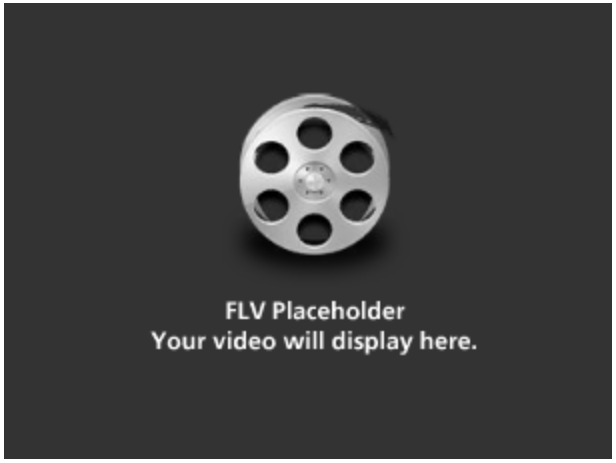
Foundations of Technology

Characteristics and Scope of Technology

Foundations of Technology - ITEA 1

Montgomery County Public Schools, eLearning

You will learn…



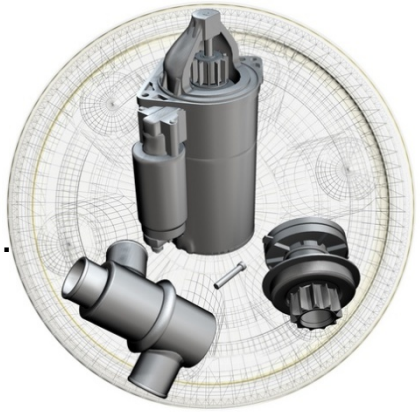
"For a successful technology, reality must take precedence over public relations, for nature cannot be fooled."

- Richard Feynman

Outcomes:

- The nature and development of technological knowledge and processes are functions of the setting. (ITEA 1-J)
- The rate of technological development and diffusion is increasing rapidly. (ITEA 1-K)
- **Inventions** and **innovations** are the result of specific, goal-directed research. (ITEA 1-L)
- Most development of technologies these days is driven by the market and profit motive. (ITEA 1-M)

What is Technology?



Broadly speaking, technology is how people modify the Natural world (science) to suit their own purposes (technology).

- **What is science?** From the Latin "scientia,"meaning knowledge. Science is the concerted human effort to understand how the natural world works, with observable physical evidence as the basis of that understanding.
- **What is technology?** From the Greek word *techne,* meaning art or artifice or craft, technology literally means the act of making or crafting, but more generally refers to the diverse collection of processes and knowledge that people use to extend human abilities and to satisfy human needs and wants.
- Science provides the knowledge about the natural world that underlies most technological products today. In return, technology provides science with the tools needed to explore the world.
- The fundamental difference between them is that science seeks to understand a universe that already exists, while technology is creating a universe that has existed only in the minds of inventors.

Technology and Setting

The nature and development of technological knowledge and processes are functions of the setting

"The most important and urgent problems of the technology of today are no longer the satisfactions of the primary needs or of archetypal wishes, but the reparation of the evils and damages by technology of yesterday." - DENNIS GABOR, *Innovations: Scientific Technological and Social*, 1970.

Setting Influences Technology

The nature and development of technological processes are functions of the setting. The history of mankind is the story to the relationship between environment and technology.

- Man, the hunter, developed new technologies to overcome disadvantages in size, speed, and natural weapons (claws).
- Man, the nomad, responding to a locally over hunted animal herd developed the technology needed to move with the herds.
- Man, the farmer, developed the technologies of plow and storage as the environment of the hunter no longer supported a growing human population.
- Man, the builder, adapted his environment with technologies designed to meet human needs in highly concentrated populations (cities).
- Man, the rebuilder, will respond to the impact of technology on the environment with new technologies designed to restore our environment and extend it to other worlds.

Rate of Development

The rate of technological development and diffusion is increasing rapidly

"It's ridiculous to live 100 years and only be able to remember 30 million bytes. You know, less than a compact disc. The human condition is really becoming more obsolete every minute." - *Marvin Minsky*

Technological Development and Diffusion

Science and technology develop through the flow of knowledge between people and cultures. The flow of new tools, techniques, concepts, questions, results, data, etc., is a **diffusion** process.

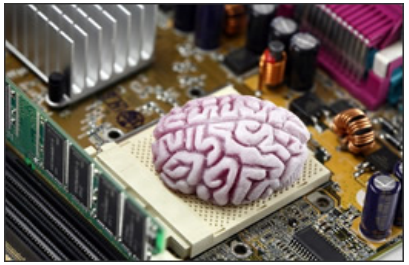
Technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across fields. The sharing of knowledge about irrigation techniques, for instance, has enabled developing countries to try out new ideas and make innovative adjustments to their current systems to improve food production.

The pace of technological development and the diffusion of new technologies is increasing rapidly. There were thousands of years between the development of the arrow, the plow, and the printing press, but the rate of change between technologies and technological ages, has gotten progressively faster, and we have moved from an agricultural age, through an industrial society, to an information age in barely more than 100 years. Whole areas of science, technology, and engineering now double their knowledge base every few months. This pace of technological development and diffusion continues to speed up.

Rate of Technological Change

One example of the increased rate of technological change is found in the development of computer capabilities. An estimate of human brain capacity is 100 billion neurons times an average 1,000 connections per neuron times 200 calculations per second. At current rates of development, computers will achieve:

- one human brain computing capability for $1,000 around 2023.
- one human brain capability for one cent around the year 2037.
- one human race capability for $1,000 around the year 2049.
- one human race capability for one cent around the year 2059.



Of course not all technologies improve at the same pace as computers. A slower paced advance over the past 100 years has been the automobile. This has changed in some ways (safety) due to market forces, but in areas like fuel efficiency development has been slow, perhaps in part due to competing interests (like oil industry profits).

"If the automobile had followed the same development cycle as the computer, a Rolls-Royce would today cost $100 and get a million miles per gallon…"

Robert X. Cringely, Computerworld

Invention and Innovation

Invention is a process of turning ideas and imagination into devices and systems.
Innovation is the process of modifying an existing product or system to improve it. Inventions and innovations are the results of specific, goal-directed research. All technological refinement occurs through the process of innovation.

Innovation: Invention Refined

Technological invention and innovation have developed to meet human needs and wants. Each invention and innovation was the result of specific, goal-directed research.

The automobile industry is an example of goal-directed research leading to innovation. As consumer demands and needs have changed over the decades, research has developed cars that are safer, more reliable, and easier to maintain. Cars are increasingly able to take over some of the chore of driving both for safety and convenience. As fuel sources change, the goals of the research have changed to refine the car even further, through a series of innovations into personal transportation with a greatly reduced carbon footprint.

Research has been a necessary part of the process of improving and innovating inventions in medicine, agriculture, transportation, and all areas of technology.

The Market Drives Technology

Most development of technologies these days is driven by the profit motive and the market

"Invention is the practice of coming up with something new. Innovation, however, is delivering something new to a market that wants it. In other words, innovation is figuring out how to take something new and actually bring it to market successfully."

Market Forces Drive Invention and Innovation

Market forces of supply, demand, and profit often determine investment in technological invention and innovation. What people and society want, gets developed, sometimes regardless of need. If people want a product, then it is generally evident in the sales figures of products that satisfy that want. Each of the examples that follow are of a need or want leading to invention, and later through a series of innovations, developed to satisfy our wants and needs. Each has provided huge financial profit.

Demand	Invention	Changed Demand	Innovation
Communication	Telephone	Need for mobility, features	Cell phone
Data storage	Floppy disk	High capacity, speed, portability	Flash drive
Transportation	Automobile	High fuel costs, unreliable supply	Electric car

Our way of life has been influenced by the way technology has developed. In future, it seems to me, we ought to try to reverse this and so develop our technology that it meets the needs of the sort of life we wish to lead. - PRINCE PHILIP, *Men, Machines and Sacred Cows, 1984.*

Technology in the Music Industry

The music industry is a great example of market forces driving technological innovation.

Portable Radio

CD

I-POD

I-PHONE

Before radio and recording, the music industry as we know it today did not exist. Radio permitted a means to develop consumer demand for music. Recorded music supplied the demand.

The Internet enabled consumers to have greater choice, convenience, and affordability in music distribution. Among many similar innovators, Apples iTunes developed as a technological innovation in response to market demand.

As people began to listen to more music via portable devices such as iPods, the demand for portable players began to increase. The idea to incorporate mp3 players into cell phones was a result of market force.

Other market forces that influence cell phone design have pushed mobile phones to become multifunctional communication, entertainment, and work devices. The public demand for aesthetic appeal, and a healthy battery life, drives manufactures to satisfy this demand with the hope that it will reward them in financial profits.

Auto Industry Technology

Supply problems in the oil and gasoline industry have changed market demand and driven innovation in the automobile industry in the direction of fuel efficiency and alternative fuels. Gas prices have increased to a point where people choose their automobile differently than they did in the past. Consumers today are more concerned with fuel economy, reliability, and safety. This public concern is a market force that is felt by the auto makers. As a result, cars are becoming more fuel efficient. The hybrid car is a an innovative new design that meets the public desire for fuel efficiency.

Hummer

Hybrid Car

"Environmentally friendly cars will soon cease to be an option…they will become a necessity."

- Fujio Cho, President of Toyota Motors

Summary

- An **invention** is the conception of a new and useful article, machine, composition, process, or system.
- An **innovation** is the creation or introduction of something new to an already existing, invention, product, idea, or system.
- New technologies are built on previous technologies, often resulting in quick development and dispersion.
- The pace of technological development, invention, and innovation is increasing at an exponential rate. The pace is influenced by cost and profit.
- **Market forces** are driven by consumer wants and needs. Market forces are driven by profit for companies that can meet and satisfy customer demand. Market forces determine investment in research and development of new technologies.
- Our environment and our social settings determine our needs and wants, and the technologies developed to meet those needs and wants.

This has been a presentation on…

Foundations of Technology

Characteristics and Scope of Technology

Glossary

Invention	A process of turning ideas and imagination into devices and systems
Innovation	The process of modifying an existing product or system to improve it
Diffusion	A process that relates to the flow of new tools, techniques, concepts, questions, results, data, etc.
Market forces	Driven by consumer wants and needs