

## TECHNOLOGY TRANSFER IN INDIA WITH SPECIAL FOCUS ON BIOTECHNOLOGY

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### **Abstract:**

Biotechnology has been in the spotlight for decades now and it has revolutionized the production specifically industry relating to agriculture, pharmaceuticals for health and nutrition and environment. This science holds a lot of significance because it holds the power to solve world's intractable problems concerning the abovementioned industries. The nuances of this area are wide, and the issues pertaining to patenting the life forms explicitly "Genetically Modified Crops" are huge in nature. There is the question of patenting processes that are involved with Biotech. Moreover, with the added benefits that the researchers have claimed, there are several questions like if they are safe for consumption and assessment of its effects on the international trade is also a question. Transfer of Technology (TOT) is a process which involves movement from one organization to another, the transfer consists of Data, Knowledge, Information like prototypes, software, trade secrets, designs, other materials including software and other technical know-how. The process of TOT is governed by the policies and practices of each organization. Under Normal circumstances, these technologies hold immense potential to be commercialized increasing their value in general and in the markets upon commercialization. Here an attempt is made to understand the legal implications, issues and solutions related to transfer of technology in respect to biotechnology.

**Keywords:** *Biotechnology, Technology transfer, Genetically Modified Crops, Intellectual Property*

### **I. INTRODUCTION**

#### **a) Brief discussion on Genetically Modified Organisms (GMO):**

A GMO is a process where a foreign DNA is inserted in its genome by means of genetic modification. While a microbiological process is where the main component is a microorganism. Genetically Modified plants normally are engineered plants which are modified to include a component which is not naturally present in the plant. Under this Biotechnology the DNA is inserted into the Genome of the plant and its cells and such transfer results into new tissue growth and the plant inherits the new DNA. This process provides a new characteristic in the plant and it can make the plant disease or infection resistant as well. There are different stages which are involved in making a Biotechnology plant. The step to be followed is that the transfer of DNA is one and there are different methods which are used for the same. The plant cells receive this DNA. One of the methods is transferring the DNA through

a virus or bacteria and the host cell carries it with the DNA. The plant cell when receives the DNA results into growth of a new plant with new properties. There is whole lot of different scientific process that involves itself in the making of a Biotechnology plant but this was just a brief description of the same.<sup>ii</sup>

There are different advantages of using GMO seeds to grow out GMO plants which include using the resources effectively, the natural habitat is conserved and the pests and diseases are taken care of through the seed itself. In the U.S., there are GMO seeds available for the Corn, Soybean, cotton, Canola, Squash, Potato, Papaya, Apple etc. these crops are commercially sold in the market and are safe for consumption as well.<sup>iii</sup> GM crops are beneficial because they avoid the use of pesticides which not only are harmful for health of the consumer but the crop also. The Chemical pesticides are known to have detrimental effect on the environment as well. The GMO are resistant towards pathogens which spread diseases are good for production. The soil is also not harmed and it improves the quality of soil.<sup>iv</sup>

The limitations of such crop are feeble in nature apart from the side effects that can wipe out the population if needed. The human intervention serves a factor in determining whether the organisms which existed independently now has taken a new form which in differently modified from its old form. Under most regimes of the world bio-patents are permissible and the argument which is often used in not providing patents is that those biological materials are the products of nature but these argument does not hold any substance anymore.<sup>v</sup> Another issue is with regard to the Prior Informed Consent<sup>vi</sup>, the intention of the inventor has to be known by the subject when it is commercial in nature. There is a plethora of moral and ethical issues involved when it comes to bio patents. The effect on the environment is also to be considered and the public order and morality are also to be highlighted.<sup>vii</sup>

#### **b) The Historical Evolution: A Brief look in the World of Biotech**

Biotechnology has been a part of the science form even before the term was coined. In 500 BC there was a discovery of first antibiotic known as the mouldy soybean curd in China. There was a discovery of an insecticide from the powdered form of the flower chrysanthemums in China during 100 A.D. In 1870 there was crossbreed production of cotton and several different forms of cotton were found. During the same period a hybrid corn was founded in a laboratory. In 1911 the cancer-causing virus was discovered and in 1933 the form of hybrid corn was commercialized to be sold in the market. During 1940-60s antibiotics and DNA<sup>viii</sup> related discoveries were made. While in 1980s smallpox was eradicated through a vaccine. In 1986 a drug named interferon is produced which becomes an anticancer medicine made through Biotechnology. Bt Corn was produced in 1988 and during this period different causes of life-threatening diseases were found. The vaccines for certain diseases were approved for use to combat them. During the 21<sup>st</sup> Century, new Biotechnology crops were produced and tested while an endangered species was cloned for the first time. The Modern period is when Biotechnology took off. After the end of WWII, the structural model of DNA was found<sup>ix</sup> while with such discovery the replication of DNA became easy. The community discovered scientific tools for inserting foreign DNA into a host and such process could be monitored and transfer could be used to make the host better. In the 2000s the progress was made in the field of Human

Genome and synthetic genome and its replication. This was the very base of the development of Biotechnology in today's age.<sup>x</sup> Till 2003 the human genome sequencing was completed and different genes were being used to combat diseases. This is a brief overview of the historical revolution of Biotechnology industry.<sup>xi</sup>

**e) Introduction to Technology Transfer:**

*“Technology transfer is the mechanism by which the accumulated knowledge developed by a specific entity is transferred wholly or partially to another one to allow the receiver to benefit from such knowledge”.*<sup>xii</sup> Although, there might not be a universally accepted definition for the concept, the broadly accepted ones suggest the same annotations.<sup>xiii</sup> It's simply the transfer of the research for its commercialization. The process of the same can be said to be more complicated but considering the value of the research it should be complicated and stricter in every sense of the word.<sup>xiv</sup> These ground-breaking research which eventually are converted into products and commercialized create new opportunities in terms of economic value creation or furthering the research for the upcoming technologies. In terms of the process, these technologies face huge hindrances which some of them overcome and become commercialized, and other remain in the laboratories where they were invented. It means that some of these ideas, are referred to establishment who are willing to invest in its commercialization, it is pertinent to note that funding the research for such technologies is also a way of investing in the future. One of the most common hindrances are Intellectual Property Rights issues.

**II. BIOTECHNOLOGY AND TECHNOLOGY TRANSFER**

**a) A brief look into the Legal Landscape for Biotechnology:**

TOT is futuristic technology which is essential for furthering economic growth. In India, Biotech is one of emerging sectors, a growth is estimated considering the present business opportunities. We will focus on the Legal obligations and the concerned authorities for the sector. The concerned authority for the same is the Department of Biotechnology<sup>xv</sup>, which focuses on Policy making, encouraging R&D, manufacturing obligations and fulfilling the international cooperation obligation. The Genetic Engineering and Approval Committee (GEAC) is also a significant authority which is under the umbrella of Ministry of Environment and Forests. There are a number of subsidiary committees which have been constituted to govern each step diligently and efficiently. The Institutional Biosafety Committees, and Review Committee on Genetic Manipulations to name a few of such committees. Through the lens of the legislations perspective, there are a number of applicable legislations which are case to case basis.<sup>xvi</sup>

Guidelines for the Implementation of International Treaty on Plant Genetic Resources for Food and Agriculture for Facilitated Access under Multilateral System<sup>xvii</sup> are issued by the Department of Agriculture and Cooperation, under Ministry of Agriculture for Govt. of India. Under the Indian regime the Department of Biotechnology under Govt. of India serves as a governing body when it comes to establishing what is biodiversity, what are the resources under it and how are they characterized and how will the genes be used for products.<sup>xviii</sup> And the Indian Patent Act, 1970 with the Patent Rules 1972 which fall under the Paris Convention administer

the Patent framework. The Indian Patent Office grants the patent by following the requirements. Under Sec. 3 of the 1970 Act which discusses what all don't amount to inventions, the provision of Sec 3 (b), (j) and (p) specifically relate to the topic.<sup>xix</sup>

The Patent Amendment Act, 2005 has made certain changes to mould itself with the biological advancements and it has focused on finding the origin and source of such materials during an invention and has included new grounds for revocation of Patents. The Biotechnology Regulatory Authority of India<sup>xx</sup> also focuses on providing a safe environment and regulate this field. Under the Protection of Plant Varieties and Farmer's Rights (PPV & FR) Act of 2001- Sec 29(2) sets out the standard for receiving application by the authority who reviews applications of notified crop species under the Act itself. There is Extant Variety Registration Committee<sup>xxi</sup> which provides speedy registrations for such crops and species and throughout the country there are Plant Variety Offices which regulate the sector and are helping the farmers and plant breeders.<sup>xxii</sup> India is known to be the first country which has experimented with the Benefit sharing model under the Convention on Biological Diversity (CBD) regime specifically Art 8 (j). domestically, there are community registers and people's Biodiversity registers which are a register containing details about the same. India has also become a part of the Budapest treaty on International Recognition of the Deposit of Microorganisms for the purpose of Patent Procedure.<sup>xxiii</sup>

#### **b) Legal Dimensions specifically Contractual issues involving TOT:**

The direct legal implications which surround the area of TOT are part of the many dimensions involved in such transactions. It is understood that the transfer itself possess two sides to it. Its characterization is dual in nature, generally it is governed by the Law of Contracts for any such agreement which is being referred to, while it includes certain special terms and conditions which are not contained in normal agreements. This specific agreement is specially garnered for transfer of technology. The normal conditions governing the contracts are applicable in this case but the additional focus has to be provided while drafting because of the nature of the transfer being made. The commodity in question is an intangible product of intellect so while transferring such product from one party to another a special focus has been given to terms and conditions pertaining to the same.

Another aspect to this is that the transfer being made is not being sold fully in this context. Its possession is being transferred which means that the tie between the property and the original owner cannot be severed totally. This a form of exclusive transfer agreement where the link between the transferor and the property remains to an extent and under some circumstances the profitability of the same is under the full control of the same as well. Another aspect which should be noted is that there are several stages which are involved in coming to the actual product and so while considering the terms of such contract these different steps of production are to be considered. The other requisite is that the property being transferred has to be defined properly and the scope of such intellectual property has to be covered which with the advent of new technology becomes harder during the initial period. The scientific dimensions of the same are to be covered in the contract and the drafting has to be done accordingly. Apart from trying to cover all the different aspects of such property being

transferred there is confusion as to what exactly amounts to transfer under this specific circumstance. So, while drafting the contract it has to be noted that the extent of transfer to be made is defined properly in terms of the different dimensions covered.<sup>xxiv</sup> Confidentiality has become a very significant clause of contract in today's day and age so the underlying obligations and restrictions and penalties should be discussed in detail based on the technology in questions. The sanctions or consequences of ignoring such restrictions or non-compliance of the same should be discussed comprehensively in the contract. The questions are based and differ on the basis of the type of agreement in question for instance it could be a licensing agreement or transfer of a know-how, which creates a huge difference in terms of the clauses which drafting such agreements. Certain number of points might seem obvious but in terms of drafting of such agreements they are to be highlighted.

**c) The Conceptual Framework- The Process of Technology Transfer:**

The Process of TOT can be divided into steps which are to be considered diligently. These steps can be a full circle and work as a repetitive cycle which can advance the research continuously. For instance, a discovery is made, the discovery is disclosed in all its forms, the disclosure is made so evaluation can be made about the significance of the discovery, after the evaluation of the same, the IP protection has to be granted by the applicable authority, after receiving such protection the next step would be marketing or commercialization of the discovery. If the discovery is converted into an idea of being a product which can be commercialized then the next step is licensing of the same which will be followed by the development of the product which will be used by the population and provide financial returns which can be used to further other discoveries. As stated above, this process is a cycle and can continuously support the research and growth of technology to further the human race.<sup>xxv</sup>

**d) Nexus between Biotechnology and Technology Transfer:**

Biotechnology being one of the ground-breaking technologies has been growing in the developing nations as well. There is a need of consonance between the technical skills and knowledge and the resources available, and that is where the concept of Technology transfer comes in. Developing nations can increase their output and productivity through the means of achieving expertise in Biotechnology methods. There has been a rise in demand of such products which can serve as alternative or a substitute and provide better results than the natural biological elements.<sup>xxvi</sup> The transfer of Biotechnology is a new area of debate where the discussions have revolved around the transfer being made to the developing countries from developed countries.

Innovation in the field of technology holds immense significance in today's society. In terms of TOT, one of its counterparts includes generating enough capital or contributions financially to further the Research and Development.<sup>xxvii</sup> The notion involving TOT is that mostly the supplier under such circumstances are the Developed nations, and the demand is generated by the Developing Nation. While a different aspect of TOT is that it can be differentiated by the form of technology being transferred whether it's Hard<sup>xxviii</sup> or Soft<sup>xxix</sup>, or if they are institutional or cooperative.<sup>xxx</sup> Taking the example of Biotech in this context, on a

first look it seems that Biotech is inclined more towards the institutional approach but through a deeper look and considering the changes in the market in the Global Trade scene it is becoming more inclined towards the cooperative approach specifically in terms of healthcare industry.

It is pertinent to note that we have understood TOT from a product's perspective but now we will study the same from the perspective of Biotech. The process of transfer changes here due to the form of the technology, Biotech is a methodology which is or can be transferred in its early or later stages of research, which means that the transfer of Biotech differs from normal process of transfer. The same can be considered in terms of teaching or training personnel about the technical know-how in the field. In terms of Biotech there is involvement of getting approval from the concerned authorities but also removing any uncertain doubts from the minds of the public about using the end products which are generated from such research. While considering the transfer the applicable local conditions<sup>xxxix</sup> are also to be kept in mind.

Under Biotech, a question referring to TOT arises which is -what constitutes a transfer in this context. Under Healthcare and pharmaceutical industries, it is most commonly used for research of vaccines. In terms of Developing nations, the vaccines are focused on tropical diseases<sup>xxxix</sup> and in Developed nations focus on the chronic diseases.<sup>xxxix</sup> The specifics of the transfer of Biotech are to be considered, apart from the basic machinery needed, there are several other components like the specific types of cell, micro-organisms which are naturally available or genetically modified, any form of Living Organism whether plant or animal (For e.g. Transgenic Mice or Seeds), DNA Sequencing, and any other type of Biomolecule which can further such research. Such additional components are to be considered while transferring Biotech, moreover there are different standards which are also referred like Local Conditions, Research Priorities, Social Acceptability and Legal Framework which includes the concerned authorities.<sup>xxxix</sup> Technologies are solution driven, hence under normal circumstances application of such technologies in a different environment from which it was initially made for becomes an issue, and modifications or alterations are to be made for successful application of the same. A lot of research-based solutions are derived from university or research-based institutions and groups which have high number of contributions towards this field. It is pertinent to note that these institutions are very significant in furthering research and economic growth of a nation, and funding them is one of essential elements in understanding TOT.

**e) Issues and Challenges in TOT:**

**i. The IPR Landscape:**

India has to fulfil its international obligations which includes being signatory to TRIPS and has modified its domestic legislations accordingly.<sup>xxxix</sup> Domestic legislations which have seen modifications include the Patents Amendments Act of 1999 and the Plant Varieties and Farmers Rights Act of 2001. The present Intellectual Property (IP) system in the country recognizes patents which include procedure or methods which ultimately can be used as medicine or drug, or food while it should not be used as an end-product itself which has resulted into manufacturers being able to analyse the product and create a method of production by themselves. But it is important to note that the TRIPS regime allows patenting of the product

itself. Henceforth, the Indian system also allows the patenting of end products which is related to medicine/drugs by setting a priority date for the same. In cases of plants, TRIPS had provided a liberal regime and it was depended on the nation to develop the legislations relating to it. The International Union for the Protection of New Varieties of Plants<sup>xxxvi</sup> is a body under WIPO which looks after the technological developments and it notifies the laws country wise under its regime.<sup>xxxvii</sup> The protection of IP gives way to protect oneself from infringement whether it be product based or Process/Method based. In the case of Technology, the focus should be on whether it has commercial effects then the form of technology itself. If any infringement is caused the relief can sought in form of damages, injunctions or seizure of infringed articles or any profit from commercialization of such articles.

**ii. TRIPS and Biotechnology:**

The provision relating to Biotechnology was a new addition while the debate went on between US and Europe as they both had different approaches when it came to patenting of Biotechnology inventions. The EU was stricter in when it came to patenting of living organisms while the US was very liberal and anything under the sky made by a human except the human being himself would fall within this category and can be patented. The strong resistance of EU in this matter resulted into establishing an agreeable middle ground where the nations settled for the provision of Art. 27.3 (b) which became the standard for patenting of Biotechnology. While in the Doha Rounds of Negotiations which started in the 2000's and is the first round since the inception of WTO as a body pursuant to Art. 71.1 of TRIPS and as per the agreement made under Para 19 of the Doha Declaration<sup>xxxviii</sup> the TRIPS Council should examine their relationship between Convention of Biological diversity.<sup>xxxix</sup>

Art 27.3 (b) of TRIPS looks into what amount to an invention and the governments are allowed to exclude certain patenting like plants, animals and essentially biological processes and what are eligible like microorganisms, with non-biological and microbiological processes. Plant varieties are eligible for patenting either through protection system or a system specifically created for providing such protection or a combination of both.<sup>xl</sup> The TRIPS regime has been harmful for the developing countries and its controversy is based on these issues. First being the poor countries are to produce cheaper drugs which are generic in nature while diseases are the cause of deaths around the world because the countries can't afford patented drugs produced by giant pharmaceutical companies. The second issue directly relates to Art 27.3(b) as the agreement has forced the provisions on countries without understanding the scientific and ethical consequences that would partake by accepting Biotechnology patents covering genes, cell lines, and other life forms. The issues have slowly and gradually through time lost their momentum because the countries are following the Biotechnology path while understanding its repercussions as well.<sup>xli</sup>

**iii. Tax Implications:**

At the end of the day such technology transfers are economic transactions and all the applicable taxes including the R&D Cess, Service Tax, Customs, Sales Tax, Income Tax and Central Excise are to be taken care of. The application of tax depends upon the technology

being transferred meaning whether such technology is a Goods<sup>xlii</sup> or Service<sup>xliii</sup> or can be included within the definition of both. The tangibility of the technology can be a good measurement in understanding whether it is within the bounds of the Definition of Goods or Services. It is pertinent to note that certain institutions are exempted from payment of certain taxes, for e.g. the National Research Laboratories, are exempted from payment of Income Tax. They are also exempted from payment of Customs mostly because these Laboratories don't conduct commercial activities or produce any goods hence Customs and Central Excise become inapplicable respectively in such instances. As there are no goods being manufactured there are no sales, therefore Sales Tax is also not applicable here. While in case of services, if it's a scientific and technical assistance-based consultancy work, or if IP services are being provided then such services are taxable.<sup>xliv</sup>

### III. LIMITATIONS OF BIOTECH

Biotechnology like every other form of science produces side effects which are strongly harmful in nature whether they are affecting the humankind or the environment. Some of the significant areas which are adversely affected due to these advancements include the environment, on the other hand we have the commercialization of these products with an intent of achieving higher profits at lower costs and the consumer awareness about the same should also be considered.

#### a) Bio-Terrorism:

Bio terrorism means manipulation of biological elements with an intent to harm the human population by leaving them to absorb in the nature and turning the natural elements harmful for consumption. These biological elements can be inserted in air, water or food which can become a weapon of mass destruction hence the use of word terrorism for explaining the effect it could have on the mankind and the other organisms as well. The prediction of this phenomenon was mentioned in a great work of literature by the celebrated English Author HG Wells<sup>xlv</sup>, where a Bacteriologist was visited by an anarchist<sup>xlvi</sup> while he boasted about his invention of cholera Bacillus in a bottle and discusses the epidemic it would cause if used by anyone. The anarchist steals the tube containing the bacteria and runs out, while the bacteriologist chases him. The anarchist wants to spread the vail through London's water supply. But like every good story this story has a twist, the bacteria is known to make the skin blue of whoever it is that consumes it rather than causing cholera and the anarchist makes the declaration of him consuming it and becoming a martyr for a cause he believes in, while the inventor is disturbingly only concerned about the fact that he would have to produce the bacterium again rather than the outbreak it would've caused if ingested by a number of people. Because the anarchist is on the loose and can cause the infection as the inventor let him go. The city of London will have blue people roaming around. The inventor here is referred to as an agent of the anarchist himself due to his behaviour and lack of ethics.<sup>xlvii</sup>

#### b) Bio-Terrorist Agents:



Historically speaking, whether with intention or unintendedly biological elements are manipulated in warfare and terrorist attacks. The suspicion of the same in today's society is an obvious after effect. The most recent suspicion of Bio terrorism is the well-known COVID-19 virus which spread across the globe with the speed of light. Around Half a Million of the population has been infected and the death toll has been increasing every day to say the least.<sup>xlvi</sup> It has been officially declared as pandemic from World Health Organization. Coronavirus in general can be considered as a threat for bio terrorism according to some reliable sources due to its properties and ability to cause chaos.<sup>xlix</sup> Some experts state<sup>l</sup> that the virus might not be a bioweapon but they are doubtful of whether it was leaked from a research lab, or it might be possible that it was a lab accident of sorts or other possible instances.<sup>li</sup>

There are different categories of organisms that are a threat to the mankind and they have been recognized<sup>lii</sup>, under the first category they have to fulfil certain conditions like easy transmittable nature, has the potential to cause a major impact on the health of the people, can cause social disruption or panic, and needs a special prevention policy meaning it's not an ordinary phenomenon. Different agents include Anthrax,<sup>liii</sup> Botulism, Plague,<sup>liv</sup> Smallpox, Tularaemia, Viral Haemorrhagic Fevers<sup>lv</sup>. Under the second category conditions are that they are moderate or rather easy in spreading, the mortality rates are low moderately, and they can be avoided by specific enhancements by the health authority. Its agents to name a few include typhus fever, Viral encephalitis<sup>lvi</sup>, water or food safety threats, Ricin toxins etc. Under the third category the conditions are that they are available, easy to produce and spread and have a major health impact to the consumers. The agents under this head are emerging diseases of Nipah<sup>lvii</sup> Virus and Hantavirus.

#### **c) Commercial Exploitation:**

The commercial exploitation of such products is also prominent in the industry and the environment gets highly affected. These Biotechnology products are genetic mutation unnaturally which are physically enhanced by the addition of other forms into the natural forms, mostly these products help support the environment but other times it harms them. There seems to be a double standard when it comes to Biotech and Environment on one hand it might enhance the nutritional value and avoid harmful effects on the plant, but it might do so at the cost of harm to the biological diversity. While we consider the development of Biotech, it has to be made sure that no Environmental injustice prevails like it always does.<sup>lviii</sup> Although, due to such advancements and Biotechnology engineering the goal of sustainable development can be achieved.

#### **IV. CONCLUSION**

In terms of development of such technologies, the ultimate goal is public good. Under normal circumstances such technologies are commercialized for the sole demand of profit, the privatization of such technologies has led to becoming a hindrance in fulfilling the ultimate goal. It is pertinent to note that even though the profit goal is a priority for the sectors commercializing such technologies, at the end of the day such technologies are furthering the

human race one way or another. It creates an unequal balance between nations, or rather widens the gap which should be shortened and instead should create equal opportunities for everyone.

Considering Biotech, the research has brought in life changing discoveries in field of health, agriculture, life sciences specifically creation of vaccines and so on. In such instance, where the development is leading to growth of the human race, the visible disparity of distribution of resources should be lessened. It is obvious that reasons behind such disparity is the resources, managerial and technical know how even social and cultural differences can be easily considered as one of the affecting factors. The gap can be lessened by clearing such differences and focusing on research and development. The funding of such research projects and encouraging development should be a priority of a nation and should be showcased by the policies drafted by its government. In conclusion, we understand the different factors which are involved in the field of technology transfer specifically concerning Biotechnology and the solution to these number of issues is to create a strong structural base of regulations or modify the ones which are already in place so take better advantage of such discoveries.

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<sup>i</sup> Mae Wan Ho, Why Biotech Patents are patently Absurd- Scientific Briefing on TRIPS and related issues, Vol. 7 JIPR 151-165 (2002).

<sup>ii</sup> What is genetic modification (GM) of crops and how is it done? (7<sup>th</sup> April, 2019 at 12:13 PM), <https://royalsociety.org/topics-policy/projects/gm-plants/what-is-gm-and-how-is-it-done/>

<sup>iii</sup> Monsanto, Benefits of GMOs and Biotechnology (7<sup>th</sup> April, 2019 at 4:13 PM), <https://monsanto.com/innovations/biotech-gmos>

<sup>iv</sup> Stanley Kowalski, Rational Risk/Benefit Analysis of Genetically Modified Crops Vol 12 JPIR pp 92-103 (2007).

<sup>v</sup> Most of the countries don't accept this argument anymore, as it holds no significance with the growth of biotech.

<sup>vi</sup> Highlighted in the case of *Moore v. Regents of the University of California* 51 Cal. 3d 120, the Supreme court of California stated that the research subject should know about the intention of the inventor/researcher especially when its patented later.

<sup>vii</sup> Ameen Jauhar & Swati Narnulia, Patenting Life the American, European and Indian Way Vol 15 JIPR 55-65 (2010).

<sup>viii</sup> Refers to Deoxyribonucleic Acid.

<sup>ix</sup> Popularly known as the double helix model of DNA propounded by the JD Watson and FHC Crick in 1953.

<sup>x</sup> Ashish Swarup Verma, et. Al, Biotechnology in the Realm of History, J Pharm Bio allied Sci. Jul-Sep; 321–323. (2011).

<sup>xi</sup> History of biotechnology, BIO CONVENTION, (24<sup>th</sup> February, 2020 at 11:43 PM), <https://www.bio.org/articles/history-biotechnology>.

<sup>xii</sup> United Nations Industrial Development Report, 2004 definition of Technology Transfer.

<sup>xiii</sup> Technology Transfer, Science Direct, <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/technology-transfer>

<sup>xiv</sup> Research transforms money into knowledge... and technology transfer transforms knowledge into money.

<sup>xv</sup> Further referred to as DBT. It was constituted under the authority of Ministry of Science and Technology.

<sup>xvi</sup> The Environment Protection Act 1986, EXIM Policy, Foreign Exchange Management Act 1999, IP Laws, DNA Safety Guidelines and so on. There are total 14 legislations which are applicable in the field.

<sup>xvii</sup> These are the guidelines which serve as national policy for implementation of ITPGRFA.

<sup>xviii</sup> A programme called “Bio-prospecting of Biological Wealth using Biotechnological Tools” was initiated by the Dept. during its 9<sup>th</sup> plan and it involves 13 different institutions working in the same field.

<sup>xix</sup> Under Sec 3 (b) invention for commercial exploitation causing prejudice to human, animal or plant life while 3(J) discusses the micro-organisms including the seed, varieties and species of biological processes for production or propagation of plants and animals and lastly 3 (p) discusses the traditional knowledge and its duplication.

<sup>xx</sup> Further referred to as BRAI.

<sup>xxi</sup> Also known as the EVRC, a body under the act.

<sup>xxii</sup> Sudhir Kochhar, Institutions and capacity Building for the Evolution of IPR Regime in India: VI- Obligations and Opportunities in Handling Plant Varieties and Agricultural Biotechnology Vol 13, JPIR 605-611 (2008).

<sup>xxiii</sup> India became the 53<sup>rd</sup> member to join the treaty on 17<sup>th</sup> December, 2001.

<sup>xxiv</sup> The different dimensions mentioned here include the duration, particulars of the technology, its renewal, training or use requirements if any, licensing requirements and conditions if any, restrictions and other such obligations should also be covered.

<sup>xxv</sup> What is technology transfer?, Knowledge for policy, European Commission. Assessed (02<sup>nd</sup> April, 2020 at 12:40 PM) [https://ec.europa.eu/knowledge4policy/technology-transfer/what-technology-transfer\\_en](https://ec.europa.eu/knowledge4policy/technology-transfer/what-technology-transfer_en)

<sup>xxvi</sup> For instance, GM crops have one basic quality of being immune to the pests and therefore resulting into a better yield and saving the costs of pesticides and other expenses made for protecting the crops by the farmers. It is entirely different story that there are questions on its authenticity and the effect it would have on the biological elements in the nature and whether it is safe for consumption or not.

<sup>xxvii</sup> Further referred to as R&D.

<sup>xxviii</sup> Hard Technologies include concepts like Machine which are transferable in a tangible form.

<sup>xxix</sup> Soft Technologies include technical know-how; skills which are acquired by practice and so on. They are most intangible hence the form of transfer changes and becomes more complicated than Hard Technologies.

<sup>xxx</sup> Institutional approach is a system where an individual’s benefit is in the focus while the cooperative approach is more traditional than modern and focuses on the benefit of the community as a whole.

<sup>xxxi</sup> Local conditions include the R&D Facilities, infrastructural conditions, social and economic conditions, environment and cultural conditions, vocational, technical and training institutions which can train personnel and so on.

<sup>xxxii</sup> Tropical Diseases include Malaria, Cholera and dengue. These diseases are neglected and are only seen in sub-tropical or tropical climates which happens to be the case for most developing nations.

<sup>xxxiii</sup> Chronic Diseases include Cancer, Cardiovascular diseases or respiratory disorders.

<sup>xxxiv</sup> Birendra Singh, Technology Transfer in Biotechnology, JNU (2014).

<sup>xxxv</sup> Trade Related Intellectual Property Rights Agreement under the WTO Regime.

<sup>xxxvi</sup> Further referred to as UPOV. It was signed in the year 1961 in Paris and the convention came into force in 1968.

<sup>xxxvii</sup> Rajkumar Dubey, India: Biotechnology Laws in India, Dubey & Partners, Mondaq (Last visited on 2<sup>nd</sup> April, 2020 at 12:34 PM). <https://www.mondaq.com/india/healthcare/26049/biotechnology-laws-in-india>

<sup>xxxviii</sup> WTO (6<sup>th</sup> March, 3:00 AM), [https://www.wto.org/english/tratop\\_e/trips\\_e/art27\\_3b\\_background\\_e.htm](https://www.wto.org/english/tratop_e/trips_e/art27_3b_background_e.htm).

<sup>xxxix</sup> Further referred to as CBD.

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<sup>xi</sup> WTO (7<sup>th</sup> April, 2019 at 12:18 PM),  
[https://www.wto.org/english/tratop\\_e/trips\\_e/art27\\_3b\\_background\\_e.htm](https://www.wto.org/english/tratop_e/trips_e/art27_3b_background_e.htm)

<sup>xli</sup> *Supra*.

<sup>xlii</sup> "**Goods**" can be defined as every kind of moveable property other than actionable claims and money; and includes stock and shares, growing crops, grass, and things attached to or forming part of the land which are agreed to be severed before sale or under the contract of sale according to the Sale of Goods Act.

<sup>xliii</sup> "**Service**" can be defined through the means of common understanding as "The act of doing something useful for a person or a company for a fee". It is an intangible commodity in the form of human effort, such as labour, skill, or advice and will not result in customer's ownership.

<sup>xliv</sup> Chapter 6: Legal Issues in Technology Transfer, Shodhganga,  
<https://shodhganga.inflibnet.ac.in/bitstream/10603/91195/1/11chapter%206.pdf>

<sup>xlv</sup> In his book called "*The Stolen Bacillus and Other Incidents*" published in 1895 which was a collection of fantasy science fiction short stories where the first short story has mentioned the phenomenon of bio terrorism and how the inventors are unaware of the power, they hold to destroy the human population through the means of their invention.

<sup>xlvi</sup> The anarchist states that "Blind fools to use Bombs when this kind of thing is attainable" – which basically sum up the premise of Bio terrorism and the potential it has in producing harm to the society.

<sup>xlvii</sup> Catherine Belling, *The stolen Bacillus* NYU Langone Health in Literature Arts Medicine Database (8<sup>th</sup> April, 2019 at 4:15 AM), <http://medhum.med.nyu.edu/view/12427>.

<sup>xlviii</sup> The Data was collected and retrieved from <https://thebulletin.org/tag/coronavirus/>.

<sup>xlix</sup> <http://www.centerforhealthsecurity.org/resources/fact-sheets/>.

<sup>i</sup> While doubts remain and this is all on basis of suspicion, it is considered that it may have been intentionally released with a certain motive. The origin of the Virus is Wuhan, China and its impact has led to such drastic changes in literally every country's policies and population. The effect of the same can be felt first hand now with everyone being ordered to not step out of their homes strictly. The virus once spread with an intent to cause terror is mostly claimed by the terror group or organization behind it which does not seem to be the case for current scenario but that has not ruled out the suspicions from rolling in.

<sup>ii</sup> Matt Field, Experts know the new coronavirus is not a bioweapon. They disagree on whether it could have leaked from a research lab (March 31, 2020 at 12:34 AM) <https://thebulletin.org/2020/03/experts-know-the-new-coronavirus-is-not-a-bioweapon-they-disagree-on-whether-it-could-have-leaked-from-a-research-lab/>.

<sup>iii</sup> The Centers for Disease Control and Prevention ("CDC") which is American governmental body under its head of specific hazards provides the categories of Bio terrorism.

<sup>iiii</sup> These are known suspicious diseases that are said to be spread due to the anthrax are Midnapur in 1999, and in 2001 an area in the city of Mumbai called Mantralaya.

<sup>lv</sup> In 1994, in the city of Surat there was Bubonic plague which caused death of a certain number of people, it also comes within the category of suspicious bio terrorist attacks.

<sup>lv</sup> An instance of the Dengue haemorrhagic fever was in the year 1996 in the city of Delhi. This head includes filoviruses and arenaviruses. There are no proper proof that these instances were caused due to bio terrorism but there is suspicion that they were the reason behind it.

<sup>lvi</sup> There was also an encephalitis caused in the year 2001 in Siliguri.

<sup>lvii</sup> There was a documented Nipah Virus outbreak in 2018 in Kerala, which served as a potential act of Bioterrorism. The first outbreak was recorded in the year 1998 by the Malaysian Pig Farmers community and the virus is named after a village in Malaysia. Other locations of outbreak include Bangladesh in 2001, and West Bengal in 2007.

<sup>lviii</sup> Carmen G. Gonzalez, Genetically Modified Organisms and Justice: The International Environmental Justice Implications of Biotechnology, 19 Geo. Int'l Env'tl. L. Rev. 583 (2007).