



From prototype to production: Careers that bring ideas into being

Domingo Angeles | November 2018

Consider the work that goes into making the products you see every day. What is the process for developing and manufacturing them? Which occupations are involved? What are their wages and outlook?

For nearly all manufactured goods, workers in different occupations collaborate to develop an idea into a product. Take automobiles, for example: The combined efforts of workers such as designers, engineers, and assemblers result in the production of new and different cars each year.



According to the U.S. Bureau of Labor Statistics (BLS), the 2017 median annual wages for the occupations mentioned in this article were higher than \$37,690, the median wage for all occupations. In addition, BLS projects thousands of openings annually from 2016 to 2026 in these occupations, primarily because of the need to replace existing workers who retire or leave the occupations permanently for other reasons.

Keep reading to learn more about some of the occupations involved in the manufacturing process, from creating a prototype (a kind of preliminary model) to making a product. We'll highlight these occupations using automobiles as an example, although the data shown are for workers in all industries.

Creating the prototype

Every manufactured product begins as an idea. [Industrial designers](#) develop ideas into designs by creating digital images. [Mechanical engineers](#) and [electrical engineers](#) analyze these designs to determine how to build them into prototypes.

In our automobile manufacturing example, [graphic designers](#) create the look of a car's interactive menus and improve their usability, such as determining what is on the main and subsequent screens. [Systems software developers](#) program how data from sensors, such as those that measure fuel temperature and engine speed, are used by the engine computer to make a car more fuel efficient. The product development team repeats the process of creating and reviewing prototypes until it arrives at a final design.

The occupations shown in table 1 accounted for 1.2 million jobs in 2016. More than a quarter of these jobs were in the manufacturing industry.

Table 1. Selected occupations involved in prototyping

Employment, 2016; occupational openings, projected 2016–26 annual average; median annual wages, 2017; and education typically required for entry



Occupation	Employment, 2016	Occupational openings, projected 2016–26 annual average	Median annual wage, 2017 ¹	Typical entry-level education ²
Software developers, systems software	425,000	32,900	\$107,600	Bachelor's degree
Graphic designers	266,300	26,000	48,700	Bachelor's degree
Mechanical engineers	288,800	21,200	85,880	Bachelor's degree
Electrical engineers	188,300	13,900	95,060	Bachelor's degree
Industrial designers ³	39,700	3,900	65,970	Bachelor's degree

Note: Data shown are for all industries. More than a quarter of the jobs in these occupations were in manufacturing.

¹ Wage data exclude self-employed workers.

² None of these occupations typically requires work experience in a related occupation for entry or on-the-job training to obtain competency.

³ Includes commercial designers.

Source: U.S. Bureau of Labor Statistics.

Combined, the occupations in table 1 are projected to have nearly 98,000 openings each year, on average, from 2016 to 2026. These projected openings are for occupations in all industries.

You typically need a bachelor's degree to enter these occupations. In addition, you may need specific skills that vary by occupation. For example, industrial and graphic designers should be able to express design ideas visually.

Making the product

Although products may be manufactured in small quantities, large-scale production is often more cost efficient. Cars, for example, are produced in large quantities and are standardized on an assembly line. [Industrial engineers](#) make decisions about the production process, such as the method or sequence of assembly, which is largely mechanized. [Metal and plastic machine workers](#) operate computer-controlled equipment or robots to perform tasks on the materials used in assembly.

The different parts and components are then put together by [assemblers](#) in sequence on the assembly line. [Electricians](#) and [industrial machinery mechanics](#) maintain and repair the conveyors, robots, and other equipment essential to production.

The occupations shown in table 2 accounted for about 2.5 million jobs in 2016. More than half of these jobs were in manufacturing.

Table 2. Selected occupations involved in production

Employment, 2016; occupational openings, projected 2016-26 annual average; median annual wages, 2017; and typical education and training



Occupation	Employment, 2016	Occupational openings, projected 2016-26 annual average	Median annual wage, 2017 ¹	Typical entry-level education ²	On-the-job training typically required to attain competency
Team assemblers	1,130,900	107,400	N/A	High school diploma or equivalent	Moderate-term on-the-job training
Electricians	666,900	82,000	\$54,110	High school diploma or equivalent	Apprenticeship
Computer-controlled machine tool operators, metal and plastic	145,700	14,500	39,230	High school diploma or equivalent	Moderate-term on-the-job training
Industrial machinery mechanics	346,900	33,000	51,360	High school diploma or equivalent	Long-term on-the-job training
Industrial engineers	257,900	19,700	85,880	Bachelor's degree	None

Note: Data shown are for all industries. More than a quarter of the jobs in these occupations were in manufacturing.

¹ Wage data exclude self-employed workers. Data are unavailable for values denoted with "N/A."

² None of these occupations typically requires work experience in a related occupation for entry.

Source: U.S. Bureau of Labor Statistics.

From 2016 to 2026, these occupations as a whole are projected to have about 256,600 openings annually, on average. As mentioned previously, projected openings are calculated for occupations in all industries.

Of the occupations in table 2, assemblers is the one projected to have the most openings from 2016 to 2026. Even though employment in the occupation is projected to decline, there will be a need to replace workers who are leaving the occupation.

Industrial engineers is the only occupation in table 2 that typically requires workers to have a bachelor's degree at the entry level. The other occupations usually require that workers have a high school diploma and on-the-job training, which may include an apprenticeship. And most states require that electricians be licensed.

For more information

BLS collects employment and wage data and provides employment projections for more than 800 occupations in over 300 industries. Learn more about the occupations in this article—and hundreds of others—in the [Occupational Outlook Handbook](#) (OOH). The OOH describes what workers do, what their job outlook is, what their typical entry-level education and training requirements are, and more.

[Industries at a Glance](#) snapshots provide more than 100 industry pages of data and information gathered from BLS programs and surveys. The [manufacturing sector](#) page includes an overview with links to data for 21 subsectors. The [automotive industry](#) page has data associated with several aspects of motor vehicles, including production.

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