Notes on the Software Industry Research Project
Sloan Foundation Meeting
June 28, 1994

Current Activities

Working papers: Satoshi’s paper on games now finished. Ed’s Japan paper being revised. Student research papers on their way to becoming working papers: Rhodes (intellectual property), Tessler (startup financing), Cao (offshore software development), Lent (models of the software industry).

On-line repository now available to all CIP researchers. Contains: articles and news bulletins culled from on-line services, notes from all SIRP seminars, student papers and memos, working papers, and transcripts of all interviews.

Preliminary work on specifying the software industry (SWI) database and continuing work on defining a rational (and predictive) segmentation of the SWI.

Interviews at HP and Microsoft are scheduled for July.

The Tessler, Barr, Feigenbaum article on the US Software Products Industry will soon be ready for Bill Miller’s book on the computer industry.

Collaborations with Paul Saffo’s group at the Institute for the Future (regarding SWI data from government sources), and Dave Mowery’s group at Berkeley (involving embedded software in Japan and international alliances).

We have started hosting informal meetings with other CIP researchers. Collaborative efforts being discussed, especially regarding data sharing.

Education: CS290 in Fall ‘94

Avron Barr and Shirley Tessler will be teaching a Stanford course on the software industry this fall, Computer Science 290. Brian Lent will be the TA for the course, which will include lectures on the research and analysis of the industry we have done on the project so far. Students will also be involved in interviews of industry luminaries and in independent research projects on open questions. We expect 40-50 graduate students from computer science, business, economics, and engineering. (See preliminary syllabus, attached.)

Research Directions

Refine our understanding of the SW products segment.

- Compile, over the next year, a definitive database of revenue and employment information for the SWI for the last 10 years. (See the attached description of the database project.)
• Continue to interview industry leaders and will revisit many of those whom we’ve talked with in the last year to discuss our preliminary conclusions and develop ongoing relationships.

• Examine the role of entrepreneurialism in the SWI, since it seems that, so far, much of the innovation and direction in the industry has emerged from new ventures rather than established firms.

• Continue to track events in this rapidly changing segment of the SWI.

Study in-house SW development for corporate operations improvement.

• Very little data is available on in-house software development expenditures, and categories are confused (analysis, coding, maintenance, etc.). We are developing a strategy to begin to examine this enormous segment of the industry.

• Using soon-to-be-published census bureau statistics on employment by SIC code, we will begin to estimate the size and nature of this segment. We will then interview CIO’s in several industries, with the goal of developing a survey instrument that will be used to try to accumulate our own data on the status, trends, and issues in this segment.

• We would also like to examine specific “failures” of major software development projects in industry and government, to gain a better understanding of the issues in this segment.

• Besides furthering our own understanding (e.g., in preparation for a systematic survey of CIOs re. software) we also have an opportunity to influence the way the Dept. of Commerce collects data on the industry in the future.

Study the development of software to be embedded in non-software products.

• As in the above corporate operations software segment, there is very little data on software that is embedded in the products a company sells. The range of such products, from computing equipment to cars to cellular phones, is rapidly expanding.

• The Japanese “new hard” concept focuses on intelligent devices and embedded software. There may be constraints in this type of software (efficiency, size, speed, usability, quality) that will allow Japanese software developers to excel, where they have not in the past.

• We will follow a methodology similar to the one we propose for studying in-house development for operations improvement: start with the Commerce Department’s Economic Census, interview key executives to determine what information is available and how we can better acquire it, and then plan a survey to discover the state of this segment and significant trends.

Study the SW services segment.

• Here the data is a bit better, although still the breakdown and analysis of data on consulting, custom programming, systems integration, and other services in the published literature is not clean. We hope to work from sources like IDC to quickly develop a model of this rapidly growing segment.
Emerging segments of the SWI.

- Multimedia, on both CD-ROM and interactive TV platforms
- Webware for the NII
- New platforms and architectures, e.g., set-top vs. PC, open systems standards, middleware.

Trends in SW development methodology and tools.

- In our interviews, we have found that some companies (particularly Microsoft) are beginning to develop specialized expertise about software project management. We feel that this is a critical issue for all segments of the industry, but all we have now are questions:
  - Will demand for quality in software systems and products increase and force changes in the way systems are developed?
  - Have leading-edge software products companies, systems integration firms, or in-house software groups developed methodologies that do, in fact, give them competitive advantage in time to market, quality or maintainability?
  - Will object-oriented technology and the emerging “software components” industry do what CASE has not been able to do: dramatically change the way teams develop software?

The global SWI.

- Here we have a good start, but we will continue to track the Japanese SWI.
- We will also look into Europe, especially countries besides France and Germany, which we have examined, at least initially. We also need to look into anomalously successful European firms, like, SAP and Software AG.
- Finally, we will continue to track the growing off-shore development phenomenon.

Organizational issues.

- Working with other members of the CIP, we will explore the role of software and software project management specifically in the relative adaptability of firms in the industry. We have targeted HP and Silicon Graphics for initial interviews this summer.
- Are there elements of different corporate cultures that directly effect software projects of all sorts?
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<tr>
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<td>Sept. 26:</td>
<td>Introduction</td>
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<td>Definition and Overview of the Industry</td>
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<td>Quantitative overview</td>
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<td>Oct. 3:</td>
<td>Structure of the SWI</td>
<td>Guest lecturer: Brian Lent</td>
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<td>How to Study the SWI: Resources and Techniques</td>
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<td>Segments of the industry</td>
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<td>Oct. 10:</td>
<td>The SW Products Segment</td>
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<td>Overview</td>
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<td>Marketing and distribution channels</td>
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<td>Start-up financing, venture capitalists and industry capital flows</td>
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<td>Alliances</td>
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<td>Oct. 17:</td>
<td>Enterprise computing</td>
<td>1st research memo due</td>
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<td>The origins of the SWI</td>
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<td>Computing and business operations</td>
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<td>Client/Server and technology diffusion</td>
<td>Guest lecturer: Garth Saloner</td>
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<td>Oct. 24:</td>
<td>Demand-side perspective on the SWI</td>
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<td>Corporate: ROI vs. technology introduction cycle</td>
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<td>Consumer: User interface, learnability, quality, content</td>
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<td>Case Study: The emergence of CD-ROM as a consumer platform</td>
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<td>Oct. 31:</td>
<td>Law and Government</td>
<td>Interview: Fenwick &amp; West?</td>
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<td>Intellectual Property Law and Software</td>
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<td>SW patents and copyrights</td>
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<td>The Government and the SWI</td>
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<td>Policy issues: trade, antitrust, national security, anti-dumping,</td>
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<td>SEC, taxation (small business incentives), immigration</td>
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<td>Standards</td>
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<td>The government as a market segment</td>
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<td>The government as a funding source</td>
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<td>Nov. 7</td>
<td><strong>Growth Areas of the SWI</strong></td>
<td>2nd research memo due</td>
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<td>Games and Consumer Segment</td>
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<td>Intuit: SW as a consumer product</td>
<td>Guest lecturer: S. Nishimura</td>
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<td>Nintendo and Sega</td>
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<td>Set-top vs. PC: Platforms for the home market</td>
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<td>Interactive Hollywood: Multimedia and the new digital media</td>
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<td>Emerging segments</td>
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<td>Content publishers: multimedia, on-line services, etc.</td>
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<td>Webware and the NII</td>
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<td>PDAs and mobile, wireless computing</td>
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<td>Nov. 14</td>
<td><strong>The Embedded SW Segment</strong></td>
<td>Interview: TBA</td>
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<td>Intelligent and complex consumer products</td>
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<td>Japan’s “new hard”</td>
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<td>Automobiles and cellular phones</td>
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<td>Nov. 21</td>
<td><strong>The Global SWI</strong></td>
<td>Guest lecturer: E. Feigenbaum</td>
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<td>Japan</td>
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<td>Europe</td>
<td>Guest lecturer: J.J. Cao</td>
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<td>Off-shore SW dev. &amp; contract programming</td>
<td>Thanksgiving break</td>
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<td>Nov. 28</td>
<td><strong>SW Development Methodology and Tools</strong></td>
<td>Final papers due</td>
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<td>History</td>
<td>Interview: TBA</td>
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<td>Trends: GUIs, object-orientation, distributed systems, middleware, CASE</td>
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<td>SW project management</td>
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<td>Dec. 5</td>
<td><strong>Managing a Software Organization</strong></td>
<td>Interview: Larry Ellison?</td>
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<td>Organizational issues</td>
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<td>Coping with rapid change</td>
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<td>Corporate cultures</td>
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<td>Motivating and managing software superstars</td>
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<td>Human Resources for the SWI</td>
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<td>Quantity of well-trained software engineers</td>
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<td>Other resources: managers, marketers, etc.</td>
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<td>Future industry needs</td>
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In the course of our research on the software industry, we have discovered a number of disparities in the reporting of industry segment data by analysts, information services and trade publications. We have even uncovered disparities in the reporting of financial results for individual public companies. There are several reasons for these sometimes significant differences:

- Commercial data collection services, such as IDC, structure their information in the manner required by their corporate clients for their particular strategic uses. For research purposes, the data for a specific segment may be incomplete, or cause a double-counting in some related segment. In addition, internal politics in these data collection firms sometimes dictate artificial segment boundaries or breakdowns that introduce a bias in the data that is not well articulated in their published reports. Finally, data from the bigger services such as IDC are interpreted and referenced widely by a number of other publications, whose second-hand filtering of the information introduces further inconsistencies.

- Methods of data collection and presentation differ. Some services compare companies with different fiscal year-ends, or rely too heavily on stated SIC codes when determining which companies should be included in particular segments. We have found that SIC codes for companies with similar products or activities vary widely, depending on the source. Moreover, estimation methods for the activities of privately held companies are almost never described, so that data for these companies are even more suspect.

- Variations in reporting and restating of company data (by secondary sources) after mergers, acquisitions or divestitures, or as a result of differing exchange rate assumptions.

- Outright mistakes and typos during the transmission of data from original sources to prepared analyses.

Because we believe that credible statistics are an important part of our research, we are exploring various printed and on-line data services for original source data, primarily annual reports and SEC filings. Our strategy for developing a reliable database is as follows:

1. Identify the most complete and accurate collections of original source data. We have already examined approximately half a dozen different services, including Edgar, Lexis/Nexis, Worldscope, Compact Disclosure, Hoover, and Jackson Library's printed and microfiched annual report collection. We are also discussing how we might be able to leverage the contacts that were developed with computer companies through the
McKinsey Excellence in Electronics database, and determine whether we might be able to survey some of the respondents to that study about their software development activities.

2. Reach agreement on the scope of the data to be collected. For example, after examining the data available from the various services, we have decided to expand our scope somewhat to collect quarterly data so that we can adjust all company results to compare them on the same calendar year basis. Moreover, our data collection will differ from most other efforts in that we have committed to obtaining information from the prose sections of the annual reports, such as the letter to stockholders, management analyses, and statement footnotes, in order to obtain data on segments sales, sales by region, and distribution channels.

3. Develop a database format using Filemaker Pro so that data collected can be accessed more easily for a wide variety of purposes.

4. Continue to nurture a relationship with information providers such as IDC. We are waiting for final confirmation on a third meeting with IDC next week, where we hope to be granted access to their historical company data, as well as conduct interviews with their industry analysts.

5. Develop a questionnaire and procedure to estimate financial results and segment activities for important privately held companies.

6. Initiate a collaboration with Price Waterhouse to use our database needs as a test set for the new intelligent data retrieval system that PW is developing to search SEC filings and other public databases. The first search will concentrate on 9 test companies, and attempt to gather data automatically for the last 10 years.

7. Continue our collaboration with Institute For the Future to exchange data of interest, such as industry analyses by SIC code, and industry labor statistics.

8. Establish a dialog with officials from the Census Bureau (see Brian Lent's memo) regarding collection of software industry data. Not only do we have pointers to additional information to investigate, but also SIRP has a chance to influence the data collection process for the Department of Commerce's next Economic Census.

While our efforts to build a software industry database "bottom-up" will continue to be both challenging and time-consuming, we believe that they will lead ultimately to a more useful and reliable study of the software industry.
Software Industry Research Project
Interviewees as of 6/30/94

Below is a listing of the people that we have interviewed to date for the Software Industry Research Project. As you can see, we are developing some depth in several areas of interest, such as corporate computing and research. We recognize, however, that we need to do further work in some important areas such as demand-side perspectives, embedded systems, in-house development, offshore software development, government computing in the US, and the European software industry.

Consumer Software
Heidi Roizen  T/Maker
Ridgely Evers  Intuit
Jim Gregg  3DO

Corporate and Academic Research
John Seely Brown  Xerox PARC
Bob Burmeister  US-Japan Tech. Management Center
Randy Davis  MIT
Michael Dertousos  MIT
Dave Liddle  Interval
Paul Saffo  Institute for the Future

Corporate Computing
John Armstrong  IBM
Ron Braniff  ASK
Alan Buffington  Shawmut Bank
Mitchell Kurtzman  PowerSoft
John Landry  Lotus (formerly of Dun & Bradstreet)
E. G. Mahler  E.G. Mahler Assoc. (formerly of DuPont)
Robert Marshall  Tandem
Sam Prather  Hewlett Packard
Kanwal Rekhi  Novell
Benjamin Riggins  IBM
Peter Schavoir  IBM
Howard Schrobe  Symbolics
Way Ting  Silicon Graphics
Phil White  Informix

Distribution channels
Rob Edenzon  Baker and Taylor

Industry Associations
Kay Caldwell  Software Industry Association
Joyce Plotkin  Massachusetts Software Council
Our strategy with regard to all our interviewees is to try to interest them in our work, and establish an on-going relationship with them, so that we can be in a position to call upon their expertise in an advisory capacity whenever it seems appropriate. We also have a number of other members of the academic and business communities whom we regard as resources and advisors to our project. This group includes:

Forest Baskett
Gordon Bell
Tilda Brown
John Hennesey
David Mowery
Douglas Puffert
Nathan Rosenberg
Andrea Saveri
Marty Tenenbaum
David Tremblay
Bruce Whitney

Silicon Graphics
Bell Associates
Wyatt
Stanford
Berkeley
International Trade Commission
Institute for the Future
Enterprise Integration Technologies
Software Publishers Association
IDC
Software Industry Research Project
Japanese Software Industry Interviewees

Large Computer Manufacturers
Fujitsu
Hitachi
NEC
Toshiba
IBM Research – Japan

Executive Vice Presidents (2)
Director, Fujitsu Labs
Executive Vice President
Senior Vice President
Director, Research

Packaged Software
Encyclosoft (IBM)
JUST Systems
Japan LOTUS
Nintendo

Chief Executive Officer
Chief Executive Officer & Chief Technical Officer
Director, Product Development
Director, General Affairs Department

System Integrators
Argotechnos 21
Andersen Consulting

Chief Executive Officer & Chief Operating Officer
Director, Japan Office

Independent Software Houses
ADIN
Kanrikoogaku Kenkyusyo
Sogo Software

Chief Executive Officer
Chief Executive Officer
Chief Executive Officer

Academic
Keio University, Engineering

Dean Aiso
Computer Engineering Faculty Members

Government
MITI
Info. Promotion Agency
JIPDEC

Director, Electronic Policy Division
Director
Director

Financial Services
Nikko Securities Research

Director, Research