The Software Talent Shortage Impact on the Software Industry

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Stanford Computer Industry Project
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  - Fifteen year’s experience in banking and corporate finance
  - Expert on software startup financing and management
  - Research on the worldwide software labor supply

- **Avron Barr**
  - Edited the *Handbook of Artificial Intelligence* with E. A. Feigenbaum
  - Consultant for 15 years on corporate use of advanced technologies
  - Expert on software technology & knowledge management systems
A Serious Shortage of Talent Will Reshape the SW Industry

- The ITAA (1997) reports 190,000 open positions, excluding government and non-profit orgs.
- Gartner estimates a shortage of 500,000 people.
- The fundamental cause of the shortage is the inexorable rise in demand for SW of all types.
- The rise in demand was masked for years by massive downsizing in MIS, aerospace/defense and large computer firms, and the simultaneous growth of Indian software services exports.
- Software publishers are the last to feel the pinch.
The Software Labor Pool — The Best are Significantly Better

“Not All Programmers Are Created Equal,” G. Edward Bryan, IEEE, 1994
Software Labor Shortages: Who’s Getting the Top Talent?

- Software start-ups & boutique services firms
- Software publishers
- R & D (corporate & university)
- VARs, consulting firms, systems integrators
- Software intensive industries (IBM, AT&T...)
- Aerospace systems firms
- Incidental embedded SW (GM, Boeing...)
- Corporate IS, application development
- DoD
- Federal, state & local government
Some Common Misconceptions About the SW Talent Shortage

◆ This shortage is global, not local to Silicon Valley or to the US.
◆ It is not limited to Year 2000, Java, SAP or any other technical specialty.
◆ The shortage is not likely to be very sensitive to future economic cycles because it is driven by demand for software across all industries.
Reasons for the Talent Shortage: Supply vs. Demand

- Demand for SW of all sorts is growing.
- Productivity of developers is constant.
  - SW development is still a tedious process.
  - Tools have not kept up with complexity.
- Global supply of programmers is limited.
  - Interest in computing careers has declined.
  - This is not the job for everyone.
The Shortage is Driven by the Growing Demand for Software

- Publishing: applications, tools, games, ...
  - $106B, growing at 15%
- Enterprise information systems
  - $1Tr, growing worldwide at 10%
  - Competitive weapon, not just “productivity”
  - Infrastructure in developing countries
- Embedded code in products of all types
  - Cellular phones, airbags, Tamagotchi
  - Creators are not counted as “programmers”
The Supply of Software Talent Has Natural Limitations

- Talented people have many alternatives
  - Still not recovered from layoffs in early ‘90s
- Not an attractive career, especially in IS
  - The Dilbert Syndrome, low prestige
  - Time pressure, working conditions
  - Good work not recognized, errors brutalized
- Schools have a limited capacity
  - Competent teachers have better alternatives
Productivity of developers is constant
  - SW development is still a tedious process
  - Tools have not kept up with complexity

Offshore outsourcing is small potatoes
  - Indian SW services exports totaled $1B in ‘96

Demographics are working against us
  - The first generation is retiring
  - Women & minorities are not entering the field
CS Graduates in the US 1986-1994

Source: Science and Engineering Indicators, 1996, 1997
Note: Associate Degrees includes Math and CS
EE Graduates in the US 1986-1994

Source: Science and Engineering Indicators, 1996, 1997
Full-Time CS Students
MS & Ph.D., Fall, 1996

Source: Engineering Workforce Commission, 1996
# Supply and Demand in the US: A Back-of-the-Envelope Tally

## Demand
- 2 million SW people in the US, 15% growth in demand
- 10,000 retiree replacements (increasing rapidly after 2000)
- 310,000 new jobs this year
- 415,000 new jobs in 2000

## Supply
- 46,000 CS graduates (all levels)
- 31,000 EE grads
- 8,000 foreign students who go home
- 20,000 MIS graduates
- 30,000 permanent immigrants (0% growth)
- 119,000 new people this year, max
- 184,000 new people in 2000 (with 20% growth in graduates)
The Talent Shortage Will Have Serious Consequences

- Slower technology adoption & evolution
  - Your customers must integrate new offerings
  - Their best talent is now working for you
- Project delays
  - Key people leaving, hiring delays
  - Bringing less qualified people up to speed
- Predatory recruiting practices
- Escalating wages
Customers are Already Having a Hard Time with Their Projects

There Is No Quick Solution

- Education and re-training of SW people
  - Attracting more bright, young engineers
  - Increasing the capacity of training programs
- Tapping talent pool in other countries
  - There will not soon be another India
- New technologies for SW development
  - E.g., component-based software assembly
- Conclusion: a ten year drought, at least
  - Things will get worse before they get better
How to Approach the Problem

1. Rethink the way we satisfy the demand for software products and applications
   - SAP and the off-the-shelf movement
   - Assembly of software components: investment in architecture & infrastructure
   - Synchronize with customer adoption, needs
   - Help them avoid “build and scrap” cycles

2. Rethink skills and job classifications

3. Rethink the way we train the labor force
Some Possible Actions

- Industry-funded training programs
  - In addition to partnerships with schools
  - Certification of some types of professionals
  - Project management as important as coding
  - Making this international would be smart
- Maximize productivity of current workforce
  - Retraining and retooling
- Lobby for research on
  - Skills needs for the future
  - SW development technologies