

# The Plant Of The Future: 3D Printing

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3D printing is a technology that has, for more than a decade, seen inroads mostly in the hobbyist community. It's expensive and slow, but is capable of producing items that are difficult — if not impossible — to replicate with more traditional processes, like injection molding or CNC machining. Popular examples are fully-functioning gears or intricate chains made only by designing it on a computer and pushing “print.”

But 3D printing could have a real place in the future of manufacturing. Kevin Sullivan, director and global practice lead of the Industrial Practice, Cisco Internet Business Solutions Group (IBSG), says that day will come by the end of this decade. To many, that seems awfully fast, considering that 3D printing has long been seen as cost-ineffective compared to those proven manufacturing processes. And while that conclusion isn't exactly wrong, it's not representative of the bigger picture.

## Why 3D Printing Isn't Here Yet

The DIY, hobbyist and hacker communities first took interest in innovating on 3D printing technologies, as they wanted desktop printers that behaved much in the same way a standard inkjet printer works for documents. A variety of community-based, open-source projects, like the RepRap, began to develop their own cheap models that could be either built from parts, or bought from a variety of providers. Today, they are available for about \$500.

Other companies took 3D printing into the commercial space. MakerBot develops 3D printers that cost north of \$2,000, and others have developed industrial-scale models that can be far more expensive. All the while, the technology got faster and more reliable. For these early adopters, speed and cost were not necessarily a concern — they simply wanted to innovate with a burgeoning technology that held great promise.

But this isn't enough for major manufacturers. Those same problems, which are overlooked on the consumer level, are glaring necessities on the corporate one. Sullivan says 3D printing “has been on the wrong side of the cost curve, definitely in terms of high volume,” which includes, for example, small plastic parts for the automotive industry. While it has long been useful in rapid prototyping for product design, it can't compete on mass production scales.

That combination of high costs and low speed is, essentially, what has kept 3D printing from grabbing a handhold any faster in an average manufacturing operation. Like all burgeoning technologies, there is a period of growing pain, which 3D printing seems on the verge of breaking through. Thanks to the efforts from hobbyists, the technology is nearing a period of sea change on the plant floor, so much that Sullivan thinks a 3D printer will be a commonplace feature in

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manufacturing plants in the next three to five years.

### **The Landscape is Changing**

The amount of buzz surrounding 3D printing in the industrial space is increasing exponentially from all fronts: governments, executives, R&D professionals and more. The U.S. government is investing \$70 million into a private-public consortium of 3D printing experts that's based out of Youngstown, Ohio. This effort will, with any luck, increase the pace of innovation in how to make the 3D printing process cheaper and more efficient. This movement will, in turn, bring more additive manufacturing technology to plant floors around the U.S.

Regarding the Youngstown innovation, President Obama said: "This institute will help make sure that the manufacturing jobs of tomorrow take root not in places like China or India, but right here in the United States of America. That's how we'll put more people back to work and build an economy that lasts."

Dave Burns, the President and COO of ExOne, a North Huntingdon, PA-based company that is part of the Youngstown consortium, agrees: "There's a dawning awareness that additive manufacturing could well be a transformational industry that could, in of itself, create a lot of jobs and create a strong manufacturing base. There's lots of competition. It could be a strong backbone industry."

Sullivan says that major manufacturing companies are already testing 3D printing in various small applications to gauge its efficacy. GE is using 3D printing in its R&D and research labs, as rapid prototyping is one of the technology's strongest suits. Daimler is working on creating gearboxes with 3D printing. There is promise that 3D printing could be used to make an entire gearbox in one fell swoop, eliminating the need for later assembly.

Hunters and gun aficionados will know that many firearm components are extremely sophisticated, with small tolerances. Sullivan suggests that these types of components — small, sophisticated parts that are needed in large volumes at close tolerances — could someday be made with 3D printing. The yields won't be as high, but the level of complexity in manufacturing them to specification could be significantly reduced.

### **The Future of 3D Printing in the Plant**

While 3D printing might not yet be the most cost-effective solution for many products currently made with injection molding, for example, Sullivan argues that the technology will easily make stronger inroads into a new breed of American-made products: customized consumer goods. On a bigger scale, many are looking forward to whole new product categories that 3D printing could enable. That changeover could occur within the next three to eight years, he says, and might focus on basic consumer goods like shoes, jewelry and accessories, allowing customers to have a piece developed exactly to their specifications.

He says, "Rapid changes in consumer desires and wants — this is where this

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technology really makes a difference.” And we’re seeing that kind of rapid change occur on a daily basis, with the hyper-speed pace of various retail seasons. Trends come and go on monthly, if not shorter, scales of time. On a more sophisticated scale, medical devices like earpieces, dentures and replacement joints could be 3D printed, as most of those already need to be custom-made to an patient’s body.

The technology has its sincere advocates, particularly in the way it could represent a real way to create new jobs in America. Burns says, “The real value of additive manufacturing is that we can conceive of and make things now that we couldn’t before. There are no limits on the designs we can manufacture, in an additive sense.” While other technologies might be faster, or cheaper, they’re always limited in some way. 3D printing holds the promise that given a big enough printer, it can make almost anything.

But what about the products that have been made for decades, that have been refined to be as efficient as possible? One controversy surrounding 3D printing is that many manufacturers won’t be willing to hand over their time-tested processes for the “latest and greatest” until it’s been proven to provide a real return on investment.

Burns, and his company, as one of the major players in the Youngstown initiative, agrees with that argument. He says, “Additive manufacturing is not about substituting one thing for another thing.” At least in Youngstown, it’s not being developed as a drop-in replacement for those goods with a long history of profitable manufacturing. If that was the only value of 3D printing, Burns argues, then it wouldn’t have much value at all.

Sullivan has a rosier view on the future of the technology as a mainstream process technology. He says, “Existing equipment wears out, and when people are looking for replacements, they’re actually looking for something that is the next generation — the next wave — of technology. They’re not pushing for a simple replacement.” Automakers, for example, could easily start using 3D printing to make concept cars, and bring that technology straight into core manufacturing as the car goes into production.

And the advance of the technology will be “an upward curve that will be similar to what injection molding was say, 25 or 30 years ago,” according to Sullivan. Perhaps most intriguing is how that curve will, in the future, change the way the plant floor looks and behaves. Sullivan thinks 3D printing will be an ideal technology for the next generation of manufacturing — the “digital natives” who have a unique and comprehensive experience in tackling new technologies and warping them to new ends. And that, more than anything, is the promise of 3D printing on the plant floor: there are few limits in any dimension.

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