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Technology Transfer Intermediaries: Enabling Innovation Diffusion and Economic Growth in Developing Countries

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ABSTRACT

Today, it is imperative to disseminate technology knowledge throughout the world in order to innovate, improvise, and explore new frontiers. Institutions in the public and private sectors, universities, funding organizations, philanthropic foundations, international development organizations, governments, non-governmental organizations (NGOs), and other organizations in developing nations are the main users of technology transfer. Disseminating educational resources for academic and governmental research faculty, administrators, and decision-makers should also be a priority for international technology transfer. A globally recognized policy should be used to construct the intellectual property rights on the technology that needs to be transferred. To increase awareness of intellectual property rights and technology transfer, seminars, educational training programs, and workshops are essential. Every nation has its own set of laws and regulations. These rules should be adhered to by the technology that must be used. Our goal is to raise awareness about ways to enhance the dissemination of technology-related information in nations with poor market flow. The paper focuses on educating governmental and academic research organizations about organizations that serve as technology transfer intermediaries. These organizations manage all facets of technology transfers in a way that is advantageous to both technology providers and recipients. They aid in bridging the divide between the technology's suppliers and users. These companies oversee the transfer of newly developed technologies to the market as well as the acquisition of proprietary knowledge to support technology development. These organizations assist in determining and protecting the intellectual property rights of all parties involved in a way that is advantageous to all of them, in addition to serving as guiding sources for organizations prepared to share their technological wealth with organizations that have the potential to benefit from the technology. This paper's main focus is on providing the education and training required to raise awareness about these intermediaries and the different ways to find them and use their services.

Keywords: Technology Transfer, Intellectual Property Rights, Intermediaries.

INTRODUCTION

In today's world, every organization wishes to exploit its technological assets in a profitable way. This has paved the way for Technology Transfer. Globalization of Business, liberalization of economic regimes and the impetus given to the protection of Intellectual Property have emerged as the prime factors that have facilitated International Technology Transfer. This in turn has resulted in organizations making commercial transfer of technology as an important element of their business activities.

At the same time, organizations in developing countries have a strong interest in getting access to international technologies in the wake of globalization and competitiveness. These organizations view learning from and adapting to new technologies as a critical factor for sustenance and productivity growth in the market. Thus, both the developed and the developing countries show a keen interest in technological advancements. Technology Transfer has emerged as the primary component to facilitate international assistance.

Technology transfer, also known as **Transfer of Technology (TOT)** is the term used to describe the processes by which technological knowledge moves within or between organizations. It can be defined as the process of transferring skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among various institutions or

organizations to ensure that scientific and technological developments are made accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services. Technology transfer is primarily horizontal, but sometimes it can also be vertical [1]. International technology transfer refers to the way in which technology transfer occurs between countries. Technology transfer may deal with the knowledge of using the specified technologies or changing the technologies to enable innovations. A review of literature on technology transfer reveals that technology transfer is a complex, difficult process even when it occurs across different functions within a single product division of a single company (Zaltman et al., 1973; Kidder, 1981; Smith and Alexander, 1988). Technology transfer is commonly acknowledged to be a complex process that needs time to evolve (Agmon and von Glinow, 1981).

Existing studies on technology transfer and international technology transfer have attracted researchers from cross-section of disciplines including organizational management, political science, economics, sociology, anthropology, marketing and recently management of technology (Cusumano and Elenkov, 1994; Zhoa and Reisman, 1992). They have connected technology directly with knowledge and more attention is given to the process of research and development (Dunning, 1994)

Classification of Technology Transfer

Technology transfer has been classified into vertical transfer and horizontal transfer. In Vertical transfer, transmission of new technologies is done from the generation of new technology during the research and development programs into the science and technology organization. In horizontal technology transfer, the movement of a well-known technology is from one equipped environment to another. In developed countries, initially it begins with the Research, Development, Design and finally Production. In developing countries, it begins with Production, Design, Development and finally Research.
Trends in the developing countries vary from developed countries as the procedure that they follow basically depends on the transfer, absorption, and adaptation of existing technology.

Activities of Technology Transfer

Activities involved in Technology Transfer include: processing and evaluating invention disclosures; filing for patents; technology marketing; licensing; protecting intellectual property arising from research activity; and assisting in creating new businesses and promoting the success of existing firms. The result of these activities will be new products, more high-quality jobs, and an expanded economy.

Process of Technology Transfer

Technology transfer takes place basically in two forms, Knowledge Management and Patent & Licenses. Technology goes through the phase of technology acquisition, skill development, technology adaption, dissemination and finally increases production efficiency.

Technology transfer process includes technology creation, knowledge acquisition, technology sourcing and Brokering. The figure below [Fig. 1] explains the process of Technology Transfer.

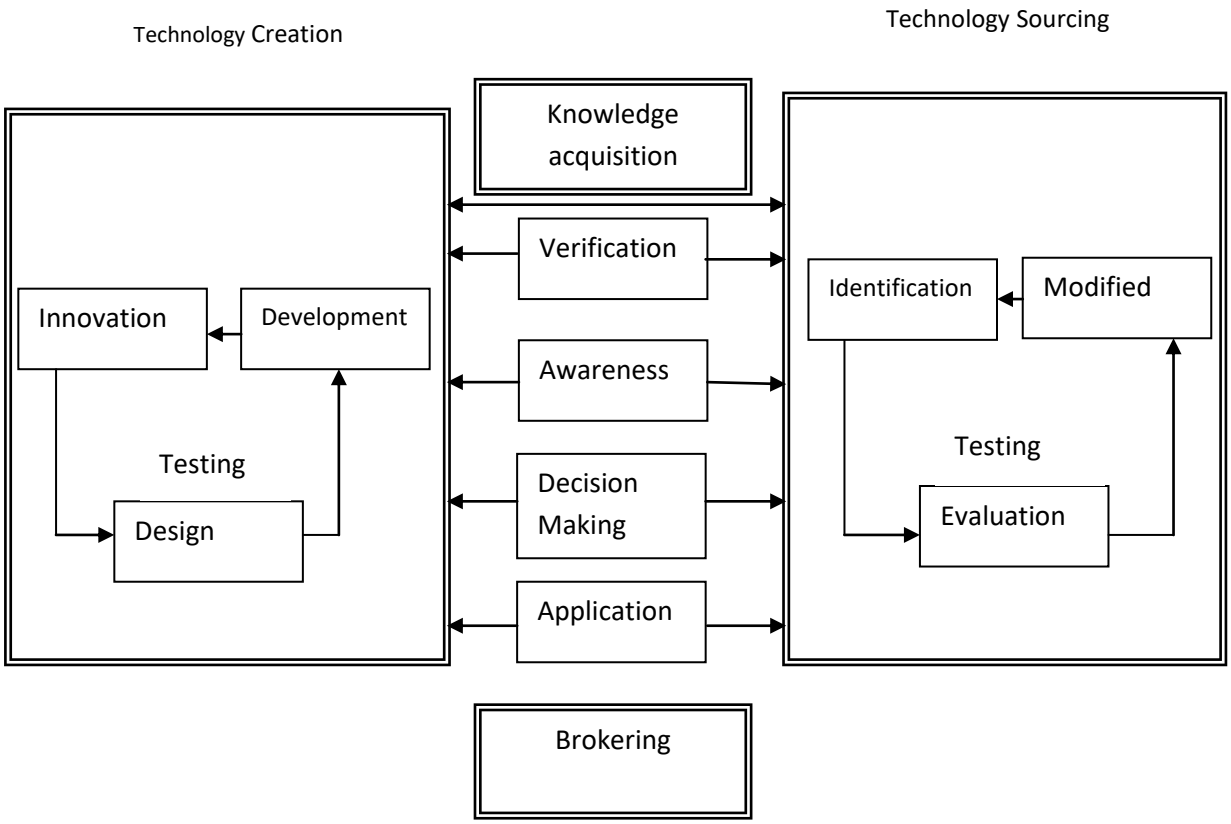

Fig. 1 Process of Transfer of Technology

Benefits of Technology Transfer

From the viewpoint of developing nations, Technology transfer helps these nations to improve their material circumstances on par with the International market. It aids optimal utilization of the resources available and also serves as a tool to develop indigenous technologies. Developed countries on the other hand aim to make optimal and profitable use of their technological assets and thus involve in Technology transfer.

Technology transfer is important as it strengthens industry through identification of new business opportunities. It also enhances the technical know-how and competitiveness of technology providers which ultimately results in broadening their business area by helping then to focus on usage of the technology in several different fields. Technology transfer promotes awareness of new technology and new systems which in turn assures wider use of the same.

Technology transfer brings economic growth by boosting revenues for both technology providers and seekers alike. This is achieved through new and improved products, processes and services. These lead to additional efficiency, effectiveness, greater market share and increased profits.

Drawbacks of Technology Transfer

1. Transfer of technology is meant for business activities and there prevails a high risk in financial or commercial aspects.
2. Unlicensed Patent applications will cost lot of money.
3. Institutional tensions may arise within the organization due to the fact that there will be low utilization or non-utilization of technology for the new inventions.
4. Institutions would be frustrated to share the profits earned with the external groups as there will be only partial utilization of the technology that is transferred.
5. Unrealistic demands from the licensor will lead to frustrations.
6. If there are no future enhancements included in the initial agreement made by the Licensor, there is no scope of improvement in technology.

Modes of Technology Transfer

Technology transfer can be achieved in any of the following ways

- Public dissemination
- Reverse Engineering
- Purposeful acquisition
    - Licensing
    - Franchise
    - Joint venture
    - Turnkey project
    - Foreign direct investment
    - Technological consortium & joint R&D

In an economy that is globalized, factors such as technology licensing and transfer of technology are playing a major role in strategic alliances and international joint ventures. In the market economy, this helps to maintain a competitive edge. At the International level, to facilitate licensing and technology transfer, policy tools are frequently been considered. This plays an important role for creating an appropriate climate for both the investment and economic progress of the country.
To facilitate an optimal and seamless transfer of technology, several intermediaries have come forth to act as a bridge between the owners of technology and the seekers of technology. With the recent trends for 'Open Innovation' involving complex networks of firms and users, organizations such as consultants, service incubators, conference organizers, trade organizations, government innovation agencies etc. are now recognized as playing a central role in facilitating and coordinating innovation.

Technology brokers is the term used to refer to people who discover and exploit the possibilities of how to bridge the emergent worlds and apply scientific concepts or processes to new situations. Many companies, universities and governmental organizations now have an Office of Technology Transfer (TTO) dedicated to identifying research which has potential commercial interest and strategies for how to exploit it. But since patents are normally only issued for practical processes and there should also be commercial value, someone—not necessarily the researchers—must come up with a specific practical process. The Technology brokers generally handle these aspects. Technology Transfer personnel evaluate and manage invention portfolios, oversee patent prosecution, negotiate licensing agreements and periodically review cooperative research agreements already in place. Part of the technology transfer process involves the prosecution of patents which is overseen by the national Patent and Trademark Office.
Our focus in this paper is to highlight various intermediaries available for aiding Technology transfer and the role they play in achieving a successful technology transfer in a way that is beneficial and profitable to both the owners and seekers of technology.

There are several agencies and organizations acting as intermediaries for technology transfer

1. **Universities**: Many universities with research cells have developed specialized offices called Technology Transfer Office (TTO) which aid in technology transfer by facilitating the conversion of the research into commercial applications to be utilized by others. TTO are focal points of technology transfer. Their responsibility is to transfer the intellectual property of the university in a cost-effective and profitable way. Their goals are:
    - Help the university research departments in establishing and maintaining effective technology transfer
    - Providing legal services for promoting and licensing Intellectual Property
    - Promoting and negotiating technology transfer
    - Establishing policies and procedures to avoiding conflict of interest
2. **Government agencies**: Several Government agencies have developed consortiums to facilitate the transfer of knowledge to non-governmental public and private sector entities. The role generally played by government agencies is:
    - Removing barriers to the free market to allow technology transfer
    - Developing a well-specified industry and marketing goals and supporting research to meet those goals.
    - Creating a link between public sector and private sector
    - Stimulating technology by partnering the development of technology
3. **Industrial associations**: Several industrial associations form linkages to aid technology transfer. They also take part in framing rules, policies and procedures to enable easy technology transfer
4. **Trade organizations**: Trade organizations also serve as intermediaries for technology transfer by aiding various organizations in gathering knowledge about technologies available and also highlighting the intellectual property rights.

5. **Consultancies**: Consultancies also help technology providers and seekers to source, develop and commercialize innovations. They act as an interface between research organizations and the Industry. These consultancies keep track that any research or innovation from national laboratories, private innovators, small firms and universities does not go unnoticed.
6. **Patent offices**: Patent offices are often the external link that aid technology transfer. They help with the activities pertaining to Patenting, licensing and protection of Intellectual Property rights of the technological innovations.

Role of Intellectual Property Rights in International Technology Transfer

IPR regulations are very important from a nation's perspective as they provide a legal framework for technology transfer. In particular, patent system provides security and legal assurance to an inventor that he has the right to exclude others from utilizing the technology discovered by him without his consent. On the other hand, through technology transfer the inventor may allow others to utilize his technology based on certain terms and conditions. Therefore, IPR plays an important role in technology transfer.

When strong intellectual property rights (IPR) policies and regulatory checkpoints are applied, it ensures patenting of appropriate technologies while making it accessible for use by the public and other research entities.

There are many ways in which the current policies affecting technology transfer can be reformed for the benefit of developing countries. Most of the reforms stress on the fact that the restrictions to knowledge exchange must be removed. This can be achieved in the form of mandatory licensing of technology to developing countries, which should be accompanied by specially reduced royalty fees for developing countries. This would be a very strong and positive step for those countries to build a base of technology from which they can begin research and ultimately produce their own high-tech goods. With stronger IPR and shorter patent duration, transnational corporations would still have incentive to bring technology to the developing countries.

The Intellectual Property Assessment is done to evaluate the technology being transferred on various factors.
In general, the following factors are considered while evaluating the technology:
1. Uniqueness of the discovered technology
2. Patentability of the technology (if not patented).
3. Place of the technology in an array of other similar technologies.
4. If the technology is already patented, assessing the strength of the patent.
5. Cost involved in protecting the technology and maintaining the IPR protection, etc.
6. Requirement of additional in-licensing for practicing the technology.
7. Know-how or trade-secret associated with the technology in order to achieve the best results by practicing the technology.
8. Other exclusive or non-exclusive licensing agreements associated with technology.

In addition to above-mentioned factors, some other factors such as, competitor analysis, market potential, financial evaluation, technical evaluation and industrial scalability may also be considered for performing the IP assessment.

Role of Intermediaries in Technology Transfer

The parties involved in technology transfer generally have different interests. However, for the technology transfer to take place the parties should have some mutually beneficial interests. Further, these interests should be agreed upon in the contractual agreements, including technology license for a successful technology transfer. For example, consider a scenario of technology transfer between a university and a technology company. The interest of the university may be to acquire expertise to commercialize the technology. On the other hand, the technology company may be interested in commercializing the technology for accruing revenues and profit. Thus, a contractual agreement between these two parties will result in benefit to both the parties.

Generally, when the parties have some common interests in technology, the negotiation for technology transfer begins. It is important for both the parties to sign confidentiality agreements (Non-Disclosure Agreements). Additionally, Interim Agreements, Feasibility Agreements, and Prototype Agreements may also be used depending upon the nature of technology to be transferred. However, it is not advisable to use memorandum of understanding and letter of intent in technology transfer transactions as these are not agreements, but a mere statement of intents and future plans.

The Intermediaries such as Universities, Government agencies, Industrial associations, Trade organizations, consultancies and Patent offices will facilitate the Technology Transfer for the Stake holders. They play a vital role in bridging the gap between the providers and the seekers.

Stake holders in broader sense include Technology Producers, Technology Consumers & Product Producers, Product Consumers and Resource Providers.

Role played by the Intermediaries for Technology Producers include:

1. Opportunity analysis – when the technology needs meet they start assessing.
2. Idea/Invention clearinghouse – when it is appropriate, they start screening the devices.
3. Prototype evaluation – after evaluation, they start obtaining stakeholder's input.
4. Product information – they will determine what exists in the marketplace.
5. Research & development – whenever appropriate they focus on improving prototypes.
6. Business agent – they will be the mediators in representing technology and negotiating transfers.

Role played by the Intermediaries for Technology Consumers & Product Producers include:

1. Marketplace gateway – they provide the access to information and resources in a field.
2. Concept reviews – they ensure the correctness by securing feedback on market receptivity.
3. Market research – they conduct analyses of market opportunities to provide insight of the product.
4. Research & development – incase of necessity, they refine pre and post production products.
5. Product testing – they ensure the bench mark put forth by technicians and field use by Product Consumers.
6. Local or national surveys – they help in assessing the size and composition of markets.

Role played by the Intermediaries for Product Consumers include:

1. Focusing input – their role is to distinguish between technologies and products and guide evaluations.
2. Guiding selection – they have the ability to evaluate features in existing products.
3. Convening evaluations – they will be involving end-users, family members and care providers in the evaluation of new inventions and existing products.

Role played by the Intermediaries for Resource Providers include:

1. Advising – they help by ensuring all necessary stakeholders are involved.
2. Networking – they will identify and recruit resource providers for process.
3. Negotiating – they act as brokers to establish a deal by addressing return to resource providers.

Future scope of study:

Keeping in view the changing political dynamics and increasing interdependence of countries, technology transfer plays an immense role in translating the spirit of cooperation into concrete action. This scenario gives rise to a need of study on the technology transfer and the facilitating environment of which intermediaries play a crucial role. The study therefore throws open research for exploring the functioning of the existing intermediaries, need for the greater role of the intermediaries and the institutions / mechanisms for more effective technology transfer.

CONCLUSION

This paper focuses on the importance of International Technology Transfer in the wake of globalization and need for developed and developing countries to improve their economic growth. It highlights the benefits that technology transfer offers to both the providers and the seekers of technology. It also specifies the various modes in which technology transfer takes place. The paper also focuses on the benefits and drawbacks of technology transfer. While specifying the process of technology transfer, it also focuses on the various legal aspects of technology transfer. The paper mainly highlights and emphasizes upon the various role players in technology transfer referred to as the intermediaries. It tries to list out the various intermediaries, the role they play in technology transfer, and the members who are involved in the process. The paper also specifies the utility of these intermediaries to both the providers and seekers of technology. Thus, we conclude by stating that the intermediaries play an extremely important role at various levels in technology transfer as they act as a bridge between technology providers and technology seekers, thus facilitating a profitable and optimal use of technology by varied users resulting in the economic growth of organizations and countries alike.

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