

**A PERSONAL PERSPECTIVE ON LESSONS LEARNED
FROM THE EVOLUTION OF TECHNOLOGY TRANSFER
ACTIVITIES AT UCSD**

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WHY DO WE NEED TO INNOVATE AND TRANSFER ECHNOLOGY?

**Innovation
Ignites
Wealth Engines**



Economic Growth

→ Studies show half of **GDP** growth of last decades due to innovation

High-tech Jobs

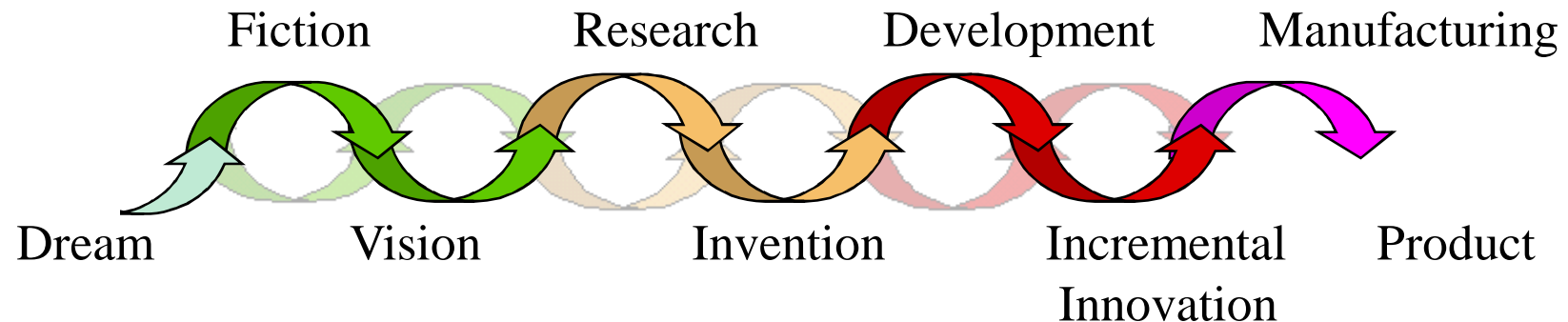
- E.g., Transistor/Integrated Circuit →
Semiconductor Industry: 255,000
U.S. Jobs
2002 Sales: \$70B
- E.g., MIT spin-offs*
 - 4,000 companies; 1.1 million employees
 - Annual world sales of \$232 B

**University Spin-offs play an increasingly important role in
High Tech driven economies**

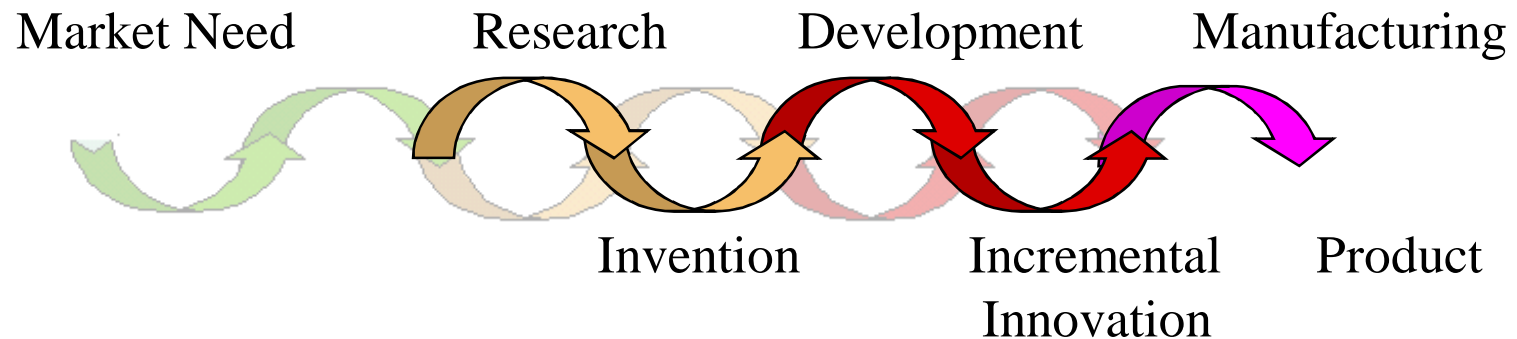
The Bumpy Road from Dream to Reality



Tech push: Science or Technology Driven Innovation



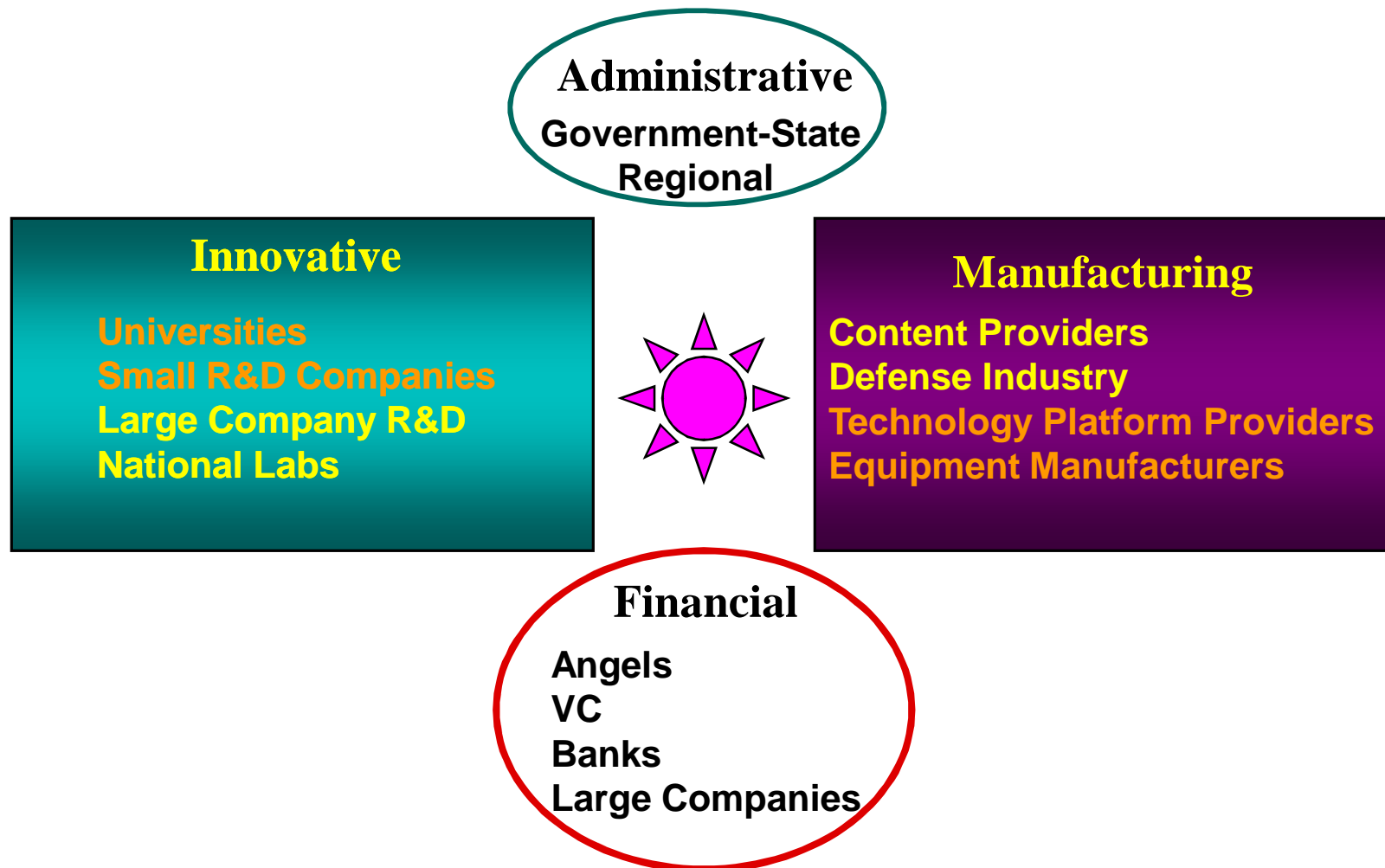
Application pull: Market Driven Innovation



Key Challenge:

Speeding up the pace of innovation to maintain economic growth

The Four Key Components of High Technology

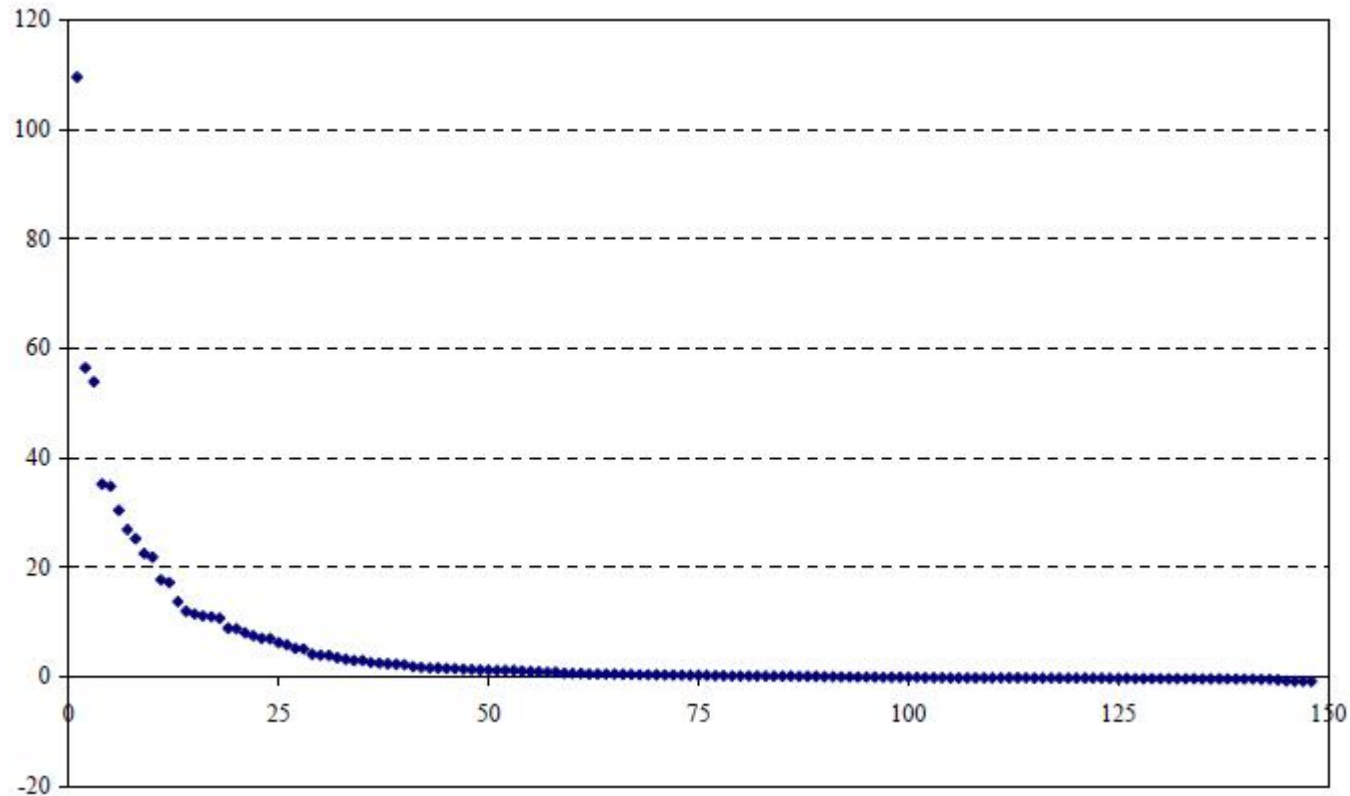


Tech Transfer: Impact on Universities

Beyond the Bayh-Dole act (1980)

- | The number of universities with a technology transfer office (TTO) increased from 25 in 1980 to 200 in 1990
- | A 15-fold increase in university patenting and a more than 5-fold increase in the number of universities granted patents were observed between 1965 and 1992 (Henderson, Jaffe and Trajtenberg, 1998).
- | Licenses and options executed by 55 U.S. universities increased 139% between 1991 and 2001, and their gross license revenue increased 485% between 1991 and 2001.
- | The aggregate gross license revenue obtained by all U.S. universities approached \$1 billion in FY 2002
- | The licensing income generated is found to be the most important criterion by which TTO offices measure their success (Thursby, Jensen, and Thursby, 2001)
- | **HOWEVER, only a few U.S. universities are obtaining large returns,, whereas others are continuing with these activities despite negligible or negative returns.**

Net Licensing Returns of U.S. Universities, 1998-2002 (in million dollars)



Harun Bulut and GianCarlo Moschini 2006

U.S. Universities' Net Returns from Patenting and Licensing: A Quantile Regression Analysis

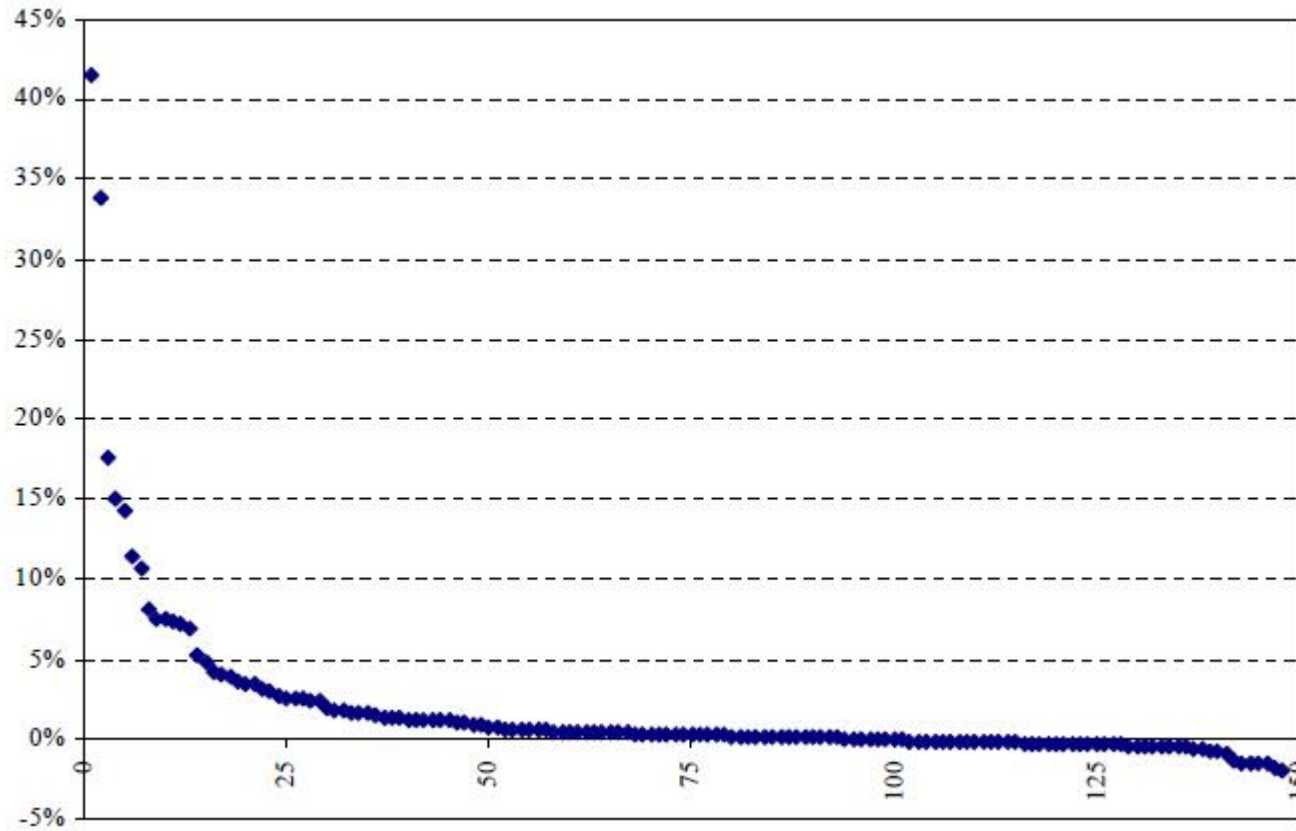
Data on U.S. Universities, 1998-2002: Descriptive Statistics

U.S. Universities	N	Variables	Min	Median	Max	Mean	Std. Dev.
All	148	Net Returns	-0.80	0.31	109.59	4.42	12.53
		Size	9.7	116.9	2,079.2	183.7	224.7
		Quality	0.6	318	2,691	485	519
		State R&D	0.0003	0.021	0.209	0.031	0.036
Public & No Medical School	45	Net Returns	-0.39	-0.03	4.02	0.47	1.06
		Size	17.9	67.1	426.4	110.2	96.5
		Quality	0.6	169	780	218	196
		State R&D	0.0003	0.013	0.070	0.018	0.019
Private & No Medical School	11	Net Returns	-0.77	0.24	26.97	4.12	8.23
		Size	16.9	44.5	780.3	147.4	224.9
		Quality	179	385	2,362	740	817
		State R&D	0.0063	0.056	0.209	0.060	0.053
Public & Medical School	59	Net Returns	-0.80	0.31	56.50	4.58	11.28
		Size	9.7	163.4	2,079.2	222.8	284.3
		Quality	3	325	1,882	469	407
		State R&D	0.0013	0.021	0.209	0.030	0.031
Private & Medical School	33	Net Returns	-0.29	1.65	109.59	9.61	20.46
		Size	25.0	184.7	1,120.0	226.1	210.3
		Quality	29	627	2,691	794	674
		State R&D	0.0019	0.036	0.209	0.043	0.047

Harun Bulut and GianCarlo Moschini 2006

U.S. Universities' Net Returns from Patenting and Licensing: A Quantile Regression Analysis

Net Licensing Returns as a Fraction of Total Research Expenditures of U.S.



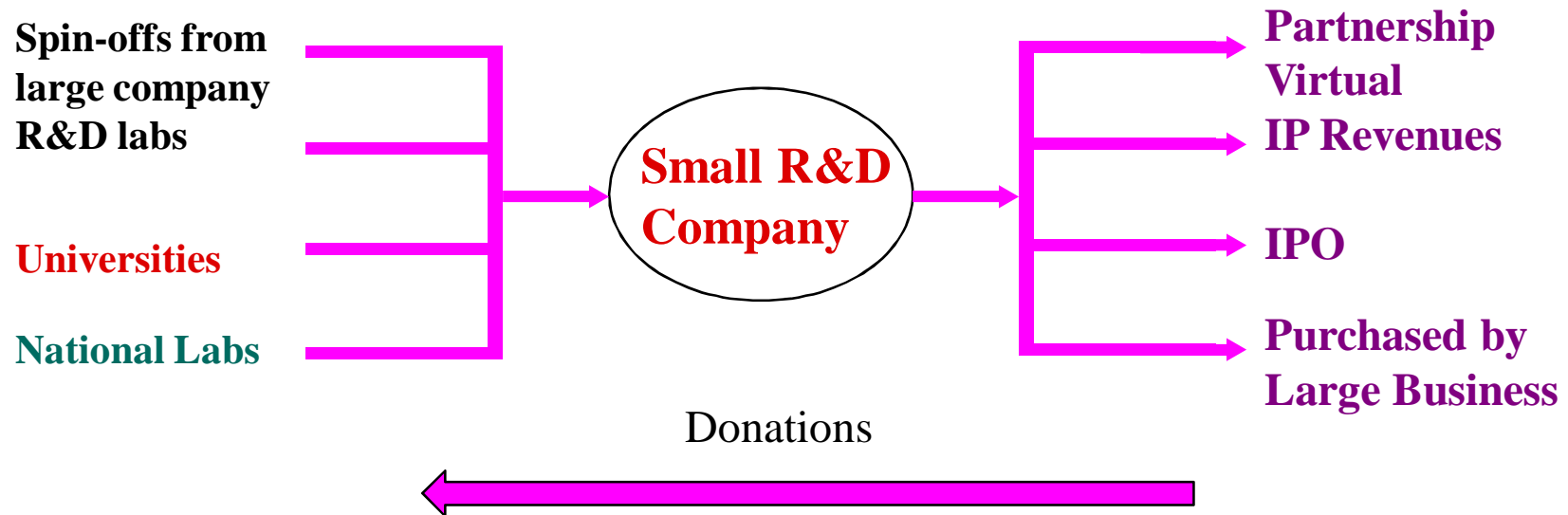
Harun Bulut and GianCarlo Moschini 2006

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Explosive growth in Small R&D Business in the 90's



50% of US High Tech Workers became employed in Small Businesses



Strengths:

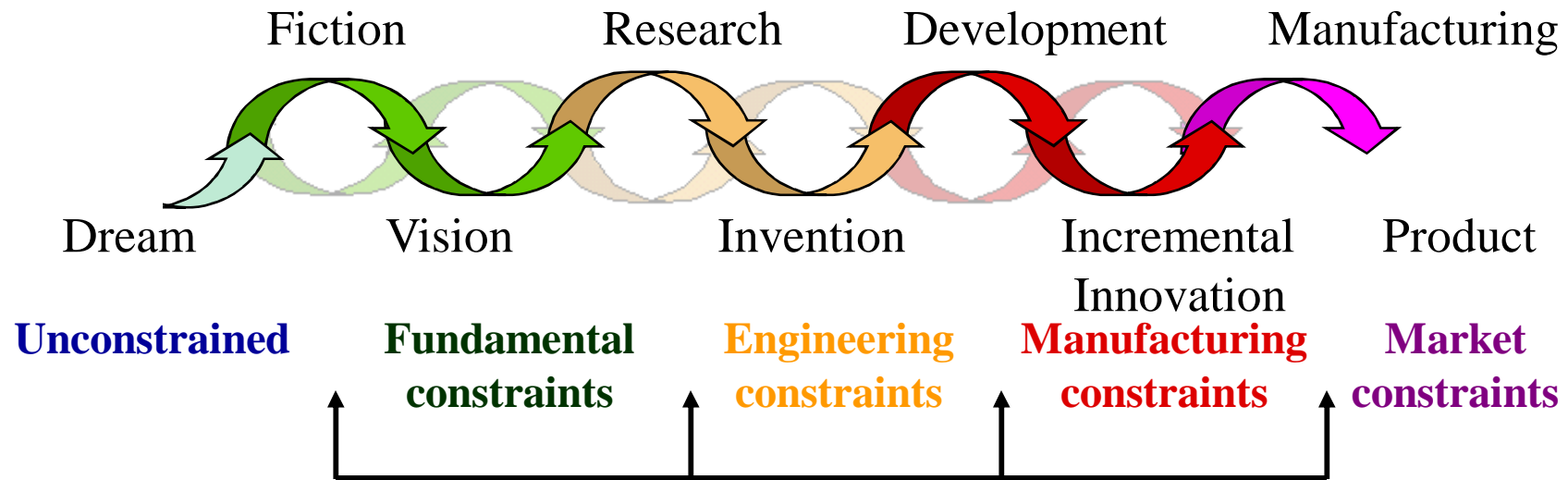
- Agility-flexibility-ability to learn
 - Open to novelty
 - Understanding of market constraints
- High productivity
 - Frugal
- High return promise to investors
- Low margins in manufacturing

Vulnerabilities:

- Uncertain access to technology platforms
- Vulnerable during economic recession
 - Virtually big through alliances
- Require short innovation cycles for quick profitability

The Bumpy Road from Dream to Reality

Barriers to Innovation



**Formation of Barriers preventing
idea-knowledge-technology
transition**

**Key Challenge:
Removing barriers to Innovation and Tech Transfer**

EXTRINSIC BARRIERS TO INNOVATION TRANSITION



Human factors

- Lack of proper education-training
 - entrepreneurs,
 - venture capitalists
 - technology managers
 - educated workforce
- Cultural
 - Risk taking

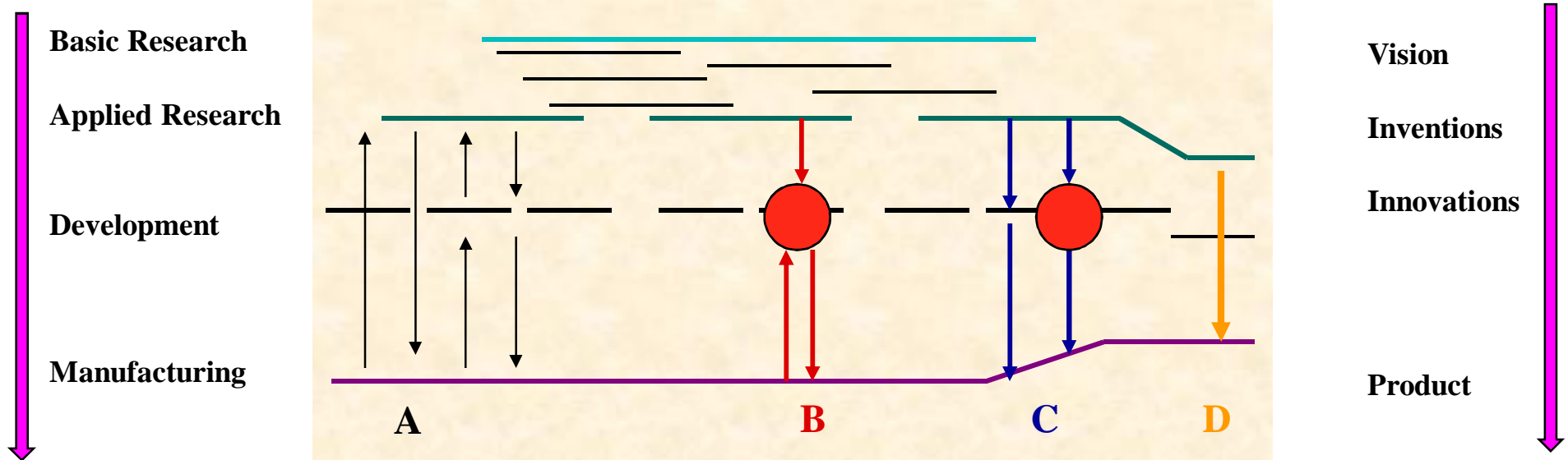
Technological factors

Economic factors

Political factors

Not invented here syndrome

Overcoming the Intrinsic Barriers



When there is a gap there is an opportunity!

A) Exchange of personnel

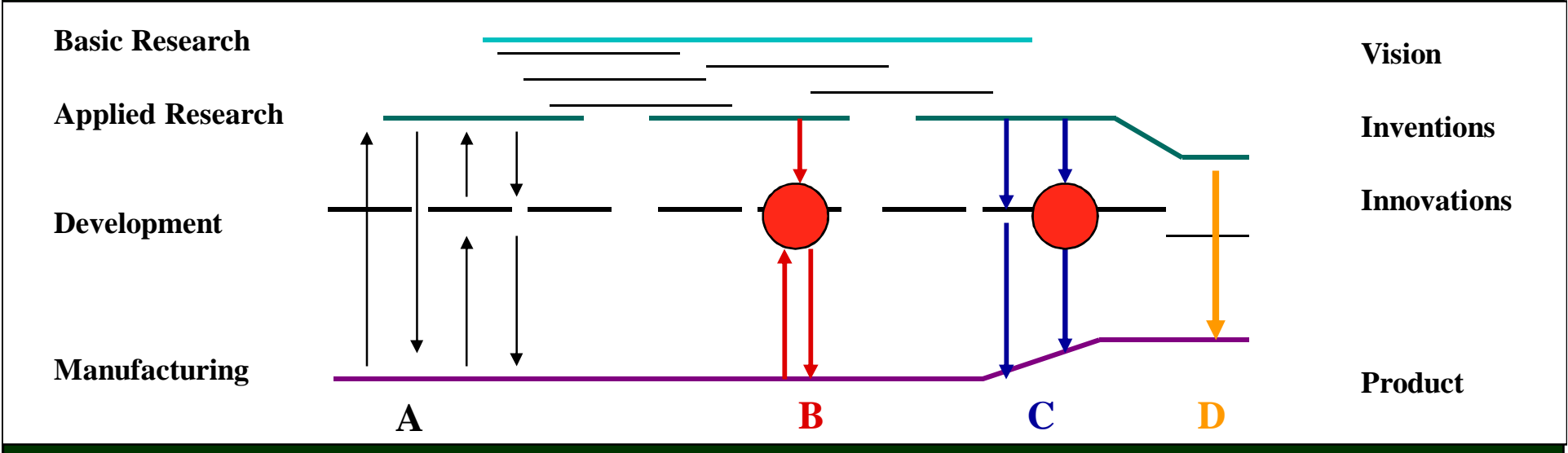
- Graduating students
- Industrial visitors
- Faculty engineer exchange
- Employee carries invention through

B) Applications Centers Small Business

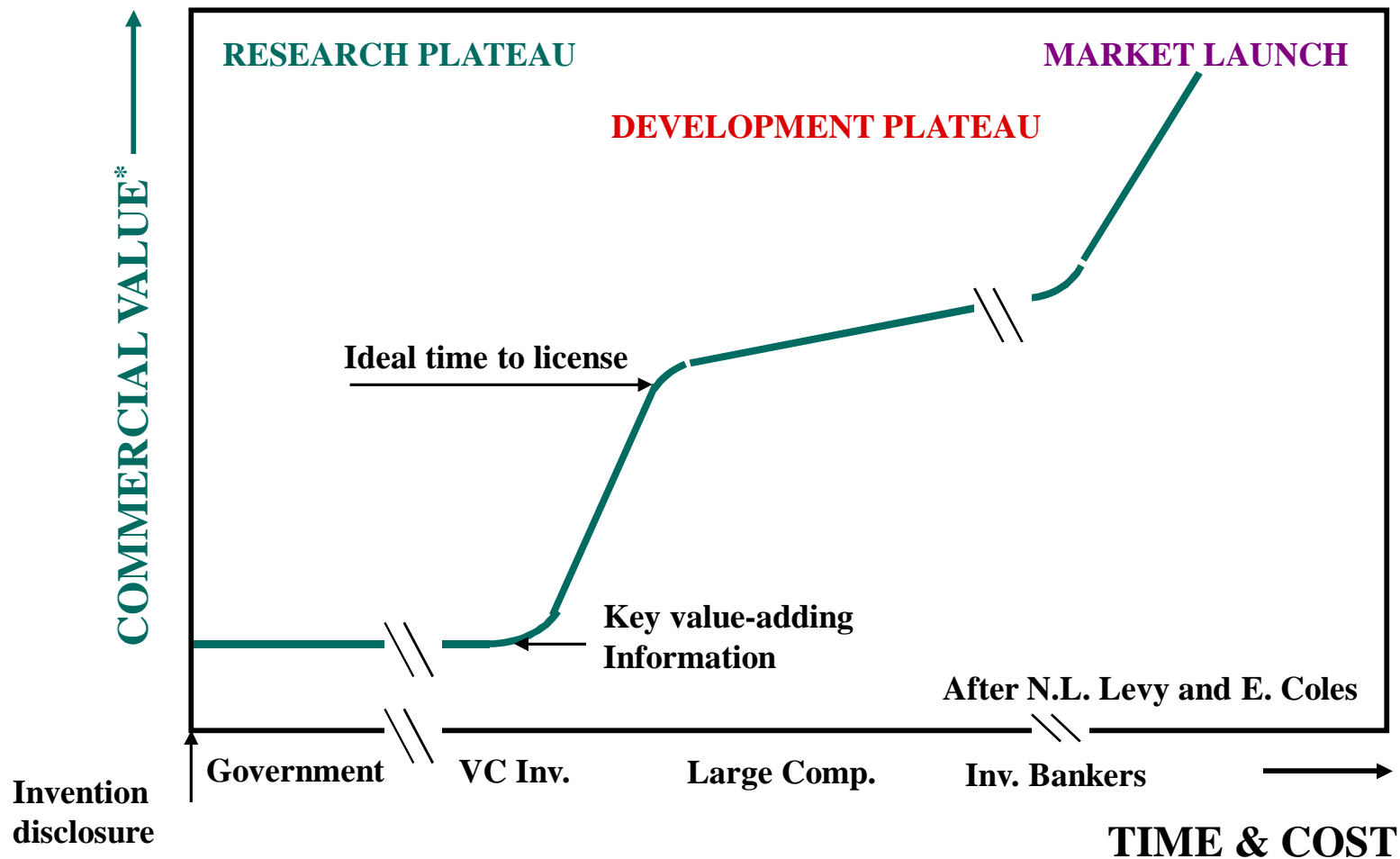
C) Consortia

- University-Industry
Research centers of excellence
- Small Business -University

Key to success: CONVERGENCE OF DIFFERENT WORLDS



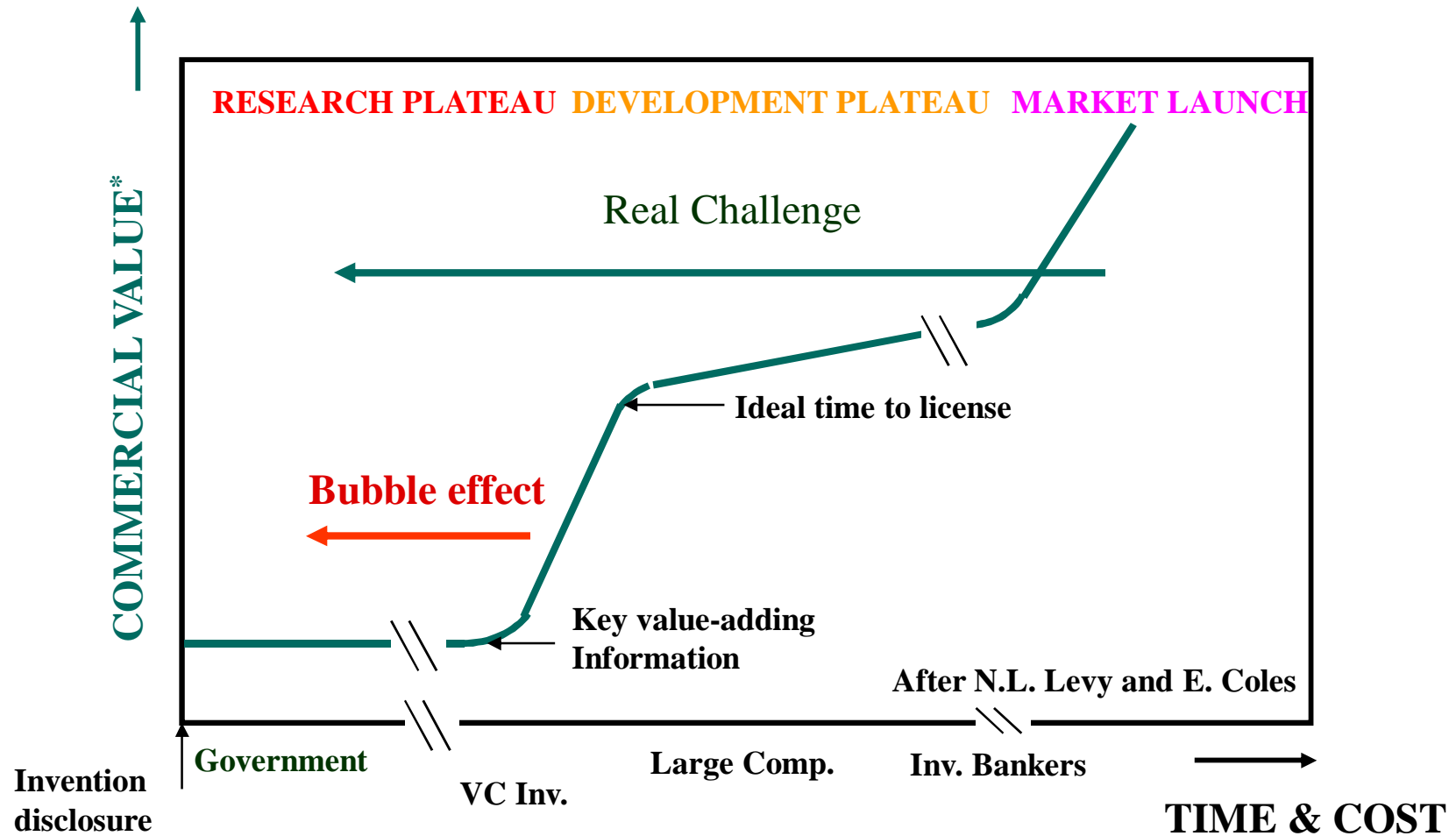
Impact of Barriers



* Value refers to the sum that would be paid for the technology by a license

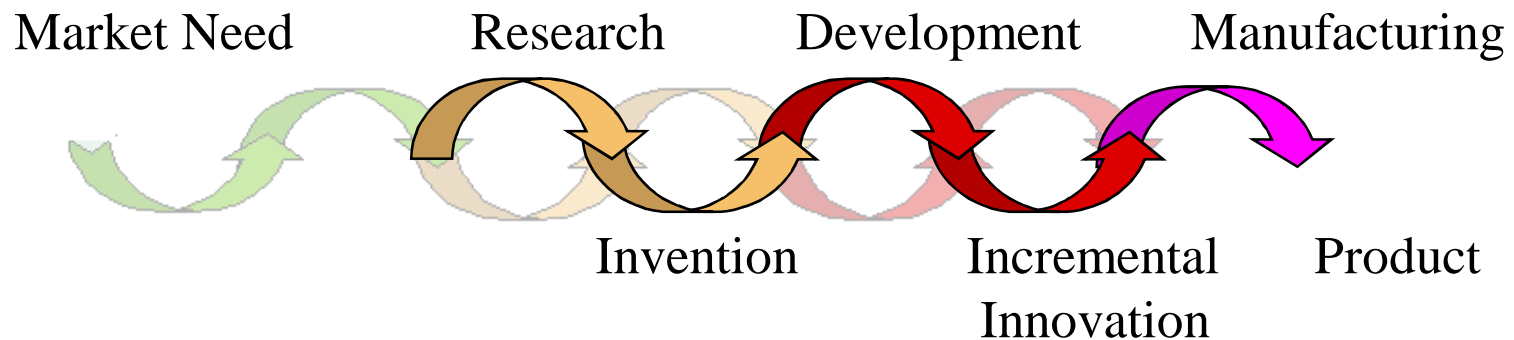
**BARRIERS EXTEND THE DURATION AND COST OF DEVELOPMENT
LIMITING ECONOMIC GROWTH**

Bridging the gap: Which gap?



The Bumpy Road from Market Need to Product

Market Driven Innovation
(rarely happens at Universities
Except University Hospitals)



Examples: Invention of Mouse GUI



Timeliness of the Innovation

- | Is there a need now? If not when?
- | What is the state of the competition?
- | Which supporting technologies are needed? Are they available?
- | Is the cost compatible with market constraints

Starting it right



Selecting Partners

Technical team

Business team

Angels and Venture Team

Selecting Location and Ecosystem

Selecting your customers

Managing risk factors

Setting up the right interaction with TTOs

standardization

or case by case

CONCLUSIONS



For the university and faculty to derive benefits from innovation

- **Promote innovation culture with the right ecosystem**
 - **Find ways of planning the innovations such that they are timely**
 - **Understand and manage conflicts of interest**
 - **Team up with a seasoned business team and define exit strategy**
 - **Clearly define your risks and risk management approach**
 - **Donate some of the proceeds back to the university**
-
- **TTO office should be able to see the big picture and understand how the particular innovation will benefit the university in the long term. Establish a suitable strategy to maximize gain in the long run**
 - **Create suitable ecosystem to facilitate local and global alliances**
 - **Establish a culture for donations**