

Recap of:

## The IT Innovation Ecosystem

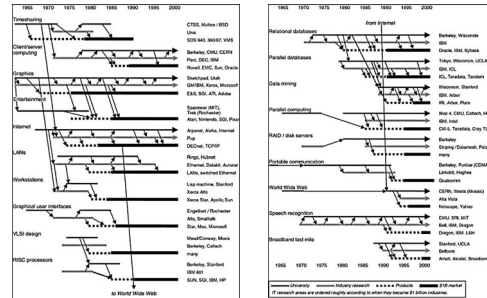
Lessons from the "Tire Tracks Diagram"

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IT & Public Policy  
Autumn 2004



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In our last exciting episode ...



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### Key "Tire Tracks" concepts illustrated

- Every major \$1B IT sub-sector bears the stamp of federal research funding
- Every sub-sector shows a rich interplay between university and industry
- It's not a "pipeline" - there's lots of "back-and-forth"
- It typically takes 10-15 years from idea to \$1B industry
- There are many research interactions across sub-fields

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### Key "Tire Tracks" concepts not illustrated but discussed

- Unanticipated results are often as important as anticipated results
- It's hard to predict the next "big hit"
- Research puts ideas in the storehouse for later use
- University research trains people
- University and industry research tend to be complementary
- Visionary and flexible program managers have played a critical role

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### Examples used to illustrate these concepts

- The Internet
- Bob Kahn at DARPA
- Impact of AI
- Technologies employed in e-commerce
- Time sharing -> email and instant messaging
- Tire Tracks 1995 vs. 2003

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### Other points

- The key role of research institutions in high tech success

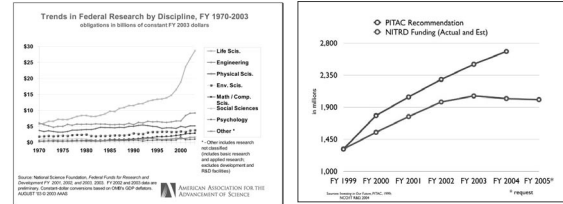
	Inception	Growth	Fertilization
Public Policy			
Tax Incentives	***	*	
Public Investments	*	***	
Commercialization of Ideas	*	***	**
Comparative Location Benchmarking			
Cost Factors		***	
Research Institutions	***	***	***
Skilled or Educated Labor Force	**	***	***
Transportation Center	*		
Proximity to Suppliers & Markets	**	*	*
Social Infrastructure Developments			
Attending Changing Needs		**	***
Reeducation & Training Activities	***	*	
Establishing Trade Groups & Alliances	***	***	
Housing, Zoning, & Quality of Life	**	**	***
*** Critical			
** Very Important			
* Important			

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- The special role of universities
- The nature of industry R&D in IT (mostly D!)
- Federal science agency evolution since 1945

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### ■ Federal research budget trends



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### ■ Where the jobs are



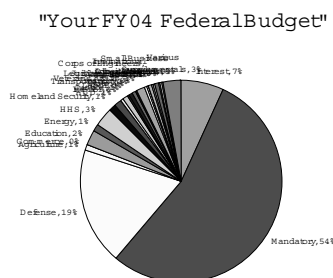
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### ■ Recap of science support issues:

- About \$55B of the nation's \$2,319B budget goes to basic and applied research
- More than half of this goes to the life sciences (IT is less than 4%)
- IT research funding is actually decreasing
- More than 80% of the employment growth in all of S&T in the next decade will be in IT - and more than 70% of all job openings (including those due to retirements)
- Recent news provides little encouragement!

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### The federal budget: How the sausage is made



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- Most of the budget is mandatory
- Half of what's discretionary is defense
- The rest involves dozens of agencies
- They are grouped irrationally, and tradeoffs must be made within those groups
- "Balancing the budget" is a foreign concept

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## IT, economic growth, and productivity

- "Advances in information technology are changing our lives, driving our economy, and transforming the conduct of science."

┆ Computing Research Association

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## Economic Growth can Derive from:

- Increased levels of inputs
  - Labor, IT, other capital
  - Capital deepening and labor productivity
- Improved quality of inputs
- Increased multifactor productivity
  - Improved production methods

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## Productivity

- In the US, our wages are high, so our productivity needs to be high, or we're SOL
  - ┆ A US worker who is twice as productive can compete with a foreign worker who makes half as much

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## The productivity paradox

- We all "believe" that IT increases productivity
- There have been continuous investments in the application of IT for more than 40 years
- But there were at most *very* modest signs of any increase in organizational productivity from 1975-1995
- "Computers show up everywhere except in the productivity statistics"

┆ - Robert Solow, Nobel prize winning Economist, 1987

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## Between 1995 and 2000

- A huge surge in economic growth, driven by dramatic increases in productivity (double the average pace of the preceding 25 years), attributed almost entirely to IT!
- "We are now living through a pivotal period in American economic history ... It is the growing use of information technology that makes the current period unique."

┆ Alan Greenspan, Chairman of the Fed, 2000

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## So, what happened?

- Not clear the economic data was capturing the right things
- Also, it was measuring entire industries, not individual firms (accounting for quality differences)
- Changes in processes, stimulated by changes in technology, take time to show impact

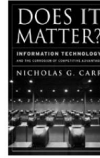
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## Impact of IT on the economy, 2004

■ "We have completed our program of attributing US economic growth to its sources at the industry level. ... Our first conclusion is that many of the concepts used in earlier industry-level growth accounting should be replaced ... investments in information technology and higher education stand out as the most important sources of growth at both industry and economy-wide levels ... the restructuring of the American economy in response to the progress of information technology has been massive and continuous ..."

l Dale W. Jorgenson, Harvard, Mun S. Ho, Resources for the Future, and Kevin J. Stiroh, Federal Reserve Bank of NY, "Growth of US Industries and Investments in Information Technology and Higher Education" 19

## Does IT Provide Competitive Advantage?



"As availability increases and cost decreases ... [technologies] become commodity inputs. From a strategic standpoint, they become invisible; they no longer matter ..."

"Executives need to shift their attention from IT opportunities to IT risks — from offense to defense."

- Nicholas Carr

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## What Does All This Mean?



- Continuing IT innovation will continue to provide opportunities for firms to raise productivity
- Back to the basics – understand and leverage the role of IT in key business processes
- Investments in IT capital must be complemented with corresponding investments in organizational capital

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