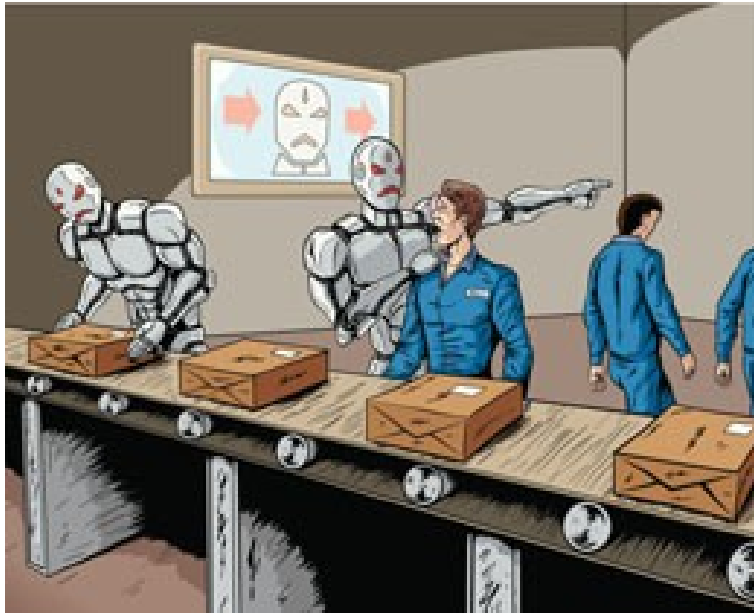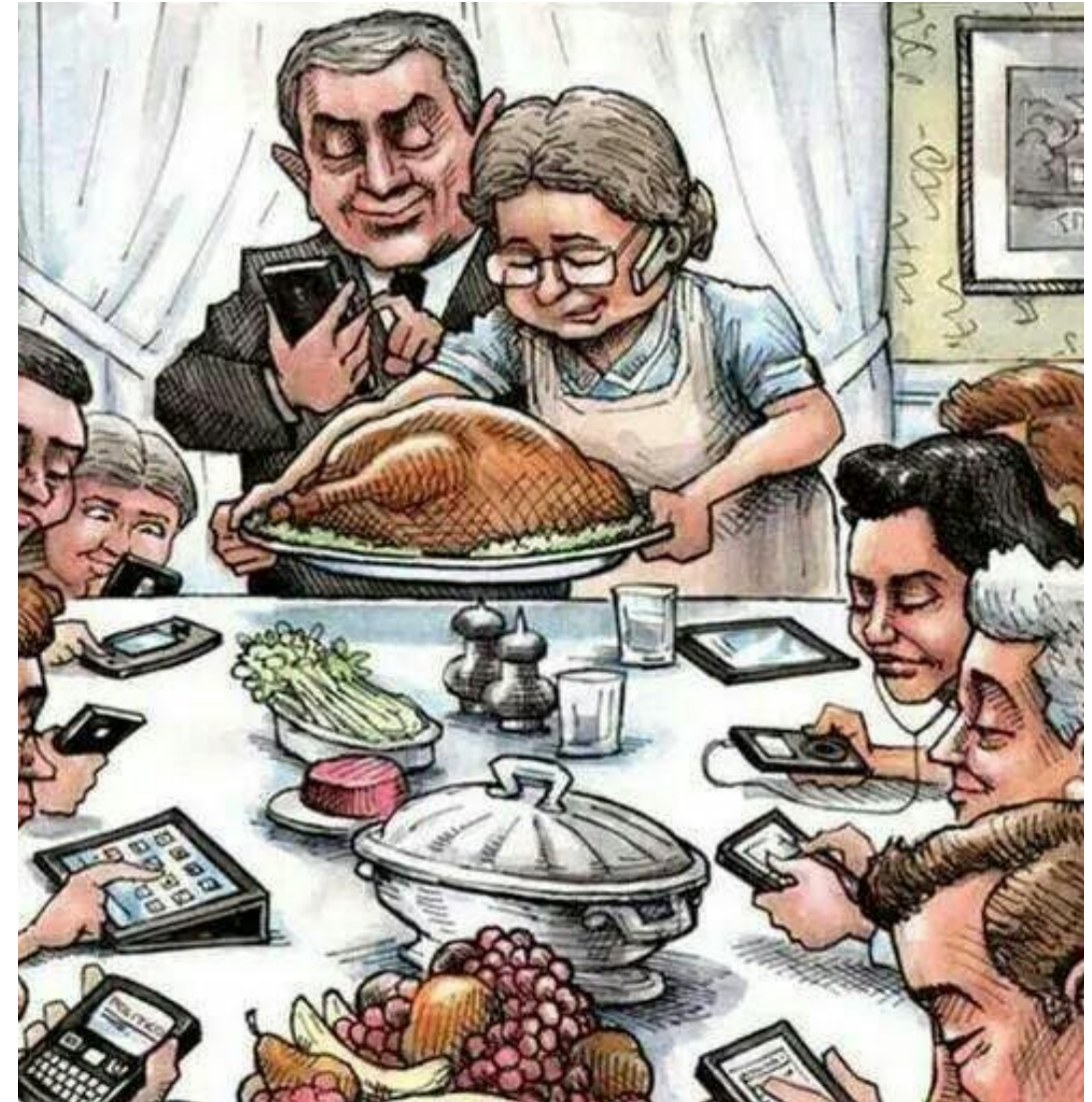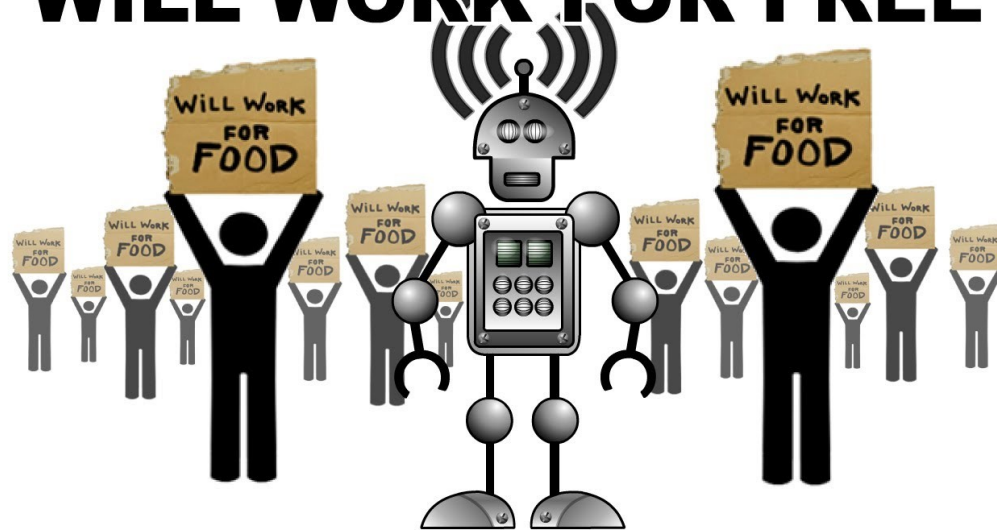# Equity and Access, Employment and Work

Prepared by,

Ms Anitha Velayutham

WILL WORK FOR FREE

# Introduction

- Information technology and automation affecting workplace
  - Increases in productivity
  - Job creation and destruction
  - Globalization of job market
  - Organization of companies
  - Workplace monitoring
- Impacts of information technology on society
  - Digital divide

# Automation and Job Destruction

- Between 1979 and 2011...
  - U.S. population increased 39%
  - Manufacturing employment dropped 40%, from 19.4 million jobs to 11.7 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

# Impact of Layoffs on Workers
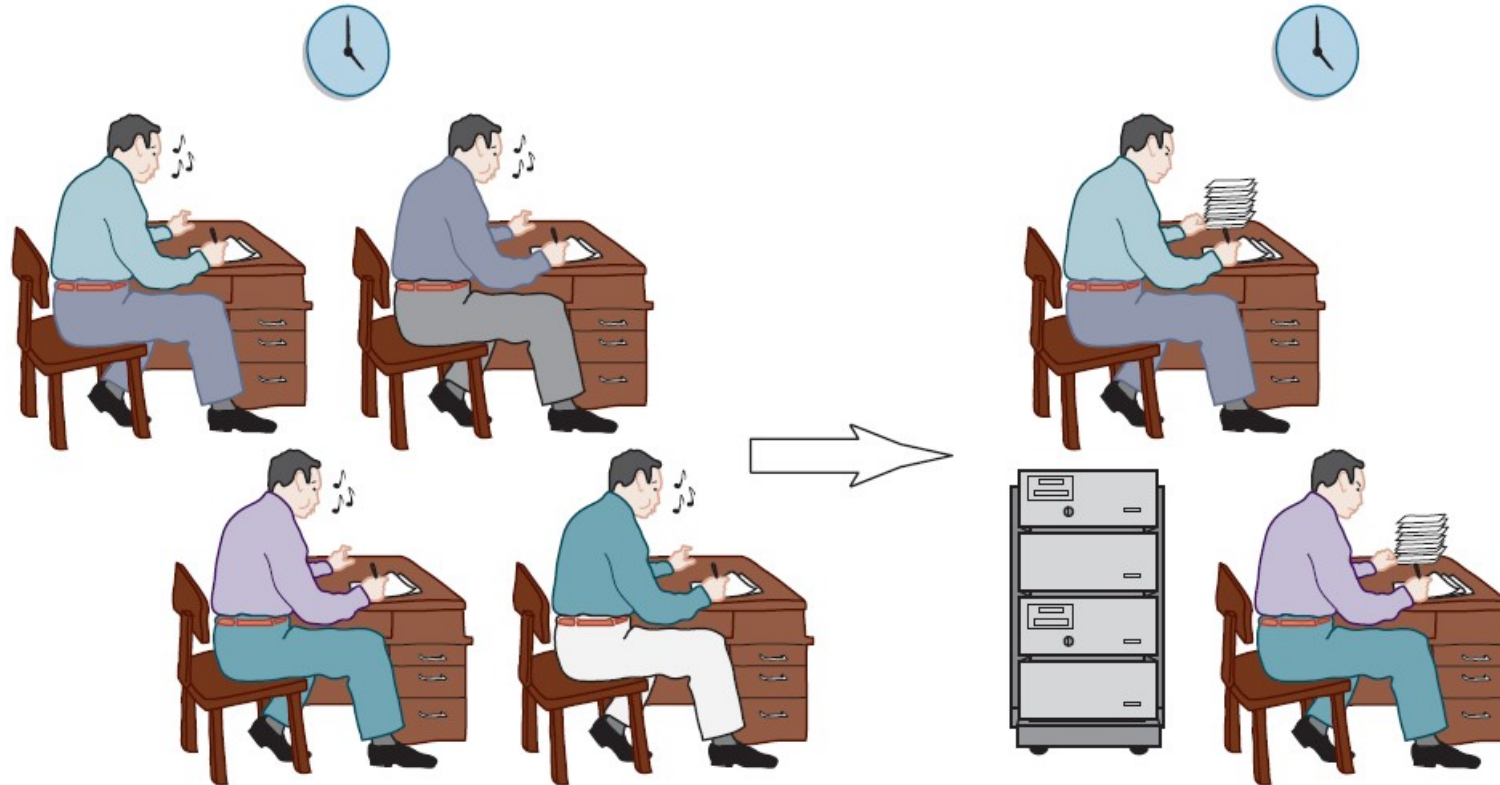


When jobs are lost to automation or the introduction of information technology, the remaining workers may work harder in order to avoid being part of the next layoff.
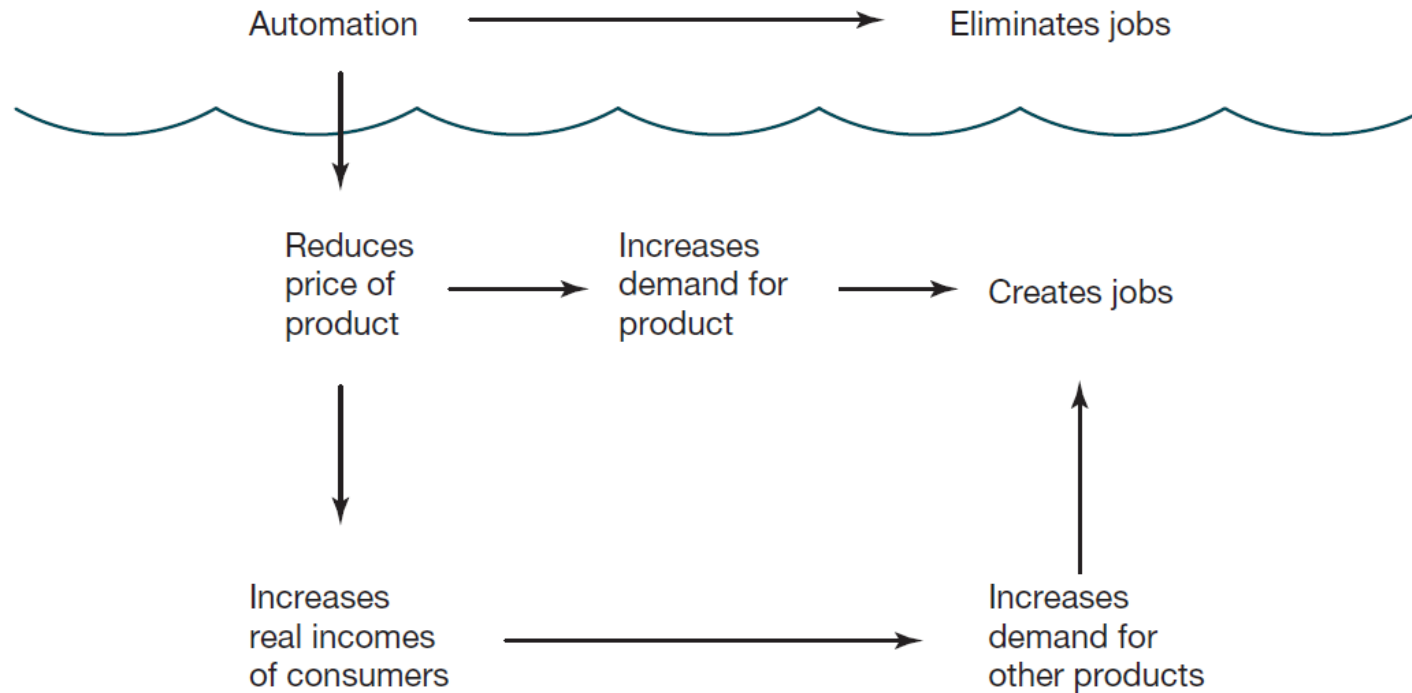
# Automation and Job Creation

- Automation lowers prices

- That increases demand for the product

- It also increases real incomes, increasing demand for other products, which means more jobs for people making those products

- Number of manufacturing jobs worldwide is increasing

- Martin Carnoy: Workers today work less than workers did 100 years ago

# Effects of Automation

Automation  →  Eliminates jobs

Reduces price of product  →  Increases demand for product  →  Creates jobs

Reduces price of product  ↓  Increases real incomes of consumers  →  Increases demand for other products  ↑  Creates jobs

Superficially, automation eliminates jobs; but automation can also stimulate the creation of new jobs.

# 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 (i.e., they weren't consumers)
    - When wages rose, laborers worked less

**AI and Robotics**

# 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 A I

- 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 climbed and descended stairs (2000)

- 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

- Google's self-driving cars logged more than one million miles between 2009 and 2015 without an accident (caused by the car)

- AlphaGo program created by Google trounced Ke Jie, world's #1 Go player, in multiplayer match in 2017

# Google Self-Driving Car



Between 2009 and 2015 Google self-driving cars drove more than a million miles in autonomous mode without causing a single accident. (John Green/TNS/Newscom)

# 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?

- How will our ideas about privacy change if superfast computers constantly analyze our electronic records?

# Artificial Intelligence (AI)

- The view that only humans are rational is currently challenged on two separate fronts:

    - recent research in animal intelligence suggests that many primates, dolphins, and whales are capable of demonstrating skills we typically count as rational (while many humans are not, or are no longer able, to demonstrate those skills);

# Should we Continue to Research in AI?

- John Weckert asks:

  Can we, or do we want to, live with artificial *intelligences*? We can happily live with fish that swim better than we do, hawks that see and fly better, and so on, but do we want things that can reason better to be in a different and altogether more worrying category....

  What would such [developments mean for] our view of what it is to be human?

# Nanotechnology

- *Nanotechnology*, a term coined by K. Eric Drexler in the 1980s.

- A is a branch of engineering dedicated to the development of extremely small electronic circuits and mechanical devices built at the molecular level of matter.

- A primary goal of this technology is to provide us with tools to work at the molecular and atomic levels that are analogous to what we have at the macroworld level.

- Drexler (1991) believes that developments in this field will result in computers at the nano-scale, no bigger in size than bacteria, called *nanocomputers*.
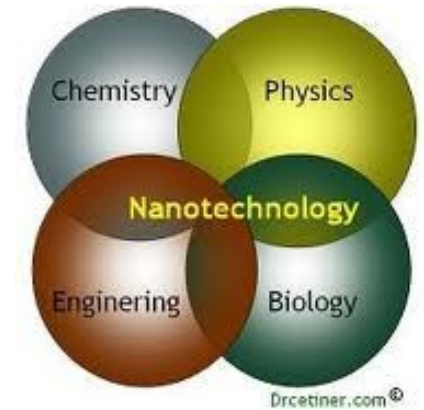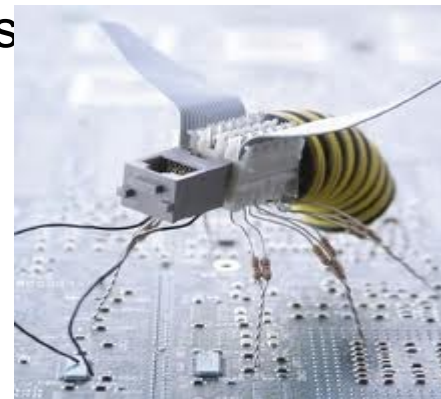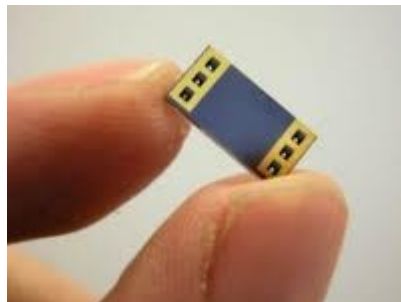
# Nanotechnology

- Nanocomputers could have "mass storage devices that can store more than 100 billion bytes in a volume the size of a sugar cube."

- Merkle (2001) predicts that these nano-scale computers will be able to "deliver a billion billion instructions per second – a billion times faster than today's desktop computers."

- In 1989, physicists at the IBM Almaden Laboratory demonstrated the feasibility of development in nanotechnology by manipulating atoms to produce the IBM logo.

# Pros of Nanotechnology

- Nano-particles inserted into bodies could diagnose diseases and directly treat diseased cells.

- Doctors could use nanomachines (or *nanites*) to make microscopic repairs on areas of the body that are difficult to operate on with conventional surgical tools. (with nanotechnology tools, the life signs of a patient could be better monitored.

- With respect to the environment, nanites could be used to clean up toxic spills, as well as to eliminate other kinds of environmental hazards.

- Nanites could also dismantle or "disassemble" garbage at the molecular level and recycle it again at the molecular level via "nanite assemblers

# Worries about Nanotechnology

- Since all matter (objects and organisms) could theoretically be disassembled and reassembled by nanite assemblers and disassemblers, what would happen if strict "limiting mechanisms" were not built into those nanites?

- If nanomachines were created to be self-replicating and if there was a problem with their limiting mechanisms, they could multiply endlessly like viruses.

- Nanite assemblers and disassemblers could be used to create weapons or that nanites themselves could be used as weapons. As Chen (2002) points out, guns, explosives, and electronic components of weapons could all be miniaturized.

- Privacy and freedom could be further eroded because governments, businesses, and ordinary people could use molecular sized microphones, cameras, and homing beacons to track and monitor people.

- People with microscopic implants would be able to be tracked using Global Positioning Systems (GPS), just as cars can be now.
    - On the one hand, children could never be lost again;
      on the other hand, we would likely have very little privacy
      given that our movements could be tracked so easily by others.

# Ethical Aspects of Nanotechnology

- Already there are controversies about bionic chip implants made possible by nanotechnology.

- Weckert points out that while "conventional" implants in the form of devices designed to "correct" deficiencies have been around and used for some time, their purpose has been viewed as one of assisting patients in their goal of achieving "normal" states of vision, hearing, heartbeat, etc.

- Future chip plants, in the form of "enhancement implants" could be designed to make a normal person super-human.

# Implants Involving Nanotechnology

- Some frame the controversy about implants in terms of an "enhancement vs. therapy" debate.

- Moor (2003) points out that this distinction might suggest the basis for a policy that would limit unnecessary implants.

- He also notes that because the human body has "natural functions," some will argue that implanting chips in a body is acceptable as long as these implants "maintain and restore the body's natural functions."

- Although Moor does not argue for a policy along the lines of a therapeutic-enhancement distinction, he believes that many will find such a policy would appeal to many.

# Implants (Continued)

- According to Moor (2004):
  - Pacemakers, defibulators, and bionic eyes that maintain and restore natural bodily functions are acceptable.

  - But giving patients added arms or infrared vision would be prohibited.

  - It would endorse the use of a chip that reduced dyslexia but would forbid the implanting of a deep blue chip for superior chess play.

  - It would permit a chip implant to assist memory of Alsheimer patients but would not license implanting of a miniature digital camera that would record and playback what a person had just seen.

- Clear policies and laws will need to be framed needed, as more and more bionic parts become available.

# Should Research in Nanotechnology Continue?

- Weizenbaum (1984) has argued that there are certain kinds of computer science research that should not be undertaken – specifically, research that can easily be seen to have "irreversible and not entirely unforeseeable side effects."

- Joy (2000) has suggested that because developments in nanotechnology are threatening to make us an "endangered species," the only realistic alternative is to limit the development of that technology.

- Merkle (2001) disagrees with Joy, arguing that if research in nanotechnology is prohibited, or even restricted, it will be done underground.

- If that happens, Merkle worries that nanotechnology research would not be regulated by governments and social policies.

# Should Research Continue in Nanotechnology?

- Weckert (2001) argues that, all things being equal, potential disadvantages that can result from research in a particular field are not in themselves sufficient grounds for halting research altogether.

- He suggests that there should be a *presumption in favor of freedom in research*.

- Weckert also argues, however, that it should be permissible to restrict or even forbid research where it can be clearly shown that harm is more likely than not to result from that research.

Workplace Changes
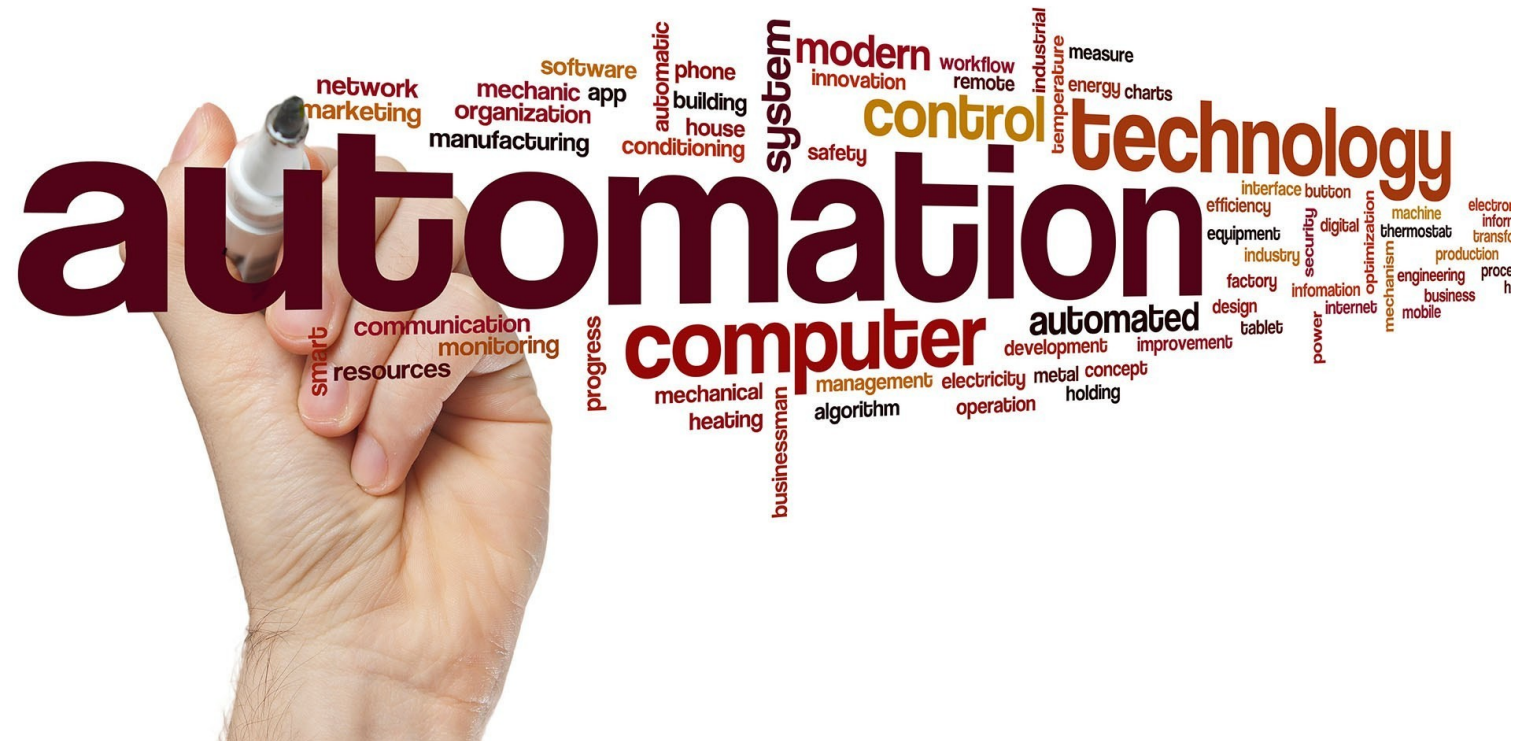
# Organizational Changes

- 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
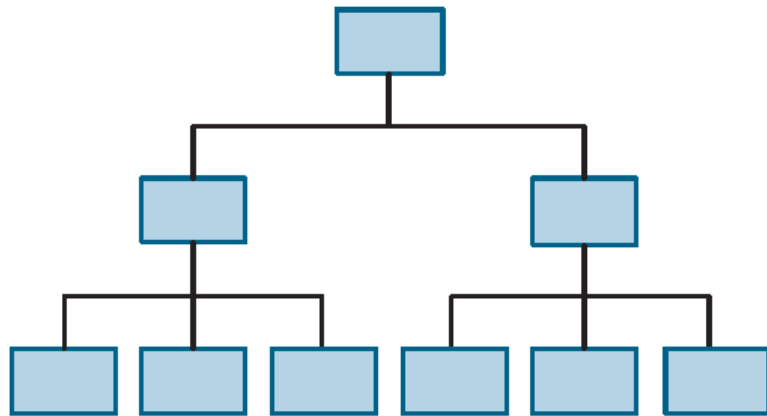
(a)
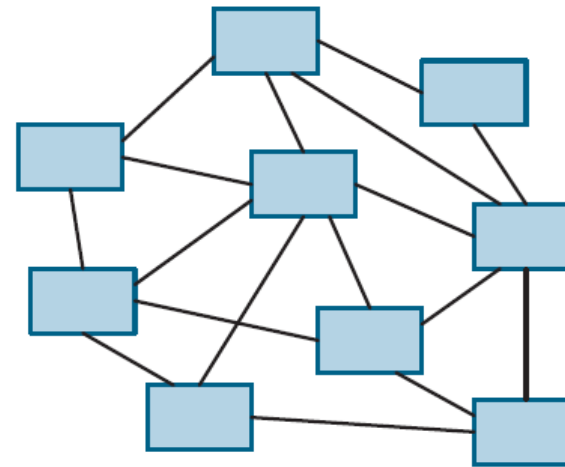
(b)

(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

| Higher Demand | Lower Demand |
|---|---|
| Software engineers-applications | Butchers |
| Computer support workers | Secretaries and stenographers |
| Software engineers-systems | Payroll clerks |
| Network administrators | Bank tellers |
| Network systems analysts | File clerks |
| Desktop publishers | Cashiers |
| Database administrators | Typist |
| Personal and home-care aides | Pharmacists |
| Computer systems analysts | Bookkeepers |
| Medical assistants | Postal clerks |

Greater use of information technology in the workplace has increased demand for employees in certain job categories while reducing demand for employees in other categories.

# The Gig Economy

- Companies less committed to employees

- Lay-offs not taboo as they once were

- Companies hiring more subcontractors and temporary employees
  - Saves money on benefits
  - Makes it easier to downsize

- Some start-ups make money by connecting people who want a service with people willing to provide that service

- Gig economy: Service workers making a living by completing short-term jobs for clients

- Examples
  - Uber, Lyft: Connect riders and drivers
  - Instacart: Grocery delivery service
  - Airbnb: Connect travelers and those with accommodations

# The Gig Economy

- Proponents say workers gain independence, flexibility

- Critics say these are last-resort jobs and competition among workers drives down wages

- Robert Reich: "The big money goes to the corporations that own the software. The scraps go to the on-demand workers."

- Uber and Lyft drivers filed lawsuits to be classified as employees

# Monitoring

- Two-thirds of companies monitor Internet use of their employees

- Other examples of monitoring
  - Video surveillance
  - Monitoring keyboard activity
  - Monitoring time spent on phone
  - Monitoring emails

- Purpose: Identify inappropriate use of company resources
  - Can also detect illegal activities

# Monitoring

- Other uses of monitoring
  - Gauge productivity
  - Improve productivity
  - Improve security; i.e., in schools
- Evidence shows that monitoring...
  - Makes employees more focused on work
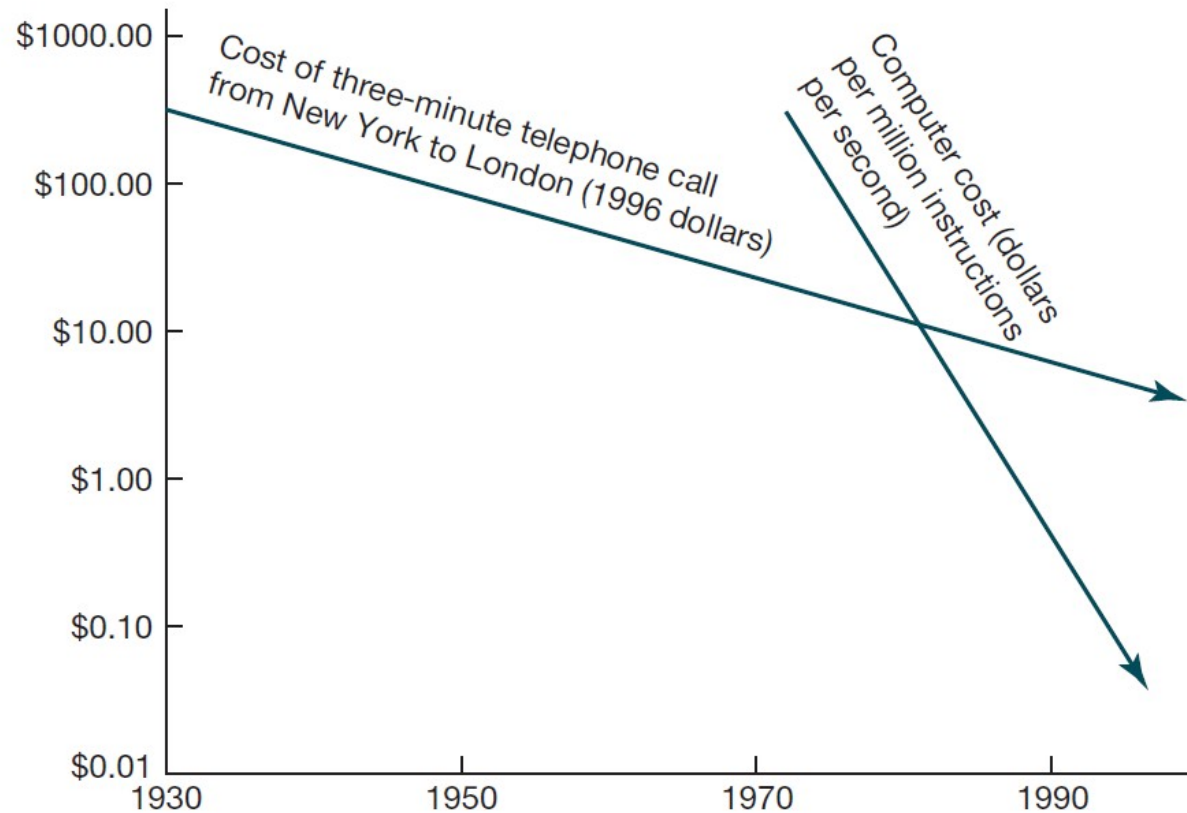  - Reduces job satisfaction

# Common Arguments Used to Support and to Oppose Monitoring

| Some Arguments in Favor of Monitoring | Some Arguments Against Monitoring |
|---|---|
| Helps to reduce employee theft | Increases employee stress |
| Helps to eliminate waste | Undermines employee trust |
| Helps employers to train new employees | Reduces individual autonomy |
| Provides employers with a motivational tool | Invades worker privacy |
| Improves competitiveness | Focuses on quantity rather than quality of work |
| Saves the company money | Creates an "electronic sweatshop" |
| Guards against industrial espionage | Provides employers with an "electronic whip" |
| Improves worker productivity and profits | Reduces employee morale and overall productivity |

# IT Improvements Led to Global Enterprises



Cost of three-minute telephone call from New York to London (1996 dollars)

Computer cost (dollars per million instructions per second)

| | | | |
|---|---|---|---|
| $1000.00 | | | |
| $100.00 | | | |
| $10.00 | | | |
| $1.00 | | | |
| $0.10 | | | |
| $0.01 | | | |
| 1930 | 1950 | 1970 | 1990 |

Dramatic declines in the cost of computing and communications made global enterprises feasible by the mid-1990s.

# Dot-Com Bust Increases I T 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 Competition

- China is world's number one producer of computer hardware, making 90 percent of all PCs

- IT outsourcing to India is growing rapidly

- Number of college students in China increasing rapidly

- ACM Collegiate Programming Contest provides evidence of global competition
    - No American team has placed first since 1997
    - From 2011-2015, only 1 of 20 teams earning gold medals was from the United States

# Digital Divide

# Digital Divide

- The term was coined in the mid-1990s.

- The expression *digital divide* is now commonly used to describe the disparity between those who have access to the Internet and those who do not.

- The phrase "digital divide" is essentially a new label for an old concept:
  - "Information haves and have-nots." In the US, much of the discussion about "the divide" has traditionally centered on divisions involving income and education.

# 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

# The Analog Divide

- The *analog divide* refers to the social inequities involving haves and have-nots that underlie the digital divide and that exist independently of digital technology.

- Some believe that the lack of access to digital technology experienced by certain groups will perpetuate and most likely exacerbate the broader cultural divide.



FM Radio Wave

FKS Signal
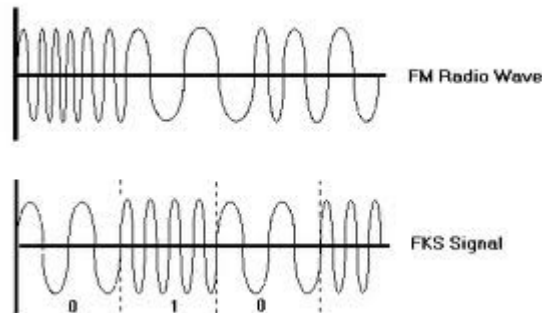
# Global Digital Divide

- As of 2000, it was estimated that 429 million people were on-line globally.

- This number represents approximately 6% of the world's population.

- Of those currently on-line, 68% live in North America and Europe.

- Two billion people in the world don't even have electricity.

- In developing countries there are roughly 69 phones for every 1000 people.

# 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

# Is the Digital Divide an Ethical Issue?

- Moss (2002) argues that ethical issues involving "the global divide" arise because people in developing countries are unfairly disadvantaged for three reasons:
    - they are denied access to knowledge;
    - they are unable to participate fully in democratic decision making processes;
    - their prospects for economic growth are hindered.

# Evidence of Global Divide
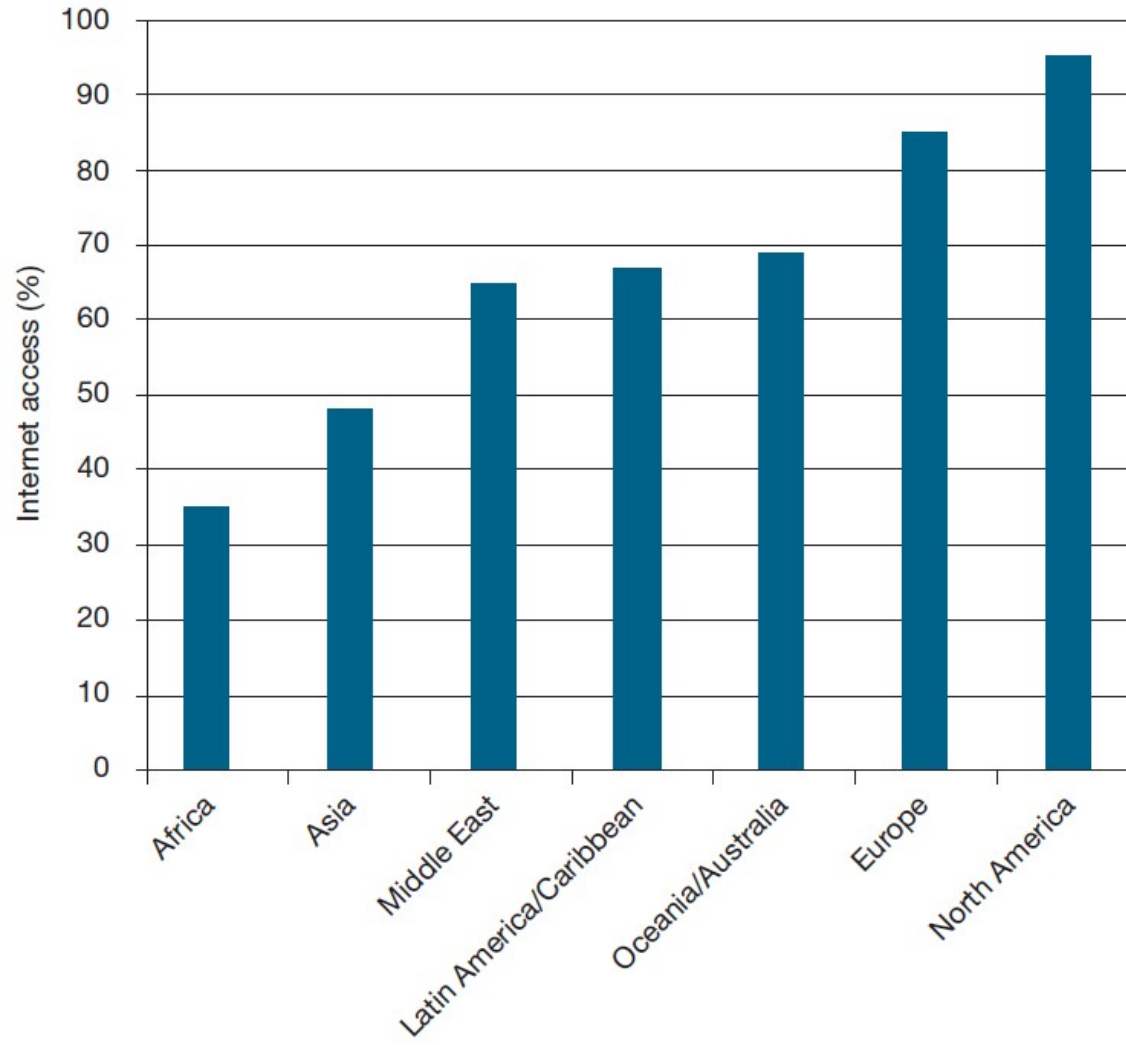


Percentage of people with Internet access, by world region.

# 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
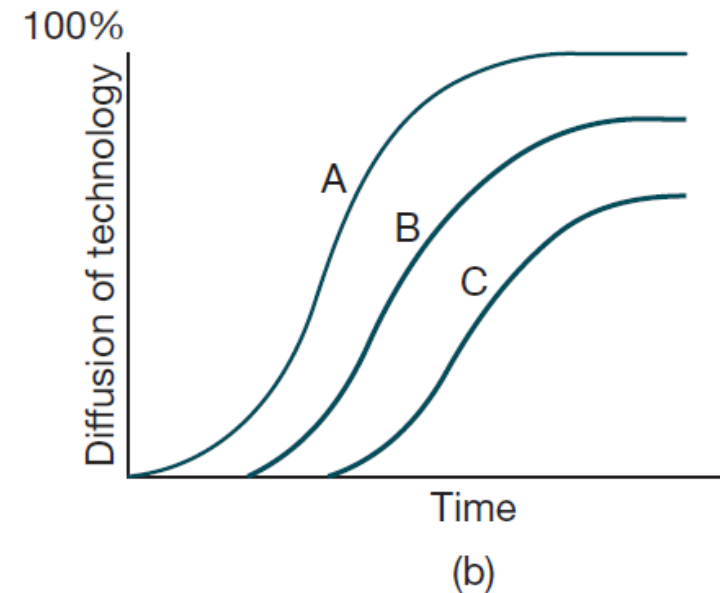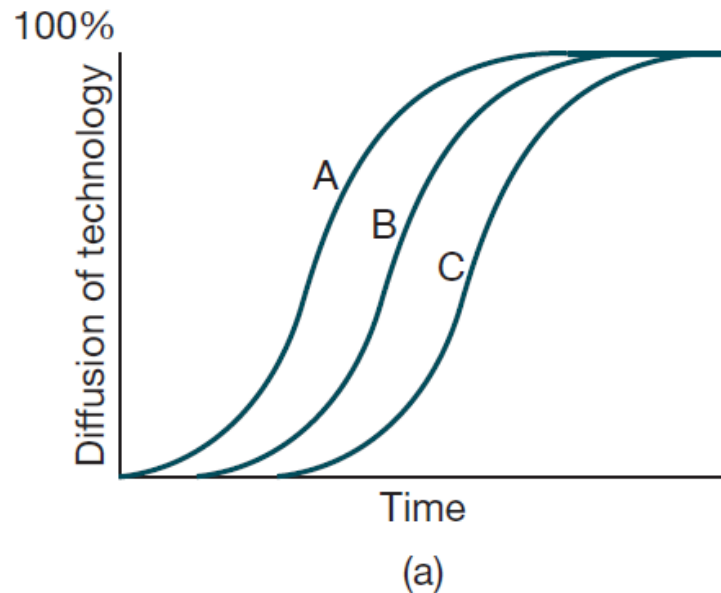


In both models the most advantaged group A is the first to adopt a new technology, while the least advantaged group C is the last to adopt it. (a) In the normalization model, the technology is eventually embraced by nearly everyone in all groups. (b) In the stratification model, the eventual adoption of the technology is lower for less advantaged groups.

# Technological Optimists v Pessimists

- Technological optimists
  - Global adoption of information technology will follow normalization model
  - I T will reduce poverty in developing countries
  - Greater opportunities elsewhere will reduce immigration into U S
- Technological pessimists
  - Adoption of I T will follow the stratification model, leading to a permanent condition of "haves" and "have nots"
  - I T will exacerbate existing inequalities between rich and poor countries and between rich and poor people within each nation
  - Evidence: Gap between rich and poor countries continues to grow

# Critiques of Digital Divide

- Mark Warschauer: 3 reasons why term "digital divide" not helpful
  - Promotes false idea that difference between "haves" and "have nots" is simply matter of access
  - In reality, people are somewhere on continuum, not simply in "haves" category or "have nots" category
  - Does lack of access lead to a less advantaged position in society, or is it actually the other way round?
- Warschauer also notes that the Internet is not the pinnacle of IT development

# Massive Open Online Courses

- Rate of tuition increases at U S universities has exceeded inflation for several decades

- Financing college education increasingly difficult for poorer families

- Free massive open online courses (MOOCs) promoted as a way to make higher education more affordable

- Study by Community College Research Center
  - Students less likely to complete and do well in MOOCs than traditional courses
  - MOOCs widen achievement gap between white and black students and between those with higher G P As and those with lower GPAs

# 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

- Other critics believe companies controlling Internet might favor some content over other content

# Net Neutrality

- 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; e.g., those doing video conferencing willing to pay more than those sending email

- February 2015: Under President Obama, FCC issued the Open Internet Order to preserve net neutrality

- December 2017: Under President Trump, FCC changed course and repealed net neutrality rules; some states introducing legislation to preserve rules

# Summary

- Automation
  - Results in job gains as well as job losses
  - Widespread unemployment has not occurred in countries where it is used the most
  - Will developments in A I change pattern and result in massive job losses?
- Productivity has more than doubled since World War$^{II}$
  - Standard work week roughly the same
  - Has led to an increase in standard of living
- Globalization has impacted the I T sphere, not just manufacturing
- Concept of "digital divide" dividing world into technological "haves" and "have nots" is too simplistic

- Ethics for the Information Age, 8th Edition by Michael J. Quinn (Pearson)
- Ethics and Technology: Ethical Issues in an Age of Information and Communication Technology by Tavani H. T.