

# TRENDS IN 3D PRINTING AT SCALE

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A Survey of 3D Printing Stakeholders  
in Production Manufacturing

**DECEMBER 2020**



## Introduction

Historically, 3D printing has been viewed primarily as a prototyping technology enabling engineers and inventors to experiment with innovative designs and materials on a small scale. But in recent years, more and more manufacturing companies are relying on 3D printing as an additive manufacturing (AM) technique to mass fabricate a wide range of physical products from digital design using 3D printing technology. 3D printing is disrupting traditional manufacturing processes by uniting product strength and production speed at scale.

This study highlights the realities of 3D printing for the production of parts at manufacturing companies to capture current experiences, challenges, and trends. Participants were asked about various topics related to the present and future use of industrial 3D printing and their opinions on outcomes.

The following report, sponsored by Essentium, is based on an online survey of 169 managers and executives working at manufacturing companies responsible for decisions regarding 3D printing for production parts. Certain questions were repeated from similar 2018 and 2019 studies to enable trend analysis. We have also included a special section exploring the impact of the COVID-19 pandemic on 3D printing at scale.

## Key Findings

### 3D PRINTING FOR PRODUCTION CONTINUES IMPRESSIVE GROWTH TRAJECTORY

- 49% say they use more than 25 3D printers today up from only 15% last year
- 51% report they are doing runs of thousands of 3D printed parts, up from 18% two years ago
- 53% indicated that 3D printing at their company grew by five times or more in the past year

### INVESTMENTS ARE PAYING OFF, BUT CHALLENGES REMAIN

- 99% have realized benefits from use of 3D printing for large-scale production
- Increased expertise, improved technology, and lower costs have encouraged adoption
- 90% admit they must still overcome obstacles to the adoption of 3D printing
- 96% agree open ecosystems are important to avoid vendor lock-in

### 3D PRINTING OFFERS SUBSTANTIAL ECONOMIC VALUE

- 80% say 3D printing at scale will reduce costs when it matures; 84% say it will increase their revenues
- 90% continue to believe the overall industry could save billions in production costs

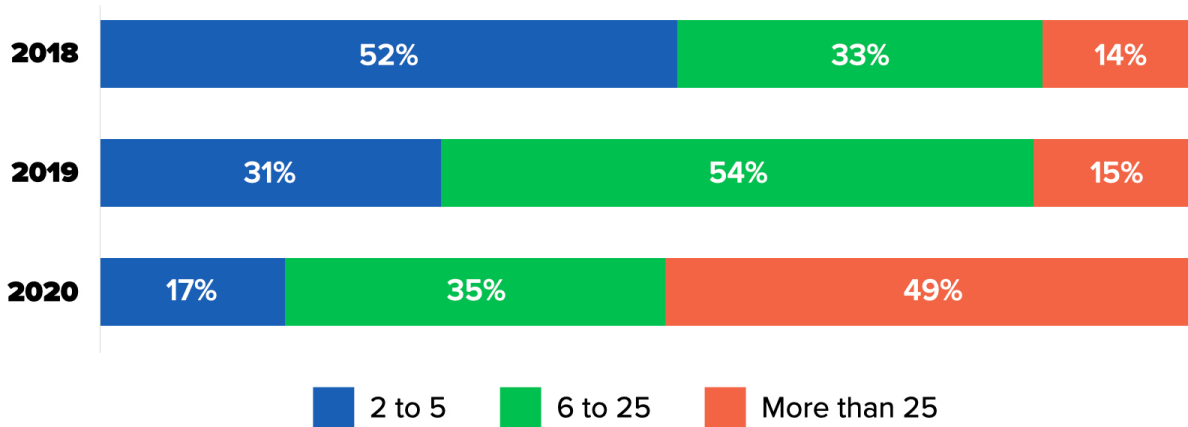
*NOTE: This study focuses exclusively on companies using 3D printing for use cases beyond simple prototyping. The data in this report is not representative of all manufacturing companies.*

# Detailed Findings: 3D Printing for Production Continues to Impressive Growth Trajectory

## THE NUMBER OF 3D PRINTERS IS GROWING DRAMATICALLY

One of the most basic measures of growth in 3D printing are the number of printers in use. More printers enable more 3D printing. The number of 3D printers has grown tremendously in the past years. The majority, 84%, report they are using more than five printers, up from to 69% last year. And nearly half (49%) of manufacturers report they are using more than 25 printers this year, up dramatically from only 15% in 2019 and 14% in 2018.

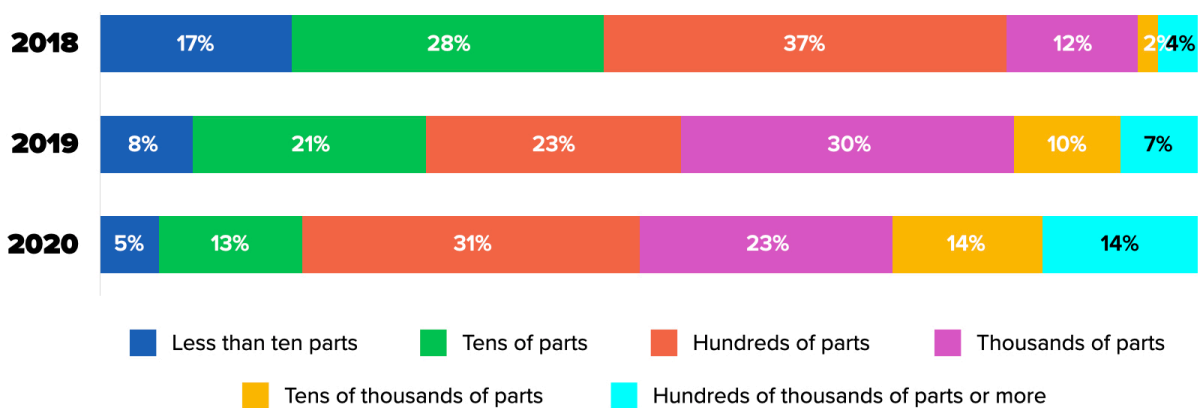
Number of 3D Printers in Use



## LARGE PRODUCTION RUNS OF 3D PRINTED PARTS CONTINUE TO INCREASE

Unsurprisingly, this growth in the number of 3D printers has mapped to more large production runs. Just over half (51%) are doing runs of thousands of parts, up from 18% in 2018. This impressive growth is also seen at the very highest levels. More than a quarter (28%) report doing runs in the tens of thousands of parts, up from only 6% two years ago.

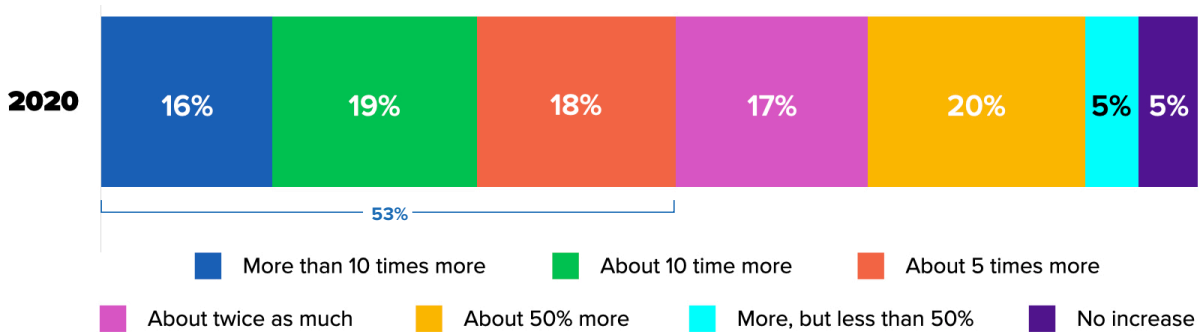
How Big is the Largest Production Run Your Company has Ever Done Using 3D Printing?



Another way to consider growth is to consider the overall print yield. More than half (53%) report that they have increased their volume of production parts by five times or even more. This growth compounds the high levels of growth reported last year, when two thirds (66%) reported they more than doubled their 3D printing of production parts.

It is interesting to note that mid-sized companies (1,000 to 5,000 employees) are experiencing particularly high growth levels, with 62% reporting a printing increase of at least five times more in the past year. This upward trend suggests that 3D printing of production parts is proving to be a valuable part of the manufacturing process across companies of various sizes, not just for the largest enterprises.

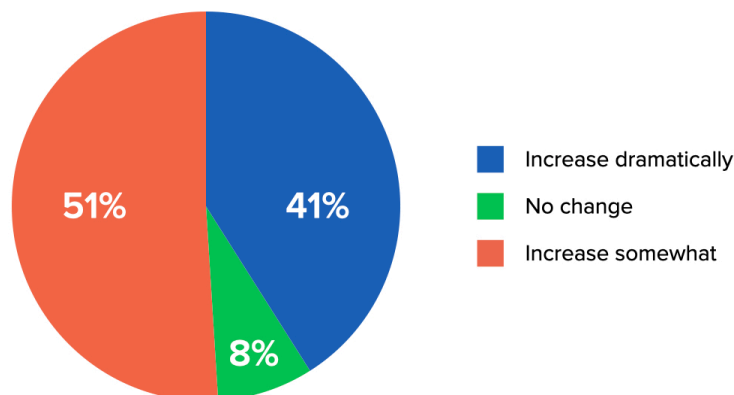
### Approximately How Much Has Your Company Increased 3D Printing of Production Parts in the Past Year?



### MOST STAKEHOLDERS SAY 3D PRINTING WILL GROW EVEN MORE IN THE NEXT THREE TO FIVE YEARS

There does not appear to be any indication that these incredible growth rates in production use of 3D printing are slowing down. To understand the growth potential of 3D printing, we asked the manufacturing managers and executives in our study about their expectations of this technology over the next three to five years. We discovered that the vast majority (92%) say their use of 3D printing will increase. Interestingly, not one person in our study believes their use of 3D printing will decrease in the near future.

### How Do You Expect Your Company's Use of 3D Printing Will Change Over the Next 3-5 Years?



# Detailed Findings: Investments Are Paying Off, But Challenges Remain

## A WIDE RANGE OF BENEFITS HAVE BEEN REALIZED WITH 3D PRINTING FOR LARGE-SCALE PRODUCTION

The potential benefits of 3D printing for core manufacturing or assembly processes have been anticipated since the technology was first developed. There has been hope for substantial benefits such as the elimination of lengthy wait times for spare parts or mold development, a reduction in shipping costs and inventory expenses, as well as the ability to quickly make customized products.

The good news is that the returns on 3D printing are here today, it is no longer a future dream. Almost all manufacturing companies using 3D printing for production (99%) are already seeing direct business benefits. These include high part performance (46%), cost reduction (46%), speed-to-part (45%), reduced lead time (42%), mass customization (40%), complex geometries (38%), and economies of scale (37%).

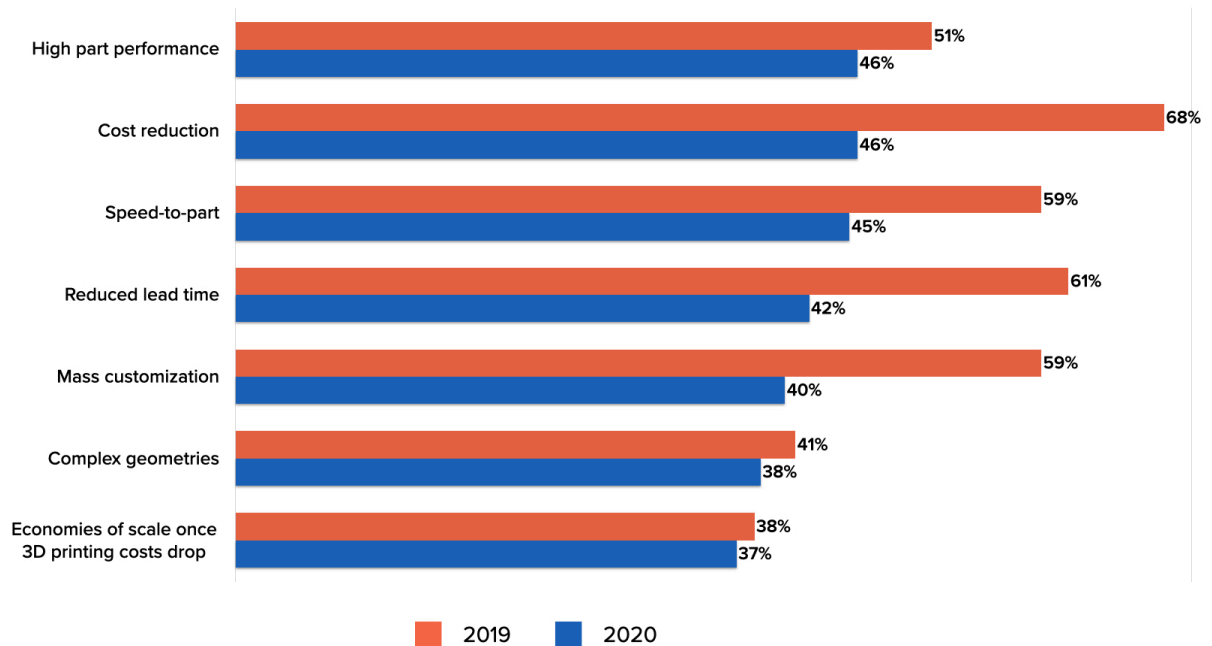
### What Are the Benefits Your Company Has Realized by Using 3D Printing for Large-Scale Production Manufacturing?



So has 3D printing achieved peak benefit for production manufacturing? While this is hard to analyze conclusively, our research indicates that there is still room to do even better. In the version of this study conducted in 2019, we asked about potential benefits, but offered similar question options. If we compare that to the actual benefits reported in this year's study, we see that actual benefits have already matched expectations in many areas including part performance and support for complex geometries.

However, there were higher expectations in areas of cost reduction, speed-to-part, lead times, and mass customization than have yet to be realized. Only time will tell if 3D printing will continue to evolve to meet the very high level of expectations, but the initial data is very promising.

## What Are the Benefits/Potential Benefits Your Company Has Realized by/for Your Company Using 3D Printing for Large-Scale Production Manufacturing?

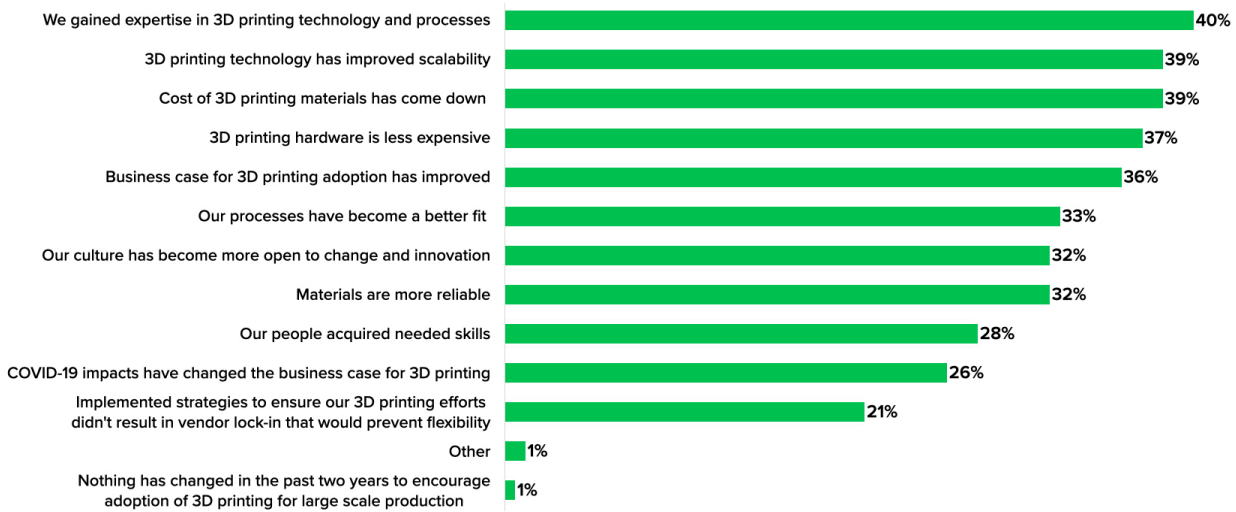


### MANY CHANGES HAVE ENABLED THE ADOPTION OF 3D PRINTING FOR LARGE-SCALE PRODUCTION

The promise of 3D printing at scale has been tremendous. In the past, there have been major technological and organizational obstacles to its adoption. However, this next generation of 3D printing for production manufacturing is poised for faster adoption as more companies strive to cut lead times and respond more quickly to customer needs.

When we asked manufacturing stakeholders what has shifted opinions, there is close to complete agreement (99%) that there have been specific changes just in the past two years that have encouraged the adoption of 3D printing for large-scale production. In particular, organizations have gained expertise in 3D printing and processes (40%), technology has made scalability improvements (39%), material costs have decreased (39%), the cost of hardware has dropped (37%), business cases for 3D printing are stronger (36%), process have evolved to make better fit (33%), customers have changed to be more open to innovation (32%), and more. Some individuals took the time to write other responses, such as their competitors using 3D printing and a desire to be ahead of the industry.

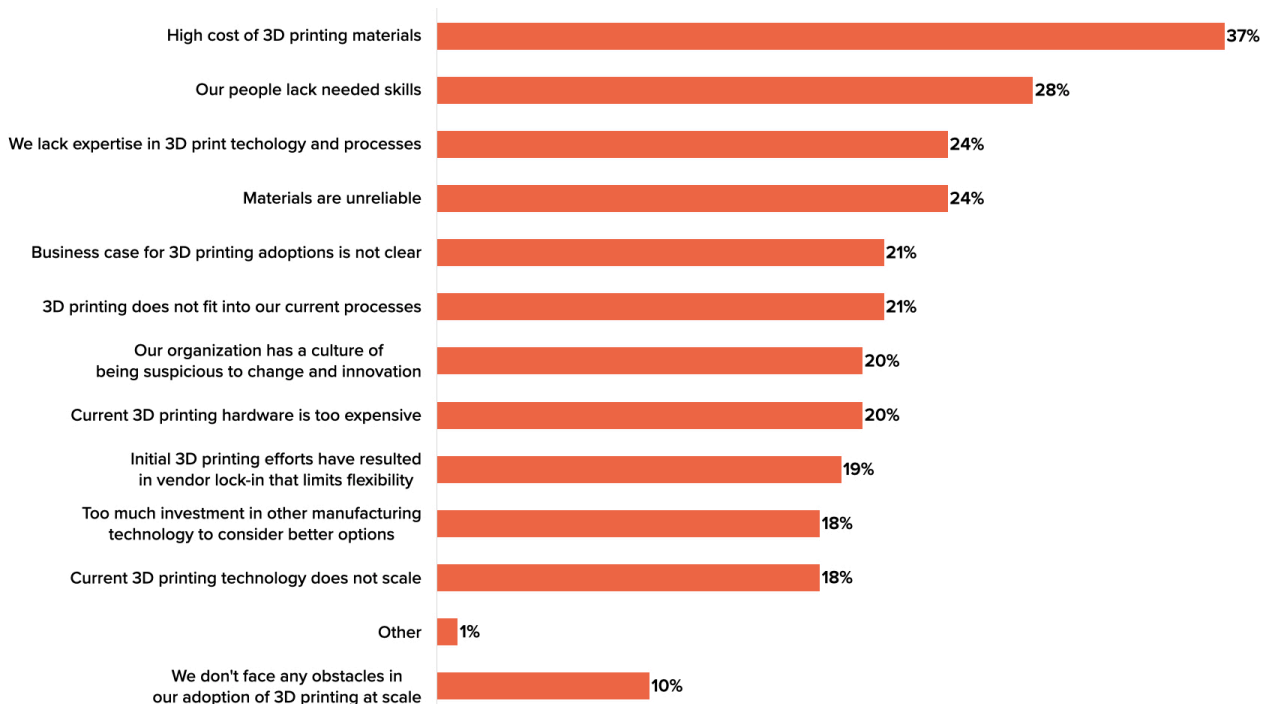
## What Changes Have Happened in the Past Two Years That Have Encouraged Adoption of 3D Printing for Large-Scale Production?



### COMPANIES STILL MUST OVERCOME OBSTACLES TO THE ADOPTION OF 3D PRINTING AT SCALE

Even though many companies have propelled forward in their adoption of 3D printing for large-scale production, most (90%) admit they are still facing obstacles. These include high material costs (37%), lack of employee skills (28%), insufficient expertise (24%), unclear business cases (21%), and more. While most these individual numbers tend to be relatively small overall, with less than a third facing most individual obstacles, they do need to be taken seriously by management to continue to make gains.

## What Obstacle Does Your Company Continue to Face with Adoption of 3D Printing for Large-Scale Production?

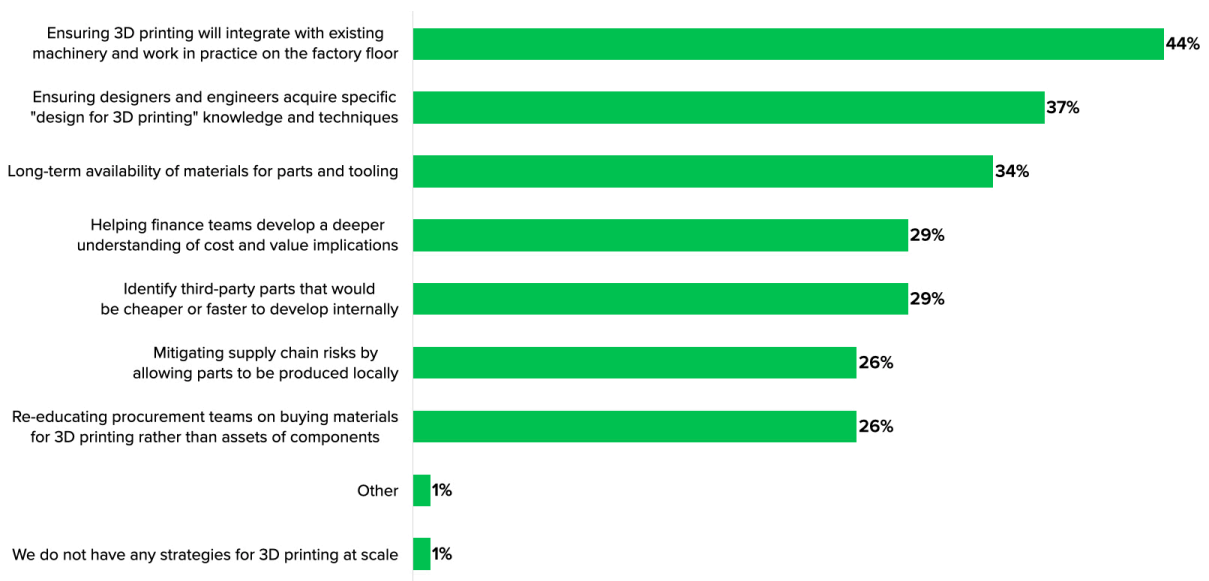


## FUTURE-PROOFING INVESTMENTS IN 3D PRINTING AT SCALE REQUIRES MULTIPLE STRATEGIES

3D printing is currently at a technological and economic inflection point, opening the door to a digital reinvention of the manufacturing sector with billions of dollars at stake. As more companies adopt this innovative technology, they must also think about how to best future-proof their investment.

When we asked manufacturer stakeholders about protecting their investment in 3D printing for production parts, the top strategic consideration cited was ensuring 3D printing will integrate with existing machinery and work in practice on the factory floor (44%). Other strategies considered are ensuring designers and engineers acquire specific “design for 3D printing” knowledge (37%), long-term availability of materials (34%), helping finance teams develop a deeper understanding of cost and value implications (29%), identifying third-party parts that are cheaper or faster to develop internally (29%), and more. One participant also wrote an “other” response of ensuring hardware supplier commitments to the ongoing support of existing processes and systems.

### When You Think About Future-Proofing You Invest in 3D Printing at Scale, What Strategic Considerations Are MOST Important?

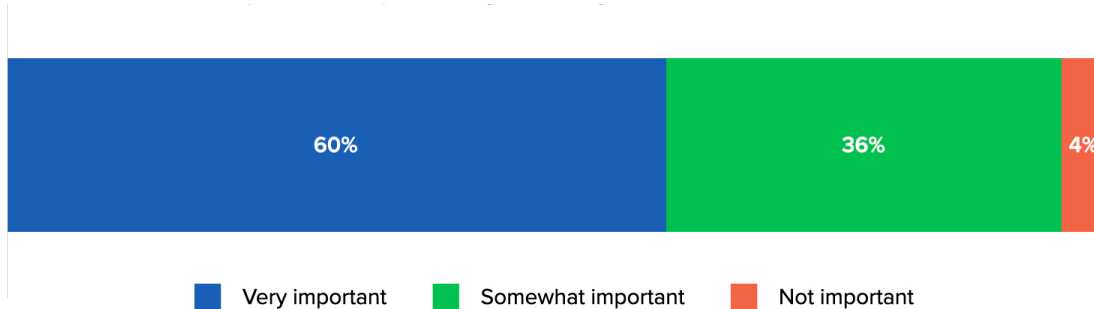




## OPEN ECOSYSTEMS CONTINUE TO BE IMPORTANT TO THE SUCCESS OF 3D PRINTING AT SCALE

A critical aspect of this research is the requirement for an open ecosystem to the additive manufacturing market. Why is this option so crucial to 3D printing at scale? Previously, the market was dominated by closed systems where customers were locked into vendors' hardware, processes, and materials. Today 96% of manufacturers are demanding more open ecosystems to give them greater control. But even though this requirement is top of mind, few vendors are currently in the position to sustain open systems. This is one area where the industry needs to improve.

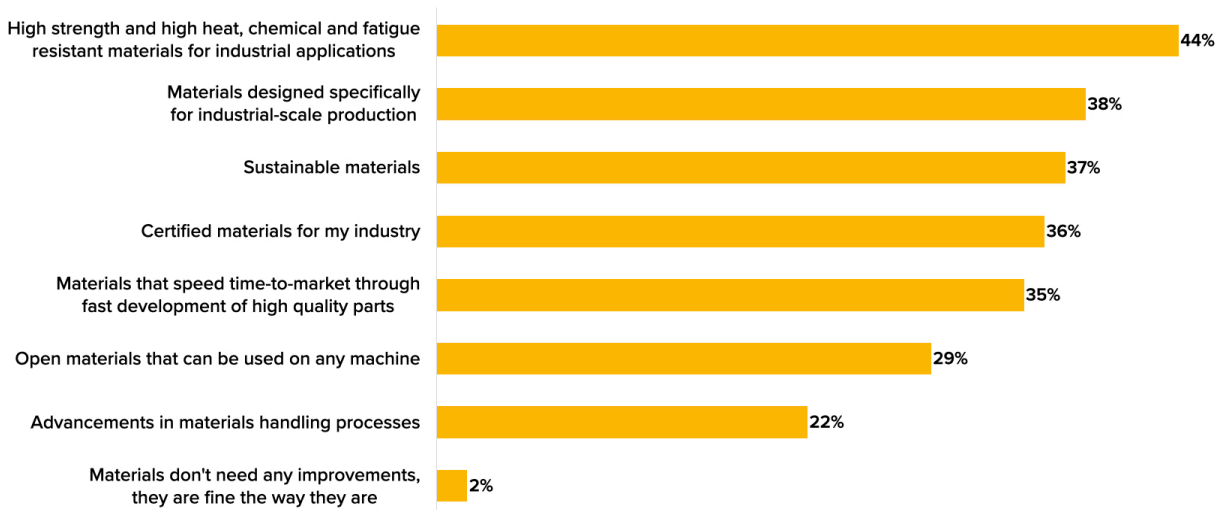
### As You Evaluate Options for 3D Printing at Scale, How Important Is It That Your Vendors Are Part of an Open Ecosystem So You Avoid the Risk of Vendor Lock-In?



## MANUFACTURERS SEE VALUE IN IMPROVED MATERIALS

Materials are a fundamental success factor to strengthening overall quality output in 3D printing at scale while also achieving higher yields and consistent print repeatability. Without optimal materials for mass producing an object, manufacturers will face continual difficulties making 3D printing an integral part of their production floors. Manufacturing managers and executives couldn't agree more, with 98% citing a desire for improved materials for 3D printing. The most requested improvements in materials are high strength and high heat, chemical, and fatigue resistant materials for industrial applications (44%), materials explicitly designed for industrial-scale production (38%), sustainable materials (37%), industry certified materials (36%), materials that speed time-to-market through fast development of high parts (35%), open materials that can be used on any machine (29%), and advanced materials for handling processes (22%).

### What Improvements in Materials for 3D Printing Would Be of Most Value To Your Organization? Choose up To 3 of the Following.



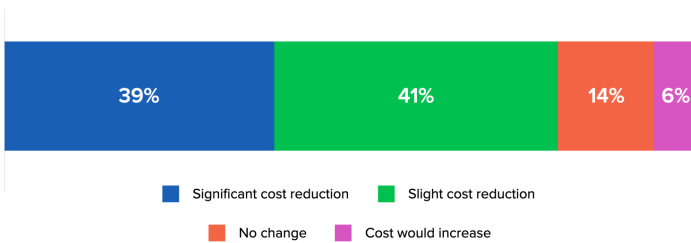
# Detailed Findings: 3D Printing Offers Substantial Economic Value

## 3D PRINTING AT SCALE CAN REDUCE COSTS AND INCREASE REVENUE

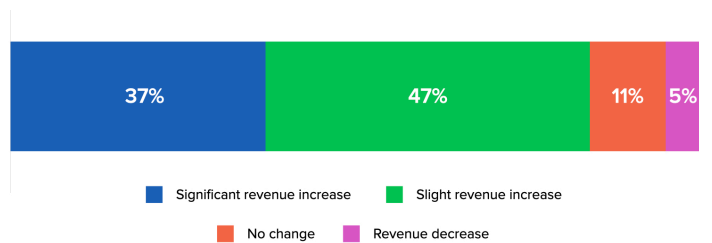
To further assess the opinions on the expected future value of 3D printing at scale industry wide, we presented survey participants with an optimistic scenario for 3D printing. We then asked a series of questions about potential cost savings and increased revenue earnings from this scenario.

Our goal was to determine if experienced 3D printing stakeholders believe the positive outcome is a realistic future or merely wishful thinking. What we found are high levels of optimism when 3D printing at scale matures with immediate financial impact at most manufacturers represented. According to participants, almost all (96%) anticipate reduced manufacturing costs. And, 39% expect “significant” cost reductions. Similarly, 95% of stakeholders estimate that they will increase revenues, with more than a third (37%) predicting a “significant” revenue increase.

**Imagine the Scenario Where Your Company Has Solved All Hardware, Materials, and Organizational Challenges of 3D Printing at Scale, What Would Be the Most Likely Impact on MANUFACTURING COSTS at Your Company?**



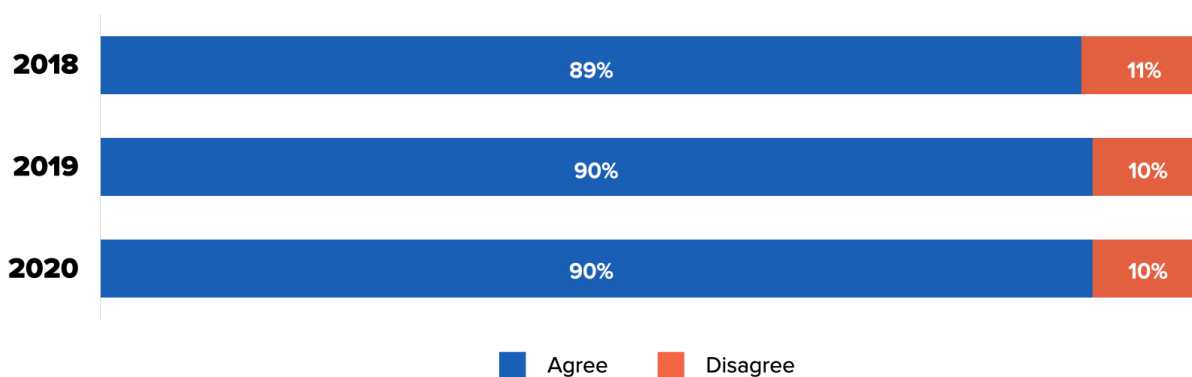
**Imagine the Scenario Where Your Company Has Solved All Hardware, Materials, and Organizational Challenges of 3D Printing at Scale, What Would Be the Most Likely Impact on REVENUE GENERATION at Your Company?**



## THERE IS CONTINUED STRONG AGREEMENT IN THE VALUE OF 3D PRINTING

When we assess the predicted savings impact year over year, the strong confidence in 3D printing maturity continues. The vast majority (90%) of manufacturing managers and executives agree the industry could save billions in production costs once the technology matures. This high number is consistent with the responses gathered from similar surveys in 2018 and 2019. It suggests that the perceived value of 3D printing at scale continues to be favorable even as companies get more experience. While new technology can often be oversold and people can become more pragmatic and less excited over time, this situation is not happening with 3D printing.

**Please Indicate Your Level of Agreement: The Manufacturing Industry Could Save Billions of Dollars in Production Cost Once 3D Printing Technology Matures**



# Special Report: COVID-19 and 3D Printing at Scale

## 3D PRINTING AT SCALE CAN REDUCE COSTS AND INCREASE REVENUE

The COVID-19 pandemic, also referred to as the coronavirus, is changing the world as we know it. Who would have thought that we would ever see store shelves stripped of essentials like toilet paper, disinfecting products, and pasta? That our medical professionals and first responders would run out of personal protective equipment (PPE)? Or that factories would come to a halt due to a lack of parts and sub-assemblies produced half a world away?

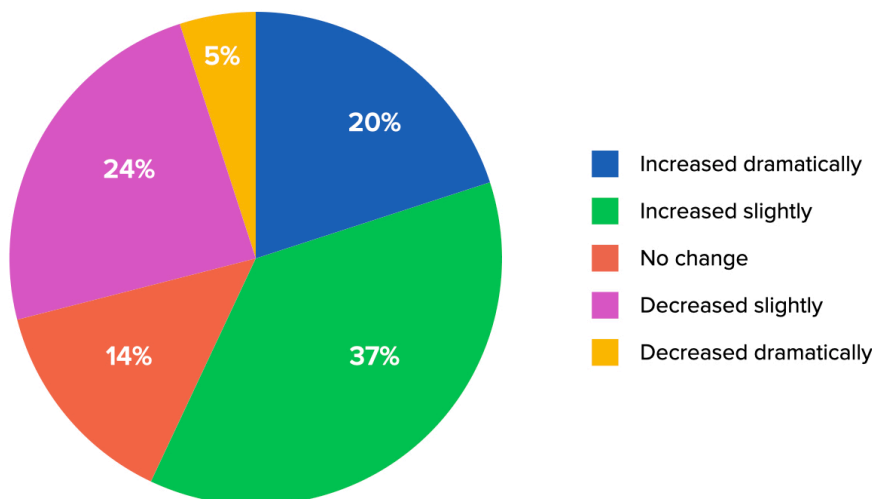
This survey was fielded as the second large wave of COVID-19 was hitting the United States and around the world. This research demonstrates its impact on 3D printing at scale has been significant yet unique for each company:

- 86% say their company's use of 3D printing for production parts was impacted
- 90% believe COVID-19 is influencing their organization's adoption of 3D printing
- 89% report varying effects on 3D printing investments
- 86% agree 3D printing will increasingly drive more local manufacturing

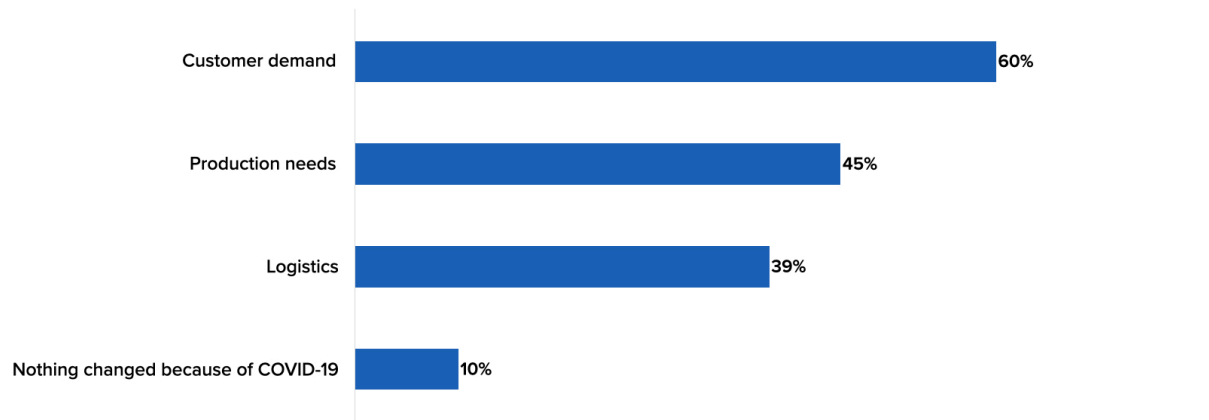
The coronavirus pandemic has shown us how easily global supply chains can snap for indeterminable lengths of time. And changing customer demands (e.g., pandemic buying) often shorten or completely deplete resources. Agile companies that can adapt quickly to increased customer demands are proving to be successful. Yet on the opposite end, some manufacturers are experiencing less demand for their products and, as a result, will have less money to invest in additive manufacturing.

Clearly, the pandemic is affecting most manufacturing companies in one way or another, with 86% saying they are impacted. However, it has been a mixed bag of positive and negative outcomes. While more than half (57%) of companies increased their use of 3D printing for production parts during the pandemic, it was not ubiquitous as over a quarter (29%) say it decreased.

### Overall What Changes Has COVID-19 Made on Your Company's Use of 3D Printing for Productions Parts?

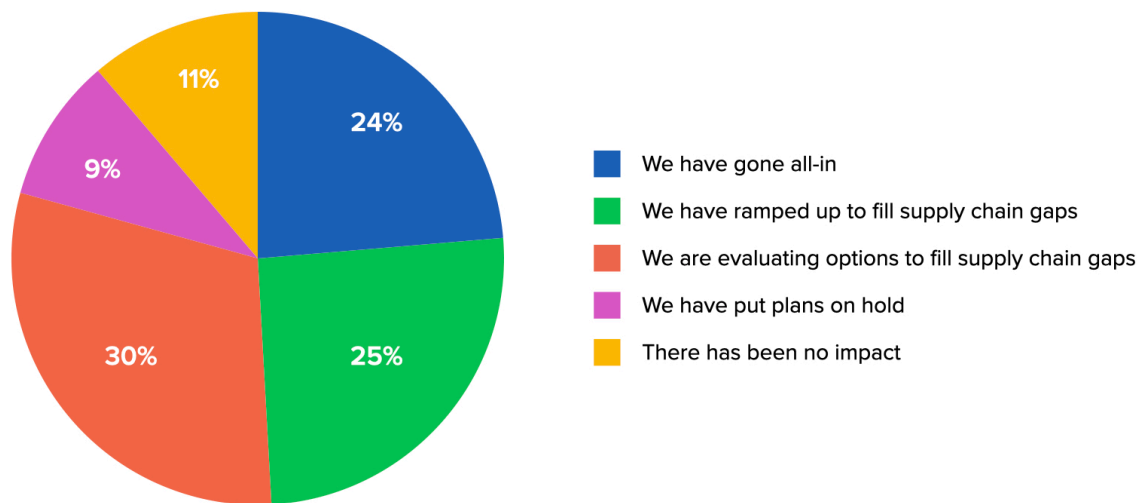


## Has COVID-19 Impacted Any Business Factors Related to Your Organization's Adoption of 3D Printing for Production Parts?



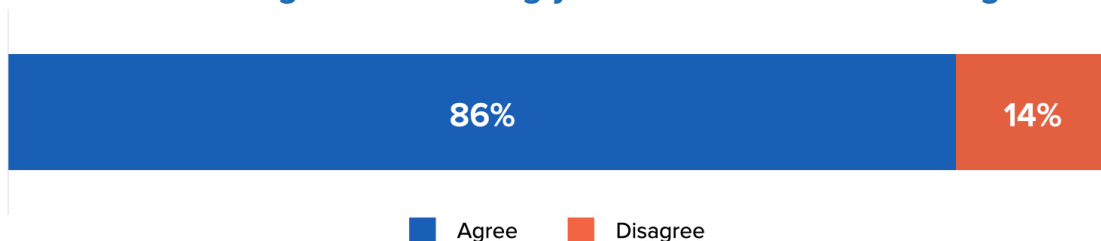
Conversely, every business is unique and COVID-19 is reshaping their 3D printing investment plans varyingly according to stakeholders. We are encouraged that nearly one third (30%) of manufacturers say they are evaluating options to fill supply chain gaps.

## How Has COVID-19 Impacted 3D Printing Investment Plans at Your Company?



One of the major lessons from COVID-19 is that borders can be closed quickly making logistics harder and on-shoring/off-shoring more valuable. Most manufacturing managers and executives agree, with 86% anticipating 3D printing will increase local manufacturing. A shift to more local production is one way companies might eliminate particular logistics issues exacerbated by COVID-19.

## Please Indicate Your Level of Agreement: 3D Printing Will Increasingly Drive Local Manufacturing

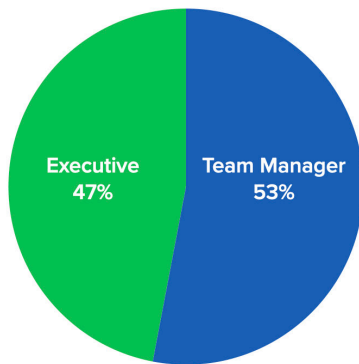


There are also commonalities influencing organizational adoption of 3D printing for production parts at this time, including customer demand (60%), product needs (45%), and logistics (39%). Only 10% of manufacturing companies report nothing has changed their business due to COVID-19.

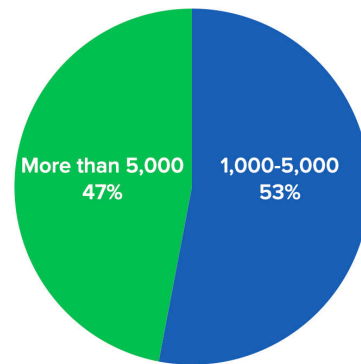
## Survey Methodology and Participant Demographics

An online survey was sent to an independent database of managers and executives working at manufacturing companies worldwide. A total of 169 qualified individuals completed the survey. All participants were responsible for decisions regarding 3D printing for production parts. Participants included a mix of job levels, roles, and industries across the globe. To enable trend analysis, certain questions were repeated from similar surveys conducted in 2019 and 2018.

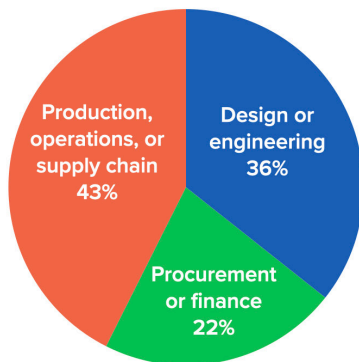
**Job Level**



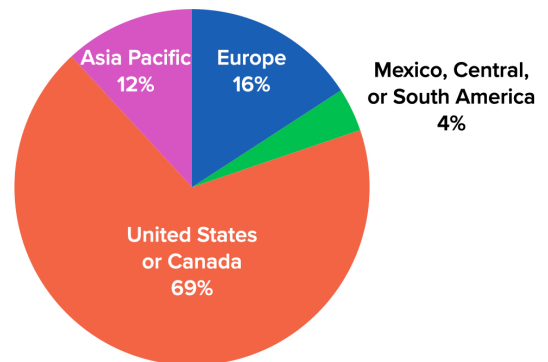
**Company Size**



**Role**



**Region**



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## About Essentium

Essentium, Inc. provides industrial 3D printing solutions that are disrupting traditional manufacturing processes by bringing product strength and production speed together, at scale, with a no-compromise engineering material set. Essentium manufactures and delivers innovative industrial 3D printers and materials enabling the world's top manufacturers to bridge the gap between 3D printing and machining and embrace the future of additive manufacturing. Essentium, Inc. is ISO 9001:2015 and ITAR certified.