

## New dimension: Revenue will rise as demand from aerospace and medical fields takes off

# IBISWorld Industry Report OD4428 3D Printer Manufacturing in the US

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# About this Industry

## Industry Definition

This industry manufactures 3D printers. 3D printing is a form of additive manufacturing technology where a three-dimensional object is created by laying down successive layers of material.

3D printers offer product developers the ability to print parts and assemblies made of several materials with different mechanical and physical properties in a single build process.

## Main Activities

### The primary activities of this industry are

3D printer manufacturing  
Build materials manufacturing  
3D printer service and maintenance

### The major products and services in this industry are

3D printers  
Build materials  
Maintenance and services

## Similar Industries

### 32521 Plastic & Resin Manufacturing in the US

This industry manufactures resins, plastic materials (i.e. polymers) and synthetic rubber.

### 33211 Metal Stamping & Forging in the US

Firms in this industry produce forgings, metal custom roll forming products, stamped and spun products and powder metallurgy products.

### 33271 Machine Shop Services in the US

Firms in this industry use lathes, milling machines and drill presses to shape materials.

### 33331 Copier & Optical Machinery Manufacturing in the US

Firms in this industry manufacture commercial and service machinery, including photographic and photocopying machinery and optical instruments and machinery.

## Additional Resources

### For additional information on this industry

[www.3dsystems.com](http://www.3dsystems.com)  
3D Systems  
[www.stratasys.com](http://www.stratasys.com)  
Stratasys  
[www.wohlersassociates.com](http://www.wohlersassociates.com)  
Wohlers Associates

# Industry at a Glance

3D Printer Manufacturing in 2014

## Key Statistics Snapshot

Revenue	Annual Growth 09-14	Annual Growth 14-19
<b>\$1.4bn</b>	<b>22.8%</b>	<b>15.7%</b>
Profit	Exports	Businesses
<b>\$250.6m</b>	<b>\$599.1m</b>	<b>50</b>

### Market Share

3D Systems Corporation  
19.5%

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Stratasys Inc.  
18.4%

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Revenue vs. employment growth

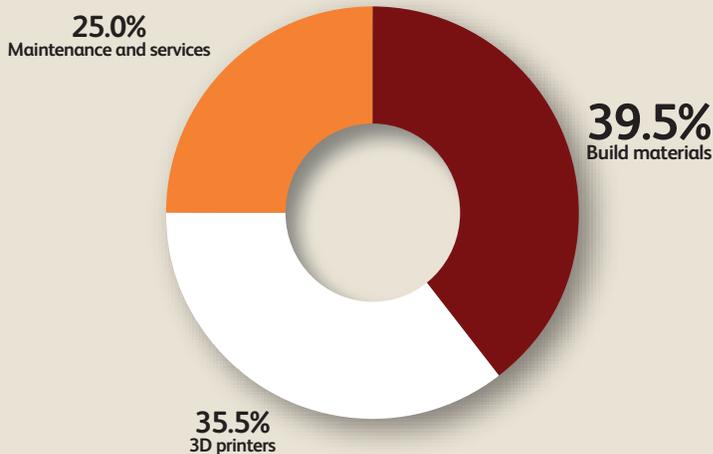


Demand from manufacturing



SOURCE: WWW.IBISWORLD.COM

Products and services segmentation (2014)



SOURCE: WWW.IBISWORLD.COM

### Key External Drivers

- Technological change for Television Networks and Providers
- Demand from architects
- Demand from manufacturing
- Research and development expenditure
- Trade-weighted index
- Demand from medical device manufacturing

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## Industry Structure

Life Cycle Stage	Growth	Regulation Level	Light
Revenue Volatility	High	Technology Change	High
Capital Intensity	Medium	Barriers to Entry	Medium
Industry Assistance	None	Industry Globalization	High
Concentration Level	Low	Competition Level	Medium

FOR ADDITIONAL STATISTICS AND TIME SERIES SEE THE APPENDIX ON PAGE 30

# Industry Performance

Executive Summary | Key External Drivers | Current Performance  
Industry Outlook | Life Cycle Stage

## Executive Summary

The 3D Printer Manufacturing industry has leaped ahead in recent years, driven by rapid technological developments, falling costs and new applications for 3D printing technology. Over the five years to 2014, revenue is expected to grow at an average annual rate of 22.8% to total \$1.4 billion. While industry revenue decreased 10.5% in 2009 due to recession related declines in demand, it bounced back in 2010 with 18.2% growth as downstream markets recovered. In 2014, revenue is expected to grow an additional 19.2%.

manufacturing techniques. 3D printers are capable of converting designs into 3D models almost instantaneously. As a result, they have grown in popularity within this field. Aerospace manufacturers comprise another market that has the potential for strong future growth for 3D printer manufacturers, as the aircraft industry's continual desire to reduce the weight of their aircraft in order to improve fuel efficiency will drive demand for 3D-printed products.

The price for most commercial 3D printers typically begins at about \$15,000 and quickly rises upward and out of the price range of the average consumer. However, a number of enterprising startups, in addition to commercial 3D printer manufacturers, have focused on developing low-cost 3D printers for home use among hobbyist consumers. As the price of 3D printers falls, a growing number of hobbyists are anticipated to purchase them. Over the five years to 2019, industry demand and revenue are forecast to surge forward as 3D printers increase in popularity and more customers from a wide array of industries use 3D printing. In the five years to 2019, IBISWorld projects that industry revenue will grow at an average annual rate of 15.7% to reach \$3.0 billion.

**Demand for 3D printers will rise as a growing variety of industries adopt the technology**

3D printers are increasingly being used in medical device manufacturing to create customized medical devices, such as medical devices that more accurately replicate the human form. These products include hearing aids, orthopedic implants and dental implants; moreover, future applications such as 3D-printed organs and blood vessels are in development. Historically, architecture, design, engineering and construction industries have had to create models by hand or use older subtractive

## Key External Drivers

### Technological change for Television Networks and Providers

The high rate of technological change in this industry allows 3D printers to be used for a greater number of applications. Technological advancements may also lower the cost of purchasing a 3D printer, which makes the technology more likely to be adopted by downstream industries and customers. This driver is expected to grow over 2014, representing a potential opportunity for the industry.

### Demand from architects

The architectural industry uses 3D printers to quickly convert their designs and blueprints into tangible models. Model building is an essential part of the architecture and design field; the success of architecture and design firms tends to drive demand for new 3D printers from this industry. The architectural industry is expected to increase over 2014.

# Industry Performance

## Key External Drivers continued

### Demand from manufacturing

Manufacturers, including aerospace customers, industrial plastic fabricators, industrial designers and other manufacturers use 3D printers to create prototypes of products, rapid or limited-run items, as well as customized products for customers. The health of the overall manufacturing sector determines whether these customers are willing to invest in capital purchases like new 3D printers. Downstream manufacturing markets are expected to increase over 2014.

### Research and development expenditure

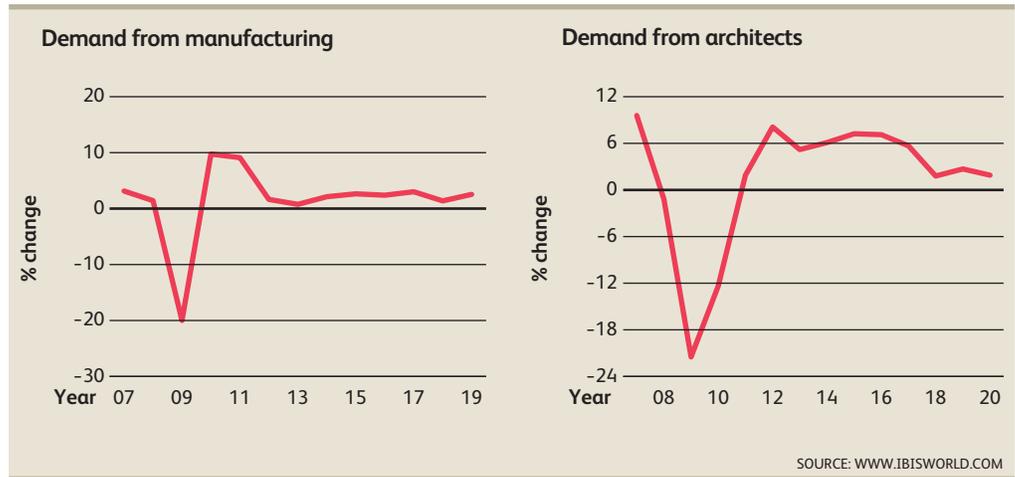
Research and development (R&D) expenditure influences demand for the industry because 3D printers are often used to create quick prototypes when developing new products. Therefore, an increase in R&D expenditure positively affects the industry. Research and development expenditure is expected to increase over 2014.

### Trade-weighted index

The trade-weighted index, which measures the relative strength of the US dollar to its trading partners, influences the industry. When the dollar appreciates, imports become more affordable and meet a greater share of domestic demand. Conversely, when the dollar depreciates, the industry's products become more affordable for foreign buyers. In 2014, the trade-weighted index is expected to increase, representing a potential threat to the industry.

### Demand from medical device manufacturing

Medical device manufacturers use 3D printers to create customized medical devices, such as prosthesis. These items include prosthetic limbs, teeth and cutting-edge items in development such as artificial organs and blood vessels. The Medical Device Manufacturing industry is expected to increase over 2014.



# Industry Performance

## Current Performance

3D printing is considered a form of additive manufacturing, which involves taking a raw material and melting it into microscopic layers until it creates a three-dimensional (3D) object. It differs from subtractive manufacturing, which removes material from an object to achieve a desired shape. While the 3D printing industry is nearly three decades old, it has surged ahead in recent years. The industry has been driven by rapid technological developments, falling costs and new applications for 3D printing technology.

Despite aggressive long-term growth rates, the industry endured bumpy ride navigating through the recession. For

example, industry revenue declined by 10.5% in 2009 as downstream markets suffered, though it bounced back in 2010 with 18.2% growth on the back of these markets' recovery. Furthermore, revenue and demand have continued to grow in recent years, as downstream customers have more money available to invest in 3D printers. Additionally, new features and lower prices are winning over customers that were previous holdouts. Over the five years to 2014, revenue is expected to grow at an average annual rate of 22.8% to \$1.4 billion. In 2014, revenue is expected to grow a further 19.2%.

## Sources of revenue

3D printing is being used to create some finished products, but these are mostly for niche applications and niche industries. Industrial components that would be costly or complex to manufacture (and only needed for a limited run) are already being manufactured using 3D printers.

Demand for 3D printers has grown as their technology has improved and their cost has gradually declined. The industry hit a speed bump when the overall manufacturing sector declined by 19.4% in 2009 and demand for 3D printers followed suit. As manufacturing activity has recovered, 3D printer purchases from manufacturers have correspondingly increased.

Most companies use 3D printers to create prototypes, as 3D printing is limited to specific materials. 3D printers have been used to create prototypes for the medical, dental, aerospace, automotive and motorsports industries as well as lower-technology consumer industries, including home accessories, toys and fashion products, such as jewelry. Developing a prototype is an essential part of product development, and manufacturers are often weighed

**Manufacturers are increasingly using 3D printers for prototypes and customizable products**

down by the time and costs involved in the traditional prototype manufacturing process. 3D printing allows them to develop a prototype in a fraction of the time and at a lower cost.

3D printers are increasingly being used in medical device manufacturing in response to rising demand for new healthcare products. The Medical Device Manufacturing industry (IBISWorld report 33451b) has grown at an average annual rate of 3.6% over the five years to 2014, helping drive demand for 3D printers. 3D printers are also being used to create customized medical devices and medical devices that more accurately replicate the human form, including 3D-printed hearing aids. In fact, 3D printing is used as the dominant technology for manufacturing generic in-the-ear hearing aids, which have dramatically increased patient comfort. In

# Industry Performance

## Sources of revenue continued

In addition, there are about 30,000 patients with 3D-printed orthopedic implants. 3D printing has also grown in popularity within the dental market. IBISWorld estimates that there are more than half a million 3D-printed dental implants in patients worldwide. Dental implants created by 3D printers include crowns, bridges and caps. 3D printers are also used to produce models to help surgeons plan for complex surgeries; CT or MRI scans are turned into 3D files and printed for surgeon reference during surgery.

Architecture, design, engineering and construction industries comprise another market for 3D printers. These industries have a steady need for models of their current and proposed projects. Historically, they have had to make these designs by hand or use older, subtractive manufacturing techniques. However, 3D printers can convert 3D computer-aided design (CAD) and other digital data and designs to near-instantaneous 3D models. 3D printers have helped

customers in these industries reduce delivery times and quickly present changes to clients. Purchases from customers in these fields have increased over the past few years as the economic climate for construction-related industries has improved from recessionary lows.

Revenue for the 3D Printer Manufacturing industry is heavily influenced by changes in economy-wide research and development (R&D) because 3D printers are used heavily in prototype development. Total R&D spending is tied to total corporate revenue; as a result, it moves closely with the overall economy. As revenue tightens during a recession, businesses tend to cut back on funding to develop new products. During times of economic expansion, however, increased revenue is often invested back into businesses. R&D expenditure is expected to rise at an annualized rate of 4.4% in the five years to 2014.

## Pricing trends

Major players such as 3D Systems, Stratasys and Z Corporation, all of which are all based in the United States, now offer a wide range of commercial 3D printers. Traditional 2D printer manufacturers are also starting to venture into the 3D market. For example, Hewlett-Packard Development Company (HP) now sells the HP Designjet 3D printer series after developing a partnership with Stratasys. Prices for most commercial 3D printers start at \$15,000 and quickly rise out of the price range of the average consumer. However, some online companies, such as Shapeways, manufacture 3D-printed objects for customers. A number of enterprising startups, in addition to

**Purchases from customers in the construction fields declined in response to adverse trends**

commercial 3D printer manufacturers, have also focused on developing more affordable 3D printers for home use among hobbyists. One of those companies is Makerbot, which designs basic 3D printers for hobbyists starting at \$1,299. The development of lower-priced 3D printers is making the technology more attainable for these consumers, therefore driving up demand.

# Industry Performance

## A growing industry

The industry's profitability has risen as demand and revenue have grown over the past five years. Existing manufacturers are selling a greater number of units, with their fixed costs and R&D costs being spread out over a higher volume of units. This factor has driven down per-unit costs and, in turn, increased profit. Profit is expected to account for 17.5% of industry revenue in 2014.

Industry participation is also growing as new companies attempt to ride the wave of rising unit shipments and growing revenue. Over the five years to 2014, the number of industry

establishments is expected to grow at an annualized rate of 4.5% to 122. The increasing number of establishments has also helped support employment growth. As a result, the number of employees has grown at an annualized rate of 6.6% to 6,933 over the same period. Existing establishments have also increased their hiring to keep up with rising demand. Furthermore, trade in the industry has been booming. In the five years to 2014, industry exports are expected to increase at an annualized rate of 17.5% to \$599.1 million, and imports are expected to grow at an annualized rate of 7.8% to \$401.6 million during the same period.

## Industry Outlook

Demand for 3D printers is forecast to continue surging over the five years to 2019. As 3D printers explode in popularity, revenue is anticipated to grow aggressively over the next five years. Additionally, more customers from a wide array of industries will increasingly adopt 3D printing technology. These trends will cause industry revenue to increase steadily over the next five years. In the five years to 2019, IBISWorld forecasts that revenue will grow at an average annual rate of 15.7% to \$3.0 billion.



## Growth areas

The aerospace manufacturing market has the potential for strong growth for 3D printer manufacturers. The aerospace manufacturing industry's continued desire to reduce the cost of developing models and prototypes will drive future demand for 3D-printed products. Aerospace firms are currently using 3D printers to develop parts such as landing gears, with future plans to make parts as large as an airplane wing. Using 3D printers wastes fewer raw materials,

which lowers overall material costs and can make projects less costly. In addition, 3D manufacturing could help build greener aircraft, as a greater proportion of their parts can be created from lightweight materials such as titanium and plastic.

While 3D printing already has a significant presence in the medical device manufacturing field, more opportunities are still on the horizon. Over the five years to 2019, revenue for the Medical

# Industry Performance

## Growth areas continued

Device Manufacturing industry is forecast to grow at an average annual rate of 7.1%. Furthermore, new and innovative applications for 3D printing are being developed. For example, researchers have perfected a method for printing human blood vessels, which will help improve the likelihood of transplant donors accepting new organs. Over the past few years, scientists also created a method for custom printing vital organs such as kidneys and bladders. The technology has improved dramatically, and scientists recently printed a heart the

size of a quarter that started beating a few minutes after being printed.

IBISWorld forecasts that total research and development (R&D) expenditure in the United States will rise steadily in the five years to 2019, at a rate of 2.1% per year, which will benefit 3D printer manufacturers. Total R&D spending will continue to increase over the next five years as the economy expands and corporate profit grows. Advances involving the materials that can be used by 3D printers, particularly metals and composites, will also boost 3D printing.

## A customized 3D future

Demand for mass customization will be one of the primary drivers for future 3D printer growth. When each product is printed individually from software, manufacturers have the ability to create unique products for each customer. This factor may create a fundamental change in manufacturing and product lines, marketing and even business models.

As demand and revenue for 3D printers expand over the coming years, profitability is expected to slowly creep upward. While there is currently a fair amount of competition within the industry, increasing competition will not likely put downward pressure on prices in the future because of booming demand for 3D printers. A new crop of firms will

**Because of substantial demand, players are competing more on features than on price**

likely pop up over the next five years that will be more specialized and target niche markets, such as creating 3D printers for medical device or aerospace clients. Thus, over the five years to 2019, the number of establishments is forecast to grow at an average annual rate of 3.7% to 146, while industry employment will grow at an average annual rate of 4.0% to 8,416 workers.

## Profitability strengthens

In the five years to 2019, IBISWorld expects that industry profit, measured as earnings before interest and taxes, will expand to an estimated 18.2% of industry revenue. Additionally, IBISWorld expects that the largest operators will continue acquiring smaller start-ups. Additionally, trade is expected to remain important for the industry. In the five years to 2019,

exports are expected to increase at an annualized rate of 9.6% to \$946.8 million, while imports are expected to increase at an annualized rate of 5.9% to \$534.1 million over the same period. As 3D printing technology becomes more affordable for consumers, US operators are expected to continue innovating products and selling them to foreign markets.

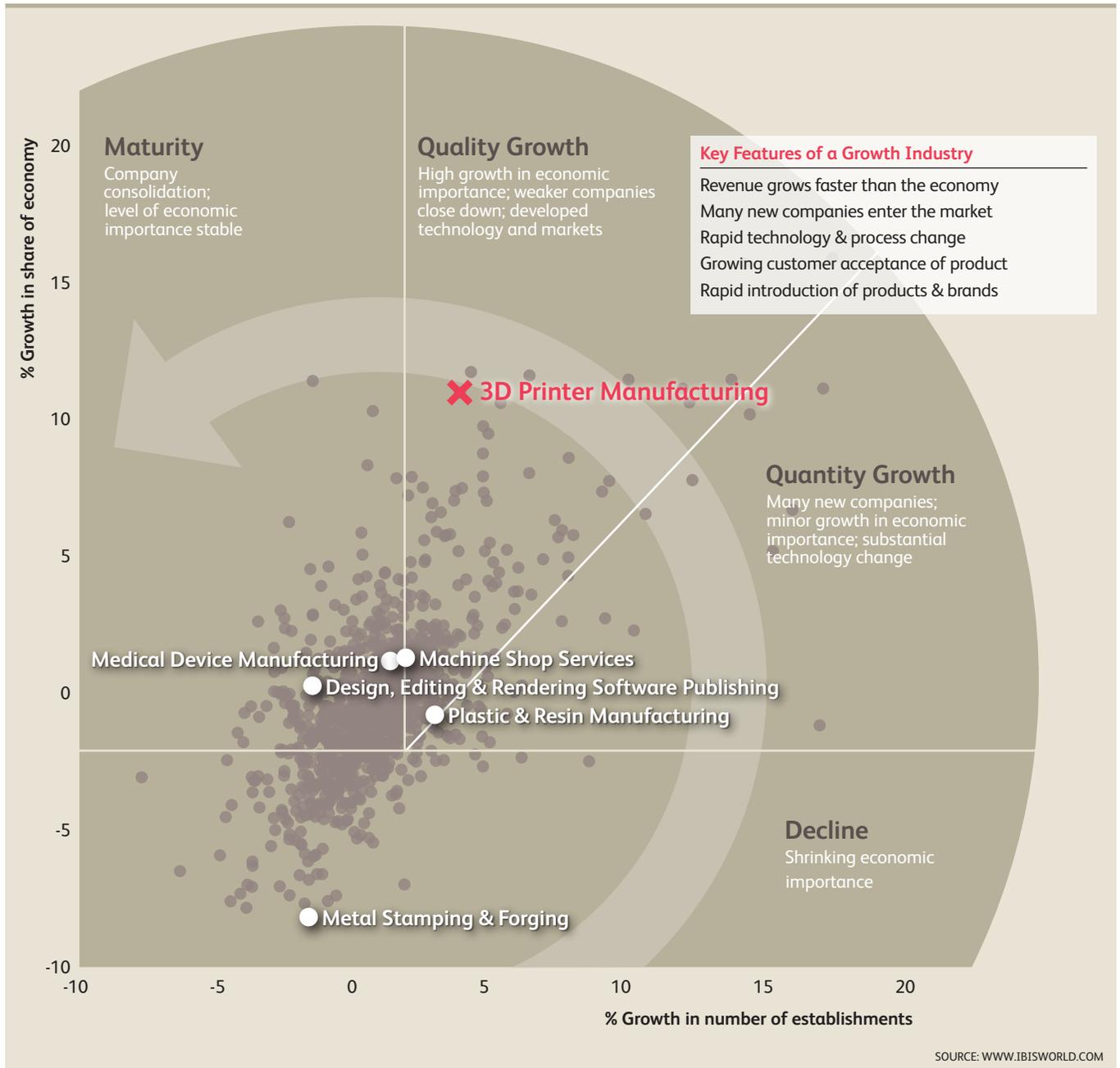
# Industry Performance

## Life Cycle Stage

Industry value-added growth is much faster than GDP growth

New applications for industry products are continually being discovered

The price of industry technology is falling, which is reducing barriers to entry



# Industry Performance

## Industry Life Cycle

This industry is **Growing**

The 3D Printer Manufacturing industry is growing at a rate that consistently surpasses that of the overall economy. Over the 10 years to 2019, industry value added, which measures an industry's contribution to GDP, is expected to grow at an average annual rate of 14.1%, while GDP is expected to grow at an average annual rate of 2.7% during the same period.

The industry's growth has largely been driven by rapid technological progress, which has increased the number of applications for industry products and lowered average product prices. These factors have encouraged new downstream industries and more customers to purchase industry products. 3D printers are being used to create customized medical devices that more accurately replicate the human form. These devices currently include hearing aids and orthopedic and dental implants; future applications include 3D-printed organs and blood vessels. Also, the architecture, design, engineering and

construction industries have a steady need for models of their current and proposed projects. Historically, they have had to make these designs by hand or use older subtractive manufacturing techniques. 3D printers can convert designs to 3D models nearly instantaneously; therefore, they have risen in popularity within this field. Aerospace manufacturers are also a market that has the potential for strong future growth within the industry. The aircraft industry's continual desire to reduce the weight of their aircraft to boost fuel-efficiency will drive future demand for 3D printed products.

Commercial 3D printers are typically priced from about \$15,000, rising quickly out of the range of the average consumer. A number of enterprising startups and commercial 3D printer manufacturers have focused on developing more affordable 3D printers for home use among hobbyists, which will likely drive future demand for products and add to the industry's growth.