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Technology Transfer

Technology transfer is the movement of technical and organizational skills, knowledge, and methods from one individual or organization to another for economic purposes.

This process usually involves a group that possesses specialized technical skills and technology that transfers it to a target group of receptors who do not possess those skills and who cannot create that technology themselves. Technology refers to a society's capability to transform natural resources into products for consumption. Technology transfer in a narrow definition includes movement of technical equipment, material, designs, engineering knowledge, techniques, and procedures of production. A broader understanding also refers to the transfer of the capacity, knowledge attached to the technology, personal know-how, and skills of workers. Technology transfer may accelerate economic growth, regional development, and industry innovation, and by offering workplaces, reduce unemployment and poverty in developing countries.

Types of Technology Transfer

There are many types of technology transfer: horizontal and vertical, internal and external, commercial and noncommercial, and passive and active. Horizontal transfer is when established technology is processed from one environment to another, and its aim is not commercialization but the dissemination of technology and extending its application. It includes licenses, sale of patents and designs, know-how, industrial cooperation, technical services, joint ventures, and turnkey contracts. An example of horizontal transfer can be a company that tries to maximize the return from its technology but is unable to do this by directly selling end products. It occurs in relations between industrial (the global north) and developing countries (the global South). There is no improvement of technology unless it is necessary to adapt it to local conditions. The vertical transfer means moving technology from research to development and production. This includes progressive stages of invention, innovation, and diffusion, usually by commercialization. The vertical transfer takes place within one organization or in the transaction between different actors, such as a research institute and company. Examples include contract research and development, scientific and technical advice, technical staff movement, and spin-offs.

The internal transfer is based on knowledge existing in the enterprise, which is not documented, and on results of internal research, as well as on knowledge of company employees and customer relations management. In contrast, the external transfer includes

individuals and inventors, technology companies, research and development units, joint or cooperative research and development agreements, research consortiums, higher education institutions, science and technology parks, fairs and economic missions, Internet databases, and brokerage events. The commercial transfer is related to the flow of tangible assets in commercial transactions between different entities. It is also the conversion of scientific and technological knowledge into commercial products or services. For example, trade in goods, foreign direct investment, licensing agreements, joint ventures, international subcontracting, turnkey contracts, patents, licensing, spinoffs, cross-licensing, and strategic supplier agreements. The noncommercial transfer is a movement of knowledge and capacities from one place or organization to a recipient country, firm, or community. Examples are capacity building and training, exchange of personnel, technical assistance programs, trade fairs, the flow of books and journals, movement of persons through immigration, academic exchange, project and study visits, and collaborative research.

The passive transfer takes place when technology movement is based on the application of a potential user. It includes only the knowledge, without transferring the skills connected to it (e.g., reports and manuals). The active transfer is when the provider of the technology assists with its application (e.g., demonstration of the technology and training in developing countries), and in semi-active form when a third-party agency or broker provides the transfer process to the final user.

Technology Transfer Models

The more complex configuration of stages in the interaction between transferor and transferee are technology transfer models. Usually, such models include the following: (1) proposal and planning, including a techno-economic analysis to establish the project, including location and preparing a business case and resources; (2) identification of technologies needed to be transferred; (3) basic engineering studies, specifying details of the plant to be designed; (4) detailed civil engineering plans, plant construction, and production startup; (5) selection of local suppliers for equipment and subcontracting services, adapting the process and product if needed; (6) training and improving local skills for transferred technology; and (7) providing external support to strengthen the relationship between sender and recipient. Transfer models show that transferees from developing countries should be involved at all stages of the process from the beginning; the transfer does not end with the start of technology usage, and it should be supported with the training of engineering and worker skills.

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Factors influencing technology movement can be grouped into four categories: firm-specific, industry-specific, region-specific, and nation-specific. At the company level, barriers and factors of success include stakeholder awareness of foreign technologies, internationalization and connections with research institutions, relationships between transferor and recipient, and level of education and technological capabilities of the workforce. Industry-specific factors include the level of market development and profitability and political and regulatory conditions for the sector. On regional and national levels, factors include political support for industry, the openness of trade, investment regime, quality of institutions, business risk, availability of human capital, cultural values and norms, local needs, and relations between academic, political, and business organizations. Those factors can also be analyzed as micro- and macro-barriers. Micro-barriers can be resolved by transferor and transferee, whereas macro-barriers need external influence on economic, financial, political, institutional, cultural, and social contexts.

Technology Gap

A technology gap between developed and developing countries influencing world poverty can be reduced by technology transfer. The effective transfer can be established by engagement, financial and training support of industrialized countries, corporate responsibility, international organizations, and determination of global south countries' governments. In the past, programs often failed because of problems such as the selection of technologies from uncompetitive areas, lack of human capital, lack of engineering studies (e.g., resulting in a large displacement of people and destruction of agricultural lands), lack of intellectual rights protection, and investment by companies that are owned and controlled by overseas investors, and thus do not support the citizens of developing countries.

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See Also: Financing New Technology; International Trade; International Trade, High Technology and; Technology Absorption and Appropriate Technology; Technology Diffusion;

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