of origin to be rewarded for their biological resources and to be helped in the preservation of these resources.

Debate over the Role of International Research Institutions:

The nature and functioning of the International Research Institutes, Germ Plasm Banks, Botanical gardens etc, has also been a major part of the North-South

debate. They are seen as facilitating the technological development of developed nations at the expenses of developing nation's rich biodiversity. The understanding of the geopolitical nature of Botanical gardens and Germ Plasm banks provides the insights into the different ways by which the developed nations and MNCs control the world's biodiversity (RAFI 1996a). The biodiversity of the earth is controlled in two ways: insitu (protected Areas and as yet unprotected regions of great biodiversity) and exsitu (Botanical Gardens and Germ Plasm Banks). Eighty three percent of insitu biotic resources and the knowledge regarding these resources are located in the developing nations of southern hemisphere as opposed to only 17 percent in developed nations. On the other hand, 75 percent of ex-situ biodiversity is concentrated in the developed north and the rest in developing south (RAFI 1996a). Most of the material found in the north originated in the south. All the germplasm of the developing countries was virtually collected prior to the enforcement of the convention on biological diversity thereby all these resources are currently beyond the reach of the convention, as currently interpreted (*ibid*). With this ex-situ form of accumulation, developed nations are freed from physical, political and social limitations, as well as those related to national interests and intellectual property. This monopolized ex-situ accumulation of biological resources is considered socially predatory, economically unfair and ecologically suicidal (Delgado 2002). However the developed countries real control over the ex-situ resources is more than that shown by the share of north in ex-situ collections. For instance, the developed countries have only 22% of the Crop Gene Banks but still they have controls over 55% of all seed accessions and 62% of all crop species (RAFI 1996a).

Germ Plasm Banks (GBs)

The first germ plasm banks appeared within the US military apparatus, which boast the largest Armed Forces Institute of Pathology in the world (Delgado 2002). The germ plasm banks are internationally regulated by the Budapest Treaty which is administered by the World Intellectual Property Organization (WIPO). Since 1981 these banks have been concentrated in only 26 institutions in 15 countries, and have been officially recognized for the purpose of patent (*ibid*).

Geopolitically these GBs are of great significance as they hold large number of biological samples collected from around the world and the majority of the institutions conserving these resources are located in developed nations. The importance of GBs is realized from the fact that they currently contain over six million kind of samples, nearly 5, 00,000 of which are held in the Consultative Group of International Agricultural Research (CGIAR's) network of genetic banks.[2] Similarly, in 1992, the world's largest GB, the American Type Culture Collection (ATCC), located in Maryland, already stored 41 percent (17,724 deposits) of all microorganisms deposited, with the aim of processing patents (*ibid*).

Botanical Gardens (BGs)

Like the GBs most of the Botanical Gardens are also located in developed nations. Nearly three-quarters of the world's 1500 Botanical Gardens are located in developed nations which contain samples of most of the taxa from this type of gardens in developing nations. According to a study by the Secretary General of the international Association of Botanical Gardens, 120 Botanical Gardens in developed nations have collections of species cultivated for the production of food, fibres, oils, etc., while another 170 Gardens, also in developed nations, have collection of plants from developing nations (RAFI 1996b).

2.6.4.2 Debate on Intellectual Property Rights with Special Reference to Patents

The compelling forces of technological change and economic globalisation have made the issue of IPR an important subject of North-South debate. IPRs and their relation to international trade, investment, technology transfer, innovation growth and biodiversity has become a critically important issue that remains intensely controversial.

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[2] In 1974 a world network of germ plasm banks was set up by the International Board for Plant Genetic Resources (IPGRI), which has been promoting this idea since the Green Revolution and continues to this day, with help from the World Bank and under the supervision of the United States. IPGRI comprises 16 research centres, university research programs and governmental storage units as well as the CGIAR (Delgado 2002).

Since 1990's, IPRs particularly the patents has become important determining factor in north-south relationship. Today with increased globalisation process, the issues of production, protection and exploitation of IPRs particularly the patents are becoming continuously significant. The problem of patents in combination with biological resources is complex involving many aspects of North-South debate. Chauhan (2001) outlines four aspects of North-South differences over patent protections which are as follows:

(a) Differences over the strengthening of patent protection by the developed countries;

(b) Difference over the relative recognition of formal and informal innovation;

(c) Differences over the expansion of the scope of patent protection by the developed countries; and

(d) Differences over the developed nations efforts to globally harmonise the patents and other intellectual property rights.

(a) Difference over the Strengthening of Patent Protection by the Developed Countries:

There are wide variations found in relation to the theoretical positions on patent as well as the practical prospects for actually protecting anything in particular areas or regions. There are sharp differences between the developed and developing countries over the strengthening of IPR particularly the patents. The developed countries argue that strong protection of patent is essential to provide incentives for future innovations and to ensure that the companies and institution engaged in research receive adequate profits. Conversely, the developing countries support only very weak protection of intellectual property which is based upon modern western values and culture. It is also argued by developing countries that developed nation in the early stages of their development did not favour the IPRs but now when they have acquired enormous technological capabilities in various fields particularly in biotechnology and

pharmaceutical they are trying to enforce the IPRs (Correa 2000). These IPRs particularly the patents in their present form are said to favour the western developed nations and could block the development process of developing Third World nations.

Many arguments are provided by developed countries in support of IPRs or patents. The first major argument is that it enables people to realize their potential and thus is an expression of liberty. The second argument put forth for the protection of IPR is that people who work and make an effort have a right to the fruits of their labour. This argument was formalized by John Locke in his famed example of the hunter going into the forest to hunt a deer (Locke 1965). Locke's argument assumes plentiful natural resources as well as conditions of fair access. The third argument of western nations is based upon incentives to innovate. This argument is more utilitarian in nature and claims that strong protection of IPRs will lead to the most beneficial social consequences (Steidlmeier 1993).

However these arguments in support of intellectual property protection does not hold good for the patents protection of products derived from biological resources based on the traditional knowledge. The patents protection in relation to biodiversity would restrict the traditional communities which hold an extensive amount of knowledge evolved over the years from receiving the fruits of their labour. The traditional communities and the developing countries which are engaged in the preservation of the major part of the global biodiversity will not be able to realize its benefits. Thus it would also restrict their creative liberation of human potential.

The developing countries have used the same argument of liberty and self-actualization to oppose the IPRs. The Government of India (1989 p.1) makes the argument and provides that IPRs are necessarily relative:

"The essence of the intellectual property protection system is not to "liberalise", but to confer exclusive rights on their owners. Recognizing the extra-ordinary implication of the system, international convention on this subject incorporates, as a central philosophy, the freedom of the member states to attune their intellectual property protection system to their own needs and conditions".

India argues for the freedom of member states to set the fundamental conditions for intellectual property rights because it believes that any principles or standards which govern intellectual property should be true to the socio-economic, developmental, technological and public interest priorities and needs of developing countries. India's position finds great sympathy in developing countries on both developmental and moral (fairness) ground (Lepp, 1990). The developing nations argue that the fundamental right of social well-being should be given priority over the individual right on intellectual property. They argue for the people right to development to be given certain priority over private property claims.

The developing nations also argue that though people may have a right to the fruit of their labour but they also have a duty to reward society which practically made the very fruitlessness of labour possible (Steidlmeier 1993). The argument that IPRs provide incentive to innovate also does not hold good for strengthening of IPRs because of the unavailability of reliable empirical evidence in support of this argument (*ibid*). The greatest utilitarian benefits are seen in an intellectual property regime which makes arrangement for the development of entire population.

(b) Differences over Relative Recognition of Formal and Informal Innovations:

In the mid-1980s differences between the developed and developing nations over the relative recognition given to formal and informal innovation emerged. The right of traditional communities and farmers was considered as a part of the notion of information innovation and they began to be referred as 'informal innovators' in more generic terms. Southern nations have not accepted this arrangement and demands for the recognition and strengthening of rights of traditional communities and farmers. They objected to the continuous expansion of scope of formal patent rights on the one hand, and non recognition of informal innovation on the other (Shiva 2001; Chauhan 2001). They warned that these growing inequities in the relative recognition of formal and informal innovation will lead to a widening of the technological and economic gap between developed and developing nations.

(c) Worldwide Harmonisation of Intellectual Property Rights Particularly

Patents:

In the mid-1980s, developed countries having acquired advanced technologies particularly in biotechnology and pharmaceutical sector started making efforts for the harmonisation of the intellectual property protection. At this point of time, the intellectual property legislation of different states had wide variation. In general, the developing countries had weaker legislation than the developed countries.

The prime motivation for this harmonisation process came from the United States (Chauhan 2001). The worsening balance of trade being experienced by the United States prompted the examination of structural changes in its competitiveness. It was claimed that unfair trade practices in other countries, including barriers to imports and foreign investment and weak intellectual property protection, were restricting its trade. Therefore, United States began to press for stronger intellectual property protection in other countries, especially the developing countries.

Eventually the North's specific interest in the subject led the GATT Uruguay round of multilateral trade negotiations to establish a distinct negotiation group on Trade Related Aspects of Intellectual property Rights (TRIPs) (*ibid*). The establishment of TRIPs within the WTO in 1994 signified the extension worldwide of high standards of intellectual property protection. WTO provided the north with a useful multilateral forum for discussion on trade related issues, which could be used to pressure developing countries to strengthen their intellectual property legislation. TRIPs Agreement is seen as a powerful legally-binding agreement, because of the strong enforcement capability backing it. The member countries that do not fulfil their obligations can face trade sanction after being found guilty by the WTO panel (Khor 2004).

However the developing countries strongly objected to the pressure being put on them. Most of these countries suffer from economic, social and technological backwardness. Thus they felt that it is in their national interest to preserve their existing legislation. Most of them also found that the intellectual property protection system in its present form would work in the favour of developed countries who

would be the biggest beneficiaries of it. There is a concern that TRIPs and IPRs favour MNCs and developed countries having modern technology, partly due to the definition and criteria used for granting of patents. It is said that the strong IPRs regime being established through TRIPs will confer monopoly rights on private research institutes and powerful corporations. This would increase the already high concentration of economic and technological power in a few corporations, which would be able to impose higher prices for products protected by IPRs. Thus they would earn large profits at the expense of consumers as well as smaller producers, especially those in developing countries.

However the patent systems in its present form do not recognize the role traditional knowledge plays or the legitimate rights of farmers, indigenous peoples and local communities, all of whom have been major contributors to knowledge and innovations in the sustainable use of biological resources. Hence, for many developing countries, a strengthened system of intellectual property protection is not particularly attractive.

(d) Expansion of Patent Protection to Living Organism:

In the latter half of the 1980s the scope of the Intellectual property protection was extended in the field of biotechnology against which concerns were raised by the southern developing countries. The main reason for the anxiety of the southern nations was the extension of the patents to living organisms. Practically all the developing states opposed the industrialised developed nation's endorsement of the patenting of living organisms.

During negotiations in GATT, the United States (US) pressed for the extension of patent protection to all non-human living organisms, while the European Union (EU) left the decisions on the exclusion of animals and biological processes to individual countries. However, major developing countries including India, China, Argentina, Brazil, Nigeria and Tanzania, proposed the exclusions of materials existing in nature, along with plant and animal varieties, from patent protection (Chauhan 2001). Southern nations expressed great concerns over the extension of patents to life because it could restrict their access to Northern genetic resources and the products of

biotechnology and pharmaceuticals. They raised fears that with the patenting of genetic resources by the northern nations, they would not be able to strongly assert their sovereign right over their biological and genetic resources. This apprehension is raised because of the low technological capability of most of the Third World Nations which would make it impossible for them to establish the origin of specific genes that are expressed in an organism (Sinha 2007).

The patent granting in developed countries on ingredients and other substances of plants for functions and uses that have already been in the public domain and in practice for many years or generations has become a matter of grave concern for developing countries. The patenting of biological resources by MNC's and other institutes who wants to fulfil their private interests has the potential to restrict the ability of producers to use the processes and products relating to traditional knowledge. For example, a company that has been granted a patent over some specific use of a plant (for instance, to treat some disease) could attempt to prevent others from using the plant for the same purpose. Thus it could have adverse implication for traditional communities and could lead to an erosion of traditional knowledge. This could discourage the conservation and sustainable use of biodiversity.

The large-scale granting of patents for biological and genetic resources has lead to an even greater concentration of control over the world's food crops, such as maize, potato, soybean and wheat, in the hands of a few MNCs. The top five corporations involved in agricultural biotechnology (AstraZeneca, DuPont, Monsanto, Novartis, and Aventis) account for23 percent of the commercial seed market, 60 percent of the global pesticide market and almost 100 percent of the transgenic seed market (Action Aid 1999: 8).

Some countries have already established the patenting of genetically – modified organisms as well as some types of naturally occurring organisms and their parts, including genes of animals, plants and human beings. Many of these organisms originate in the developing world. Many critics of patenting of life forms have argued that it is inappropriate to use the patent system to reward scientific work in the field of biological resources and processes, as living organisms are qualitatively different

from non-living materials, and knowledge relating to biological processes and materials are not "inventions" (Khor 2004).

The patenting of life forms is linked to the phenomena of 'biopiracy". Patent claims over biodiversity and indigenous knowledge that are based on the innovation, creativity and genius of the people of the Third World are acts of 'biopiracy". Biopiracy refers to the use of intellectual property systems to legitimise the exclusive ownership and control over biological resources and biological products and processes that have been used over centuries in non-industrialised cultures (Shiva 2001).

2.7 GLOBAL STATUS AND TRENDS IN PATENT ACTIVITY FOR BIOLOGICAL AND GENETIC MATERIAL

The international expansion of patent protection system to biological and genetic materials mainly through the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs) took place in the 1990s. Since then, the internationalisation of patent protection in the realm of biodiversity has become a matter of intense debate at global level between the proponents of patents i.e. the developed nations and MNCs and opponents like developing nations, NGOs, Civil Society Organisations etc. However one major problem that is confronting the NGOs, civil society groups and policy makers in debates surrounding the patent protection is the lack of clear view of patent activity in relation to biological and genetic material (Oldham 2006). The quantitative analysis along with qualitative analysis is very much necessary to have better understanding of the intensity of implication of global patent activity in relation to biological and genetic material for society, biodiversity, science and policy.

For quantitative analysis, therefore, it is necessary to identify and isolate the main areas of the patent system that involve direct claims over biological and genetic materials. Oldham and Cutter (2006) identifies the main classifiers for genetic and biological material and sectors of patent activity (see Table 2.5). These classifiers under the International Patent Classification (IPC) are identified at class and sub-class level. The present study utilise this information about Classifiers at Class Level along

with the information provided in Appendix III to analyse the international status and trend in patent activity for biological and genetic material.

Table: 2.5 Main Classifiers for Biodiversity (class and sub-class level)

Classifiers (Sub-Class Level)	
Section A	**Human Necessities**
A01	***Agriculture***
A01H	**New plants or processes for obtaining them**
A01N	**Preservation of Bodies of Animals or Plants or Parts thereof; biocides**
A23	***Food or Foodstuffs***
A23L	**Foods, Foodstuffs, or Non-Alcoholic Beverages**
A61	***Medical or Veterinary Science; Hygiene***
A61K	**Preparations for Medical, Dental or Toilet Purposes**
Section B	**Transportation**
B82	***Nanotechnology***
B82B	**Nanostructures, Manufacture or treatment thereof**
Section C	**Chemistry; Metallurgy**
C07	***Organic Chemistry***
C07C	**Acyclic or Carbocyclic compounds**
C07D	**Heterocyclic compounds**
C07H	**Sugars; derivatives thereof; nucleosides, nucleotides; nucleic acids**
C07K	**Peptides**
C08	***Organic macromolecular compounds***
C08H	**Derivatives of natural macromolecular compounds**
C08L	**Compositions of macromolecular compounds**
C09	**Dyes (C09B); Paints (C09D); Natural Resins (C09F); Polishes (C09G); Adhesives (C09J); Other Applications (C09K)**
C11	***Animal or vegetable oils, fats, fatty substances or waxes***
C11B	**Producing, refining preserving fats, fatty substances, waxes**
C11C	**Fatty acids from fats, oils, waxes**
C11D	**Detergent compositions**
C12	***Biochemistry, Beer, Spirits, Wine, Vinegar, Microbiology, Enzymology etc.***
C12N	**Microorganisms or Enzymes; Compositions thereof...; Mutation or genetic engineering...**
C12P	**Fermentation or Enzyme using processes to synthesise chemical compounds**
C12Q	**Measuring or testing processes involving enzymes or microorganisms**
C12R	**Indexing classifier for microorganisms & biochemistry.**
C12S	**Processes using enzymes or microorganisms to liberate, separate or purify a compound, to treat textiles or clean solid surfaces**
C40	***Combinatorial Technology***
C40B	**Combinatorial Chemistry; Libraries**
G01	***Measuring; Testing***
G01N	**Investigating or analysing materials by determining their chemical or physical properties i.e. for biochemical electrodes**
G06	***Computing***
G06F	**Electrical Digital Data Processing**

Source: Oldham and Cutter 2006

2.7.1 Temporal Analysis of Patent Activity Trend for Biological and Genetic Material

The temporal analysis of patent activity in multiple areas of biology has been necessitated in context of the rise in the debate surrounding the issues of patents, biodiversity and traditional knowledge mainly between developed and developing countries. Recently the rise of bioprospecting has become a matter of controversy. The research and patent activity related to biological resources and traditional knowledge mainly done by developed nations and their business corporations, research institutions has led to allegations of biopiracy. This has raised many issues surrounding the human rights and ethical dimensions of patent activity in relation to the rights of indigenous peoples, the extraction and patenting of biological diversity from developing countries by individuals, universities and companies in developed countries, and the wider implications of intellectual property in relation to biological and genetic material. In this background it becomes important to analyse the global status and trend of patent activity in the realm of biology.

Table: 2.6 Patent Applications by Field of Technology: 2001-2005

Field of Technology / Country of Origin	2001	2002	2003	2004	2005	Annual Growth
COMPUTER TECHNOLOGY	1,17,545	1,11,675	1,16,656	132787	144594	5.3
MEASUREMENT	72,009	69,353	71,859	77,042	81,038	3.0
ANALYSIS OF BIOLOGICAL MATERIALS	18,518	17,878	16,861	15,789	14,416	-6.1
MEDICAL TECHNOLOGY	1,08,106	1,07,072	1,05,554	99,868	99,195	-2.1
ORGANIC FINE CHEMISTRY	64,170	64,026	59,622	59,835	63,317	-0.3
BIOTECHNOLOGY	45,573	47,576	44,632	41,993	40,861	-2.7
PHARMACEUTICALS	69,355	69,160	66,050	68,650	74,254	1.7
MACROMOLECULAR CHEMISTRY, POLYMERS	41,842	38,615	36,656	36,108	38,137	-2.3
FOOD CHEMISTRY	21,296	23,535	24,850	23,110	24,653	3.7
BASIC MATERIALS CHEMISTRY	51,058	48,418	46,106	45,508	48,040	-1.5
MICRO-STRUCTURAL AND NANO-TECHNOLOGY	3,425	2,770	2,994	2,967	3,357	-0.5

Note: The international Patent Classification (IPC) symbols assigned to the patent document are linked to the fields of technology by a concordance.

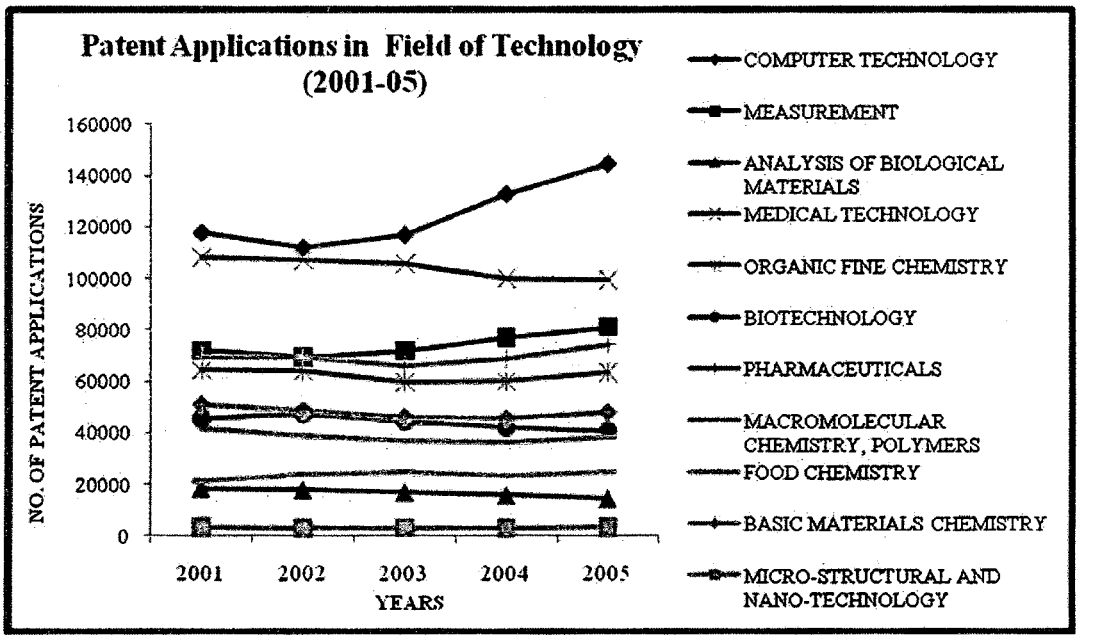
Source: WIPO Statistics Database, July 2008

The table 2.6 shows the trend in the filing of patent application in relation to the various field of technology associated with the biological and genetic resources from year 2001 to 2005. It shows that there has been negative growth over the years in most of the field of technology except computer technology, measurement, pharmaceuticals and food chemistry. Fields like analysis of biological materials, biotechnology have the highest negative growth. This negative trend in patent filing in areas related to biodiversity could be partly because of the debates and controversies associated with the issue surrounding patent and biodiversity. It has to be noted here that all those fields which have shown negative annual growth in patent filing are closely associated with biodiversity in terms of their high direct dependence on biological and genetic resources. Though the fields of technology showing positive growth in patent filing are also associated with biodiversity, however except pharmaceuticals and food chemistry these fields of technology are in their initial stage of development with relatively low dependence on biodiversity.

The fields of technology like measurement and computer technology are related to the emerging areas of genomics, proteomics and bioinformatics. Though their contribution in these areas related to biological and genetic resources is presently low, but they are becoming important over the years. The field of food chemistry is mainly associated with the areas of agriculture (a01), foodstuffs (a23) and biochemistry, beer spirits, wine, vinegar etc (c12). This table shows that patent activity is rapidly increasing in the field of agriculture and foodstuff. Pharmaceutical is another field which has shown growth in patent activity though there also have been debates associated with patent activity in this field.

The figure 2.2 also shows the trend in the international patent protection in the realm of biodiversity over the years 2001-05. It is obvious that the there has been sharp growth in patent activity in field of computer technology along with the field of pharmaceuticals, measurement and organic fine chemistry. The growth trend becomes more prominent from year 2003 onwards. The patent activities in other field of technology have either remained stable or have decreased.

Figure: 2.2 Patent Applications in Different Field of Technology (2001-05)

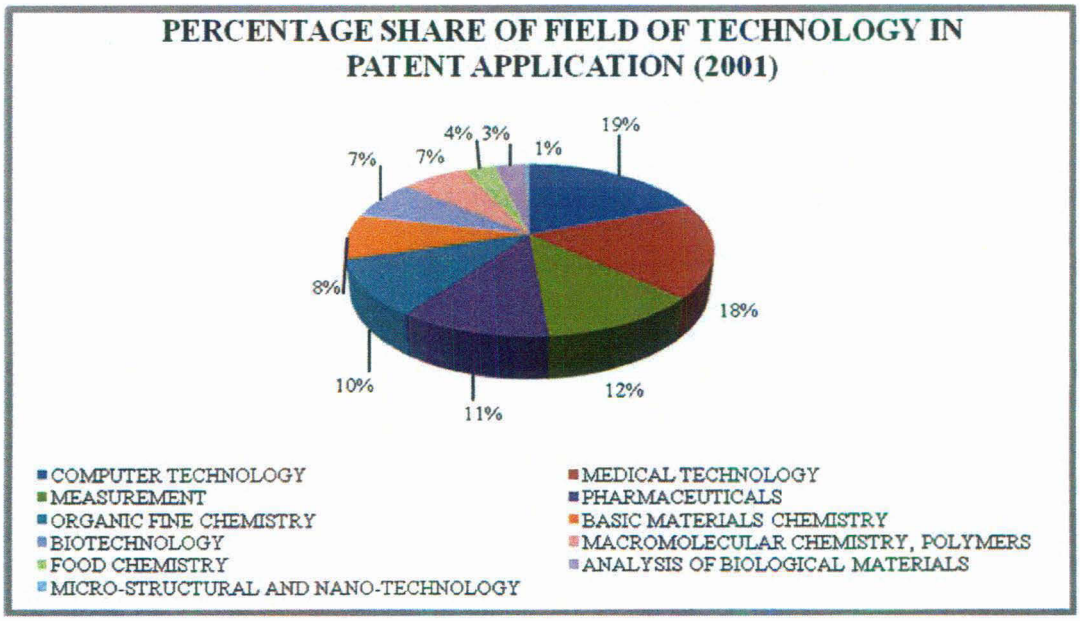


Source: WIPO Statistics Database, July 2008

The figure 2.3 & 2.4 shows the share of field of technology in total patent application filed in year 2001 and 2005. These diagrams shows that the field of computer technology has the major contribution in the filing of patents related to biodiversity and its share in total patent application has also increased during 2001 to 2005. However it is to be noted here that the actual patent activity related to biodiversity under the field of computer technology is low. It is because of the unavailability of data regarding the patent activity specifically related to biodiversity in the field of computer technology that the contribution of this area in biodiversity related patent activity has been exaggerated.

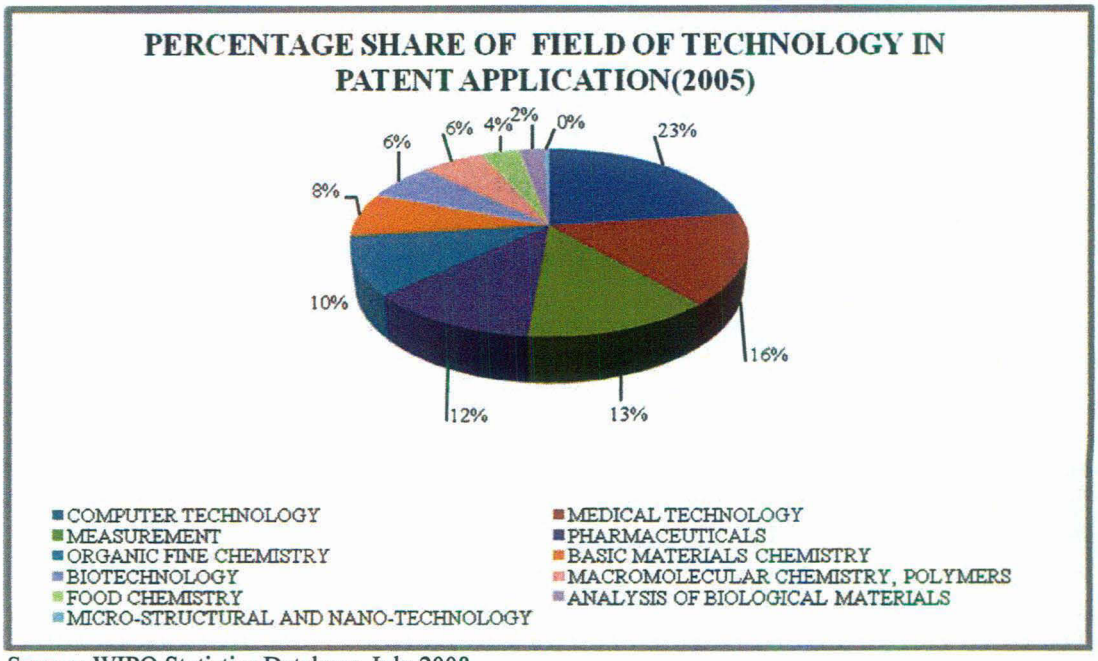
Fields of technology like pharmaceutical has shown some increase in their share of biodiversity related patent activity. However there has been decrease in the contribution of fields like biotechnology, medical technology, analysis of biological material etc. to the patent activity in the realm of biodiversity. These fields of technology along with pharmaceuticals deal directly with the biological and genetic resources.

Figure: 2.3 Percentage Share of Field of Technology in Total Patent Application (2001)



Source: WIPO Statistics Database, July 2008

Figure: 2.4 Percentage Share of Field of Technology in Total Patent Application (2005)



Source: WIPO Statistics Database, July 2008

2.7.2 Spatial Analysis of Patent Activity for Biological and Genetic Resources

The globalisation of patent system and its expansion to the biological and genetic resources over the years seems to facilitate and increase the intensity of patent activity in the realm of biodiversity. However, the developing countries which holds major part of the global biodiversity but are technologically backward have raised apprehensions and doubts regarding the benefits that can accrue to them through the increased patent activity related to biological and genetic resources. The doubts raised by the developing countries seems genuine for the reason that these countries lack the technological capability required for making effective utilisation of the present patent system. There are also apprehensions that harmonisation of high standards of patent protection through trips will result into the unequal distribution of patents because of the huge technological gap between developed and developing countries. In the background of this debate it becomes important to have an insight into the distribution of patent associated with biological and genetic resources among the developed and developing countries.

Table: 2.7 Total Patent Application Filing in the Area of Biodiversity by the Country of Origin (2001-05 Average)

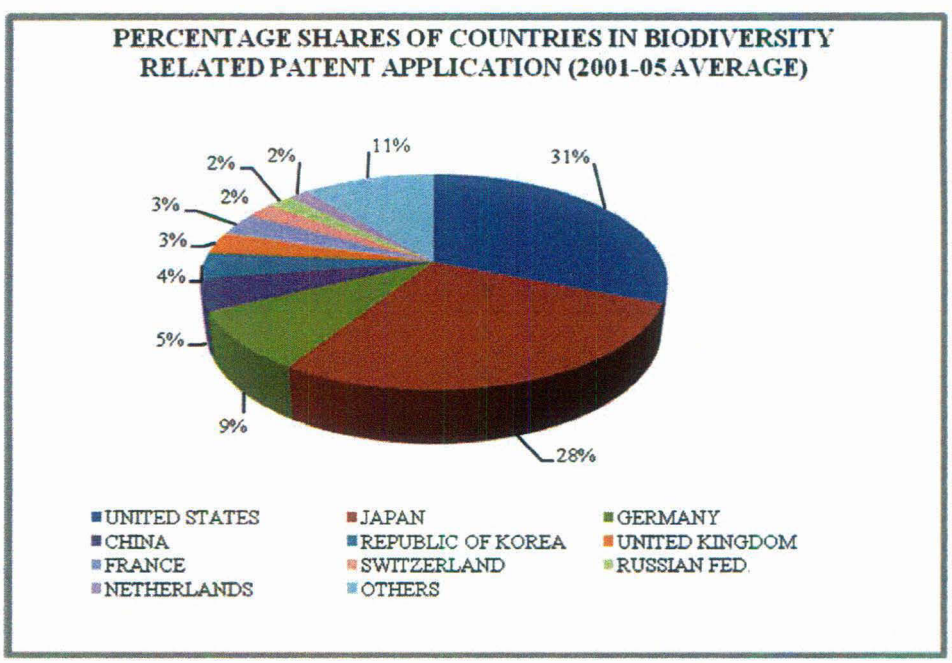
Field / Country of Origin	Biodiversity Related Patent Application	Percentage Shares in Biodiversity Related Patent Application
UNITED STATES	9,43,126	31.0
JAPAN	8,47,745	27.9
GERMANY	2,70,362	8.9
CHINA	1,43,493	4.7
REP. OF KOREA	1,15,306	3.8
UNITED KINGDOM	1,03,645	3.4
FRANCE	1,01,250	3.3
SWITZERLAND	71,709	2.4
RUSSIAN FED.	62,060	2.0
NETHERLANDS	49,253	1.6
OTHERS	3,32,385	10.9

Source: WIPO Statistics Database, July 2008

The table 2.7 shows the countries which have major share in the filing of patent application associated with biological and genetic resources. It shows that the developed countries have the major share in the patent applications filed in the areas associated with biodiversity. The first ten countries account for about 90 percent of the total patent applications filed in fields associated with biodiversity. United States and Japan which holds the first and second position shares almost 60 percent of the total patent application filed in the area of biodiversity. There is only one developing country i.e. China in the top ten applicants of patents related to biodiversity and holds only 4.7 percent of the total patent applications. It is clear from the above table that the technologically developed countries are the major applicants of patents related to biodiversity and therefore they are the major holders of patents related to biodiversity.

The figure 2.5 also shows the unequal distribution of patent application associated with biodiversity among the developed and developing countries.

Figure: 2.5 Percentage Share of Countries in Biodiversity Related Patent Application (2001-05 Average)

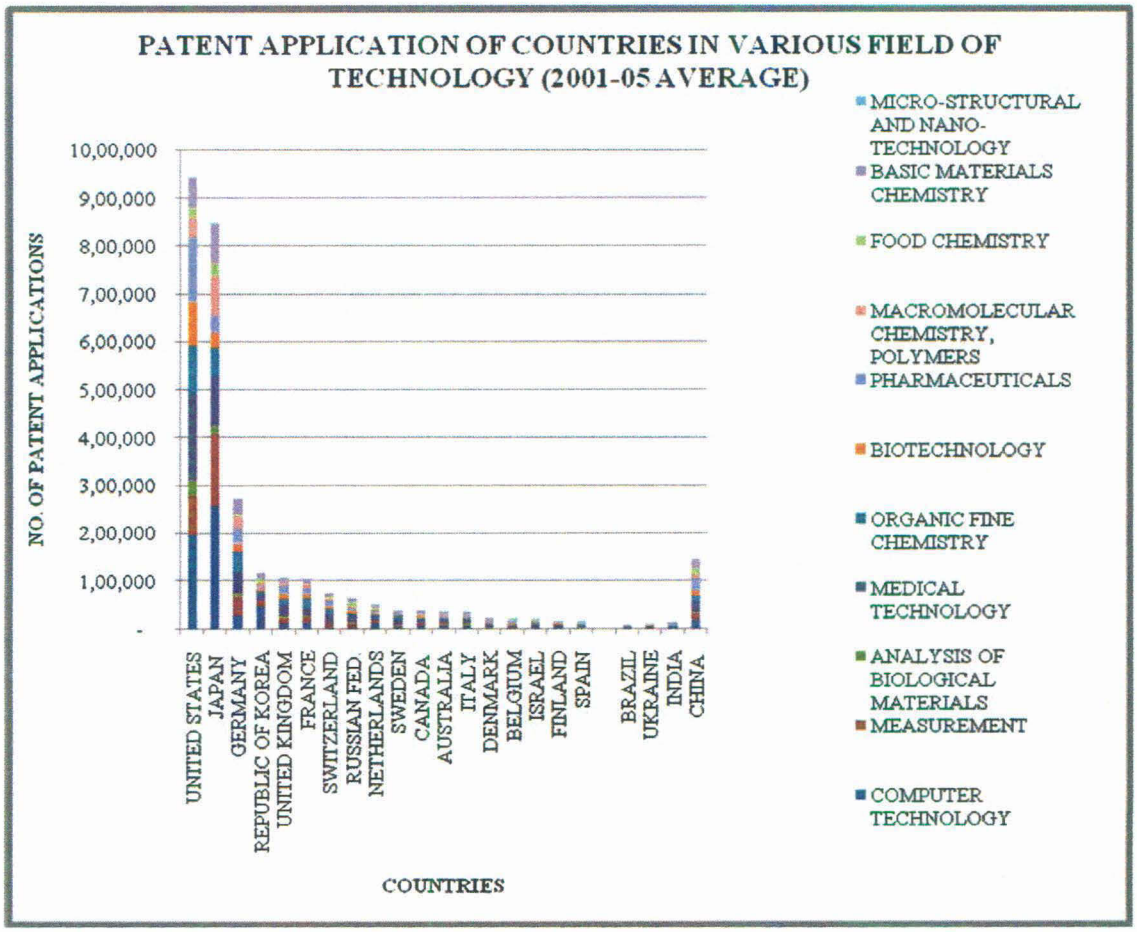


Source: WIPO Statistics Database, July 2008

2.7.2.1 Distribution of Patent Applications between Developed and Developing Countries

The analysis of the distribution pattern of patent applications in fields of technology associated with biodiversity between major developed and developing countries is necessary for understanding the functioning of the present patent system and its relationship with biodiversity and traditional knowledge. This could provide a better comprehension of the debates associated with patents in relation to biodiversity.

Figure: 2.6 Patent Applications of Countries in Different Field of Technology (2001-05 Average)



Source: WIPO Statistics Database, July 2008

The figure 2.6 shows the share of major developed and developing countries in the patent applications associated with different fields of technology related to biological and genetic resources. It shows the developed countries on the the left-hand side and developing countries on the right-hand side. Again it shows that the developed countries are the prominent applicants and holders of patents related to biodiversity with only china as the sole developing country having major share in the patent application related to biodiversity. However China, unlike US and Japan has prominence in patent application in few fields. US, Japan and Germany has dominance in almost all the biodiversity-related fields of technology.

Among the major developing countries China holds the majority of biodiversity related patent applications followed by India, Ukraine and Brazil. Thus almost all the developing countries except China are far backward in terms of the patent applications filed and patents holded in relation to biodiversity. The developing countries have failed to make effective utilisation of the patent system partly because of their socio-economic backwardness and lack of modern technologies. They have also not been able to utilise it properly because the present patent system is mainly based on ideas and values of developed countries. The structure and the content of the present patent system is the creation of developed north which does not recognise the traditional knowledge as innovation and prior art. It fails to prevent the appropriation of biological resources and associated knowledge through which products are derived and patented. Therefore it is required that efforts and measures are taken at national and international level to provide a better consensual patent system which could be beneficial to all the countries of the world.

Thus, finally, it could be said that it is of utmost importance to know the trend and pattern of patent activity in relation to biological and genetic resources both temporally and spatially to have better understanding of the geopolitics associated with patents and biodiversity.

2.8 PATENT ACTIVITY IN VARIOUS FIELD OF TECHNOLOGY

The table 2.8 shows the share of countries in fields of technology associated with the biological and genetic resources. It is seen that Japan and USA use holds more than 50 percent of the patent applications filed in almost all the field of technology. There is high level of concentration of the patent application filed in the field of computer technology, measurement and macromolecular chemistry & polymers with above 60 percent applications originating from USA and Japan. In biotechnology and pharmaceutical sectors which are highly crucial in terms of their implications on developing countries, also has major share of patent application held by Japan and USA, both together accounting for 56 and 49 percent respectively. China is the sole developing country among the top ten applicants of patents related to biodiversity. Though, China has relatively better position in the field of food chemistry, micro-structural and nano-technology, pharmaceuticals and biotechnology but still its share is very low in this field compared to USA and Japan.

2.8.1 Global Distribution of Patent Application in Biotechnology and Pharmaceuticals

Though the patent protection in relation to biodiversity as a whole has been a matter of debate among developed and developing countries, however the debate has been highly intense in relation to the field of biotechnology and pharmaceutical.This has been partly because of the huge implications it could have on socio-economic development particularly in relation to developing countries.

2.8.1 Distribution of Patent Applications In Biotechnology

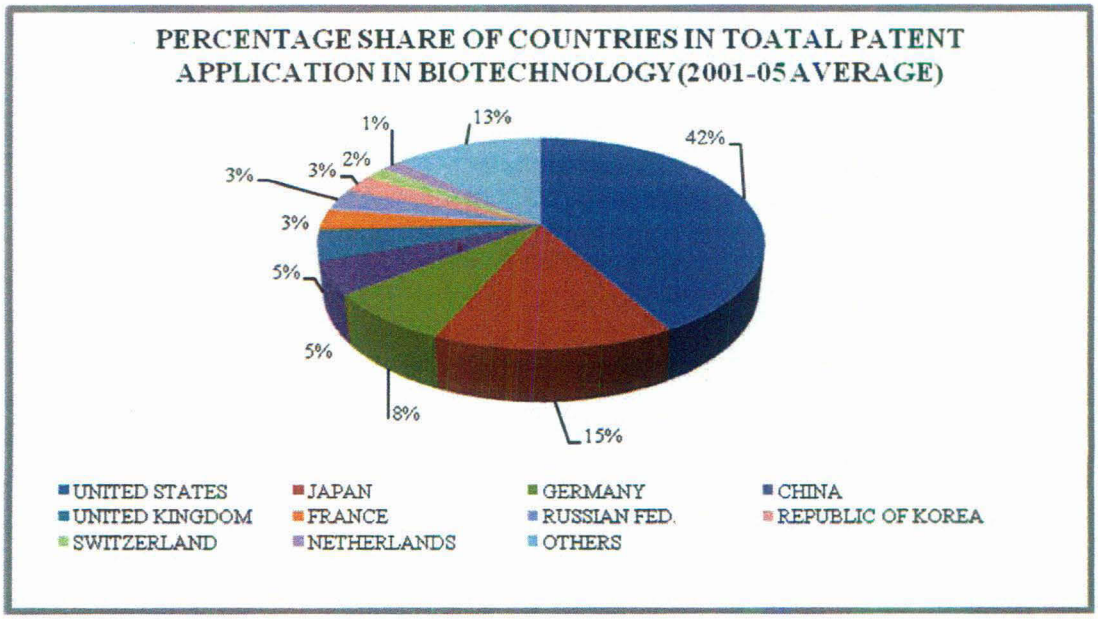
The figure 2.7 below shows that the patent application in relation to biotechnology are mainly filed by developed countries. United states and Japan are the top two major applicants of patents related to biotechnology and together accounts for 57 percent of the total patent applications filed.

Table: 2.8 Countries' Percentage Share of Total Patent Application in Field of Technology (2001-05 Average)

Field of Technology / Country of Origin	JAPAN	UNITED STATES	GERMANY	REP. OF KOREA	CHINA	FRANCE	U.K	RUSSIAN FED.	NETHER-LANDS	SWITZER-LAND	OTHERS
COMPUTER TECHNOLOGY	41.22	31.30	4.19	7.28	3.08	1.88	1.70	0.24	1.53	0.42	7.16
MEASUREMENT	40.68	22.11	10.72	3.55	3.41	2.76	2.70	2.40	1.26	1.82	8.58
ANALYSIS OF BIOLOGICAL MATERIALS	20.04	40.34	8.74	1.45	2.67	3.30	5.25	3.08	1.13	1.91	12.09
MEDICAL TECHNOLOGY	20.10	34.97	8.56	1.94	4.32	3.62	4.30	2.98	1.30	3.44	14.47
ORGANIC FINE CHEMISTRY	18.52	31.29	13.94	1.99	3.62	6.48	4.79	0.80	1.83	3.98	12.76
BIOTECHNOLOGY	14.69	41.81	7.95	2.74	5.06	3.30	4.59	3.21	1.58	2.04	13.02
PHARMACEUTICALS	10.51	38.76	8.89	1.52	7.69	4.13	5.12	1.79	1.35	3.80	16.43
MACROMOLECULAR CHEMISTRY, POLYMERS	42.63	21.91	12.69	3.74	3.69	3.35	1.47	0.75	1.63	1.79	6.35
FOOD CHEMISTRY	22.87	19.42	4.64	9.02	11.69	2.25	2.10	9.29	3.57	3.20	11.96
BASIC MATERIALS CHEMISTRY	32.83	23.98	12.46	3.73	6.55	2.68	3.33	2.23	2.52	2.27	7.41
MICRO-STRUCTURAL AND NANO-TECHNOLOGY	33.37	26.85	8.72	8.14	8.52	3.14	1.32	0.46	0.68	0.70	8.11

Source: WIPO Statistics Database, July 2008

Figure: 2.7 Percentage Shares of Countries in Total Patent Application in Biotechnology (2001-05 Average)



Source: WIPO Statistics Database, July 2008

China is the only developing country among the top ten applicants of patents in biotechnology and holds the 4th position among the top ten patent applicants in this field. It shares only 5 percent of total patent applications in this field compared to US and Japan which shares 42 percent and 15 percent respectively.

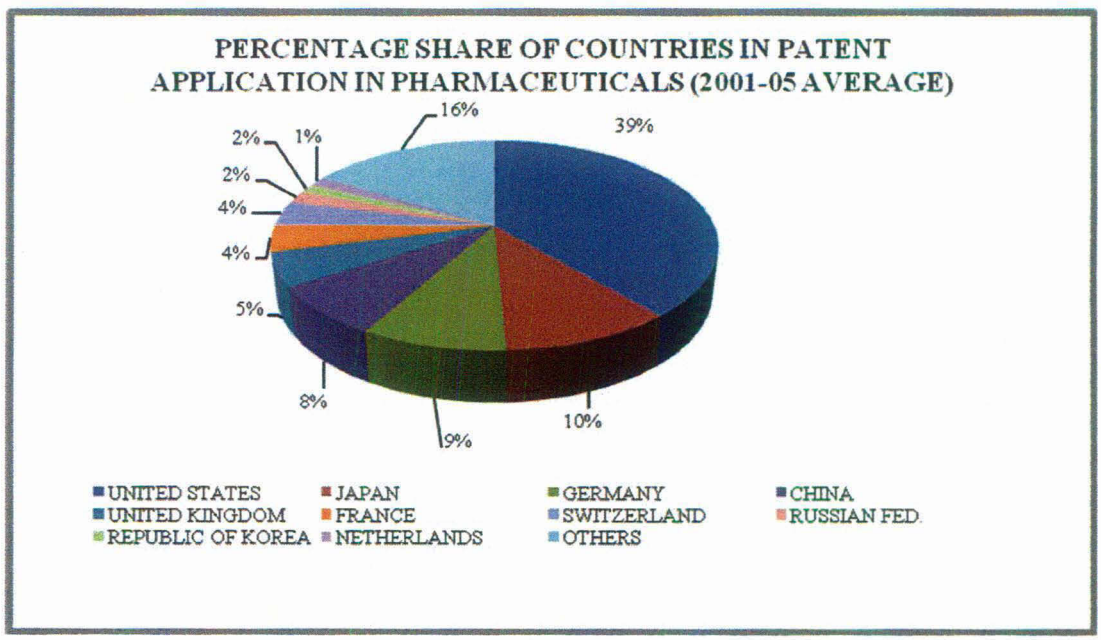
2.8.2 Distribution of Patent Applications in Pharmaceuticals

Patent protection in relation to pharmaceutical compounds is a focus of international policy debate in relation to bioprospecting, access to affordable medicines in developing countries, and the costs, orientation and performance of the pharmaceutical sector in developed countries (Oldham 2006 b).

In the context of this debate associated with pharmaceutical sector it becomes important to understand the distribution of patent activity in this field among the different countries. The figure 2.8 shows that the trends in pharmaceutical sector are

similar to that in the biotechnology sector with major share of patent application in the field of pharmaceutical holded by the few developed countries. United States, Japan and Germany are the top three patent applicants in this field which together accounts for about 58 percent of the patent application. Again, China is the only developing country in the top ten applicants and holds the 4th position. It shares about 8 percent of the patent applications in this field which is relatively better compared to its share in biotechnology but still not enough compared to the US, and Japan. However the concentration of the patent applications in the field of pharmaceutical among few developed countries is comparatively less than that in the field of biotechnology.

Figure: 2.8 Percentage Share of Countries in Total Patent Application in pharmaceuticals (2001-05 Average)



Source: WIPO Statistics Database, July 2008

Thus this concentration of patent application and patents in relation to biodiversity in the hands of few developed countries is a matter of grave concern as it could lead to enormous increase in the economic and political power of the developed

countries and their business corporations. This trend could have serious implications for the developing countries which holds majority of the humanity and biodiversity. This could also have serious consequences for the whole world as the globalisation has integrated the different parts together.

2.9 CONCLUSION

The study of the geopolitics of patents right in relation to the biological and genetic resources shows that the issues associated with it are becoming a major part of the north-south debate. This geopolitics is also a part of the new geopolitical order that emerged after the cold war which saw the emergence of the concept of 'third world' referring to the developing countries. The major issues associated with this geopolitics are regarding the expansion of the scope of patents, and its strengthening and harmonisation through various measures. This geopolitics has been made complex and interesting due to the intense globalisation process, involvement of non-state actors like NGOs, MNCs etc. The asymmetric distribution of biodiversity and technological capabilities are the basic reasons for the emergence of this geopolitics. The quantitative analysis of the distribution of the filing of patent application in various fields of technology associated with biodiversity provides an insight into the highly unequal distribution of patent application filed in the area of biodiversity between the developed and developing countries, thereby indicating the inequality in the possession of biodiversity related patents. It is found that developed countries are the major holders of biodiversity related patents. Thus, it could be said on the basis of this study that there is high inequality in the patent distribution between the developed and developing countries which has led to the rise of genuine concerns of developing countries about its implications on the global development in general and developing countries in particular which needs to be adequately addressed.

Chapter 3

Biodiversity Related Patent Policies of Developed Countries

Chapter 3

BIODIVERSITY RELATED PATENT POLICIES OF DEVELOPED COUNTRIES

3.1 INTRODUCTION

In this era of globalisation, the events which take place at local level have global implications and similarly the policies made at national level have its effects reflected beyond the national borders. Therefore, it becomes imperative to study the patent policies of developed countries in relation to the biodiversity, so as to understand the implications of these policies on the developing process of the Third World. In this globalisation period, the economically strong developed countries have dominated the international fora like World Bank, WTO, and IMF etc. and therefore the policies formulated at international level are influenced by the economic values of the developed countries and their business corporations. These views have also been expressed in relation to the TRIPs agreement which makes it necessary to study this Agreement particularly its patents provisions in relation to biodiversity. Thus this chapter analyses the TRIPs Agreement and the patent policies of major developed countries like US, EU and Japan in terms of its implication on biodiversity and associated knowledge originating from developing countries.

3.2 HISTORICAL DEVELOPMENT OF PATENT SYSTEM

3.2.1 Patent System before TRIPs

Patents constitute only one of the several forms of existing intellectual property rights like copyrights, industrial designs, trademarks, and geographical indications. They provide legal monopoly to inventors for a limited time and are intended to act as an incentive to innovation (Sreenivasan and Christie 2002). Patents have consistently been conceived as privileges granted by States over their several centuries of development (Cullet 2005: 16).

Modern day patents have their origins in medieval Europe, where rulers would issue letters granting monopolies over certain activities. The earliest known patent in England was granted by King Henry VI in 1449 to a Flemish man for a twenty-year monopoly over a method of making stained glass.[3] In 1610, James I revoked all patents following allegations about the abusing of royal monopolies in England and declared monopolies as illegal. However he made an exception for new inventions.[4] After fourteen years, the English Statute of Monopolies was passed which declared all monopolies as illegal except those granted for "new manufactures" that were not against law and national interest.[5] Later when England and other European nations expanded their empires, the patent system spread around the world.

Thus the modern patents system, which requires a working model or written description of an invention, dates back to the eighteenth century and was established first in Britain (1718) and then in the United States (1790), followed closely by France (Hall 2007). Later Japan passed its first patent act in 1871, and Germany passed a national patent act in 1877 (Johnston and Wasunna 2007).

During the colonial period, attempts were made to harmonise the western intellectual property protection system. One of the first major attempts in this direction was the Paris Convention of 1883 which was followed by the Berne Convention of 1887. Berne Convention for the Protection of Literary and Artistic works was ratified in the year 1887 by the four major colonial powers viz., France, Germany, UK and Spain. Each of these colonial powers included their territories, colonies and protectors in their accession to the convention (Drahos 2002). This led to

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[3] The U.K. Patent Office, *"History of Patents"*, Accessed 10 February, URL: http://www.ipo.gov.uk/types/patent/p-about/p-whatis/p-history.htm.

[4] *ibid*

[5] Statute of Monopolies 1624 (England), Section 6. Quoted in Josephine Johnston and Angela A. Wasunna, "Patents, Biomedical Research, and Treatments: Examining Concerns, Canvassing Solutions," Special Report, Hastings Center Report 37, no. 1 (2007), S1-S36.)

the international movement of IPRs from developed to developing countries. Thus colonialism had a major impact on the spread of intellectual property rights.

After World War II many developing countries that had been colonies became independent states. Some of them began to review the operation of the intellectual property systems that had been left to them by their colonisers. So, for example, after India's independence two expert committees conducted a review of the Indian patent system. They concluded that the Indian system had failed to stimulate inventions among Indians and to encourage the development and exploitation of new inventions (Vedaraman 1972: 43). Interestingly, India did not choose to abandon patent policy, but instead restructure it in a form which suits its own national circumstances. India was not the only country that began to reform its patent law. During the 1970s, the central and southern American countries viz. Argentina, Mexico, Brazil and the Andean Pact Countries passed laws that weakened patent rights in the pharmaceutical area (Drahos 2002).

Later during the 1960s and 1970s developing countries started to question the international standards of intellectual property that had emerged in previous decades. They sought the restructuring of the international patent regime. However they were unsuccessful in their attempts. But, as already been noted these developing countries formulate their patent laws in a manner that does not harm their interests. Therefore the patent legislations of most of these countries differs from the western intellectual property legislations, in terms of the principle and criteria used for granting patents or the manner in which this principle and criteria are interpreted. There are also countries which lacks a patent system.

The variation in the patent legislation compels the inventors to apply for patents in many different countries in order to control the use of their inventions. Developed countries saw this weakness or absence of patent laws as working against their interests. United States regarded this weak intellectual property protection partly responsible for its worsening balance of trade (Chauhan 2001: 131). The rising concerns about the impact of national variations of patent legislations on trade have led to treaties and guidelines seeking some level of international uniformity in patent

legislations. Therefore, in the mid-1980s, a trend towards the worldwide harmonisation of intellectual property began in the North.

To ensure the success of this harmonisation process the US adopt a strategy of forum - shifting (Braithwaite and Drahos 2000). The US feared that in the fora such as WIPO, UNCTAD and UNESCO, the developing - country blocs could defeat its proposals on intellectual property or advance their own. Thus the US along with other Western countries began to argue that the issue of intellectual property protection should become the subject of a multilateral trade negotiation within the General Agreement on Trade and Tariffs (GATT). The US was the most influential member in the GATT or the present WTO (*ibid*).

Unlike WIPO, the GATT was not a UN Organisation. It has proved to be successful in working out pragmatic multilateral trade agreements rather than just making statements of principle. The GATT was formed with the IMF and the World Bank to administer the Bretton Woods Settlement as the economic component of the Post War American Hegemony (Purdue 1995). The US and her large business community lobbied and got the Trade-Related Aspects of Intellectual property Rights listed as a subject for negotiation during the Uruguay Trade round (Drahos 2002; Sreenivasan & Christie 2002).

TRIPs Agreement was, thus, established as a multilateral trade agreement binding on all the members of the WTO. The establishment of TRIPs within the WTO in 1994 signified the world wide extension of high standards of intellectual property protection that were formerly applied only in developed countries. TRIPs have allowed intellectual property to be introduced into international trade negotiations, whereas previously they had been seen as completely separate issues, with no logical connection. The link that has been established between these issues is an arbitrary one, driven by very specific economic interests of Western Nations particularly that of United States (Purdue 1995).

TRIPs oblige WTO members to develop legal protection for IPR that meet its prescribed minimum standards. Developing countries have to comply by 2015 or will face sanctions or disbarment from the WTO (Ismail and Fakir 2004). TRIPs

Agreement was important turning point in the history of patents for it globalise the patents on life by providing patent protection to micro-biological processes. It does not go beyond the then existing protection for life patents but enforces upon the member countries to recognise the patents on certain life forms. But the TRIPS agreement fails to recognise the contribution of the indigenous people to the biodiversity and human society and does not provide protection for the indigenous knowledge.

3.2.2 Post-TRIPs Scenario

Though the TRIPs was established as a powerful legally-binding agreement for the member-countries of WTO, but its purpose to harmonise the western – backed international patent regime was not so easy to be accomplished. The post – TRIPs scenario saw the TRIPs agreement been severely criticised by developing countries, NGO's, academicians, civil society groups etc. It was severely criticised for globalising the high standards of IPRs and the extension of patents on certain life forms. Large number of developing nations were opposed to TRIPs Agreement been part of the Uruguay Round of negotiation. They are sceptical about the claimed benefits for them of IPRs and TRIPs. Several NGOs have criticised TRIPs claiming that its implementation is having or will have adverse impacts on the environment, public health, livelihood of farmers, food security and human rights.

However the criticism of TRIPs has not met with any success in reviewing the Agreement. As a result, many developing countries and civil society organisations are working to establish diverse and appropriate Sui generis system of IPR for plant and genetic resources which suits their national circumstances. The TRIPs agreement provides for the sui-generis system as an alternative to the patents but does not specify what constitutes an "effective" sui-generis system (Pretorius 2002: 187).

However there have been internal and external efforts made to prevent the developing countries to build their specific sui-generis intellectual property system for plants and life forms. Developed nations particularly the United States are using bilateral treaties and agreements to exert political pressure on developing nations to

fulfil or comply with the TRIPs – plus commitments (Wade 2003). TRIPs plus refers to the possibility that is offered to WTO member states to implement more extensive protection than TRIPs standards (Pretorius 2002).

Bilateral pressure to impose TRIPs has come as a surprise to developing countries when they have already expressed serious concern about the impact of TRIPs agreement on their development process.[6] United States have signed bilateral investment treaties and free trade agreements with the developing countries where the later have little power to bargain. While the US has been the most active country in seeking the adoption of bilateral agreements with developing countries, it is not alone in doing so. The European Union has also used bilateral agreement to impose higher levels of intellectual property rights protection in developing countries (Picciotto 2002: 229-30).

This trend of bilateral pressure on developing countries to adopt higher standards of IPR beyond TRIPs requirements signifies badly for the biodiversity and poverty concerns. They also erode the possibility for WTO multilateral negotiations to effectively address core issues raised by developing nations.

3.3 DEVELOPMENT OF PATENT SYSTEM IN BIODIVERSITY CONTEXT

The history of patent system, as already noted, are centuries old, but the extension of the scope of patents to living entities and associated knowledge is only a recent development. The development of modern scientific technologies in biotechnology and pharmaceutical sector like genetic engineering mostly in the developed countries is intrinsically linked to the introduction of patents on life forms. The patents of life forms were initially introduced in US by the 1930 US Plant Patent Act which accorded IPRs to asexually reproduced plant variety (Kothari and Anuradha 1999). Subsequently, several other countries extended some form of protection to plant varieties. In 1961, an International Convention for the Protection of New Varieties of Plants was signed which came into force in 1968. Most signatories

[6] The Trips Agreement has provided a basis for the signing of supplementary bilateral treaties (Cullet 2005: 145).

to this convention were industrialised developed countries who had also formed a Union for the Protection of New Varieties of Plants (UPOV).

Plant Varieties or Breeder's Rights (PVRs/PBRs) provide the holder of the right regulatory powers for limited time period over the marketing of their varieties. Until recently, most countries exempt farmers and other breeders from such rights, as long as they did not indulge in branded commercial transactions. However, a 1991 amendment to the UPOV has tightened the monopolistic nature of plant breeder's rights, and some countries have virtually eliminated the exemptions for farmers and breeders (*ibid*).

Until recently, the members of the UPOV Convention, was mainly comprised of Organisation for Economic cooperation and Development (OECD) countries. However, the signing of the TRIPs agreement during the Uruguay round of negotiations in WTO makes it mandatory for all WTO member states to provide protection to plant breeder rights (*ibid*). In addition, in many countries, patent protection is provided with total monopolistic restrictions to plant varieties, micro-organisms, and genetically modified animals.

The year 1972 has great significance in the history of patents as it was in this year that the US Supreme Court decision in the Diamond vs. Chakrabarty case opened the door to the patentability of micro-organisms in the United States (Taylor And Cayford 2002: 18). The US Supreme Court recognised micro biologist Ananda Chakrabarty's patent claim for a genetically engineered bacterial strain. This event provides legitimacy to the view that anything made by humans that are not found in nature was patentable (*ibid*). Later, several patents have been claimed on human genetic material, including material that has hardly been altered from its natural state, and some of these patents were actually granted.

However the major instrument for extending patent to life forms is TRIPs Agreement which aims at harmonisation of IPRs. TRIPs Agreement requires countries to provide patent protection for certain lower life forms: micro – organisms, non-biological and micro-biological process. However it allows member states to restrict patentability concerning plants and animals as well as essentially biological

processes for the production of plants or animals. Thus TRIPs agreement is a turning point in the history of patents related to biodiversity.

3.4 THE TRIPs AGREEMENT

The TRIPs Agreement is the most comprehensive legal regime ever concluded in the area of IPRs at the multilateral level. Today, it is the most important agreement having wide long term implications for all WTO member states. It was the most important instrument for the global application of higher standards of IPRs (Maskus 2000). It generally provides for the introduction of intellectual property protection standards present in most developed countries to all WTO member states.

TRIPs Agreement was innovative in the sense that it brought together different categories of intellectual property rights which had previously been dealt with separately. Further, the TRIPs agreement is one of the treaties which fall under the dispute settlement of the WTO which ensures a much higher of compliance from its members.

3.4.1 General Framework

The preamble of the TRIPs Agreement outlines the objectives of the treaty as to reduce the distortions and obstacles to international trade as well as the desire to promote adequate and effective protection of IPRs (Cullet 2005: 57). One of the main features of the TRIPs Agreement is to impose minimum standards of protection. In other words, it seeks to harmonise national laws but does not provide for uniformity (*ibid:* 57). Article 33 of the Agreement specifies the minimum term period of 20 years for which the patent protection is granted. Also it does not restrict the countries from imposing higher IPRs standards if they so wish.

Further the TRIPs agreement strengthens the principle of national treatment which was outlined in the Paris convention and introduces the concept of most-favoured-nation treatment to intellectual property (*ibid:* 58). This arrangement of differential treatment of nations in the TRIPs agreement links it with other trade agreements of the WTO.

The article 7 & 8 of the TRIPs Agreement provides the main basis for the states to fulfil their TRIPs obligation by taking into consideration their socio-economic concerns. Article 7 is the only provision which talk of the balance between the rights granted to individual IPRs holders and the broader social interests. Article 8 specifically provides the states to take measures to protect public health, as well as to promote the public interest in those areas which are of vital significance to its socio-economic and technological development (TRIPs Agreement 1994). However, the measures which are taken by the states must be in consistency with the provisions of the TRIPs Agreement. This condition limits the scope of the measures taken by the member states and could have major implication for their development particularly for the developing nations.

3.4.2 TRIPs and Biodiversity

3.4.2.1 Patents on Life

TRIPs Agreement has been subject to severe criticisms in relation to the impact it could have on the biodiversity. Article 27.3 (b) of the TRIPs agreement has aroused significant controversy. The Article is at the core of debates surrounding the patenting of life forms, the effects of IPRs on traditional community rights and environmental effect of IPRs (Khor 2004: 69).

Article 27.3 (b) states: "Members may also exclude from patentability plants and animals other than micro-organisms, and essentially biological processes for the production of plants and animals other than non-biological and microbiological processes. However, members shall provide for the protection of plant varieties either by patents of 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." Thus this article requires countries to provide patent protection for micro-organisms, non-biological and micro-biological processes for the production of plants and animals. It specifically excludes the patenting of plants and animals, the diagnostic, therapeutic and surgical methods for the treatment of humans or animals. It also excludes essentially biological processes for the

production of animals and plants (Hegde 1998). The basic criteria provided by TRIPs agreement for patentability are namely novelty, non-obviousness and industrial applicability or utility. The TRIPs agreement provides for patents in all fields of technology. It also requires patentability for processes and products in all fields of technology.

The TRIPs Agreement obligates its members to provide for the protection of plant varieties, either by patent or by an effective sui-generis system such as the plant breeder's rights established in the International Union for the Protection of New Varieties of Plants (UPOV) Convention (Lanoszka 2003: 183). But there is no definition provided for sui-generis system and thus this indicates that there is no particular form of IPRs for plant variety protection that is favoured and advocated by TRIPs Agreement.

3.4.2.2 Relationship between TRIPs and the Convention on Biodiversity

There has been a growing interest among scholars & analysts on the subject of the existing relationship between TRIPs and Convention on Biological Diversity (CBD). Some analysts and scholars view is that there exist has no conflicts (or at least no serious conflict) between the two international agreements. However several other analysts saw serious conflicts that are inherent between these two agreements (Nijar 1996; Dhar and Chaturvedi 1999).

The Convention on Biological Diversity was adopted in 1992 as a framework agreement that provides the general principles that will guide States action in biodiversity management, by outlining certain broad obligations. It provides an institutional framework to ensure continued cooperation among states to protect biodiversity and to develop specific commitments and areas where cooperation is possible (Cullet 2005). The objectives of this convention are the conservation of biodiversity, the fair and equitable sharing of benefits arising out of the use of genetic resources, and to facilitate appropriate transfer of technology.

Unlike TRIPs, the commitment and obligations specified in this convention are general and flexible (Cullet 2005: 92).This flexible approach of CBD provides an edge to the TRIPs in realisation of its objectives & purpose and obliging its members to fulfil their commitments fairly. This fact makes it more important to understand the conflicting relationship between TRIPs and CBD. The provisions contained in Article 16.5 of CBD states" "Contracting parties, recognising 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 objective." It seems that Article 16 recognise the possibility of IPRs having negative effect on the implementation of CBD and that the contracting parties have to cooperate to ensure that IPRs supports and do not run counter to the objectives of CBD. However this clause itself has a condition that is the cooperation is subject to national and international law (Khor 2004: 52).

In so far as the TRIPs Agreement represents the main international treaty for the regulation of the effective protection of the IPRs, there seems to be conflict between TRIPs and the CBD provisions & obligations on transfer of technology and on cooperation to prevent intellectual property system to work against the CBD's objectives (*ibid:* 53). Unlike CBD, TRIPs agreement contains no provision for the protection of indigenous community knowledge. Instead it favours MNCs and institutions, enabling them to acquire rights including rights over products or knowledge developed and held by traditional communities (Kothari and Anuradha 1999). As pointed out by Nijar (1996), the definitional constructs in TRIPs selectively favour the developed countries and marginalise the developing countries. Traditional knowledge because of its nature may not be amenable to protection under the present patent regimes (Kothari & Anuradha 1999).

CBD recognises the State's sovereign rights over their biodiversity and knowledge and thus gives the state rights to regulate access to its biological resources. It enables the states to enforce its rights on arrangements for sharing benefits. But trips provides no provision for the equitable sharing of benefits, accruing to the patent holders, with the state or the traditional communities in the countries of origin of

knowledge or biological resources on which the patent product is based (Khor 2004: 55). In fact, TRIPs provides no mechanism to the country of origin or traditional people to enforce their benefit sharing rights.

There are also inherent conflict in the rationale, origin and whole framework of TRIPs and CBD (*ibid*: 54). TRIPs agreement has been established with the active support of developed nations and their business corporations to promote their technological dominance and receive large profit through obtaining patent monopolies (Shiva 2001: 95-96). On the other hand, CBD was established to address the problem of rapid worldwide loss of biodiversity and to recognise the role of traditional communities in the conservation of biodiversity and their right to share the benefits derived from the preservation and sustainable use of biological resources.

Unlike CBD, that requires the prior informed consent of the contracting party providing genetic resources to be taken by collectors of biological resources, TRIPs has no provision for the person or institution applying for IPRs over biological resources to obtain prior informed consent (Cullet 2005: 94). Thus TRIPs fails to acknowledge the rights of nations and its traditional communities over their biodiversity and related knowledge. Thus there are inherent conflict between TRIPs and CBD which needs to be resolved for the sustainability of the biodiversity and socio-economic development of human kind.

3.4.3 Criticism and Concern about TRIPs

Since the establishment of TRIPs in 1994, it has been subjected to severe criticism by developing countries, NGO's, civil society groups, academicians and others. The criticisms levelled against TRIPs are:

(a) The major criticism of TRIPs is in regard to its attempt to expand the scope of patent to lower life forms making it mandatory for WTO member states to patent some categories of life forms and living processes. This has raised ethical, environmental and development concerns. The ethical and environmental concerns

have become crucial particularly in the context of the increasing role of patenting in the arena of biotechnological inventions (Shiva 2000).

(b) It has been criticised for harmonising standards of patents which could confer monopoly rights on MNCs and research organisation resulting into concentration of power in the hands of few corporations. Also there is a concern that IPRs hinder the transfer of technology from developed to developing countries as the major share of patents are held by corporations originating in developed countries (Khor 2004).

(c) There is also a growing concern & criticism that TRIPs could exaggerate the "biopiracy" phenomena as the definitional construct of patents as provided in TRIPs does not recognise the traditional knowledge (Shiva 2001; Conforto 2004). With the increasing patent activity for genes plant varieties and medicines, there are increasing evidences of biopiracy coming into light. TRIPs has greatly increased the number of countries which have to allow patenting of some biological resources and the IPRs protection of plant varieties, thereby facilitating and accelerating the biopiracy phenomena (Khor 2004).

(d) TRIPs has also been criticised for allowing IPRs over genetic material, thereby, facilitating the global control over drugs, food crops and seeds in the hands of few companies which could adversely affect the general public and farmers (Khor 2002).

(e) It does not recognise the legitimate rights of traditional communities & farmers thereby not acknowledging the role played by them in the sustainable use of biological resources which could have adverse impact on the conservation of biodiversity (Cullet 2005).

(f) It has also been criticised as inherently inequitable for developing countries. There are many arguments that are put forward in support this view point. Critics points out that requirement for applying and granting patents does not suited the developing countries conditions and cultures (Chauhan 2001). Also, the IPRs standards set up by TRIPs are seen too high or inappropriate for developing countries and can conflict with their national interests and needs (Drahos 2002). There is a broad agreement that the TRIPS agreement would make the developed countries and their existing business companies economically stronger at least in the early years of its implementation

thereby, increasing the socio-economic inequalities between developed and developing countries (Dommen 2002). Figures from a variety of sources show that transnational corporations own approximately 90 percent of technology and product patents in the world, and up to 80 percent of technology and product patents in developing countries (Braga and Fink 1998).

3.5 PATENT POLICY OF DEVELOPED COUNTRIES

Developed countries have been the major proponents of intellectual property rights. They were the first to establish patent laws and formulate patent policies. Most developed countries established their patent laws between 1790 and 1850 and established other elements of their IPR system, such as copyright laws (first introduced in Britain in 1709) and trademark laws (first introduced in Britain 1862), in the second half of the 19th century (Chang 2001: 290). The first patent system was invented in Venice in 1474 (it granted 10 years' privileges to inventors of new arts and machines) (*ibid*). The British patent law came into being in 1623 with the Statute of Monopolies, although some argue that it did not really deserve the name of a ''patent law'' until its reform in 1852 (McLeod 1988). France adopted its patent law in 1791, the USA in 1793, and Austria in 1794. Many of the other European countries established their patent laws in the first half of the nineteenth century - Russia (1812), Prussia (1815), Belgium and the Netherlands (1817), Spain (1820), The Vatican state (1833), Sweden (1834), Portugal (1837), Saxony (1843) (Penrose 1951: 13).

Almost all of these IPR regimes were of very low standards compared to the present IPR regime. Patents systems in many countries lacked requirements of disclosure of origin and provide inadequate protection to the patentees (Chang 2001: 290). Few of them allowed patents on chemical and pharmaceutical products (as opposed to the processes). However countries like France, Germany, Italy, Sweden, Japan and Switzerland, home of some of the most innovative pharmaceutical companies, persistently resisted providing pharmaceutical product patents until their industries has reach a certain higher degree of development (Pretorius 2002: 184). Chemical substances remained unpatentable until 1967 in West Germany, 1968 in the

Nordic countries, 1976 in Japan, 1978 in Switzerland, and 1992 in Spain. Pharmaceutical products remained unpatentable until 1967 in West Germany and France, 1979 in Italy, and 1992 in Spain. Pharmaceutical products were also unpatentable in Canada into the 1990s (Patel 1989: 980). Also the IPR laws in most of these countries accorded only very inadequate protection of the IPR (Penrose 1951: 13). Also many of patent laws were very lax in terms of examining the originality of the invention. In the US, patents were granted without any evidence required in support of originality of the invention before the 1836 reform of patent law (Chang 2001: 291).

The development of patent laws in the Netherlands and Switzerland were also interesting. Switzerland did not provide any protection of intellectual property until 1888, when a patent law protecting only mechanical inventions was introduced (Schiff 1971: 85). It was only in 1954 that patent law in Switzerland became comparable with those of other developed countries *(ibid)*. The Netherlands, which originally introduce a patent law in 1817, abolished it in 1869, partly because of the widespread anti-patents movements in Europe at that time. This movement condemned patents as being no different from other monopolistic practices (Schiff 1971).

Thus the history of development of intellectual property protection and patent laws in developed countries shows that these countries also opposed patents in their early phase of development and established laws in a manner that suits their national interests and socio-economic developments. This fact becomes important in the context of the efforts made by the developed countries to harmonise the higher standards of IPR and compel the technologically backward developing countries to adopt these standards through the mechanism of TRIPS agreement.

3.5.1 Patent Policy of United States

United States, like most of the developed nations, initially supported lower standards of IPRs. During the first hundred years, the US was still a relatively young and developing country and refused to respect international intellectual property rights

in pursuance of its social and economic development (Pretorius 2002: 184). At that time, UK as the most technologically advanced nation criticised the US for not providing strong patent protection. However, US and its business community does not favour strong patent laws. The initial patent laws of United States, like of European countries, were granted for introducing new methods, which were practiced elsewhere but not known in the US. They were, thus, not related to inventiveness, but only to the fact that the practice was not being undertaken within the sovereign's domains, and hence could be treated as "presumed to be unknown" (Shiva 2000: 502).

Under the US Constitution, Congress has the power "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". Therefore in 1790, Congress had enacted the first patent act under Article I, section 8 of the constitution (Poland 2000). The Patent Act of 1793 broadly defined patentable subject matter as "any new and useful art, machine, manufacture, or composition of matter, or any new or useful improvement (thereof)". All the subsequent patent statutes of 1836, 1870 and 1874 does not show any broad difference and were moreover, similar to the original patent act (Conforto 2004: 362). In 1952, the patent act was recodified by the Congress and the word "art" was replaced with "processes". The Patent Act of 1952, treat prior art as something that has been in use in the US or described in a publication in foreign countries. This definition of prior art has been criticised for it ignores the prior art and prior use in most of the developing countries which has not been documented (Shiva 2000; Ruiz 2002). Use in a foreign country does not constitute prior art in US patent law. This US Patent Act allows patent to be granted for existing knowledge and use in other countries by non-recognition of prior art developed by traditional people. This could accelerate the biopiracy of biological resources and associated traditional knowledge by MNCs and research institutions.

Today, the U.S. Patent and Trademark Office issues three types of patent: 1) utility patents for inventions or discoveries of new and useful processes, machines, articles of manufacture, or compositions of matter, or any new and useful improvements; 2) design patents for designs for an article of manufacture; and 3)

plant patents for distinct and new varieties of plant.[7] Most of the patents relevant to this discussion are utility patents on, for example, new chemical entities, new devices, new organisms, or new processes. Also the patents to be granted under the US patent Act requires the invention to be (1) useful or having industrial applicability, (2) non-obvious, and novel. This three requirements for patent grant has been interpretated in such manner that it provide no recognition to the traditional knowledge developed over centuries and their legitimate right over biological resources (Gepts 2004: 1303). Thus there is no provision to reward the traditional communities for their efforts done in the past for conservation of biodiversity and innovation of related knowledge. Therefore, this definitional construct of patents could exacerbate the position of developing nations and their traditional people by allowing the multi-national corporations to use biological resources and associated traditional knowledge without providing any compensation. Simultaneously it acts to block indigenous populations from patenting and thereby protecting their own traditional knowledge (Conforto 2004).

Regarding the novelty requirements, as already noted above, the US Patent law allows the patenting of inventions known or used in foreign counties, as long as the invention has not been patented or disclosed in a printed publication (in either the United States or a Foreign Country). Thus, contrary to other patent system, US Patent law does not require" absolute novelty" for obtaining a patent, which effectively liquidates the novelty requirement (Mc Manis 2003). Thus this provision encourages the importation of technology to the United States mainly from the developing countries (*Ibid*).

The apparent one-sidedness of this requirement has raised debate among critics about the objective and intention of US patent system and its role in encouraging the protection of genuine inventions. The genuineness of the US patent system regarding the protection of the rights of valid patent holders has been

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[7] 35 United States Code 101. Quoted in Josephine Johnston and Angela A. Wasunna, "Patents, Biomedical Research, and Treatments: Examining Concerns, Canvassing Solutions," Special Report, *Hastings Center Report* 37, no. 1 (2007), S1-S36.

questioned. There are suspicions that it merely grants privileges to accrue benefits from another country's traditional knowledge (Shiva 1997: 9-10). This criticism is supported by the Enola bean patent controversy and also the neem patent controversy. In 1999, Larry Proctor, owner of Colorado – based seed company Ponders was granted patents for his (Enola) bean variety. The Enola bean was found to fulfil the novelty requirement even though indigenous populations had cultivated yellow beans like Azufrado and Maycoba[8] for centuries in Mexico and despite the fact that Mexican seed companies had been exporting for many years the very same type of variety for which Proctor had been granted a patent (RAFI 2000)

The second requirement of non-obviousness has been criticised as being the "most unfair" to indigenous communities (Shiva 2001). Similar to the novelty requirement, the obviousness of the invention has been defined such that it does not recognise prior knowledge or use of the invention outside the United States. The third requirement of utility is the easiest out of the three requirements to fulfil.

The US patent system proposed it purpose to promote scientific innovation. However the critics argue that it's broad approach to patent protection just have the opposite effect (*ibid*). Also it is often argued in the context of biopiracy that the US patent system, instead of rewarding the primary innovator (which are mostly traditional knowledge holders), merely recognises and rewards those who confirms a prior discovery, manipulates its properties for the manufacturing purpose and then earn huge profit from the marketing of "new" product (Conforto 2004). Recent cases of biopiracy demonstrate the need for patent examiners in the United States to consistently access and adequately evaluate prior art to ensure patents are not awarded for wrong invention.

United States Policy on life patents

United States has been one of the pioneers in introducing patents to life forms. The rapid technological development of US in sectors like genetic engineering,

[8] Azufrado and Mayocoba are considered the ancestors of newly patented Enola Bean.

pharmaceuticals etc. led to the expansion of the scope of its patent law on life forms in the last couple of decades. The first major step in this regard was the adoption of the plant patents Act 1930 in the United States that provides protection for inventors or discovers who asexually reproduce distinct and new varieties. The period between 1930 and 1980 show the development of plant breeder's right in US as an alternative form of intellectual property protection for plant varieties. The year 1980 was a landmark in the history of the development of life patents. The Supreme Court of United States accepted the patentability of artificially created life forms, there by paving the way for the rapid development of the biotechnology industry (Cullet 2005). The decision in Diamond vs. Chakrabarty case led to the most significant changes in the patent regime in recent time (Taylor and Cayford 2002: 18-19). In this case, the court recognised the genetically modified life form as invention and ignores the principle that products of nature did not constitute patentable subject matter under United States law (Cullet 2005: 221). This decision provided great encouragement and support to the patentability of micro-organisms in the United States.

In the United States, many of the changes in patent policy during the past two decades have been as a result of court decisions. As the courts deal with individual cases, these decisions do not always consider the broader policy implications as they set precedents. As a result of a series of court decisions, the subject matter eligible for patenting has been extended to new technologies (biotechnology) and to upstream scientific research tools, materials and discoveries (Hall 2007).

Critics have argued that the US patent system has a negative impact on access to biotechnology for developing country purposes (Taylor and Cayford 2002: 39). The extension of patents to biotechnology could harm the interests of technologically backward developing countries which rely mostly on developed countries cooperation and funding.

United States and TRIPs

United States was one of the major proponents of TRIPs which provides for harmonisation of higher standards of patent laws that suits the developed countries.

US found weak intellectual property protection in different countries partly responsible for its worsening balance of trade. It was also under pressure from many new advanced technological industries which were losing large profits for the same reason. Thus United and its business corporation lobbied for the introduction of TRIPs agreement in WTO and succeed in the making it mandatory for WTO member countries to accept its obligations.

US and Unilateral treaties

The increasing importance of IPRs for the technologically advanced countries particularly the US, has led them to rely on different strategies and mechanisms to achieve the policy goals they are seeking at the global level (Cullet 2005: 139). The US has been active in this area and has relied on strategies such as unilateral measures and bilateral treaties to supplement multilateral standard. The US has used the unilateral measures in significant way for strengthening of IPR protection standards. The US adopts the Trade Tariff Act in 1984 in response of lack of progress in either WIPO or the GATT to stop piracy. The 1984 Act introduced amendments that made enforcement of IPRs a part of trade policy (Kuruk 200: 432-433).

Later the Omnibus Trade and Competitiveness Act of 1988 provide for annual reviews of intellectual property practice of foreign trading partners. This process termed as 'Special 301' procedures identifies counties that do not provide adequate and effective protection of IPRs laws (Cullet 2005: 139). The "Special 301" provisions of the Omnibus Trade and Competitiveness Act of 1988 gave further teeth to this unilateral pursuit of intellectual property protection (*ibid*). This was also used in shaping up multilateral negotiations on IPR during Uruguay Round of WTO. Also it was used to target many countries like Argentina, South Korea, Brazil, China, Taiwan and Thailand (Kuruk 200: 432-433). The Special 301 procedure has remained as an additional tool in the hand of US government to put pressure on individual countries to implement their commitments under the TRIPs agreement (Lanoszka 2003: 187).

US and Bilateral Treaties

In the past few decades US has frequently use bilateral agreements like bilateral investment treaties and free trade agreements to put pressure on non-complying countries. Bilateral investment treaties do not necessarily cover IPR in great detail but tend to include them under the definition of investment (Correa 2004). However Free Trade agreements to which elaborate IPR provisions have been included in recent years have been used as an effective strategy by United States . For example the free trade agreements signed by US with Jordan, Laos, Bahrain, Morocco and other countries (Cullet 2005)

Today, a considerable number of countries are facing strong pressure from USA to adopt TRIPs - Plus standard of IP protection through the use of Bilateral and Regional Free Trade Agreements and Investments Agreements (Chiarolla 2006: 38). Thus these unilateral and bilateral treaties indicate that the TRIPs agreement is not the only determining factor of the relationship between developed and developing countries in the context of intellectual property rights.

3.5.2 Patent Policy of European Union

The patent system in the European countries is centuries old but the development of the patent has been gradual in many countries reaching its present framework in the mid-20th century. As has been already noted the earliest proponents of patent system were the colonial powers of Europe like Britain, France etc. However the expansion of the scope of the patent protection in relation to the biodiversity is mainly the work of United States Patent regime. In Europe, the experience to extend the patens to life forms and related processes has been very different. The issue of patenting biotechnology inventions has been a matter of intense debate in Europe. This debate has gained continuous significance with the regional economic integration of the European countries in the form of European Union.

In Europe the main organization that deals with patent issues is the European patent organisation (EPO) headquartered in Munich. It now has 31 member states.

The members of the EPO may or may not be members of the European Union. In fact EPO is not an institution of the European Union. Its member's states are bound by the provisions of the European Patent conventions, but are not bound by any E.U. Decisions. However the member states common to EPO & EU are bounded by E.U. Decisions (Brody 2007: 72-73). The EPO was created in 1973 by the European Patent Convention (EPC), which established uniform standards for the issuance of patents. Inventors can file a single application with the EPO and thereby receive a patent that is valid in specified European counties. The administrative council of EPO which includes representatives from each member state is the main body responsible to take crucial policy decisions.

Even though there has been generally a more cautious approach to the patenting in Europe but developments in Europe have, however, largely kept pace with the United States (Cullet 2005: 222). The general requirements for patentability are substantially similar to those of the US patent system and the TRIPs Agreements which include the criteria of novelty, inventiveness, and industrial applicability. However, article 52 provides for the exclusion of four broad categories from patentability such as:

(i) Discoveries, Scientific theories or mathematical methods,

(ii) Artistic/aesthetic creations,

(iii) Schemes, rules or methods for performing mental acts, playing games or doing business, or computer programs, and

(iv) Presentation of information

Among these four excluded categories, the first one is quite important in relations to the biological and genetic resources. Under this category it is provided that though discoveries are not patentable but discoveries which have a technical aspect, or which represent some technical contribution, are patentable (Gazivoda 2003: 36).The distribution and the dividing line between a discovery and a patentable invention has been a subject of intense debate in the European Union, particularly in the context of the European directive on the legal protection of Biological Inventions

(*ibid*). This debate was significant in influencing the development of European patent laws. In Europe there was no easy resolution of many fundamental moral issues raised by patenting of biotechnological inventions. This issues plagued efforts by the European Union to develop a common European law covering IPRs in biotechnology.

The history of the much-debated European Directive on Patenting Biotechnology goes back to the year 1988, when the Commission of the European Community's proposed a Directive on the Legal Protection of Biotechnological Inventions. The European parliament found the proposed directive as ineffective and inadequate in addressing the moral issues emerged due to such patents and so revised proposal was submitted in 1992, but it also was found unsatisfactory. Thus this debate continues while many committees and revisions of the directive take place. In 1998 a revised text was passed by European Parliament. But many European countries, concerned about moral issues, failed to implement the directive until forced to do so by courts in 2004-05. Even then, these directives were implemented in such a manner that it reflected their continuing concerns about patenting life. During these developments, there was continuous increase in the matters which can be restricted from patents. By the time the final directive was adopted in 1998, the following matters were added to be excluded from the patentability to safeguard public morality such as (a) Processes for cloning human beings (b) Process for modifying the germ line genetic identity of human beings (c) use of human embryos for industrial or commercial purposes (Brody 2007: 79-80).

With the passage of the 1998 directive it was made clear that patents would be granted for biological inventions but not for discoveries. However most of the EU Countries continued opposing the directive. Also as the directive binds member states to achieve certain objectives within a set time frame, these opposing countries can implement it in a way that really undermine or simply not implement it all (*ibid*). Thus in Europe, unlike in the US, it has been very difficult process to extend patents to biotechnological inventions.

The main instrument concerning life patents is the European Patent Convention (EPC) which provides a general framework for the harmonisation of

patent law throughout Europe (Cullet 2005: 223). The EPC generally provides a uniform patent granting procedure that applies throughout the member states.

Some specific exceptions to patentability are also provided in Article 53 of the EPC. This article includes inventions whose exploitation may work against public morality which has been interpreted as covering public order or serious prejudice to the environment. The EPC also excludes from patentability the plants and animals, but provides for the patenting of microbiological processes or their products. The reason provided by the European patent office for the exclusion of plant varieties from patentability was the presence of national and international agreements and conventions for the protection of plant breeder's rights (Cullet 2005: 223). This interpretation results in the exclusion from patentability only of plants or their propagating material in the genetic fixed form of the plant variety but not the patentability of the plant or the animal itself (*ibid*). However under the current patent law, it remains partly unclear whether the discovery of a new plant that fulfilled the criteria of novelty and inventiveness could be patentable given uncertainties concerning the definition of a plant variety under the EPC (Schertenleib 2004).

The EPC considers an invention novel if it does not form part of the state of the art which includes everything made available in public domain by means of a written or oral description, by use, or in any other way, before the filing of European patent application (Gazivoda 2003: 37). This provision indicates that articles which are publicly available through written publication or in oral tradition will form part of the prior art and could be sued to challenge patents. This suggests that in European countries there is probability of effectively opposing the misappropriation of traditional knowledge, even that which has not been published or documented.

However some critics argue that an intensive analysis of European definition of Prior Art suggests that it would not be easy for many cases of biopiracy to be legally challenged in Europe (Dutfield 2002: 926). In Europe the traditional knowledge databases would not be much effective in preventing the patents covering traditional plant varieties, as it would require the database to provide descriptions of all existing landraces which is not a feasible process (*ibid*). Thus there is a prevailing

scepticism that while T.K. databases would prevent only some four patents, many would not be effectively challenged.

Unilateral Measures

The EU has also employed a review mechanism under the Trade Barriers Regulation which has the same role as that of the annual review of the US Trade Representatives (under the special 301 provision of the Trade Act) to cover the intellectual property protection (South Centre 2005).

Bilateral Treaties

Like US, European Union has also used bilateral treaties to impose higher level of IPRs protection in developing countries (Drahos 2001). European Organisation like the European Free trade Agreement (EFTA) have also engaged in the practise of signing bilateral agreements with a limited number of countries like Jordan, Singapore etc. to extract the same kind of concessions which United States has negotiated with its trading countries. However, it does not have the strong capacity as US to make it partner countries to negotiate and obliges to its terms and commitments.

3.5.3 Patent Policy of Japan

In Japan the patent system was established in 1885 by the Patent Monopoly Ordinance. In the initial stage of development Japanese follow the principle of providing priority to social interest over the individual rights (Albach 1993: 426-427). As long as the Japanese felt that it would be more beneficial to them not to grant patent, they did not sign the Paris Convention or specified areas that could be excluded from patents. Japanese government developed Utility Model law in 1905 which have played a crucial role in Japanese intellectual property system (Doi 1986). This law was formulated to protect the domestic inventors from foreign researchers

and to enable the country to attain the state-of-the art technology which was lacking at that time.

This approach to patent was followed when Japanese industry was weak and depended on technology transfer from abroad. Later when Japanese industry become self-confident and technologically developed, the Japanese government used patent policy to encourage a change of emphasis in industrial activity from imitation and improvement to innovation The Patent Monopoly Ordinance was replaced by the patent ordinance of 1888 (*ibid*). Later, in 1899 Japan acceded to the Paris convention for the protection of industrial property, and enacted the patent law, the design law and the trademark law which recognized the intellectual rights of foreigners for the first time. The patent law describes its objectives in Article 1 as: "to encourage invention by promoting their protection and utilization and thereby to contribute to the development of industry." Patentable inventions include both new and useful products and processes (*ibid*). For an invention to be patentable, it must fulfil the requirements of novelty, utility and inventive step or non-obviousness under Article 29 of the patent law.

The Japanese patent system has had some important variation from US patent system (Ryan 1998). Traditionally the Japanese Patent office (JPO) used to lay open the patent application for eighteen months of public scrutiny to offer the opportunity for opposition from third parties. But in 1994, due to continuous pressure from United States there were some policy changes in Japan. These changes led to the increased harmonisation of Japanese patent policy with the US patent office practice of providing tightest secrecy to the patent application (*ibid*). Now the patent laws in Japan are similar to US. The scope of patent protection shows only minor differences. Now the Patent laws in Japan are similar to US. The scope of patent protection shows only minor differences. Japanese patent law grants patent to micro-organism considering them technical inventions.

The Japanese patent law had historically excluded the food and beverages, pharmaceutical products, and chemical compounds from granting of patent (Doi 1986). The reason for this exclusion was that the granting of patents for these products was considered to restrict their supply in the domestic markets through the

practices of patent monopolies which could make the consumer suffer due to short supply. The exclusion of these products was also provided so as to protect the Japanese companies from strong competition by foreign enterprises. Later when the Japanese companies become competitive and technologically developed, amendment to patent law was made in 1975. Japan ratified the patent cooperation treaty in 1978 and therefore, international applications under this treaty are acceptable by the JPO (*ibid*).

Today, Japanese law provide patent protection for twenty years from the date of application or fifteen years from the day of granting of the patent in Japan. Patents are made public after filing of application in Japan. The US influence on Japanese patent law has led to the adoption of pro-patent policy. This trend is reflected in the patent enforcement process (Koizumi and Takenaka 2008). Originally, under the Japanese patent laws it was the Japanese patent office which used to play a major role in the development of patent policy and was also given power to decide not only the validity of patents granted but also the scope of patent protection. But later revisions of patent law had taken away the JPO's power to decide the protection scope under the Japanese patent laws (*ibid*). However the JPO's exclusive power to decide patent validity remained intact until the Supreme Court handed it down through the Fujitus/TI decision in 2000 (*ibid*). This decision gave Japanese Courts the power to examine the validity of a patent. This case signifies a movement toward the US approach to patent validity.

During the 1990s, Japanese government took major steps toward developing stronger patent system so as to encourage radical technological innovations. To fulfil this objective it drew much inspiration from US patent policy. Therefore it took several measures like the possibility of filing multiple-claims applications; reduction of the period for requesting examination (from seven to three years); and the creation of a centralised, specialised Court of appeal for patent matters in 2005; and the weakening of the utility model system (by suppressing examination, hence weakening their legal validity) so as to encourage filing of stronger patents by inventors (Guellec and Potterie 2007).

Japan is also making efforts to enforce stronger patent protection through bilateral agreements. It is putting much pressure on China to strengthen its patent system (*ibid*).

3.6 CONCLUSION

The study of the TRIPs Agreement and the policies of the developed countries provide an understanding of the manner in which these are used by the developed countries and their business corporations to maximise their interests and to propagate their values, at the expense of interests of the developing countries. It is found that the TRIPs Agreement was the creation of the developed countries particularly the USA and multinational business companies originating in developed countries. The TRIPs agreement and the policies of the developed countries have been formulated in such a manner that it works against the interest of the developing countries. This agreement and policies do not recognise the informal innovation done by the traditional communities and farmers while recognising the formal innovation of the MNCs and research institutions. Thus this difference in the relative recognition of the innovation of traditional communities and MNCs could have serious implication on developing countries in terms of the appropriation of their biological resources and associated knowledge by developed countries and MNCs.

The structure and content of this agreement and the policies of developed countries in terms of their interpretation of the conditions for patent grants and their definition of prior art is such that it could seriously obstruct the proper and fair utilisation of the patent system particularly by the developing countries. it is also found that the developed countries are using other measures like bilateral treaties and unilateral agreements, besides TRIPs to enforce the developing countries to adopt more stringent patent laws than those prescribed in TRIPs agreement. Thus there is an urgent need to review and reform the present patent system in a consensual manner.

Chapter 4

Patents and Biopiracy: Causes and Implications

Chapter 4

PATENTS AND BIOPIRACY: CAUSES AND IMPLICATIONS

4.1 INTRODUCTION

Biodiversity has been a major basis of livelihood and survival for majority of the population of developing countries. The developing countries and their traditional people have been preserving their biological diversity and associated knowledge for centuries. Developed countries, on the other hand, failed to take proper measures for conservation of their biodiversity in the process of their development and therefore have lost most of their biological resources and knowledge. However, in recent years, the increase in the awareness about the side-effects of synthetic materials and the resulting attraction for natural products have boost up research in biological sciences. This situation has increased the dependence of the developed countries and their business companies on the developing countries and their traditional communities. This has led to the increase in the cases of biopiracy reported from different developing countries. This has also led to the adoption of bioprospecting mechanism and access and benefit sharing agreements between MNCs and traditional people which have been regarded as mutually beneficial. However, in practise they have benefitted MNCs at the expense of traditional communities. The present patent system which is the creation of the developed countries and their business communities has also been formulated in such manner that it provides no recognition to the rights of traditional people and farmers over their resources.

In this background, this chapter will discuss the phenomenon of bopiracy in terms of the evolution and development of the debate associated with biopiracy and patent, the conflicting viewpoints of the developed and developing countries over this issue, the cases of biopiracy, the causes and implications of biopiracy, and the efforts made by developing countries to check this phenomenon.

4.2 PATENT AND BIOPIRACY DEBATE: EVOLUTION AND DEVELOPMENT

The gene-rich developing nations after having contributed their biological resources fully and freely to the developed nations for centuries, are no longer willing to have their biological wealth taken for free and sold back at exorbitant prices to the third world as 'improved' seeds and packaged drugs (Chauhan 2001: 136). The developing countries regarded it to be highly unjust that while their biodiversity has been treated as the 'common heritage of mankind', the return flow of biological commodities has been patented, priced and treated as private property of corporations of developed countries.

The present patent laws and related international agreements seems unfair and one-sided favouring the developed nations at the expense of developing nations. The southern countries often accuse the north of 'biopiracy'. The term "biopiracy" was coined in 1993 by Pat Mooney, president of the Rural Advancement Foundation International (RAFI, now the ETC Group), and refers specifically to:

"..the use of intellectual property systems to legitimize the exclusive ownership and control of biological resources and knowledge, without recognition, compensation or protection for contributions from indigenous and rural communities" (Delgado 2002).

Biopiracy refers to the use of intellectual property systems to legitimise the exclusive ownership and control over biological resources and biological products and processes that have been used over centuries in non-industrialized cultures (Shiva 2001: 49). It has been defined as the 'patenting of plants, genes, and other biological products that are indigenous to a foreign country' without compensating the keepers of those resources and the holders of knowledge appropriated during the ethnobiological research process" (Bagley 2003). Thus the biopiracy debate involves the developing South, home to the large majority of the earth's flora and fauna, at odds with the developed North, which owns the capital and technology necessary to develop this natural wealth.

Biopiracy occurs because of the inadequacy of Western Patent Systems and the inherent Western bias against other cultures (Shiva 2001: 49). Though the debate

over the intellectual property protection and patents emerged only in the mid-1980s but the phenomenon of biopiracy has a long history back to the colonial period. The collection and trade of plants for use as foods, drugs, or insecticides dates back to the earliest hunter-gatherer communities. The knowledge and use of local plants was important in the development of medical practises. While many of these materials were traded throughout the ancient world, it was not until the development of European colonial empires that moving plants from one side of the globe to another took on real economic significance (Tyler 1996: 3-10).

The wealth of Europe in the colonial era was largely based on the transfer of biological resources from the colonies to the centres of imperial power, and the displacement of local biodiversity in the colonies by monocultures of raw material for European industry (Chauhan 2001: 133). Various industrially profitable plantation crops like spices, sugar, bananas, coffee, tea, rubber, indigo, cotton etc were moved to new production sites under the control of newly emerging colonial power and their state backed trading companies. Violence and control were an intrinsic part of this process by which the Northern countries accumulated capital and wealth by gaining control over the biological resources of the south. Control of the Third world's biodiversity for profits is still the primary logic of North-South relationship on biodiversity (*ibid*).

The transfer of plant and animal species from one colonial region to another led to both enormous profit for the imperial powers and environmental disaster for the colonies. In the late eighteenth and early nineteenth centuries, botanical gardens were established in Europe and in the colonies which were of great importance for agricultural, medical and scientific purpose. Botanical gardens at Kew and Leiden became major centres for adapting economic and medicinal plants from around the world for cultivation. Botanical gardens established in the colonies also became part of a sophisticated international network (Merson 2000: 286).

Thus, the northern countries extracted much of the south's biological wealth when the latter were colonised and there existed few barriers to exploitation. There has been phenomenal growth in biopiracy with the development of modern technologies particularly in pharmaceutical and biotechnology sectors. The

pharmaceutical and biotechnology companies of developed nations are engaged in the biopiracy of biological resources of the South mainly because of two factors. First, it is highly profitable, especially with respect to the pharmaceutical and biotechnology industry (McManis 1998). In 1995, the worldwide estimated market value of pharmaceutical products - derived form indigenous traditional knowledge was $43 billion (Singh 1999). The major pharmaceutical companies which control a large share of the world market in this sector hails from developed countries (See Table 4.1). The top 10 pharmaceutical companies account for 55% of total sales (ETC 2008).

Table: 4.1 Top Ten Pharmaceutical Companies of the World

Company	2006 sales (US$ millions)	pharma sales as % of total sales	% share of total sales of top 100 companies
1. Pfizer (USA)	45,083	95.9	8.9
2. GlaxoSmithKline (U.K.)	40,156	86.5	8
3. Sanofi-Aventis (France)	38,555	100	7.6
4. Roche (Switzerland)	27,290	79.2	5.4
5. AstraZeneca (U.K.)	26,475	100	5.3
6. Johnson & Johnson (USA)	23,267	43.6	4.6
7. Novartis (Switzerland)	22,576	62.7	4.5
8. Merck & Co. (USA)	20,375	90	4
9. Wyeth (USA)	16,884	83	3.4
10. Lilly (USA)	15,691	100	3.1
Total	2,76,352		54.8

Source: ETC Group(2008), Communiqué , November

Similarly most of the top biotech companies which have a major share in global market hail from developed countries (See Table 4.2). The top 10 publicly-

traded biotech companies account for two-thirds of the sector's $78 billion revenues in 2007 (ETC 2008). Revenue potential in agribusiness is similarly impressive. Revenues for the agricultural biotechnology industry in 2002 were estimated at more than $ 5 billion, and are expected to reach $ 20 billion by the year 2010 (Nicholson 2003).

Table: 4.2 Top Ten Publicly-Traded Biotechnology Companies of the World

Company	2007 sales (US$ millions)	% change from 2006
1. Amgen (USA)	**14,771**	**4**
2. Genentech (USA) (Roche acquisition pending)	**9,443**	**24**
3. Monsanto (USA)	**8,563**	**17**
4. Gilead Sciences (USA)	**4,230**	**40**
5. Genzyme (USA)	**3,784**	**19**
6. Biogen Idec (USA)	**3,171**	**18**
7. Applied Biosystems Applera (USA)	**2,089**	**10**
8. PerkinElmer	**1,787**	**16**
9. Cephalon	**1,727**	**0**
10. Biomerieux	**1,645**	**2**

Source: ETC Group (2008), Communique, November.

Second factor that facilitate biopiracy is the occurrence of large majority of global biodiversity in the southern developing countries which are socially and economically backward. Most of the governments of these countries are either unaware of the biopiracy phenomenon or did not take it seriously as they are already engaged in solving the socio-economic problems of their countries. There is also a high level of corruption prevailing in these countries. Therefore, majority of the biopiracy occurs in the developing south.

The value of the South's germplasm for pharmaceutical industry ranges from estimated US $ 4.7 billion now to US $ 47 billion by the year 2000 (Chauhan, 2001). As drug companies realise that nature holds rich sources of profit they begin to access the potential wealth of tropical moist forests as a source for medicines. For instance, the Periwinkle plant from Madagascar is the source of at least 60 alkaloids which can treat childhood leukaemia and Hodgkin's disease. Drugs derived from this plant bring in about US $ 160 million worth of sales each year (*ibid*). Yet another plant, Rauvolfia Serpentina, from India is the base for drugs which sell up to $ 260 million a

year in the US alone (*ibid*). Pharmaceutical companies are engaged in collecting biological resources from developing countries. For example, Merch, Sharp and Dohme is collecting species from Costa Rica, SmithKline Beecham from Malaysia, Bristol Mayers Squibb form Surinam and Hoechst from India (Mukhopadhyaya 2005: 9).

Between 1985 and 1998, US patent and Trademark office granted as high as 40 patents on various derivatives of Neem, of which 29 were assigned to corporations of US origin. W.R. Grace and Co. alone has acquired 13 patents while Indian organisations, have only seven such patents (Dutfield 2000: 132-134). Thus throughout the world TNCs, biotechnology universities & research institutes, are making agreements with local communities and bringing out patents based on local knowledge in exchange of minimal royalties of 1 to 2 percent (Mukhopadhaya 2005: 10).

The phenomenon of biopiracy is also enormously expanding because of the nature of the presently established patents legal regime which endorses and sympathise with western stand on intellectual property protection. The present definition of patent and the criteria for its grant in the present regime is facilitating the biopiracy. The present patent legal regime is greatly influenced and shaped by western patent laws particularly those of United States.

The western patent laws interprets the three conditions of novelty, non-obviousness of the invention and utility, which are required to be fulfilled for patent grant, in such manner that it allows the western companies to use traditional knowledge without compensation, and simultaneously acts to block indigenous populations from patenting and protecting their own traditional knowledge (Conforto 2004: 363).

However the trouble mainly lies in the definition of prior art. Section 102 of the US patent Act of 1952 treats as a prior art that which is used in the US and published in foreign countries. Use in foreign countries is not recognized as prior art. Section 102 of the US law, which defines prior art, ready as follows:

A person shall be entitled to a patent unless:

A. The invention was known or used by others in this country or patent or described in a publication in this or a foreign country before the invention thereof by the application for patent or

B. The invention was patented or described in a trade 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.

Therefore use in a foreign country does not constitute prior art in US patent law. Since patents are granted for new inventions, denial or non-recognition of prior art elsewhere allows patent to be granted for existing traditional knowledge and use in other countries (Shiva 2000: 503). This is the basis of biopiracy of traditional knowledge and use of biological resources (*ibid*). Thus the problem of biopiracy is, moreover, a result of western-style IPR system and not the absence of such IPR system in developing countries.

4.3 BIOPIRACY: CONTRARY VIEW POINTS

There is a conceptual conflict regarding the nature and purpose of the mechanism that facilitate the commercial use of the genetic resources and associated traditional knowledge of indigenous communities mainly by the developed nations, their MNC's and research institutions. Developed countries are of the view that this mechanism is beneficial for the human society as it increase the likelihood of finding and distributing medicinal cures.

They also argue that it enhance the value of biological resources thereby providing economic benefits to the indigenous and local communities and encouraging them in the conservation of biological diversity. They argue that it provide economic incentives for large business corporations to invest in protecting in protecting the world's biodiversity so as to ensure the availability of biological resources (Heald 2003: 532-34). Developed countries and MNC's use the term 'bioprospecting' for this mechanism considering this mechanism as beneficial for all. It is also argued that this protective mechanism could dramatically increase the

bargaining power of developing nations and facilitate to bridge the north-south divide (Nard 2003: 232-34).

On the other hand, developing nations, traditional community groups, environment and human rights NGO's and civil society groups have different perspective regarding this mechanism and terms it as "biopiracy' that indicates the negative effect of this system. They found this mechanism exploitative which does not recognise the legitimate rights of indigenous communities and does not provide them their due share of benefits accrued from the use of biological resources. It would lead to increased technological dependence and widening North-South divide, destruction of traditional cultures & biodiversity etc.

Though there exists two contrary perspectives about the effect of this mechanism, however generally it is found that MNC's appropriating biological resources and associated knowledge either does not share the benefits accrued to it with the indigenous communities or share it in unfair manner.

4.4 BIOPIRACY AND BIOPROSPECTING

Bioprospecting refers to the exploration of biological diversity for potential commercial benefits in return of which economic incentives and benefits are promised to the communities and nations who have preserved those biological resources for centuries (Mulligan and Stoett 2000: 232). Bioprospecting is often advocated by the developed countries as a mechanism which could help the developing nations and traditional communities in the conservation of biodiversity by providing economic incentives. Funds from bio-prospecting agreements can help to cover the costs of maintaining protected biological rich areas (*ibid*).

However, still there is no clarity about the meaningfulness of the principle of property right over the biological and genetic resources for the developing nations in terms of encouraging the conservation of biodiversity (Merson 2000). There are several economic, legal, and scientific factor that may weaken and undermine the anticipate benefits. Some of these factors are reflected in the pronounced inequality,

in both scientific and industrial resources, that exists between the biologically-rich developing countries and the transnational biotechnological, agrochemical and pharmaceutical corporations which are most capable of making use of biological resources.

Thus it is said that bioprospecting is a model for relationships between corporations who commercialise indigenous knowledge and traditional communities which through their collectively innovated and evolved the knowledge. This mechanism has been criticised and considered merely as a sophisticated form of biopracy (Shiva 2001: 63). Though bioprospecting differs from biopiracy in literal and theoretical sense, but the manner in which bioprospecting mechanism functions, makes it vulnerable to the allegations of biopiracy. And in most of the cases bioprospecting eventually leads to biopiracy. Most of the bioprospecting agreements provide for negligible amount of royalties and benefits to the traditional communities who are the genuine holder of biological resources and knowledge.

Here, Shiva (2001) identifies two basic problems from which the bioprospecting model suffers. Firstly, it is of self-contradictory nature because its promise to provide economic benefits to traditional communities indirectly recognises the traditional knowledge. In other words it recognises the existence of knowledge which makes a patent based on it, totally unjustified since it violates the principles of novelty and non-obviousness. The second problem with this mechanism is that it facilitates the appropriation of indigenous knowledge which is later converted into an exclusive right through patents which ultimately results into the establishment of an economic system in which people to have to pay higher costs for the products in the production of which they have major contribution.

The politics associated with bioprospecting or biopiracy reflect the established North-South relationships in the global economy. There is fairly clear distinction between suppliers and users of genetic resources. The developing countries share the major part of global biodiversity but the distribution of patents gives an indication of the existing technology imbalance between North and South. Some 25,000 biotechnological patents were granted throughout the world between 1990 and 1995

of which only about 6 percent originated outside of the United States, Japan and the European Union (Correa 1995).

Bioprospecting seems to establish a system which denies benefits to the traditional people and creates impoverishment rather than uplifting them. This model also does not work well for developing nations and traditional people as the actual royalties paid are minimal. Thus, bioprospecting or biopiracy will benefit developed nations and their Corporations at the expense of southern nations and their consumers.

The emergence of 'biopiracy' debate coincided with the development of advanced technologies in the field of biological sciences. Increasingly high competition and decreasing profit in the manufacturing and allied sector prompted increased investment in research and development activities in the biological field by the developed countries governments and private research institution. Also the growing public health concerns about the adverse effects of synthetic medicines and other chemicals further encouraged research in biological sciences.

However it was the developing south which holds the majority of the biological diversity and associated knowledge used and preserved by the traditional communities for centuries. Therefore the developed countries and their business cooperation were attracted toward the developing countries biological resources. The increased interaction occurs between developed and developing countries on the one hand and between MNC's and traditional communities on the other, which eventually, led to the emergence of the biopiracy debate.

4.5 FORMS OF BIOPIRACY

In the context of globalisation and trade liberalisation, IPR regimes has become instrument of biopiracy occurring in three mutually interrelated forms of resource biopiracy; intellectual and cultural biopiracy and economic biopiracy (Shiva 2001: 62).

Resource piracy is the appropriation of the biological and natural resources of communities and country, without recognition or permission, and is used to build up

global economies. In Intellectual and cultural biopiracy, the cultural and intellectual heritage of traditional communities and the country is taken free of cost without recognition given to it. In this type of biopiracy, patents are claimed over products based on traditional knowledge. For instance, the granting of patents related to neem which has been used traditionally in India for various purposes.

Economic biopiracy is that in which the MNC's making use of the patents control the domestic and international markets. This biopiracy destroy the local economies thereby threatening the survival of several indigenous communities. For instance, Grace usurping the US market from small – scale Indian producers of neem–based biopesticides.

Conforto (2004) also talks about two forms of biopiracy: traditional and modern. The traditional form of biopiracy, mainly involves the developed nations as the biopirates directly appropriating biological resources and associated knowledge from developing countries. It occurs when the source of the traditional knowledge (i.e. an indigenous population) does not share the financial benefits of a traditional knowledge based product that is patented and commercialised.

Recently, however, a new form of biopiracy has emerged which differs from the traditional biopiracy in terms of the issues focused and the players involved in the debate. The main issue emphasised within the modern form of biopiracy is related to the impact of MNC's activities of patenting the genetically modified seeds on agriculture and farming communities. This will have negative consequences for farmers and consumers. Modern day biopiracy also varies in terms of the position and role of different players involved in biopiracy debate. Unlike its traditional counterpart, modern day biopiracy make no discrimination between the industrialised developed nations and the biologically rich southern nations. Instead it makes the global consumer and the traditional farmers stand against the corporate world. Thus the modern day piracy debate mainly involves the MNC's and traditional farmers and communities (*ibid*: 360-361).

4.6 CAUSES OF BIOPIRACY

The origin and development of the biopiracy phenomenon has been facilitated due to several legal, economic, social and political reasons.

4.6.1 Geographical causes of Biopiracy

The whole debate of biopiracy has occurred mainly due to the unequal distribution of biodiversity and the technological capability between developed and developing countries. The developing nations hold major share of the biological and genetic resources but lacks the proper technologies to make use of them on the contrary, developed nations are technologically well advanced but are poor in biological and genetic resources.

4.6.2 Legal Causes of Biopiracy

Earlier the concept of 'common heritage of mankind' was used to facilitate the appropriation of biological and genetic resources particularly of developing countries. Later the development and spread of the western patent laws and international patent regime through the TRIPs Agreement accelerate this trend in biopiracy. Further the US Supreme Court decision in Diamond v/s Chakrabarty case, expand the scope of patents to genetically modified life forms/biological resources. The international patent system defines patents on the basis of the criteria of (a) novelty, (b) non-obviousness and (c) industrial applicability in such a manner that it makes traditional knowledge unrecognisable and unprotected by these regimes. Within the indigenous tradition undertaken by traditional practitioners, the knowledge is an ancient heritage, which continues over time and hence is not considered 'novel' even though it is based on innovation (Chauhan 2000: 146). In US patent law, the 'prior art' which is used to ascertain the novelty and obviousness of an invention does not include prior knowledge or use outside the United States (Conforto 2004; Shiva 1999).

It allows patents to be granted on anything known or used outside the United States which has not been used or disclosed in a pointed publication (Conforto 2004; Shiva 1999). Also the absence of an effective mechanism to regulate the access to resources by MNCs and sharing of benefits (accrue out of use of biological resources)

between MNC's and traditional communities also increase biopiracy and exacerbate the situation. The flexible approach of CBD as compared to TRIPs agreement increases the danger of large–scale biopiracy. The lack of proper intellectual infrastructure and outdated government policies in developing countries are also responsible for biopiracy. The lack of effective legal protection in developing countries for their biological and intellectual heritage has also lead to increased biopiracy.

4.6.3 Economic Causes of Biopiracy

In recent decades the demand for the natural products has increased with the growing awareness about the harmful effects of synthetic drugs, pesticides and other chemicals which created a large market for nature-based products. The huge market for natural product and large profit margin brought firms from developed countries in contact with the traditional cultures of developing countries. This increased interaction lead to rise in the phenomenon of biopiracy.

4.6.4 Political Causes of Biopiracy

The increased corruption in developing countries mainly in the bureaucracy has also facilitated biopiracy. The lower bargaining power of the governments of developing nations at the international level has imposed western legal patent standards over them which favour the MNC's of the developed nations at the expense of traditional communities.

4.6.5 Social causes of Biopiracy

Lack of proper education and awareness of rights and freedom among people has made the developing countries an easy victim of MNC's biopiracy. The increased adherence of western values and cultures by the people of developing nations and less regards for their own culture and knowledge has made them insensitive towards the growing appropriation of their indigenous cultural and biological resources and associated knowledge.

4.7 CASES OF BIOPIRACY

The biodiversity richness of developing countries has made them prone to biopiracy by multi-national corporations. The establishment of TRIPs and extension of patents on life has aggravated the effect of biopiracy on indigenous people. It has also led to the increase of biopiracy activities and in recent years many cases of biopiracy has occurred.

4.7.1 Cases of Biopiracy from India

India home to large number of flora and fauna has been victim of biopiracy for a long time. There have been many cases of biopiracy from India of which only three has been successfully challenged. Today biopiracy costs on estimated loss of $ 5.4 billion per year India (Chauhan 2000: 232).

(i) Case of Basmati Rice (Chauhan 2000; Shiva 2006)

Basmati rice is a traditional Indian and Pakistani rice is a traditional Indian and Pakistani staple food. The Indian subcontinent is the biggest producer and exporter of superfine aromatic basmati rice. In 1997, Rice Tec, a Texas – based company, was awarded several patents on the basmati rice lines and grains. The patent covers the genetic lines of the basmati and includes genes from the varieties developed by farmers.

As the Rice Tec line is essentially derived from Basmati, it cannot be claimed as 'novel' and therefore should be patentable. Therefore Indian government and later an India NGO Research Foundation for science, technology and ecology submitted petitions to United States Patent and Trademark office challenging the patent. In 2001, the USPTO cancelled fifteen of the twenty patents granted to rice tec.

(ii) Neem Patent Case (Shiva 2001)

Neem or Azadirachta indica, has been used for various purposes over centuries in India. In 1971, US timber merchant imported Neem seeds and after making some development was granted a patent for a Neem extract called – Margosan –O (which

could be used as pesticide) in 1985. This patent was subsequently sold to the MNC, W.R. Grace and company.

Today, there are more than ninety patents related to Neem tree including patent claims by American, Japanese and German companies. However two of the neem patents held by W.R. Grace one in the USPTO and other in the European Patent office have been legally challenged by over 200 organisation from all over the world. In 2000 the European patent office revoked the patent no. 0436257B1 jointly owned by W.R. Grace and the United States Department of Agriculture because of substantial evidence of 'prior use'. However this decision has no bearing on many other patents that have been granted on Neem extracts and properties.

(iii) Turmeric Patent Case (Mashelkar 2001)

Turmeric is used as a food dye and flavouring substance as well as in ingredient in medicines and cosmetics. In 1995, the USPTO awarded a US patent no. 540504 to the University of Mississippi Medical Centre on the "use of turmeric in wound healing". In 1996 Council of Scientific and Industrial Research (CSIR) challenged the patent arguing that the patent does not fulfil the legal requirement of novelty because the usage of turmeric to heal wounds was prior art. In 1997, USPTO rejected all claims regarding the patent 540504 on account of its non-novelty, obviousness and known-utility.

(iv) Other Instances of Biopiracy in India

There are many other cases of biopiracy in India. Recently companies like UK- based Xenova Ltd., the Spanish firm Pharma Mar, US – based Sabinsa corp., Hiji Y, Phytera Inc., Ecopharm and others have been engaged in the illegal trade of medicinal plants from India (Chauhan 2000). Recent patents on the anti-diabetic properties of Karela, Jamun, and Brinjal granted to US Company, Cromak Research Inc., based in New Jersey again highlight the problem of biopiracy (Shiva, 2001).

4.7.2 Biopiracy in Brazil

Ayahuasca Case (Stenton 2003: 33; Sahai et. al. 2007: 37)

Banisteriopsis Caapi or Ayahuasca plant of Amazon basin is used by the indigenous tribes to produce a vine which is used in religious ceremonies and healing ceremonies. In 1986, USPTO granted a patent to American scientist Loren Miller for an alleged variety of B. Caapi which he called "Da Vine". In March 1999, the Centre for International Environmental Law (CIEL) on behalf of the Coordinating Body of Indigenous Organizations of the Amazon Basin (an organization representing over 400 indigenous groups) filled a re-examination request on the patent. In November 1999, the USPTO rejected the patent claim on grounds of lack of novelty and prior use. However persuaded by the patentee arguments, the USPTO reversed its decision and in 2001 announce that the patent should stand. The patent expired on 17th June 2003 and can't be renewed.

4.7.3 Biopiracy in South Africa

Hoodia Cactus case (Ostergard et al. 2006: 324)

The San, who lived around the Kalahari Desert in Southern Africa, have traditionally eaten the Hoodia cactus to stave off hunger and thirst on long hunting trips. In 1995 South African Council for Scientific and Industrial Research (SACSIR) patented Hoodia cactus plants appetite – suppressing ingredient termed P57. In 1997 sold the license of P57 to the UK biotech company, Phytopharm. In 1998, Phytopharm transfer the right over the ingredient to the pharmaceutical company, Pfizer for a substantial royalty. Pfizer develop and market the ingredient to the pharmaceutical company, Pfizer for a substantial royalty. Pfizer developed and market the ingredient as a cure for obesity. The San people learning about the possible exploitation of their traditional knowledge threatened CSIR of legal action on grounds of 'biopiracy'. As a result, in March 2002, an agreement was reached between the CSIR and the san whereby the latter were promised to receive a share of any future royalties. However the San are likely to receive only a very small percentage of royalties.

4.7.4 Biopiracy in Madagascar

Rosy Periwinkle Case (Ostergard et al. 2006: 318)

Catharanthus roseus or the Rosy Periwinkle plant, demonstrates the potential of rainforests. In the 1980's, two drugs namely Inblastine and Vincristine, were developed from the rosy periwinkle plant which are used to treat Hodgkinson's disease and childhood Leukaemia, respectively. Eli Lilly, the company that manufactured the drug received huge profits but Madagascar or the indigenous people have never received a penny in royalties or otter compensation.

4.7.5 Biopiracy in Ethiopia

Endod berry case (Roht-Arriaza 2004:923)

Ethiopians have used the Endod berry plant as laundry soap and fish intoxicant for centuries. These plants also have been utilized for medicinal purposes by other indigenous communities. However a patent was granted over this plant.

4.7.6 Biopiracy in Peru & Bolivia

Quinoa Plant

In 1994, some researchers of Colorado University were granted a patent over the 'Apelawa variety' of Quinoa plant found in Peru & Bolivia. The patent over a product used to attack male sterility allowed the development of hybrid varieties for larger crops, but did not recognize the contribution of traditional people(Zerda-Sarmiento et al. 2002: 107). The patent was opposed by the Bolivian association of Quinoa producers and NGO's led by RAFI. Due to this pressure exerted through international campaigns, the university abandoned the patent by 1998 (GRAIN 2000).

4.8 IMPLICATIONS OF BIOPIRACY AND PATENTS

The use of intellectual property systems to obtain the exclusive ownership and control over biological resources and biological products and processes that have been used for centuries in developing countries has become a matter of great concern because of its adverse socio-economic implications on developing countries in general and traditional communities in particular (Shiva 2001). The patenting of misappropriated biological resources and associated knowledge has the following main socio-economic implications:

(a) Implication on Public Health

Balancing Patent right against access to medicine is today a major problem. Critics argue that patents have strong adverse impact on public health (Cullet 2007). The present patent system promoted bio piracy and rob the developing countries people of their traditional knowledge through which local communities have provided health care to themselves over centuries. The patent rights granted in relation to biological resources particularly plants that have been used for medicinal purposes by people in developing countries or patents purposes by people in developing countries or patents on medicines for serious ailments, have become an issue of major debate for its impact on public health.

The presence of patents has prevented the product of cheap drugs in some countries and led to increase in price of essential drugs. For example in case of patented drugs for treatment of HIV/AIDS this implications of patents are clearly noticed. Almost all Anti Retroviral Drugs (ARVs) which are highly beneficial for HIV/AIDs patients are currently held by developed countries (Johnston and Wasunna 2007: S15). Presently in developing countries less than 5 percent of people who need ARVs have access to them and in sub-Saharan Africa only 1 percent of the people in need have aces to ARVs drugs. However in developed countries majority of people who need antiretroviral treatment have access to it (*ibid*).

(b) Implication on Agriculture

In developing countries many varieties of food crops has been developed by farmers through cross-breeding centuries. But now with increased biopiracy and patent protection on plant varieties, great deal of concern is expressed about farmer's access to seed. The patenting of seeds and plants would make small farmers in the developing countries dependent on the MNC's that own the patents (Hartungi 2006). This could make the farmers pay royalties and huge price for seeds. This could also lead to fundamental changes in the way agriculture is practiced in developing countries by facilitating the growth of global agribusiness operated by MNC's and the decline of small farms own by farmers in developing countries (*ibid*). This could lead to greater concentration of control over the world's food crops supply in a few global corporations.

Table: 4.3 Top Ten Seed Companies of the World

Company	2007 sales (US$ millions)	% change from 2006
1. Amgen (USA)	14,771	4
2. Genentech (USA) (Roche acquisition pending)	9,443	24
3. Monsanto (USA)	8,563	17
4. Gilead Sciences (USA)	4,230	40
5. Genzyme (USA)	3,784	19
6. Biogen Idec (USA)	3,171	18
7. Applied Biosystems Applera (USA)	2,089	10
8. PerkinElmer	1,787	16
9. Cephalon	1,727	0
10. Biomerieux	1,645	2

Source: ETC Group(2008), Communique, November.

The implications on the farmers of developing countries would be highly disastrous as a major share of global proprietary seed market (that is, brand-name seed that is subject to exclusive monopoly – i.e., intellectual property) is held by a few seed companies of the developed companies. The table 4.3 shows that almost all the top ten seed companies of the world are located in developed countries

The top 10 seed companies account for $14,785 million – or two-thirds (67%) of the global proprietary seed market.[9] The world's largest seed company, Monsanto, accounts for almost one-quarter (23%) of the global proprietary seed market. The top 3 companies (Monsanto, DuPont, Syngenta) together account for $10,282 million, or 47% of the worldwide proprietary seed market (ETC 2008). According to Context Network, the proprietary seed market now accounts for 82% of the commercial seed market worldwide. In 2007, the global proprietary seed market was US$22,000 million (*ibid*). The commercial seed market, of course, does not include farmer-saved seed. Thus this rapid growth of proprietary seed market and its increased control in the hands of few corporations of developed nations could lead to increased dependence of southern countries and their farmers on developed nations and their corporations.

The introduction and strengthening of patents in the agricultural sector has also led to growing food security concerns which remain a central concern of most developing countries. Interestingly both the groups that favours and oppose patents in agriculture argue on the basis of the impact of patents on food security. The proponents of patent in agriculture argue that IPRs such as patents or plant breeder's rights provide incentive to develop seeds with higher yields or some specific characteristics which will improve food security and agro-biodiversity. However the contribution of patents to food security in developing countries must be analysed from a broader perspective which takes into account a number of other variables. Patents system tends to facilitate control over seeds and related knowledge by agri-businesses at the expense of small farmers.

The impact of patents on agro-biodiversity is also a contentious issue. Agro-biodiversity is important for the long term sustainability of agricultural systems. Patens in agriculture lead to replacement of landraces.[10] With new hybrid varieties because protected varieties generally offer higher yields than local varieties of that crop. This process of displacement tends to promote homogenisation in agricultural

[9] ETC Group assumes that virtually all of the seed revenues from the top 10 seed companies are derived from proprietary seed products.
[10] Landraces are geographically or ecologically distinct crops or animals selected by farmers for their economic value.

fields which leads to a loss in diversity and generally reduces the crops resilience to pests and disease (Swaminathan 1997). This increased monoculture of crops also increases the risk of food insecurity/decreased food production because of destruction of crops by pests and diseases.

(c) Implication on Biodiversity

The biopiracy and the patenting of biological resources have also increased the threat of loss of biodiversity. Biopiracy may threaten biodiversity for it leads to the overuse of biological resources that may leads to the depletion and degradation of biodiversity (Masood 1997: 570).

The patent system facilitates biopiracy which leads to exploitation of traditional people and cultures which exist in harmonious relationship with the environment. The increased commodification and monopolisation of bioresources by MNC's at the expense of indigenous people could lead to decrease in the conservation biodiversity. The lack of fairness in sharing of benefits derived from this bioresources failed to encourage the protection of biodiversity.

(d) Implication on Traditional knowledge

It is widely recognized that traditional knowledge has been playing a major role in the social, economic and cultural development of human society. However the present patent regime does not provide the due recognition and protection to traditional knowledge, which in turn, has lead to the legitimisation of biopiracy, under the veil of bioprospecting. The present patent system favours the concept of individual innovation and private ownership. The structural and conceptual construct make it function against traditional knowledge and cultures, which are based on collective innovation and ownership of knowledge. The present patent system failure to protect the traditional knowledge on the one hand and recognition of the inventions based on traditional knowledge on the other, could have serious impacts on traditional knowledge holders.

The appropriation of biological resource done through patents by MNCs has the potential to restrict their genuine owners' i.e. indigenous people to use the processes and products relating to traditional knowledge. This could further leads to erosion of indigenous knowledge and thus of the conservation of biodiversity.

However the appropriation of traditional knowledge has also led to the increased awareness about the increased importance of biological resources and associated traditional knowledge. This in turn has led to demand for development of a legal regime to regulate the access to traditional knowledge and to make proper allocation of benefits accruing from products derived from traditional knowledge.

The protection of products or processes derived from traditional knowledge has lead to increased commercialisation of traditional knowledge. This involvement of commercial practices in traditional knowledge and biological resources increases the risk of depletion of that traditional knowledge which is not commercially beneficial. Most of the MNC's does not honour the rights of traditional people to have a proper adequate share in the benefits accrued out of the products or processes derived from the traditional knowledge. They are paid no monetary compensation and as, Shiva (2001) says they lose their rightful share to emerging markets.

(e) Implication on Transfer of Technology

The biopiracy phenomenon give rise to an ironic situation of "reverse transfer of technology" in which the transfer of knowledge takes place in reverse direction from developing to developed nations (Khor 2004: 22). This knowledge highly facilitates the social and economic development of developed countries while the originator of knowledge i.e. developing nations does not receive their due share of benefits for their contribution. Thus biopiracy could cause the exploitation of developing countries by the developed countries and established a neo-colonial relationship between developed and developing nations.

4.9 OPTIONS AND ALTERNATIVES

The patent system has come under heavy criticism from various groups and organizations like scholars, NGOs, indigenous communities, civil society groups etc and mainly from developing countries who found it to be biased towards western nations and their multinational corporations. The structure of the present patent system is found to be such that promotes biopiracy mainly by MNC's but provides inadequate protection and recognition to traditional knowledge holders. As Khor (2004) argues that the patent system promotes injustice by facilitating misappropriation of resources and traditional knowledge on the one hand on the other promotes monopolization which leads to concentration of economic power in a few corporations that can control the global supply of seeds, food, medicines and other products.

Today the phenomenon of biopiracy has created such a situation in which there is serious lack of trust between developed and developing countries on the one hand and MNC's and traditional people on the other. The persistence of this situation will not benefit any body and therefore it is necessary to resolve the situation. Several suggestions have been put forward to resolve the major issues surrounding biopiracy, patents and traditional knowledge.

(a) Community Registers for Traditional Knowledge

The appropriation of traditional knowledge occurs because of insufficient written documentation of existing knowledge or because relevant documentation has not been seen by patent examiners. So in order to prevent biopiracy and to protect traditional knowledge it is necessary to have better documentation of existing knowledge and better communication of this knowledge (Cullet 2005: 338-42). Documentation of traditional knowledge can be done at the community level, and made available to patent offices, so that they can protect the knowledge from being patented. Community registers can be used not only as a defensive mechanism against inappropriate patenting, but also as a basis for promoting the conservation, use and transfer of traditional knowledge (Khor 2004: 40).

(b) Digital Database on Traditional knowledge

Biopiracy can be prevented through the compilation and publication of information on previous and existing uses of biological resources and associated knowledge at national level, such databases can be used to improve the efficiency of prior art searches (Khor 2004: 40). For instance, India is preparing an easily – navigable computerized database of documented traditional knowledge related to the use of medicinal and other plants, known as the Traditional Knowledge Digital Library.

The idea of Traditional knowledge (TK) database is generally not opposed, although there are some differences of opinion on whether TK databases should be made publicly available only or provided for the exclusive use of patent office (Dutfield 2002: 925).

(c) Disclosure Requirement and Prior Informed Consent from Countries of Origin

It has been proposed that the patent applicants should be required to disclose the source of origin of genetic resources and associated knowledge that has been utilized in their invention (Ruiz 2002). This proposal was originally mooted by civil society organisations, but has now been adopted by a number of countries.

There should also be requirement for the patent applicant to obtain prior informed consent of the countries of origin of the biological resources from which the invention is desired. The fulfilment of both these requirement would enable proper sharing of benefits of commercial utilisation of biological resources by the patent holders with the indigenous communities whose traditional knowledge has been used.

(d) Banning Patents on Life

There has been strong opposition to the patenting of living organisms by activists NGOs, and by some developing countries. It has been considered inappropriate and unfair to apply the patent to biological resources and processes. This strong opposition to patents on life makes it important to consider the option of excluding these from patentability (Khor 2002: 211). This exclusion of life from patentability can be applied wither globally or nations can be given these option. But this would require the TRIPs article 27-3 (6) to be amended which provides for patents to be granted on life forms.

(e) National Legislation on Biodiversity Access and Benefit-Sharing Agreements

Countries should make proper laws to regulate access and benefit – sharing arrangements in relation to bio diversity and associated knowledge. The regulation of benefit-sharing agreement can facilitate the socio-economic development of traditional people and the technology transfer to developing countries it managed properly. The law should provide for strong enforcement of these agreements which should involve more than just cash payments. The benefit sharing arrangement should ensure that benefits are in fact properly shared, technological capacity of the developing country is enhanced and that the sustainability of biodiversity is maintained (Ismail and Fakir 2004)

(f) Community Intellectual Rights Policy

To protect and promote the rights of local communities over their biological resources and knowledge, national legislation can be enacted to establish such rights (Chauhan 2001).

(h) Proper Utilisation of Sui Generis System

Article 27 (3) of the TRIPs Agreement allows for the exclusion of plants and animals from patentability, as well as of plant verities, which could be protected by some other 'effective' form of IPR. Therefore, developing countries can utilise this provision to establish their own "effective" Sui generis system of intellectual property protection in respect of plant varieties. Regarding the sui generis system Khor (2004), states that it should be such that it maintains proper balance between the rights of private breeders, the farming and traditional communities, and the consumers. He further argues that an appropriate, designed sui generis system can affirm the role and value of traditional knowledge and the rights of farmers, indigenous peoples, as well as the interests of consumers. However, Kothari and Anuradha (1999), here raise apprehensions (which seems genuine) that there is possibility that the definition of an effective sui generis system could be determined by powerful countries in which case almost patent – like regime being advocated by UPOV could be established.

(i) South-South Cooperation

The developing countries acting individually will not be able to bargain effectively for the benefits derived out of bioprospecting mechanism. Cooperation among the developing countries will help them in effective utilization of their resources and also reduce the risk of biopiracy. Recently, Seventeen developing countries rich in biological diversity and associated traditional knowledge have formed a group known as the Like-Minded Megadiverse Countries (LMMC). These countries are Bolivia, Brazil, China, Colombia, Costa Rica, Democratic Republic of Congo, Ecuador, India, Indonesia, Kenya, Madagascar, Malaysia, Mexico, Peru, Philippines, South Africa and Venezuela. The LMMC GROUP was formed in 2002 with the adoption of Cancun Declaration in Mexico. This group, which holds more than 70% of all biodiversity, and 45% of the world's population, is now well recognized as an important negotiating block in the UN and other international fora (LMMC).

(j) Other Options

There are a number of other options that can be used to prevent biopiracy and to give traditional knowledge holders more control over their resources and knowledge. Firstly there are options available under the general clauses of article 7 and 8 of the TRIPs agreement. Article 8 authorise the member countries to take legal measures to protect public health and public interest. Therefore developing countries can utilize these provisions in framing their patent laws that protects their biological resources and traditional knowledge from being misappropriated (Cullet 2005)

Secondly the options allowed under Article 27 (2) could be incorporated in their national patent laws to prevent biopiracy. Article 27 (2) allows for the exclusion of those inventions form patentability, commercial use of which if not prevented could "seriously prejudice" to the environment. However this provision's utility may be limited because a country will both need to make a determination of the potentially serious environmental implications of the invention and the need to prevent commercial application to justify denial of patent (Kothari and Anuradha 1999).

4.10 RESPONSES OF DEVELOPING COUNTRIES TO BIOPIRACY

Some regional and national initiatives have been taken by developing countries so as to regulate the access and benefit-sharing in relation to their biological and genetic resources. The developing countries have either establishes regional legal framework or adopt national legislation. These initiatives have attempted to regulate the practise of patents so as to harmonise it with the goals of the convention of biodiversity. Few prominent initiatives are given below.

(a) Andean Community Common System on Access to Genetic Resources (Dutfield 2000)

The Andean Community Common System on Access to Genetic Resources was adopted in 1996 by the Andean Community member countries (Bolivia, Colombia, Ecuador, Peru and Venezuela).This common system proclaims that member countries have sovereign rights over the use and exploitation of their genetic

resources and the right to determine conditions of access. However the Andean Community has gone further than the CBD by extending sovereign rights to the derivatives of these resources. The common system recognises the historical contribution of the traditional communities to biodiversity. It also talks of strengthening the close interdependence between these communities and biodiversity.

(b) The ASEAN Framework Agreement on Access to Biological and Genetic Resources

This Framework Agreement sets out a set of guiding principles with regard to the implementation of the CBD to ensure that Member States have uniform access regulations. It pledges to maintain the biological diversity of the Association of South-East Nations (ASEAN) region and to ensure fair and equitable sharing of the benefits arising out of the utilization of its genetic resources. Each Member State has to designate a competent national authority which shall be responsible for implementing the national legislation on access. Prior informed consent of the Member State is necessary before access can take place. The competent national authority shall establish legally binding procedures for the determination of prior informed consent up to the local level, which should provide for the active involvement of indigenous peoples and local communities and respect their traditional and customary laws (Thomas 2005).

(c) The Central American Protocol

The Central American Protocol on Access to Genetic and Biochemical Resources has been adopted by the Member States of the Central American Commission on Environment and Development. The regime provides for access control and prior written consent measures. The regime functions through contracts concluded between companies conducting research and the local communities (*ibid*).

(d) The African Union's Model Legislation

The AU Model Legislation for the Protection of Local Communities, Farmers and Breeders and for Regulation of Access to their Biological Resources declares that the Member States and their peoples exercise sovereign rights over their natural resources. The community rights over biodiversity are held as natural, inalienable and pre-existing rights. The legislation applies to biological resources in both in situ and ex situ conditions, their derivatives and knowledge associated with them, as well as to plant breeders. Any access to biological resources, knowledge or technologies of local communities is subject to written prior informed consent of the designated national authority as well as of the local communities (*ibid*).

(e) National Legislations

Few developing countries such as Philippines, Costa Rica, Brazil, India, Bolivia, Peru etc. have established national legislation regulating access to genetic resources. Philippines adopted such legislation in 1995 (Straus 2005). Similarly Peru (1997) and Bolivia of the Andean Community has formed laws which enforce the decision 391 regarding the implementation of the CBD (Thomas 2005). Costa Rica (1998) and India (2002) adopted a biodiversity law which aims at implementation of the provisions of CBD. It regulates access to biological resources and associated knowledge. Indian law also prohibits the transmittal of results of research relating to any biological resource occurring in or obtained from India to any foreign person or entity (*ibid*).

4.11 CONCLUSION

Biopiracy has become a major issue in the north-south debate and a matter of serious concern for developing countries and their traditional people. It is found that biopiracy cases have been reported from almost all the emerging developing

countries. The occurrence of biopiracy cases in these emerging countries, which are relatively more socio-economically developed than the other section of the developing countries, indicates the scale at which this phenomenon might be taking place in those developing countries which are relatively less developed. The expansion of patent to certain life-forms and the intense efforts made to harmonise the western-biased patent system has facilitated the occurrence of biopiracy. Also the absence of proper intellectual infrastructure and policy framework in developing countries provide further encouragement to the biopiracy activities done by MNCs and research institutions. However it is found that there has been an increase in the awareness about biopiracy among developing countries and their citizens, due to efforts done by NGOs, civil society groups and others. Thus there have been initiatives taken at regional and national levels by developing countries to regulate the access to their biological and genetic resources. Thus it could be hope that the increased south-south cooperation would help in checking biopiracy and reforming the present patent system.

Chapter 5

Conclusion

Chapter 5

CONCLUSION

The discipline of geopolitics has been rejuvenated by the recent globalisation of environmental problems and issues especially those related to the intellectual property rights in general and patent in particular. The establishment of TRIPs had facilitated the harmonisation of Western influenced Intellectual Property Regime. There are also efforts made by developed countries for the adoption of higher standards of IPR protection through bilateral and unilateral measures. These current developments have become a matter of great concern for developing countries and their traditional communities for the reason that the present patent system is based on western economic values which more or less provides priority to individual rights over the social or public interest.

The structural construct of the present patent system which has been established through the TRIPs Agreement does not recognise the traditional knowledge present in most of the developing countries which has orally evolved and passed over generations, thus raising the genuine fear of biopiracy. The appropriation of biological resources and associated knowledge from the original holders' i.e. traditional communities without their consent or without providing any compensation to them has become a subject matter of intense debate at global level. This debate is more than just North-South debate as it involves many non-state actors like NGOs, traditional communities, and civil society groups standing against MNCs and research institutions. The involvement of state and non-state actors has complicated the geopolitics surrounding this whole debate in a significant manner.

However there are variation in the views expressed by these actors regarding the utilisation and monopolisation of biological and knowledge resources through patents. Developing countries, NGOs, traditional communities etc. provide a negative connotation in terms of biopiracy to this whole mechanism which could have adverse implication on humanity and biodiversity. On the other hand developed countries and

their business corporations consider this mechanism as beneficial for the socio-economic development of human society and also for biodiversity conservation and provide it a positive connotation in the form of 'bioprospection'.

However it has been found that most of the bioprospecting agreements are practiced in such a manner that it makes the bioprospection mechanism virtually similar to biopiracy in terms of its implication on society and environment.

The geopolitics surrounding biodiversity and patents involves mainly issues related to North-South debate like access to and control of genetic resources, differences over the strengthening and harmonisation of patent protection and differences over the expansion of scope of patent protection. The expansion of the scope of patent protection to life forms and its harmonisation through TRIPs Agreement has been a major issue in relation to appropriation of biological resources and associated knowledge.

The debate associated with biopiracy and the geopolitics surrounding biodiversity related patents have been fundamentally determined by geography. The unequal geographical distribution of biodiversity with tropical developing countries holding a major share of biological resources has led to the increased dependence of developed countries and their MNC's on the developing countries and their indigenous people which in turn increased the risk of biopiracy. The developed countries which are technologically highly advanced particularly in pharmaceutical and biotechnology sector have used patents to monopolise the products derived from the biological resources and knowledge of developing countries.

The quantitative analysis done during the course of this study also indicates that most of the biodiversity related patents are holded by the developed countries. United States, Japan and Germany has the major share in the total patent application associated with biological and genetic resources. China is the only developing country which could find place in the first ten major applicants of biodiversity related patents. Thus, this analysis indicates the highly unequal distribution of biodiversity related patents between developed and developing countries. Taking into account the fact that most of the biodiversity lies in developing countries, there is high possibility of

increase in the number of bioprospecting agreement established between MNC's and traditional communities and thereby increase in the cases of biopiracy as most of the developing countries lacks proper laws and policies regulating bioprospecting agreements.

The TRIPs Agreement and its patent regime have favoured developed nations and facilitated the MNCs in carrying out biopiracy activities. However, biopiracy is not a recent phenomenon rather it has been continuing since the colonial period. Earlier the appropriation of biological and genetic resources was done under the veil of the concept 'common heritage of mankind', but now this has been facilitated and legitimised through TRIPs Agreement.

The TRIPs agreement was actually the creation of developed nations and their business communities. The developing nations which are socially and economically backward had little stake in the formulation of TRIPs Agreement. Therefore the TRIPs Agreement which seeks internationalisation of intellectual property protection favours the large business corporations at the expense of traditional people. The high illiteracy and lack of awareness among traditional communities about their rights in developing nations has made them easy victim of the MNCs and research institutions.

Most of the benefit-sharing agreement signed by MNCs and research institutions with traditional people, are not respected by the former entities. They either do not compensate the traditional knowledge holders or the royalties and benefits provided to them are minimal. Thus the present patent regime, if not revised and reviewed, will have adverse implications for biodiversity, traditional knowledge, and the socio-economic development of developing nations and their indigenous communities. The developed nations also could not remain isolated from the negative impacts of TRIPs Agreements in this globalised world. The increased concentration of economic power in the hands of few MNCs in the long run will result into suffering of consumers of both developed and developing nations.

Thus, it seems that the present TRIPs regime is an attempt to establish the neo-colonial relationship, but this neo-colonial exploitative relationship is established not

only between developed and developing nations but also between multinational corporations and traditional people.

However in recent years the issues associated with TRIPs Agreement and biopiracy has been intensely debated by NGOs and Civil Society Organisation which has led to increased awareness among the general public about the unjustified approach followed by the present Patent Regime. Therefore, recently there has been a demand for revision of TRIPs Agreement globally and enactment of laws regulating bioprospecting and benefit-sharing agreements. But still there are only few nations which have formulated laws protecting their biological & intellectual heritage, and regulating the benefit-sharing agreement.

However the effectiveness of these laws and the demand for revision of TRIPs Agreement, so as to make it compatible with the Convention on Biological Diversity will depend on the bargaining power of the developing countries. The developing countries traditionally have low bargaining power in formulation of agreements affecting them at international level partly because of their socio-economic backwardness and lack of collective approach. Therefore there is urgent requirement of South-South cooperation. The developing countries should cooperate among themselves and present a consensual collective approach at international level. They should also cooperate with international environmental and human rights NGOs, civil society organisations etc. to present their viewpoint effectively at WIPO, WTO, UNO and other international forums.

Finally it could be said that there is urgent need to address the concerns of developing countries and indigenous people regarding the structure and functioning of the international patent regime. These concerns if not adequately addressed could lead to degradation of biodiversity, erosion of traditional knowledge, increased North-South divide etc.

There is a need to follow a collective, consensual and sustainable approach in addressing this whole debate surrounding biodiversity and patents. The developed countries should realize that the sustainability of the earth requires the development to take place in all corners of the world and not just concentrated in few nations. They

should respect the developing nations right to development and in this respect should formulate the international patent system in a consensual manner so that it does not harm the interest of both developed of both developed and developing nation.

Evidently the greatest need of the hour is to realise and follow these words of Mahatma Gandhi, "Earth provides enough to satisfy everyone's need, but not enough to satisfy everyone's greed."

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Appendix I

Patent Applications by Field of Technology: 2001-2005

Field of technology/year	2001	2002	2003	2004	2005
I - Electrical engineering					
Electrical machinery, apparatus, energy	1,01,276	98,673	1,01,959	1,14,426	1,21,350
Audio-visual technology	90,401	84,928	91,405	1,06,765	1,09,253
Telecommunications	96,631	91,313	94,867	1,05,652	1,16,770
Digital communication	44,017	42,977	45,076	48,995	50,069
Basic communication processes	21,889	20,651	20,653	21,691	21,671
Computer technology	1,17,545	1,11,675	1,16,656	1,32,787	1,44,594
IT methods for management	34,070	25,110	21,615	21,267	22,579
Semiconductors	78,398	78,729	81,411	89,548	95,107
II – Instruments					
Optics	85,113	84,236	86,565	94,868	1,03,390
Measurement	72,009	69,353	71,859	77,042	81,038
Analysis of biological materials	18,518	17,878	16,861	15,789	14,416
Control	38,100	34,937	35,351	37,883	37,921
Medical technology	1,08,106	1,07,072	1,05,554	99,868	99,195
III – Chemistry					
Organic fine chemistry	64,170	64,026	59,622	59,835	63,317
Biotechnology	45,573	47,576	44,632	41,993	40,861
Pharmaceuticals	69,355	69,160	66,050	68,650	74,254
Macromolecular chemistry, polymers	41,842	38,615	36,656	36,108	38,137
Food chemistry	21,296	23,535	24,850	23,110	24,653
Basic materials chemistry	51,058	48,418	46,106	45,508	48,040
Materials, metallurgy	39,882	37,451	36,813	35,579	37,705
Surface technology, coating	41,086	39,478	39,894	41,208	42,437
Micro-structural and nano-technology	3,425	2,770	2,994	2,967	3,357
Chemical engineering	51,319	48,148	46,306	44,906	44,845
Environmental technology	29,889	28,718	28,636	28,365	28,650
IV - Mechanical engineering					
Handling	52,960	50,088	49,897	51,465	52,072
Machine tools	44,722	41,703	41,147	42,018	43,691
Engines, pumps, turbines	45,462	45,213	46,531	47,896	48,725
Textile and paper machines	49,570	48,276	48,519	48,459	51,090
Other special machines	63,169	60,912	57,225	55,465	56,157
Thermal processes and apparatus	27,958	27,856	28,203	29,526	30,314
Mechanical elements	54,363	51,874	52,268	53,861	55,277
Transport	70,698	69,533	75,362	78,067	82,031
V - Other fields					
Furniture, games	44,921	44,821	46,419	49,331	51,219
Other consumer goods	38,596	36,850	38,305	40,254	40,741
Civil engineering	56,701	54,694	56,680	57,450	60,245

Note: The International Patent Classification (IPC) symbols assigned to the patent document are linked to the fields of technology by a concordance. Because a patent application may be assigned multiple IPC symbols, the sum of patent filings by fields of technology is higher than the total number of patent filings.

Source: WIPO Statistics Database, July 2008

Appendix II

PATENT APPLICATION BY FIELD OF TECHNOLOGY AND COUNTRY OF ORIGIN: 2001-05 AVERAGE

Field of Technology / Country of Origin	Japan	U.S.A.	Germany	Rep.of Korea	China	France	U.K.	Russian Fed.	Netherlands	Switzerland	Canada	Australia	Italy	Sweden	Finland	Belgium	Denmark	Spain	Austria	Israel	Ukraine	Brazil	Norway	India	Ireland	Poland	Singapore	New Zealand	H.K.	Other
I - Electrical engineering																														
Electrical machinery, apparatus, energy	271029	79890	45298	46710	16270	14183	7970	4704	6064	4358	4260	2503	3851	2156	1489	800	688	1221	1887	701	829	1005	429	131	312	533	486	326	755	16846
Audio-visual technology	278958	65750	15550	52953	10561	8792	5891	1075	12810	1796	2274	2253	806	1250	1363	521	849	443	637	708	138	417	324	61	222	181	631	196	570	14772
Telecommunications	206626	110999	20679	66682	19960	15861	9294	1885	8164	2058	5940	3212	1607	6680	9704	420	342	802	338	1697	143	378	462	183	320	229	691	197	421	9259
Digital communication	63195	77898	12516	20860	12497	10097	5118	484	3844	898	4522	1702	836	3968	5749	175	188	378	148	1048	20	77	228	107	247	73	455	101	131	3574
Basic communication processes	45383	26362	6940	8013	2029	2857	1721	998	3150	422	948	412	514	993	1042	127	110	87	160	196	94	40	65	142	58	48	366	33	44	3201
Computer technology	256879	195085	26145	45345	19186	11707	10602	1522	9553	2638	6186	4978	1788	2983	3950	738	437	364	422	2013	247	295	729	438	585	138	1162	313	331	16498
IT methods for management	65040	39383	2909	4839	853	1182	2035	215	835	775	1199	1480	198	437	572	110	66	76	85	241	19	51	91	44	217	17	191	118	57	1306
Semiconductors	219804	70207	19165	63183	8478	4273	2652	746	5439	1099	683	797	1035	484	426	571	103	103	470	378	112	40	216	32	157	78	1733	33	236	20460
II - Instruments																														
Optics	287600	58981	16438	41536	8642	5351	4617	1135	7359	2365	1847	1513	1173	1055	488	939	318	217	483	804	151	163	148	45	157	148	532	100	173	9694
Measurement	151063	82087	39797	13170	12654	10253	10027	8920	4696	6773	3836	2877	2274	2865	1947	946	891	795	985	1316	1332	653	1078	201	335	598	484	365	228	7855
Analysis of biological materials	16723	33666	7294	1213	2232	2756	4384	2568	940	1596	1535	1522	515	1037	432	708	646	317	285	518	318	122	280	102	129	120	120	219	45	1120
Control	82575	41010	16094	8147	3966	5590	4710	2117	1661	1967	1765	2421	1364	1321	754	315	334	850	564	509	349	641	357	52	302	257	248	183	110	3659
Medical technology	104453	181798	44478	10098	22472	18791	22367	15505	6747	17897	6452	7604	6676	11312	1755	3225	4654	3018	1538	4971	2605	1498	1111	1795	1669	572	376	998	374	12986
III - Chemistry																														
Organic fine chemistry	57587	97301	43336	6197	11263	20157	14892	2488	5700	12382	2777	2388	4502	6714	748	3006	3020	2281	707	2033	255	363	364	3127	572	622	100	222	115	5751
Biotechnology	32416	92254	17540	6050	11175	7274	10135	7083	3490	4491	4270	4374	1744	1968	828	2136	3011	1106	862	1683	227	325	546	714	344	187	372	544	154	3332
Pharmaceuticals	36521	134682	30887	5290	26730	14359	17805	6227	4679	13205	5892	5122	5578	8129	1127	3616	4139	2693	1166	3484	1129	677	834	2872	1233	229	256	649	213	8046
Macromolecular chemistry, polymers	81571	41932	24274	7159	7063	6419	2806	1433	3124	3424	1140	949	2503	346	967	1677	314	261	624	202	217	220	186	182	137	207	109	57	52	1803
Food chemistry	26855	22804	5451	10591	13729	2646	2462	10909	4191	3763	1064	1433	1195	392	483	726	1629	906	225	495	887	497	379	393	287	242	63	522	79	2146
Basic materials chemistry	78500	57352	29807	8930	15667	6401	7961	5334	6028	5432	1626	2094	1347	686	610	1307	859	732	597	647	771	703	440	547	217	452	61	198	75	3749
Materials, metallurgy	80409	27205	16892	10497	14071	6394	2943	6736	1662	1689	1862	2061	1477	1636	1244	1084	528	633	1665	251	1325	459	484	323	77	314	150	62	52	3245

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Surface technology, coating	95808	47369	17963	7806	5231	5418	3134	2254	1786	2286	1578	1290	1700	1235	1014	908	338	475	648	251	324	245	374	78	212	234	215	123	86	3720
Micro-structural and nano-technology	5177	4165	1353	1263	1322	487	204	71	105	108	82	192	103	125	70	25	24	24	19	28	4	5	25	3	9	3	75	16	5	421
Chemical engineering	77451	55755	28483	8614	8327	9489	7310	6006	3925	3615	2607	2545	3154	2070	2204	1182	1086	1053	1145	529	1012	670	920	351	331	312	171	365	122	4720
Environmental technology	65368	21888	12929	10100	6770	4548	3295	3268	1528	821	1752	1406	1093	1088	980	497	451	569	592	322	534	386	512	122	113	404	107	107	108	2600
IV - Mechanical engineering																														
Handling	108658	46671	26327	8935	3872	9746	7432	2264	3966	7997	2589	3138	6249	2135	2132	1080	995	1802	1197	442	416	1113	594	81	386	388	157	587	234	4899
Machine tools	81143	39556	27935	10973	6707	5604	3511	5570	1633	3331	2381	1865	3331	3158	1267	375	491	777	1517	754	865	465	292	50	216	304	278	240	248	8444
Engines, pumps, turbines	95878	39210	37326	13227	5413	8429	4838	6671	1005	2388	2447	1403	2916	1882	460	647	1030	609	1029	281	924	774	440	62	57	321	105	176	56	3823
Textile and paper machines	133669	38417	23657	8369	5912	4631	3211	1050	2098	4461	828	3341	2735	1419	3236	1668	461	559	1114	324	180	421	81	70	78	160	133	97	106	3428
Other special machines	108772	57821	30761	12873	9555	10264	6648	9614	4151	5338	4417	4060	5396	2275	1463	1694	1291	1878	1550	930	1387	1220	761	178	491	541	208	695	163	6533
Thermal processes and apparatus	59643	18826	13659	17334	8591	3413	2294	2886	1220	1560	1466	1217	1798	1063	978	437	595	572	733	230	519	508	328	59	143	320	113	133	125	3094
Mechanical elements	110412	42643	45284	10674	4949	10807	6824	4643	1798	2745	2511	2391	4018	3674	927	695	1058	978	1390	238	647	801	838	54	178	395	85	310	91	5585
Transport	148429	57180	64113	28177	5806	19876	7231	5835	2408	2086	4567	3194	4930	4207	913	819	441	2099	1838	355	610	1219	953	73	231	538	113	370	103	6977
V - Other fields																														
Furniture, games	102202	50545	13438	16352	5388	6561	7324	1543	2374	2468	3555	3423	3452	1257	488	635	535	1290	1454	341	155	1131	586	31	303	371	129	514	785	8081
Other consumer goods	69725	39034	15127	20291	7814	8482	6099	1721	2135	2606	2316	2650	3360	1006	471	779	342	953	749	426	189	1153	267	53	237	286	148	286	564	5477
Civil engineering	99488	47882	26370	18831	11533	10700	10267	9683	4723	2425	5923	5810	3759	3065	1493	1258	1019	2254	3043	483	1144	1330	1751	23	646	1304	227	686	208	8442

Note: The International Patent Classification (IPC) Symbols Assigned to the Patent Document are Linked to the Fields of Technology by a Concordance. Because a Patent Application may be Assigned Multiple IPC Symbols, the Sum of Patent Filings by Field of Technology is Higher than the Total Number of Patent Filings.

Source: WIPO Statistics Database, July 2008.

Appendix III

IPC AND TECHNOLOGY CONCORDANCE TABLE		
FIELD OF TECHNOLOGY		INTERNATIONAL PATENT CLASSIFICATION (IPC) SYMBOLS
I: Electrical engineering		
1	Electrical machinery, apparatus, energy	F21#, H01B, H01C, H01F, H01G, H01H, H01J, H01K, H01M, H01R, H01T, H02#, H05B, H05C, H05F, H99Z
2	Audio-visual technology	G09F, G09G, G11B, H04N-003, H04N-005, H04N-009, H04N-013, H04N-015, H04N-017, H04R, H04S, H05K
3	Telecommunications	G08C, H01P, H01Q, H04B, H04H, H04J, H04K, H04M, H04N-001, H04N-007, H04N-011, H04Q
4	Digital communication	H04L
5	Basic communication processes	H03#
6	Computer technology	(G06# not G06Q), G11C, G10L
7	IT methods for management	G06Q
8	Semiconductors	H01L
II: Instruments		
9	Optics	G02#, G03B, G03C, G03D, G03F, G03G, G03H, H01S
10	Measurement	G01B, G01C, G01D, G01F, G01G, G01H, G01J, G01K, G01L, G01M, (G01N not G01N-033), G01P, G01R, G01S; G01V, G01W, G04#, G12B, G99Z
11	Analysis of biological materials	G01N-033
12	Control	G05B, G05D, G05F, G07#, G08B, G08G, G09B, G09C, G09D
13	Medical technology	A61B, A61C, A61D, A61F, A61G, A61H, A61J, A61L, A61M, A61N, H05G
III: Chemistry		
14	Organic fine chemistry	(C07B, C07C, C07D, C07F, C07H, C07J, C40B) not A61K, A61K-008, A61Q
15	Biotechnology	(C07G, C07K, C12M, C12N, C12P, C12Q, C12R, C12S) not A61K
16	Pharmaceuticals	A61K not A61K-008
17	Macromolecular chemistry, polymers	C08B, C08C, C08F, C08G, C08H, C08K, C08L
18	Food chemistry	A01H, A21D, A23B, A23C, A23D, A23F, A23G, A23J, A23K, A23L, C12C, C12F, C12G, C12H, C12J, C13D, C13F, C13J, C13K
19	Basic materials chemistry	A01N, A01P, C05#, C06#, C09B, C09C, C09F, C09G, C09H, C09K, C09D, C09J, C10B, C10C, C10F, C10G, C10H, C10J, C10K, C10L, C10M, C10N, C11B, C11C, C11D, C99Z
20	Materials, metallurgy	C01#, C03C, C04#, C21#, C22#, B22#
21	Surface technology, coating	B05C, B05D, B32#, C23#, C25#, C30#
22	Micro-structural and nano-technology	B81#, B82#
23	Chemical engineering	B01B, B01D-000#, B01D-01##, B01D-02##, B01D-03##, B01D-041, B01D-043, B01D-057, B01D-059, B01D-06##, B01D-07##, B01F, B01J, B01L, B02C, B03#, B04#, B05B, B06B, B07#, B08#, D06B, D06C, D06L, F25J, F26#, C14C, H05H
24	Environmental technology	A62D, B01D-045, B01D-046, B01D-047, B01D-049, B01D-050, B01D-051, B01D-052, B01D-053, B09#, B65F, C02#, F01N, F23G, F23J, G01T, E01F-008, A62C
IV: Mechanical engineering		
25	Handling	B25J, B65B, B65C, B65D, B65G, B65H, B66#, B67#

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26	Machine tools	B21#, B23#, B24#, B26D, B26F, B27#, B30#, B25B, B25C, B25D, B25F, B25G, B25H, B26B
27	Engines, pumps, turbines	F01B, F01C, F01D, F01K, F01L, F01M, F01P, F02#, F03#, F04#, F23R, G21#, F99Z
28	Textile and paper machines	A41H, A43D, A46D, C14B, D01#, D02#, D03#, D04B, D04C, D04G, D04H, D05#, D06G, D06H, D06J, D06M, D06P, D06Q, D99Z, B31#, D21#, B41#
29	Other special machines	A01B, A01C, A01D, A01F, A01G, A01J, A01K, A01L, A01M, A21B, A21C, A22#, A23N, A23P, B02B, C12L, C13C, C13G, C13H, B28#, B29#, C03B, C08J, B99Z, F41#, F42#
30	Thermal processes and apparatus	F22#, F23B, F23C, F23D, F23H, F23K, F23L, F23M, F23N, F23Q, F24#, F25B, F25C, F27#, F28#
31	Mechanical elements	F15#, F16#, F17#, G05G
32	Transport	B60#, B61#, B62#, B63B, B63C, B63G, B63H, B63J, B64#
IV: Other fields		
33	Furniture, games	A47#, A63#
34	Other consumer goods	A24#, A41B, A41C, A41D, A41F, A41G, A42#, A43B, A43C, A44#, A45#, A46B, A62B, B42#, B43#, D04D, D07#, G10B, G10C, G10D, G10F, G10G, G10H, G10K, B44#, B68#, D06F, D06N, F25D, A99Z
35	Civil engineering	E02#, E01B, E01C, E01D, E01F-001, E01F-003, E01F-005, E01F-007, E01F-009, E01F-01#, E01H, E03#, E04#, E05#, E06#, E21#, E99Z

Source: WIPO, World Patent Report - A Statistical Review, 2008

Appendix IV

AGREEMENT ON TRADE-RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS

PART I GENERAL PROVISIONS AND BASIC PRINCIPLES

PART II STANDARDS CONCERNING THE AVAILABILITY, SCOPE AND USE OF INTELLECTUAL PROPERTY RIGHTS

1. Copyright and Related Rights

2. Trademarks

3. Geographical Indications

4. Industrial Designs

5. Patents

6. Layout-Designs (Topographies) of Integrated Circuits

7. Protection of Undisclosed Information

8. Control of Anti-Competitive Practices in Contractual Licences

PART III ENFORCEMENT OF INTELLECTUAL PROPERTY RIGHTS

1. General Obligations

2. Civil and Administrative Procedures and Remedies

3. Provisional Measures

4. Special Requirements Related to Border Measures

5. Criminal Procedures

PART IV ACQUISITION AND MAINTENANCE OF INTELLECTUAL PROPERTY RIGHTS AND RELATED INTERPARTES PROCEDURES

PART V DISPUTE PREVENTION AND SETTLEMENT

PART VI TRANSITIONAL ARRANGEMENTS

PART VII INSTITUTIONAL ARRANGEMENTS; FINAL PROVISIONS AGREEMENT ON TRADE-RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS

Members,

Desiring to reduce distortions and impediments to international trade, and taking into account the need to promote effective and adequate protection of intellectual property rights, and to ensure that measures and procedures to enforce intellectual property rights do not themselves become barriers to legitimate trade;

Recognizing, to this end, the need for new rules and disciplines concerning:

(a) the applicability of the basic principles of GATT 1994 and of relevant international intellectual property agreements or conventions;

(b) the provision of adequate standards and principles concerning the availability, scope and use of trade-related intellectual property rights;

(c) the provision of effective and appropriate means for the enforcement of trade-related intellectual property rights, taking into account differences in national legal systems;

(d) the provision of effective and expeditious procedures for the multilateral prevention and settlement of disputes between governments; and

(e) transitional arrangements aiming at the fullest participation in the results of the negotiations;

Recognizing the need for a multilateral framework of principles, rules and disciplines dealing with international trade in counterfeit goods;

Recognizing that intellectual property rights are private rights;

Recognizing the underlying public policy objectives of national systems for the protection of intellectual property, including developmental and technological objectives;

Recognizing also the special needs of the least-developed country Members in respect of maximum flexibility in the domestic implementation of laws and regulations in order to enable them to create a sound and viable technological base;

Emphasizing the importance of reducing tensions by reaching strengthened commitments to resolve disputes on trade-related intellectual property issues through multilateral procedures;

Desiring to establish a mutually supportive relationship between the WTO and the World Intellectual Property Organization (referred to in this Agreement as ''WIPO'') as well as other relevant international organizations;

Hereby agree as follows:

PART I

GENERAL PROVISIONS AND BASIC PRINCIPLES

Article 1

Nature and Scope of Obligations

1. Members shall give effect to the provisions of this Agreement. Members may, but shall not be obliged to, implement in their law more extensive protection than is required by this Agreement, provided that such protection does not contravene the provisions of this Agreement. Members shall be free to determine the appropriate method of implementing the provisions of this Agreement within their own legal system and practice.

2. For the purposes of this Agreement, the term ''intellectual property'' refers to all categories of intellectual property that are the subject of Sections 1 through 7 of Part II.

3. Members shall accord the treatment provided for in this Agreement to the nationals of other Members.[11] In respect of the relevant intellectual property right, the nationals of other Members shall be understood as those natural or legal persons that would meet the criteria for eligibility for protection provided for in the Paris Convention (1967), the Berne Convention (1971), the Rome Convention and the Treaty on Intellectual Property in Respect of Integrated Circuits, were all Members of the WTO members of those conventions.[12] Any Member availing itself of the possibilities provided in paragraph 3 of Article 5 or paragraph 2 of Article 6 of the Rome Convention shall make a notification as foreseen in those provisions to the Council for Trade-Related Aspects of Intellectual Property Rights (the ''Council for TRIPS'').

Article 7

Objectives

The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations.

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[11] 1. When ''nationals'' are referred to in this Agreement, they shall be deemed, in the case of a separate customs territory Member of the WTO, to mean persons, natural or legal, who are domiciled or who have a real and effective industrial or commercial establishment in that customs territory.

[12] In this Agreement, ''Paris Convention'' refers to the Paris Convention for the Protection of Industrial Property; ''Paris Convention (1967)'' refers to the Stockholm Act of this Convention of 14 July 1967. ''Berne Convention'' refers to the Berne Convention for the Protection of Literary and Artistic Works; ''Berne Convention (1971)'' refers to the Paris Act of this Convention of 24 July 1971. ''Rome Convention'' refers to the International Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organizations, adopted at Rome on 26 October 1961. ''Treaty on Intellectual Property in Respect of Integrated Circuits'' (IPIC Treaty) refers to the Treaty on Intellectual Property in Respect of Integrated Circuits, adopted at Washington on 26 May 1989. ''WTO Agreement'' refers to the Agreement Establishing the WTO.

Article 8

Principles

1. Members may, in formulating or amending their laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provisions of this Agreement.

2. Appropriate measures, provided that they are consistent with the provisions of this Agreement, may be needed to prevent the abuse of intellectual property rights by right holders or the resort to practices which unreasonably restrain trade or adversely affect the international transfer of technology.

PART II

STANDARDS CONCERNING THE AVAILABILITY, SCOPE AND USE OF INTELLECTUAL PROPERTY RIGHTS

SECTION 5: PATENTS

Article 27

Patentable Subject Matter

1. Subject to the provisions of paragraphs 2 and 3, patents shall be available for 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.[13] Subject to paragraph 4 of Article 65, paragraph 8 of Article 70 and paragraph 3 of this Article, patents shall be available and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced.

2. Members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect ordre public or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by their law.

3. Members may also exclude from patentability:

(a) diagnostic, therapeutic and surgical methods for the treatment of humans or animals;

(b) plants and animals other than micro-organisms, and essentially biologicalprocesses 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.

Article 28

Rights Conferred

1. A patent shall confer on its owner the following exclusive rights:

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[13] For the purposes of this Article, the terms "inventive step" and "capable of industrial application" may be deemed by a Member to be synonymous with the terms "nonobvious" and "useful" respectively.

(a) where the subject matter of a patent is a product, to prevent third parties not having the owner's consent from the acts of: making, using, offering for sale, selling, or importing6 for these purposes that product;

(b) where the subject matter of a patent is a process, to prevent third parties not having the owner's consent from the act of using the process, and from the acts of: using, offering for sale, selling, or importing[14] for these purposes at least the product obtained directly by that process.

2. Patent owners shall also have the right to assign, or transfer by succession, the patent and to conclude licensing contracts.

Article 29

Conditions on Patent Applicants

1. Members shall require that an applicant for a patent shall disclose the invention in a manner sufficiently clear and complete for the invention to be carried out by a person skilled in the art and may require the applicant to indicate the best mode for carrying out the invention known to the inventor at the filing date or, where priority is claimed, at the priority date of the application.

2. Members may require an applicant for a patent to provide information concerning the applicant's corresponding foreign applications and grants.

Article 30

Exceptions to Rights Conferred

[14] This right, like all other rights conferred under this Agreement in respect of the use, sale, importation or other distribution of goods, is subject to the provisions of Article 6.

Members may provide limited exceptions to the exclusive rights conferred by a patent, provided that such exceptions do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties.

Article 32

Revocation/Forfeiture

An opportunity for judicial review of any decision to revoke or forfeit a patent shall be available.

Article 33

Term of Protection

The term of protection available shall not end before the expiration of a period of twenty years counted from the filing date.[15]

[15] It is understood that those Members which do not have a system of original grant may provide that the term of protection shall be computed from the filing date in the system of original grant.