

Issues in Technology Transfer

- In general terms, technology is transferred through the actions of both the supplier and receiver of a technology (such as enterprises or the governments).
- Technology transfer can take a number of different forms, depending on:
 - the capacity and policies of the parties involved,
 - the size of the technological gap,
 - the amount and quality of the technical information available,
 - the degree of supplier intervention and,
 - the initiative shown by the recipient.

- The United Nations Conference on Trade and Development (UNCTAD) in its International Code on the Transfer of Technology narrowed the definition of “technology” to just knowledge.
- Thus, technology means “systematic knowledge for the manufacture of a product, for the application of a process or for the rendering of a service, which does not extend to the transactions involving the mere sale or mere lease of goods”.
- This definition clearly excludes goods that are sold or hired from the ambit of “technology”.
- Thus, it is the knowledge that goes into the creation and provision of the product or service that constitutes “technology”, not the finished product or service as such.

- But as we already knew from the examination of the concept of technology, UNCTAD's definition is restrictive and narrow.
- Don't forget that we had earlier conceptualized technology as encompassing:
- ***tools and instruments*** to enhance human ability to shape nature and solve problems;
- ***knowledge*** of how to create things or how to solve problems; and,
- ***culture*** (our understanding of the world, our value systems).

- The ordinary meaning of “transfer” is “to move from one place to another, or cause somebody or something to do so”.
- With regard to technology, the term “transfer” encompasses **diffusion of technologies** and technology cooperation across and within countries.
- Technology transfer is the suite of processes encompassing all dimensions of the origins, flows and uptake of know-how, experience and equipment amongst, across and within countries, stakeholder organizations and institutions.

- Technology transfer involves 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 also comprises the process of learning to understand, utilize and replicate the technology, including the capacity to choose it and adapt it to local conditions and integrate it with indigenous technologies.
- Despite the simplicity in the foregoing explanation, defining technology transfer is difficult due to the complexity of the technology transfer processes; perceptions of different disciplines and the purpose of the research.

- As Zhao and Reisman (1992) noted in their review of technology transfer literature that the definition of technology transfer differs substantially from one discipline to the next.
- They observe that economists tend to define technology on the basis of the properties of generic (broad) knowledge, focusing particularly on variables that relate to production and design.
- Sociologists tend to link technology transfer to innovation and to view technology, including social technology, as “a design for instrumental action that reduces the uncertainty of cause–effect relationships involved in achieving a desired outcome”.

- Anthropologists tend to view technology transfer broadly within the context of cultural change and the ways in which technology affects change.
- Those from the business disciplines tend to focus on stages of technology transfer, particularly relating to design and production stages, as well as sales.
- Management researchers are more likely than others to focus on intra-sector transfer and on the relation of technology transfer to strategy.
- Recently, researchers have focused extensively on alliances among firms and how alliances pertain to the development and transfer of technology.

- As already mentioned, technology transfer specifically involves the process of movement of technology from one entity to another.
- The transfer may be said to be successful if the receiving entity, the transferee, can effectively utilise the technology transferred and eventually assimilate it.
- The movement may involve physical assets, know-how, and technical knowledge.
- Technology transfer in some situations may be confined to relocating and exchanging personnel or the movement of a specific set of capabilities.

- Technology transfer has also been used to refer to movements of technology from the laboratory to industry, developed to developing countries, or from one application to another domain.
- In a very restrictive sense, where technology is considered as information, technology transfer is sometimes defined as the application of information into use.

- In essence, we can say that ***Technology transfer*** is the process by which commercial technology is disseminated.
- It is also the process of sharing of skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among governments and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or service.

- Technology transfer can take place via informal interactions between individuals; formal consultancies, publications, workshops, personnel exchanges, and joint projects involving groups of experts from different organizations; and the more readily measured activities such as patenting, copyright licensing, and contract research.

- **Types of Technology Transfer**
- Edwin Mansfield in *Technology Transfer, Productivity, and Economic Policy* (1986) classified technology transfer into:
 - ✓ vertical and,
 - ✓ horizontal technology transfer.
- **Vertical technology transfer** occurs when information is transmitted from basic research to applied research, from applied research to development, and from development to production.
- Such transfers occur in both directions, and the form of the information changes as it moves along this dimension.

- **Horizontal transfer of technology** occurs when the technology used in one place, organisation, or context is transferred and used in another place, organisation, or context.
- Technology transfer may include “material transfer, design transfer, and capacity transfer.”
- *Material transfer* refers to the transfer of a new material or product while *design transfer* corresponds to the transfer of designs and blueprints that can facilitate the manufacturing of the material or product by the transferee. *Capacity transfer* involves the transfer of know-why and know-how to adapt, and modify the material or product to suit various requirements.

- **Types of Transactions in Technology Transfer**
- Among the types of transfer transactions that may be used, the TOT Code has listed the following:
- *“(a) The assignment, sale and licensing of all forms of industrial property, except for trade marks, service marks and trade names when they are not part of transfer of technology transactions;*
- (b) 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;

- (c) The provision of technological knowledge necessary for the installation, operation and functioning of plant and equipment, and turnkey projects;
- (d) 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;
- (e) The provision of technological contents of industrial and technical co-operation arrangements

- **Distinction between Technology Transfer and Technology Diffusion**
- Technology diffusion is better seen as another benefit that the transfer of technology may bring to a host economy.
- This can be achieved by the fact that the introduction of a technology into a host country creates an awareness of that technology.
- That awareness may spill over into the economy as a whole. This may occur without any deliberate intent, simply through the passage of time, or it may occur as a result of deliberate policies on the part of the host country, such as training requirements for local personnel or the compulsory licensing of technology to local firms, or as a result of TNC strategy in the form of purchase of inputs, components and services from local firms, requiring the latter to become familiar with the technology involved so as to be able to perform the functions required by the TNC.

- At an earlier stage in the debate on technology transfer to developing countries, it was assumed that the main issue to be resolved was the securing of access to new technology.
- What has become increasingly apparent since that time is that the mere possession of technology does not result in improved technical development or economic gain: the capacity to understand, interact with and learn from that technology is critical.
- Thus, in the contemporary context, the design of policies must rely on an understanding of the technology development process, the role of TNCs in this process, and their interactions with local learning (UNCTAD, 1999, pp. 196-197).
- Furthermore, TNCs play an important role in the generation, transfer and diffusion of technology.

- **Stakeholders in Technology Transfer**
- *Technology Producers* - University and federal laboratories(public sector); corporate laboratories and independent inventors (private sector);
- *Technology Consumers* – Manufacturers (private sector); government agencies (public sector);
- *Product Producers* – Manufacturers (private sector);
- *Product Consumers* – primary (end users) and secondary consumers (individuals who buy and recommend or service providers);
- *Resource Providers* – government agencies (grants, contracts, public insurance); private insurance companies (reimbursement); Technology transfer intermediaries (brokers); venture capitalists (private investors)

- **The transferring level**
- **International**—from the DCs to NICs or LDCs
 - **Regional**—indigenous vs. foreign (between international organisations and national organisations)
 - between industrialised economies and developing economies)
 - **Industrial**—the threat of outsiders (between the research and development (R&D) departments and the other departments of a single business)

- **Corporation**—licensing program (between various entities or branches of a business group)
- in a franchising operation from the franchisor to the franchisee)
- **Internal**—the issue of transferring price. Transfer can be between Public Universities or Government Research Institutes and private industry

- **Channels of Technology Flow**
- And while the WIPO emphasizes licensing as the major vehicle for technology transfer there are other methods of transmission
 - Government's local participation requirements for foreign firms setting up in its jurisdiction;
 - Legitimate reverse engineering;
 - Access to publicly available knowledge through patent data bases;
 - Straight out infringement activity
 - ❖ Industrial espionage
 - ❖ Most large corporate enterprises today have divisions for strategic planning that require intelligence reports.

- Competitive enterprises are undeniably interested in the plans of their competitors; despite laws against such practices, industrial espionage is difficult to detect and control and is known to be an active tool for gaining such foreknowledge.
- Many of the tools of government intelligence work are used, including electronic surveillance and aerial photographic reconnaissance, and attempts are even made to recruit defectors.

- **Common Pathways to Transferring Technology**
- There are pathways through which stakeholders can interact to transfer technologies.
- They vary depending on:
 - sectors:
 - country circumstances; and.
 - type of technology.
- Pathways may be different for “close to market” technologies and for technology innovations still in the development phase.

- **Common pathways** include:
- Government assistance programmes,
- Direct purchases,
- Licensing,
- Foreign direct investment,
- Joint ventures,
- Cooperative research arrangements;
- Co-production agreements,
- Education and training, and,
- Government direct investment.

- **Technology Transfer Processes**
- While technology transfer processes can be complex and intertwined, certain stages can be identified.
- These may include:
 - The identification of needs,
 - Choice of technology,
 - Assessment of conditions of transfer,
 - Agreement and implementation.
 - Evaluation and adjustment to local conditions, and replication.

Barriers To The Transfer Of ESTs May Arise At Each Stage Of The Process.

- These vary according to the specific context, for example from sector to sector, and can manifest themselves differently in developed countries, developing countries and countries with economies in transition.
- These barriers range from:
 - Lack of information;
 - Insufficient human capabilities;
 - Political and economic barriers such as political instability and lack of capital,

- High transaction costs,
- Lack of full cost pricing,
- Trade and policy barriers;
- Lack of understanding of local needs;
- Business limitations, such as risk aversion in financial institutions; and
- Institutional limitations such as insufficient legal protection, and inadequate environmental codes and standards.
- There is no pre-set answer to enhancing technology transfer.

- **Dimensions of Effective Technology Transfer**
- The three major dimensions of making technology transfer more effective are:
 - Capacity building,
 - An enabling environment; and,
 - Mechanisms for technology transfer
- **Capacity building**
- Capacity building is required at all stages in the process of technology transfer.
- Social structures and personal values evolve with a society's physical infrastructure, institutions, and the technologies embodied within them.

- New technological trajectories for an economy therefore imply new social challenges.
- This requires the development of capacity of people and organizations to continuously adapt to new circumstances through the acquisition of new skills.
- **Enabling environment and extra effort to enhance technology transfer**
- Governments can create enabling environment for private and public sector technology transfers through:
 - Sound economic policy and regulatory frameworks:
 - Transparency and political stability,

- **Mechanisms for technology transfer**
- National Systems of Innovation;
- Official Development Assistance (ODA);
- Global Environment Facility
- Multilateral Development Banks.
- ***National Systems of Innovation***
- National Systems of Innovation (NSIs) integrate the elements of capacity building, access to information and an enabling environment into comprehensive approaches to environmentally sound technology (EST) transfer.

- The concept of NSIs can be enhanced through partnerships with international consortia.
- Partnerships would be system oriented, encompass all stages of the transfer process, and ensure the participation of private and public stakeholders, including business, legal, financial and other service providers from developed and developing countries.
- NSI activities may include:
 - Targeted capacity building, information access, and training for public and private stakeholders and support for project preparation;
 - Strengthening scientific and technical educational institutions in the context of technology needs;
 - Collection and assessment of specific technical, commercial, financial and legal information;

- Identification and development of solutions to technical, financial, legal, policy and other barriers to wide deployment of ESTs;
- Technology assessment, promotion of prototypes, demonstration projects and extension services through linkages between manufacturers, producers and end users;
- Innovative financial mechanisms such as public/private sector partnerships and specialized credit facilities;
- Local and regional partnerships between different stakeholders for the transfer, evaluation and adjustment to local conditions of ESTs;
- Market intermediary organizations such as Energy Service Companies.

- ***Official Development Assistance (ODA)***
- Official Development Assistance (ODA) is still significant for developing countries and successful transfers of ESTs.
- ODA can also assist the improvement of policy frameworks and take on long-term capacity building.
- There is increasing recognition that ODA can best be focused on mobilizing and multiplying additional financial resources.

- ***Global Environment Facility***
- The Global Environment Facility (GEF), an operating entity of the United Nations Framework Convention on Climate Change (UNFCCC) Financial Mechanism, is a key multilateral institution for transfers of ESTs.
- The GEF currently targets incremental, one-time investments in mitigation projects that test and demonstrate a variety of financing and institutional models for promoting technology diffusion, thus contributing to a host country's ability to understand, absorb and diffuse technologies.
- GEF also supports capacity building projects for adaptation consistent with limitations currently imposed by Convention guidance.

- The continued effectiveness of GEF project funding for technology transfer may depend on factors such as:
- Sustainability of market development and policy impacts achieved through GEF projects;
- Duplication of successful technology transfer models;
- Enhanced links with multilateral-banks and other financiers of ESTs;
- Funding for development and licensing of ESTs;
- Coordination with other activities that support national systems of innovation and international technology partnerships;
- Attention to technology transfer among developing countries.

- ***Multilateral Development Banks***
- Governments may use their leverage to direct the activities of Multilateral Development Banks (MDBs) through their respective Boards and Councils in order to:
 - Strengthen MDB programmes to account for the environmental consequences of their lending;
 - Develop programmatic approaches to lending that remove institutional barriers and create enabling environments for private technology transfers;
 - Encourage MDBs to participate in NSI partnerships.