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# TECHNOLOGY MANAGEMENT

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## Module 3



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## Objectives

1. [Technology Absorption](#)
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### Technology Absorption

#### Introduction

We have to acquire technology from sources within or outside the country, and one of the ways to acquire technology is by the process of technology absorption. Once a technology is imported from another country, it needs to be absorbed and updated in accordance with the local requirements. Foreign technology may have been developed keeping in view different parameters relating to scale of production, raw materials and components, quality standards, costs, levels and types of production techniques, maintenance requirements, social aspects including environmental and pollution aspects, employment, so on. It is common in many developing countries (such as South Korea, Taiwan, Thailand, Indonesia, India, Pakistan, Sri Lanka, Bangladesh, Philippines) to import technology as a package.

Most of these countries have developed indigenous R&D capabilities of varying order to absorb and upgrade the imported technologies, and to achieve technological self-reliance. While some countries, such as South Korea, Taiwan and Singapore have absorbed technologies predominantly from exports, India has done so predominantly for local markets. The concept of technology absorption differs from country to country, and even from firm to firm. In India, absorption is generally considered as the capacity to reproduce or manufacture products according to the “knowhow” supplied by the licensor of technology, without really understanding the “know-why” of the technology. In a country like South Korea, know-why exercises to understand the “black-box” of technology have been emphasized at the firm level without which exports are difficult. In fact, there are only a few countries, which have attempted to provide incentives to industry to undertake technology absorption exercises, with a view to reducing-imports and enhancing exports. India is one of them.

### Concepts in Technology Absorption

In discussing the broad issues on technology absorption, adaptation and up gradation, it will be desirable to distinguish the following terminology, and the related concepts. It involves the following concepts.

#### *Adoption*

Adoption of technology is a process under which the various features of the technology that is the subject of transfer are suitably modified, changed or altered keeping in view the needs of the buyer. In other words, the needs of the buyer of technology get crystallized and the supplier makes suitable modifications in the technology being supplied so that it conforms, as far as possible, to the requirements of the buyer. This in essence would mean that a foreign technology is scaled up or down or modified where necessary, by the supplier in accordance with the requirements of the buyer of technology. Such 'adopted' features, are finalized as a part of the technology package.

#### *Adaptation*

Adaptation of technology that takes place after a technology has been adopted and put to use in production activities/ facilities. During this stage, a number of alterations and modifications to suit the indigenous conditions are made and they may relate to the use of raw materials/components manufactured, practical difficulties in down scaling etc. Thus, the particular plant in India could gear itself up to meet the desired, capacity, production, product quality and other related aspects, as planned. The adaptation exercise covers both product modifications as well as production technology changes, using indigenous skills and facilities as well as local materials.

#### *Absorption*

Technology is said to be absorbed if it is fully understood, so that it is in a position to be further optimized and upgraded. Technology absorption involves 'Know-why' exercises, basic investigations into the product and/or process and/or systems. This will require un- packaging' of a technology package. To avoid further dependence, technology absorption enquires R and D projects in know-why, optimization and improvement of product or process or systems and related equipment's. Such efforts encompass design investigations, alternate raw materials/ components, modifications to suit Pakistani requirements, and so on. Successful projects in these areas will lead to achieving technology absorption capabilities.

### Optimization

After understanding the relevant features of technology, further exercises in removing rough edges through R and D and value engineering to effect savings in the use of material and energy consumption, and so on, both in product and processes constitute 'optimization' of technology.

### Improvement and up gradation

Capability in technology absorption and optimization lead to further exercises in improving the existing products and processes by R and D efforts of industry and other associated research organizations. This will enable industry to meet the changes in technology of the product or processes. Technology up graduation exercises lead to industry's efforts in extending its know-why capability to a higher range of products or in up scaling the existing process/ production technology or manufacturing equipment.

The role of technology absorption in the implementation of a project is shown in the below figure,

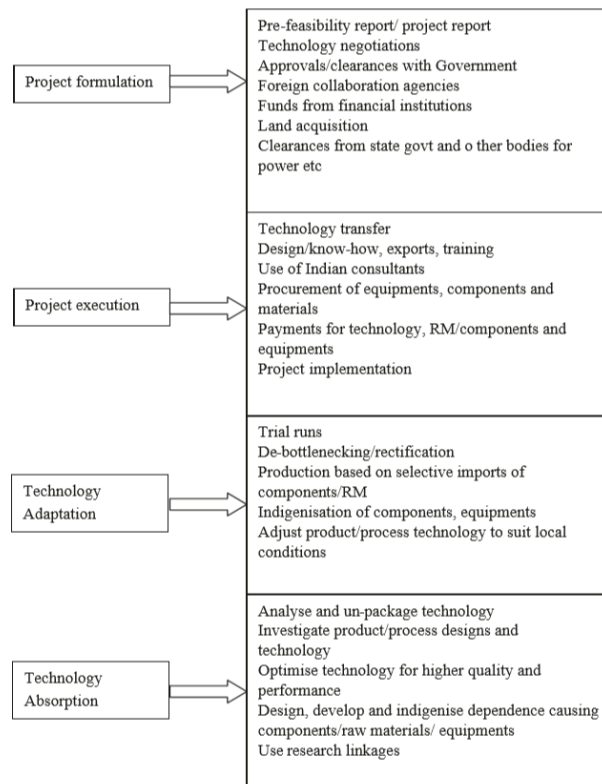


Figure: Project implementation and technology absorption

It will be seen that Technology Absorption activity is taken up only after a project is executed through acquired technology or when the company diversifies or faces threats from market forces to update its products or processes. “Know why” exercises lead to better understanding of the basics or principles involved in the design and production of a product/process, which enables an organization to develop or build technological capabilities for further improvements.

### Benefits of Technology Absorption

The benefits that we get from technology absorption exercises, as evidenced by Government and industry experiences so far are:

- Repeated collaborations for the same product/ process are avoided.
- Acquisition of further technologies becomes selective.
- Ability is developed to un-package the technology.
- Savings can be affected in foreign exchange due to indigenization /use of indigenous alternatives.
- Effective utilization is made of available indigenous research expertise and facilities to achieve the desired results.
- Know-why and technology up-gradation capabilities are built-up.
- Exports are increased.
- Technically competent groups of scientists and engineers trained in technology absorption get matured and strengthened.
- The base for technological self-reliance is enhanced

### Constraints of Technology Absorption

Improved productivity and quality as well as reduced costs, lead to higher efficiency in industrial operations. In labour intensive industries, these could be achieved from optimum man/machine utilization, lower overheads, use of versatile machines and quality control measures and industrial engineering techniques. In capital intensive industries involving sophisticated operations to manufacture products which are in continuous demand or which command large markets, these can be achieved by higher automation and by organizing the operations on larger scale. In hazardous industries, safety and pollution control measures necessitate higher capital investments in sophisticated equipment based on latest technologies.

The following factors are important in achieving higher productivity, quality and reduced costs:

- Optimum utilization of capital equipment's to bring about maximum production leading to better capital-output ratio.
- Adequate investments for quality control, material and energy conservation/recovery, elimination of hazards which would necessitate use of sophisticated equipment's.
- Minimum economic scale of production, particularly in industries where scale factor is important in optimizing the operations, especially if in larger quantity of critical production equipment is employed.
- Targeting and achieving; international levels of performance and operating parameters

These invariably require use of contemporary technologies needing larger capital investments, and/or accompanied by sizeable domestic demands and satisfactory absorption of technology. In scale sensitive industries, lower the scale of operation, lesser is the level of technology. Level of technology is also reflected by the use of less productive and sometimes second-hand machinery from abroad. In mass consumption industries such as petrochemicals, man-made fibers, organic chemicals, electronic components, and so on, lower the initial installed capacity, lesser is the technological level. In such cases modernization/R and D costs would be heavy in order to jump to the next generation of technology.

Some of the major constraints in absorption of technology are:

- Choice and use of imported technology by Pakistani industries have not been at international levels. This is an important factor while establishing scale sensitive high technology industries.
  - The demand of products in our country whose production is influenced by scale factors of latest technologies is generally not very large; presently these are being met by a number of units of sub-optimal sizes as compared to international levels. This constraint increases the gaps to be bridged through technology absorption. Industry would not be in a position either to invest similar R and D resources in comparison with international units, or even to improve the products/processes. Expanding the existing units and establishing new units with larger capacities tend to minimize this gap.
  - In general, industry has not given adequate attention to absorption of technology, in such cases; the firms have usually approached the

collaborators once again for renewal of earlier agreements or for new collaborations for improved or new products and processes.

There are instances where existing items made with marginal process or product improvements have continued to be supplied even after extensions of collaborations. In the absence of a competitive domestic market, or where industrial users are dictated by equipment's/products based on imported technologies, the inherent tendency to supply the same product has continued, till the users' requirements change or substantial imports of a new product take place. The possibility of continued access to improved technology through further collaboration involving only nominal costs (in any case, not very high payments) and assured markets have desisted many Pakistani firms from channeling adequate resources for absorption and improvement of imported technology. In scale-sensitive technologies, technology gaps have increased because of inadequate absorption of existing technologies.