How 3D printing will shape industry

Now that 3D printing is a maturing technology, we all need to understand how it's changing industries, impacting business models and where it's going in the future.

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KONICA MINOLTA

3D printing technology in a nutshell

Also known as Additive Manufacturing, 3D printing is any of the various processes used to make a physical object from a digital file – where layers of material are laid and combined, or 'added' together.

3D Printing is changing the way people work and how businesses operate and compete.

In the last few years, adoption of 3D printing technology has significantly increased within manufacturing, with more and more applications uncovered. Innovative organisations in Pharmaceuticals and Medicine, Engineering and Architecture are applying 3D Printing technology to streamline and improve their work.

According to International Data Corporation (IDC), global spending on 3D printers will exceed $35 billion by 2020, double the $15.9 billion forecast for 2016 – representing a compound annual growth rate of 24.1% between 2015 and 2020.[1] Early adopters of 3D printing are already experiencing a transformation of their end-to-end business processes, from initial concept to production: enabling a new level of affordable customisation, reducing risk of loss of Intellectual Property by keeping it in-house and significantly decreasing time to market. In an increasingly competitive world, these changes are delivering its adopters solid competitive advantage.

Importantly, it is currently being introduced in Science, Technology, Engineering and Mathematics (STEM) education curriculums, and becoming a crucial consideration for innovative research programs. The opportunities for future applications of 3D printing are wide-ranging and exciting.

3D printing technology consists of hardware and software components.

The hardware can range from small desktop printers to large-scale industrial manufacturing systems; instead of printing a single layer of ink onto paper, 3D printers create a three-dimensional solid object by layering a material. Computer-Aided Design (CAD) software is used to create the digital design files (i.e. STL, OBJ) used by the printers.

A variety of hardware technologies can handle over 120 different materials, from polymers to metals, ceramics to plastics and waxes. The methods used to form final products vary depending on the material state and the form of energy used to change it to a solid.

Outputs can range from a single component to an integrated build: multiple components created using a variety of materials. In some cases 3D printing can create a complete unit, removing the need for later assembly.

3D Printing can produce a final product, or it can be used to create tools, dies, jigs, fixtures, moulds and support structures used to create a final product.

[1] IDC, *Worldwide Spending on 3D Printing Expected to Surpass $35 Billion in 2020*, 21 January 2016

Who is using 3D Printing?

3D printing is becoming widely used in manufacturing. PwC research with US industrial manufacturers found that 67% were using 3D printing technology in some way in 2014 and 71% by 2016. In 2014, 29% were simply experimenting to see how they could use it; in 2016, that figure was down to 17% – indicating that trials of 3D printing successfully proved its worth.[2]

Drilling down, PwC observed some important shifts that demonstrate 3D printing is growing in importance within the manufacturing sector. In 2014, just 35% surveyed were using it for prototyping and final products, while in early in 2016 that figure had risen to 51%. Furthermore, less than 11% were using it in the final production of products; that number almost doubled to 20% by 2016.

Adoption of 3D printing has transformed industries that need to produce 'one-off' or short-run products such as healthcare, engineering and architecture.

3D printing is also spawning new business models focused on customised products within both B2B and B2C sectors. B2B examples include companies that specialise in delivering outsourced design and prototyping services, and reengineering of existing components and replacement parts that are no longer in production.

For consumers, dedicated 3D websites are springing up to offer unique or short-run gifts. Some offer ready-to-print design files for customers to produce a range of useful objects, from smartphone cases to toys to sports trophies, in any colour and bearing customised messages or graphics on their personal or school 3D printer.

Even food is being 3D printed, as famously demonstrated at the Los Angeles **3D Systems Culinary Lab**. Here in Australia, crowd-funding is enabling NSW's new Eromanga Natural History Museum to print **life-sized 3D bones of giant dinosaurs** from locally discovered fossils. The same technology is having life-saving benefits, with an Australian neurosurgeon recently replacing a patient's cancer-riddled vertebrae with **3D-printed body parts**.

HEALTHCARE	• Medical manufacturers custom-make human spare parts, such as hip joints, as well as the tools to embed them during surgery
	• Dental labs 3D print prostheses, amalgam or crown moulds as well as customised guides for accurate drilling
	• Vets and volunteers create prostheses for injured **wildlife and pets**

ENGINEERING	• Civil, structural and industrial designers can create prototypes, production equipment and even end products to solve unique design challenges
	• In the aerospace industry where value is high and volume low, 3D printing is used to produce everything from air vents to engine components

ARCHITECTURE	• RMIT University's Spatial Information Architecture Laboratory is part of a global consortium engaged in realising Gaudi's vision of the **Sagrada Familia cathedral** in Barcelona, commenced in 1882 and due for completion in 2026

[2] PwC, *3D Printing comes of age in US industrial manufacturing*, April 2016

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Why 3D printing?

The rapid adoption of 3D printing by industry is principally due to three strong commercial benefits:

Speed to market

In addition to the opportunity 3D printing offers to manufacturers of short runs, it also delivers the ability to create the tools that are needed to manufacture volume products. After the prototype, 3D printing can be used to create tooling for mass manufacturing production lines.

Integrated builds, such as electronic control boxes, can be printed as a single unit, where traditional manufacturing would have involved tooling up and creating multiple components individually and then assembling them. When several components must be manufactured separately, 3D printing can assure 'line-up' so they all fit together correctly.

It is also a potential game-changer for companies in highly competitive, risky or time-sensitive markets; an initial run can be printed in 3D for a product launch or to test usage and acceptance. Once a product's viability and demand has been proven, it can then be manufactured through traditional high-volume processes or outsourced to overseas suppliers with lower overheads.

As 3D designs are developed in CAD software, designers are able to work freely, without physical constraints, to quickly produce working models for review, testing and feedback.

Prototypes conventionally take weeks if not months to model, iterate, test and finalise, whereas 3D printed prototypes can be evaluated in a matter of hours. This enables organisations to arrive at their final prototypes faster and with a better version of their final design, then streamline manufacturing processes with confidence.

In industries which depend on continuous and rapid innovation for competitive advantage, such as smartphones, 3D printing enables comprehensive redesign rather than modification of previous models, without the time lag.

Better manufacturing

3D Printing is a layered approach to manufacturing, allowing greater opportunities for the construction of complex geometries otherwise impossible or cost-prohibitive through traditional manufacturing methods.

In turn, this ability to unlock the manufacturing of complex geometries allows designers greater freedom to design more intricate, purely functional objects.

Intellectual Property protection

Perhaps the most important driver for 3D printing is the ability it gives innovative companies to keep their valuable IP in-house. There's no longer a need to send prototype designs outside for service companies to build. Even when the intention is to outsource manufacturing to the local or overseas supply chain, tooling can be kept in house until the last possible moment.

In industries related to defence, this is of critical importance. The protection of designs and prototypes is essential, not just for commercial advantage but for national security.

Even in less sensitive industries, 3D prototyping and tooling gives businesses the ability to change suppliers at short notice – keeping the bulk of their IP within their own domain.

Case Study: CENTOR®

As an award-winning manufacturer with over 60 years' experience in windows and doors, Centor has created a world-first integrated door that combines door, screen, shade and hardware as one.

Centor started experimenting with 3D printing around 2005, bringing it in-house five years later. Senior Industrial Designer Michael Smith says that it has transformed prototyping items such as hinges, locks and handles.

"We get faster feedback, because everyone can see and feel and touch it. It also speeds up design time and we get to the final design faster, and a better version of that design."

Centor is looking to use 3D printing in manufacturing short runs in the future.

Watch how Centor uses 3D printing at
www.konicaminolta.com.au/News/Centor-3D-Printing

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3D printing in education

Fortunately for the future of Australian industry innovation, 3D printing is becoming established by forward-thinkers within our education system:

- Innovative Primary schools are investing in 3D printing technology to allow children to explore its possibilities by creating tangible objects and introducing the concepts of digital design and manufacture

- Secondary school students are actively involved in creating 3D printed items where extrusion technology is included in the curriculum, gaining an understanding of the digital design process and tools involved

- Vocational education and training services with 3D modelling software are exploring or implementing 3D printing capabilities in-house

- At a tertiary level, Engineering, Design, Architecture, Physics, Maths, Natural Science, Biology, Chemistry, Geology, Palaeontology students are using 3D printing to solve complex problems and create innovative prototype and design projects – with many institutions now offering 3D technology resources via their libraries and shared resource facilities

At a higher level, forward-looking institutions and their research entities have been investing to be ready to help industry realise commercial value and digital transformation from 3D printing, as well as engaging in consortia created to exploit 3D technology innovation.

A 3D future

According to PwC research, 42% of industrial manufacturers now see 3D printing as likely to be used for high-volume production within the next 3-5 years. Just over half (53%) see it as more useful in the production of after-market parts than new products, while 64% expect that it will be useful to replace older, obsolete parts.[3]

An interesting global perspective from the **World Economic Forum**[4] lists ten ways in which 3D printing can help improve or even save our world. Standouts include stronger, safer and lighter vehicles in the air and on the road; less pollution from shipping when goods can be produced where they're needed; better, safer, quieter factories and less waste by eliminating offcuts of materials; and miniaturisation of power sources, citing how Harvard researchers have innovated a way to print 3D lithium-ion batteries smaller than a grain of sand.

3D printing is delivering innovation to businesses across the globe, enabling faster and more effective product development by streamlining business processes and production. By understanding and effectively designing your end-to-end workflow, you can unlock the potential of 3D printing technology.

The full possibilities and benefits of 3D printing are still being explored and new delivery technologies developed. But the consensus is that this rapidly developing technology will continue to transform traditional industries and create new ones.
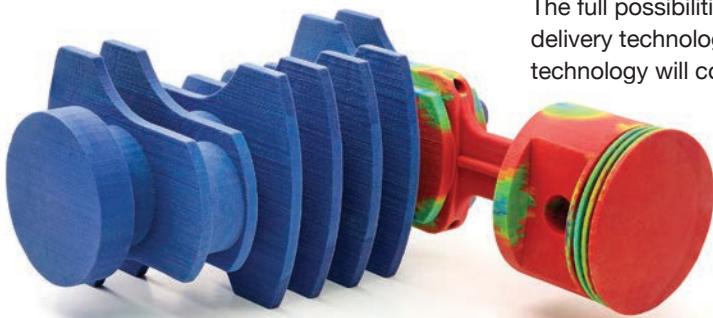
[3] PwC, *3D Printing comes of age in US industrial manufacturing*, April 2016
[4] World Economic Forum, *10 ways 3D printing can change the world*, 22 June 2015

3D Systems

As the originator of 3D printing and a leader of future 3D solutions, 3D Systems has spent its 30-year history enabling professionals and companies to optimise their designs, transform their workflows, bring innovative products to market and drive new business models. 3D Systems was co-founded by Charles Hull in 1986, three years after he invented Stereolithography (SLA), the first commercial 3D printing process. Some of 3D Systems technologies are now in their fifth generation, and the company continues to stretch the boundaries to deliver new innovations in 3D printing.

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How we help

Konica Minolta Business Solutions Australia is committed to helping innovative organisations with industry leading 3D printing solutions that meet their unique needs.

As a 3D Systems Authorised Partner, we design flexible solutions that deliver the right 3D printing technology for the relevant application.

We also provide the essential and comprehensive support that designers and manufacturers need; industry leading rapid next business day service, local helpdesk expertise, operator training support and financing flexibility.

In addition to this, our established logistical infrastructure not only means that organisations have readily available access to consumables and spare parts, but that they continue to fast-track their ideas and manufacture exciting new ideas for the future.

To discover more about our solutions and services,

visit www.konicaminolta.com.au/Products/3D-Printers
or contact your 3D Printing Specialist on 1800 789 389.