

The IT Workforce

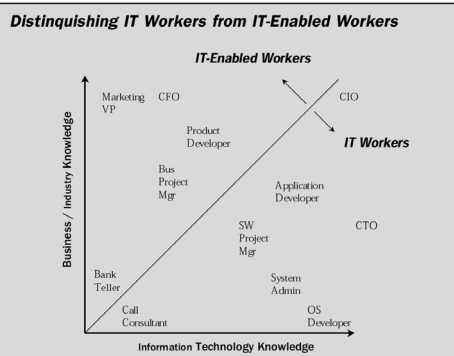
Ed Lazowska
IT & Public Policy
Autumn 2004



Topics

- Characterizing the IT workforce
- Size of the IT workforce
- Recent trends in IT workforce size
- Longer-term trends in IT workforce size
- Education for IT jobs
- Positioning of Washington State
- Positioning of the US as a whole
- H-1B's, worldwide sourcing
- A few miscellaneous thoughts

Figure 2-2



Source: Computing Research Association, Intersociety Study Group on Information Technology Workers, April 1999.
Freeman & Aspray, *The Supply of Information Technology Workers in the United States*, Computing Research Association, 1999

IT industry puts money in American pockets



Computer Systems Policy Project, *Choose to Compete*, 2004

Professional IT Workers Hold a Wide Array of Science, Engineering and Other Degrees

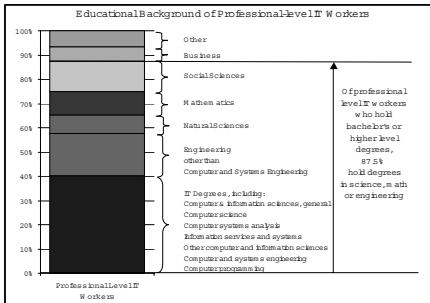
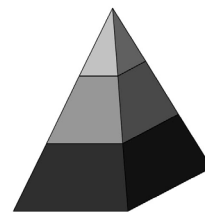


Figure 2-6

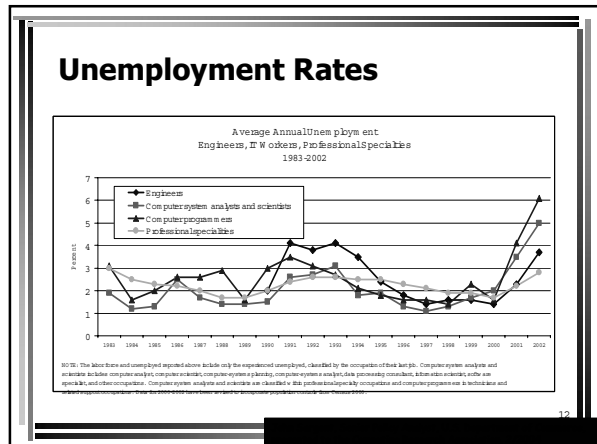
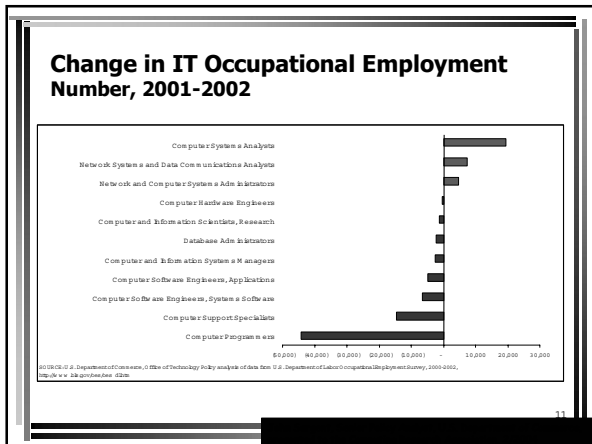
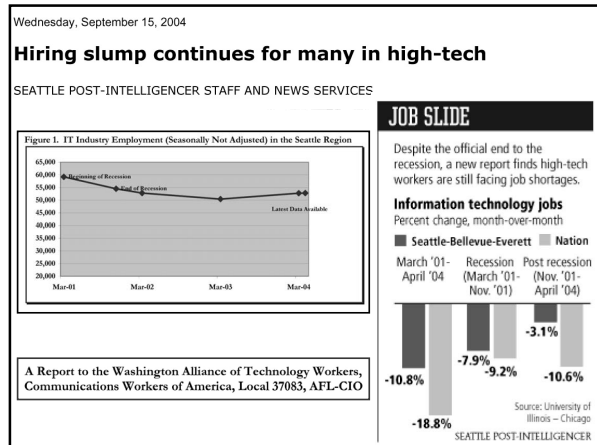
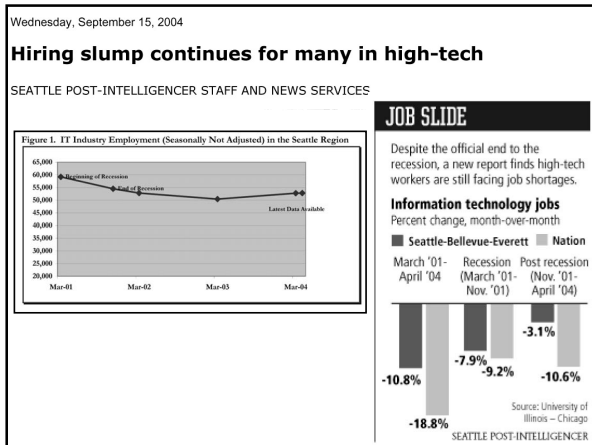
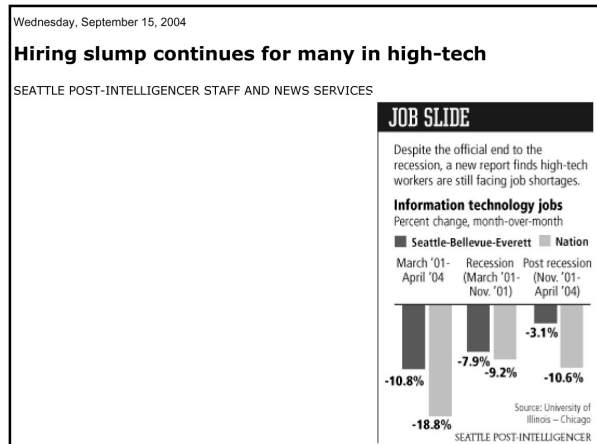
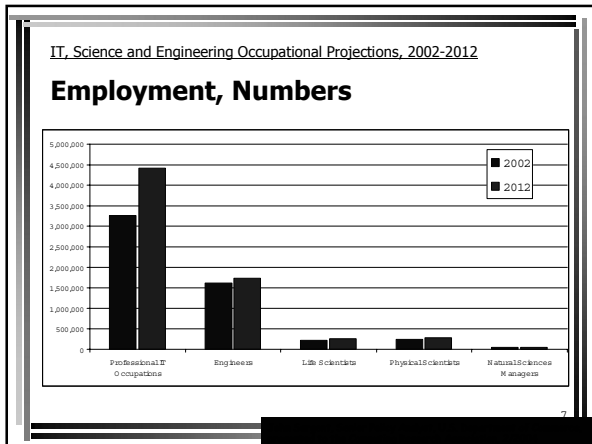
Who's Getting the Top Talent?

- Tier 1 - Hot Software Companies
 - Software start-ups and boutique service firms
 - Software publishers
 - Wall Street
 - R&D (corporate and university)
- Tier 2 - Software-aware Companies
 - VARs, consulting firms, systems, integrators
 - Software intensive industries (computer hardware, communications, financial services)
 - Aerospace systems firms
- Tier 3 - Everyone Else
 - Other industries with incidental software
 - Most IS applications development and maintenance
 - DoD, federal, state, and local governments

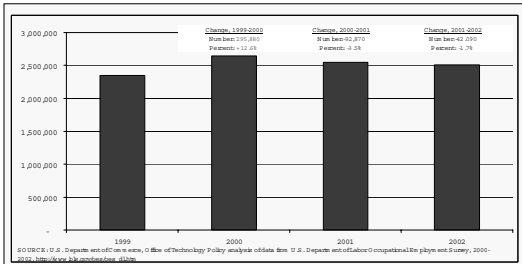


Source: Stanford Computer Industry Project, 1999.

Freeman & Aspray, *The Supply of Information Technology Workers in the United States*, Computing Research Association, 1999

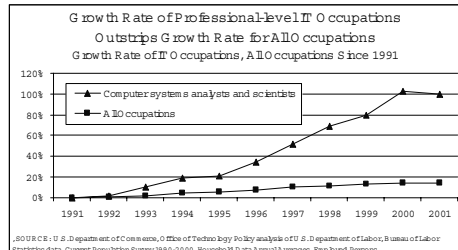


Aggregate IT Employment 1999-2002



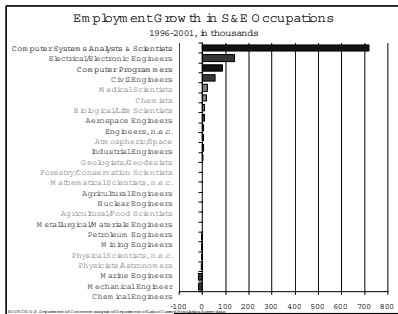
SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of data from U.S. Department of Labor Occupational Employment Survey, 2000-2002. <http://www.itp.com/techpolicy/otps.htm>

Occupational Growth Rates IT vs. All Occupations



SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of U.S. Department of Labor, Bureau of Labor Statistics data, Current Population Survey 1990-2000, Socioeconomic Data Annual Averages, September 2002

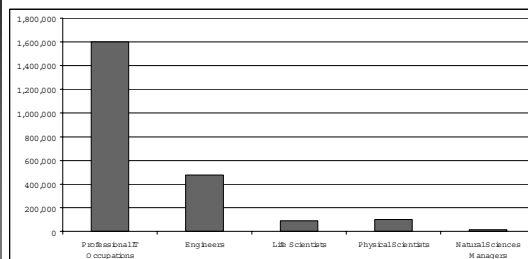
Recent Occupational Growth in Numbers



SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of U.S. Department of Labor, Bureau of Labor Statistics data, Current Population Survey 1996-2001

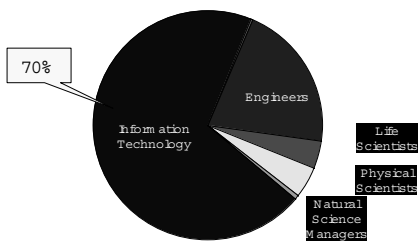
IT, Science and Engineering Occupational Projections, 2002-2012

Total Job Openings



SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of U.S. Department of Labor, Bureau of Labor Statistics data, Current Population Survey 2002-2012

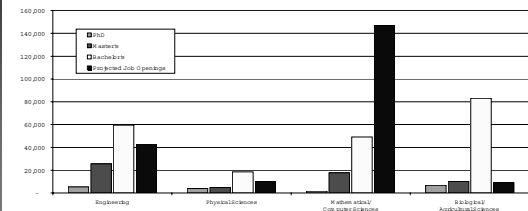
Occupational Distribution of Projected S&E Job Openings (new jobs plus net replacements) 2002-2012



SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of U.S. Department of Labor, Bureau of Labor Statistics data, Current Population Survey 2002-2012

The Market Perspective Degree Production vs. Projected Job Openings

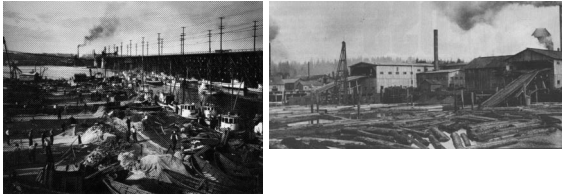
Annual Degrees and Job Openings in Broad S&E Fields



SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of U.S. Department of Labor, Bureau of Labor Statistics data, Current Population Survey 2002-2012

Education for the "innovation economy"

- Once upon a time, the "content" of the goods we produced was largely physical



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- Then we transitioned to goods whose "content" was a balance of physical and intellectual



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- In the "innovation economy," the content of goods is almost entirely intellectual rather than physical



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- Every state *consumes* "innovation economy" goods

- Information technology, biotechnology, telecommunications, ...

- We *produce* these goods!

- Over the past 20 years, the Puget Sound region has had the fastest pro-rata growth in the nation in the "high tech services" sector

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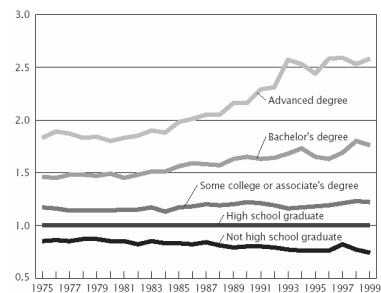
What kind of education is needed to produce "innovation economy" goods?



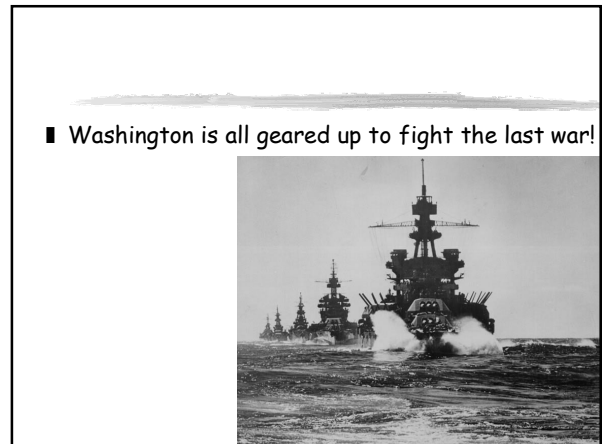
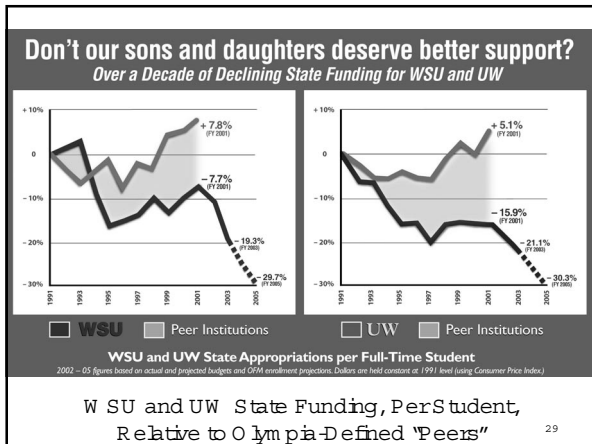
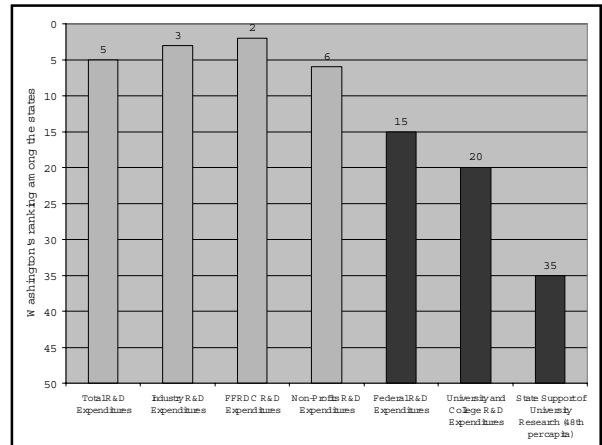
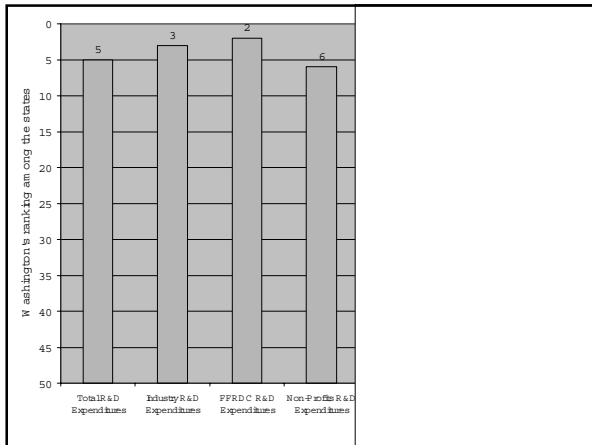
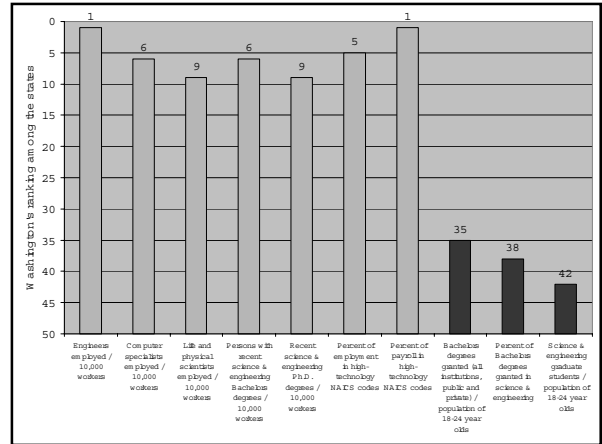
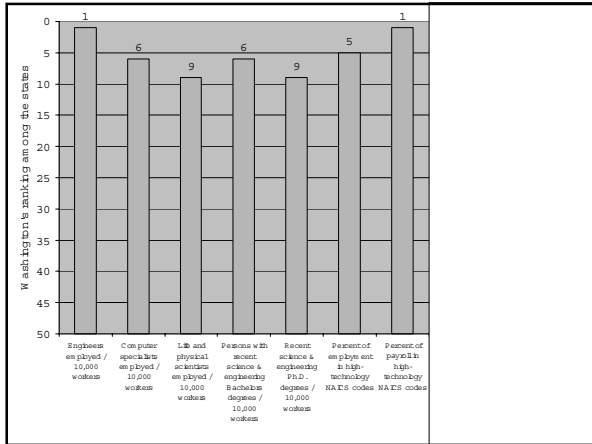
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- National and regional studies conclude the 3/4ths of the jobs in software require a Bachelors degree or greater (and it's highly competitive among those with this credential!)

Average Earnings as a Proportion of High School Graduates' Earnings, 1975 to 1999



Source: U.S. Census Bureau, Current Population Surveys, March 1976-2000.



More broadly (some data is not current, but nothing much has changed)

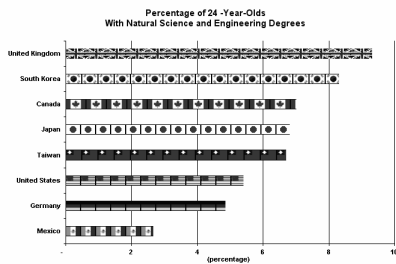
- Bachelors degrees, nationwide, 1997:
 - 222,000 in business
 - 125,000 in the social sciences
 - 105,000 in education
 - 63,000 in all of engineering
 - 25,000 in computer science

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- China granted only 1/4 as many Bachelors degrees in 1997 as did the US (325,000 vs. 1.2M)
 - But China granted 2.5 times as many Bachelors degrees in engineering (149,000 vs. 63,000)
- In 2003, China and India each produced about 200,000 Bachelors degrees in engineering

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U.S. Lags Other Nations in Share of 24-Year-Olds With Natural Science, Engineering Degrees



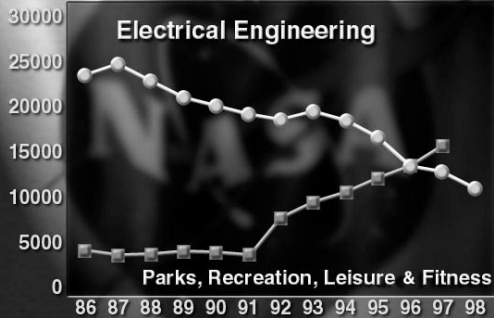
A. Iso: The United States ranks 61st out of 63 nations in the share of S&E degrees as a total of all bachelor's degrees.

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- What's the fastest-growing undergraduate major in America today?

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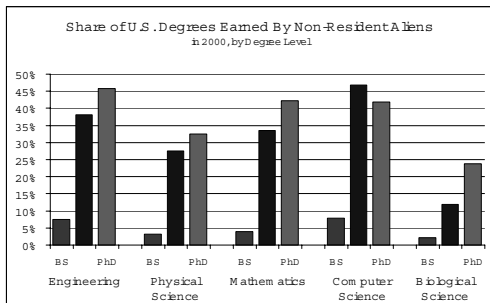
BACHELOR'S DEGREES Awarded by Institutions of Higher Learning



- At the doctoral level (also 1997):
 - 40,000 J.D.'s
 - 857 Ph.D. computer scientists
 - And roughly half of the Ph.D.s in engineering and computer science were awarded to non-residents

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Share of Total S&E Degrees Earned by Non-Resident Aliens, by Degree Level



H-1B visas

- Roughly 20K engineers/year enter on H-1B's
- Total IT + engineering workforce: ~5M

Worldwide sourcing

- It works both ways! The US ran a \$60B surplus in services trade in 2003 - it has grown every year since 1996
- Even at its peak, in 2001, trade-related layoffs represented 0.6% of unemployment
 - Fewer than 200K jobs have shifted abroad in each of the past 3 years, but 15M jobs have been lost in the US in each recent year
- BLS projects a US workforce of 165.3M in 2012; Forrester Research projects 3.3M jobs outsourced by 2015

Bill Wulf, President, National Academy of Engineering:

- If [managers] can get comparable talent at 1/5th the cost in India, and if the start-up cost is small, and if the cost stays small, and if the productivity per unit cost is high enough, and if they can manage from 10,000 miles and 12 time zones away - then they will outsource, and they should!
- The problem is the nation's access to engineering talent; and it is not the individual manager in an individual company that is responsible for solving that problem.

Working smarter

Perhaps the best way to understand how increased innovation and productivity improve our standard of living is to consider the change over time in the number of Americans working on farms. Through the introduction of mechanized farm equipment, improved seeds and modern farm management techniques, American farmers dramatically improved their productivity. In 1800, nearly 95 percent of workers made their living on a farm. By 1900, only about 40 percent of the American workforce was employed in agriculture. Today less than 2 percent of the workforce is needed to feed America — and to grow enough to export approximately \$55 billion per year, making the United States the largest exporter of agricultural goods in the world. Workers who are no longer needed on farms are now available to work as engineers, doctors, automobile assemblers, architects, fashion designers, Web designers, writers, entertainers and countless other jobs that make our lives richer, more comfortable and more enjoyable.

Source: U.S. Department of Agriculture, National Agricultural Statistics Service's "Trends in U.S. Agriculture, Myths of Rich and Poor" by W. Michael Cox and Richard Alm



Table 2
High-Tech Development Factors

	Inception	Growth	Fortification
Public Policy			
Tax Incentives	***	*	
Public Investment	*	**	
Commercialization of Ideas	*	**	**
Comparative Location Benchmarking			
Cost Factors	***		
Research Institutions	***	***	***
Skilled or Educated Labor Force	**	***	***
Transportation Center	*		
Proximity to Supplies & Markets	**	*	*
Social Infrastructure Developments			
Attending Changing Needs		**	***
Re-education & Training Facilities		***	*
Establishing Trade Groups & Affiliations		***	***
Housing, Zoning, & Quality of Life	**	**	***

*** Critical
** Very Important
* Important



Figure 2-4

