

3D Printing and the Future of the US Economy

3D printing could bring millions of manufacturing jobs back to US shores and set off a fresh wave of economic growth across several industrial sectors. Thoughtfully targeted government support could significantly accelerate realization of these economic gains.



From complex jet engine parts to hearing aids and dental implants, an array of industries have embraced 3D printing—also known as additive manufacturing or 3DP—to make small batches of high-performing and custom-made parts. So far, additive manufacturing has primarily served niche markets, proving ideal for fabricating prototypes, small batches, and one-off items.

Now 3D printing is poised to enter more high-volume playing fields. Expanding 3D printing envelopes will soon allow manufacturers to fabricate much larger objects. Costs are dropping. Production materials are more readily available. And print speeds have been doubling every two years. 3DP mass production could be here much sooner than many people expect.

3D printing could realistically bring 3-5 million skilled jobs back to US shores in the next decade.

In fact, a new A.T. Kearney analysis shows that 3D printing could realistically bring 3–5 million skilled jobs back to US shores in the next decade, and yield up to \$900 billion in total economic value. This paper describes how that potential impact was calculated, and explores what US policymakers might do to help rev this promising engine of economic growth.

On the Road to a 3DP Future

Additive manufacturing is destined to grow because it offers many inherent advantages. It uses less material and creates less waste. Products are easier to customize or modify, and can be brought to market much faster. And because 3D printing can be used to make almost anything, it can soon become a practical alternative to a broad spectrum of traditional manufacturing processes.

Some traditional manufacturers are already gravitating toward 3D printing. Earlier this year, Adidas announced it has partnered with Silicon Valley 3D printing company Carbon to create soles for high-performance athletic shoes. Carbon's innovative material bounces back almost instantly, whereas previous 3D-printed materials might be too rigid for an athletic shoe. Freed from the challenges of injection and compression molding, Adidas aims to produce 100,000 pairs of its new Futurecraft 4D shoes by the end of 2018.¹

A big part of the future is 3DP-enabled manufacturing—where products are created using both traditional manufacturing methods (such as machining and injection molding) and 3DP. The possibilities are bountiful across multiple industries, as evidenced by 55 M&A deals over the past five years that illustrate traditional companies' willingness to bet on the future of additive manufacturing. For example, Forecast 3D, one of the oldest and largest privately owned service bureaus in the US, recently announced the acquisition of 12 HP Jet Fusion 3D printers, making it the first with the capacity to provide full-run 3D manufacturing. General Electric has acquired Arcam and Concept Laser, two of the world's leading providers of 3DP machine and plant technology. Looking ahead, we expect manufacturing to continue to consolidate across the 3DP ecosystem.

¹ ["Adidas Unveils New 3D Printed Shoe," CNNMoney, 7 April 2017](#)

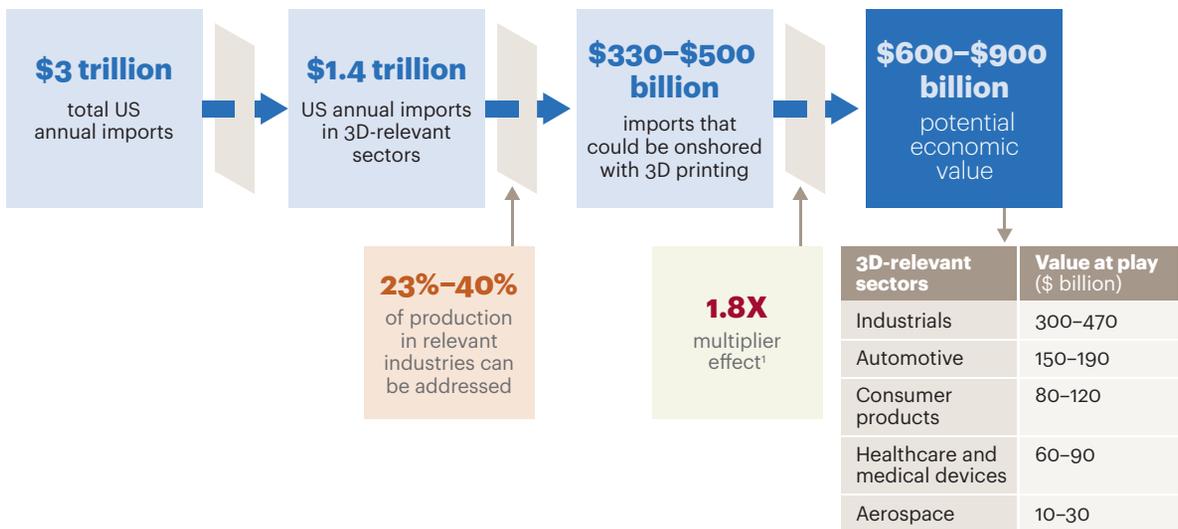
Major Economic Impact

As 3D printing becomes more competitive for mass production, it gains potential to deliver major economic impact. In the world's \$80 trillion economy, traditional manufacturing accounts for about 16 percent, or \$12.8 trillion. Today, 3D printing is used to create less than 1 percent of the world's manufactured parts. But take a look ahead and the picture is very different: 3D printing is expected to triple its market value from today's \$8.8 billion to more than \$26 billion by 2021.²

In the next 10 years, 3D printing could affect up to 42 percent of production in industrials, automotive, consumer products, healthcare and medical devices, and aerospace.

A.T. Kearney studied the potential of 3D printing in the five sectors where informed business leaders believe 3DP will likely have the greatest impact (see sidebar: About the Study on page 5). Our analysis suggests that in the next 10 years, 3D printing could affect up to 42 percent of production in industrials, automotive, consumer products, healthcare and medical devices, and aerospace. And we estimate the total economic value that could be onshored using 3DP is at least \$600 billion (see figure 1).

Figure 1
3D printing's potential economic value



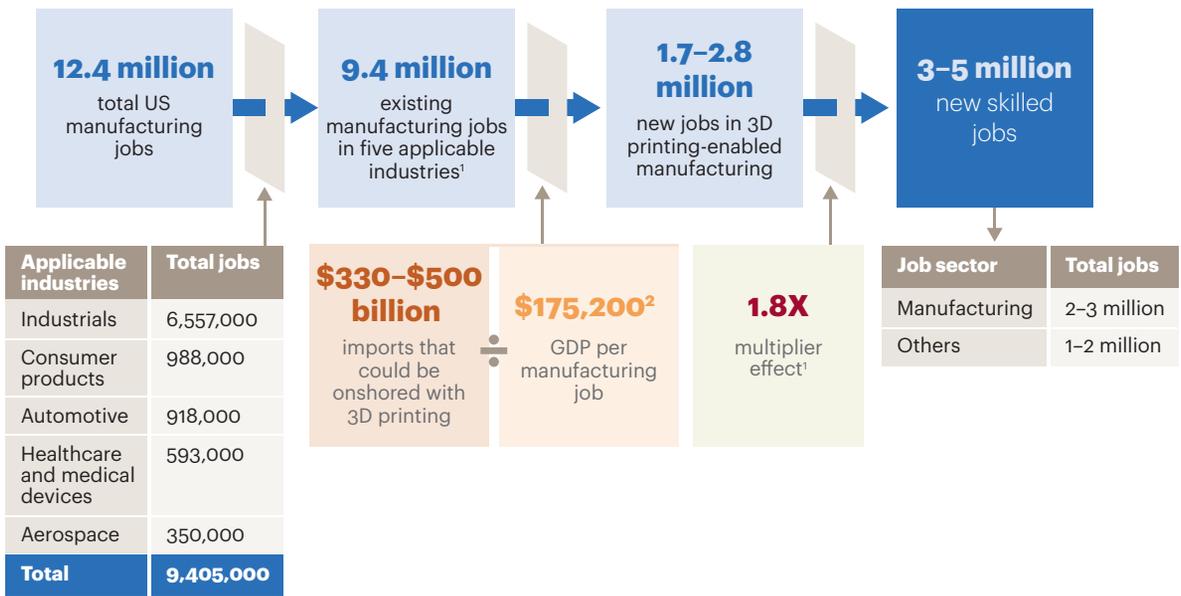
¹ For every dollar spent in manufacturing, another \$1.81 is added to the economy, according to the National Association of Manufacturers.
Source: A.T. Kearney 2017 3D Printing Study

² "Value of the additive manufacturing (3D printing) market worldwide from 2017 to 2021" Statista, 2017

Millions of New Jobs

3D printing could also bring millions of manufacturing jobs back to US shores. In fact, our study shows that 3D printing could create 3–5 million new skilled jobs (see figure 2).

Figure 2
3D printing’s potential job creation



Note: Numbers may not resolve due to rounding.

¹For every dollar spent in manufacturing, another \$1.81 is added to the economy, according to the National Association of Manufacturers.

²Total US manufacturing GDP divided by total number of manufacturing jobs

Source: A.T. Kearney 2017 3D Printing Study

A significant factor in both the economic value and job creation projections is the macroeconomic multiplier effect (MME), by which a gain in one form of economic value causes economic stimulus in related areas (for example, professional services, finance and insurance, and retail). Our review of relevant research by the National Association of Manufacturers suggests that the adjacent benefits of 3DP will be substantial. Accordingly, we applied an MME factor of 1.8X.

The jobs 3DP could add to the US economy include many warranting high levels of compensation.

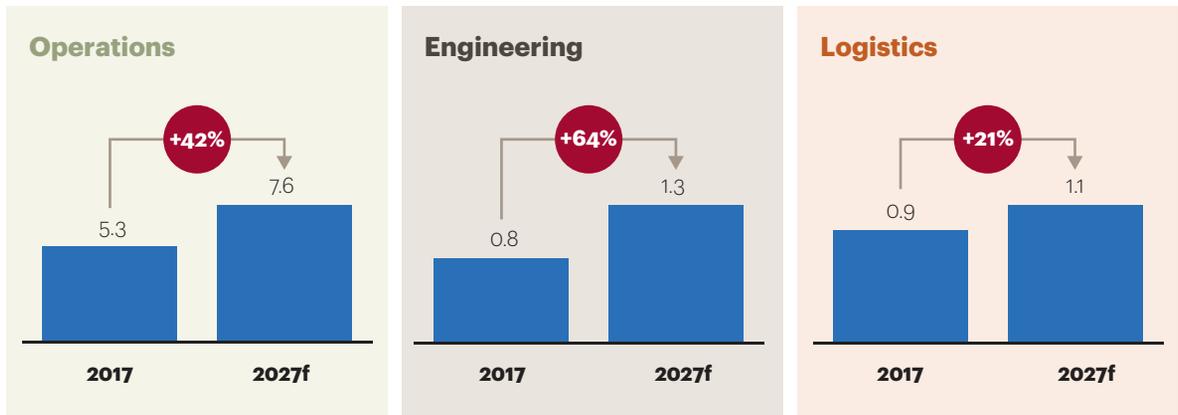
As important, our analysis strongly suggests that the jobs 3DP could add to the US economy would include many roles requiring considerable skill, thus warranting relatively high levels of compensation. The jobs that 3DP will create will mainly be in three areas (see figure 3 on page 5):

Figure 3

3D printing's potential job creation by category

Growth in the number of US jobs as a result of 3D printing 2017–2027

(millions)



Source: A.T. Kearney 2017 3D Printing Study

Operations. As 3DP expands into mass production, making domestic manufacturing markedly more cost competitive, companies will need more technicians, machinists, and operators to run shop-floor machines.

Engineering. 3DP growth will stimulate significant fresh demand for employees with design and engineering skills, which tend to command relatively high levels of compensation.

Logistics. 3DP expansion will also increase demand for employees skilled in logistics, although job growth in this area will be somewhat slower as 3D printing enables manufacturers to make spare parts on demand, reducing inventory requirements. However, the impact on trucking and last-mile delivery is expected to be minimal.

Revvng the Economic Growth Engine

To accelerate realization of 3DP's substantial economic benefits, the private sector will need government support in devising policies that encourage 3DP manufacturing:

Support educational reform. Over the next decade, 2 million manufacturing jobs could go unfilled because of a lack of qualified workers, according to the National Association of Manufacturers. Capitalizing on the new jobs that 3DP will create will require closing this skills gap. Federal, state, and local governments can support 3D printing curriculum programs by offering grants to implement digital technologies programs at government-funded universities and vocational schools.

Provide R&D support. From research grants to R&D tax credits, the US government has a central role to play in the evolution of 3D printing. Government investments are essential to support the private sector, which will ultimately bring products to market. Ideally, a public-private R&D partnership will fuel the technology's development.

About the Study

A.T. Kearney partnered with the global digital data collection company Research Now to conduct the firm's 2017 study of the 3D printing industry in the United States. As part of our study, we surveyed 112 people with knowledge about or experience with 3D printing representing companies in a range of sizes (see figure). More than half of the study's participants are in management roles, and nearly a third are in operations and production. Our

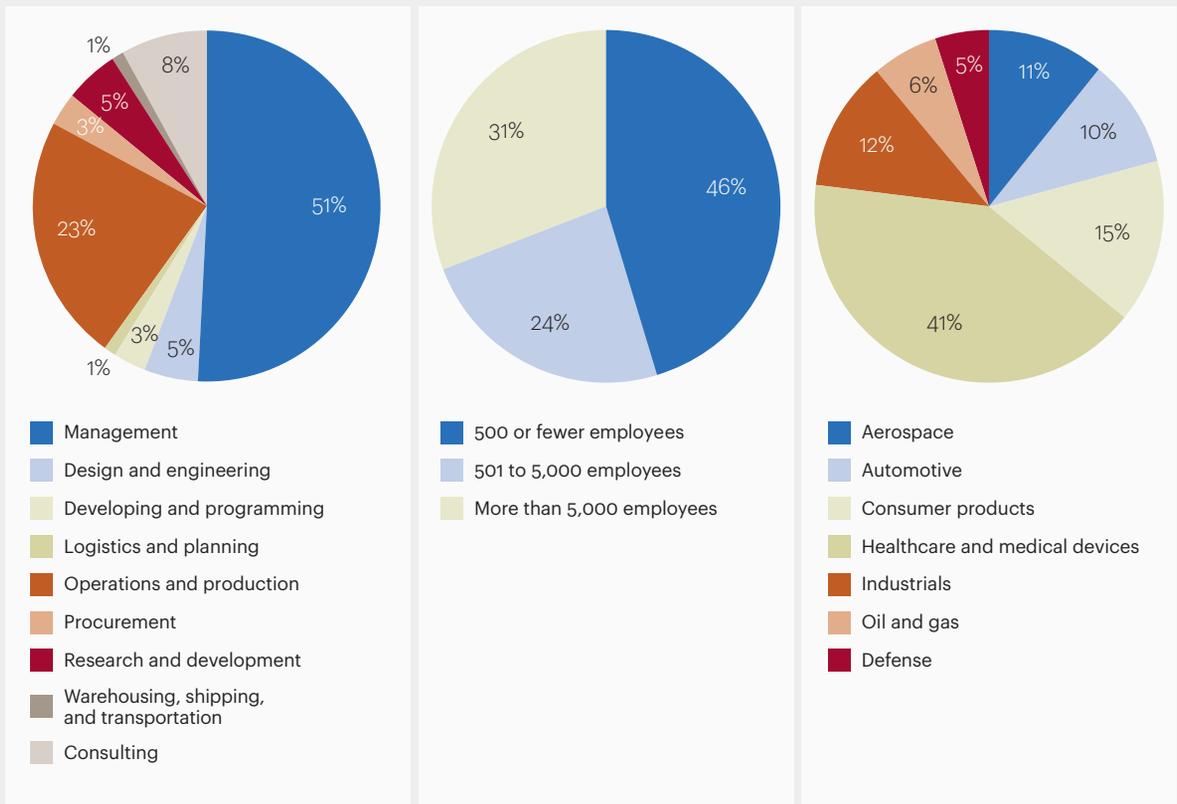
executive research suggests that 3DP will have the greatest near-term impact in five sectors: industrials, automotive, consumer products, healthcare and medical devices, and aerospace.

To calculate total economic value and job creation the US might realistically gain using 3DP across those five sectors, we next referenced various macro-economic data compiled by a range of authoritative sources, including The US Bureau of

Economic Analysis, The National Association of Manufacturers, The US Bureau of Labor Statistics, and The Organisation for Economic Co-operation and Development.

Figure
A.T. Kearney 2017 3D Printing Study

Study participants



Notes: The study's survey had 112 participants. Percentages may not resolve due to rounding.
Source: A.T. Kearney 2017 3D Printing Study

Create incentives. Beyond R&D, the government can invest in the future of 3DP by offering tax breaks and funding to help US companies localize manufacturing. For example, tax credits can encourage large companies to create new and improved products and processes, while loans and grants can help small and medium-size enterprises invest in 3DP equipment.

Protect intellectual property. One weak spot in the 3DP revolution is that the digital files used to create products are easy to access and easy to transfer—a real plus for counterfeiters and copycat producers. Companies must protect their data both by evaluating their internal security and by using patents to protect all aspects of their 3DP objects. However, existing laws, many enacted nearly two decades ago, are insufficient. The Digital Millennium Copyright Act’s anti-circumvention rule gives copyright owners one method to address this issue: prevent access to their 3D printing software files. The government must do more, including introducing criminal sanctions for copying a registered design, supporting businesses that opt to undertake costly legal proceedings, and sharing information about yet-to-be published patent applications with other nations’ patent offices. Stronger rules for intellectual property and data security will also help designers and investors feel more confident about 3D printing.

A Race to the Future

Forward-thinking companies are already embedding 3DP in their strategic planning. A.T. Kearney has helped an array of companies capitalize on the opportunities with cost modeling, scenario planning, and future-proofing for the inevitable disruptions in the value chain. Those that plan for this revolution will be able to ride its turbulence and seize powerful opportunities for growth.

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