Technology Transfer in R&D

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R&D and Technology Conference

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Table of Contents

- Art, technique, and technology
- From scientific knowledge to product
- What is technology?
- Some rules for managers
- Technology transfer stages
- Adoption of innovation
  - Who are “early adopters”?
  - Requirements
- Factors affecting technology transfer
- Approaches to technology transfer
- Role of users
- Technology Transfer: Characteristics of innovation
- Two quick examples (to be discussed)
- Summary
- Appendix: Tech Transfer cases
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The technology label seems to be given primarily to the “techniques” which are the cornerstones of the new industrial revolution, such as electronics, computers, and biotechnologies.

The term technology has been used extensively in the management literature, frequently to describe the “production process” or the “throughput” of an organization.
From Scientific Knowledge to Products

Relationship of technologies to scientific and engineering knowledge and to products and processes

Products
- PVC polymer sheet
- PVC molded parts

Technologies
- Continuous sheet extrusion of thermoplastics
- Formulation of PVC resins
- Extrusion of thermoplastics

Engineering and scientific knowledge
- Free radical chemistry
- Polymer rheology
- Vinyl chloride chemistry
What is Technology?

What is Technology? is a question often asked in the field of technology and engineering. The relationship of technologies to scientific and engineering knowledge is a fundamental concept in understanding how technology is developed and evolved.

Definition of technology

The above definition can be represented graphically as in Figure.

Relationship of technologies to scientific and engineering knowledge and to products and processes

Scientific Knowledge

Existing Techniques

Research & Development Process

Problem to be solved

Technology
What is Technology?

Technology

- **Application of tools and methods:**
  - The study, development, and application of devices, machines, and techniques for manufacturing and productive processes
  - Example: *recent developments in seismographic technology*

- **Method of applying technical knowledge:**
  - A method or methodology that applies technical knowledge or tools
  - Example: *a new technology for accelerating incubation.*
    “...Maryland-based firm uses database and Internet technology to track a company’s consumption of printed goods...” Forbes Global Business and Finance November 1998

- **ANTHROPOLOGY sum of a society’s or culture’s knowledge:**
  the sum of a society’s or culture’s practical knowledge, especially with reference to its material culture

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What is Technology?

The following definition of technology is suggested:

A process which, through an explicit or implicit phase of research and development (the application of scientific knowledge), allows for commercial production of goods or services.

It is not claimed here that this definition is universal or even that it is superior to some of those reviewed here. However, it is designed to be suited for examining the competitive impact of technology, and for improving the strategic management of technology.
## Science, Technology, and Industry

<table>
<thead>
<tr>
<th>Problems to be solved</th>
<th>Scientific fields</th>
<th>Existing techniques</th>
<th>Technology</th>
</tr>
</thead>
</table>
| To balance the brake system according to the grip of a vehicle’s wheels on the road | ● Fluid mechanics  
● Strength of materials | ● Conventional brake system technique  
● Microprocessor data analysis  
● Transmission of data through sensors | ABS brake system |

- Science, technology and industry: a few examples
- A few examples of technologies and their linkages to problems, science, and technique
Technology transfer for R&D Organization

Process by which science and technology are transferred from one individual or group to another that incorporates this new knowledge into its way of doing things.
Some Attributes of a New Technology

**New technology**
- Must have considerable *relative advantage* to the user
- Must provide *significant value to the user*
- Can be more expensive than the older one but *must provide value to the following to motivate its adoption* by the user:
  - Quality
  - Flexibility
  - Responsiveness
- There are numerous management challenges
Some Rules for Managers in Charge of Adopting New Technology

- **Continuous improvement** is the basis of future competitive advantages for an organization.

- Some *rules of thumb for managers* in charge of adopting new technology:
  - Do not accept performance as it is, and focus on **continuous improvement**
  - Do not just do the same thing a bit faster (or cheaper, or automatically). Careful re-examination of the product and process design is essential to make **significant improvements**
  - Recognize and learn to deal with *people’s natural reluctance* to accept change that is necessary to incorporate innovation in a firm.

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General Hypothesis Related to Tech Transfer

- Technology transfer of research results is essential if a mission-oriented research organization is to be effective in fulfilling its task.

- The effectiveness of technology transfer provides the essential measure of productivity of a mission-oriented R&D organization.

- Effective technology transfer increases user involvement in the innovation process.
  - In turn positively affect R&D productivity and has long-term benefits in terms of funding support from the sponsors.

- Institutional and organizational constraints, as well as improper planning for technology transfer, impede the process.

- Technology transfer techniques and approaches can be developed to facilitate the process.
Stages of Technology Transfer

- R&D Lab ⇒ Manufacturing ⇒ Marketing ⇒ User

What should you keep in mind if you have developed a technology within R&D and desire to transfer it to Manufacturing?
Five main steps leading to adoption of technology.

Knowledge: Potential user learns about the new technology and gains some understanding of its capabilities and usefulness. User wants to:
1. Know what the innovations are
2. What its capabilities are
3. How it works
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  - The user is looking for *comparative advantages and disadvantages* of the innovation.
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  - **Decision**: User takes steps that leads to *adoption or rejection* of the innovation
  - **Implementation**: User *incorporated the innovation* in its way of doing things

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- **Confirmation:** User seeks to confirm the implementation decision and continues to use the innovation

**Note:** Confirmation step is not always well understood, which is why many innovations first implemented are later discontinued. Certain activities to reinforce user acceptance of the innovation need to continue after implementation.
Trying to convince the mass of a new idea is useless. Convince innovators and early adopters first.
Adoption of Innovation

Please contact Advanced Technology Consultants for a complete copy of the presentation.

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Technology Transfer Cases Discussed
Technology Transfer Case: AMGEN I

Joint Venture
Joint Tech Transfer
Technology Transfer Case: Monsanto-Harvard

University/Industry Collaboration & Tech Transfer

Funding Pure Basic Research
Technology Transfer Case:

CAD for Microelectronics_I

• Inadequate incremental improvement of existing technology
• Rapid changes of the base technology
• University/industry/government collaboration and tech transfer
• Entrepreneurship by university students

• Disagreement on IP in partnership
Government/Industry Collaboration for Advanced Technology Development and Transfer

Technology for Jet Engine: Case Study in Science and Technology Development
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Dr. Chehroudi, has accumulated years of technical and leadership experiences in different capacities and organizations. This includes such positions as a Principal Scientist and Group Leader at Engineering Research Corp appointment at the Air Force Research Laboratory (AFRL), a Chief Scientist at Raytheon STX, a Visiting Technologist at Ford’s Advanced Manufacturing Technology Development (AMTD) center, a tenured Professor of Mechanical Engineering at Kettering University and University of Illinois, and served as a Senior Research Staff/Research Fellowship at Princeton University. Dr. Chehroudi directed numerous multimillion dollar interdisciplinary projects in areas involving chemically reacting flows, combustion and emission of pollutants, sustainable and alternative energy sources, distributed ignition, material/fuel injection, advanced pollution reduction technologies, propulsion concepts, gas turbine and liquid rocket engines, combustion instability, laser optical diagnostics, spectroscopy, supercritical fluids and applications in environmental and propulsion systems, advanced composites, MEMS, nanotechnology, and micro fluidics. He has won many merit and leadership awards by such prestigious organizations as the Society of Automotive Engineers (1. Arch. T. Colwell Merit Award for technical excellence only to top 1% yearly, 2. Ralph R. Teetor Award for outstanding teaching/research/leadership, 3. Forest R. McFarland Award for sustained leadership in professional and educational service and a key contributor to the Continuing Professional Development Group, 4. Appreciation Award for 10 years of dedicated and inspiring service and commitment to providing quality technical education, and 5. Outstanding Faculty Advisor), American Institute of Aeronautics and Astronautics (Best Publication Award of the Year), Air Force Research Laboratories (1. Outstanding Technical Publication Award, and 2. STAR Team Award for demonstrating world-class combined scientific and leadership achievements), Institute of Liquid Atomization and Sprays Systems (Marshall Award for best publication with lasting contributions), Liquid Propulsion Sub-committee of JANNAF (Best Liquid Propulsion Paper Award involving undergraduate/graduate students), and the 2nd International Symposium on Turbulence and Shear Flow Phenomena (Top 10 Technical Publication Award). He has been a consultant with many organizations such as, Ford, GM, Honda R&D, AFRL, Honeywell, NASA, AFOSR, VW, Bosch, Siemens, NGK, Cummins, and TRW. Through professional societies, Dr. Chehroudi delivers invited professional seminars on Management of R&D Teams and Organizations, Management of Innovation, Combustion and Emission of Pollutants in Automotive and Gas Turbine Engines, Ignition Issues, Gasoline Direct Injection engines, R&D on Homogeneously-Charged Compression Ignition (HCCI) engines, and Liquid Injection Technologies. He has a PhD in Mechanical & Aerospace Engineering and Post-Doctoral Fellow (Princeton University), MS in Mechanical Engineering (Southern Methodist University, Summa Cum Laude), MS in Economics (Swiss Finance Institute, Magna Cum Laude, and BS in Mechanical Engineering (Sharif University). He is a senior member of American Institute of Aeronautics and Astronautics Propellant & Combustion Committee (2008-present) and an Associate Fellow of American Institute of Aeronautics and Astronautics. Dr. Chehroudi acts as a reviewer for many scientific and engineering journals and publishers, has delivered over 200 presentations in technical meetings and to nontechnical audiences, over 20 technical reports (Princeton University, General Motors, Ford Motor Co, Department of Energy, NASA, AFRL), five 600-plus-page monographs on combustion and emission of pollutants from mobile power plants, ignition technologies, liquid material injection, and nanotechnology, two book chapters on propulsion system combustion instability and applications of graphene (a nanotech product) in ignition and combustion of fuels, ground-breaking patents on applications and synergy between nanotechnology, light, and chemical reaction for a light-activated distributed ignition of fuel-air mixtures, and has more than 150 publications with extensive experience in both scientific and management areas and intensive trainings in finance and financial engineering.
The End