CHAPTER 2: CONCEPTUAL UNDERSTANDING OF TECHNOLOGY TRANSFER

With the evolution of the concept of world trade, the economy of the world has undergone major changes in the past decades. Factors like increasing costs, perfect competition, market forces and technological knowledge across countries have played a major role[87]. Technology today has become an integral part of international trade. Hence, the transfer of technology is crucial at present to stimulate the growth and development of a nation. Not to doubt the potential of the developed countries, who were the forerunners in the growth and evolution of technology, the developing countries depended on the developed countries for sharing this information and technology.

The conclusion of the UNCTAD XIII[88] (UNCTAD XIII, Doha Mandate and Doha Manar), emphasized upon by the Member states was that the development of a strong and robust science technology and innovation (STI) capacity would be key in addressing many of the pressing and persistent challenges on emerging trade and development that the developing countries are facing. These effectively designed and decisive STI policies should be a part of the developmental strategies of a nation. One important component of these policies for long has been transfer of technology[89]. In addition to this, discussions at the thirteenth conference also highlighted that the policies for developing countries on transfer of technology are rather multifaceted. The outcomes of such policies should focus on increasing access to technology which includes improving the capabilities of the borrower to identify, acquire, adapt and use technology and related knowledge[90].

While these policies may help the developing countries achieve the desired goal, their end is not only to ensure the successful transfer of technology; rather to create an

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[87] *Supra* Note 35, 9.
[88] United Nations Conference on Trade and Development, under the aegis of the United Nations, is a permanent intergovernmental body within the United Nations Secretariat, established by the United Nations General Assembly in 1964, with headquarters in Geneva, Switzerland. The UNCTAD promotes the interests of the developing countries in world trade by helping them participate more equitably in the global economy. *See,* https://unctad.org/.
[89] UNCTAD XIII Doha Mandate and Doha Manar, Available at https://unctad.org/system/files/official-document/iss2012d1_en.pdf.
[90] *Id.*

effective ecosystem of innovation that adds economic as well as social value (economic when the successful application of technology bears anticipated results and profits and social when it serves needs of the people in society).

Transfer of technology has internationally been discussed prominently at not only the United Nations, but also by the World Trade Organization (WTO)[91], TRIPS and the Doha Ministerial Declaration. Why this transfer is beneficial to the developing countries needs no over emphasis. Developing countries like India can have access to this technology and can also incorporate them into their domestic trade practices and development.

Whereas in more developed and advanced economies, technological progress may involve innovation and generation of new knowledge to speed the "productive activity, for developing countries this technological progress is dependent upon technology and related knowledge that has been developed abroad[92]." As suitable organisation and usage of technology is essential for any kind of developmental process, all developing countries are influenced by and look towards the developed countries for sharing of this technology and knowledge in order to accomplish and boost its goals[93]. Given the vast pool of resources available to the developed nation and the resources that is spent in research and development (R&D) by them, it is logical to consider how developing nations can gain advantages by acquiring technology through borrowing. Yet, merely adopting technology does not fulfil its purpose, and consequently, the technological advancement of developing countries is also influenced by their "ability to access, adapt and diffuse this knowledge to meet their suitable needs." For the very same reason, the consequences of bridging the technology gap between the nations on trade and

[91] "UN International Development Strategy, Action programme of the General Assembly for the Second United Nations Development Decade [Sale no.E.71.11.A.2, 1970] - In the International Development Strategy for the Second United Nations Development Decade (1971-81) Chapter on Science and Technology, the General Assembly stipulated that, developed countries and competent international organizations will implement a programme for promoting the transfer of technology to developing countries, which include the review of international conventions on patent, the identification and reduction of obstacles to the transfer of technology to developing countries, facilitating the utilization of technology transferred to developing countries."

[92] *See* Working Paper, *Transfer of Technology and Knowledge Sharing for Development: Science, Technology and innovation issues for Developing Countries*, UNCTAD Current Studies on Science, Technology and Innovation.

[93] *Supra* Note 67, 20.

development has been the core of international discussions for decades. To achieve the said goal, encouragement to transfer of technology is vital.

For a long time, industrialized countries dominated the international trade scene. During the post second world war scenario, the developing countries organised themselves as the group of 77 (G-77) and in the UNCTAD introduced a series of negotiations which visualised establishing a New International Economic Order (NIEO). Due to them facing a tough time during the 1980's where the developing countries were going through external debt problems, and balance of payment crisis, they were forced to borrow from the World Band and the International Monetary Fund (IMF)[94]. The West launched the Uruguay Round of Negotiations in the GATT. The UNCTAD which represented hopes for the north south negotiations was left behind and GATT which was less active and more of a sleepy organization initially limiting its scope to tariff and trade negotiations only, came to make the more far-reaching negotiations which were out of the scope of its competence.

DEFINING TECHNOLOGY AND TECHNOLOGY TRANSFER

Although the term transfer of technology is self-explanatory, it is important to define it in the present related context. Technology conceptually is a combination of equipment, knowledge and skill. Hence, defining technology transfer would be effective if a comprehensive definition is arrived at that discusses "the nature of the transfer of all forms of this commercially usable equipment, knowledge and skill, whether patented or unpatented; which is difficult as no proper consensus exists about the nature of the process of the transfer. Nevertheless varied attempts have been made to define transfer of technology as this transfer to developing countries has undoubtedly been one of the most debated areas of international economic relations and international trade."

The definition of 'technology transfer' in the Oxford Dictionary of Economics is "*the transfer of techniques from countries where they are more advanced to other countries where they are less advanced. Technology transfer may involve foreign direct investment, transfers of skilled personnel from more advanced countries, training of workers from less advanced countries, or licensing of patents*". This concise definition highlights a crucial aspect of the transfer process: the licensing of patents when the

[94] JAMES M. BOUGHTON, THE IMF AND THE SILENT REVOLUTION 2 (2000).

technology being transferred is patented. Transfer of patented technology would bring in a host of intellectual property rights issues with itself governing the transfer process.

The developing countries stand at a disadvantage in matters of resource generation and endowment, international competition and population growth. Consequently, the development and exploitation of modern day technology appears to the most sought after and vital route to overcome the impasse of growth. This could have been achieved by the developing countries and the less developed countries (LDCs) if such economies due to human, physical and monetary resource constraints were not fighting to be in a position where they could comfortably acquire technological production knowledge and meet their developmental needs by themselves without external support of any kind. Since most of the advanced knowledge to acquire these developmental needs rests with the global north, it is understood that developing as well as less developed nations benefit from this knowledge from the advanced nations.

Transfer of technology is this process of transfer by which backward economies obtain this knowledge, skill and equipment from the north, process such knowledge and initiate a journey of economic development of their own to meet their own needs. The "UNCTAD Draft International Code of Conduct on Transfer of Technology, that was negotiated between the years 1978 and 1985 defined technology[95] as systematic knowledge for the application of a process that results in the manufacture of a product or for rendering of a service, which does not extend to transactions involving the mere sale or mere lease of goods[96]." This definition seeks to exclude sale and lease of 'goods' from the domain of technology that it describes, meaning thereby that it refers only to the information or knowledge that is utilized and processed for the creation of a good or provision of service, as 'technology' *per se* and does not include the final product or service itself.

The terminology 'transfer of technology' is as broad as even to encapsulate "a process by which a particular technology that is developed for a specific purpose and a specific setting becomes applicable to a completely different productive setting. This transfer may refer to the process that takes place within or even across national boundaries. It

[95] Pedro Roffe, *Transfer of Technology: UNCTAD's Draft International Code of Conduct,* 19(2) INTERNATIONAL LAWYER (1985), https://core.ac.uk/download/pdf/216913331.pdf
[96] UNCTAD, 1985, chapter 1, para 1.2.

may happen on a commercial or a concessionary basis depending on the terms that have been negotiated between parties[97]." The subject matter of the transfer can be both tangible and intangible assets; tangible involving the physical movement of technology products and intangible where sharing of knowledge, know-how and other technical information is involved. A transfer of technology process can even involve the transfer of both physical assets and know-how sometimes[98]. Conceptually, this transfer process has relevance to the transfer of human potential and capabilities, where it is the human mind that develops the particular technology and the same mind which identifies the technology gap and realises its need in the present world.

The above definitions of technology conclude that while technology may not just refer to the finished product or technology, the product itself may be an important part of the transfer process. Technology not only comprises "knowledge or methods that are necessary to carry on or to improve the existing production and distribution of goods and services or indeed to develop entire new products or processes, but also entrepreneurial expertise and professional know-how[99]". When it is not just the end result, it includes "entrepreneurial expertise and professional know-how to deliver products and services[100]". These two elements, usually in the possession of the technology owner, put him at a competitive advantage over others. The technical knowledge or the professional know how on which the final finished product is based should include the knowledge leading to the final product or service and the organisational capacity of the entity to convert productive inputs into the end result.

Based on the aforementioned comprehension of the technology concept, the transfer of technology was delineated by the UNCTAD Draft International Code of Conduct on the Transfer of Technology[101] as "the transfer of systematic knowledge for the manufacture of a product, for the application of a process or for the rendering of a

[97] *Supra* Note 92, 34.
[98] *Id.*
[99] Mingsarn Santikarn, *Technology Transfer: A Case Study,* 42(4) THE JOURNAL OF ASIAN STUDIES, 4-5 (1983).
[100] UNCTAD, 1985.
[101] *Supra* Note 95, 36.

service and does not extend to the mere sale or lease of goods." The UNCTAD further categorised five major possible kinds of transactions from the given definition to be[102]:

- *"The assignment, sale and licensing of all forms of industrial property, except for trademarks, service marks and trade names when they are not part of technology transfer transactions;*
- *The provision of know-how and technical expertise in the form of feasibility studies, plans, diagrams, models, instructions, guides, formulae, basic or detailed engineering designs, specifications and equipment for training, services involving technical advisory and managerial personnel, and personnel training;*
- *The provision of technological knowledge necessary for the installation, operation and functioning of plant and equipment, and turnkey projects;*
- *The provision of technological knowledge necessary to acquire, install and use machinery, equipment, intermediate goods and/or raw materials which have been acquired by purchase, lease or other means;*
- *The provision of technological contents of industrial and technical cooperation arrangements"*

While this definition given by the UNCTAD was thought to be narrow and not all inclusive, it turned out to be a good attempt at defining the aspects of transfer as the definition was comprehensive and precise at the same time. However, due to the negotiations of the Code never came to realisation; there isn't an internationally agreed definition on transfer of technology.

Blakeney in his book[103] has also conceptualised technology transfer as "the process by which commercial technology is disseminated. This takes the form of a technology transfer transaction, which may or may not be covered by a legally binding contract, but which involves the communication, by the transferor, of the relevant knowledge to the recipient." As transfer of environmentally sound technologies has also been

[102] UNCTAD, 1996a, vol. 1, p.183. "Draft TOT Code, Chapter 1, para.1.3. During negotiations the Group of 77 countries wished to see these as mere examples of technology transfer transactions, while the major developed capital- and technology-exporting states, Group B, and the then socialist Group D, saw them as exhaustive."

[103] MICHAEL BLAKENEY, LEGAL ASPECTS OF THE TRANSFER OF TECHNOLOGY TO DEVELOPING COUNTRIES, 136 (1989)

discussed on international platforms such as the United Nations Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change has discoursed that "the broad and inclusive term 'transfer' encompasses diffusion of technologies and technology cooperation across and within countries. It covers technology transfer processes between developed countries, developing countries and countries with economies in transition, amongst developed countries, amongst developing countries, and amongst countries with economies in transition. It comprises the process of learning to understand, utilize and replicate[104] the technology, including the capacity to choose and adapt to local conditions and integrate it with indigenous technologies[105]." It further defined technology transfer as "the broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organisations (NGOs) and research/education institutions."

In order to come to the most comprehensive definition of transfer, the IPCC focused on both diffusion of technology and harmony and co-operation among countries. From this co-operation among countries, the ability of the economy to adapt and master technologies so received by the transfer became much more important and vital to the transfer process.

There have also been other attempts at defining the 'transfer' in transfer of technology focusing on its operational framework. It indicates that the term 'transfer' ought to be "*regarded as putting the technical concepts into practice locally in a sustainable manner and replicate projects to speed up successful implementation*[106]*;*" or "*any process by which a party in one country gains access to technical information of a foreign party and successfully absorbs it into its production processes*[107]". Both of these

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[104] *Infra* Note 105, 39. The final stage of the five basic stages of technology transfer (assessment, agreement, implementation, evaluation and adjustment, replication) as defined in the Report as a combination of actions that lead to the deployment of a given technology, once transferred, to meet a new demand elsewhere.

[105] *See,* The IPCC Special Report on Methodological and Technological Issues in Technology Transfer (SRTT) (IPCC 2000), https://archive.ipcc.ch/pdf/special-reports/spm/srtt-en.pdf

[106] Wilkins, G., *Technology Transfer for Renewable Energy - Overcoming barriers in Developing Countries*, Royal Institute of International Affairs/Chatham house, (2002).

[107] Glass, A.J. and Saggi, K., *The Role of Foreign Direct Investment in International Technology Transfer*, in, INTERNATIONAL HANDBOOK OF DEVELOPMENT ECONOMICS (Dutt A. and Ros JMA eds.,2008)

definitions include a crucial concept of 'absorption of new technology by the recipient country' and its 'sustainability'. Without absorption of the borrowed technology and devising methods of sustainability of the same, a transfer process cannot be a successful one. Another definition defines technology transfer as "*transmission of know-how to suit local conditions, with effective absorption and diffusion both within and across countries",* bringing into light different factors such as 'suitable local condition', 'diffusion' and 'effective absorption' which are essential for the transfer process and its sustainability. It puts the recipient country in a position of responsibility to produce the good using the technology in a desired manner-one that suits the local needs and requirements.

What can thus be concluded from all the above definitions is that technology transfer for certain is a complex process starting from identifying the particular technology to its adaptation in the recipient country. In order to support the process, the recipient country needs to have a robust technical and administrative set-up in addition to strong intellectual property laws with their proper implementation.

A number of studies during the late 1960s raised these concerns regarding transfer of technology. The studies that were conducted identified acute dependence of the developing countries for the acquisition of technology to further development, on a limited number of suppliers. There were issues with the flow of technology to these countries. The insufficiencies in the scientific and technological base of the country, which posed a hurdle to adaptation and absorption of the foreign technology, further aggravated the problem. Technology under such circumstances was being traded under terms and conditions which had many social, economic and financial repercussions for the developing countries that lacked the innovative and legal ecosystem for the acquisition and absorption of the technology[108]. Hence, developing countries couldn't actively make best use of the opportunities ushered by the developments in science and

[108] *See generally*, early work by the "UNCTAD secretariat, e.g., The Transfer of technology to developing countries, with special reference to licensing and know-how agreements (study prepared by G. Oldham, C. Freeman, E. Turkman), TD/28/Supp.1 (1967); Major issues arising from the transfer of technology to developing countries, TD /B /AC. 11 / 10Rev.2 (1975); and An International Code of Conduct on the Transfer of Technology, TD/B/C.6/AC.1/ 2/ Supp. 1 / Rev. 1 (1975). See also A. F. Ewing, UNCTAD and the Transfer of Technology, 10J. WORLD TRADE L. 197 (1976) and S. J. Patel, The Technological Dependence of Developing Countries, 12 J. OF MOD. AFRICAN STUDIES, 1 (1974)."

technology. The absence of a well-defined science and technology policy led to an uncoordinated approach to deal with matters of technology transfer.

TECHNOLOGY GENERATION, DIFFUSION AND TRANSFER

Although they might seem to mean similar things, but the terms "technology generation", "technology transfer" and "technology diffusion", all carry different meanings and conceptual understanding. Technology transfer and diffusion are most commonly used interchangeably, while they differ significantly.

Given the supremacy of technology to overall growth and development, the need for its acquisition by developing countries rises. It is desirable that the not so advanced economies also get to benefit from whatever technology is being generated all over the world, fruitful to the needs of the society. Thus, the generation, transfer and diffusion of such available technology should be promoted[109]. Majority of the world's most advanced and useful technology is being generated by private entities, i.e. transnational corporations (TNCs), that even though operate businesses in different countries by being involved in the production of goods or services and asset management internationally, usually base their prime research and development activities in developed countries where innovation thrives[110]. This creates an asymmetry between technology possession and technology requirements, resulting in a huge gap between technology that is generated and subsequently owned by private entities in developed countries and technology which is desired to be adopted and utilized in developing nations. Developing countries attract only minimal portions of investment on foreign research and of what they get, is mostly utilised for adaptation to the technology and related technical support instead of innovation.

Technology generation happens with ideas, and how those ideas see the end of the tunnel. A nation progresses with such corporations investing in information and technology and making an effort to spread it to the world. Additionally, good research and development also make a strong economy. Research and development (R&D) indicates and influences the innovation capacity of a country, its sustainable

[109] *Supra* Note 92, 34.
[110] Lei Lv, Yuchen Yin, Yuanchang Wang, *The Impact of R&D Input on Technological Innovation: Evidence from South Asian and Southeast Asian Countries*, in DISCRETE DYNAMICS IN NATURE AND SOCIETY, Hindawi (2020).

development potential and the measure of international technology input and output. A country's inclusive technological strength marks its competitiveness in the world. Thus, generation of technology and having the technology infrastructure where such entities rooting for the technology generation can flourish, is utmost essential for development. After all, transforming invention into productivity gains is the core of economic growth[111].

Technology transfer and diffusion revolve around the concept of the independent production of a good or service, identification of its utility in society leading to widespread use and adoption of the process (it may even include the knowledge required for all the three stages). This process may involve different incentives, which might have incompatible effects on research and innovation. On a broader and a more general level, the difference between transfer and diffusion process of technology involves an element of purposefulness and efficaciousness[112].

What differentiates between the two subtly is the fact that diffusion appears to be a progressive approach of adoption of a particular kind of technology to serve the needs of a given population in a society. The nature of this process is more passive than active. Nevertheless, technology transfer can be perceived as a more proactive procedure, wherein a country or users actively pursue acquiring knowledge related to or the rights of or the particular technology itself to be able to make use of that technology effectively. They furthermore, adapt or mould the utilisation of the technology as per the required need which makes transfer as a procedure more purposeful[113]. Another general point of differentiation may be that technology transfer generally involves a transfer from an entity to another exhibiting the participation of two parties which may not be the case with technology diffusion.

Since the transfer process is in the nature of an agreement between two parties, it carries with itself a concern on the part of the owner for return on the innovation[114], a result of time, money and effort invested. On the contrary, diffusion relies more on the country's willingness and its capacity and capability to embrace it.

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[111] Stewart, C. T., *Technology transfer vs. diffusion: A conceptual clarification,* 12(1) THE JOURNAL OF TECHNOLOGY TRANSFER 71–79 (1987).
[112] *Supra* Note 92, 34.
[113] *Id.*
[114] *Supra* Note 111, 42.

The innovator (corporation or other private entity, who is the first owner of the technology/product) which has developed a new product using a particular technology with a certain amount of investment, invests a lot more in further producing it at a large scale and its marketing to encourage its purchase by others who may use it. This process is known as diffusion of use; which results in a blessing in disguise to not only the economy but also to the society where more and more people are able to make use of the product. The innovator also profits this way, with the widespread use of the product. Diffusion of use encourages growth and is also rewarding to the innovation that went behind processing the good. The adoption of the particular product/good by others for their utility, whether by means of sale, lease, gift or even theft is diffusion of use, where in the case of theft, the innovator receives no profit as even though the product becomes popular, there is no legal incentive that the owner receives. Diffusion of use concerns spread of the product; whereas it does not necessarily entail the transfer of the technology embodied in the product which is necessary for its production.

In most of the instances, the innovator wishes to avoid the unauthorised distribution or utilisation of the product or technology which leads to them investing huge amounts for its protection. The knowledge behind the invention needed for its production is protected by legal measures to avert its unwarranted spread to other competing entities. The same may be achieved by intellectual property rights (patents, trade secrets)[115]. Logically such an innovator, trying to keep the technology and knowledge protected by conscious efforts, does not intend to transfer the same to other firms or corporations due to lack of any kind of incentive. On the contrary, if this information or technology were to be transferred without any gain to the innovator, the other firms would take over the monopoly established by the innovator and also the market share. This encroachment on the monopoly would lead to a substantial amount of loss in the profits incurred to the innovator along with a drop in the price of the product/technology. The only way it shall benefit the society is by an unintentional diffusion of use.

To facilitate the transfer effectively, the owner may enter into licensing and confidentiality agreements with the other firms for proper use and diffusion of the technology, along with negotiating a suitable price, agreeable to both the parties, so that

[115] Rod Falvey & Neil Foster, *The Role of Intellectual Property Rights and Technology Transfer and Economic Growth,* Working Paper, United Nations Industrial Development Organization, 2006.

no party suffers[116]. The agreement would then conclude a proper transfer process resulting in accelerated growth and development for an economy where the subjects benefit from the same and the owner, adequately compensated[117]. If the transfer goes on to remain unrestricted, it would eventually undermine the sweat and labour behind the invention in absence of a fortifying reward, which in turn would be detrimental to economic growth and productivity gain.

The innovator in both the cases has every reason to promote his invention[118], to extend the market for his product, but be apprehensive about an early unrewarding transfer process. Once the innovator loses control on first sale of rights, or if protected by intellectual property rights, on either the expiration of the patent term or loss or break in secrecy, it can no longer prevent or control the sale and further distribution of rights of the technology and consequently would not be able to profit further from the particular technology.

Whenever a purchase of any product is made, there is some amount of transfer of technology that happens with it. The buyer of the product usually receives an instruction manual which illustrates in detail the ideal use of the product. By means of the instruction manual, the company or the proprietor shares instructions in the nature of technical assistance or training, on learning which the buyer can make good use of the product. The instructions are generally self-explanatory to ensure the best use of the product by the buyer. This promotes use and publicity. These instructions in the form of knowledge transfer come with the product and are not charged for extra. This, however, is different from technology transfer and know how licensing as the latter entails the methodology of manufacture of the product.

Cost is also a factor that can distinguish between the two concepts. The cost involved in the process of technology transfer is much higher when compared to diffusion. For technology transfer, the receiver country incurs the costs for construction of relevant machinery, purchase and installation of equipment, both as part of infrastructure; training, technical assistance, servicing, maintenance as after sale expenses, and expenses for advertising and marketing. As these costs add up to be a good amount, the

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[116] *Supra* Note 67, 20.
[117] *Supra* Note 111, 42.
[118] Eveland, Jd., *Diffusion, Technology Transfer and Implementation: Thinking and Talking about Change,* SCIENCE COMMUNICATION 303-322 (1986).

recognition given to technology transfer remains low. The process will not turn out to be a success if there is unwillingness on the part of the receiver country to incur the costs for adoption of the technology. Also, if there be an increase in the number of transferees on successful transfer of technology, the transferor would fear losing market share which can also cause a hurdle to the transfer process. Thus, there can be bottlenecks on both the sides of the transferor and the transferee which can limit technology transfer.

On the contrary, diffusion entails costs that are most commonly associated with the cost of the product. The costs of diffusion are the price of the product which is paid by the buyer in addition to the small incremental costs of installing, assembling or servicing the product if necessary. When compared with the costs of technology transfer, these costs seem minimal.

Lastly, there can be other relevant factors that can always hold relevance for differentiation between transfer and diffusion. What kind of technology is being transferred[119] happens to be the most important factor, as based on that depends its use; to whom the technology transfer is made; whether the receiver has ability to make optimum use of the technology/or can advance it or the pace of adoption[120] of the technology by the receiver. Sometimes the proprietary knowledge associated with the product may be patentable or not. Sometimes the users of the technology might not be general public who can make do with general knowledge about the product, but its market may be limited to a handful of skilled people who possess specific knowledge[121].

As has been rightly pointed out, *"The importance of technology transfer lies in its ability to stimulate and strengthen the innovation process."* Technology transfer is to be seen as intrinsically linked with innovation[122]. The two mutually affect each other. Innovation entails an idea that is manifested as an invention and worked upon to its

[119] *See, Infra* Note 122, 45.
[120] EDWIN MANSFIELD, *Innovation and the Diffusion of New Techniques,* THE ECONOMICS OF TECHNOLOGICAL CHANGE 25(1968).
[121] *Id.*
[122] Gee Sherman, *The Role of Technology Transfer in Innovation,* 17(6) RESEARCH MANAGEMENT 31-36 (1974).

societal acceptance and utility. More innovation in the technological field will stimulate technology transfer and global utility.

THE EVOLUTION OF TECHNOLOGY TRANSFER

Technology transfer, as a concept, is not new and has existed in the discussions and debates between nations and of bodies and organisations at the international level for decades now. From research to invention, disclosure, figuring out means of protection of the technology, commercialisation and revenue management, the process involves more complexities when the same is transferred. From the society's perspective, it brings a host of benefits when the borrowed and adopted technology saves lives, provides a cleaner environment to breathe, provides better health facilities and many other technological paybacks that not only generate new opportunities but also drive local/national innovation[123].

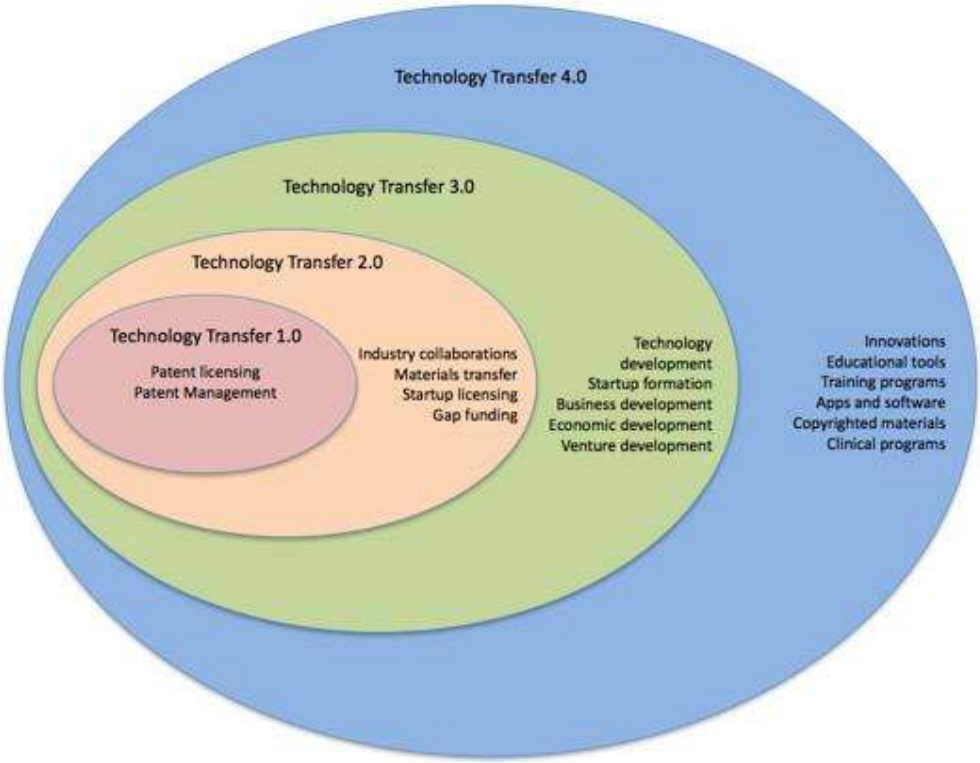
For the past few years, developing countries have put in effect a number of policies to encourage and expedite, as per need, technology transfer from developed countries and multinational/transnational corporations[124]. The subject matter of these policies ranges from promotion of science and technology to formation and procurement of innovative technology along with intellectual property rights protection. The UNCTAD XIII[125] also focused on how these policies on science technology and innovation should be a part of the developmental strategies of a nation.

To fulfil these aims regarding technology transfer much of the efforts were set in motion in developing countries after passing of the TRIPS Agreement[126]. In developed countries like the U.S, the Federal Government every year spends billions of dollars on universities to do research and subsequently contribute to the society. This is understandable as developed economies like the U.S. contribute majority of their resources on just research and development (R&D)[127]. With so much of investment, they are able to generate more. The Bayh-Dole Act[128], which was passed in 1980 by

[123] Theodore Harper, *Understanding Technology Transfer*, 10 WHITTIER L. REV. 161 (1988).
[124] T.A. Faunce, *Technology Transfer,* 2 ENCYCLOPEDIA OF APPLIED ETHICS 7 (2012)
[125] *Supra* Note 88, 33.
[126] *Supra* Note 30, 8.
[127] CARLOS M. CORREA, TRADE RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS: A COMMENTARY ON THE TRIPS AGREEMENT, 91 (2007)
[128] 1980. "A legislation permitting ownership by contractors of inventions arising from federal government funded research. It enabled academic and non-profit research institutions to patent and

the American government, is deemed to be the pillar on which America's research and innovation ecosystem rests.

While there is no defined pathway of the journey of technology transfer and how it progressed, the same can be studied under four phases:



commercialise inventions developed under federally funded research programs within their organizations. This was not possible before the passage of this Act. Employees of the federally-funded institution (the 'grantee') must disclose each invention promptly, to their employer and in turn the institution must disclose any new invention within two months of disclosure to the funding agency. A procedure that is laid down is as follows:

- Academic or other non-profit institutions must decide if they wish to retain title over the invention or not
- Within one year of electing for ownership, universities must file an initial patent application – (provisional, utility or PCT).
- All patent applications must indicate that the invention was made with federal funding and that the government has certain rights in the invention.
- A decision not to pursue issuance of a patent must be reported to the funding agency, which may take over prosecution of the patent.
- Importantly, the grantee must agree that products manufactured by the grantee or an exclusive licensee using the invention must be manufactured substantially in the United States.

Universities must license their innovations to industry and share income with the inventor(s). The federal government retains a nonexclusive, royalty-free irrevocable license to the subject patent. Any remaining funds, after the institution's technology management overhead costs have been covered, must go towards the support of scientific research or education at the institution such as supporting graduate students, buying research equipment, and funding additional research."

First: During early 1980's, The Bayh-Dole Act was passed in the U.S. in order to overcome the threat that the federal government thought U.S. faced at that time due to non-commercialisation of thousands of patents that the government owned. The government for a long time intended to boost the economy and trade by commercialisation of patents that resulted from the research which the government was funding[129]. The Act gave the autonomy and power to such academic institutions (universities) to own the patents which resulted from federally funded research[130].

Obligations under the Bayh-Dole Act:

Hence, thereafter, the patenting and licensing regime of many universities was chiefly regulated by the obligations under the Bayh-Dole Act. Some universities even started to license their inventions to start-ups. The basic agenda that the academic organisations had in mind was to extend the exploitation of their invention to other potential commercial uses. Focus on advertising and marketing remained low. The only way by which the universities spread information about their invention was by providing briefs on non-confidential summaries to other companies. Thus, the first phase of the evolution focused on public funded research in universities as these organisations were believed to play a pivotal role in conducting researches and generating path-breaking ideas.

As harnessing local innovation and promoting creative ideas to grow is key to ensuring global trade harmony and competitiveness, the Indian government on December 15, 2008, introduced in the Rajya Sabha, a bill inspired by and largely based on the United States Bayh-Dole Act of 1980, titled, 'THE PROTECTION AND UTILIZATION OF PUBLIC FUNDED INTELLECTUAL PROPERTY BILL[131], 2008'. This Act highlights advantages of and addresses issues which may cause hindrance to government funding to the academic institutions in order to promote innovation and

[129] *Supra* Note 29, 8.
[130] *Supra* Note 128, 46.
[131] *See,* Sandeep Hegde M., Salient Features of the Indian Bayh-Dole Act, Banana IP Counsels (April 26, 2011), https://www.bananaip.com/ip-news-center/protection-and-utilisation-of-public/

growth[132]. Although a few changes and clarifications on how to promote innovation while regulating the grant from the government in the form of public funds was required before the Bill could pass with assent from both the Houses, it was unfortunately withdrawn on December 8, 2014[133] and could not see the light of the day.

Second: The second phase of the evolution of technology transfer saw a bent towards increasing entrepreneurial activity in making the inventions generated meet industry collaborations. It was thought that if university-industry collaborate, the technological research can advance towards better commercial value as there would be more private players willing to invest in the research, apart from just local government. With industry collaborations, the invention could reach out to more people with communication to targeted stakeholders[134].

This phase of technology transfer evolution was dominated by industry sponsored research and a number of licenses of access to the invention being given to other companies. The need to strengthen the industry relationship was thus realised for better growth and commercialisation of research. A handful of universities[135] were successful in creating a research ecosystem and were making good of the funds that were available to them for research, like Stanford University[136] and Massachusetts Institute of Technology (MIT)[137]. With the rising awareness about intellectual property rights as a legal measure to protect innovation, some universities were hesitant to license the technology to the inventor. However, realising the non-profit status of such academic institutions and the benefits that IPRs could bring to the inventions as return on investments, universities were actively participating in licensing negotiations with

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[132] Bhaven N. Sampat, *The Bayh Dole Model in Developing Countries: Reflections on the Indian Bill on Publicly Funded Intellectual Property,* UNCTAD-ICTSD Project on IPRs and Sustainable Development (Oct. 2009), https://unctad.org/system/files/official-document/iprs_pb20095_en.pdf

[133] *See,* https://prsindia.org/billtrack/the-protection-and-utilisation-of-public-funded-intellectual-property-bill-2008.

[134] Arundeep S. Pradhan, The evolution of technology transfer (Dec. 13, 2016), https://www.linkedin.com/pulse/evolution-technology-transfer-arundeep-s-pradhan-rttp

[135] Hamermesh, Richard G., Josh Lerner, and David Kiron, *Technology Transfer at U.S. Universities*, Harvard Business School Background Note 807-124 (Jan. 2007).

[136] Stanford University Office of Technology Licensing (OTL) Inventor's Guide, https://web.stanford.edu/group/OTL/documents/OTLinventorsguide.pdf.

[137] Top Universities that engaged in research and transfer of technology during that time were Stanford University, Massachusetts Institute of Technology (MIT), Harvard University, University of Pennsylvania and University of Washington.

industry partners on collaboration. All such negotiations were centred around ownership of the technology and licensing rights.

Another thing that mushroomed during the same time and rapidly gained importance was "Material Transfer Agreements" (MTA)[138]. Material transfer agreement is a mechanism to strengthen university industry collaboration (here with regard to technology transfer), through the use of a contract between two organisations governing and regulating the terms for transfer of relevant research materials, usually tangible, for when the recipient wishes to use the invention for its own research purposes. The Agreement contains a detail of all the rights of the provider organisation along with the rights and obligations of the receiving organisation. MTA's were resorted to for not just ordinary research transfer but also commercialisation of unpatented biological material.

Third: The third phase of technology transferred can be seen where the process of technology transfer became better resourced and structured in terms of strengthening of the university-industry relationship leading to better industry-sponsored funding and economic development. Academic institutions came to the realisation that even when they have funding from different sources, they have to work hard to build a research innovation ecosystem. After all they even had to cater to the demands of the state's generation of high paying technology based jobs. Technology transfer offices developed (TTO)[139] at institutions which started to work proactively in this direction. They focused on marketing so as to target internal and external stakeholders. By means of education, awareness about the significance of transfer of technology and outreach became more organised. Through marketing, tools were used to study market research on understanding the commercial applications of the inventors along with the requirements of the people to assess how consistent they are with each other.

The Technology Transfer Offices also saw an opening of their legal departments which worked towards understanding the requirements of intellectual property protection of the inventions along with maintaining and managing an IP portfolio. This would help them in the preparation and filing of patent applications and keep a record of how many and for what inventions applications have been filed. The biggest challenge though

[138] *Infra* Note 257, 109.
[139] Jennifer Rossi, *Streamlining the MTA Process to Alleviate the Burden on Technology Transfer Offices and Facilitate the Dissemination of Research Tool*, 3(1) TECHNOLOGY TRANSFER AND ENTREPRENEURSHIP 52-55 (April 2016).

remained the high cost of filing. As the demand for legal protection increases, so does its cost. The price paid for obtaining protection increased as number of inventions increased. More the inventions, more will be the filing of patent applications which in turn raises demand for legal advice and attorneys. As technology advances and upgrades with time, the inventions keep pace with it, resulting in complexities which reflect in patent applications. The demand for legal assistance and growing intellectual property rights concerns grew as transfer of technology progressed during the period which could be reckoned as the third phase of technology transfer's evolution.

Fourth: The evolution of technology transfer in the period that followed saw rise in research in the field of human health; both clinical and translational research. Clinical research is a kind of medical research that has people as its subject. The research involves people who volunteer to participate in carefully conducted research investigations that are undertaken to discover appropriate ways to treat people from known diseases and other health problems. The research includes clinical trials that serve as a means of discovering new methods of diagnosis, treatment or prevention by testing it on human volunteers[140]. The clinical trials help understand not just new treatments and therapies but also long-term natural history on how the disease grew in juxtaposition to how human health improved and progressed. It is a patient oriented research in the sense that human subjects or material of humans is used for research such as tissues and specimen for which the investigator (person conducting the research) directly interacts with the human volunteers. Consequently, such trials do not include in-vitro studies[141] which have no link with a living individual and are performed in laboratories in a controlled environment.

Translational research has two aspects. One is that it applies studies that are generated during research in the laboratories, or in pre-clinical studies to the studies or trials in humans. It basically takes these laboratory studies and transforms them into *new treatment and approaches to medical care that improve the health of the population*[142]. The other area of translation concerns adoption of best practices in the

[140] Malcom Green, *Clinical Research,* 305(6861) BRITISH MEDICAL JOURNAL 1081-85 (1992).
[141] *See, Differences between in vitro, in vivo, and in silico studies,* The Marshall Protocol Knowledge Base, Autoimmunity Research Foundation, https://mpkb.org/home/patients/assessing_literature/in_vitro_studies.
[142] *See generally, Clinical and Translational Research,* School of Medicine, North Carolina Translational and Clinical Sciences Institute, https://tracs.unc.edu/index.php/clinical-translational-research.

community[143]. Broadly a crucial part of translating laboratory research to human treatments is clinical research. Translational research also involves cost-effectiveness of prevention tactics and treatments from known diseases.

With emphasis on clinical and translational research, figuring out ways to advance the favourable and promising research into inventions grew more and more. Developing core competencies in the area of clinical and translational science, improving public health research management, accelerating the diffusion of the findings of research into clinical practice, set up the agenda for growth of transforming biomedical research into products.

The ambit of technology transfer increased as we moved from inventions to innovations, the latter impregnating improvisations in inventions. Some innovations from the different areas that technology transfer touched upon, turned out to be usually non-patentable, with a novel approach that could still help the innovation get commercialised. When such kinds of innovations (and not purely inventions) become the subject matter of technology transfer, they may have an impact on the nature of the process of transfer. More than concerns on intellectual property protection and the resulting licensing mechanisms, much thought goes into the means of diffusion of the innovation. A broader approach of dissemination and diffusion was thought to be adopted rather than just the traditional means of licensing. This triggered the need to realise other methods of transfer.

What could be the future?

The progression from the path laid out for technology transfer so far, only intends to get stronger. What can be seen from so much that has been done in the relevant field is that there will be more universities and companies who will make their way through solid university-industry collaborations[144]. The universities themselves would develop strong infrastructure and facilities in order to work with companies and entrepreneurs.

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[143] "Phases of translational research include:
T1 – First stage of translational research, in which a foundational discovery or innovation is studied in healthy humans
T2 – This next stage of research translates the finding from people to patients
T3 – This stage focuses on implementation of research findings in clinical practice
T4 – After evaluating effects on practice, this stage of translation is focused on influencing populations and policy"

[144] *Supra* Note 134, 49.

The universities acting along such lines would also help develop local innovation ecosystem which is the need of the hour to facilitate technology transfer in any manner.

The inventors would also be in a position to better negotiate licensing of patented technology in return for commercialising with fixed and pre-determined financial terms. Technology transfer professionals are also transforming their roles into more proactive participation considering the complexities attached with multiple related aspects of technology transfer such as collaborations, joint venture capital funds, licensing and commercialisation.

Even though the journey of transformation of technology transfer till date has seen many ups and down, it nevertheless should never give up the primary intent behind the Bayh-Dole Act, i.e. ensuring transfer of technology for the benefit of the public[145]. The future holds immense potential for such projects of technology transfer, benefitting especially the developing countries. Successful transfer of technology shall not only be the result of robust university-industry partnership but also healthy trade relations between developing countries and the developed economies.

RATIONALE BEHIND TRANSFER OF TECHNOLOGY

The rationale behind technology transfer can be easily established by slightly modifying the old proverb, *"Give a man a fish and you feed him for a day, teach a man to fish and you feed him for a lifetime",* to *"Give a man a fish and you feed him for a day; give a man a fishing rod and he feeds himself and his family for as long as the rod lasts; help a man develop the knowledge and means to improve the fishing rod and to design and produce new ones, and he may feed himself and his society for years to come*[146]*."*

The distinction is simple and clearly illustrates how technology transfer shall benefit the society. In the first instance, the man, who is given the fish (end product required for survival) consumes it and feeds himself. When given the fishing rod and taught how to fish, he uses the rod when fishing and is able to feed himself and his family. Learning how to fish is important; but he is able to do that only when he is in possession of a

[145] *Supra* Note 131, 48.
[146] *See,* Press Release, Technology Transfer and Development, WIPO Magazine (September 2006), https://www.wipo.int/wipo_magazine/en/2006/05/article_0005.html

fishing rod. Consider a scenario, where if anything were to happen to the rod, there is no other fishing rod available that he can purchase. In such a case, the moment the rod breaks, he no longer will be able to feed himself or his family. The third instance takes note of the perfect situation, where knowledge is imparted to the man not only on how to fish, but also to mend the rod in case of damage or even produce a new one in case of damage beyond repair. The man then would no longer be dependent on anybody or any product in this case and will be able to manufacture what is required to feed himself and his family. The third instance is the ideal instance for self-sufficiency.

The rationale behind technology transfer can be best explained by the idea of self-sufficiency. Technology transfer imbibes the essence of transfer of knowledge, essential information and know-how along with transfer of the product or service and subsequently gathering the knowledge to mould and adopt the same in accordance with one's own needs. For this, a good manufacturing infrastructure is required to accommodate the willingness to adopt the technology and manufacture it further the way it has been moulded. Simply put, if one is dependent for a product on somebody else, the dependence will always be there so long as the requirement for the product remains. Once the knowledge to produce the product is acquired or garnered from sources (in case of desired adoption of the technology) the receiver would never be perennially dependent on the inventor for the technology.

The ultimate aim of a successful technology transfer process is to have ensured the capacity of the receiver to manufacture in bulk the relevant product obtained with the help of the borrowed technology after duly complying with the laid down specifications and terms, if any, as part of the transfer agreement. "*Technology transfer requires a proactive approach that combines engaging researchers, promoting the technology, and encouraging potential industrial partners to use the technology*[147]*."*

An inventor may wish to transfer its developed technology to a third party for the following reasons:

a) **Commercialisation:** One of the major reasons behind technology transfer is commercialisation or establishing a commercial relationship with a third party

[147] Agnes Lenagh, *The Importance of Technology Transfer,* UNeMed (Dec. 18, 2012) https://www.unemed.com/blog/the-importance-of-technology-transfer

(the buyer). With enhanced commercialisation and publicity of the technology, the developer will be able to drive more profits.

b) **Lack of manufacturing capacity:** Sometimes the inventor country/entity may have developed the technology well by means of research conducted in labs and small scale operations, but they may not have large scale manufacturing capacity, for which they find the need to partner with other corporations or entities.

c) **Lack of distribution capability:** The developer of the technology may after its invention have acquired the necessary product approvals and the necessary registration yet may not be able to market the product well. It may even not have proper distribution channels for which it may realise the need for collaborations.

d) **Building trade relations:** The licensing agreements which bind both the parties to the terms of the transfer lay down conditions for consideration in return for the transfer. With the help of such agreements and their implementation, good trade alliances are formed with different partners who can help enhance the development of the technology by placing it into the market.

e) **Exploitation in different field of application:** Sometimes a technology may be offered by the developer to potential buyers for an application much different from the intended use of the particular technology. Its exploitation in a different field may be worked out on legit terms, and subsequently transferred.

A buyer may for the following possible reasons purchase the technology:

a) The development of a technology from scratch, sustenance and commercialisation may seem like a costlier affair to buyers who may choose to rather purchase the technology for their current need.

b) A technology which has already proved to be commercially successful after testing is a good investment. Such a technology has known utility and seems to be an attractive buy.

c) A firm that may have no motivation to become a leader in the market by means of such a technological innovation would find it easier to buy a technology from a transnational corporation than take the risk of innovating.

d) If dire need of a particular technology is felt in one's own country, a buyer with a potential to market and distribute the technology in that country may purchase the technology from the developer to fulfil the demands for it.

Only the publication of a research will not ensure that the research will culminate into a product on further development which will be useful to the end user. As much as development is necessary, so is the collaboration with industry partners for proper commercialisation. The utility of the technology has to be proved; and which happens when people's needs are satisfied. An example of technology transfer in pharmaceuticals can be used. Once a drug compound id developed and identified as a cure not known before to a rare disease, it must undergo the process of pre-clinical research followed by further development in the labs, all phases of clinical trials, fulfilling requirements from the regulatory authorities and finally getting market approval. It is only beyond this step that the inventor company will worry about the marketing and distribution of the drug[148].

CLASSIFICATION OF TECHNOLOGY TRANSFER

The transfer of technology can be classified in to:

a) **International Technology Transfer**: Transfer that takes place across national boundaries is known as international technology transfer. E.g. transfer from industrialised countries to developing countries.
b) **Regional Technology Transfer**: This transfer happens from one region of the country to another region. E.g. technology transfer from one state to another state within the same country.
c) **Cross Industry or Cross Sector Technology Transfer**: The technology transfer that happens from one industrial sector to another is known as cross industry or cross sector transfer. For e.g. a technology developed by NASA for a space program may be transferred for research into the health sector for commercial purposes.
d) **Inter-firm Technology Transfer**: The technology which is transferred from one firm to another. A technology which is developed primarily by a machine tool manufacturing firm to a utensil producing firm.
e) **Intra-firm Technology Transfer**: A transfer that takes place within a firm is known as intra-firm technology transfer. It may take place from one location to

[148] Annexure 7, "*WHO guidelines on transfer of technology in pharmaceutical manufacturing",* World Health Organisation, WHO Technical Report Series No.961, 2011, https://extranet.who.int/pqweb/sites/default/files/documents/TRS_961_Annex7_2011.pdf

another within the same firm or may even happen from one department to another within the same firm.

The classification or types of technology transfer as mentioned above has been done on the basis of how technology flows from one place to another. Below are some examples of the same-

Different ways in which technology transfer can take place: Some of the ways in which transfer of technology may happen are:

1. Transfer between government labs (government funded research) and private sector organizations.
2. Transfer among different private sector organizations or transnational corporations (TNCs) within the same country.
3. Transfer between different private sector firms or TNCs belonging to different countries.
4. Transfer from academic institutions to private firms or TNCs.
5. Transfer amongst academia, government and industry collaborations.

Depending upon the nature and kind of technology, the developer of and the requirement for the technology, a technology transfer may take the form of any of the instances mentioned above.

SIGNIFICANCE OF TECHNOLOGY TRANSFER IN INTERNATIONAL SPHERE: PROVISIONS UNDER INSTRUMENTS SUPPORTING AND ENCOURAGING TECHNOLOGY TRANSFER

Having the ability to create and develop new technology and to procure while adapting to such technology is a key determinant of a nation's capability to compete effectively on the global front. As discussed, the developing countries have since decades expressed their desire for better access to foreign technologies. The transfer of technology from these foreign sources and from research institutes at international and domestic levels are major sources from where developing countries receive technology and technological information. The major challenge is to accomplish and maintain uninterrupted access to such information and know-how and also to create mechanisms for organizing while making the best use of the technology within an economy.

Technology transfer has been the topic of discussion at the international level by many prominent bodies. If not directly many international agreements and covenants talk about rights or contain provisions which can be interpreted to support access to technological information or transfer of technology directly or indirectly. Notable contributions have been made by **UNCTAD**[149] and the **WTO**[150]. Discussions on technology transfer were raised at international forums like the "Earth Summit 1992[151], United Nations Framework Convention on Climate Change (UNFCCC)[152], WIPO and the Commission on Intellectual Property, Innovation and Public Health (CIPIH) of the World Health Organisation (WHO)[153]." These forums have discussed the acquisition, use and learning from these technologies that would prove to be more than beneficial in the public domain.

In the coming years, around 1990's the growing significance of intellectual property and the attitude of the developed economies who wanted to legally protect the interests of the right holders, in a way made intellectual property rights a vital component of the "General Agreement on Tariffs and Trade (GATT)[154] and the WTO negotiations." This led to establishing that IPRs are now a significant part of trade and technology in a globalised world[155], especially after the WTO negotiations culminating into the passing of the TRIPS Agreement[156]. Considering that the TRIPS Agreement specifically contained provisions out rightly supporting the transfer of technology, it was thought that its implementation would lead to increased levels of investment, innovation and technological dissemination world over.

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[149] *Supra* Note 88, 33.
[150] "The Doha Round, being the latest round of trade negotiations among the WTO membership, focused on achieving major reforms of the international trading system through the introduction of lower trade barriers and revised trade rules. The Round was officially launched at the WTO's Fourth Ministerial Conference in Doha, Qatar, in November 2001. The Doha Ministerial Declaration provided the mandate for the negotiations, including on agriculture, services and an intellectual property topic, which began earlier."
[151] For the implementation of Agenda 21, action plan of the UN on sustainable development as held at the Earth Summit in Rio de Janeiro (1992), the General Assembly 19th Special Session highlighted special issues such as finance and technology transfer, patterns of production and consumption, use of energy and transportation, and to identify priorities for future action.
[152] *Supra* Note 105, 39. Report of The Intergovernmental Panel on Climate Change defining transfer of technology.
[153] World Health Organisation, *Draft Working Document: WHO guidelines on the transfer of technology in pharmaceutical manufacturing*
[154] *Supra* Note 17, 5.
[155] *Supra* Note 42, 11.
[156] *Supra* Note 29, 8.

Talking about international instruments in the context of technology transfer, a general distinction on two broad yet overlapping categories of instruments concerning technology-related provisions, can be made. The first category illustrates "standard setting" instruments and the second relates to "direct measures of transfer". The standard setting instruments generally provide for rights of the creators or owners and the obligations of the potential users of the technology thereby creating a balance between the two[157]. Such standard setting instruments protect proprietary technology. The TRIPS Agreement would be a good example here. The Agreement with its basic principles provides minimum standards that the member nations should follow to ensure basic level of protection extended to their creations with the help of different intellectual property rights. In its Article 7, it provides that "the protection and enforcement of intellectual property rights (IPRs) should contribute to the promotion of technological innovation and to the transfer and dissemination of technology[158]." The instruments set out rights of creators and aims to protect it. Thus, even though the TRIPS Agreement has an express provision on transfer of technology, it fails on providing a mechanism to operationalise it. There is a need to develop the Article further, in letter and in spirit.

There are also other standard setting instruments which have been recognised as such at the regional level, namely, NAFTA, Andean Group and ASEAN to name a few[159].

The instruments which fall in the second category majorly focus on providing direct measures for technology transfer and capacity building especially in the developing and least developed countries. These instruments are generally concerned with transfer of specific technologies like green technology for the protection of environment and conservation of biodiversity, technology useful for marine exploration or technology for the protection of public health. While the first category includes instruments which express concern and significance of technology transfer, it leaves the implementation

[157] "In this context, due to the intellectual property rights system, inventions and creative works become commodities that may be transferred by commercial transactions, e.g. bought, leased or sold, and thus have their utilization and diffusion facilitated through investment, licensing or other transfer arrangements."

[158] "TRIPS Article 7: 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."

[159] UNCTAD, *Compendium of International Arrangements on Transfer of Technology: Selected Instruments*, United Nations, UNCTAD/ITE/IPC/Misc.5.

of the provisions to the respective member states, who may devise their own mechanisms whereas the second category has instruments that usually provide for in-built mechanisms for implementation and also addresses concerns on financing.

UNESCO: United Nations Educational, Scientific and Cultural Organisation's (UNESCO) primary role in the field of science can broadly be seen as promoting science, technology and innovation (STI) and using science to manage the Earth's resources in a sustainable way. It is believed that the 'S' in UNESCO has been its integral part since the very foundation of the organisation in 1945. From discharging its duties towards fulfilment of its goals, it has also been responsible for establishing many scientific bodies and union such as "International Union for Conservation of Nature (IUCN, 1948), and the European Organization for Nuclear Research (CERN, 1954). Initiatives with far-reaching implications for sustainable human security and well-being – such as the International Hydrological Programme (IHP), the Intergovernmental Oceanographic Commission or the Man and the Biosphere Programme (MAB) – were launched in the first thirty years of UNESCO's history[160]."

UNESCOs Universal Declaration on Bioethics and Human Rights (UDBHR) that encompasses a reflection of scientific and technological developments on society and how it leads to establishing a global balance, is a declaration that discusses the interrelation between human rights and fundamental freedoms in the field of bioethics along with principles addressing sharing of scientific research including transfer of technology (as associated with principles requiring access to scientific and technological knowledge and capacity-building facilities for research purposes) applicable to individuals, corporations and states, to advance global health policy initiatives[161]. In continuation to these efforts, UNESCO has in November 2021,

[160] UNESCO Advancing Science for Peace and Sustainable Development, UNESCO, https://www.un.org/en/ecosoc/innovfair2013/docs/unesco1.pdf

[161] Article 14 Social Responsibility and health: "2) Taking into account that the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition, progress in science and technology should advance:
(a) access to quality health care and essential medicines, especially for the health of women and children, because health is essential to life itself and must be considered to be a social and human good;
(b) access to adequate nutrition and water;
(c) improvement of living conditions and the environment;
(d) elimination of the marginalization and the exclusion of persons on the basis of any grounds;
(e) reduction of poverty and illiteracy.

entered into an agreement with Ghana for the establishment of International Centre of Excellence in Engineering, Innovation, Manufacturing and Technology Transfer in Ghana[162].

International Bill of Rights: In a similar context of the progressive realisation and wide interpretation of human rights, a support towards adoption of advancements in technology and technology transfer can be seen in the International Bill of Rights. The Universal Declaration of Human Rights (UDHR) in its Article 27 mentions the human right to share in scientific advancement and its benefits[163]. The International Covenant on Economic, Social and Cultural Rights (ICESCR) in its Article 2[164] mandates states to take certain suitable measures "individually and through international assistance and cooperation, especially economic and technical to fulfil their human rights obligations in a manner that is non-discriminatory and responsive to the needs of the most vulnerable and marginalized groups." It further goes on to ensure that there is no discrimination on the point of assurance of these rights to nationals[165]. The Covenant in its Article 15 mentions individual's right to benefit from scientific progress and also enjoy authorship rights in case of a scientific, literary or artistic invention of his[166]. Another relevant provision from the International Covenant on Civil and Political Rights (ICCPR) is the right to seek, receive, and impart information (which includes

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Article 15 Sharing of Benefits: Benefits resulting from any scientific research and its applications should be shared with society as a whole and within the international community, in particular with developing countries."

[162] *See* Press Release UNESCO signs agreement with Ghana for new International Centre of Excellence in Engineering, Innovation, Manufacturing and Technology Transfer, UNESCO (May 10, 2022) https://www.unesco.org/en/articles/unesco-signs-agreement-ghana-new-international-centre-excellence-engineering-innovation

[163] "Article 27: 1) Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits.

[164] Article 2: 1. Each State Party to the present Covenant undertakes to take steps, individually and through international assistance and co-operation, **especially economic and technical**, to the maximum of its available resources, with a view to achieving progressively the full realization of the rights recognized in the present Covenant by all appropriate means, including particularly the adoption of legislative measures.

[165] *Id.* 2. The States Parties to the present Covenant undertake to guarantee that the rights enunciated in the present Covenant will be exercised without discrimination of any kind as to race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth or other status."

[166] "Article 15: 1. The States Parties to the present Covenant recognize the right of everyone:
(a) To take part in cultural life;
(b) To enjoy the benefits of scientific progress and its applications;
(c) To benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author.

technological information also) that is part of the right to freedom of expression as enshrined in Article 19[167] of the covenant.

UNCTAD: As already mentioned, the UNCTAD[168] has contributed immensely in the domain of technology transfer. The UNCTAD Draft International Code of Conduct on Transfer of Technology[169] gave a comprehensive definition to both the terms 'technology' and 'technology transfer'. An intergovernmental group of experts were formed within the UNCTAD to work upon and submit a final draft on the International Code of Conduct. The actual negotiations for the same began around 1976. Both developing and the developed economies submitted their views on the code. The Conference accepted large parts of the draft code pertaining to aspects of the development and transfer of technology. The Draft Code which was concluded at the fifth session of the Conference in November 1983[170], has thus become a key instrument in the area of international trade and economic relations.

The main characteristics of the Code[171] provide for equitable standards regulating the relationship between parties to the transfer considering their legitimate interests and the special requirements of the developing countries[172]. Other provisions in the Code concern transfer between parties where the bargaining position of both the parties are so balanced that any chances of abuse of a stronger or dominant position are avoided. The Code also provides for non-disclosure terms and establishing confidence between parties, the importance of technological information, how international transfer of technology aids growth of scientific and technical capabilities of a nation, identification of social and economic problems of a nation and how the transfer of a particular technology would provide a solution to the identified problem and the formulation and

[167] Article 19: 2. Everyone shall have the right to freedom of expression; this right shall include freedom to seek, receive and impart information and ideas of all kinds, regardless of frontiers, either orally, in writing or in print, in the form of art, or through any other media of his choice."
[168] *Supra* Note 88 and 89, 33.
[169] *Supra* Note 95, 36.
[170] "See Draft International Code of Conduct on the Transfer of Technology as at the Close of the Fifth Session of the Conference on 4 November 1983, TD/CODE/TOT/41 (1983).
[171] The text of the draft code consists of a preamble and nine chapters dealing respectively with: 1. Definitions and scope of application; 2. Objectives and principles; 3. National regulation of transfer of technology transactions; 4. Restrictive practices; 5. Responsibilities and obligations of parties; 6. Special treatment for developing countries; 7. International collaboration; 8. International institutional machinery and 9. Applicable law and settlement of disputes.
[172] *See* provision 2.1(i) of the Draft Code."

also adoption of national policies which would lay down the foundation of technology transfer.

In its applicability, the Code is universally applicable to all nations (applicable equally to parties to the transfer transaction) regardless of their levels of development. It acknowledges the distinctive needs and interests, especially those of developing countries.

Apart from giving a comprehensive definition of technology transfer[173], the Code limits its applicability to 'international transfer of technology transactions', meaning that the provisions of the code will apply when technology is being transferred across national boundaries. However, there is some amount of discrepancy on the point of the Code's applicability in situations where the technology is not transferred across national boundaries and that one of the parties is controlled by a foreign entity but both located in the same country. The Code in addition to its objectives adds that "restrictive business practices should be avoided which unreasonably restrain trade and adversely affect the international flow of technology; particularly as such practices hinder the economic and technological development of acquiring countries[174]."

WTO: Similarly, the World Trade Organisation (WTO) considered technology transfer as imperative in the era of globalisation. In the year 2002, WTO constituted the Working Group on Trade and Transfer of Technology (WGTTT), which is constituted according to the mandate in para 37 of the Doha Ministerial Declaration[175] that emphatically states that "*members agree to an examination, in a Working Group under the auspices of the General Council, of the relationship between trade and transfer of technology, and of any possible recommendations on steps that might be taken within the mandate of the WTO to increase flows of technology to developing countries. The General Council shall report to the Fifth Session of the Ministerial Conference on progress in the examination*."

The Working Group documented all the efforts that it made in the relevant field. It identified technological differences not only across countries but also across the field

[173] *Supra* Note 102, 38.
[174] *Supra* Note 95, 36.
[175] Background Note by Secretariat of Working Group on Trade and Transfer of Technology is available at WT/WGTTT/W/1 [Dated 2nd April 2002].

of technology. It disclosed two different ways how technology transfer occurs across countries- One, by means of "*using technologically advanced intermediate products that have been invented abroad"*. Intermediate products are raw products that are used to make final products. Similarly intermediate technological products would be products which have been made keeping in mind a sophisticated idea or technology but with the help of comparatively cheap and readily available raw materials with the final aim of replicating the sophisticated technology and product. Second, this transfer can take place by means of learning about foreign technology. This learning, it further revealed can happen through three channels:

a) *"Accessing the knowledge codified in a blueprint. This may lead to copying of the foreign technology and adjustment of the technology to domestic use*[176].
b) *Communication that stimulates cross-border learning. This channel of diffusion of knowledge is particularly important to transmit tacit knowledge, non-codified information. Part of this is learning-by-doing, which is the cost lowering effect of cumulative production.*
c) *Direct interaction between domestic and foreign firms."*

In the case of copying of foreign intermediate technology by the recipient country, successful copying may not be possible unless the recipient country has intermediate level advanced technical infrastructural support and know-how in that particular field of technology with the existing labour and skill[177]. The channels of transfer of technology as discussed above may also sometimes entail infringement of rights in case the technology is protected by intellectual property in the donor or recipient country and the borrower does not have legit means of accessing the technology by not having licensed rights.

The Working Group's discussion also highlighted the four phases of technology transfer process namely- cross border transfer, learning, adaptation and diffusion. There are also various other factors that have their own impact on the entire process of transfer like type of technology, mechanism used to transfer technology, type and kind of

[176] "Two important factors limit the potential of technology diffusion through this channel. First, the right to use this technology is usually protected by a patent. Second, not all knowledge is codified. It is in the interest of the inventor not to reveal all information and some of the information is "tacit" knowledge, in the sense that it would be very difficult to codify."
[177] *Supra* Note 175, 63.

foreign direct investment (FDI), difference in bargaining powers of the donor and borrower, absorptive capacity of the receptor country to name a few[178].

In the 19th session of the Working Group, representatives from UNCTAD discussed the relationship between trade and transfer of technology. They mentioned six different indicators which were identified by them in order to assess the "Trends in Cross-Border Flows of Technology". "These indicators were:

(i) amount of royalties and license fees paid by the users of new technology,
(ii) amount of trade in capital goods,
(iii) amount of trade in business and professional services,
(iv) number of patents filed,
(v) expenditure by foreign companies in research and development, and
(vi) growth of industrial alliances."

The Working Group also invited comments from the developing country representatives. The representatives submitted certain critical issues that were faced by the developing and least developed countries like promotion of capacity-building, elimination of discriminatory practices and assimilation of technologies transferred[179]. In the Fifty-Seventh Session of the WGTTT, in April 2018, the Agenda of the relationship between trade and technology was adopted[180]. Through the Agenda it was revealed that technology and technical know-how are the prime factors which should be paid regard to in order to improve productivity and promote growth and economic development specifically in the least developed countries. It was also suggested that the objectives of Sustainable Development Goals (SDGs) should guide the work of the WGTTT thereby augmenting the process of access to science, technology, innovation (STI) and knowledge sharing by mutually agreed terms (MAT). Not only should the existing coordination mechanism improve but efforts should be made for the inclusion of a global technology facilitation mechanism. In the course of the entire process,

[178] Report (2002), *Taxonomy on Country Experiences on International Technology Transfers*, by Working Group on Trade and Transfer of Technology, available at WT/WGTTT/W/3 [Dated 11th Nov 2002].
[179] "Trade Related Aspects of Intellectual Property Rights, Article 66. Least-developed country members: (2) Developed country Members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members in order to enable them to create a sound and viable technological base."
[180] Note on the Meeting of 25 April 2018 of the Working Group on Trade and Transfer of Technology, available in WT/WGTTT/W/57 [Dated 14th June 2018]

assessment of the requirements of the developing and least developing countries is essential and should not be ignored. Also a vital component of the process is the effective transfer of skills and know-how which are the intangible aspect of the transfer[181].

TRIPS: The Agreement on Trade Related Aspects of Intellectual Property Rights contains Articles that specifically deal with transfer of technology. Article 7[182] states the objectives of the Agreement to clarify that the protection of intellectual property rights should not only promote individual interests but also further promotion of technological innovation and encourage transfer of technology and dissemination of knowledge. Similarly Article 8[183] in its clause two, focuses on giving member states the liberty to take appropriate measures to prevent abuse of monopoly rights that may lead to affecting adversely, the international transfer of technology.

In addition to this, the Agreement has a dedicated Article which pays special attention to the needs and plight of the least-developed nations. An important feature of the instruments containing provisions on transfer of technology should be distinguishing between the obligations of developed and developing nations so that the flow of technology happens from developed to developing nations and also to the LDCs. Technology related provisions that deal with the transfer of technology and capacity building, contained in Agreements often lay down broad objectives yet specific targets to be achieved. These obligations have to be met by addressees with different capacities. Thus, certain amount of leverage is given to certain identified economies who may want to benefit desperately from the technological information but may not have adequate means and support to develop[184].

Regarding the technology transfer, focus on countries with low capacities is utmost important. Like Article 66.2 of the TRIPS[185], providing for the LDCs, the Vienna

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[181] *See also* UNCTAD (1996a) and UNCTAD (1999).
[182] *Supra* Note 158, 59.
[183] "TRIPS Article 8. Principles: 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."
[184] *Supra* Note 158, 59.
[185] "TRIPS Article 66. Least-developed country members: (1) I n view of the special needs and requirements of least-developed country Members, their economic, financial and administrative constraints, and their need for flexibility to create a viable technological base, such Members shall

Convention for the Protection of the Ozone Layer (Article 4.2)[186] and the Convention on Biological Diversity (Article 16)[187] also walk on similar paths, providing for a favourable treatment to the LDCs in the form of differentiated obligations for them as regards the implementation of the objectives of technology transfer. Similarly, Article 10 of the Montreal Protocol on Substances that deplete the Ozone Layer has also recognised the special needs of the developing countries[188] . Both Vienna Convention and the Montreal Protocol deal with clean technologies for environmental protection.

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not be required to apply the provisions of this Agreement, other than Articles 3, 4 and 5, for a period of 10 years from the date of application as defined under paragraph 1 of Article 65. The Council for TRIPS shall, upon duly motivated request by a least-developed country Member, accord extensions of this period. (2) Developed country Members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members in order to enable them to create a sound and viable technological base."

[186] "Article 4.2 COOPERATION IN THE LEGAL, SCIENTIFIC AND TECHNICAL FIELDS: The Parties shall co-operate, consistent with their national laws, regulations and practices and taking into account in particular the needs of the developing countries, in promoting, directly or through competent international bodies, the development and transfer of technology and knowledge. Such co-operation shall be carried out particularly through: (a) Facilitation of the acquisition of alternative technologies by other Parties; (b) Provision of information on alternative technologies and equipment, and supply of special manuals or guides to them; (c) The supply of necessary equipment and facilities for research and systematic observations; (d) Appropriate training of scientific and technical personnel."

[187] "Article 16. Access to and transfer of technology: (1) Each Contracting Party, recognizing that technology includes biotechnology, and that both access to and transfer of technology among Contracting Parties are essential elements for the attainment of the objectives of this Convention, undertakes subject to the provisions of this Article to provide and/or facilitate access for and transfer to other Contracting Parties of technologies that are relevant to the conservation and sustainable use of biological diversity or make use of genetic resources and do not cause significant damage to the environment.(2) Access to and transfer of technology referred to in paragraph 1 above to developing countries shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed, and, where necessary, in accordance with the financial mechanism established by Articles 20 and 21. In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights. The application of this paragraph shall be consistent with paragraphs 3, 4 and 5 below. (3) Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, with the aim that Contracting Parties, in particular those that are developing countries, which provide genetic resources are provided access to and transfer of technology which makes use of those resources, on mutually agreed terms, including technology protected by patents and other intellectual property rights, where necessary, through the provisions of Articles 20 and 21 and in accordance with international law and consistent with paragraphs 4 and 5 below. (4) Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, with the aim that the private sector facilitates access to, joint development and transfer of technology referred to in paragraph 1 above for the benefit of both governmental institutions and the private sector of developing countries and in this regard shall abide by the obligations included in paragraphs 1, 2 and 3 above. (5) The Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of this Convention, shall cooperate in this regard subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to its objectives."

[188] No 26369, *Multilateral Montreal Protocol on Substances that Deplete the Ozone Layer*, concluded at Montreal on 16 Sep 1987.

The United Nations Convention on the Law of the Sea deals with technology transfer of marine technology specifically along with focusing on capacity building in the management, exploration and exploitation of marine resources. Contrary to the Law of the Sea Convention and Agenda 21, the Vienna Convention discusses the significance of access to technology more than the development of local manufacturing capacities.

If the treaty or agreement fails to provide a generally accepted definition of technology, then technology for that particular agreement or convention should be interpreted in light of the treaty's aims and objectives. This necessarily concludes that even in the case where similar terms are used in different treaties, specific meaning should be accorded to those terms taking into consideration the object of the document.

While transfer of technology may be the prime agenda to be achieved by many a nations through means of various international agreements at the multilateral level, regional level, interregional level or bilateral level, the major challenge faced by majority is properly ensuring the seamless process of transfer and diffusion by translating into practice the various technology-related provisions. Appropriate implementation is the key to a successful transfer which may be achieved through different mechanisms. A detailed study on these mechanisms follows in the forthcoming chapter.