



The SCIP Software Industry Study

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The Stanford University Computer Industry Project

- ◆ A. P. Sloan Foundation, Industry Studies
- ◆ SCIP's Corporate Partners Program
 - ❖ Andersen Consulting
 - ❖ British Petroleum
 - ❖ Citibank
 - ❖ CMP Media
 - ❖ Daiwa Inst. of Research
 - ❖ EDS
 - ❖ Ernst & Young
 - ❖ Fujitsu Limited
 - ❖ Merrill Lynch
 - ❖ Microsoft
 - ❖ Montgomery Securities
 - ❖ Moore Corporation
 - ❖ Philips
 - ❖ Sumitomo Corporation
 - ❖ Symantec
 - ❖ Toshiba America



SCIP's Research Initiatives — Investigating Trends and Issues

- ◆ IT in use — technology adoption
- ◆ Global IT services
- ◆ Information Age organizations
- ◆ Organization and strategy for rapid innovation in product management
- ◆ Networks
- ◆ Software



The Software Industry Programming & Resultant Value Chain

	Worldwide Expenditures	Impact, Value	Examples
Publishing	\$92B	Tools Education Entertainment	Microsoft, Oracle, Nintendo
Services	\$170B	25% of MIS?	Andersen, IBM, TRW
In-house/ MIS	\$700B+	Productivity Informed ops. Strategic apps.	Payroll, mfg. automation Yield mgt., supply logistics FedEx, home banking
Embedded	?	Functionality Communication	Consumer electronics (auto) Complex systems (airplane)



SCIP Software Industry Study

- ‘93 Feigenbaum’s Study of the Japanese SW Industry: “Where’s the Walkman”**
- ‘93-5 Interviews with 100 Industry “Insiders”**
Structure, trends and critical issues
- ‘95-6 Pilot Survey on SW Product Management**
- ‘96-7 The Impact of the Global Talent Shortage: On Software Projects, and On the Industry**



Issues That Will Shape the Software Industry

- ◆ Intellectual property: patents, piracy
- ◆ Global competition and trade
- ◆ Consolidation, distribution & antitrust
- ◆ Software quality and systems failures
- ◆ Labor supply, immigration & education
- ◆ Technology: new markets & new tools
- ◆ Software project management practices



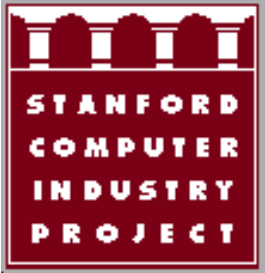
Software Product Management

Results of a Pilot Survey



Software Product Management Issues Investigated

- ◆ Software Development Practices
 - ❖ Team composition
 - ❖ Engineering effort, technologies, quality
- ◆ Product Management Practices
 - ❖ Release/project management
 - ❖ Planning: formality, participants, horizon
 - ❖ Time-to-market tradeoffs
- ◆ Corporate Style
 - ❖ Decision-making, communication, outsourcing
 - ❖ Balance between engineering and marketing



Software Product Management Pilot Survey Design

- ◆ Focus on a particular recent release
- ◆ Survey pairs of team members
 - ❖ Marketing product manager
 - ❖ Engineering team leader
- ◆ One-hour questionnaires
- ◆ Follow-up interviews
- ◆ Firms in different segments



Companies Surveyed—1995

	RDBMS	Call Center	Firms
Very Small < \$10M	1	1	2
Small \$10-50M	2	4	6
Large > \$100M	3		3
Total	6	5	11



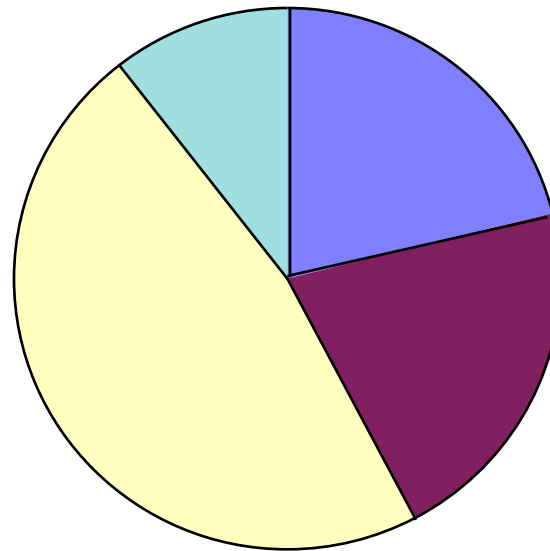
Requirements Formulation Process

- ◆ How formal was the process used to determine the requirements for this release?
 - ❖ Long-term product line plan
 - ❖ Formal marketing requirements document
 - ❖ Informal, but before programming started
 - ❖ Continuously revised



Product Requirements Formulation

Requirements Formulation - Overall

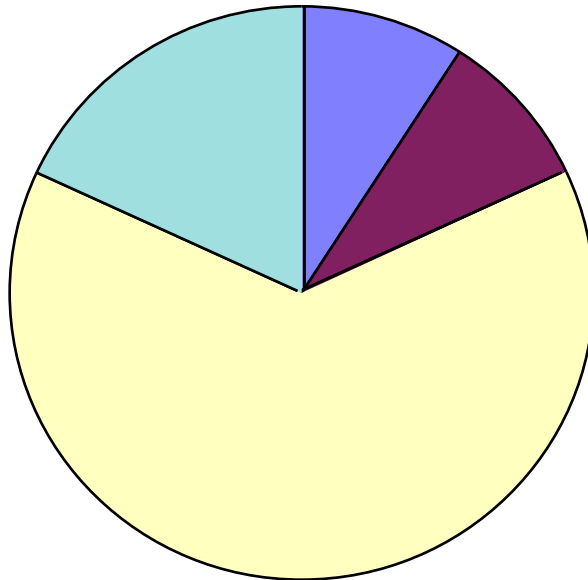


- | | |
|-------------------------|-----------------------|
| ■ Long-Term Prod. Plan | ■ Formal Release Plan |
| ■ Informal release Plan | ■ Continuous Revision |

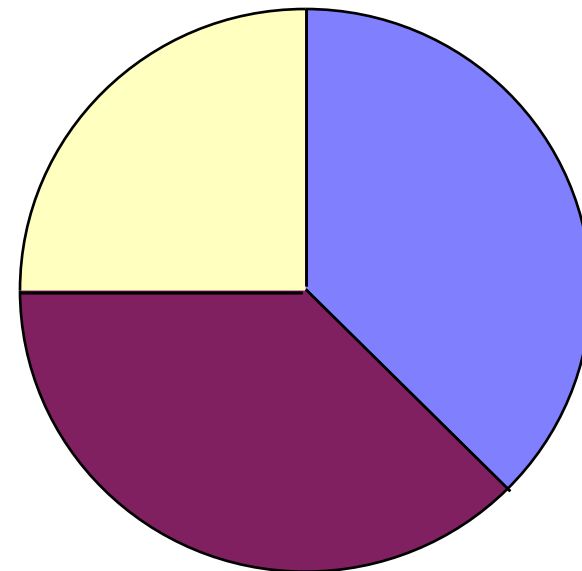


Product Requirements Formulation: Different Perceptions

Engineering (11)



Marketing (8)



■ Long-Term Prod. Plan ■ Formal Release Plan
■ Informal release Plan ■ Continuous Revision



What would you do with 3 more weeks? Top Response

Engineering

- ❖ Testing/QA 36%
- ❖ More beta 18
- ❖ Docs 18
- ❖ Functionality 9
- ❖ Fix bugs 9
- ❖ Installer 9
- ❖ Training 0
- ❖ Performance 0

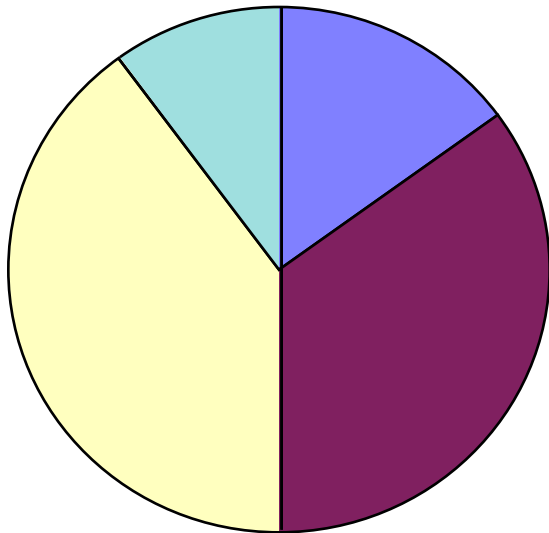
Marketing

- ❖ Functionality 27%
- ❖ Testing/QA 18
- ❖ More beta 18
- ❖ Docs 9
- ❖ Nothing 9
- ❖ Training 0
- ❖ Performance 0
- ❖ Installer 0
- ❖ Marketing 0

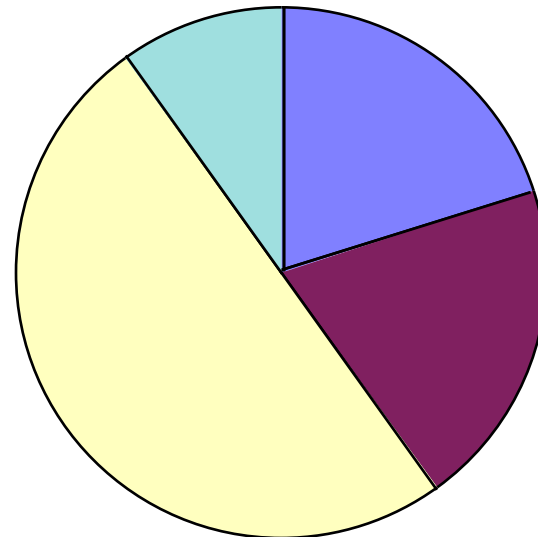


Last Minute Changes

Last Stage When a Feature Can Be Added



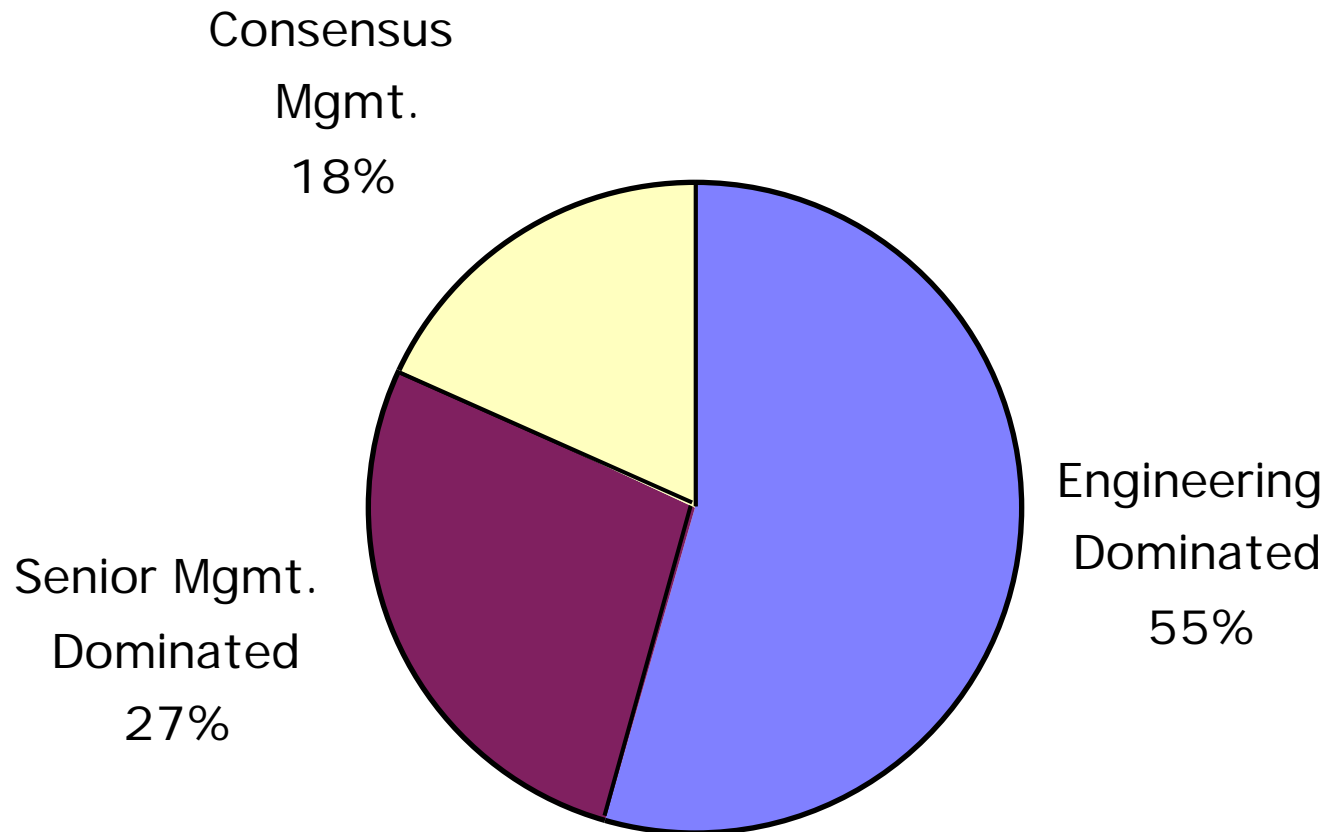
Last Stage When Feature Can Be Dropped



Before Alpha Before GM
Before Beta Other



Decision-Making Style





Second Pilot Survey of Product Management Practices -- 1996

- ◆ Feedback from 1995 pilot incorporated
 - ❖ shorter, more focused instrument
 - ❖ more segments of industry included
 - » products for business & technical users, consumers
- ◆ Web-based instrument tested
- ◆ Discussions with software process groups and other academic researchers



Companies Surveyed

	Technical End User Mkt. (IT, Eng or Scientific)	Business End User Mkt.	Firms
Small < \$20M	3	1	4
Medium \$20-200M	3		3
Large > \$200M	3	2	5
Total	9	3	12



Release Schedule Statistics

- ◆ 1 team on schedule (so far), 17 revised schedules
- ◆ Number of times schedule revised
 - ❖ Range: 1 time to “constantly”
 - ❖ Average: 3 times
- ◆ How late to market
 - ❖ Range: 1.5 to 12 months
 - ❖ Average: 4 months



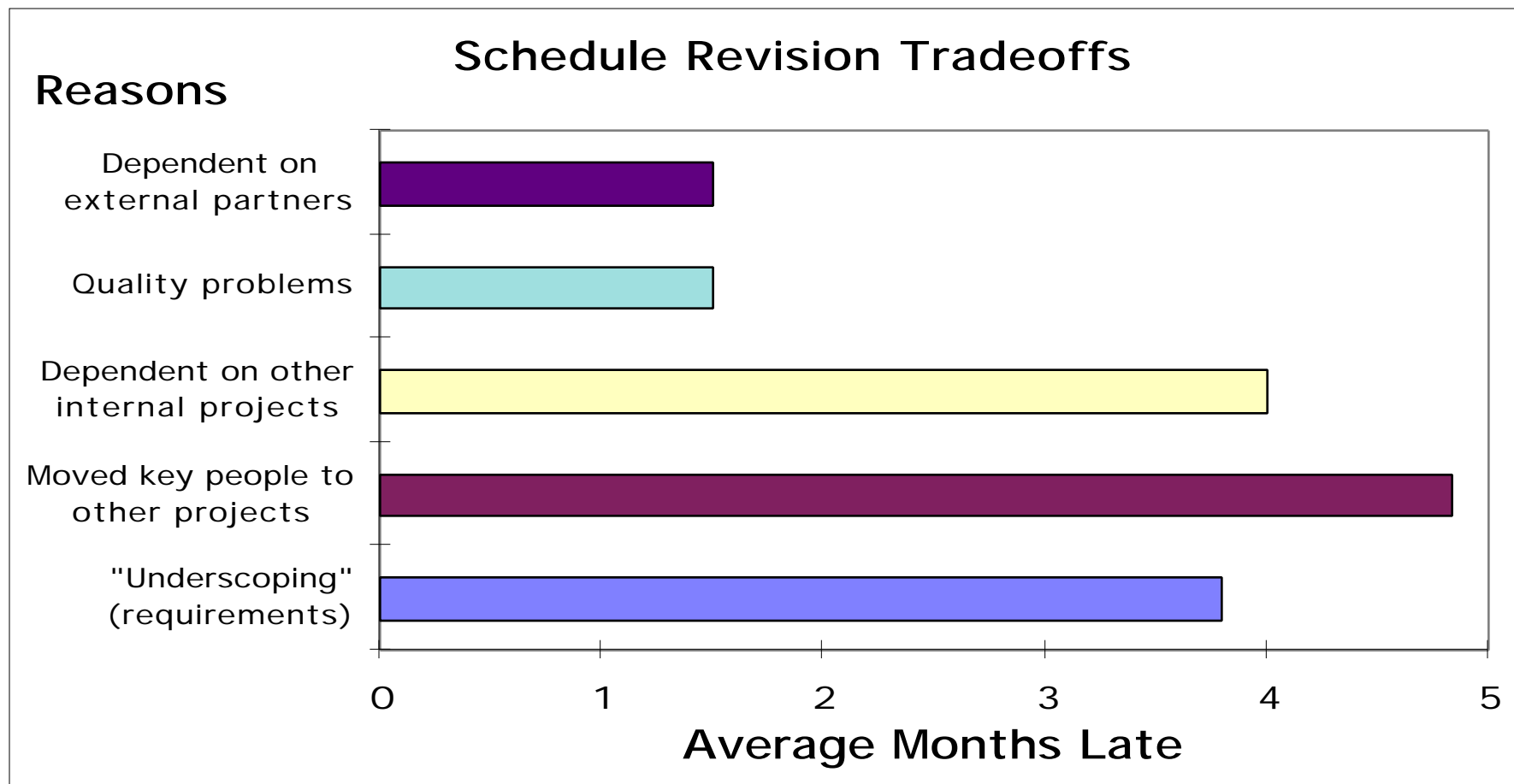
Top 5 Reasons for Revision of Release Schedule

- ◆ Poor requirements specification
- ◆ Moved key people to other projects
- ◆ Quality problems
- ◆ Dependent on other internal projects
- ◆ Dependent on external partners



Schedule Revision Reasons vs. Average Months Late

Q. Please describe briefly the reasons for the [release] delay:





Formality of Planning & Development Process

- ◆ **Process methodology**
 - ❖ Small companies used formal methodologies
 - ❖ Larger companies used internally developed methodologies
 - ❖ 2/3 of respondents used something
- ◆ **Planning**
 - ❖ Formal planning: 16
 - ❖ No formal planning: 2
 - ❖ Mostly informal planning beyond current release



Research Issues Arising From the Pilot Survey

- ◆ Life cycle planning vs. release planning
- ◆ Communication & decision making styles
- ◆ Addressing shortfalls in technical talent
 - ❖ Team management for focus
 - ❖ Managing external relationships
 - ❖ Aggressive recruiting and retraining



The Worldwide Supply of Software Labor



There is a Serious Shortage of Software Talent Worldwide

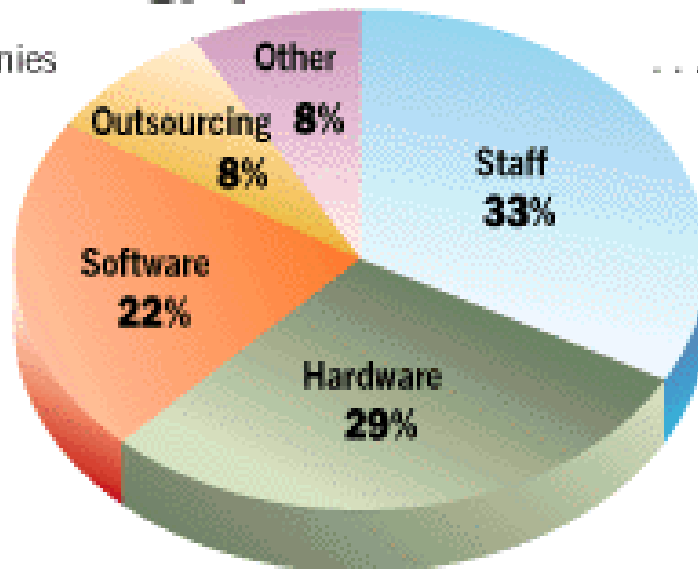
- ◆ The ITAA (1977) reports 190,000 open positions
- ◆ Reasons for the shortage:
 - ❖ Demand for SW may be growing non-linearly.
 - ❖ Interest in computing careers has declined.
- ◆ The rise in demand was masked for years by the growth of Indian software services and simultaneous massive downsizing in MIS, aerospace/defense and large computer firms.
- ◆ The situation will worsen and must be addressed in project planning.



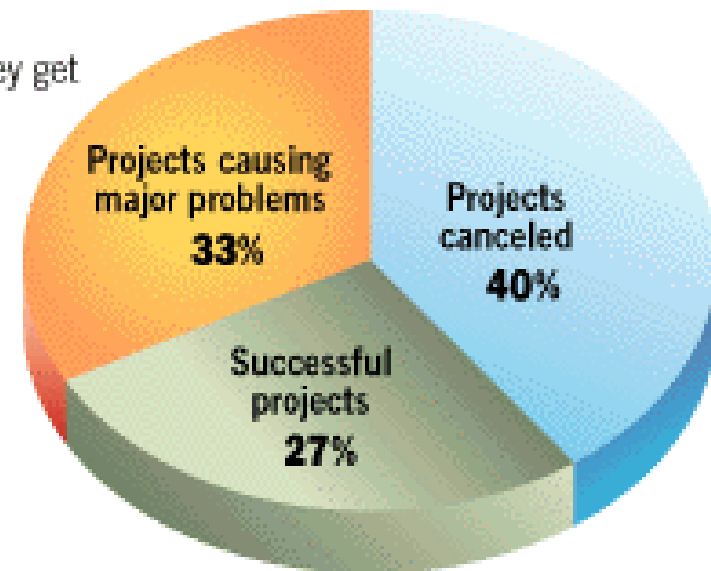
Software is Not Easy

The technology pit

How companies spend . . .



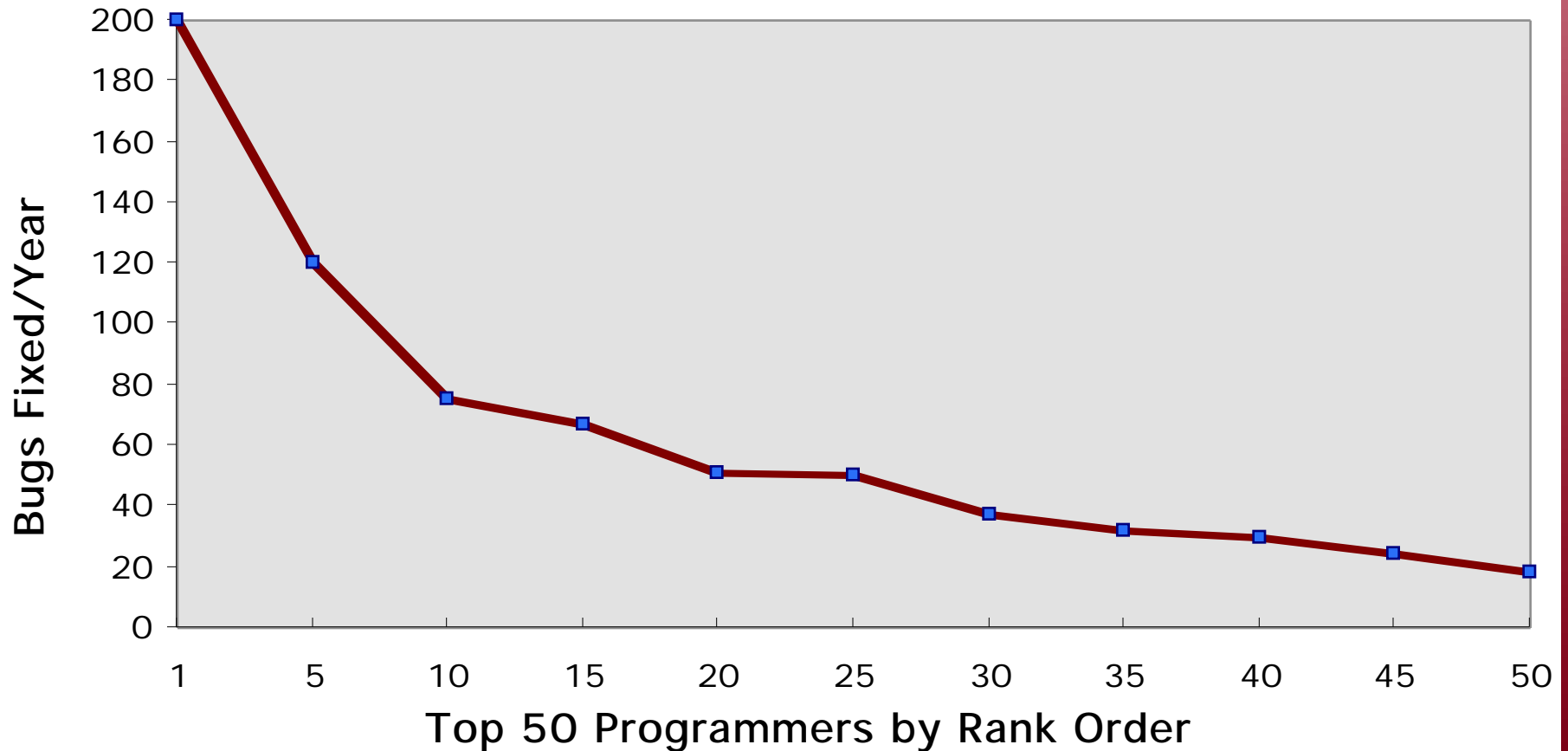
. . . What they get



From **Forbes**, December 30, 1996. Sources: Computer Economics, Inc.; based on a survey of 300 managers; The Standish Group International, Inc.; based on a survey of 365 companies



The Software Labor Pool — The Best are Significantly Better

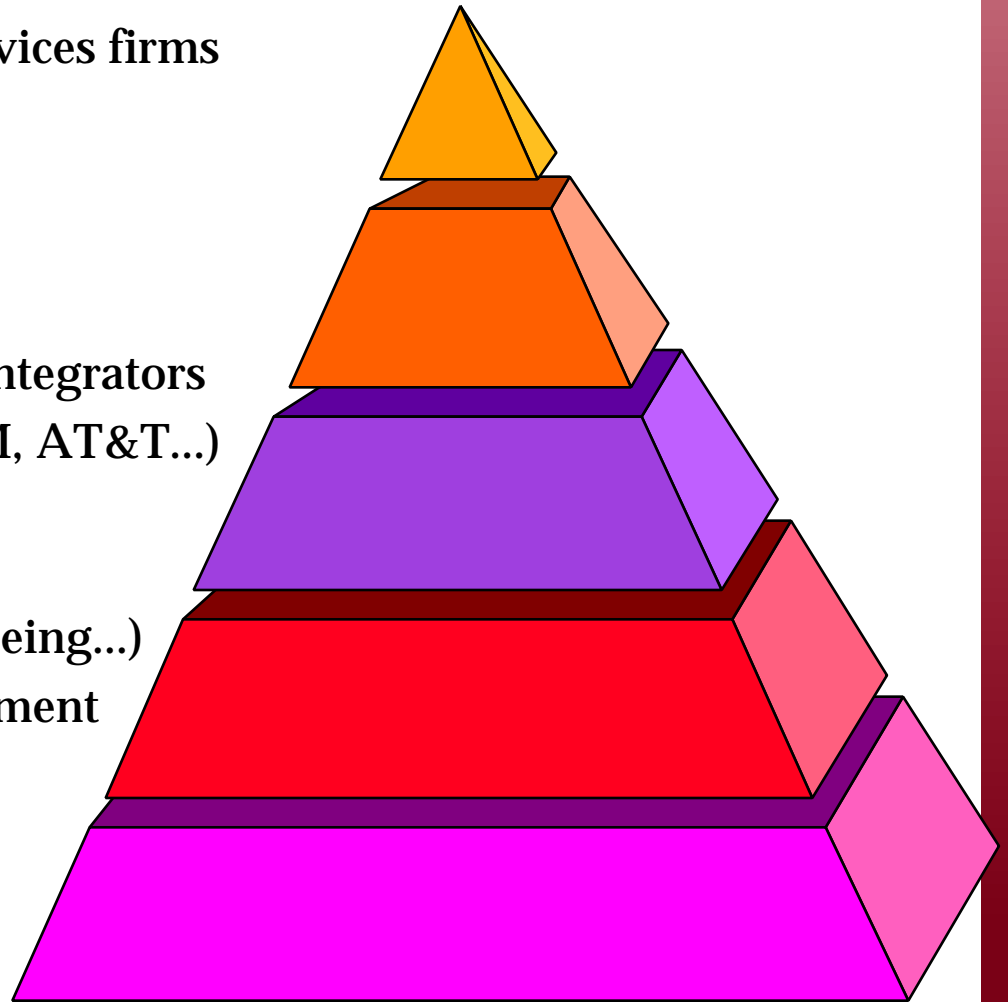


“Not All Programmers Are Created Equal,” G. Edward Bryan, IEEE, 1994



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





Will Offshore Sources of Labor Meet Rising Demand?

Will other countries with underutilized engineering talent, as was the case in India, supply a larger percentage of the world's software products and services needs in the future?



India: A Major Software Services Exporter

- ◆ Large supply of engineering talent
 - ❖ High quality technical education
 - ❖ High prestige for engineers
 - ❖ English language competence
 - ❖ Underutilized in domestic economy
- ◆ Movement towards more enlightened government policies
- ◆ Entrepreneurs created international business
 - ❖ Early growth as low-cost provider
 - ❖ Now, quality software delivered on time



Country Comparison: Enabling Factors in Development of SW Export Industry

	India	Russia	E. Europe	Malaysia	Singapore	China	Japan	Israel	Ireland
Good general engineering education system	+	+	+	●			+	+	
Specific software and systems training	+			●			+	+	
Large pool of capable programmers	+	+	+	●	●	+	+		
Limited (non-IT) opportunities for engineers	+	+		●	●		●	●	●
English language competence	+	●	●			●	●	+	+
Government policies or investment	+	●		+	+	●	+	+	+
Communications infrastructure	+	●		+	+		+	+	+
Entrepreneurial know-how	+	●			+		+	+	+
Foreign corporate investment	+	+			+	+	●		+

Strong positive: +

Strong negative: ●



What Can Be Done?

- ◆ Aggressive recruiting, training and retention of talent if your business depends on software
- ◆ Education initiatives to produce more SWE's
- ◆ Private and public investment in retraining
- ◆ Explore certification of SW professionals
- ◆ Encourage immigration of qualified SWE's
- ◆ Encourage research in software development technology and methodology
- ◆ Undertake detailed industry & labor censuses