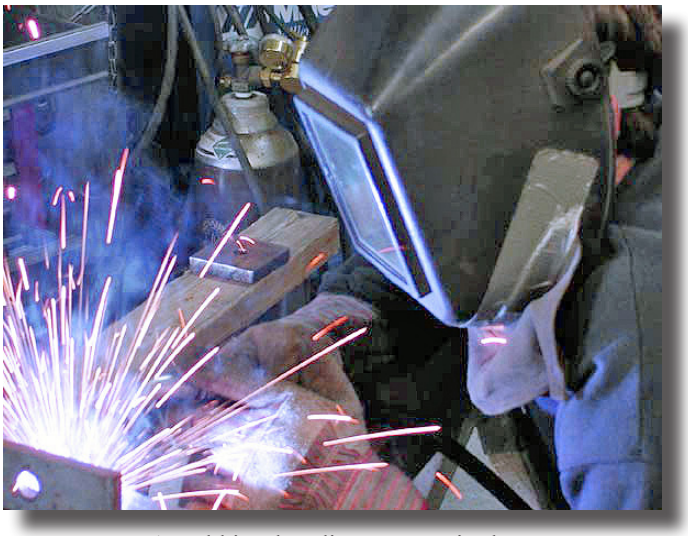
MANUFACTURING TECHNOLOGY
STUDENT INFORMATION

Area of Study: Manufacturing

Objectives: Students will participate in a production run that will produce a product.

Related Occupations:



A weld is a bonding process in the manufacturing of a custom motorcycle.
Evolution Custom Cycles photo

Assemblers and Fabricators
put together the pieces of components of a product and sometimes join the components into a whole product. They may begin by reading working drawings and then use hand or power tools or machines to finish the assembly.

Food Manufacturing Workers
process raw fruits, vegetables, grains, meats, and dairy products into finished products that are ready for a grocer to sell. In this process they may slaughter animals, process milk, preserve fruits and vegetables, make bread, cookies, and cakes, prepare frozen dinners, and other products.

Quality Control Inspector
work to ensure the quality of the goods being produced. They may measure or check products for imperfections using electronic gauges, lasers, computers, or mechanical checking means. Some jobs require a quick visual inspection while others may required a more detailed assessment.

Key Words and Definitions:

1. **Assembly Line**: An arrangement of machines, tools, and workers in which the work passes from operation to operation until the product is assembled and finished.

2. **Innovate:** Improvement of an existing product, system, or method of doing something.

3. **Jig:** A device used to maintain the correct relationship between the work and the tool or between parts during assembly. The device is not attached to a machine.

4. **Manufacturing Technology:** The technologies people use to make the things they want and need.

5. **Mass production:** To produce a product in large quantities.

6. **Prototype:** An original model from which copies or duplicates are produced.

7. **Specification**: Description of work to be done and materials to be used in making something.

MANUFACTURING TECHNOLOGY

Occupational Choices

Focus: Assemblers and Fabricators

Classes to take in School:

- English
- Math
- Drafting
- Technology
- Welding

After High School:

New assemblers and fabricators are normally considered entry-level employees. A high school diploma is preferred for most positions. Some jobs require specialized training in electronics and these assemblers may be required to have technical school training or military training in that area. Other companies will require only on-the-job training, sometimes including employer-sponsored classroom instruction.

Earnings:

In 2010, people employed as Team Assemblers nationally had an median ***salary*** of **$27,180.**

In 2010, Assemblers that didn't specialize had average yearly wages of **$27,000.** In Utah, the wage was lower coming in at **$23,800.**

In 2010, yearly earnings ranged nationally from **$17,600 to $54,600.** Earnings vary by experience and location.

The Work:

Assemblers and fabricators must be able to perform their work quickly and accurately. More than half of all assemblers are team assemblers. There are various types of assemblers involved in different industries like aircraft, electrical, engine, and structural metal. Work areas may be noisy, and many assemblers may have to sit or stand for long periods. A high school diploma is preferred for most positions, but specialized training is required for some assembly jobs. Assemblers may read blueprints, run machinery, hand or power tools to make parts fit together. Many fit parts on automobiles or aircraft.

Employment Opportunities

- Temporary Workers
- Manufacturing Firms
- Retail establishments

Personal Characteristics

- Manual dexterity
- Eye-hand coordination
- Good eyesight
- Ability to work in teams
- Good reading skills
- Good Communications skills

Source: Occupational Outlook Handbook 2010-2011 Edition & Career One Stop

What would you be doing right now if you were not in school? In the history of our own country, young people went to work when they were your age. In many countries in the world today, authorities still allow children to work in factories for very poor wages. Can you imagine working 12 hours a day for a few dollars just so you had something to eat?

In this country, labor laws changed hiring practices early in the 20th century which has allowed young people of today the advantage of an education. The addition of labor laws, the organization of workers into groups called unions, and advances in technology have changed the way goods are made in this country.

"Carrying-in" boy in Alexandria Glass Factory 1911.
Library of Congress
Lewis Wickes Hine Photo

Originally, products were made by skilled craftsman who produced one part at a time. Today, raw materials are changed into usable products in large quantities. Manufacturing is the transformation of raw materials into finished goods for sale. This occurs usually in a factory. During the history of the world, people learned to make things more exact. It became possible over time to make things so exact that parts could be switched out between like pieces in a product. Manufacturers looked for other ways to make products cheaper and more efficiently.

Assembly lines

Henry Ford, came up with the modern version of the factory when he added conveyor belts to the assembly line and examined the speed of the assembly of parts. An assembly line is an arrangement of machines, tools, and workers in which the work passes from operation to operation until the product is assembled and finished. This development forever changed the way products are made. More work was produced on the assembly line in a shorter amount of time and more products could be sold making a profit for the manufacturer much quicker. Today, most products that you own are manufactured because the manufactured goods are **less expensive** when compared to making a product one-at-a-time. Consumers (person buying the product) and manufacturers both benefit which explains why manufactured products are so integrated within our society.

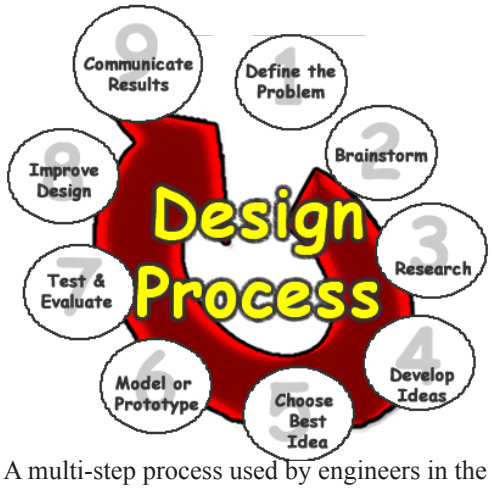
Manufacturing System

Manufacturing Technology is all the technologies people use to make the things that they want and need[1]. All manufacturing can be broken down into the things it takes to make a product which includes: ***Input*** (people, materials, money, knowledge, energy, time, tools and machines); ***Processes*** (transformation of the materials needed to make a finished product); ***Outputs*** (product and sometimes undesired results such as pollution or traffic); and ***Feedback*** (information is sent to go ahead with production or to make adjustments).

1 Brusic, S.

Departments:

There are several stages to manufacturing a product. All manufacturing can be broken down into departments. These departments fit into the manufacturing system just described and are needed to create a product.



A multi-step process used by engineers in the development of a product.
Figure 1

Design & Engineering

Manufacturing starts with product research and development. A planned series of steps are taken to design a product. Figure 1 illustrates the steps that engineers take. These planned step are known as the design process, and it is used to **innovate** or invent a product. Once a product is designed, it has to be tested to see if it meets engineering standards as well as consumers tastes. An original model of the product is called a **prototype**. The prototype looks and works just like the finished product.

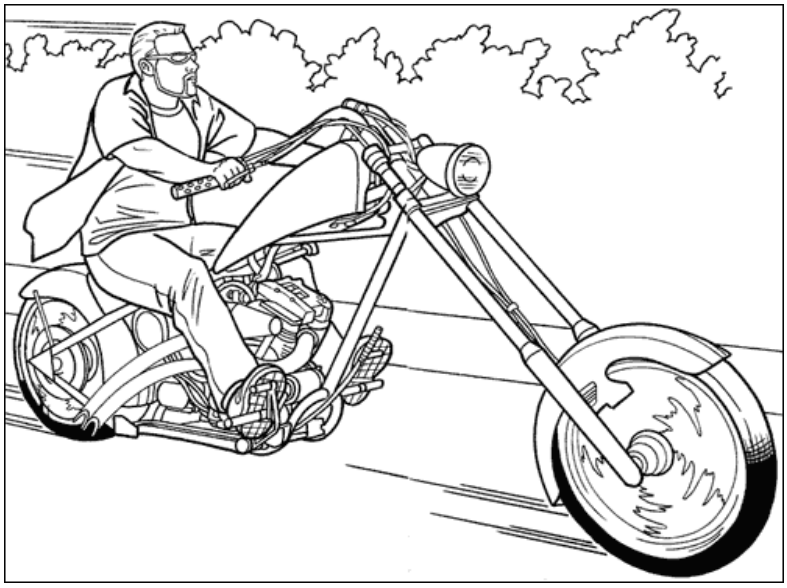
Purchasing

Once the product has been developed, materials to make the product need to be purchased. When all the materials arrive, the factory can begin to make a product.

Production

Making the actual product occurs in the production department. The type of product being made and the number of pieces being made will determine the production system to be used. There are three types of production systems:

•Custom Production:
Products are made to order. It is used when demand for the product is low, but the consumer is willing to pay for the added cost of customizing . Much of the items made are one-of-a-kind items. The workers in this production system are highly skilled. (i.e. clothing made just for you by a tailor/seamstress or a motorcycle with just the design features you pick)



A custom motorcycle is made to the customer's specifications. As a custom cycle, this is the only one made with this design.
Evolution Custom Cycles - Ronnie Plumb Photo

•Intermittent Production:
With intermittent production, products are mass produced in notable quantities; but the process of making

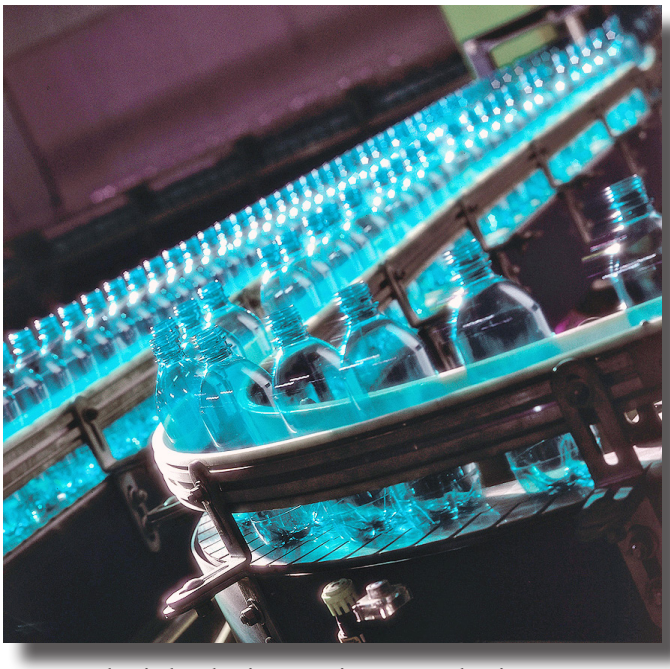
the product **stops** for a period of time after a run of the product. After there is a need for the product again, another production run is made and the cycle continues. The same manufacturing line may be used to create variations of similar products in this system. For instance, a member of your family may have made a batch of your favorite cookies. After those cookies are gone, another batch may be made a week or so later. The next batch could have a variation from the original (like switching out chocolate chips for M & M's). The same process to make the cookies was used; the two baking activities were separated by a period of time. (Other examples: 1. A manufacturer that produces versions of coats depending on demand and the season. 2. Production of a newspaper. 3. Fast food restaurants serving breakfast in the morning and later non-breakfast production).

A pizza being manufactured is an example of Intermittent production.
Mike Breen Photo

In intermittent manufacturing, the production system can further be categorized as to whether it is used for primary processing or secondary processing. In **primary processing,** materials are measured by volume or weight and are **batch processed** (i.e. concrete, steel, & cookie dough). In **secondary processing**, products that can be **counted** are processed by groupings called **job-lots** (i.e. chair legs, newspapers, & picture frames).

Intermittent manufacturing is more efficient than custom manufacturing. Jobs must be scheduled throughout the plant and it takes more time to setup. The **workers** however, are less skilled and receive lower pay than those that are employed in custom manufacturing.

•Continuous Production:
Products are mass produced in a steady flow. The parts go in and finished products come out the other end of the plant. Parts may pass by on a conveyor, or people may move to the product, but the process of making the product does not stop until the product is finished. In this system, **workers** have a single task. (i.e. In the production of a new car, a worker who installs head lights all day)



Plastic bottles in a continuous production run.
Amcor Limited Photo

The newest angle in continuous production is called **flexible production**. In this system, computers are used to operate machines and material handling equipment. This allows for rapid change with the product being produced. Tools and equipment can be quickly changed to produce a different product. It also incorporates ***Just-In-Time*** (JIT) inventory management which means that the part comes from the supplier when it is needed on the line. There are no warehouses to store parts.

Quality Control

The next department is the quality control department. During the production phase, the product must be checked to see that it meets the standards that it has been designed for.

Packaging and Sales

The last two departments are the packaging and the sales departments. The product comes off the assembly line and must be packaged for distribution. The product must also be sold to someone once it is packaged. Without sales, the company would be out of business.

A Quality control inspector evaluates the circuitry of solar controllers.
RESOL/ESTIF*Photo*

Impacts

Manufacturing has been instrumental in the transformation of many countries from agriculture to industrialized societies. People in developed nations have moved to urban centers where manufacturing jobs were located and away from the farms. As a result, an impact of manufacturing is that people have moved to where the jobs were, and manufacturing has had a part in the rise of larger and larger cities.

We benefit from manufacturing in many ways. Manufactured products have increased our free time and provided us with health care that has improved life for people of all ages. Almost every thing we use in our world today, is manufactured. From small things like a toothbrush, to larger things like a bus, manufactured products affect your life everyday.

As computers and robotics are implemented into factories, the need for skilled workers to maintain and use sophisticated technology has increased, and the demand for unskilled workers has decreased. With automation being used in today's manufacturing plants, the manufacture of products has become more information based as operators guide machines to perform tasks.

A step in the manufacture of computer memory chips.
Micron Technology, Inc. Photo

The Future

Many products today are global in how they are made. The research and engineering for the product may be done in the United States, however, the actual

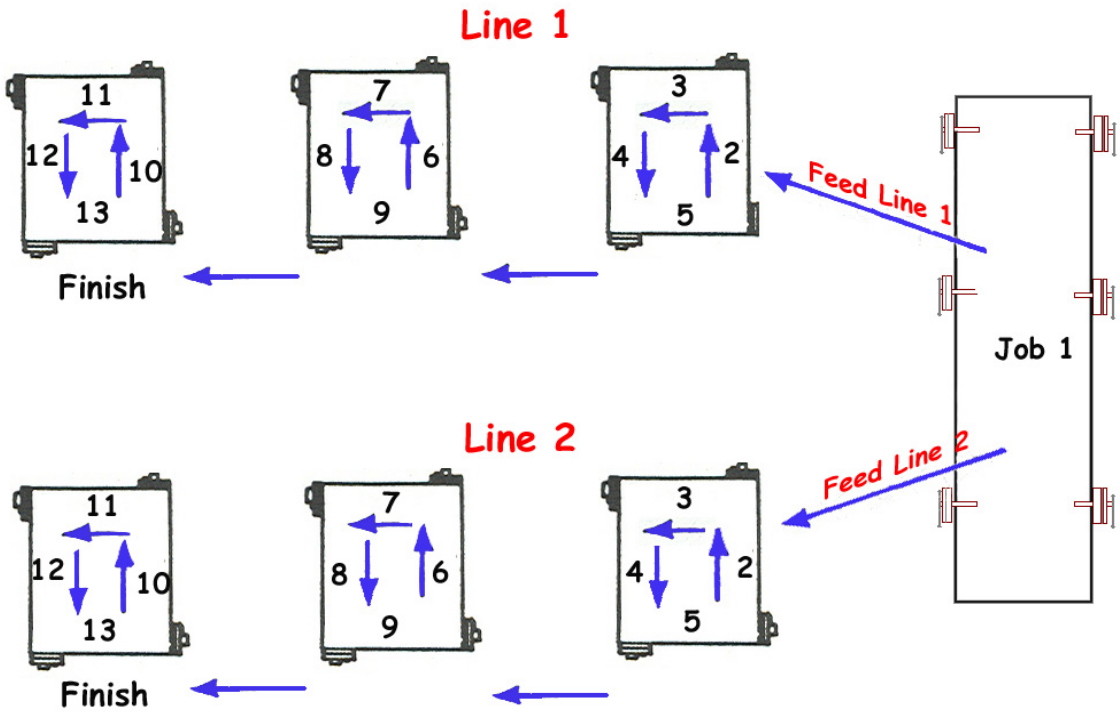
production of the product may be done in a foreign country. This occurs because **labor** costs are often much lower in other countries. Many larger companies, are located all over the world for this very reason. As products are produced in the future, companies will continue to become more global.

Manufacturing is always evolving. As manufacturing technology changes, the need for workers who are highly skilled, can communicate efficiently and work in **teams** will become more and more important. The future of manufacturing lies with those companies that can change and adapt quickly.

Today, a new trend involves using computer software to virtually manufacture products. Problems in setting up the assembly line are found and corrected before production begins which saves time and money. Automation will continue to be important as new products will come to consumers faster because of improved manufacturing technologies which will allow companies to compete in the global economy.

The Activity

In this activity, you will be participating with your class to produce a product. Each student will be given a "job" to complete a task on the product. For example, you may be assigned as one of the quality control inspectors to make sure that the product meets quality standards. Your instructor will now set the class up for the production run. An example of the possible layout for the assembly lines in your production run is shown in **figure 2**. Each number in the diagram represents a job to be done. The instructor will teach each group what their task is before it sent to the next person in the assembly line. Make sure to follow the directions that your instructor gives you so that you have a smooth production run and a quality product to take home or sell.



A possible layout of tasks in the assembly of the product in your class.
Figure 2

MANUFACTURING TECHNOLOGY
Student Work Sheet

Name:_____ Period: ____ Date: _____

Directions: In the blank on the left, write the correct answer to the statement or question.

1. _____ To _____means an improvement of an existing product.

2. _____ A _____ is device used to maintain the correct relationship between the work & the tool or between parts during assembly.

3. _____ A _____ is an original model from which copies are produced.

4. _____ Most products that you own are manufactured because the manufactured goods are ____ _____ for the consumer.

5. _____ People, materials, money, knowledge, energy, time, tools and machines are what part of a manufacturing system?

6. _____ _____ production is the type of production system in which products are made to order.

7. _____ _____ production is the type of production system in which workers have a single task.

8. _____ _____ production is the type of production system where the production has stops and starts.

9. _____ Many companies are "global" in nature. These companies will be located in the United States yet their product will manufactured in a foreign country. This occurs because _____ costs are often much lower in other countries.

10. _____ The need for workers who are highly skilled, can communicate efficiently and work in _____ will become more and more important.

MANUFACTURING TECHNOLOGY
Job Application Form

Company Name _____

To the prospective employee:
Your interest in this business is appreciated. Please take a few moments to complete the following questions. An understanding of your past work experience will be helpful to us as we place you into a position that best suits your qualifications and our work force needs.

Personal Information:

Name _____ (Last) _____

Address: _____ Telephone Number _____

How many years have you lived at the above address? _____

Employment Record: Position Desired: **Assembly Line Worker**

List employers you have previously worked for. Name the most recent first. (Include part time jobs)

Employer	Dates of Employment Start	Finish	Job	Reason for Leaving

Educational Record:

School Name	Dates: Start	Finish	Completed Yes	No
Grade School:				
Junior High/Middle School:				

References: List a person that knows you and your work ethic.

Name	Address:	Occupation