

Chapter 10

Technologies, Work, Wealth and Sustainability



COMP422 Ethics and Professional Issues in Computing
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Based on
Ethics for the Information Age (5th Ed.)
by
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Chapter Overview

- Introduction
- Automation and unemployment
- Workplace changes
- Globalization
- The digital divide
- The “winner-take-all society”

10.1 Introduction

- Information technology and automation affecting workplace
 - Increases in productivity
 - Globalization of job market
 - Organization of companies
 - Telework
 - Workplace monitoring
- Impacts of information technology on society
 - Digital divide
 - Winner-take-all effects

10.2 Automation and Unemployment

Automation and Job Destruction

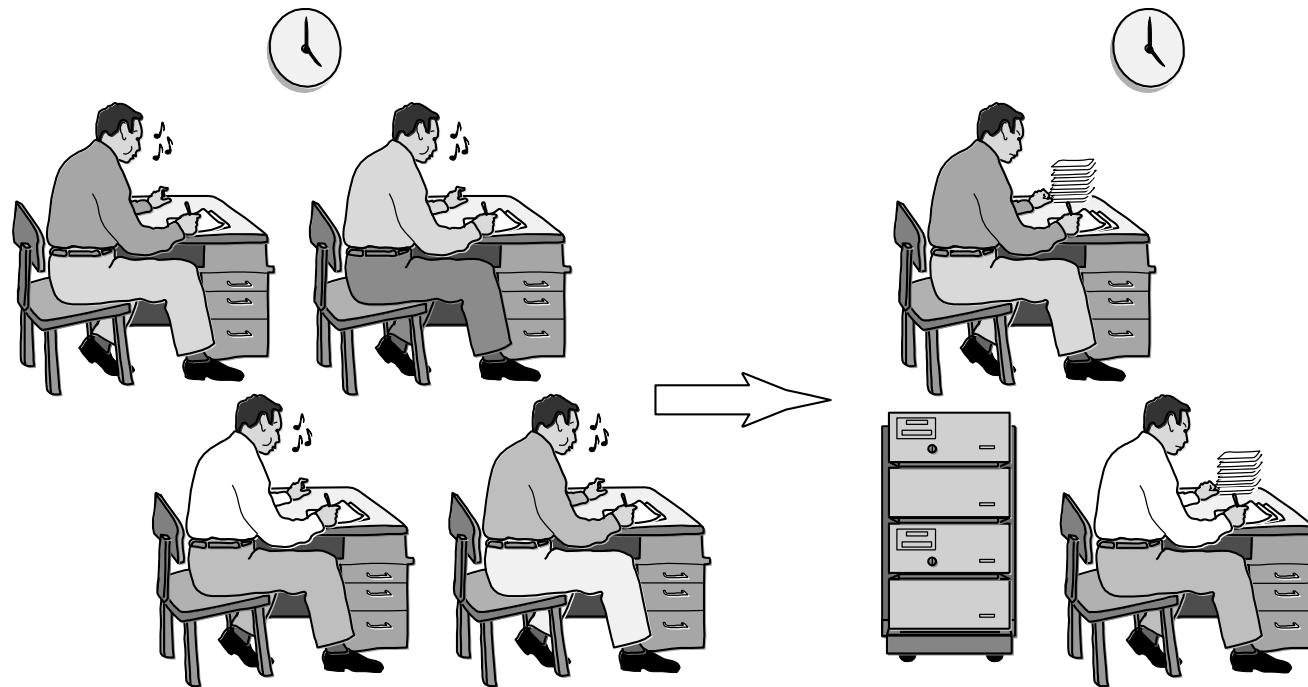
- Between 1979 and 2008...
 - U.S. population increased 35%
 - Manufacturing employment dropped 31%, from 19.4 million jobs to 13.5 million jobs
- Lost white-collar jobs
 - Secretarial and clerical positions
 - Accountants and bookkeepers
 - Middle managers
- Juliet Schor: Work week got longer between 1979 and 1990

General Motors Exited Bankruptcy in 2009 with 30% Fewer Employees



Danny Lenman / Corbis

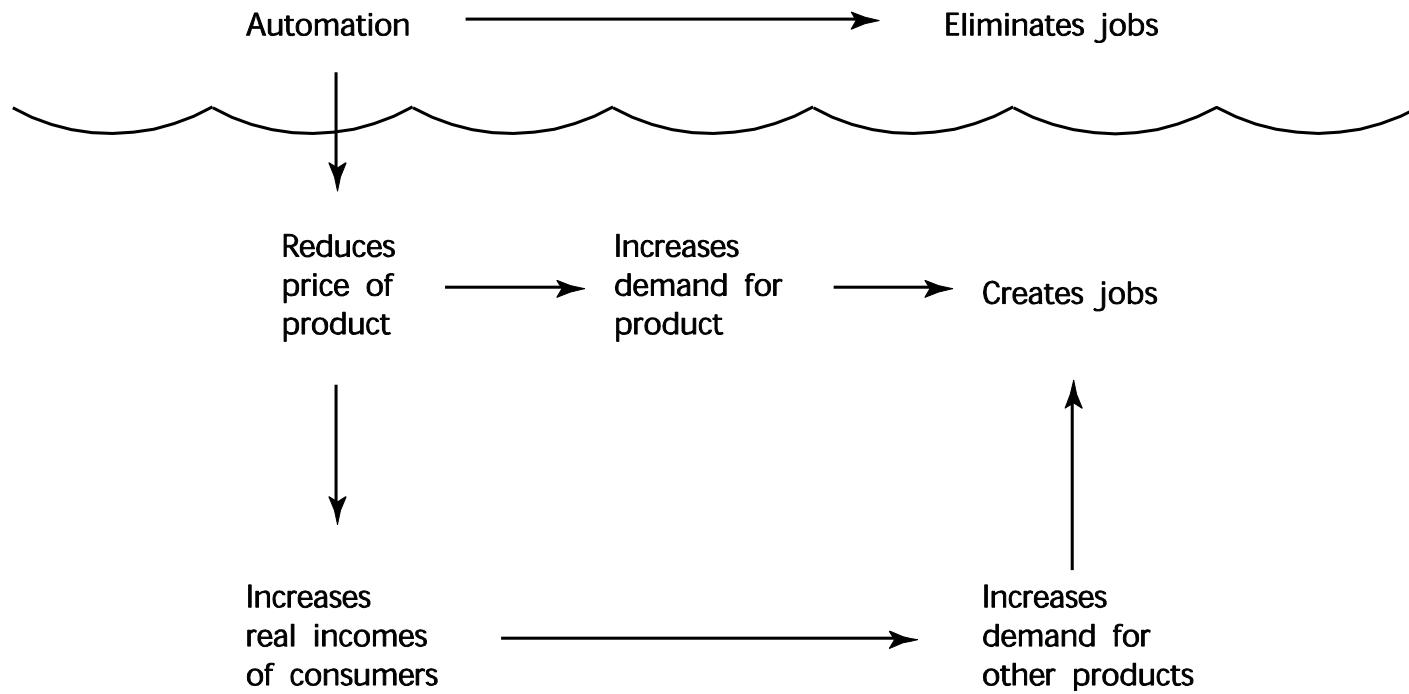
Layoffs May Increase Stress on Remaining White-Collar Workers



Automation and Job Creation

- Automation lowers prices
- That increases demand for product
- It also increases real incomes
- Increasing demand for other products
- Increased demand → more jobs
- Number of manufacturing jobs worldwide is increasing
- Martin Carnoy: Workers today work less than workers 100 years ago
- Example of job creation ([P. 452](#))

Automation Can Create Jobs, Too



Effects of Increase in Productivity

- We have used higher productivity to achieve a higher material standard of living
- This is in contrast to medieval or ancient times (before modern capitalism)
- In medieval or ancient times
 - Low caloric intake meant pace of work was slow
 - Work was seasonal and intermittent
 - Laborers resisted working if they had enough money
 - When wages rose, laborers worked less

Rise of the Robots?

- Some experts suggest most jobs will be taken over by machines
- Artificial intelligence: Field of computer science focusing on intelligent behavior by machines
- Rapid increases in microprocessor speeds have led to various successes in AI
- What will happen as computers continue to increase in speed?

Notable Achievements in AI since 1995

- Computer-controlled minivan “drove” on freeways across USA in 1995
- IBM supercomputer Deep Blue defeated chess champion Gary Kasparov in 1997
- Honda’s ASIMO android can climb and descend stairs and respond to human gestures and postures
- Electrolux introduced robotic vacuum cleaner in 2001
- Five autonomous vehicles successfully completed 128-mile course in Nevada desert in 2005
- Watson trounced two most successful human *Jeopardy!* champions in 2011

Stanley, the Autonomous Vehicle



© Gene Blevins/Reuters/Corbis

The Stanford Racing Team converted a Volkswagen Touareg into an autonomous vehicle named [Stanley](#) that successfully followed a 128-mile through the Nevada desert in 2005

Google's Self-Driving Car



<https://www.youtube.com/watch?v=cdgQpa1pUUE>

Watson Wins Jeopardy! Challenge



Moral Question Related to Robotics

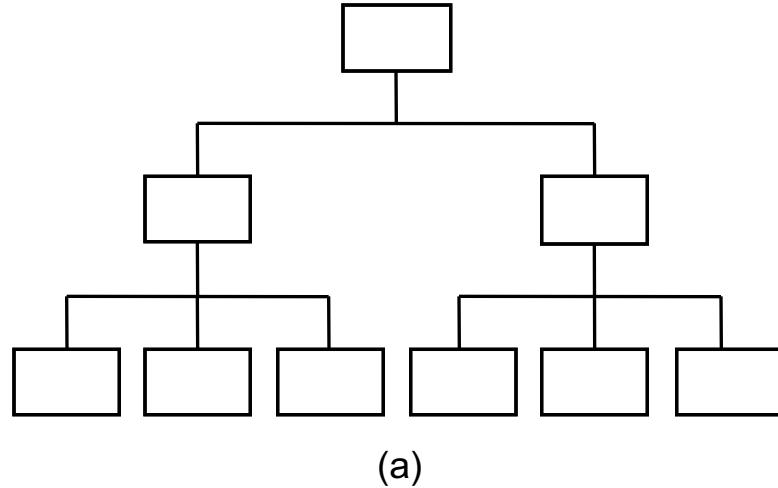
- Is it wrong to create machines capable of making human labor obsolete?
- Would intelligent robots demoralize humanity?
- Is it wrong to work on an intelligent machine if it can't be guaranteed the machine will be benevolent toward humans?
- What if a malevolent human puts intelligent machines to an evil use?
- How would creative computers change our ideas about intellectual property?

10.3 Workplace Changes

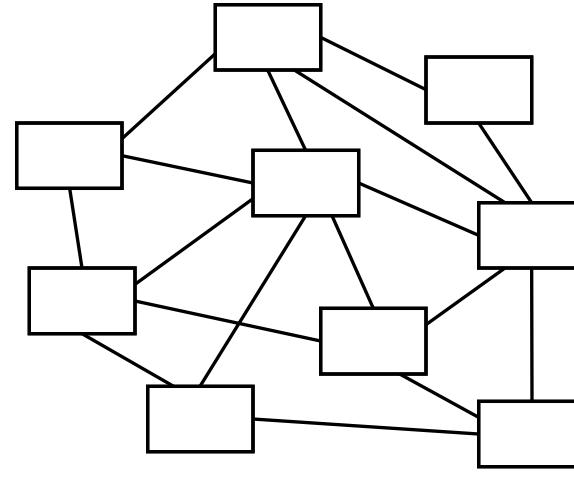
Organizational Changes

- Information technology integration into firms
 - Automating back office functions (e.g., payroll)
 - Improving manufacturing
 - Improving communication among business units
- Results
 - Flattened organizational structures
 - Eliminating transactional middlemen (supply-chain automation)

Inexpensive Interactions Lead to Flexible Information Flow



(a)



(b)

- a) When interactions are more expensive and time-consuming, most information flows between people and their managers. Organizations are rigid and hierarchical.
- b) When interactions become inexpensive and fast, the flow of information is much more flexible. Organizations become flatter and more dynamic.

Winners, Losers in the Workplace of the Future

<i>Higher Demand</i>	<i>Lower Demand</i>
Computer engineers	Bank clerks
Computer support specialists	Procurement specialists
System analysts	Financial records processing staff
Database administrators	Secretaries, stenographers, and typists
Desktop publishing specialists	Communications equipment operators
	Computer operators

Telework

- Employees work away from traditional place of work
- Examples
 - Home office
 - Commuting to a telecenter
 - Salespersons with no office
- About 20% of Americans do some telework

Advantages of Telework

- Increases productivity
- Reduces absenteeism
- Improves morale
- Helps recruitment and retention of top employees
- Saves overhead
- Improves company resilience
- Helps environment
- Saves employees money

Disadvantages of Telework

- Threatens managers' control and authority
- Makes face-to-face meetings impossible
- Sensitive information less secure
- Team meetings more difficult
- Teleworkers less visible
- Teleworkers “out of the loop”
- Isolation of teleworkers
- Teleworkers work longer hours for same pay

Temporary Work

- Companies less committed to employees
- Lay-offs not taboo as they once were
- Companies hiring more temporary employees
 - Saves money on benefits
 - Makes it easier to downsize
- Long-term employment for one firm less common

Monitoring

- 82% of companies monitor employees in some way
 - Purpose: Identify inappropriate use of company resources
 - Can also detect illegal activities
- Other uses of monitoring
 - Gauge productivity (10% of firms)
 - Improve productivity
 - Improve security

Multinational Teams

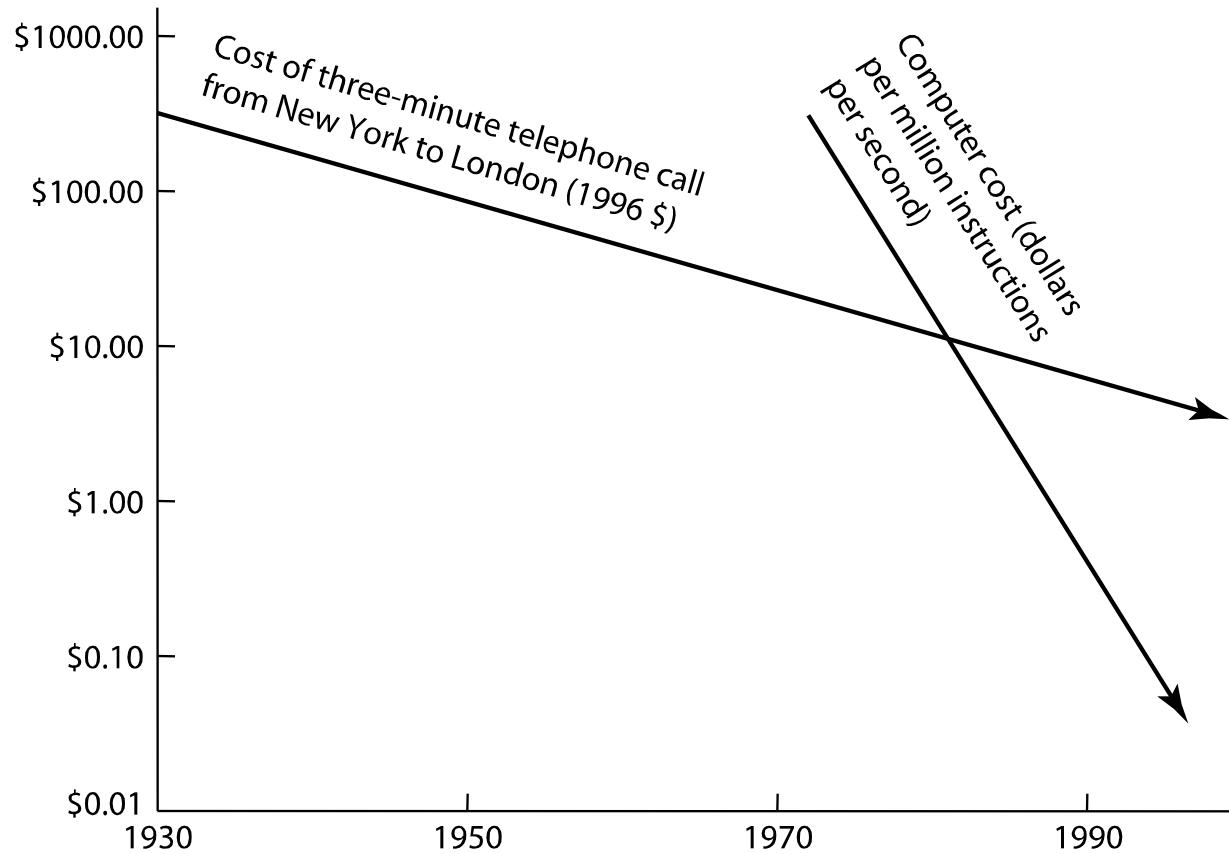
- Software development teams in India since 1980s
- Advantages of multinational teams
 - Company has people on duty more hours per day
 - Cost savings
- Disadvantage of multinational teams
 - Poorer infrastructure in less developed countries

10.4 Globalization

Globalization Basics

- Globalization: Process of creating a worldwide network of businesses and markets
- Globalization causes a greater mobility of goods, services, and capital around the world
- Globalization made possible through rapidly decreasing cost of information technology

Declines in Computing & Communication Costs Spurred Globalization



Arguments for Globalization

- Increases competition
- People in poorer countries deserve jobs, too
- It is a tried-and-true route for a poor country to become prosperous
- Global jobs reduce unrest and increase stability

Arguments against Globalization

- Makes the United States subordinate to the World Trade Organization
- Forces American workers to compete with foreigners who do not get decent wages and benefits
- Accelerates exodus of manufacturing and white-collar jobs from United States
- Hurts workers in foreign countries

Dot-Com Bust Increases IT Sector Unemployment

- Dot-com: Internet-related start-up company
- Early 2000: stock prices of dot-coms fell sharply
- Hundreds of dot-coms went out of business
- Half a million high-tech jobs lost

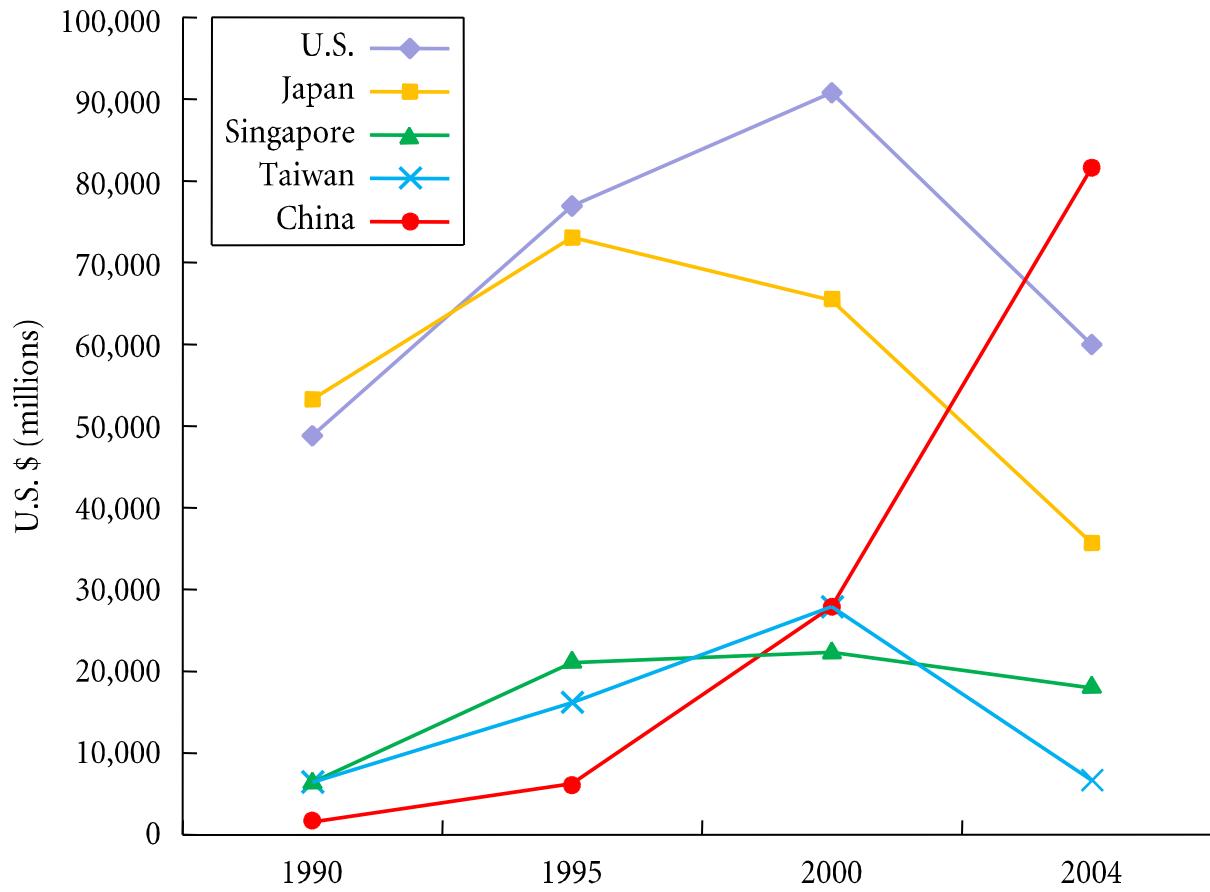
Foreign Workers in the IT Industry

- Visas allow foreigners to work inside U.S.
- H1-B
 - Right to work up to United States to six years
 - Company must show no qualified Americans available
 - Congress still authorizes 65,000 H1-B visas per year, plus 20,000 more for foreigners with advanced degrees
 - Quota not filled in 2009 due to economic downturn
- L-1
 - Allows a company to transfer a worker from an overseas facility to the United States
 - Workers do not need to be paid the prevailing wage
 - In 2006 about 50,000 foreigners in U.S. under L-1 visa

Foreign Competition

- China is world's number one producer of computer hardware
- IT outsourcing to India is growing rapidly
- Number of college students in China increasing rapidly
- ACM Collegiate Programming Contest provides evidence of global competition [\(P. 468\)](#)

Growth of China's Computer-Hardware Industry



10.5 The Digital Divide

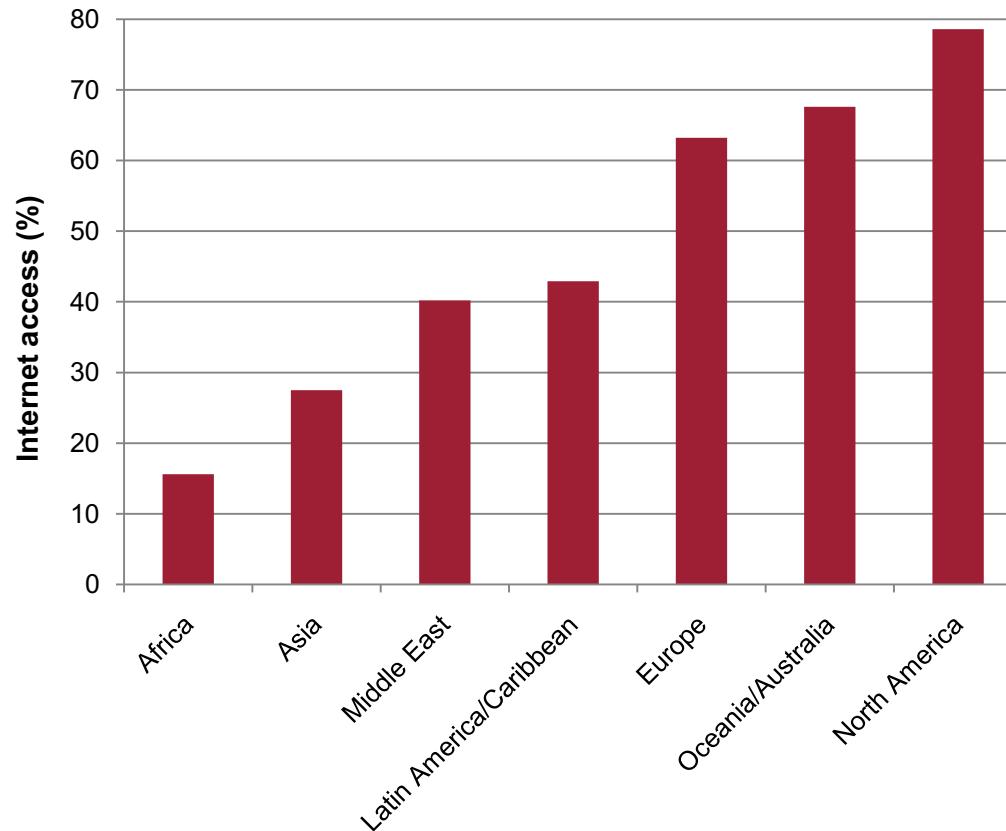
Concept of the Digital Divide

- Digital divide: Some people have access to modern information technology while others do not
- Underlying assumption: people with access to telephones, computers, Internet have opportunities denied to those without access
- Concept of digital divide became popular with emergence of World Wide Web

Evidence of the Digital Divide

- Global divide
 - Access higher in wealthy countries
 - Access higher where IT infrastructure good
 - Access higher where literacy higher
 - Access higher in English-speaking countries
 - Access higher where it is culturally valued
- Social divide
 - Access higher for young people
 - Access higher for well-educated people

Percentage of People with Internet Access, by World Region

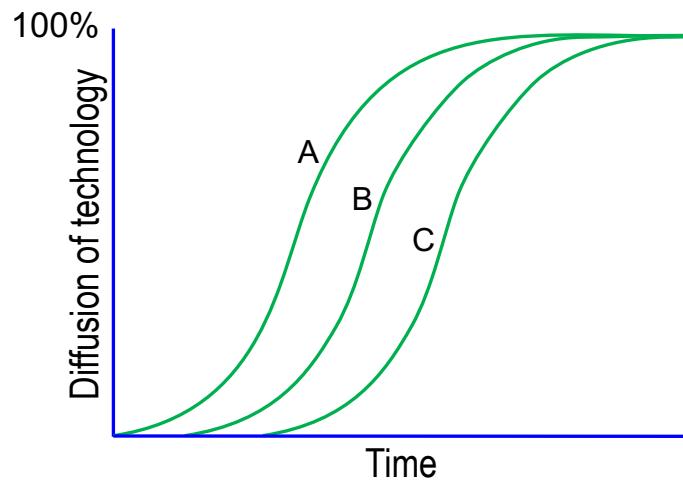


Internet penetration rates as of 2012 Q2 (cf. [P. 469](#))

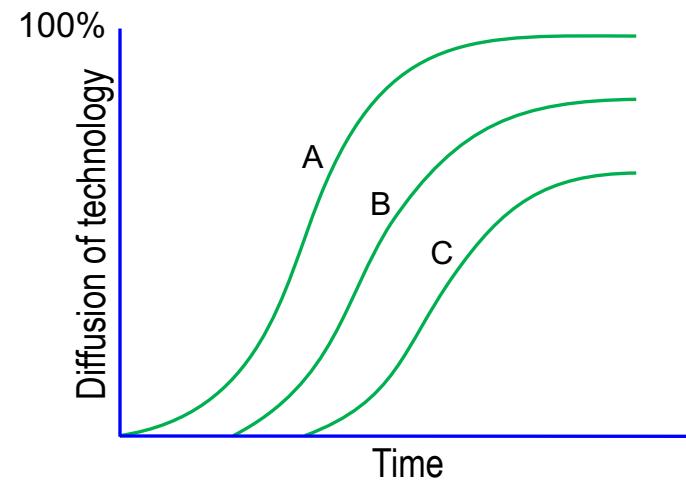
Models of Technological Diffusion

- Technological diffusion: rate at which a new technology is assimilated
 - Group A: highest socioeconomic status
 - Group B: middle socioeconomic status
 - Group C: lowest socioeconomic status
- Normalization model
 - Group A adopts first, then Group B, finally Group C
 - Eventually A use = B use = C use
- Stratification model
 - Group A adopts first, then Group B, finally Group C
 - A use > B use > C use forever

Two Models for Technological Diffusion



(a) Normalization model



(b) Stratification model

Critiques of the Digital Divide

- DD talk suggests the difference between “haves” and “have nots” is simply about access
- DD talk puts everyone in two categories, but reality is a continuum
- DD implies lack of access leads to less advantaged social position, but maybe it is the other way around
- Internet is not the pinnacle of information technology

Street Scene in Ennis, Ireland



© Richard Cummins / CORBIS

Unemployed workers in Ennis, Ireland, resisted using the Internet to receive their benefits, preferring to report in person to the social welfare office, where they could visit with other people.

Net Neutrality

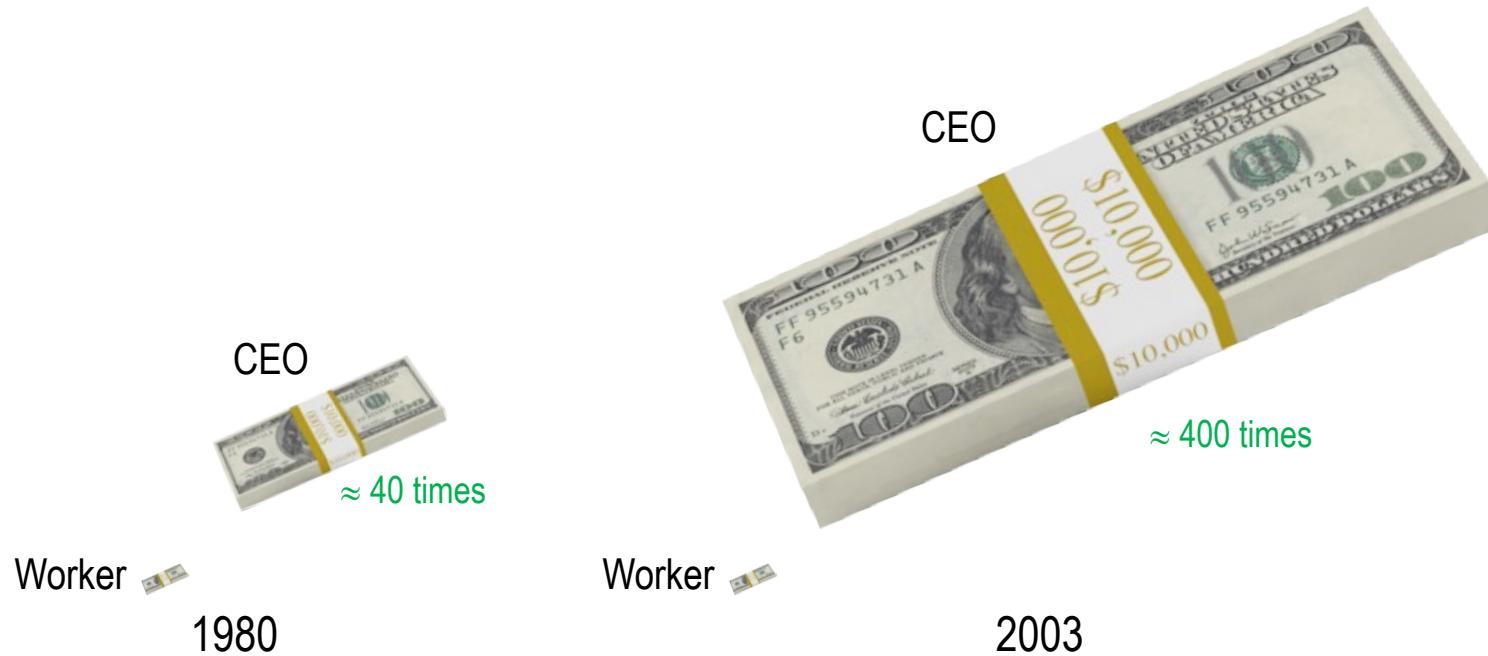
- Tiered service: Charging more for high-priority routing of Internet packets
- Supporters of tiered service say it is needed to support Voice-over-IP and other services
- Opponents to tiered service (e.g., Google, Yahoo!) say it would hurt small start-up companies and lower innovation
- Others think companies controlling Internet might favor some content over other content
- Net neutrality legislation would require all Internet packets be treated the same
- Opponents of proposed legislation say consumers should be able to pay more to get higher quality service

10.6 The “Winner-Take-All Society”

The Winner-Take-All Phenomenon

- Winner-take-all: a few top performers have disproportionate share of wealth
- Causes
 - IT and efficient transportation systems
 - Network economies
 - Dominance of English language
 - Changing business norms

CEO Pay v. Production Worker Pay, 1980 and 2003



Jim Furyk Earned 99 Times More Than Brian Bateman in 2009; Is He 99 Times Better?

<i>Metric</i>	<i>Brian Bateman</i>	<i>Jim Furyk</i>
Driving distance (yards)	289.1	278.1
Driving accuracy (%)	56.23	70.24
Greens in regulation (%)	63.95	64.67
Putts / round	29.42	28.17
Scoring average	71.89	70.24
Tournaments entered	21	21
Winnings	\$35,379	\$3,514,215

Reducing Winner-Take-All Effects

- Limit number of hours that stores remain open
- Businesses form cooperative agreements to reduce positional arms races
 - Example: salary caps on pro sports teams
- More progressive tax structures
- Campaign finance reform

10.7 IT and Sustainability

IT for Sustainability: An Emerging Research Field

- Technologies have environmental impact with their production and consumption
- However, we can develop more sustainable use of technologies
- Two directions:
 1. To stop the growth of IT's own footprint
 2. To find ways to apply IT as an enabler in order to reduce the footprint of the society

Areas of IT for Sustainability

Name of the field	Main methods	Contribution to sustainable development
Environmental Informatics	<ul style="list-style-type: none">• Information systems• Modeling and simulation• Spatial data processing	<ul style="list-style-type: none">• Monitoring the environment• Understanding complex systems• Data-sharing and consensus-building
Green IT	<ul style="list-style-type: none">• IT management• IT engineering• Software engineering	<ul style="list-style-type: none">• Reducing the environmental impacts of IT hardware and software
IT for Sustainability	<ul style="list-style-type: none">• Empirical methods (include social sciences)• Scenario-building• Modeling and simulation	<ul style="list-style-type: none">• Enabling sustainable patterns of production and consumption• Understanding and using IT as a transformational technology

Hilty L.M., Aebischer B. (2015) ICT for Sustainability: An Emerging Research Field. In: Hilty L., Aebischer B. (eds) ICT Innovations for Sustainability. *Advances in Intelligent Systems and Computing*, vol 310. Springer, Cham.

https://doi.org/10.1007/978-3-319-09228-7_1

Environmental Informatics



Researchers found that such drone image data with a pixel size of four centimetres, analysed by modern machine learning methods, are able to detect vegetation health indicators...



<https://www.utas.edu.au/news/2017/9/5/407-eyes-in-the-sky-helping-climate-research/>



Smart agriculture



Soil analysis



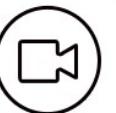
Illumination monitoring



Environmental temperature monitoring



Environmental humidity monitoring



Smoke monitoring

Smart Agriculture

The combination of modern technology and agricultural planting to realize unmanned, automated, and intelligent management.

- Controllable environment
- Intelligent perception
- Accurate planting
- Visual management
- Intelligent decision-making

Picture: <https://www.aituoiot.com/wp-content/uploads/2018/08/%E6%99%BA%E6%85%A7%E5%86%9C%E4%B8%9A.jpg>

Digital vineyards



<https://www.youtube.com/watch?v=yfxbWzjiTC4>

Green IT Example: Data Centers

nature

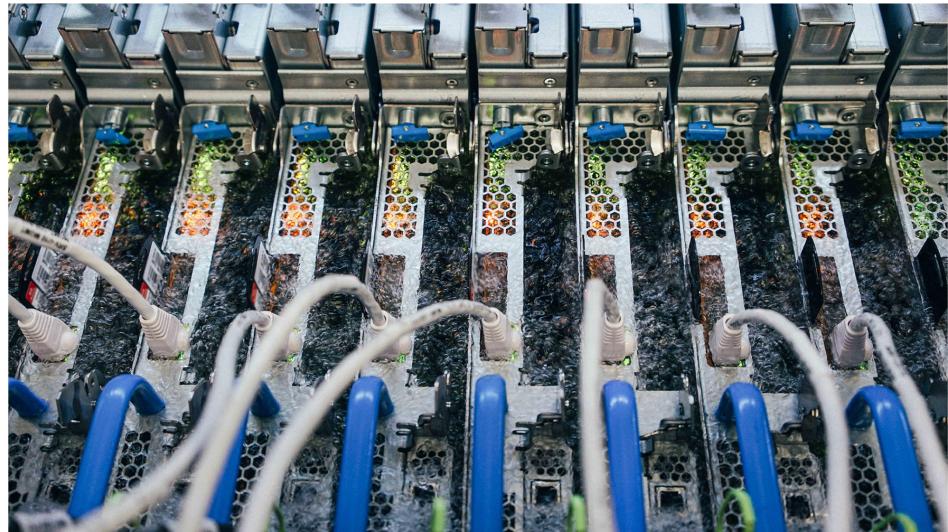
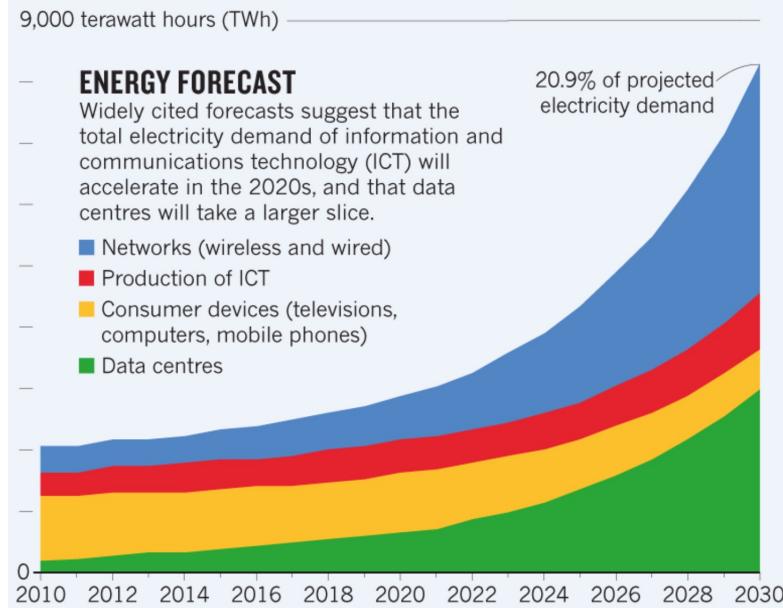
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NEWS FEATURE | 12 September 2018 | Correction 13 September 2018

How to stop data centres from gobbling up the world's electricity

The energy-efficiency drive at the information factories that serve us Facebook, Google and Bitcoin.



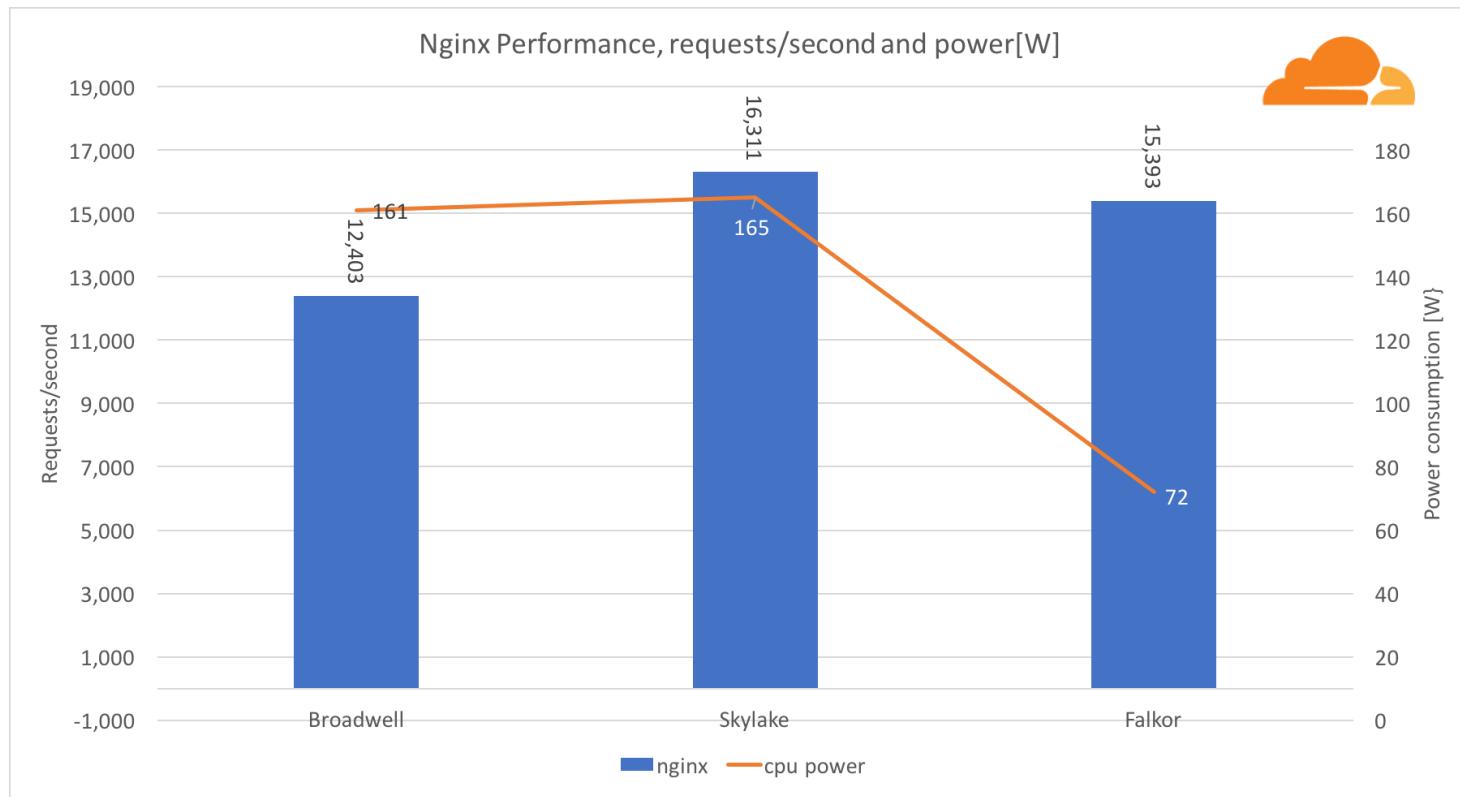
Boiling liquid carries away heat generated by computer servers at a Microsoft datacenter. Microsoft is the first cloud provider to run two-phase immersion cooling in a production environment. Photo by Gene Tweddle for Microsoft.

<https://www.nature.com/articles/d41586-018-06610-y>

<https://news.microsoft.com/innovation-stories/datacenter-liquid-cooling/>

Architecture with Less Power

- Cloudflare: ARM Takes Wing: Qualcomm vs. Intel CPU comparison



<https://blog.cloudflare.com/arm-takes-wing/>

Japanese: Data Center To Use Waste Heat to Farm Eels

- A new business venture in Hokkaido, Japan, has plans to grow 300,000 eels per annum by 2023, in waters warmed by its in-development data center.

<https://www.techspot.com/news/94125-japanese-data-center-using-waste-heat-farm-eels.html>



<https://www.youtube.com/watch?v=LpnXrsHi0xI>

Transformational Technologies

- Enabling sustainable patterns of production and consumption
- Understanding and using IT as a transformational technology

Transformational Technologies

- Smart Electricity Meters
 - Enabling sustainable patterns of consumption

