



Is 3D printing's
potential almost
fully formed?



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Over the past decade, 3D printing (3DP) has advanced from an intriguing concept to a practical reality. The dramatic role it played earlier in 2020 in alleviating shortages of personal protective equipment (PPE) for health workers on the front lines of the COVID-19 pandemic was a very visible reminder of how far flexible additive manufacturing (AM) technologies have come in just a few years, and their growing value as a source of stability in a volatile and uncertain world.

In the first few months of 2020, as the pandemic grew, some hospitals found that 3D printing helped them meet their PPE needs when external suppliers were stretched to the limit, just as AM companies had long forecast. "The scenarios additive manufacturing groups have discussed for years are playing out in real time," Laura Gilmour, global medical business development manager at EOS, a German 3D printing software services company, told an *Industry Week* reporter.¹

But was the PPE use case just a lucky one-off, or the shape of things to come? While 3DP's contribution to addressing the COVID-19 pandemic has highlighted its promise, serious practical challenges remain. In the short run, most experts believe that high equipment costs, high materials cost, limited sizing and slow production speeds will continue to limit the application of AM – but not for long. Longer term, most industry observers foresee solutions to these problems that will greatly extend the range of practical AM applications.

The COVID-19 pandemic and subsequent lockdowns revealed weaknesses in current supply chains that led many manufacturing companies to re-evaluate their supply chain strategy in several dimensions. One important alternative now being introduced at many companies is 3D printing. "As borders began to close, many manufacturers faced stock outs of spare parts. To avoid shortages, they reached out to local 3D printing service providers to enlist their help when they

were running short of something," explained Stefana Karevska, EY Global Consulting Additive Manufacturing & 3D Printing Leader. "Going forward, they are going to see additive not just as another source of parts but a crucial part of their risk-reduction strategy."

Nearing the tipping point

On paper, additive manufacturing seems almost magical – once the printer receives an order, a three-dimensional object gradually forms: either thick or thin, strong or delicate, sometimes with internal structures, precise and strong enough that it can be used as a part in a machine. The low setup costs, less waste and flexible on-site production of AM offer many advantages to any enterprise that needs specialized parts but doesn't want to hold inventory, depend on fragile supply chains or completely outsource production of key components.

Even before the pandemic, use and interest in AM was already growing rapidly. Three years ago, 24% of 900 manufacturing companies surveyed by the EY organization used the technology. By fall 2019, 65% reported deploying it in their regular manufacturing line, out of a sample operating in 9 industries based in 13 leading manufacturing countries. The average advanced manufacturing and mobility company matched that level of adoption (65%), but vertical penetration varied, from a low of 59% in automotive to a high of 75% for the chemical industry.²

1. Fretty, Peter. "It's Showtime! Has 3D Printing Finally Matured?" *Industry Week* (June 12, 2020).

2. EY global 3DP survey, April 2019.



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Over the past few years, we've seen greater sophistication in terms of the size and complexity of what additive manufacturing technology can produce. Considering less than a decade ago a 3D printer could only produce the most rudimentary objects, this is pretty exciting and cause for optimism about what additive manufacturing will mean for the factory of the future.

Jerry Gootee
EY Global Advanced Manufacturing Sector Leader

At the same time, the number of companies looking to learn more about the technology is growing: between 2015 and 2018, the number of attendees at Formnext, an annual industrial 3D printing trade show, exploded 300%, climbing from 8,982 to 27,400, even as the number of exhibitors rose 34%, from 470 to 632, according to the event company's figures.

This global uptake reflects broad awareness of the technology's current capabilities and optimism about its ultimate potential, particularly considering how quickly additive technology has evolved.

Many current AM users are confident that it will help make their supply chains more flexible. Fifty-six percent of total respondents believe AM would allow them to reduce their logistics efforts, transportation and inventories. They also hope it will better meet customer requirements and offer faster and more efficient R&D processes with rapid prototyping.³

In the short term, the future of AM is likely to be unevenly distributed. The particular needs of certain industries will make them better suited to take advantage of today's AM technology than others.

Looking ahead, many advanced manufacturing and mobility companies see a rapid increase in their industry's use of AM by 2022, to 59% from 18% in aerospace for example, or 53% from 22% in the chemical sector. They forecast that the slowest rate of adoption is likely to be automotive (44% from 17%).⁴

Speed and scale are likely to remain limiting factors to adoption as well. "An airplane manufacturer may only need to resource 100 components a month to meet their needs. Contrast that with an auto manufacturer where it would be in the thousands. Imagine the facility you'd need to meet that order on a regular basis," EY Global Advanced Manufacturing & Mobility Leader Randy Miller said.

Of the technical challenges ahead, materials costs for the resins used in AM production are perhaps the biggest in the short run, but scale and technological advances are expected to reduce those costs. The availability of knowledgeable AM engineers is also likely to be a limiting factor.

Down the line, there are also other reasons for optimism, as the technology advances beyond the layer over layer method. First, the range of materials that can be used is expanding,

and second, the old impression of slow layer-by-layer AM production, where resin would drip like syrup on a pancake, is no longer the only 3D process on tap.

"Still," Gootee added, "I think it's important to remember that when we talk about additive manufacturing, it's not all plastics and, as we're finding with technological advances, we have more at our disposal beyond the layer-by-layer approach. I think we'll see great strides on the speed and scalability issue in the coming years."

Sven Dharmani, EY Global Advanced Manufacturing & Mobility Supply Chain Leader, also believes there is cause for optimism. "I think we'll see that the pace of technology to address the challenges of additive manufacturing will further accelerate. Necessity really is the mother of invention."

Dharmani notes that given the growing awareness of the supply chain challenges, many businesses face that what AM can mitigate will spur innovation throughout the 2020s.

"These challenges are shared from Detroit to Delhi, and there's genuine – and growing – interest in seeing them addressed," he explained. "As manufacturers look to build more flexibility in their supply chains there's substantial motivation to see additive manufacturing used to its fullest potential."

3. Ibid.

4. Ibid.



We anticipate that the five main links of the AM value chain will also evolve as the industry matures:

- ▶ **Systems manufacturers:** primarily original equipment manufacturers of AM machines; most of them also offer related software, materials and services.
- ▶ **Materials producers:** providing raw materials for AM.
- ▶ **Software developers:** such as for design, process simulation, workflow and CAD-model slicing; some may also become platform owners, providing blueprints for almost any kind of 3D printing process.
- ▶ **3D scanning and reverse engineering companies:** focusing on the reverse process of scanning existing products, to digitalize or further engineer/process them.
- ▶ **AM service providers:** such as AM contract manufacturing, design, engineering or technical consulting.

The most dramatic shifts and business model changes seem likely to be among AM service providers, as 56% of companies surveyed imagine that they will own their own printer by 2022, vs. 40% now, and 32% will use a service provider, as opposed to 26% now.⁵

5. Ibid.



Finding the value

In the end, the biggest challenges may be not technological advancement but fresh thinking about the application of the technology.

Obstacles to economical production are falling steadily away. Frank Jenner, EY Global Chemicals & Advanced Materials Industry Leader, notes that “chemical companies have been developing and introducing materials in partnership with established 3D printing players. This remains a big opportunity for the chemicals industry. If you can produce lightweight polymer to substitute any sort of metal, that’s a huge advantage.”

“Often, I hear that the material costs of additive manufacturing are too prohibitive for wide-scale implementation, but we’ve been seeing that ease for some time. As with most questions of supply and demand, the costs of additive manufacturing will fall as adoption increases,” adds Jenner. “Even if your industry hasn’t yet reached breakeven for additive manufacturing, it won’t be long before it will.”

AM pioneers will need to understand the ways in which the technology can be applied to fulfill their strategy – an exciting challenge, because of the potential gains, but a complex calculation to make. Today’s AM production costs remain substantially higher than traditional manufacturing modes, but that up-front cost needs to be weighed against the potential cost-savings of on-site production against holding inventory and the resilience AM capabilities can add to a company. Given AM’s recent and ongoing advances, companies should periodically revisit areas where additive manufacturing can be pressed into use. What you think you know about AM may well no longer be true.

Transformative changes like additive manufacturing don’t happen by themselves. You need to join a community you can learn from, in a setting where you can do some hands-on experimentation, before making a commitment to a particular vendor or ecosystem. At EY, we are working with Nottingham Spirk, the design and product development leader, to create such an environment for advanced manufacturing technologies. The EY-Nottingham Spirk Innovation Hub powered by EY wavespace™, curates insight, talent and technology through a hands-on collaborative process with equipment and simulations to improve strategy development, and accelerate design and implementation of solutions. Whether you plan to use these technologies to drive more efficiency, resiliency, agility or growth, the Innovation Hub should be one of the first steps on your journey.





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