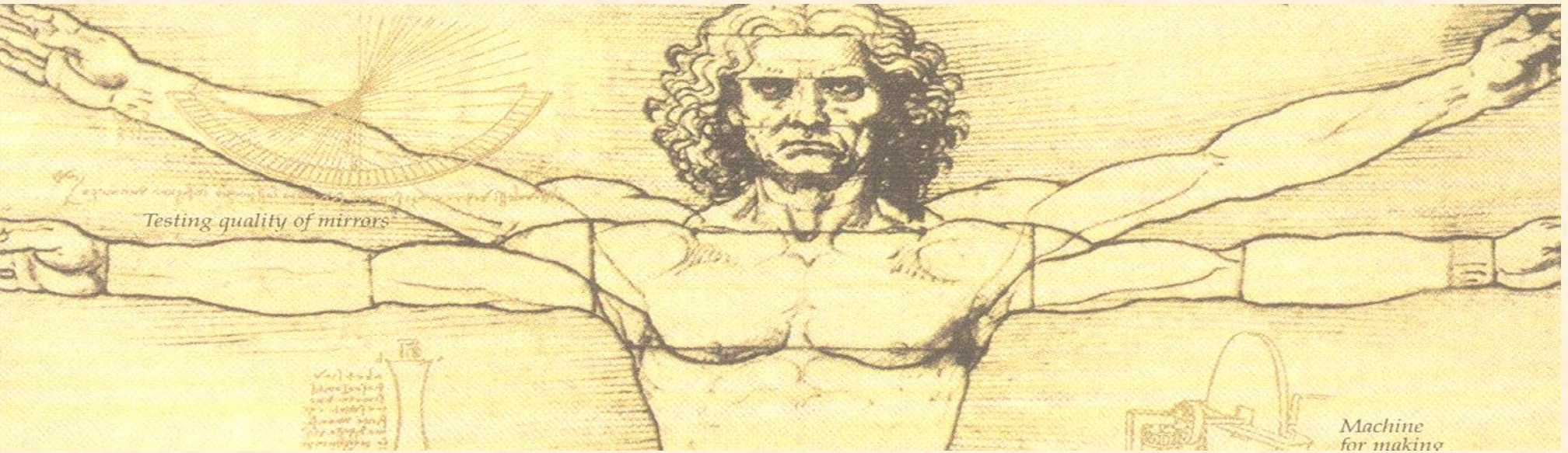
# Technology Transfer in R&D




**B. Cherhoudi, PhD**

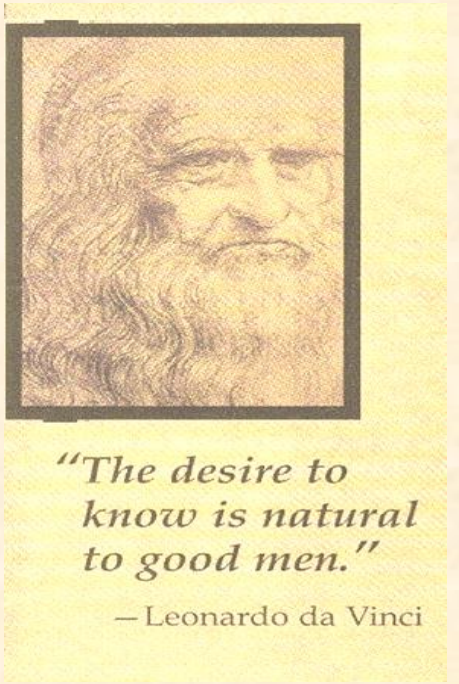
**Advanced Technology Consultants**
**www.advtechconsultants.com**
**4 Hidden Crest Way**
**Laguna Niguel, CA 92677**

**R&D and Technology Conference**

**February 18, 2015**

# Table of Contents






ATC
Advanced Technology Consultants

# Arts, Techniques, and Technology

- Arts stem from individual skills which cannot be easily systematized and reproduced.

- Techniques, in contrast, are the result of formalized and transmissible knowledge which is the basis for the development of all industrial activities

# Arts, Techniques, and Technology

- Arts stem from individual skills which cannot be easily systematized and reproduced.

- Techniques, in contrast, are the result of formalized and transmissible knowledge which is the basis for the development of all industrial activities

- Technology is literally the "study of techniques," like anthropology is the "study of man" or sociology is the "study of society."
  - One dictionary's first definition of technology is "the science of the application of knowledge to practical purposes"", which is consistent with the etymological origin of the word.


ATC
Advanced Technology Consultants

# Arts, Techniques, and Technology

- Arts stem from individual skills which cannot be easily systematized and reproduced.

- Techniques, in contrast, are the result of formalized and transmissible knowledge which is the basis for the development of all industrial activities

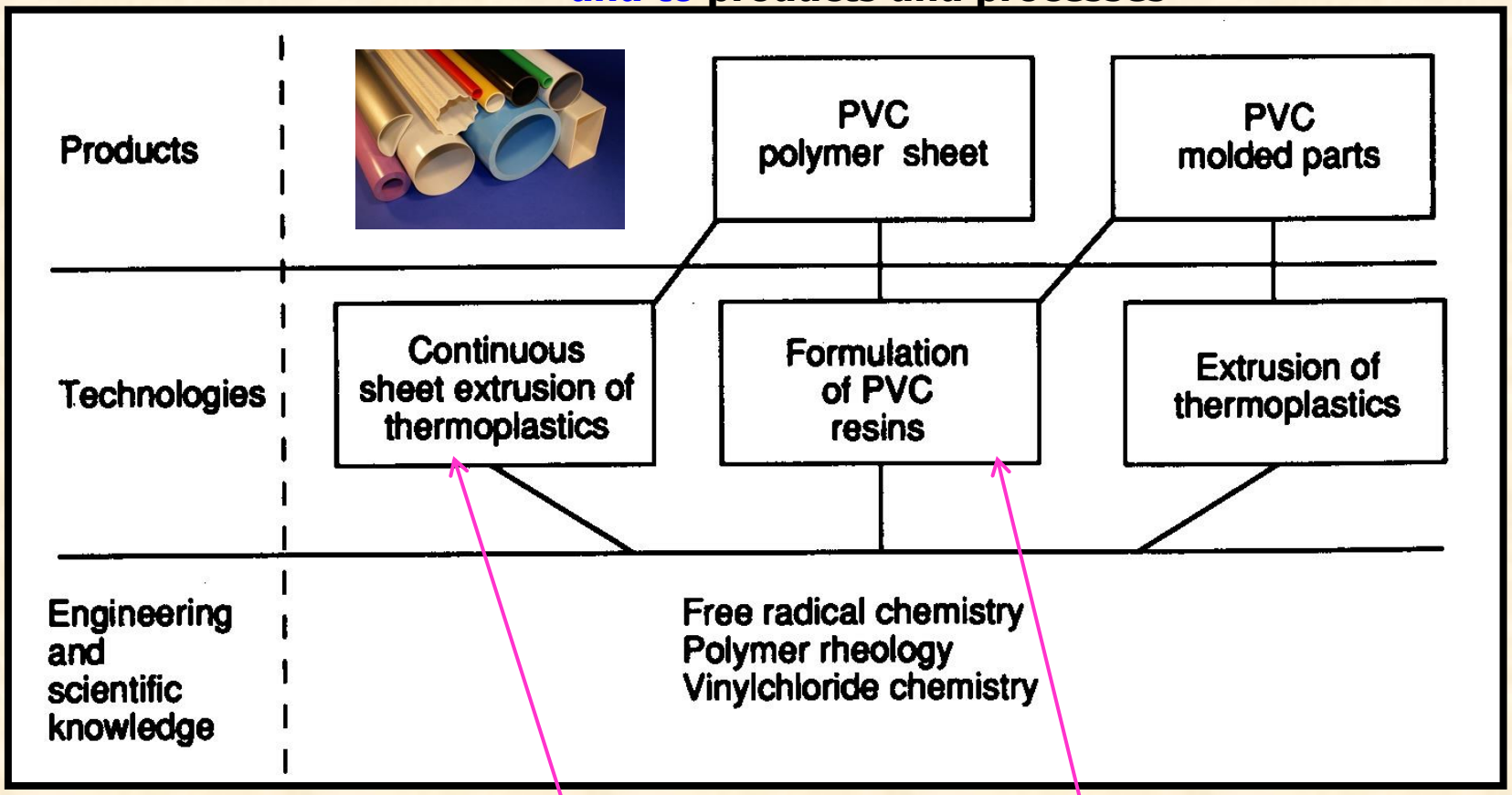
- Technology is literally the "study of techniques," like anthropology is the "study of man" or sociology is the "study of society."
  - One dictionary's first definition of technology is "the science of the application of knowledge to practical purposes"", which is consistent with the etymological origin of the word.

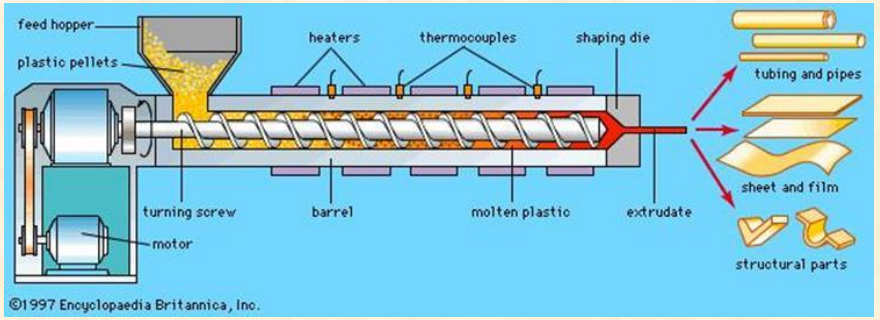

  - The technology label seems to be given primarily to the "techniques" which are the cornerstones of the new industrial revolution, such as electronics, computers, and biotechnologjes.
  - The term technology has been used extensively in the management literature, frequently to describe the "production process" or the "throughput" of an organization.

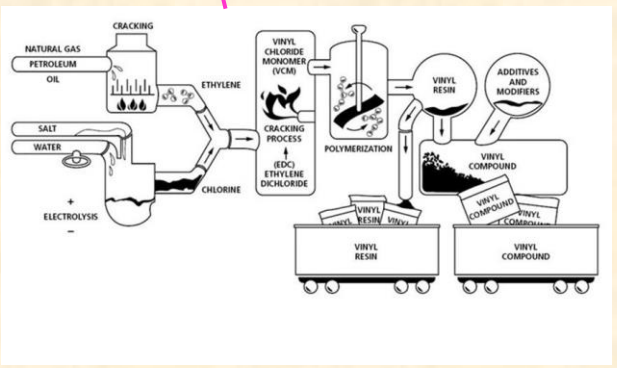
ATC
Advanced Technology Consultants

# From Scientific Knowledge to Products

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



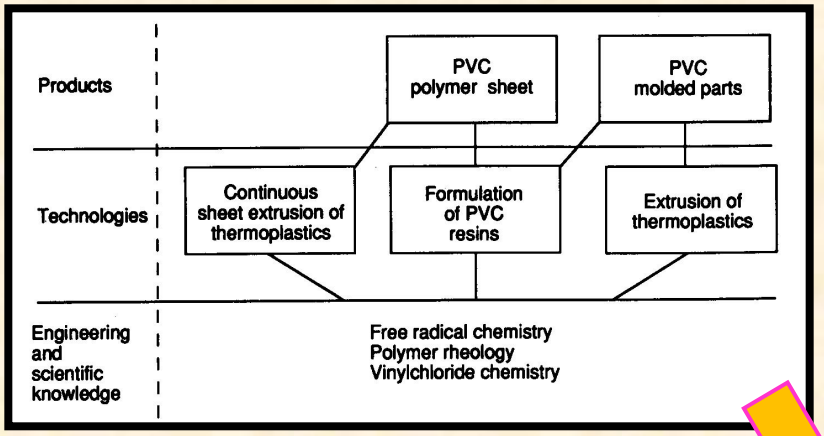




*B. Chehroudi, PhD*

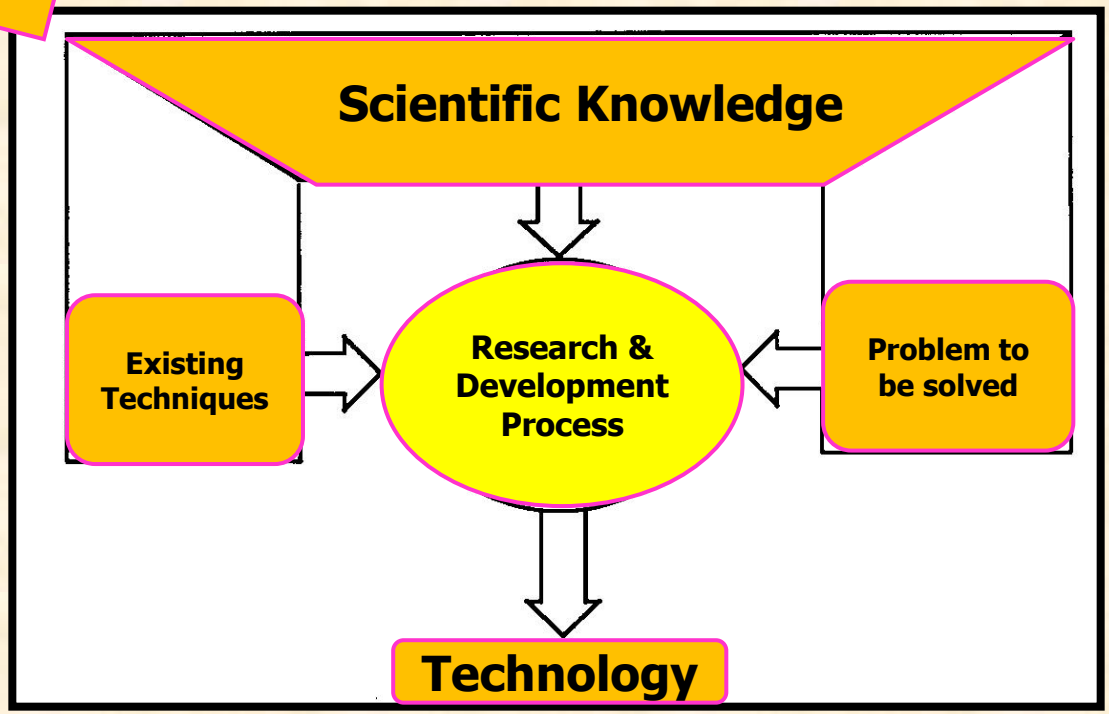
ATC
Advanced Technology Consultants

# What is Technology ?




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

The above definition can be represented graphically as in Figure.




**Definition of technology**

ATC
Advanced Technology Consultants

# What is Technology ?

**Tech·nol·o·gy**

- **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

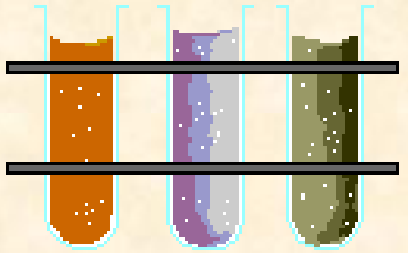
ATC
Advanced Technology Consultants

# 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** Science, technology and industry: a few examples

| Problems to be solved | Scientific fields | Existing techniques | Technology |
|---|---|---|---|
| To balance the brake system according to the grip of a vehicle's wheels on the road | • Fluid mechanics<br>• Strength of materials | • Conventional brake system technique<br>• Microprocessor data analysis<br>• 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

ATC
Advanced Technology Consultants

# Technology Transfer

- 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.**

ATC
Advanced Technology Consultants

# Some Attributes of a New Technology

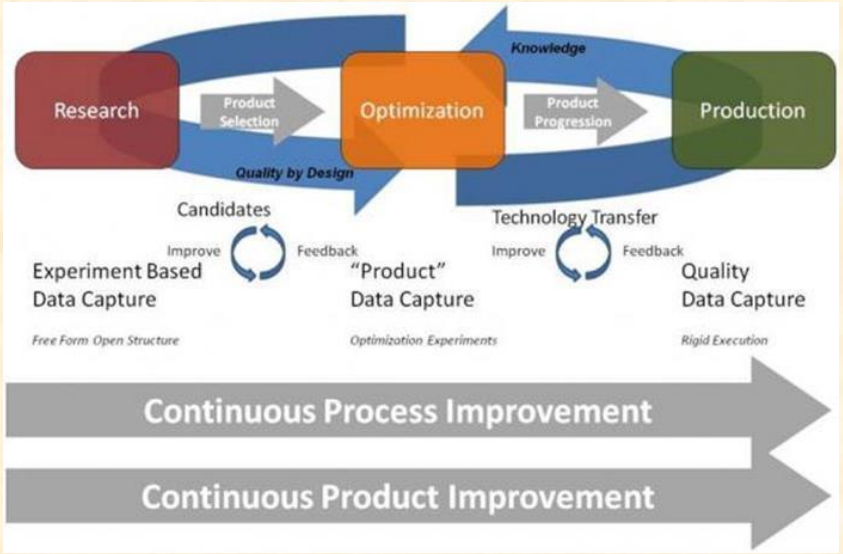
- **New technology**
  - Must have considerable **relative advantage** to the user
  - Must provide **significant value to the user**
  - Can be more expensive than the older one but **must provide value to the following to motivate its adoption** by the user:
    - Quality
    - Flexibility
    - Responsiveness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

ATC
Advanced Technology Consultants

# 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.



ATC
Advanced Technology Consultants

# 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
  - $\Rightarrow$ 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

ATC
Advanced Technology Consultants

# 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?**

ATC
Advanced Technology Consultants

# Stages of Technology Transfer

- 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

ATC
Advanced Technology Consultants

# Stages of Technology Transfer

- 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
  - Persuasion:
    - User forms a favorable or an unfavorable *impression* towards the innovation.
    - The user is looking for *comparative advantages and disadvantages* of the innovation.

ATC
Advanced Technology Consultants

# Stages of Technology Transfer

- 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
  - Persuasion:
    - User forms a favorable or an unfavorable *impression* towards the innovation.
    - The user is looking for *comparative advantages and disadvantages* of the innovation.

***Marketing*** can play an important role here. Make information brochures or demonstrations to capture the imagination of the users, motivating them to seek more information

ATC
Advanced Technology Consultants

# Stages of Technology Transfer

- 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
  - Persuasion:
    - User forms a favorable or an unfavorable *impression* towards the innovation.
    - The user is looking for *comparative advantages and disadvantages* of the innovation.
  - Decision: User takes steps that leads to *adoption or rejection* of the innovation
  - Implementation: User *incorporated the innovation* in its way of doing things

***Marketing*** can play an important role here. Make information brochures or demonstrations to capture the imagination of the users, motivating them to seek more information

ATC
Advanced Technology Consultants

# Stages of Technology Transfer

- 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

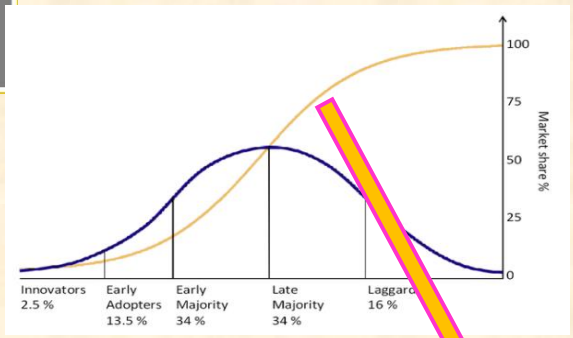
***Marketing*** can play an important role here. Make information brochures or demonstrations to capture the imagination of the users, motivating them to seek more information

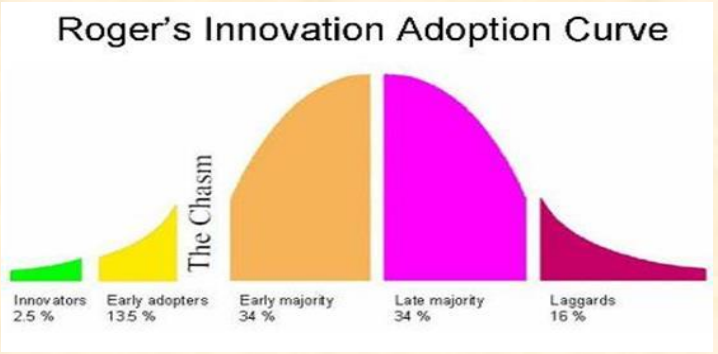
  - Persuasion:
    - User forms a favorable or an unfavorable *impression* towards the innovation.
    - The user is looking for *comparative advantages and disadvantages* of the innovation.
  - Decision: User takes steps that leads to *adoption or rejection* of the innovation
  - Implementation: User *incorporated the innovation* in its way of doing things
  - 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.

ATC
Advanced Technology Consultants

# Adoption of Innovation



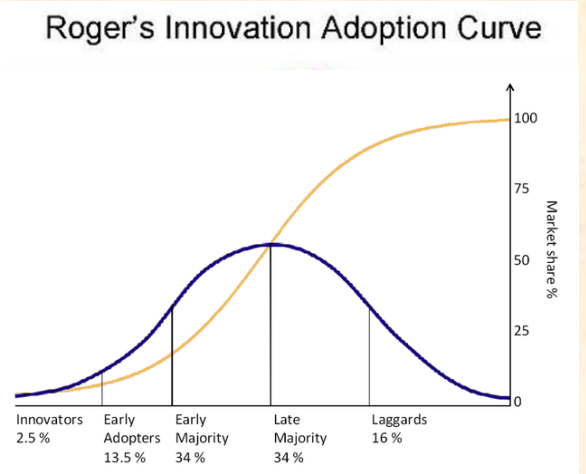

Trying to convince the mass of a new idea is useless. Convince innovators and early adopters first

AM Radio
Telephone
TV
FM Radio
Color TV
VCR
Cable TV
PC
Pager
Internet

1920
Great Depression
WW II
Korean War
Vietnam War
Gulf War
1999

*B. Chehroudi, PhD*

# Adoption of Innovation

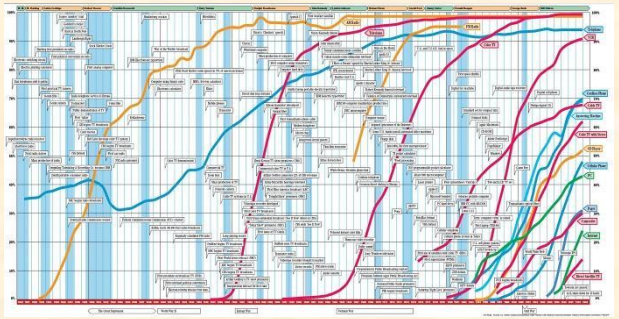



Please contact

**Advanced Technology Consultants**

for a complete copy of the presentation

www.AdvTechConsultants.com



# 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

*B. Chehroudi, PhD*

# 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

# Dr. B. Chehroudi

Advanced Technology Consultants
www.advtechconsultants.com
ChehroudiB@aol.com; (805) 559-8353; 949-467-9233

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