The U.S. Firm in the Global Innovation System

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The Innovation System

- Broad portfolio of basic science and technology
- University based research
- Open System with results freely available
- Defense R&D spill over into civilian economy
- Combination of venture capitalists, large corporate research, and start-ups
- School of engineering and medicine sources of spin-outs
- Balanced use of intellectual property protection
Performance Observations

• Increased U.S. High Tech Firm’s Global Market Share
• Increased Private Funding of R&D
• Privatization of Information
  – Increase of Patents
  – Reduced U.S. Scientific Publications
• Shift to Services
• Rising Importance of Research Universities
• Market Driven R&D
• Rise and Fall of Venture Capital
• Globalization of R&D
U.S. global market share, by high-tech industry: 1981-98

Source: nsf
National R&D and Venture Capital - %GDP

Source: G. Mitchell, Wharton & NSF/NVCA

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Privatization of Information

![Graph showing trends in U.S. publications, U.S. patent applications, and total U.S. patent applications from 1989 to 1999.](image)

- **U.S. Publications**
- **U.S. Patent Applications - U.S. Residents**
- **Total U.S. Patent Applications**
- **Total Publications**

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nsf
R&D performance by Industrial Classification

Percent Total

Manufacturing
- materials
- design
- manufacturing process

Services
- networks/systems
- operations
- customer applications

Source: G. Mitchell, Wharton and NSF

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Industrial R&D spending flows of U.S. and foreign affiliates, by world region: 1998

Source: NSF
Industry Transformation


Old Vertical Computer Industry

Circa 1980

Sales and distribution
Application software
Operating System
Assembled HW
Micro Processors
Peripherals

IBM  DEC  Sperry
Univac  Wang

New Horizontal PC Industry

Circa 1995

Sales and distribution
Application software
Operating System
Assembled HW
Micro Processors
Peripherals

Retail Stores
Superstores
Dealers
Mail Order
Microsoft
Lotus
Novell
DOS and Windows
OS/2
Mac
Unix

IBM
SUN
Motorola
RISCs
Intel
Motorola
Etc.

M.B. Myers, December 10, 1999

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Extended Enterprise

- Flat, virtual
- Webs of trust
- Dynamic links
- Outward engagements
- Competency centered
- Global
Market Driven “R&D”

• The value creation concept
• The management team
• The market segments
• The technology
• The financial plan
Technology Centric Innovation

Patterson Model
M. L. Patterson, J. PROD. INNOV. MANAG 1998, 15:390-402

R&D Input  Firm Gain Function  Revenue Performance

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Revenue Waves

Matched to historical parameters:

\( g = 5\% \)

\( D = 6.5\% \)

\( G = 18.7\% \)

\( \langle M \rangle = 4.27 \), revenue wave shape:

![Revenue wave shape](image)

Xerox simulation: historical parameter values to 1999

Revenue growth rate is 5%
Innovation → Creating New Business Value

Emergent Markets

Customer & User Needs

Critical Opportunities

Continual Engagements

Market & Customer Feedback

Emergent Technology

Technology Bets

Technology Functions & Capabilities

Market Functions & Capabilities

Market learning

Technology in use

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Emergent Market Opportunities

Emergent Technology Opportunities

Opportunity Scanning

Phase

I

Select Markets Options

Select Technology Options

Business Concept Development

II

Proof of Concept

Business Incubation

III

Licensing/Spinout

Launch Business

Terminate

The Innovation Pipeline
Fields of Risk / Opportunity

Technology

Existing Concepts

New Concepts

Market

Existing

New

Increasing Risk/Opportunity

Discontinuity

Evolutionary

Leverage Base

Radical

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Fields of Risk / Reward

Existing Concepts

New Concepts

Value Chain

Business Model

Vector of Differentiation

Market Acceptance

Technical Achievability

Competencies

Complementarily

Specification Achievability

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Issues for the Innovation System Going Forward

- Impacts on technology of current economy
- Size of the information commons
- Role of venture capital
- Continuation technology driven productivity
- Role of universities & source of basic science
- Politics of the global economy