Article

3D printing: “Complexity is free” may be costly for some

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Additive manufacturing (AM)—the proper technical term for 3D printing—is likely to have an enormous impact on all our lives, but that doesn’t mean it’s going to be good for every business.

Additive manufacturing (AM)—the technical term for 3D printing—is likely to have an enormously positive impact on all our lives, but for some businesses, it could be devastating. The outlook for many companies will hinge on the ways they respond to this evolving technology and its competitive implications.

A common additive manufacturing catchphrase helps frame the challenge some companies will face:

> ***“Complexity is free with additive manufacturing.”***

When people say complexity is free, they are implicitly recognizing that AM technology can be incredibly versatile. Because it generally produces objects “layer by layer,” it can fabricate items that simply cannot be produced using other means. Many people find this to be one of the most exciting attributes of AM.

This critical attribute could transform the way some manufacturers operate, and it may force others into obsolescence.

Consider that many products are currently assembled out of multiple subcomponents. Often, this is because of constraints imposed by the way they are designed and manufactured. For example, using traditional methods to machine complex internal structures for automotive or aircraft engine subcomponents requires that those internal structures are generally accessible to machine tools and then assembled into a larger component. Of course, in addition to the multiple subcomponents required to create a final assembly, there are also the many brackets and fasteners (screws, nuts, bolts, clips, etc.) required to hold everything together.

But with AM, such complexity may be “free.” That is, intricate structures may be created without the need for direct machine-tool access, reducing the need for multiple subcomponents. A well-known example from GE Aviation illustrates the point. For its next-generation aircraft engine, GE successfully engineered a new kind of additively

manufactured fuel nozzle that improves fuel economy and eliminates the need for subcomponents; instead of being assembled from 20 different parts, it is manufactured as a single piece. [1]

Now, eliminating 95 percent (or 67 percent, or 30 percent) of the pieces, brackets, and fasteners required for assembly is almost certainly a good thing for any business, but what are the implications for the producers of each of those lower-level items? Logically speaking, they will not be needed.

The closer you are to producing subcomponents that are not core to the function of higher-level assemblies (e.g., the screw that holds a cover plate on the side of an internally complex subcomponent), the more strategic the uncertainty you may face. Producers of brackets and fasteners should take note: If the need for assembly is significantly reduced (or eliminated), ancillary components may become unnecessary—and therefore, subject to elimination.

Of course, the die is far from cast. Most companies are still in the very early stages of exploring the impact that AM can have beyond its traditional role as a driver of rapid prototyping. Nonetheless, a shift is underway. Applications of AM to final part production now represent one of the fastest growing segments of the market.

There are a couple of steps that company leaders can begin to take to position themselves for success, rather than possible obsolescence, in an AM-enabled marketplace:

- Understand your company’s position in the supply chain. Do your company’s products facilitate the assembly of a complicated, higher-

level assembly? If yes, and especially if your product’s function is incidental to the function of the higher-level assembly, then your business may be at long-term risk from AM diffusion. You might want to think about how subcomponent elimination might affect your position in the chain.

- Develop a sense of how your supply-chain partners are approaching AM technology. Are they moving beyond rapid prototyping applications to manufacture for end use? If the answer is yes, then time may be of the essence. Consider how your company will develop the technical capability to match or exceed competitors’ and other supply chain partners’ ability to disintermediate you. If the answer is no, look for opportunities to strike as a first mover to blunt competitors’ future efforts. Either way, you want to position your company to benefit from possible part consolidations rather than being hurt by them.

It is increasingly possible to imagine an AM-driven shift toward supply chain consolidation, even as the technology is celebrated for democratizing production in other ways. AM technologies are rapidly evolving, and key aspects of their value proposition are increasingly clear. If not free, complexity is, at a minimum, getting less expensive. That may be a generally good thing, but some companies may suffer in the transition. [2]

I am interested in your other thoughts about how AM will create both winners and losers. It is important for us to separate the reality from the hype. Feel free to join the discussion by leaving a comment below.

Credits

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Topics in this article

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Endnotes

1. "Printing a high performance fuel nozzle," ASME video, December 2013, https://www.asme.org/engineering-topics/media/aerospace-defense/video-printing-high-performance-fuel-nozzle.
2. For a full discussion of the strategic paths that companies might follow on their AM journey, please see: Mark Cotteleer and Jim Joyce, “3D opportunity: Additive manufacturing paths to performance, innovation, and growth,” *Deloitte Review* , January 2014, http://dupress.com/articles/dr14-3d-opportunity/.