**MASENO UNIVERSITY**

**SCHOOL OF COMPUTING & INFORMATICS**

**DEPARTMENT OF INFORMATION TECHNOLOGY**

**CIT 404: IT and Society**

**Module**

Lecturer: Mr. Oteyo Obare

**Course Objectives:**

* To offer an environment for *critical* inquiry in which students are invited to build a new way of understanding these questions.
* To explore information technology and to investigate what is worth knowing about it.
* To complement individuals’ major with the understanding and skills that let them make effective use of the world-wide computing resources and the Internet.
* To discuss impacts of IT on society

Course outline

1. Information: An Introduction
2. Technical background
3. Social and ethical background
4. Privacy
5. Free expression
6. Intellectual property
7. Work, education and culture
8. Risks in it
9. Network structures

Delivery methodology

1. Lectures
2. Active research by students, group discussions and presentations
3. Seminars by people from industry
4. Case studies of impacts of ICT

Assessment

1. Cats 30%
2. Final written examination 70%

## **Table of Contents**

[CHAPTER ONE 6](#_Toc365558832)

[1.0 INTRODUCTION 6](#_Toc365558833)

[1.1 What this course offers 6](#_Toc365558834)

[1.2 What is information technology? 8](#_Toc365558835)

[1.3 Sources of some ideas about society 10](#_Toc365558836)

[CHAPTER REVIEW QUESTION 12](#_Toc365558837)

[CHAPTER TWO 13](#_Toc365558838)

[2.0 TECHNICAL BACKGROUND 13](#_Toc365558839)

[2.1 How IT developed 13](#_Toc365558840)

[2.2 Hardware and operating systems 14](#_Toc365558841)

[2.3 Networked computing and the Internet 15](#_Toc365558842)

[CHAPTER REVIEW QUESTIONS 20](#_Toc365558843)

[CHAPTER THREE 21](#_Toc365558844)

[3.0 SOCIAL AND ETHICAL BACKGROUND 21](#_Toc365558845)

[3.1 Foundations of ethics 21](#_Toc365558846)

[3.2 Informationalism 22](#_Toc365558847)

[3.3 Globalization 24](#_Toc365558848)

[CHAPTER REVIEW QUESTIONS 27](#_Toc365558849)

[CHAPTER FOUR 28](#_Toc365558850)

[4.0 SECURITY AND PRIVACY 28](#_Toc365558851)

[4.1Crime, law enforcement, and IT 28](#_Toc365558852)

[4.2Definitions and theories of privacy 30](#_Toc365558853)

[4.3 Privacy issues raised by IT 32](#_Toc365558854)

[4.4Proposed protections 35](#_Toc365558855)

[CHAPTER REVIEW QUESTIONS 37](#_Toc365558856)

[CHAPTER FIVE 38](#_Toc365558857)

[5.0 FREEDOM OF EXPRESSION 38](#_Toc365558858)

[5.1 Rights of free expression 38](#_Toc365558859)

[5.2 The global information infrastructure and democracy 39](#_Toc365558860)

[5.3 Limits to free expression 41](#_Toc365558861)

[CHAPTER REVIEW QUESTIONS 42](#_Toc365558862)

[CHAPTER SIX 43](#_Toc365558863)

[6.0 INTELLECTUAL PROPERTY AND IT 43](#_Toc365558864)

[6.1 Purpose and limitations 43](#_Toc365558865)

[6.2 Issues raised by IT 45](#_Toc365558866)

[6.3 Software as intellectual property 46](#_Toc365558867)

[6.4 Technical and legal solutions 48](#_Toc365558868)

[Chapter Review Questions 49](#_Toc365558869)

[CHAPTER SEVEN 50](#_Toc365558870)

[7.0 CHANGES IN WORK, EDUCATION, AND CULTURE 50](#_Toc365558871)

[7.1 Economic and work-related effects of IT 50](#_Toc365558872)

[7.2 IT in education 53](#_Toc365558873)

[7.3 Effects on culture 54](#_Toc365558874)

[Chapter Review Questions 55](#_Toc365558875)

[CHAPTER EIGHT 56](#_Toc365558876)

[8.0 RISKS, ETHICS, AND EVALUATION OF IT 56](#_Toc365558877)

[8.1 Humans and IT 56](#_Toc365558878)

[8.2 System and software failure 57](#_Toc365558879)

[8.3 Ethics of IT professionals 59](#_Toc365558880)

[8.4 Future prospects of IT 60](#_Toc365558881)

[Topic Review Questions 62](#_Toc365558882)

[CHAPTER NINE 63](#_Toc365558883)

[9.0 NETWORK STRUCTURES IN THE GLOBAL ECONOMY 63](#_Toc365558884)

[9.1 The network enterprise 63](#_Toc365558885)

[9.2 Society as flows of information 66](#_Toc365558886)

[9.3 Decentralized structures and processes 68](#_Toc365558887)

[Chapter Review Questions 71](#_Toc365558888)

CHAPTER ONE

1.0 INTRODUCTION

**Leaners Objective:**

At the end of this chapter, the learner is expected to:

1. Be capable of defining Information Technology and Society
2. Know the importance of IT on society
3. Identify features of IT
4. Describe evolution of IT
5. Distinctively define sociology, economics, ethics and Law

# 1.1 What this course offers

* As stated earlier, this course seek to create an environment to collaboratively investigate the IT and Society
* We offer
  + some questions for inquiry;
  + some information to support the inquiry;
  + ways to show learning results
  + an invitation to construct your knowledge
* What do you need to know about the ways information technology affects you, as a member of society?

## Discussion

1. Are we too dependent on technology?
2. Can we keep our privacy?
3. How freely can we share songs and videos?
4. How reliable is information technology?
5. How do social networks like Facebook bring us together, and how do they place us at risk?
6. How could information technology change your life for better or worse in the next twenty years?

*What are two instances or results of information technology that you see as*

1. a problem for you personally?
2. a benefit for you personally?
3. a problem for you socially?
4. a benefit for you socially?

## Why study IT and society?

* We all use IT as workers, consumers, citizens, family members, students
* We are all affected by changes in information technology
* Social change drives changes in technology
* Technological change raises ethical and legal issues such as privacy, intellectual property
* What social and technological changes have you seen?
* Is the structure of society changing?

## Catalog course description

*This course explores*

* the impact of computing and information technology on society
* how social factors have shaped the uses of IT

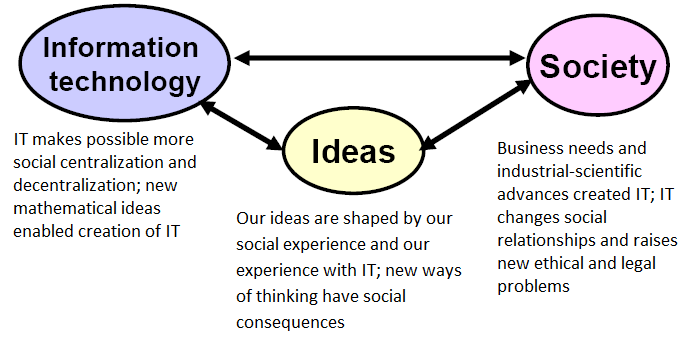
*We will discuss*

* the networked information economy and globalization,
* changes in work life and culture, and
* topics such as free expression, intellectual property, privacy, and security

Perspectives for this course

* Several disciplines are used: computer science, sociology, law, ethics, government, economics, history
* Example: technical factors raise new privacy, free-expression, and intellectual-property issues
* Textbook point of view: IT brings social benefits and problems; trade-offs and ways to solve problems are worth study

## Mutual influences



# 1.2 What is information technology?

We need to ask ourselves these questions:-

* What does IT mean to you?
* What forms of IT do you use every day?
* Is IT about computers only, or does it include some of the study of life?

## Defining IT

Today, information technology is hardware and software that processes or communicates symbolic data in digital form

• *Information* may be defined as data and its meaning

*• Data* takes the form of sequences of symbols

• *Technology:* (innovative) tools

Information technology can also be so said to be;-

* The set of techniques used in information handling and retrieval of information automatically.
* Application of appropriate technologies to the organization, manipulation, and distribution of information by computers and telecommunications
* Digital tools for processing data

*Information technology* (IT) is the study, design, development, implementation, support or maintenance of computer-based information systems.

## Features of IT

* *Relentless changes* and paradigm shifts
* *Ubiquity:* Computation becomes part of every task and device
* *Exponential rise* in computing power
* *Connectivity* of all people and devices
* *Convergence* of media (wireless Internet, cell phones, media players)
* *Interchangeability* of information

There are technical changes which raises social and legal issues when studying IT and Society. Our concerns are both the technical developments and the social results

Examples:

* Ease of copying and communicating data raises issues of file sharing
* Social networking enabled young people in the Mideast to change their countries

## Example of effect of technical change: Intellectual property

*Changes:*

* Enhancement of storage media
* Regularity of storage standards
* Speed of digital transmission
* Interoperability of media

*Key technical facts:* the nature of intellectual objects differs from that of physical ones, and digital media can store any intellectual object

## The malleability of information

* Computer technology has enabled malleability of information; the ability of all to reshape it
* This creates new possibilities for human activity
* The information revolution is not only technological but social and ethical
* Thesis: “Many new activities made possible by the new technology are so different from the previous ways of doing things that we need a new set of rules of the game’.” (Baase, p. 26)

# 1.3 Sources of some ideas about society

We need to ask ourselves the following questions

* What does “society” mean to you?
* How are resources distributed?
* What is good?
* What good behaviors so we want to make compulsory?
* How are compulsory rules decided?
* Can we learn from the past?

## Related disciplines

* Sociology
* Economics
* Ethics
* Law
* Government
* History

### Sociology

* “The scientific study of human social relations or group life…. Sociologists examine the ways in which social structures and institutions – such as class, family, community and power – and social problems – such as crime and abuse – influence society” (Encarta, 2005)
* Social interaction: “the response of individuals to each other”

#### What is society?

What is your answer?

Distinguish from:

* Groups
* Communities
* Organizations
* Systems
* Countries

### Economics

* A social science concerned with choices about scarce resources
* Microeconomics studies individual decision making
* Macroeconomics studies global phenomena such as growth, inflation, unemployment

### Ethics

* A branch of philosophy concerned with *standards* for right and wrong human actions
* *Philosophy:* the critical examination of foundations for beliefs and action
* Theories of ethics:

–Consequentialism (actions’ values depend on results)

–Deontological ethics (actions have intrinsic moral qualities)

#### The Internet has created new ethical challenges

* *Globalization*, enabled by IT, has changed economic relationships
* *Communication* is instant, cheaper, is worldwide in scope
* *Environment* is interactive
* The Internet enables *anonymous* communication
* New ways exist to reproduce information

#### Is IT value neutral?

* If IT were seen as value neutral, it would be considered just an instrument of values, such as order, freedom, or the quest for knowledge
* Some people view IT is enabling human freedom by giving more people access to each other and to expressing themselves
* Some view IT as enabling corporate or governmental power by placing communication resources at their disposal

### Law

* Concerned with the mandatory practices and rules of conduct in a community
* Varieties:

–Criminal

–Civil

–Constitutional

–Procedural

* *Our interest:* What laws do changes in IT make necessary?

### Political science (government)

* A social science that studies government, states, and related decision making
* *Origins of the field:* Plato, Aristotle, Saint-Simon, Comte
* Contributors to U.S. ideas: J. Locke, T. Hobbes, T. Jefferson
* Our interest: What are appropriate government policies concerning IT?

### History

* The study of the past and of changes that have occurred
* Our perspective: we are studying, in part, changes that occur in society under the influence of technological change.
* Questions:

–How has IT changed society in the past 40 years?

–How did previous technological revolutions change society?

CHAPTER REVIEW QUESTION

1. What is information technology
2. List and explain six features of Information Technology
3. Distinguish from:
   1. Groups
   2. Communities
   3. Organizations
   4. Systems
   5. Countries
4. What do you understand by the term Intellectual property?

CHAPTER TWO

2.0 TECHNICAL BACKGROUND

## Learner objectives

By the end of this chapter a learner should

1. Be able to explain basic principles of computing, including hardware, systems, applications, networking, and the Internet
2. Know what cybernetics is.
3. Identify factors affecting the growth of IT on society
4. Describe network structures and functionalities

# 2.1 How IT developed

The following questions should guide us in this topic of discussion

* What is technology?
* What is a revolution?
* Why are computers so widespread today?
* How have they evolved?

To discuss how IT has developed, we need to know the stages of technology. Stages of technology can be stated as;

* *Extending human power*: spear, lever, telescope, radio
* *Autonomous and modeled on natural processes*: e.g., clock, creating a new reality for users, replacing direct experience (e.g., hunger) with abstract signals
* *Information processing*: a new kind of autonomous technology that operates on and transmits information instead of power

## Electronics and the IT revolution

* *Telephone:* 1876; radio: 1898
* *Vacuum tube:* 1906; *transistor:* 1947
* *Semiconductor technology* uses the principlethat voltage above a certain threshold will be conducted (switch that switches a switch)
* *Silicon transistor:* 1954; integrated circuit:1957
* 1959-1962: price of semiconductors fell 85%
* 1962-1971: price of semiconductors fell 98%
* *Microprocessor:* 1971

## Cybernetics

*Definition:* the study of feedback-driven systems (Norbert Wiener, 1948)

* Word origin: *kyber*, person at helm of boat
* Cybernetics relates to *interaction*; much of computing is interaction
* *Cybertechnology*is computertechnology

## Development of cybertechnology

*Phases:*

1. (1950s-1960s) Stand-alone mainframes.
2. (1970s-1980s) Convergence of computers and communications as networks
3. (1990s-2000s) Internet; convergence of text, video, sound on the Web.
4. (2000s) Ubiquity of computing, computers as part of who we are

## Changes driving the IT revolution

* *Software:* advances have included desktopapplications with graphical interfaces; interactive browser-based apps and services; Web 2.0
* *Hardware:* high-speed processors and Internetservice; massive memory and storage; general-purpose computing on cell phones; communications standards

Universal interchangeability of information, made possible by standards of storage and communication

# 2.2 Hardware and operating systems

Hardware and operating systems are not new terms to us, when discussing this sub topic we need to ask ourselves the following questions:

* How do computers work?
* What’s the difference between hardware and software?
* What kinds of software exist?

## Kinds of hardware

* *Computers* (including mobile phones)
* *Output* devices (printers, monitors)
* *Input* devices (mouse, keyboard, scanner)
* *Storage* devices (hard disks, DVDs, flash drives)
* Network and Internet gear (modems, routers, transmission media

NB: Access to storage is sequential or random

## Operating systems

* *Examples*: Windows, UNIX, Mac OS
* Run all the time, providing services to users and apps
* Manage primary storage (RAM)
* Provide graphical user interface (GUI)
* Support secondary storage through file system
* Support multitasking (execution of multiple programs concurrently)

Support networking (interactions among computers)

# 2.3 Networked computing and the Internet

* What is a network?
* What is the network of all networks?
* Does the networked character of computing today accelerate the rate of change in computing and in society?

## Distributed computing

* Uses physically separated processors; networks implement distributed computing
* Much of the benefit of computing is in being connected with other users and with shared resources
* The speed and connectivity enabled by networking have major social implications

## Networked computing

* A *network* is a set of computers configured to share data and other resources
* Special system software and communication hardware enable networking
* *Standards* are required for computers to communicate and work together
* A server is a computer on a network that responds to user (client) requests for data, in *client/server computing*
* The Internet is a worldwide network of networks

## Data communication

* *Synchronous* communication requires waiting turns; e.g., telephone conversations
* In *asynchronous* communications a sender may send at any time; e.g., email
* All data is communicated in *packets*
* *Bandwidth* is speed of transmission, in herz (approximately, bits per second)

## Client/server computing

* Client initiates all actions, server responds
* Examples: browser is client, web-site host is server serving HTML files; email uses server
* No continuous connection, just requests/responses
* Some web pages are generated specifically for one transaction, e.g., flight reservations

## The Internet

* A worldwide network of networks that links almost all computing devices worldwide
* A network of networks, originated in 1960s as a decentralized military communications system invulnerable to nuclear attack
* Users connect to Internet via Internet Service Providers (ISPs)
* Is basis for a universal global infrastructure based on fiber optics and digital transmission

## Internet standards

* *Agreed standards* enable exchange of data
* URL: Uniform Resource Locator; components: protocol, server, pathname
* *Internet Protocol*: Defines “IP address” format
* TCP/IP: Transfer Control Protocol/IP; provides standard packet format for all data communication, defined, 1978
* Modem invented for PCs, 1978
* The Internet has a physical infrastructure and has governing bodies to make decisions

## Internet history

* Developed by Defense Advanced Research Projects Agency, DARPA, as a decentralized solution to danger of a disruption of military communication in case of nuclear war
* Mosaic (later, Netscape) browser, mid-1990s, enabled millions to use the Internet easily
* Web 2.0, 21st century, expressed the ability to use the Web interactively

## The World Wide Web

* World Wide Web: An abstract information space within the Internet
* HTTP: Hypertext Transfer Protocol, governs retrieval of web sites by users
* URL (Uniform Resource Locator)
  + the address of a web page
  + components: protocol, server, pathname (http://www.framingham.edu/~dkeil)
* HTML (Hypertext Markup Language) enables nonlinear, formatted documents

## How the World Wide Web works

* Servers host web pages, send data in HTML format to users
* Web pages use hypertext concept, with dynam-ic links that make requests for other web pages
* Clients access Web servers via browsers, accessing the Internet via Internet service providers (ISPs)
* Domain name servers convert domain names (e.g., cnn.com) to IP addresses

## Cell-phone technology

* Cell phones are IT, have processor, run apps, but are not general-purpose computers
* A cell is a geographic area with a tower and with transmit/receive hardware
* Voice sound (analog data) is converted to digital form by a chip
* Digital signal processor compresses bits to be transmitted in packets via radio waves, decompresses at receiving end for conversion to sound

## Internet phones

* IPhone (for Apple software) and Droid (open-source software) are mobile devices, or specs for them, that communicate and run downloaded programs (apps)
* Internet access is becoming generally available now via cell-phone technology
* Packets travel via radio waves from cell towers in this technology; computers use cables and wireless routers

## Web 2.0 (interactive Web)

* Social networks (Facebook, MySpace): Web sites that enable users to post “profile” info about themselves and to connect to “friends”
* Instant Messaging: Real-time text conversations
* Podcasts: Subscribers receive text, audio, or video files from providers as they are produced
* Blogs: public personal journals with support for user response
* Wikis: Web documents editable by multiple users as a collaboration tool

### Overview of Web 2.0

* Background: world wide web began as static linked pages
* Web 2.0 features interactive apps that rely on the user to make the sites more attractive to new users
* Examples: Facebook (social network), Flickr (photo sharing), YouTube (video sharing), Wikipedia (collaborative encyclopedia), Gmail (browser-based email with IM)

## User-generated content

* Social media sites: enable sharing information, opinion, entertainment
* Democratic journalism: news stories voted on by participants; e.g., Digg, Newsline
* Blogs: usually immediate, unedited reactions by non-journalists
* Wikipedia: 1.7 million articles (‘07), 600 million words (vs. Encyclopedia Britannica, 40 million words), anonymous writers, any article editable by anyone

## Features of Web 2.0

* Factors in development of Web 2.0:
  + Universal broadband connectivity
  + Mobile phones with Internet access
  + Web-based apps that run within browser
  + Readiness of users to contribute content; e.g., digital photos and video
* “A culture of participation”
* Mobile-phone apps and standard interfaces (Droid, Iphone)

## Web 2.0: features not seen before

* Increasing richness of interaction
* Interactive blogs (vs. one-way communication)
* Video sharing (vs. broadcasting)
* Wikis (vs. centrally edited publication)
* Social networks (Facebook, MySpace, LinkedIn)
* Web 1.0: Downloading information, hyperlinking, E business

## Examples of Web 2.0

* Social networks (Facebook, MySpace): Web sites that enable users to post “profile” info about themselves and to connect to “friends”
* Instant Messaging: Real-time text conversations
* Podcasts: Subscribers receive text, audio, or video files from providers as they are produced
* Blogs: public personal journals
* Wikis: Web documents editable by multiple users as a collaboration tool

## Twitter

* A Twitter user may send a broadcast (tweet) to all the user’s followers
* Followers choose who they follow
* Followers are known to senders
* Tweets may be forwarded
* Is follower relationship public information?

## Collaborative tools

* Wikipedia, Wiktionary, wikis
* Blogs
* Open Directory Project
* Free Software Foundation
* Webcams monitored by volunteers
* Crime reporting to other community residents to enlist volunteers
* Track Changes (MS Word)

## Cloud computing

* *Definition:* use of remote applications, services, and storage hosted by specialized data centers
* Basis: availability of mass storage in data centers, accessed via high-speed Internet
* *Advantages:* businesses are freed of the need to manage their own data centers
* *Data center:* a location for mass storage on servers
* Annual projected 2014 usage of cloud: $55B

## Cookies

* A cookie is a file that a browser allows a web site to leave on the computer of a visitor to the web site
* Browsers also allow web sites to request and receive cookies previously left on visitor’s computers
* Example: an E business site may leave a cookie at a user’s site that enables the site to give better informed service to the user on a later visit

## Effects of the Internet

* Everyone is potentially connected
* Everyone has access to vast information and culture
* Anyone can format information, process images, collect documents and media, publish information, calculate numeric results, search databases
* At risk: privacy, freedom of information, intellectual property, freedom to share

## Free Internet-based services

* *Social networking*: Unexpected uses have been political campaigns, product marketing
* *Web-based email*: Advantages includes access to email and archive from any Internet client machine
* *Search engines*: Priority of a site in the provider’s index decides site’s visibility
* *Payment for free services*: Advertising; donations or payment by a few big users

## Features of network communication with effects on society

* Scope (vastness of reach; interactivity)
* Speed (giving immediacy and access)
* Anonymity (implying diminished trust)
* Reproducibility (enables harassment and violation of privacy)
* Many-to-many communication (for first time in history)

CHAPTER REVIEW QUESTIONS

1. Describe how computing has evolved
2. Identify some basic principles of computer hardware and operating systems
3. Explain some concepts of networked and Internet computing
4. Explain some concepts of major office applications

CHAPTER THREE

3.0 SOCIAL AND ETHICAL BACKGROUND

## Learner objectives

By the end of this chapter a learner should

1. Be able to explain social factors that have driven the information revolution, technological factors that have generated social issues, and relevant theories of ethics.
2. Differentiate between world and global economy
3. Identify features of globalization and informationalism

# 3.1 Foundations of ethics

* How do you think about what is the right way to behave?
* How do we allocate ethical importance to individual and to society?
* What are your rights?

## Ethics

* Addresses principles that guide decision making: “How should I behave?”
* *Assumption:* people make free rational decisions
* Principles espoused by some ethicists:
  + *Nonmaleficence*: do no harm intentionally or not
  + *Beneficence*: obligation to help others
  + *Justice:* treat people fairly, treat like alike in compensation or distribution
  + *Autonomy*: respect decisions of rational beings

## Ethical theory: Utilitarianism

Also known as consequentialism, this is to act in a most useful way to give maximum benefit to greatest number of people for instance when you lie to a predator who is pursuing a victim

The deontological theory of ethics follow rules that can universally apply to everyone for example “Do unto others,” “Thou shalt not…” express a similar idea. They are duty-driven, regardless of circumstances and consequences.

## Theories of rights

This includes:

* *Liberal individualism*: this is where each individual has rights to life, health, freedom, property etc.
* Natural-rights theory
* *Communitarianism* which places social needs first
* Underpinnings of ideas about rights and freedoms such as;-

–Life; property

–Autonomy and rationality

## Rights, goals, laws

* Rights (*Liberties* and *claim rights*) define philosophical frameworks for ethical responsibilities in relation to others
* *Goals* (e.g., profit maximization) may be ethical, but ethical constraints may also apply to actions pursuing these goals
* *Laws* may enforce ethical principles (e.g., against stealing) or may establish conventions (e.g., driving on the right)

**Liberties** are negative rights, in most case they;-

* Imply that no one may prevent a person from acting
* Limit the power of the state
* *Examples*: freedom of speech, from unreasonable search, from arbitrary confiscation of property, to copy public-domain texts or for fair use

**Claim rights** are positive rights which

* Imply an obligation by others to provide something
* Examples: access to clean air, water, education, paved streets, firefighting, equal protection of law

# 3.2 Informationalism

* When discussing informationalism we need to ask ourselves the following questions;-
* What are the effects of universal connected-ness, ubiquity of computing, and the speed and low cost of processing, storage, copying, and communication of information?
* Does today’s IT embody values from the social environment; or is it neutral and value free?
* Does information technology, acting on itself, accelerate the rate of social change?

## The informationalist era

* Informationalism is a mode of development that has replaced industrialism, according to M. Castells.
* Technology enables social actors; social actors use technology to pursue their interests.
* State can be a leading force in technology, or can cause stagnation if it defaults.
* Current technological revolution took place in, and to enable, a restructuring of capitalism

**Network society:** A new social structure associated with emergence of the informationalist mode of development is considered as theoretical foundation of informationalism.

**Theoretical framework** of informationalism according to M. Castells includes;-

* Production: Action by humans on nature for consumption and accumulation
* Experience: Action by humans on selves, interacting with nature and other humans
* Power: Forcible imposition of will by human on others, based on production and experience

NB: Production is associated with class relationships, experience is associated with gender and power is associated with the state

## Knowledge and information

* *Knowledge*: organized statements presenting judgment or experience.
* *Information:* “data that have been organized then communicated”
* What is crucial today is not the central role of knowledge and information, but the feedback effect, applying knowledge to the process of knowledge generation

## Modes of production

Modes of production includes;-

* *Slavery* is ownership of humans by humans
* *Feudalism* binds producers to land and lord
* *Capitalism*

This is a private ownership means of production where owners appropriate surplus as profit and it follows market principle

* *Statism* places control in hands of the state; Soviet statism failed to adopt informationalism

NB: Capitalism is driven by profit maximization,statism by power maximization Capitalism and statism are modes of production while Industrialism and informationalism are modes of development

Modes of development

Modes of development are technological arrangements used in production

* Agrarian
* Industrial
* Informational

Modes of development specific to industrialism includes use of energy and action of machines on machines while those specific to informationalism are action of knowledge on knowledge .

## Industrialism and informationalism

* *Informational* mode of development is distinguished by action of knowledge on knowledge as primary source of productivity
* *Industrialism* aims at economic growth, informationalism at technical development
* From informationalism we can expect new forms of social interaction, change, and control

# 3.3 Globalization

In this section, we need to ask ourselves the following questions

* Has IT enabled a global economy?
* Have IT and globalization decreased or increased social polarization?
* Is the world “flat” and is that good?
* Does the connectedness of all people via IT raise social issues and enable changes in society?
* Why did an economic crash come in 2008?

## Features of globalization

Globalization is the creation of a single world market that operates in real time

- It is a kind of economy (not culture)

- It is enabled by IT in the form of communications technology

## ‘The world is flat’

* Technologies have changed the rules of the game in the world market
* Innovation and ability to adapt quickly are conditions of business success
* Thomas Friedman argued that globalization “flattens” the world economy
* Key elements in flattening are information technologies that enable new kinds of collaboration even at distances

## Eras of globalization

* 1492-1800: countries globalized
* 1820-2000: companies globalized
* 2000- : individuals and small groups became globalized dynamic agents
* In the current era
  + The “flatteners” (technical enablers) converge
  + Horizontal connections replace vertical control, changing all habits
  + 3 billion people from the East have joined the flattening process

## Enablers of globalization

* Windows was introduced as graphics standard
* *Communication standards* enabled interoper-ability, e.g., Netscape Internet browser, 1995
* Standards to support workflow appeared in the 1990s
* *Outsourcing* (companies purchasing components rather than producing them)
* *Offshoring:* companies moving production to other countries
* *Open source software* (Linux, Firefox, Apache)
* *Supply chaining*: sending orders to factory at time of a sale
* *Insourcing*: outsourcing internal logistics
* *Search engines* linked users with sites worldwide
* *Speedup technologies*: voice-over Internet and wireless

## The dot-com bubble of 1990s

* Netscape web browser (1995) triggered explosion in Internet use
* Popular wish to connect overcame technical obstacles
* Massive overinvestment in Internet start-ups
* Massive overdevelopment of fiber optic infrastructure
* Results: financial losses but a strong broadband Internet infrastructure

## Flattening elements

* *Outsourcing:* when a firm pays another firm to perform a function once performed in-house
* *Offshoring:* when a firm moves a factory to another country
* Both outsourcing and offshoring offer lower labor and tax costs
* Both advance globalization

## Supply chaining

* “A method of collaborating horizontally – among suppliers, retailers, and customers – to create value”
* Enabled by and enables flattening of the world economy
* Forces adoption of standards, removes frictions and borders, spreads efficiency from company to company
* Example: point-of-sale date goes from retailer to factory for resupplying

## Workflow software

* IT enables tasks for a project to be distributed across the world and later reassembled
* This requires interoperability of systems in all locations
* Interoperability is supported by standards – e.g., protocols, languages (HTML, XML)
* Distribution and reassembly of work is supported by workflow software

## A globalized economy

*Definition:* “an economy with the capability to work as a unit in real time ... on a planetary scale”

It is not the same as world economy which has existed since 16th century.

*Examples of global aspects*: financial markets, international trade, transnational production

## Pros and cons of flattening

* What is the effect of competition from Chinese and Indian industries for people in the most-industrialized countries?
* Argument by Friedman: “The higher [China and India] climb, the more room is created at the top” [for U.S. products and services]

CHAPTER REVIEW QUESTIONS

1. Contrast two concepts of ethics or rights
2. Explain economic and political origins of informationalism
3. Discuss how information technology has contributed to a globalized economy

CHAPTER FOUR

4.0 SECURITY AND PRIVACY

## Learner objectives

At the end of this chapter the learner should

1. Be able to explain security and privacy issues raised by IT, referring to values, theories, and solutions
2. Define computer crime and privacy.
3. Identify privacy issues raised by IT
4. Compare and contrast communitarianism and liberalistic

# Crime, law enforcement, and IT

* What are laws for?
* To protect public safety, do governments need to monitor all electronic communications?
* Does IT enable crime or law enforcement more?

## Crime and the Internet

* Some crime is computer assisted or targets computer use
* Computers assist in law enforcement
* Law enforcement methods:
* Interviews
* Gathering of physical evidence including search and seizure (requires consent or a court order)
* Surveillance (may not require a court order)

## Financial computer crime

* *Identity theft:* Identifying information is used by thieves to set up false accounts
* *Credit-card fraud:* Card number and ID information are stolen and used to activate card use
* *Stock fraud:* Fraudulently touting stocks one is selling, undervaluing stocks one is buying

## Other computer-enabled crimes

* *Auction fraud:* Shill bidding, failure to ship, sale of illegal items
* *Click fraud:* Padding figures for clicks received under pay-per-click advertising
* *Digital forgery:* Using high-quality printers to forge documents

## Malicious Internet activity

*Intrusion* (sometimes called “hacking”): Intruders may read or change files, including Web sites, after guessing passwords or obtaining them by deception

*Worms:* self-starting programs that harmfully affected Internet computers

*Email and other viruses:* self-propagating programs that have done billions of dollars in damage

*Denial of service attack:* Huge numbers of requests for web pages that overwhelm a server

## Malware

* *Virus* replicates self from file to file
* *Trojan horse* disguises self as a useful application
* *Worm* replicates from computer to computer
* *Botnets* are sets of computers (zombies) controlled remotely in background
* *Email address spoofing:* Email return addresses are not necessarily genuine, can deceive users into infecting their computers

## Phishing

* Seeking user names, passwords, credit card info, or money by posing as a trusted contact
* May pretend to be from popular social media, online payment processors or IT administrators
* May contain links to websites that are infected with malware
* Often uses spoofing of e-mail addresses, often asks users to enter details at a false website

## Sexting

* *Definition:* texting, emailing, or posting of sexual self-expression (text, sound, pictures, or videos)
* Sexting of images of *minors* is treated by law enforcement agencies as manufacture, possession, and dissemination of child pornography
* Sexting by adults raises questions of privacy, integrity of relationships, and professionalism

## Enforcement approaches

* Computer Fraud and Abuse Act, 1986: Addressed intrusion, viruses, denial of service
* USA PATRIOT Act increased penalties, broadened definition of terrorist acts, allowed government monitoring without court order
* Cybercrime Treaty (U.S. and Council of Europe, 2006): law-enforcement cooperation; dual criminality (only acts that are crimes in both countries are covered)

# Definitions and theories of privacy

* + - What’s privacy?
    - Is privacy about power?
    - Do privacy safeguards protect the power of individuals?

## Privacy-related concerns

* Freedom from intrusion
* Control of access to information
* Freedom from unreasonable surveillance

## Aspects of privacy

* *Solitude:* Freedom from disturbance, within reason
* *Anonymity:* Acting publicly without being identified
* *Intimacy:* Private association with others
* *Reserve:* Control of access to personal information
* *Other concerns:* Privacy in different environments; privacy of location; of body, of communication

## Two definitions of privacy

* *Control theory* (Fried; Rachels):

One has privacy if one has control of information about oneself

* *Restricted access theory* (Allen; Gavison):

One has privacy if access to information about oneself is restricted

## Theories of privacy

* All-or-nothing (have/don’t have)
* Repository of information that can be eroded
* Zone that can be invaded
* Confidentiality or trust
* “Being left alone” (Warren and Branden, 1890)

## Privacy in the public realm

* Privacy is seen as protecting integrity of an individual’s personal sphere
* U.S. Constitution prohibits unreasonable search and seizure, self-incrimination; protects freedom of conscience
* Lotus Marketplace: Households was a CDROM with 120 million records of U.S. households, including spending habits
* Outcry about LM:H showed gap created by IT between legal-philosophical theory and moral norms about privacy

## Communitarian vs. liberalistic ideas about privacy

* *Communitarianism* tends to reject moral right to privacy, accepts greater access to personal data by society: “What do you have to hide?”
* *Liberalistic* view elevates the autonomous self: “Leave me alone”

## Free market vs. consumer protection

* Both approaches value privacy, prefer different means to ensure it
* Free-market view emphasizes freedom of individuals to make voluntary agreements and responsiveness of the market; as opposed to political guarantees
* Consumer-protection view emphasizes weak position of consumers relative to vendors: Can an individual realistically negotiate a fair contract with a corporation?

## Search and seizure of electronic data

* Search requires warrant with specifics
* Seizure of evidence not related to warrant is allowed only if “in plain view”
* What is “plain view” on a laptop?
* Automated search is a grey area

## Search and seizure of electronic devices

* Based on court warrant, law enforcement may seize all electronic devices in a place known to contain evidence of crime
* Example: child-porn images.
* Seizure may be for search and deletion
* To ensure deletion of content, law enforcement may wipe clean disks or may destroy media

## Privacy landmarks

* 1928: Supreme Court decision allowing wiretapping because it involved search and seizure of conversations, not material things
* 1936: Creation of Social Security numbers, expanded later to be taxpayer IDs and for other uses
* 1974: Privacy Act requiring that federal government records be “relevant and necessary” to designated purposes, accessible and corrected by subjects, requiring consent for disclosure
* 2001: USA PATRIOT Act loosening restrictions on National Security Letters (for warrantless searches)

## Two unusual views of privacy

* (Brandeis, Warren, 1890): Privacy needs special protection; people have a right to legal protection from disclosure of any strictly personal information in print, including gossip
* (Thomson, 1975): Privacy as such does not require protection, because objectionable violations of privacy are also violations of already-protected rights

# 4.3 Privacy issues raised by IT

* Do IT-enabled security and privacy intrusions assert power over individuals?
* Is the free-market or the consumer-protection view preferable?

## Why issues are raised

* Ease, cost, speed of
  + copying
  + communication
  + collecting data
* Power of processing data
* Storage capacity
* New capabilities for data collection

## Concerns

*Protection of data*

* about a person
* owned by a person

*Data*

* collection
* integrity
* access
* protection

### RFID tags

* Small devices with an electronic chip and an antenna, including ID data in the form of a radio frequency
* Used to track individual products through manufacturing process; could track locations of individuals
* Easily readable and copiable
* Government has had plans to use this technology in ID documents such as passports

## Workplace surveillance and privacy

* Electronic Communications Privacy Act, 1986, expanded prohibitions on unauthorized surveillance
* Exception: monitoring permitted of communications in ordinary course of business, e.g., company email
* Asymmetry of employer-employee power is an issue
* Two viewpoints about workplace privacy begin from (a) fairness; (b) utilitarianism

## Issues in use of consumer data

* Customer knowledge of data collection
* Customer knowledge of profiling
* Secondary use
* Opt-in or opt-out
* Accuracy
* Use by law enforcement
* Loss (leakage) by possessor
* Large quantities of small information items can reveal more when

## Effect of data collection on privacy

* Online data is collected and linked by computers
* User is often uninformed of collection
* “Secure” data may be leaked
* Re-identification of “anonymous” data is possible, e.g., queries about one’s car make, college, etc.
* Data online is copied and re-published even if removed
* Data provided for one purpose is often used for other purposes

## Data collection

* *Secondary use:* Use of personal information for purposes other than those for which the user provided it
* *Computer matching:* Comparing and combining information from different databases, using identifying information
* *Data mining:* Analyzing and searching databases to find patterns and to support decisions
* *Computer profiling:* Predicting behavior of individual based on data analysis

## Opt-in or opt-out?

* How data (e.g., customer information) is used is set by an organization’s privacy policy
* An Opt-in policy means that before data collected about a person is distributed, the person must affirmatively choose that option
* An Opt-out policy means that a person will participate unless she/he chooses not to

### Knowledge discovery and data mining

This constitutes 3 phases: warehousing, mining, interpretation

* *Goal*: discovery of unforeseen patterns
* *Profiling* defines groups of people, with effects on how they are treated
* *Categorical privacy:* a right of individuals not to be profiled as group members based on personal data

## Who owns the information about a transaction?

* Is a transaction a fact about one party, or both?
* Do both parties have the right to make the transaction public or otherwise share information about it?
* Do both parties have the right to expect non-disclosure?
* Do one customer and a large corporation confront each other in a transaction as equals? Free-market view says yes; consumer-protection view says no

# 4.4 Proposed protections

We need to ask ourselves the following:

* Are current technical and legal solutions to security and privacy concerns adequate to address the problems?
* How may individual privacy be protected during legitimate criminal investigations?

## Processing of personal data

Some provisions of a 1995 directive of the European Parliament:

* Data quality should be high
* Legitimacy of purpose
* Use for intended purpose
* No processing of “sensitive” data (ethnic, political, religious, trade-union affiliations)
* Right of object to be informed and to correct errors

## European actions on right to privacy

* European Conference for Protection of Human Rights and Fundamental Freedoms, 1950: Respect for private and family life, home, correspondence
* European Commission of Human Rights, 1976: right to respect for private life is right to privacy requiring legal protection
* OECD data flows guidelines, 1980: 8 principles
* OECD Ministerial Declaration on the Protection of Privacy, 1998

## Preventing computer crime

* Firewall software monitors incoming communications to filter out suspicious packets
* Credit-card numbers are not printed in full on receipts; only last 4 digits
* Third-party services like PayPal protect credit-card info from untrusted vendors
* Other methods:
  + Not storing unnecessary data
  + Encryption
  + Biometrics
  + Authentication of customer ID

## Firewalls

* Most users wish to be clients (obtaining data from servers) but not servers (providing data)
* Purpose of firewalls is to block unwanted outside access to computers via the Internet
* Firewall packet filtering may block outside access to, e.g., logical Port 21 (FTP port)
* Network address translation (NAT) by firewalls assigns workstations IP addresses known only within the network

## Encryption

* Hides data in plain view
* Example: Credit-card numbers may be transformed over Web to be unreadable except by intended recipient
* A key (similar to a password) is used to decrypt an encrypted message
* One application: Digital signatures authenticate the act of accepting an agreement
* Encryption and decryption are performed with algorithms developed using math theorems

## Security and encryption

* Secure web sites are password-protected
* Secure connections are those that encrypt the data communicated; protocol is https
* Encryption transforms a message into a difficult-to-read text; decryption transforms encrypted text to readable form
* Encryption/decryption use algorithms and a private key; some algorithms also permit a public key
* Strong encryption is hard to “break”
* Public keys enable client browsers to encrypt messages for sending securely to recipients

## Surveillance of encrypted communication

* Secure encryption requires access to a key (similar to a password)
* In 1990s, government promoted encryption methods with “back door” that government could use to decrypt communications
* This issue seems gone from the news
* Intercept people’s storage or communication of key?

## Litigation

* Responsibility to prevent access: A legal principle that requires publishers to ensure that material that is illegal in some countries is inaccessible there
* Are libel cases to be tried in country where information is published, or in country where damage is done?
* Authority to prevent entry: A country may act to block material that is illegal in that country, but not to block material that is illegal somewhere else

## Wire tapping issue

* Law-enforcement officials asked Congress to require that all communications-enabling services be able to intercept communications content for surveillance purposes.

(Sept. 2010 news article, “US wants stronger wiretap powers over Web”)

* Critics said that the proposal put in question fundamental aspects of Internet use.

## The Petraeus case

* Story of U.S. CIA director’s extramarital affair broke in November, 2012
* FBI investigated a complaint of harassing or threatening emails
* Private behavior of Petraeus and a top general were revealed, leading to a resignation
* Q: Who is reading whose private emails today?

CHAPTER REVIEW QUESTIONS

1. Explain issues raised by IT related to security and crime
2. Discuss privacy in a theoretical context
3. Explain how IT raises new issues of privacy
4. Describe proposed protections for privacy

CHAPTER FIVE

5.0 FREEDOM OF EXPRESSION

## Learner objectives

1. To discuss trade-offs between conflicting legitimate concerns about freedom of expression generated by technological changes
2. Distinguish between liberties and claim rights
3. Define and discuss censorship
4. How rights enhances the computer crime activities
5. To understand global information infrastructure and democracy

# 5.1 Rights of free expression

* What is freedom of expression, for you?
* What rights of expression does the U.S. Constitution assure?
* What are human rights?

## Liberties and claim rights

* Liberties are negative rights that restrict the powers of government; e.g., to restrict speech
* International law and the U.S. Constitution protect the right of free political and religious expression
* Free expression has no meaning if government or others harm persons for expressions of opinion, religion, philosophy, or esthetics
* Hence free expression entails a claim right that government prevent violations of human rights

## Human rights

* The Universal Declaration of Human Rights was adopted in December 1948 by U.N. General Assembly
* Excerpts:

–“All human beings are born free and equal in dignity and rights.”

–“Everyone has the right to freedom of opinion and expression … through any media and regardless of frontiers.”

## Censorship

* *Definition:* “Act of changing or suppressing speech or writing that is condemned as subversive of the common good”
* 1999, two French groups sued Yahoo because its U.S. based auction site listed Nazi artifact; French government brought criminal charges
* China, Saudi Arabia, Pakistan, Burma, Singapore, Egypt, Turkey, Thailand have restricted Internet use for political reasons

## Broadcasting and free expression

* Government licenses and regulates radio/TV broadcasting, because frequencies available are limited
* “Fairness doctrine” said that broadcasters must allocate time for alternate views
* What about cable?
* Internet broadcasting entails less regulation

### Freedom-of-expression issues

* Changes in IT raise dilemmas due to
* Widespread access to sending or receiving
* Easy copying
* Faster communication
* Anonymity
* Questions:
* Is Internet more like TV broadcasting or like print publishing?
* Is a link equivalent to publishing?
* Is a chat room a public place?

# 5.2 The global information infrastructure and democracy

* + Do computer systems widen freedom of expression, or limit and constrain it?
  + Does the global information infrastructure embody democratic values?

## Global information infrastructure

* + GII: Computer and telecommunications technology, together with resources that support the Internet
  + Telcom lines can connect everyone in the world to everyone else; do they?
  + The GII’s values may be said to include symbolizing the future

## The “power to the many” argument

1. Democracy means power in the hands of many people
2. Information and access to the public space are forms of power
3. The GII puts information and access in the hands of all people
4. Hence democracy is an inherent value of the GII

## Undemocratic features of the GII

* Q: Does “Information is power” refer to information one gets or information one controls and filters for others?
* The GII creates the possibility of greater concentration of filtering and packaging power
* The GII may, with a loss of shared geographical space, foster a tendency toward insularity as individuals have the option to discuss only with those they agree with

## Architectures of freedom and of control

* Government may regulate to ensure regulability – e.g., forcing backdoors to encryption schemes
* U.S. global market dominance gives any U.S. government policy a global effect and relevance
* U.S. enforcement of an architecture of control, by virtue of this, would enable any local government to control the use of technology as it saw fit

## Election campaigns

* Hard money (controlled by candidates) is limited
* Bipartisan Campaign Reform Act (McCain-Feingold), 2002, restricted soft money use, including for issue ads; judge ordered rules to apply it to Web
* Federal Election Commission Web rules, 2006:

–Regulations apply to paid content

–Uncompensated individuals may campaign freely

* Supreme Court protected issue ads, 2007

## Electronic voting

* Some voting machines run proprietary software, whose code is a business secret
* Question: are these machines compliant with the expectation of election transparency?
* Other questions have been raised about electronic voting

## Net neutrality

* *Definition:* delivery of content by service providers without preference for some content over others
* *Example:* an ISP is net neutral if it charges uniform rates regardless of content; is not neutral if it blocks some content (e.g., of competitors) or charges more for delivering it
* *Enforcement:* only a government agency, such as the Federal Communications Commission, can assure net neutrality

## Net neutrality vs. deregulation

* FCC required phone companies to meet open-access requirements for Internet service, e.g., leasing lines at “neutral” prices
* *Net neutrality* means that government should require telcoms to treat all content on broadband lines alike
* *Motivation:* To prevent telcoms from excessively influencing content on Internet
* *Counter-argument*: Want to maintain incentive to improve infrastructure

## Anonymity

* Many classic works have been published anonymously
* Remailers enable email anonymity
* Anonymizer.com provides tools
* A federal court overruled a Georgia law against false names on Internet, 1996
* Anonymity does not protect against consequences of libel
* Some groups file suit to obtain identities of critics

# 5.3 Limits to free expression

* What expression is not protected?
* How does IT cause limits of freedom to be tested?

## Internet risks concerning children

* Predators may target children via the Internet
* Children using the Internet may download sexual or violent material, which is easily accessed, copied and communicated
* Some sexual material depicts and exploits sexual abuse of children
* Images may be edited and merged with others

## Internet content-control legislation

* Communications Decency Act (1996) outlawed “knowing transmission of obscene or indecent” material to anyone under 18, including via the Internet
* Supreme Court ruled out any content-based regulation of the Internet (1997)
* Child Online Protection Act (1998), also overruled
* Children’s Internet Protection Act (2000) required filtering at libraries and schools

## Content blocking

* Content blocking software relies on text, not image, analysis
* Blockers block some non-objectionable material (artistic, educational) and fail to block some material inappropriate for children
* Blocker software does not reveal its criteria for blocking

## Other solutions to problem of child protection

* Filters (imperfect)
* Put PC in living room facing outward
* Educate children about giving out personal info

## Video games and children

* The June, 2011, article, “Justices reject ban on violent video games for children,” discusses a law that banned the selling of certain video games to children.
* Give reasons for a rise in legitimate concern about video games and reasons for opposing such legislation. Support your view with specifics.

## Defamation

* Not protected as free speech
* Elements of a claim of defamation:

–False and defamatory statement exposing someone to contempt or ridicule

–Published to one or more third parties

–Negligence or worse by publisher

–Result is presumed or actual damage

* Distributors of information are not liable as publishers are

## Forms of defamation

* *Libel:* defamation in print or other visual form
* *Slander:* defamation by oral communication
* Defamation is not protected freedom of speech
* Remedy is civil action of lawsuit

## Dilemmas about defamation online

* Is ISP or other intermediary a publisher?
* Is anonymous speech threatened?
* Can you be sued in many countries for your posting?
* Example: Is French ban on Nazi paraphernalia applicable to Yahoo (US)?

## Incitement, threats, and cyberbullying

* Inciting crimes is not a protected form of expression
* Physical threats are not protected
* *Cyberbullying* is a widely recognized problem that includes harassment with or without threats and defamation
* Cyberbullying is a special concern because young persons have been harmed by it and some have harmed themselves

## Spam

* Free speech or unprotected activity?
* Estimate: 30 billion spam messages per day, 2006
* AOL blocked mail from spammer company Cyber Promotions, 2006; later sought injunctions against spammers
* Advocacy groups solicit web-site visitors to send messages to politicians: spam?

## Antispam solutions

* Challenge-response spam filtering: Auto-response to mail is a request to confirm message, which puts sender on white list
* Pay-to-email imposes small cost to sender per message
* CAN-SPAM legislation, 2004, regulated commercial spam

CHAPTER REVIEW QUESTIONS

1. Explain what freedoms of expression are protected under U.S. and international laws and values
2. Describe how IT offers opportunities for and risks to free expression
3. Discuss limitations on free expression in environments such as the Internet

CHAPTER SIX

6.0 INTELLECTUAL PROPERTY AND IT

## Learners Objectives

1. To explain intellectual property rights and how the informational society has created and addressed social and legal issues in this area
2. Consequences of piracy and copyright infringement
3. To define Software as intellectual property

# 6.1 Purpose and limitations

* How does intellectual property differ from other property?
* Why and how is it protected?

## Property

* A relationship among people, a claim right (positive right) because it is protected by government action
* Tangible property is exclusionary in that only one person can use it; scarcity applies to tangible property
* Theories of property:
  + rights come from labor invested (Locke)
  + personality theory: our intellectual creations are part of us (Hegel)

## Intellectual artifacts

* Are intangible
* Are results of creative mental effort
* Persist over time, rather than dissipate
* Can be used by an unlimited number of persons at a time
* Are built on the previous work of others, to a greater degree than are physical artifacts
* have value

## Intellectual property rights

* Types:
  + Copyright: protects expression
  + Patent: protects use of design
  + Trademark: protects symbol
  + Trade secret: protects information
* Rights consist of limited monopolies for creators
* Aim is to benefit the public
* Not a “natural” right [See lec for legal claim]
* To encourage innovation by reward

## U.S. Constitution

* “The congress shall have the power to … promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries…”(Art. I, Sec. 8)
* First U.S. copyright law, 1790, protected works for fourteen years

## Exclusive rights by copyright

* Copyright protects expression, not ideas
* Restrictions on
  + Making or distributingcopies
  + Performing or displaying works
  + Producing derivative works (those based on other works)
* Congress has extended the period more than twelve times, from 14 years (1790) to current period of 75 years

## Limitations on intellectual property

* Fair use: copying for purposes of criticism, comment, news reporting, teaching, scholarship, research
* Time limitation
* Not copyrightable: facts, ideas, processes, modes of operation
* A public domain of common intellectual property is desired as well (like the natural environment)

## Fair use

* Recognized by 1976 law
* Criticism, comment, news reporting, teaching, scholarship, research
* Factors:
  + Purpose of use (commercial or not)
  + Nature of work (fiction less likely to be fair use)
  + Size of material copied
  + Effect on market value
* Copying video for later viewing is fair use (Sony case, 1984)

## Two views of privacy and intellectual property

* Consumer advocates (A) vs. entrepreneurial and business advocates (B)
* Privacy: A are for more restriction on collection and sharing of data, B favors less restriction
* Intellectual property: A support less restriction, B more restriction

## Civil vs. criminal law

|  |  |  |
| --- | --- | --- |
|  | **Remedy** | **Standard** |
| **Civil** | Payment of damages to injured party | Proof beyond a reasonable doubt |
| **Criminal** | Prison or fine | Preponderance of evidence |

# 6.2 Issues raised by IT

* Is file sharing OK?
* Does the direct sharing of information and culture enabled by information technology outpace efforts to enforce intellectual-property rights?

## How IT changes the discussion

* Information is interchangeable (homologous) regardless of its medium (paper, silicon, DNA, DVD)
* Hence “the medium is not the message; the medium is irrelevant”
* Intellectual property rights have been legally expanded in copyright and then patent form
* Microsoft owns code in PCs; patents exist for some genes of humans

## Technical factors

* Before printing, intellectual property was not an issue because it was almost as hard to copy a book as to write one
* Before IT, only publishers could publish
* With IT, copying is easier (speed, accuracy, storage capacity, connectivity)
* Medium is a decreasing part of cost
* Production costs may be recovered by access control, technical assistance, advertising
* Malleability enables derivative works

## Electronic publishing and intellectual property

* Electronic publishing reduces costs and risk of publication
* “Access to an overwhelming number of elements of daily life is now controlled by intellectual property law.” (S. Warwick)
* “Copyright in the United States is becoming more a tool for securing property interests than a mode of encouraging new works.” (Warwick)

## Issues raised by 1996 White Paper on intellectual property

* Issued by Clinton administration, not adopted
* Purpose: Consider level of protection of intellectual property needed in cyberspace
* Case: software distribution by MIT student
* Repackaging database information: ProCD CDROM
* Reverse engineering: studying design of a system for which one is developing software
* Copying in transmission: copy of email attachment stays on mail server

## Peer-to-peer technology

* P2P is distinguished from communications with central server
* Napster software enabled P2P exchange of files listed in a directory on a central server
* Courts shut down Napster for enabling copyright violations
* KaZaA: true P2P application
* After courts refused to shut down similar Grokster and Morpheus sites, RIAA sued 261 users, Fall 03

## File sharing

* MP3 file format enables 10x compression
* Napster service opened, 1999, to enable sharing of MP3 files among users using central lists of users and files
* One survey found 75% of college students sampled used Napster more than once a month
* Gnutella and other services used a decentralized listing concept

## Stop Online Piracy Act (SOPA)

* A 2011 bill in the U.S. Congress aimed to counter online violations of copyright law
* Prevented networks and payment facilities from doing business with allegedly infringing websites
* Barred search engines from linking to the sites,
* Required Internet service providers to block access to the sites
* Five-year criminal penalty for streaming of content
* Defeated by Internet-based businesses’ campaign

## Response to file sharing by industry and courts

* Music industry obtained injunction against Napster users
* 18 record companies sued Napster to stop listing copyrighted songs without permission, winning in court
* Supreme Court okayed lawsuits against Gnutella-based decentralized system as encouraging infringement

# 6.3 Software as intellectual property

* Is software the property of the buyer?
* What is it fair to patent?
* Is the standard model or the “free software” model appropriate?

## Software is licensed

* Software is not purchased by a user, but licensed; may not be copied except under license rules
* Copyright law protects expression
* Patent law protects design and ideas
* Even the “look and feel” of software has been claimed in court as the right of the original designer

## Software patents

* Patents protect inventions and devices, give inventor monopoly for a time period
* Invention must not be obvious or in wide use
* Is software an invention or a writing?
* Supreme Court, 1981: software is not patentable because it is abstract; later, patents were issued with Federal court approval
* Examples: Amazon.com obtained a patent on one-click shopping, IBM on online catalogs

## Software copyright

* Recognized by Congress, 1976
* Reverse engineering of video-game machine software for research purposes (to produce games) is fair use
* Lawsuits debated “look and feel” of applications

## Example: Copying software for friends

*Is it morally justifiable to copy copyrighted software for one’s friend?*

* Is the law just or unjust?
* Is the enforcement just?
* Do ethics let us make exceptions for our friends and ourselves?
* What about software makes this case different from stealing microchips?

Note: Morality is said to be public and requiring impartiality (B. Gert)

## Considerations in software copying

* What if the friend uses the software only once?
* … to test the software for possible purchase?
* Is this case like speed limits?
* Is the cost of unauthorized copying factored into the price of software?

## Free software movement

* Challenges the standard licensing paradigm with concept that software is to be freely shared
* Core concept: Free flow and exchange of ideas and code
* Founder: Richard Stallman, Free Software Foundation, 1985
* FSF project: GNU; GNU Manifesto, 1987
* Much free software is open source (code publicly available)

## Apple-Motorola lawsuit

* Apple sued maker of Internet phones for infringing patent on Iphone
* Apple won case in U.S., 2012
* At *issue:* interface of phone, shape of case
* *Implicit:* fierce Apple-Google competition between Iphone and Droid

# 6.4 Technical and legal solutions

* Does current law sufficiently protect legitimate intellectual-property rights?
* Does it go too far?

## Industry enforcement efforts

* CD recorders were delayed long past technical introduction, 1988
* Recording industry delayed introduction of DVD players by threatening suits
* Recording Industry Association of America sued to stop shipping of an MP3 player; lost
* Industry pushed for laws to require copy-protection be built into playing devices

## Content scrambling

* Content Scramble System (CSS) enabled DVD producers to limit playing of disks to CSS-equipped players
* DeCSS software, produced by a young person in Norway, enabled unscrambling on Linux machines, allowing viewing of legally purchased DVDs on non-CSS players
* Film industry sued to prevent free distribution of DeCSS, obtaining injunctions against posting code or linking to code; upheld on appeal

## Controlling use of devices

* Digital Rights Management (DRM) allows restricted use, e.g., the Ipod system
* Secure Digital Music Initiative (SDMI) enabled industry copy protection by digital watermarking
* Digital Millennium Copyright Act (DMCA, 1998) enables lawsuits against devices that circumvent copy protection, even if no infringement occurs
* DMCA was used to threaten suit causing cancellation of presentation of research about flaws in SDMI

## Legal solutions

* Sonny Bono Term Extension Act, 1998: increased term of copyright by 20 years to life-of-author plus 70 years
* No Electronic Theft (NET) act, 1997: criminalized circumvention of copyright protection, even for fair use
* Before NET, copyright had been a civil-law issue

## Copyright infringement criminalized

* 1982, Congress made high-volume copying of music and video a felony
* 1992, copying for gain became a 5-year felony
* 1997, No Electronic Theft Act following D. LaMacchia software-distribution case that
* lacked private gain
* Digital Millennium Copyright Act criminalized circumvention of copy-protection systems
* 2005, recording in a theater became a felony

## Safe harbor and takedown notices

* The legal doctrine of safe harbor protects web site from copyright lawsuits if site managers remove material when asked to do so by copyright owners
* DMCA permits copyright owners to demand takedown of unauthorized postings
* Competitors of sites often submit such takedown notices
* Concern: If takedown notices are invalid (e.g., contravening fair use), then takedown may have a chilling effect on valid postings

## Plagiarism

* Plagiarism violates academic integrity and intellectual property but is not often a court matter
* In the August, 2010, article, “Plagiarism lines blur for students in digital age,” the author describes “a disconnect that is growing” between students and professors about plagiarism.
* Do you agree or disagree?

# Chapter Review Questions

1. Explain intellectual-property law and its motivations and exceptions
2. Explain how intellectual property rights are challenged by information technology
3. Discuss the ways in which software is protected as intellectual property
4. Explain proposed and actual solutions to issues of intellectual property in the information society

CHAPTER SEVEN

7.0 CHANGES IN WORK, EDUCATION, AND CULTURE

## Learners Objectives

At the end of this chapter the learner should be able:

1. To explain how changes in IT influence work, education, and culture
2. To identify the effect of IT on employment
3. To discuss collaborative learning and how IT promotes it.
4. To explain critics of IT on entertainement

# 7.1 Economic and work-related effects of IT

* What is work?
* Are Facebook, YouTube, and Twitter part of work life?
* Does the information revolution result in:
  + individualization of work?
  + increased fragmentation of society?
  + increased social cohesion?
  + a freer work life?
  + a disposable work force?

## Service economy and informationalism

* Accepted theory (to be challenged or qualified):
  + knowledge generation and communication explain productivity and growth
  + activity shifts from goods to services
  + managers, professionals, technician will become core occupations
* Distinction is not industrial vs. post-industrial, but between two forms of knowledge-based production
* “Goods,” “services” are hard to distinguish in the informational economy

## IT and employment

* *IT industry:* $1 trillion worldwide, 2005
* *IT jobs:* 10.5 million in U.S., 2004
* *Job churn:* 1993-2002, 310 million jobs disappeared; 328 million new jobs were created
* New jobs created by IT tend to require higher education, replacing old jobs that did not
* *Offshoring*: About 3.3 million white collar jobs will have left U.S., 2000-2015
* *Inshoring:* Working for a foreign employer

## Effects of IT on employment

* Introduction of technology does not necessarily reduce employment
  + displaces some jobs
  + creates others
  + changes characteristics of new jobs
* One factor is that introduction of technology is associated with growth
* “There is no systematic structural relationship between the diffusion of information technologies and the evolution of employment levels in the economy as a whole”

## Labor-force flexibility

* A two-layer model is emerging:
  + core labor force (“symbolic analysts”)
  + a disposable labor force (subject to automation, firing, outsourcing)
* IT fosters flexibility and the need for flexibility of the labor force
* “A crisis in the relationship between work and society”

## A global labor force

* Capital is more mobile than labor
* Labor is constrained by borders and policies
* Capital movements by multinational firms have disintegrated the work force in some ways
* A disposable segment of part time and temporary workers is formed
* Some firms and governments have chosen the “low road” of short-term profitability by taking advantage of opportunities to cheapen labor

## IT and the restructuring of employer-worker relations

* Transition to informational society is accompanied by deterioration of living and working conditions for many workers
* Since early 1980s, governments and firms have squeezed labor costs to counter the profit crunch
* Some changes were enabled by introduction of IT

## Structures of enterprises

* Small businesses have access to global market via the Web
* Mergers and splits of huge global companies
* Computer-driven narrowing of focus reduces company size because more products and services are obtained outside company
* Need for middle managers falls because IT enables more information to go directly to workers; workers manage selves more

## New occupational structures and employment projections

* Different informational societies have different occupational structures
* Polarization of income distribution has occurred
* Different management styles are used, e.g., Japan (4% managers, 1990), U.S. (13%)
* Diverse paths are taken to informational paradigm

## Effects on the work process

* A fundamental change in work: “the individ-ualization of labor in the labor process”
* A reversal of the socialization of production initiated by the industrial revolution
* Management becomes decentralized, markets become customized, work segmented, and societies fragmented
* Work time, job stability, location of work, and the social contract between employer and employee undergo changes

## The work process

* Taking advantage of productivity potential of technology requires better informed workers
* Factors fostering high performance in work: high skills, worker autonomy and feedback, teamwork
* Work force is partitioned as a result of decisions made in the course of introduction of IT
* Castells: In 1980s, technology was introduced more often to downsize, save labor, cut costs and subdue unions, than to improve quality and productivity

## Telecommuting

* increases flexibility
* reduces commuting cost and time
* increases home-related distractions
* reduces mentoring and team contact
* security issues arise

## Employee crime

*Types:*

* Embezzlement using computers
* Sabotage, e.g., “logic bombs”

*Security measures:*

* separation of roles (e.g., establishing insurance policies and authorizing claim payments)
* audit trails

## Monitoring of employees

* Screen views, keystrokes, and voice can be monitored
* Surveillance cameras monitor many work environments
* Goals: Assess productivity, courtesy, accuracy, computer theft
* Employers have an ethical obligation to explain monitoring policies
* Location monitoring may occur in transportation and is a side effect of door-key IDs

## Employer email systems

* About half of large U.S. companies sometimes access employee email, voicemail, or computer files
* 26% of employers surveyed said they had fired employees for misusing company email
* 15% of companies surveyed had had lawsuits against them because of employee email, 2006

## Monitoring of employee email

* Motivations:
  + Obligation to prevent harassment by email
  + Employees emailing jokes
  + Running businesses or betting pools
* Courts have upheld most company email and computer-file monitoring

# 7.2 IT in education

* What is education?
* How do people learn?
* Does the feedback loop of knowledge acting on knowledge aid self-reflection in learning?
* Does the information revolution result in radical changes in education?
* Is the classroom doomed?
* What is the place of online learning?
* What is the place of laptops in the classroom?

## What IT offers education

* Custom preparation of course materials
* Communication by students outside classroom
* Collaboration tools
* Access to research sources
* Support for learning as discovery and as construction of knowledge

## Active learning

* Learning is an action/feedback process of experience interacting with the environment
* The learner may interact with educational software and with instructor and other students via software and telecommunications
* Online resources support interaction and provide access to research data

## Collaborative learning

* Students reinforce their own learning by supporting each other’s learning
* Example: a student who has just learned a concept may know just the words to help another overcome a conceptual obstacle
* Software and communications technology, e.g., Web 2.0, support collaboration

## Advantages of technology

* Increases student-teacher interaction
* Cooperation and collaboration among students
* Active learning
* Prompt feedback
* Access to content
* Respect for diverse talents and learning styles
* Engagement of students
* Promotes critical thinking

## Tools

* Course management systems (CMS), e.g., Blackboard
* Web links
* Interactive multi-media objects
* Collaboration tools, e.g., Merlot

# 7.3 Effects on culture

* What is culture?
* What is your culture like?
* Is there a FSU, U.S., or world culture?
* Does integration of media radically change culture?
* Does open access radically change culture?
* What are the cultural roles of: video games; on-demand video; Facebook?

## Media and audience diversification

* VCRs and number of TV channels expanded consumer choice, market segmentation, and product diversification,
* Corporations and governments retained power
* Are we living in a global village, or in
* “customized cottages globally produced and locally distributed”? (M. Castells)
* Is information age “marked by the autonomy of culture ” in relation to material constraints?

## Computer-mediated communication

* Internet
* 1973: 25 computers
* 1999: 173 million users (of which 60% in U.S.-Canada)
* Inequality: circa 2000, industrialized countries had 88% of users but 15% of world population
* Computer-mediated communication networks are pervasive, decentralized, and flexible
* Internet is suited for developing many weak social connections

## Communications and culture

* Integration of electronic communication
* End of the mass audience
* Rise of interactive networks
* Alphabet (Greece) revolutionized mental infrastructure for thought and communication
* Integration of text, sound, images, video, interacting globally with open access, changes culture

## A culture of real virtuality

* Castells: A new culture of real virtuality is emerging
* Real virtuality: “a system in which reality itself ... is entirely captured, fully immersed in a virtual image setting” in which appearances become the experience
* Example: Dan Quayle’s debate with Murphy Brown

## Rise of the mass-media culture

* TV prevailed as path of least resistance for consumers (easier than reading)
* Mass culture resulted from control of electronic media by governments and mega-corporations
* Media are ubiquitous, but our reaction is subject to our will
* “Media tend to work on consciousness and behavior as real experience works on dreams, providing the raw material…”

## Critiques of IT in entertainment

* The simplifications of virtual reality are
* “frequently misleading and treacherous”
* Computer games are said to invite addiction, violence, health problems, dehumanization
* Web-based pornography can be accessible to children
* Opinions due to: G. Stamatellos

# Chapter Review Questions

1. Explain how changes in IT affect work life
2. Discuss educational issues raised by use of IT
3. Discuss ways in which IT influences cultural life

CHAPTER EIGHT

8.0 RISKS, ETHICS, AND EVALUATION OF IT

## Learner objectives

By the end of this chapter a learner will be able:

1. To describe human and system risks related to IT and ways to manage them ethically today and in the future
2. To apply ethical principles to problems of IT in society
3. To discuss effects of E voting systems and their problems on society
4. To discuss ethics of professionals

# 8.1 Humans and IT

* Does IT serve us well today?
* Do human interaction and community suffer because of computer use?
* Do computers invite addiction or divert people from worse addictions?
* Is e-commerce replacing human contact?
* Why is human contact good and how important is it to people?

## Computers vs. other technologies

* All technologies have benefits and risks
* We are dependent on all kinds of technology
* Unlike other technologies…
  + Computers make decisions
  + Software is often built from custom components
  + Pace of change with IT is rapid
* “Relying solely on results produced by computers is temptingly easy” (Baase)

## IT and human relationships

* “Perverse market dynamic” occurs in the fact that Wal-Marts are replacing downtowns
* Web 2.0 enables user–generated web content and greater human connectivity via Web, but leads many users to spend more time online than they intend
* We are concerned with trade-offs

## The digital divide

* *Definition:* some people’s lack of access to IT for economic reasons
* Universal access is seen by some as a claim right
* Computer ownership by U.S. households: 1990, 22%; 2001, 63% (57% with Internet)
* *Global divide:* 1B of 5B persons worldwide had Internet, ca. 2007

## IT and large-vs.-small enterprises

* J. Mander: Computers are bad for individuals and small businesses, good for large ones
* J. Naisbitt: telcom reduces size of business units
* Developing countries may benefit from IT earlier than from other new technologies

## Risk: low-quality information

* Site operators must provide for correction of dangerous misinformation posted
* Digital image and video manipulation raise problem of possible deception – which kinds of manipulation are ethical?
* Does the ease of formatting and copying by computer, compared to difficulty of critical thinking, discourage critical thinking?
* Can computers do critical thinking for us?

## Computer modeling

* Models
  + simplify by abstracting from (removing) inessentials
  + are based on assumptions
* Examples:
  + Car-crash analysis software performs well
  + Climate change modeling
* Limitations of modeling:
  + accuracy of data
  + knowledge of phenomena (e.g., clouds)

# 8.2 System and software failure

* Is the reliability of software and hardware today at an advanced or primitive stage?
* Could computer systems be much better than the ones we have?

## Computer failures

* Small errors can have huge impact , e.g., three lines in a 3M-line program disrupted phone in a region
* Failures are often caused by upgrade processes
* Failures of transportation-related systems without paper backup has caused huge travel disruptions

## System and vendor failures

* A significant problem, as with Mars Orbiter: lack of error-detection procedures
* Software-company stonewalling left students and educators on hook because of incorrect test-reporting software, used as sole criterion for decisions

## E voting problems

* Congress authorized $3.8B for voting-system improvement, 2002
* Most voters cast other than paper ballots
* Problems reported , 2002-2006:
  + Insecure encryption
  + Insufficient memory
  + Poor physical protection
  + Insufficient testing and training
  + Proprietary secret software
* S. Baase: Reasonable trustworthiness is absent

## Wasted system development

* Of $1 trillion spent on IT projects annually worldwide, 5-15% are abandoned by delivery time
* Houston airport: disastrous $193M baggage-handling system scrapped, 2005
* Hong Kong and Kuala Lumpur: failure of automation of airports falsely blamed on input errors
* Many other systems, costing hundreds of millions or billions of dollars, scrapped
* *Causes:* poor or changing requirements, mismanagement, inexpertise

## Dangerous software errors

* Therac-25 radiation therapy machines gave massive overdoses to six patients, 1985-1987
* When given reports, manufacturer denied that the machine could have done this
* Clinics were overconfident in machine
* Operators ignored error messages
* Software errors were not expected
* Poor software development practices were followed

## Measures to assure reliability

* System developers have professional responsibility to follow standard engineering practices
* Principles of good user interfaces
* Redundancy and self checking by systems
* Good testing practices
* Legal consequences for bad practices
* Warrantees
* Government regulation of safety aspects

## Software engineering principles and steps

* Specification, including good user interface
* Design, including fault tolerance
* Coding
* Testing and maintenance, including independently of developers
* Redundancy where appropriate

# 8.3 Ethics of IT professionals

* What are ethical responsibilities of people whose work is with technology?
* What theories of ethics and of rights apply?

## Ethical issues

* Concerns
  + Transparency, honesty
  + Privacy
  + Free expression
  + Intellectual property
  + Safety, security
* Factor: persons affected by IT work are often not customers of IT professional doing the work, and have no control
* Obligations include limiting risk to others

## Professional ethics

Responsibilities may exist toward

* Customers and clients
* Coworkers, employees, employers
* Others affected by products and services

Examples in other fields

* Ethics of journalists
* Business ethics
* Science research

## Ethical decision making in IT professions

Questions:

* Who is affected? What are their rights?
* What are risks or issues?
* What are benefits?
* What actions are possible?
* What are responsibilities of actors?
* What are ethically acceptable choices?

## Software developers’ responsibilities

* Consider costs and benefits to end users, including safety
* Whistle blowing may help the public and employer; some issues are worth going public or quitting over
* To assess risk one must have sufficient expertise
* Disclosure of conflicts of interest is crucial
* Testing should be independent of product development
* Maintenance of systems requires the same professionalism as initial development

## Codes of ethics for IT professionals

* Central concern: the public good, including human rights and diversity of culture
* Honesty and fairness in communication about software and related topics
* Use client or employer property only as authorized
* Assure high quality, reasonable cost and schedule
* Respect privacy, intellectual property
* Disclose conflicts of interest
* Address software errors
* Honor agreements and assigned responsibilities

## Some guidelines

* Define objectives reasonably
* Involve users in design and testing
* Plan, estimate and schedule carefully
* Design for human users, validating input
* Validate components and default settings
* Speak honestly of risks and limitations
* Disclose possible conflicts of interest

## Computers in clinical field work

* Suppose a clinic for families with problems with substances wants its staffers to have laptops to record data from home visits.
* What are the clinic’s obligations to protect privacy and what security policies are appropriate?

## Computers at court

* An expert system is a computer program that stores and applies human expert knowledge
* What are the ethical implications of judges using an expert system to decide criminal sentences?

# 8.4 Future prospects of IT

* Can a machine think?
* Where is the boundary between living things able and not able to think?
* Do humans compute?
* When humans compute, are they thinking?
* Is computer simulation of a mental process an actual mental process?
* Could computers match and surpass human capabilities?

## Computers vs. brains

* In the brain, computation is interaction among 100 billion neurons
* Neurons are cells that fire (send signals to other neurons) when incoming signals reach a certain threshold
* The brain adapts by modifying its internal neuron connections
* Other parts of human memory and information processing are muscles, hormones, and glial cells

## Emergent behavior and self-organization

* Thought and emotion arise from brain cells that each have a simple function
* This emergent behavior is more than the composition of the behavior of the neurons
* The brain is self-organized in response to its environment as sensed by the body
* Training may produce organized symbolic expressions from non-symbolic brain activity

## Where are we going with IT?

* Predicting accurately about IT has been difficult
* Technology “shapes the space of possibilities in which [people] can act: people are drawn to technologies that expand the spaces of their actions and relationships” (P. Denning)
* Technological singularity: the point at which machine intelligence reaches too far for us to see what is beyond
* Will we still be human when we can implant Internet interfaces in our brains?

## Frontiers of computation

* What is computation?
* Both human thinking and computer processing?
* Is communication (interaction) part of computation?
* Can a machine be intelligent?
* Think? Have emotions? Imagination?
* Does a computer “understand” machine language?
* Does it “know” the information it has access to?
* Is chess-playing research intelligence?
* Can computers create art?

## Debates about artificial intelligence

* *Strong AI view:* an AI system may be intelligent
* *Refutation based on phenomenology* (study of experience): machines are said to lack the experience of thought
* *Argument based on intentionality*: machines are said not to be referencing actual things in the world
* *Comparisons*: artificial sweeteners, insemination; flowers

## Objections to strong AI view

* Argument based on phenomenology (study of experience): machines are said to lack the experience of thought
* Argument based on intentionality: machines are said not to be referencing actual things in the world
* Comparisons: artificial urea, legs, sweeteners, insemination, flowers
* Q: Is computer simulation of mental process an actual mental process?

## Chinese room argument (J. Searle)

* An argument against strong-AI view
* Imagine an non-Chinese-speaking person in a room with a large rule book about how to reply in Chinese to Chinese-language utterances
* This system simulates speaking and understanding Chinese
* But if the person doesn’t understand Chinese, and the rule book doesn’t, then where is the understanding of Chinese?

# Topic Review Questions

1. Describe problems of human interaction with IT
2. Explain risks of failure of IT systems\*
3. Describe ethical responsibilities of IT professionals
4. Discuss future prospects for information technology

CHAPTER NINE

9.0 NETWORK STRUCTURES IN THE GLOBAL ECONOMY

## Learner Objectives

At the end of this chapter a learner should be able to:

1. Explain how IT enables less centralized structures and new business models that operate via multiple information flows
2. Discuss how networks enable restructuring of society
3. Describe the flow of Information in the society.

# 9.1 The network enterprise

* How has IT changed how production and exchange occur?
* In shaping our world, are we enabled by the ubiquity of computing and the connectivity of people?

## A new organizational logic

* Thesis: informationalism promotes a “new organizational logic” that challenges the previous top-down logic
* Mass production is converted to flexible production
* Crisis, not of the large corporation, but of its traditional form of hierarchical, vertical integration and functional management
* Organizational form: network, not hierarchy

## Toyotism

* Management-worker cooperation
* Multifunctional labor
* Total quality control
* Reduction of uncertainty
* Flat management hierarchy
* Just-in-time delivery of resources to production process

## Organizational forms

* Inter-firm networking
* Corporate strategic alliances for specific aims, coexisting with competition
* Shift from vertical bureaucracies to the horizontal corporation
  + flat hierarchy
  + organization around process not task
  + team management
  + customer-satisfaction-driven
  + retraining of employees
  + decentralization

## Hierarchy vs. network

|  |  |
| --- | --- |
|  |  |
| Tree(Hierarchy) with vertical relationships: each node has one parent and possibly multiple children | Graph (network): horizontal connections may predominate |

## The Cisco model

* A “global networked business model” for production of Internet backbone products
* Cisco Systems shares information and systems with key constituencies
* Relationships and communication exist in a
* “networked fabric”
* Core of Cisco’s business operations: its web site
* Cisco supplies manufactured product but contracts out the manufacturing

## Other users of the Cisco model

* Dell Computer has a similar web-based customization model
* Dell stock rose 9400%, 1995-1999
* John Deere (agricultural machinery)
* Bechtel (warehousing logistics)
* Renault (auto production)
* Cisco model is becoming predominant

## Information technology and the network enterprise

* Network organization requires a change of mentality, not just a technical change; a change in corporate culture
* Whole layers of managers become unnecessary when all workers can access needed information
* The network enterprise is enabled by wide-area networks (WANs; ultimately the Internet) enabling collaboration between users remotely

## The network enterprise

* *Organization:* “a system of means structured around the purpose of achieving specific goals”
* Goal of
  + *bureaucracy* is to reproduce system of means
  + *enterprise* is to evolve and shape system of means
* *Network enterprise*: “specific form of enterprise whose system of means is constituted by the intersection of segments of autonomous systems of goals”

## Culture, institutions, organization: East Asia

* East Asian business systems tend to be based on networks, not on firms or individuals
* Developmental states base legitimacy on ability to promote development (growth, change), promote national identity.
* Example: MITI in Japan

## East Asian business cultures

* Japan:
  + zaibatsu, horizontal conglomerates of mutually owned firms since pre-WWII (Mitsui, Mitsubishi, Sumimoto)
  + kairetsu, vertical networks
* Korea: Hyundai, Daewoo
  + hierarchical networks (chaebol) of large firms controlled by holding companies
  + authoritarian pattern
* China: family based business enterprises are managed in authoritarian and centralized way, but system is overall flexible and decentralized

## Multinational enterprises

* Basic organizational form of global informational economy is international networks of firms and their sub-units
* Kinds of networks, based on multinationals:
  + supplier
  + producer
  + customer
  + standard coalition
  + technology cooperation

## The logic of networks

* “The logic of the network is more powerful than the powers in the network”
* “The network enterprise ... seems to be flourishing …”
* “The large, multi-unit corporation, hierarchically organized around vertical lines of command seems to be ill-adapted to the informational, global economy”
* (Castells, 2000)

## The spirit of informationalism

* Max Weber: Protestantism provided the ethical
* “spirit of capitalism”, i.e., entrepreneurship and profit-seeking
* For first time, the basic unit of organization in the economy is not a subject (individual or class or corporation), but a variety of subjects, a network
* The ethical foundation for the network enterprise, or spirit of informationalism, is “a multi-faceted, virtual culture” that evolves, the culture of creative destruction running at the speed of light

## Do networks enable restructuring of society?

* Power relationships are made susceptible to major change by network organization of society
* Power is held by people at the interfaces between networks
* Global capitalist society is structured around a network of financial flows
* Dominant functions in society are organized in networks, subordinate ones are fragmented

## Does IT “flatten” the news industry?

* *Equipment* for interview or eyewitness story: phone camera, digital recording device
* *Distribution:* blog
* *Cases:* 
  + Dan Rather false story broken by a blogger
  + Wikileaks

# 9.2 Society as flows of information

* How do flows of information express what society is?
* How does IT support intense information flows?

## Transactions vs flows

* *Example of a flow:* A stream of symbols, images, transactions, messages, as between a computer and its environment
* Traditional model of most business is based on the transaction as the basic unit and objective
* In the era of connectedness, relationships expressed as flows are the objective

## Society is built around flows

* Flows are endless streams; they express processes that dominate social life
* Interaction flows presuppose simultaneity and space coupling
* Flows: “purposeful, repetitive, programmable sequences of exchange and interaction between physically disjointed positions held by social actors”

## A space of flows

* Space = society; “Space is the material support of time-sharing social practices”, having symbolic meaning
* “Space organizes time in the network society”; “Space is crystallized time”
* (Castells, 2000)
* In the informational economy, the traditional space of places is replaced by a space of flows

## Advanced services, information flows, global city

* Networks are in a spatial hierarchy, concentrated in certain metropolitan areas
* Regional and local centers reflect differences of intensity and scale
* The whole system becomes globally interconnected
* The hierarchy is not permanent or stable

## The new industrial space

* “Milieus of innovation” benefit from synergy of interaction (not composition) of elements present
* These may include industrial technopolises, Tokyo, Paris-Sud, London-M4, Milan...
* Milieus of innovation have global networks of production and distribution
* The new space is organized around flows of information

## The end of cities?

* Not just work-at-home, but “telecommuting from telecenters” seems to be emerging, using suburban facilities
* Not the end of the office, but diversification of work sites
* Online transactions will not eliminate shopping centers, but supplement them
* Emerging higher education forms combine onsite and distance education

## Transformation and urban form

* Informational mega-cities: 10 million plus, where control of media, power politics, symbol production capacity are centered
* In mega-cities there is global connectedness but local disconnection
* Mega-cities are the nodal points and power centers of the global space of flows
* Downside: urban decay, environmental problems

## Flows and their support

* Kinds of flows
  + information
  + technology
  + organizational interaction
  + images, sounds, symbols
* Layers of support for the space of flows
  + circuit of electronic interactions
  + nodes and hubs
  + spatial organization of managerial elites

## Society as embodied time

* Time is local (specific to a context) and global
* Time, history, and society
  + Industrialism places clock time in command over space and society
  + network society is leaving behind “linear, irreversible, measurable, predictable time”
* Time sequence depends on social context
* Time is compressed due to fast turnover made possible by communication technologies

## Time as the source of value

* New financial products, e.g., futures, derivatives, increase relative value of nominal capital to deposits and assets
* Pensions and insurance are put at risk in financial gambling
* “The annihilation and manipulation of time by electronically managed global capital markets are at the source of new forms of devastating economic crises, looming in the twenty-first century”

## Changes in the experience of time

* Flex-time and the network enterprise
  + Skilled workers manage their own time
  + Accept flexible schedules: “just-in-time labor”
* Shrinking and twisting of working lifetime
* *Hypothesis:* “The network society is charac-terized by the breaking down of the rhythms … associated with the notion of a life cycle”
* Individuals are choosing different times to procreate and thus determining their own life schedules

## Time, space and society

* Timeless time goes with the space of flows
* Time discipline, biological time, and sequenced time go with places
* “We have entered a purely cultural pattern of social interaction and social organiza-tion,” since culture has superseded nature in dominance
* Hence flows of messages and images are the basic thread of social structure

# 9.3 Decentralized structures and processes

* Does the IT revolution make possible centralization or decentralization of power and production, or both?
* Is IT associated with a new non-hierarchical organizational logic?
* Does research in decentralized emergent behavior, and self organization shed light on social changes driven by IT?

## An era of decentralization

* Collapse of (ultra-hierarachical) states based on centrally planned economies
* Shift in corporate organization toward decentralized management structures
* Distributed models of the human mind
* Theories of literary meaning as constructed by readers, not authors

## Recent interest in decentralization

* Enterprises are using network structures of management
* The Internet is a decentralized system
* Web 2.0 has generated interest in decentralized user-generated content
* M. Resnick, “Decentralized Thinking,” 1999
* J. Surowiecki, The Wisdom of Crowds, 2004
* D. Goleman, Social intelligence, 2007

## The wisdom of crowds

* Necessary conditions:
  + Diversity
  + Independence
  + A “certain kind” of decentralization
  + (Surowiecki, 2004)
* Decentralized communication requires support media for collective wisdom to develop; e.g., stock market

## Hierarchical structure

* Tree, with root at top
* Traditional military, corporate, or
* educational structure
* Supports clarity, decisiveness, plan-following
* Root emits commands and information, branches feed back information

## Network structure

* Supports diversity, rich connection, choice, flexibility
* Some market economics reflect this
* Empowers those at lower levels

## Emergent behavior

* System behavior that is not the sum of component behaviors is called emergent
* It is typical of certain self-organized and decentralized systems
* Example: Ants forage for food and build nests without a blueprint or supervisor
* Chaotic and complex systems display emergent behavior

## Decentralized, self-organizing systems

* Decentralized and self-organizing systems lend themselves to flexibility and adaptiveness
* Where required: in environments that are dynamic, persistent, multi-agent, decentralized, and self-organizing.
* **Decentralized system**: a multi-agent system whose components do not respond to commands from an active director or manager component, and do not execute prespecified synchronized roles under a design or plan.

## Self-organizing systems

* Multi-agent systems with a coherent global structure or pattern shaped by local interactions among components, rather than by external forces

Three features:

* open to environment
* Can create and maintain a structure in non-equilibrium conditions
* complex, in their large number of parts and in the network of feedback loops joining the parts

## “Authorities” that shaped the Internet

* DARPA’s “design” was as a decentralized
* (self-organizing) system
* Internet Assigned Number Authority (IANA) was a volunteer group that gave way…
* … to government-sponsored “cooperative agreement,” 1993 …
* … followed by government-authorized Internet Corp. for Assigned Names and Numbers (ICANN)

## Could the Internet have been designed?

* “There was no one we could have pointed to as charged with ‘creating’ the set of rules we now know as the Internet”
* “My instinct is that it could not have [been built another way], that only an ‘authority-free’ process of this kind could have constructed this system…”

## Decentralized “design”

* Example artifacts:
* The Internet
* Natural language
* Human society and culture
* Evolution of life
* Are any centralized processes capable of producing equally good results as current decentralized processes?

## Decentralized decisions and their results

* Example: A low-price WalMart replaces downtown despite townspeople’s preference for having a downtown – “an unexpected or unintended result is not the same as a coerced result”

## Possible conclusions

* The IT revolution enables anyone to have a Web site, produce videos, have daily contact with thousands of acquaintances around the world
* But also, a very small number of corporations dominate almost all media and retailing
* Decentralization of power coexists with centralization of power

# Chapter Review Questions

1. Explain the role of the network enterprise in the globalized economy
2. Describe how the network society is said to operate through information flows
3. Explain how IT is said to enable decentralized structures\*