Wisdom is not the product of schooling but the lifelong attempt to acquire it.
- Albert Einstein

Globalization and Offshoring of Software

Gerhard Fischer and Hal Eden
Fall Semester 2007

Course information environment (SWIKI):
http://swiki.cs.colorado.edu:3232/phd-intro-2007

October 24, 2007

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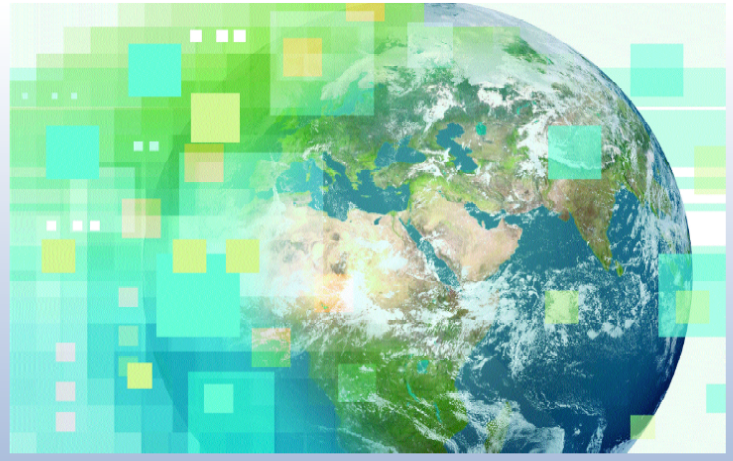
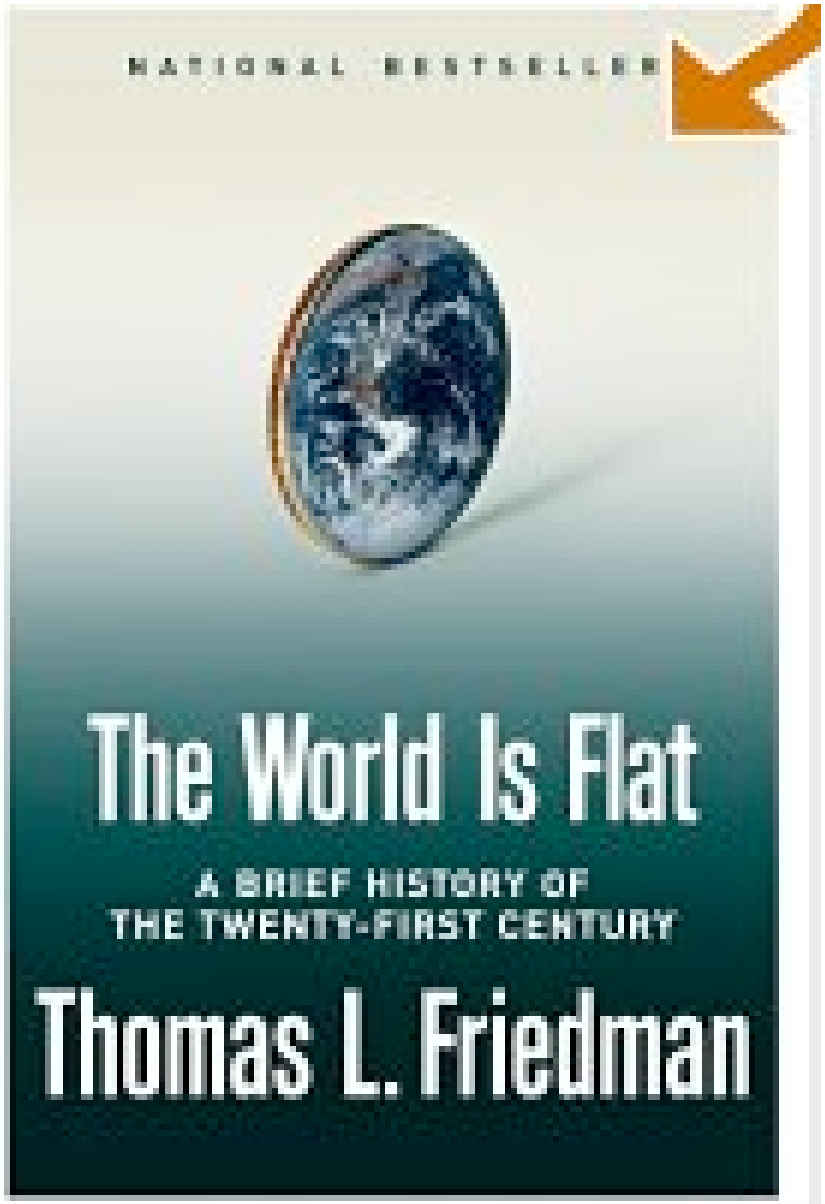
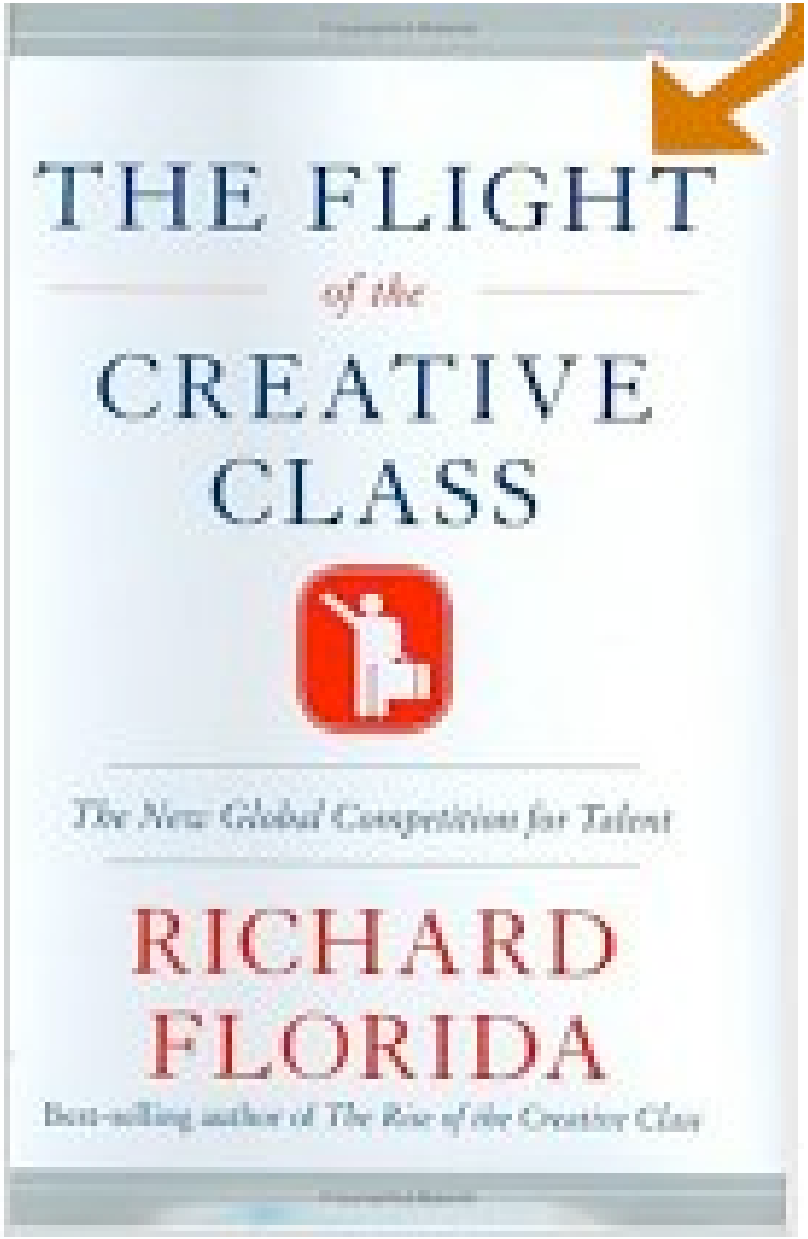
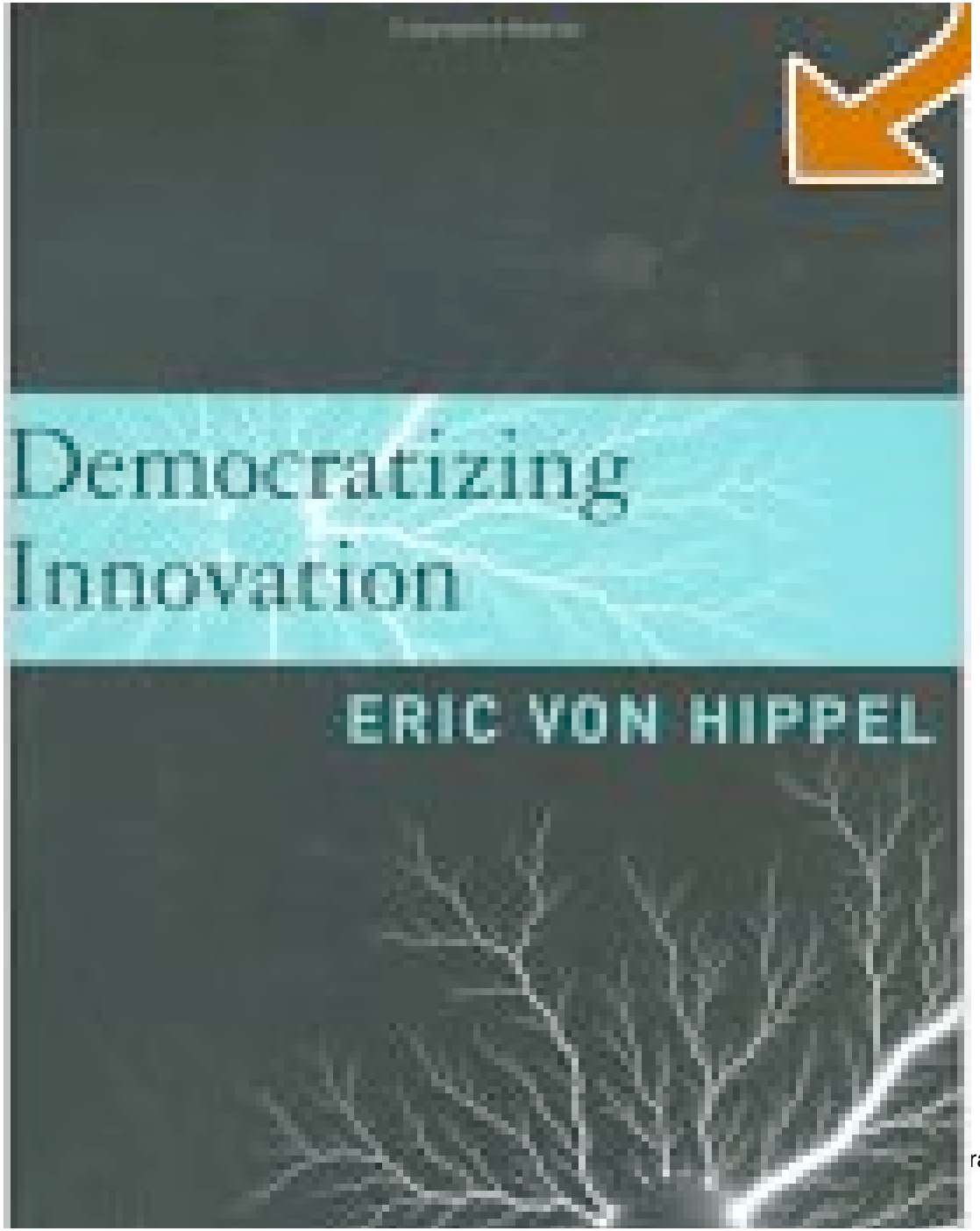
A Report of the ACM Job Migration Task Force



Association for Computing Machinery
Advancing Computing as a Science & Profession


NATIONAL BESTSELLER
The World Is Flat
A BRIEF HISTORY OF
THE TWENTY-FIRST CENTURY
Thomas L. Friedman


THE FLIGHT
of the
CREATIVE
CLASS
The New Global Competition for Talent
RICHARD
FLORIDA
Best-selling author of The Rise of the Creative Class


Democratizing
Innovation
ERIC VON HIPPEL

The Study

- study was **not** intended to be a study of offshoring from the United States to India and China and the impact of that offshoring on the computing profession in the United States

- the task force was charged with looking at the forces shaping the migration of jobs worldwide in the computing and information technology fields

- requirements for the future:
  - deep grounding in the fundamentals of computing
  - new knowledge surrounding business processes and platforms
  - a deeper understanding of the global community in which work will be done
  - the educational systems that underpin our profession will need to change

Specific Topics

- the economic theories and data that underpin our current understanding of the forces shaping globalization today and in the future.
- offshoring from the perspective of different countries—both developed and developing
- offshoring from the perspective of different types of corporations
- the globalization of computing research
- the risks and exposure that offshoring engenders.
- the implications for educational systems throughout the world
- the political responses to the opportunities and disruptions that accompany globalization

Findings and Recommendations

- Globalization of, and offshoring within, the software industry are deeply connected and both will continue to grow. Key enablers of this growth are information technology itself, the evolution of work and business processes, education, and national policies.

- Both anecdotal evidence and economic theory indicate that offshoring between developed and developing countries can, as a whole, benefit both, but competition is intensifying.

- While offshoring will increase, determining the specifics of this increase are difficult given the current quantity, quality, and objectivity of data available. Skepticism is warranted regarding claims about the number of jobs to be offshored and the projected growth of software industries in developing nations.

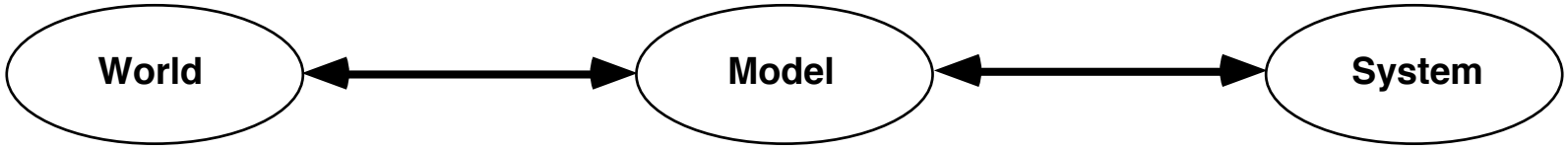
Findings and Recommendations

- Standardized jobs are more easily moved from developed to developing countries than are higher-skill jobs. These standardized jobs were the initial focus of offshoring. Today, global competition in higher-end skills, such as research, is increasing. These trends have implications for individuals, companies, and countries.

- Offshoring magnifies existing risks and creates new and often poorly understood or addressed threats to national security, business property and processes, and individuals' privacy. While it is unlikely these risks will deter the growth of offshoring, businesses and nations should employ strategies to mitigate them.

- To stay competitive in a global IT environment and industry, countries must adopt policies that foster innovation. To this end, policies that improve a country's ability to attract, educate, and retain the best IT talent are critical. Educational policy and investment is at the core.

Software Design: Upstream and Downstream Activities



Upstream **Downstream**

Design **Engineering**

- **upstream: world → model / specification**
  - ill-defined problem
  - integration of problem framing and problem solving
  - collaboration and communication between different stakeholders
  - failure leads to ***design disasters*** (wrong problem is solved)

- **downstream: model / specification → implementation / system**
  - well-defined problem
  - dealing with difficult technical problems
  - creating reliable code
  - failure leads to ***implementation disasters*** (wrong solution to the right problem)

Outsourcing

- **an emerging question** for prospective computer science students: *"if the heart and soul of computing (programming) is being auctioned off to the lowest offshore bidder, what is the future for me?"*

- **question**: what will be the computing jobs, skills, and knowledge that are less likely to migrate offshore

- **claim:** activities related to upstream activities: communication, collaboration, design, context, integration of problem framing and problem solving, deal with fuzzy and shifting requirements, satisfy customers **("soft skills")** → these are the difficult and important problems

Current Computer Science Education and Outsourcing

	upstream activities	downstream activities
themes	creative work, communication, collaboration, context, integration of problem framing and problem solving, fuzzy requirements, customer satisfaction	programming, programming languages, compilers, rule-based behavior (tax returns),….
emphasis in current CS programs	X	XXXXX
future jobs (not being outsourced)	XXXXX	X

Soft Skills

- **personal qualities:**
  - responsibility
  - self-esteem
  - sociability
  - self-management
  - integrity/honesty

- **interpersonal skills**
  - participates as a member of the team
  - teaches others
  - serves client / customers
  - exercises leadership
  - negotiates
  - works with cultural diversity

Comments/Ideas/Reflections by Students

Ashok: here are some things that students and workers in this field should do to prepare themselves for the globalized workplace. They should get a good education that will serve as a firm grounding for understanding the rapidly changing field of IT. They should expect to participate in life-long learning. They should hone their "soft skills" involving communication, management, and teamwork.

Kyuhan: To make CU students better prepare for a successful future in the system, software, and services portion of the global information technology field, I believe its curriculum should cover not only pure computer science but other academic fields such as economics, ethics and politics. Also, students should be given more opportunities to meet or co-work with foreign researchers in US or outside of US.

Jinho: The department can offer more opportunities for Internship so students can actually see the real IT world.

- TU Darmstadt collaboration
- Ruhr Universities (Dortmund, Bochum, Essen)

Comments/Ideas/Reflections by Students — Continued

Keith: I wholeheartedly agree that the US public universities need to be open to innovation faster. Many interesting things have happened in productive private funded projects, leaving the universities places of slow growth and old modes of thinking (seems contradictory when the sell of a university is one of creativity, free thought and limitless possibility). I think innovations in to broaden the scope and reach of "computer science" are important. I like what CMU is doing. I like what Indiana is doing. I like what UC Irvine is doing. More schools need to adopt innovation more quickly to come back to the fore of innovative social contribution.

→ CU

- ICS
- ATLAS
- Science of Design
- CreativeIT
- Lifelong Learning

Jane: think our department should prepare students for facing a more competitive, diverse, and extensive field of computing. They should stress the importance of continued education, specialization, and encourage students to embrace and appreciate the evolving face of our field.

Comments/Ideas/Reflections by Students — Continued

Holger: My one concern towards the future of computing as "...field of study" is that C.S., or most C.S. programs, are ignoring many of the most important and influential developments with and around computers. They tend to celebrate old ideals and ideas of C.S. that are often not useful anymore. To my surprise, the study actually addressed this concern, namely in "There is a need for CS education to evolve, whether due to globalization or not."

Jeffrey: As long as I obtain a higher degree, I do not see finding work to be a difficulty. Likewise, as long as other people also get as much education that they can then I do not see them having a difficulty finding work. The problem I see is that low level jobs will continue to be outsourced in increasing numbers, which effects the long term job market. The work I am most interested in doing is teaching and research, which are two areas not likely to be outsourced, but if I was a programmer I would be more concerned. Another area that will not be drastically effected by outsourcing is in-house technical support positions. Someone actually has to be present to fix the computer problems as they arise.

Guy: I personally feel that the public understanding of science is woefully inadequate and that as a public responsibility scientific literacy and critical thinking are two areas that the government should focus on, rather than concentrating on the immediate business issue of outsourcing.