WHITE PAPER

The Future of Making Things

majenta
solutions

"Everything's Changing" –
Navigating the Future of Making Things

We are on the cusp of the biggest transformation in manufacturing since the Industrial Revolution. The ground has been prepared over recent years with the introduction of a raft of new products, processes and materials, all of which offer great potential to fundamentally alter the way people make things.

According to Carl Bass, Autodesk President and CEO: "Technologies like the Internet of Things, augmented virtual reality, and robotics will change the way engineers and designers work. Places and things are more connected, intelligent and dynamic than ever before."

The Deloitte Centre for Edge encapsulates the problem in its recent report, "The Future of Manufacturing - Making Things in a Changing World", which states "manufacturing is no longer simply about making physical products. Changes in consumer demand, the nature of products, the economics of production, and the economics of the supply chain have led to a fundamental shift in the way companies do business."
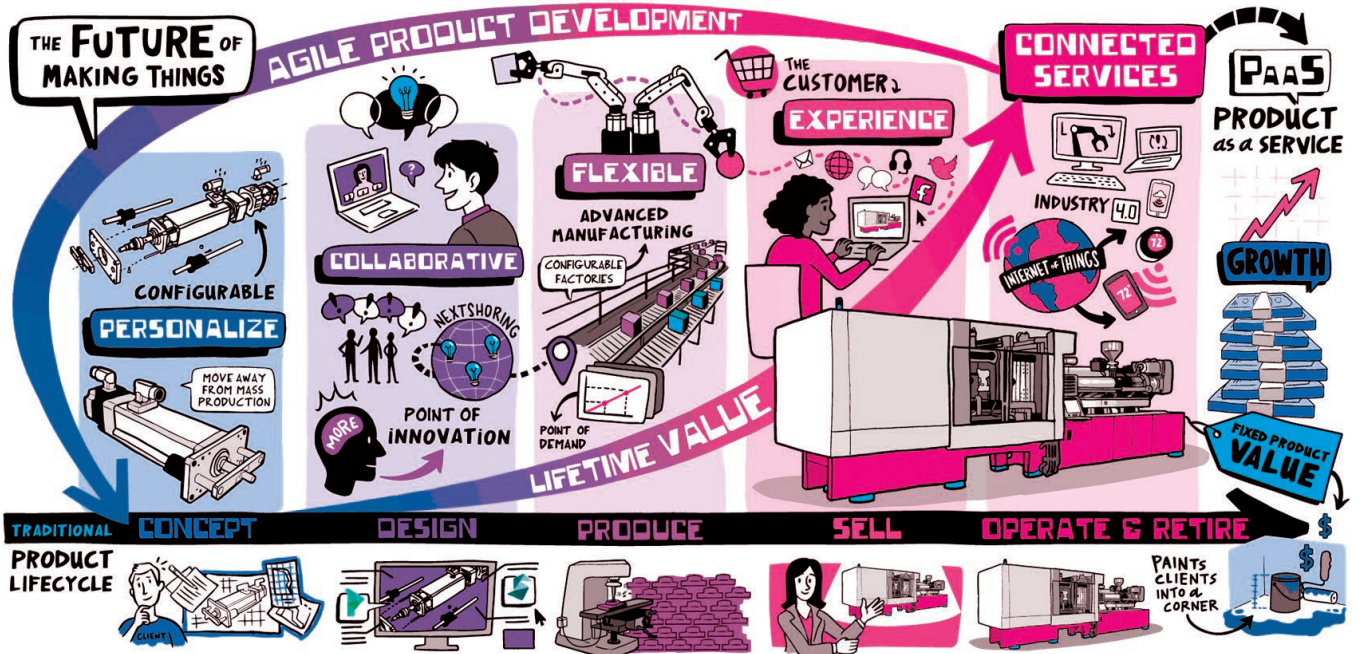
The catch-all term for the complex mesh of interwoven trends that characterise this new world is 'The Future of Making Things', and making sense of it necessitates firstly understanding the three big disruptive trends impacting design and manufacturing today: Evolving consumer demands; shifts in the means of production and the changing nature of products.

Customers are now demanding personalisation and customisation as the line between consumer and creator blurs. The changing face of customer demand is also leading to the proliferation of niche markets, focused on the fast and efficient delivery of customised products.

Technologies such as generative design, 3D printing, design automation and many others are making it easier to cost-effectively manufacture products more quickly in smaller batches at the point of demand. Such approaches increasingly support a 'build-it-where-you-sell-it' model, enabling manufacturers to create to local needs in only the volumes necessary, while radically transforming traditional supply-chain economics. Equally, they help level the playing field. Today, using techniques like crowdsourcing and collaborative design, even the smallest start-up can get crowd-funding, quickly design a new solution, manufacture it using 3D printing and get it out to market.

Products are becoming interconnected and intelligent, creating opportunities to extend product value with connected services while advancements in materials science enable more complex products to be developed. We are also seeing a closer relationship between the physical and digital worlds. Software has built-in intelligence. Consumers are less willing to purchase disposable products that they later throw away. Today, they want to buy sustainable products which update and evolve over time. Self-learning Nest thermostats are a case in point as are Tesla cars that are capable of updating their operating systems to provide automatic driving and devices like Apple Watch with its multiple sensors.

Autodesk Product Innovation Platform

'Right Here, Right Now' –
Living in a Future World

The production technology – from 3D printing to robotics – enables manufacturers to make the leap into the Future of Making Things, making it increasingly available and accessible. Manufacturers used to struggle to commercialise their most creative and innovative ideas simply because they did not have the machines that could build them.

Now, the gap between what people can design and what they can manufacture is narrowing – and the cost point reducing. One way we are seeing this is through the development of third-party platforms with plug-in architectures and common interfaces that allow the businesses using them to collaborate and share risks. All of this is bringing greater flexibility to today's generation of manufacturers, in turn helping to nurture a much more innovative and creative design and production environment.

Manufacturers can, for example, increasingly speed up the design process through the use of processes like crowdfunding and collaborative working aligned to techniques like 3D printing or indeed generative design, a technique which significantly accelerates the process of exploring design possibilities.

Furthermore, the ability to use cloud-based models to deliver enhanced collaboration, democratisation of design and faster processing at more cost-effective price points is acting as another catalyst to the Future of Making Things.

It's a trend embodied in Autodesk's pioneering cloud-enabled mechanical 3D modelling tool, Fusion 360. This innovative new solution is breaking new ground in terms of delivering one of the key themes of The Future of Making Things; the democratisation of the means of intellectual and physical production.

The key reason for that is because Fusion 360 is cloud-enabled and offered on a subscription basis. This makes it easier and faster for any organisation - large or small - to get products into the hands of its users. But the fact that Fusion 360 can be accessed quickly is just part of the story. We are actually talking about access to a sophisticated and powerful set of capabilities that was previously available to only a few businesses – typically those with profuse resources and sufficient corporate 'patience' to wait for the tools to generate value.

The geometric capabilities of Fusion 360 include; free-form modelling and sculpting with T -Splines, powerful direct modelling, mesh modelling and an API to enable third-party extensibility. All of which, taken together, move Fusion 360 far beyond the common capabilities of traditional 3D CAD (cloud and otherwise).

In addition to this detailed geometric description, Autodesk has also added powerful capabilities around data management, collaboration, simulation and fabrication including 3D printing/additive manufacturing and CAM integration. It is building Fusion 360 into a comprehensive, integrated product development platform.


Autodesk Fusion 360 screenshot

Streamlined Processes –
Showcasing How it Works

Fusion 360 is just one, albeit powerful example, of a growing number of key solutions capable of advancing the core tenets of the Future of Making Things. But as the number of solutions proliferates so too does the range of different ways in which the new movement manifests itself. Here, we take a look at a few of the new trends that have come to define The Future of Making Things:

The Internet of Things (IoT) encompasses the growing network of physical devices embedded with electronics, software, and sensor capability that are connected to the Internet and to each other. This connectivity supports communication between devices or interoperability. Autodesk believes that "the IoT combined with the cloud will enable manufacturers to capture, analyse, control, and manage data from remote products and assets," and that providing customers with an IoT cloud service will "help them create new service revenue opportunities, and help them thrive in this new era of connectivity".

INTERNET OF THINGS
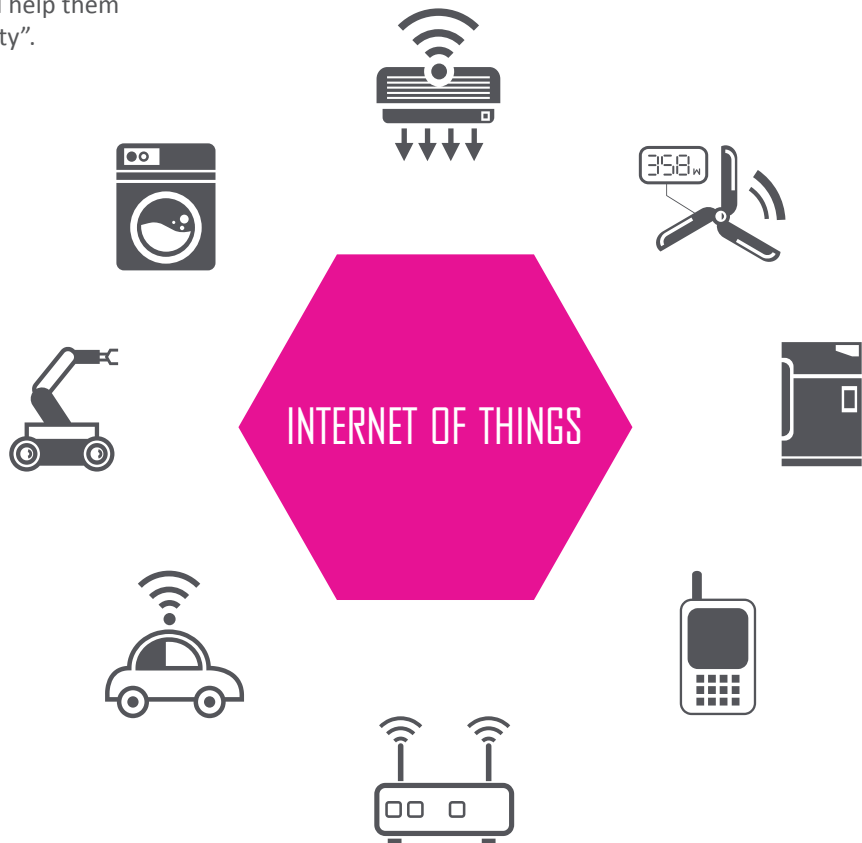
Additive Manufacturing/3D Printing typically refers to various processes used to synthesize a three-dimensional object. In 3D printing, successive layers of material are formed under computer control to create an object. These objects can be of almost any shape or geometry, and are produced from a 3D model or other electronic data source. The technology is frequently applied in conjunction with rapid prototyping - quickly assembling a physical part, piece or model of a product, often with the help of sophisticated computer-aided design or other assembly software.

Design Automation is where the process of manufacturing a product from initial customer enquiry through to designing the solution and getting a quote out to the customer can be reduced from a couple of weeks to a matter of minutes thanks to automated procedures.

Generative Design is where algorithmic modelling is used to create better designs that are lighter and better fit for purpose, that deliver added value to customers. Jordan Brandt, Technology Futurist, Autodesk helps to define the concept by comparing it with the more traditional explicit design. Explicit design is when "you have an idea in your head and you draw it. Generative design is when you state the goals of your problem and have the computer create design iterations for you."

We are seeing growing numbers of manufacturers leveraging the potential of this kind of algorithmic modelling. One such organisation is California based, Lightning Motorcycles, which is focused on fitting vehicles with the lightest, most durable parts possible. As such, when the manufacturer was looking to develop a next generation swing arm for its electric motorcycle, it turned to Autodesk's computer-aided (CAD) system, Project Dreamcatcher that automatically generates tens, hundreds, or even thousands of designs that all meet specific design criteria.

Online Product Configuration typically involves the manufacturer looking to provide engineers, sales reps, and end customers with web and mobile access to a 3D configuration of their products online. Toy car maker Mattel, for example now enables fans of its Hot Wheels die cast models to create and purchase their own configured versions online, to be delivered to their home a few weeks later.

Augmented Reality – Boeing researcher Tom Caudell is believed to have coined the term "augmented reality" some 25 years ago, to refer to a digital display used by aircraft technicians that combined virtual graphics with a physical reality. We are now seeing a growing number of applications of augmented reality, featuring computer-generated content being superimposed over a live camera view of the physical world. In the future, we are likely to see augmented reality increasingly integrated into everyday applications, such that current touch screen interaction is increasingly replaced by new 'immersion design' models that make use of the spatial dimensions offered through embryonic augmented reality platforms.

Old approaches have to change

So, given the complexities inherent in moving to the Future of Making Things, how can manufacturers best address the pressures and take advantage of the associated opportunities? Traditionally, most have focused on achieving enhanced productivity, greater process efficiencies or more innovation.

Such approaches typically no longer work because of the decreasing amount of time it takes rival firms to replicate new methods and therefore the increasing difficulty manufacturers have in achieving a position of business advantage. They also typically lock organisations into selling products at fixed value.

The larger firms, of course, have historically relied on brand reputation. They have made a success out of mass production – by reducing material costs, decreasing labour costs, etc. – but today when consumers 'want what they want when they want it,' these kinds of approaches are increasingly invalid. Loyalty to the brand is now a secondary consideration. More and more consumers simply want a product that works well and that they can quickly get hold of. The monolithic manufacturing enterprises of the past can no longer take market domination for granted, nor can they afford to rely on customer loyalty and rest on their laurels.

Barriers in the way

Some firms are already embracing the 'Future of Making Things' and achieving benefits as a result. The more agile start-ups, for example, are quick to grasp market trends and see the opportunities that these present to them. Generally they are automotive companies, many of whom have dedicated departments devoted to spotting these developments.

Typically though it has been the larger, longer-established manufacturers that have so far been slowest to engage with 'The Future of Making Things', even though, as the previous section indicates, they may well be the group that stands to benefit most from doing so.

The reality is however, that they are often too busy, focused on addressing immediate challenges to step back and get a clear perspective, while some adopt a blinkered response, falsely believing that if they carry on in the same way, the trends will prove to be a passing phase.

Delivering the process

Solution providers can be instrumental in guiding the manufacturing businesses they are working with on a journey to the Future of Making Things.

Having assessed the way in which the manufacturer is working today, the provider will generally then prepare a series of reports and presentations, outlining a recommended future path for the manufacturer's business. Key to this process should be that the provider works in close collaboration with the manufacturer, working together to agree initial and future priorities based on the needs of the company, the reality of what can be achieved at various stages and budget.

Once agreed by both parties, the approach will typically involve consultancy, training, the implementation of process changes, delivery, implementation of software solutions and then working in partnership towards mutually agreed short and longer-term objectives.

Majenta Solutions is well placed to add value here as manufacturers navigate the wide-scale disruption that the Future of Making Things will bring. Majenta is one of the only Autodesk VARs in the UK to have experience in the broad range of specialisations that support the Future of Making Things model from mechanical design and design automation, through to simulation and data management.

Majenta is also extensively skilled in Autodesk's industrial design and visualisation solutions which deliver significant benefits to manufacturers both in the early design phases and in sales and marketing communication. In addition, Majenta has an industry specialism in automotive, which stretches back more than 20 years and includes an impressive array of leading OEMs and their suppliers.

That's important because the automotive sector is at the forefront of many trends enshrined in the Future of Making Things from 3D printing to additive manufacturing to lightweighting; composites, pop-up factories, supply chain integration, 'design anywhere, build anywhere' etc.

Why the future is here today

This is not just a design or engineering message. The impact of the Future of Making Things potentially changes the whole business. It appeals to design, engineering, marketing and sales departments alike. It's a company-wide ethic that 'says' there are changes in the market. We need to adjust the way we are doing things to appeal to end prospects, possibly including different groups that may not have bought from us before.

The developments that are driving the Future of Making Things today are likely to accelerate over time. We are effectively building the platform for a new industrial future and so we expect solutions like additive manufacturing and predictive intelligence to accelerate further over time. It's also an increasingly interconnected movement. Soon the trends driving The Future of Making Things will increasingly overlap with broader industry shift from Industry 4.0 to the Connected Future to the Internet of Things.

We are on the cusp of a new dawn which is being driven by automation. There are inherent dangers in this new automated world of course. As the revolution gathers pace, it will be important that the right human/machine balance is maintained and that human creativity continues to play a key role. However, as we move into the future, it becomes increasingly important that the benefits of this new world of manufacturing far outweigh the potential downsides.

In any case there is no chance of the Future of Making Things being just a transitory trend. It may seem just a vision but it is fast becoming a reality. Not just a passing phase, the movement pioneered by leading vendors like Autodesk amounts to an unstoppable revolution in the way products are designed, manufactured, sold and distributed.

In the words of Asif Moghal, Manufacturing Industry Manager at Autodesk: "We believe that the future belongs to companies that quickly figure out how to collaborate and personalise their services, flexibly design and manufacture them and step into the world of connected services."
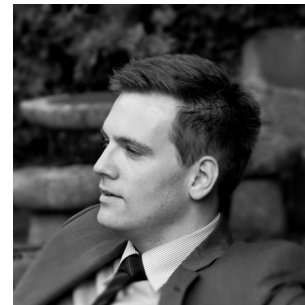
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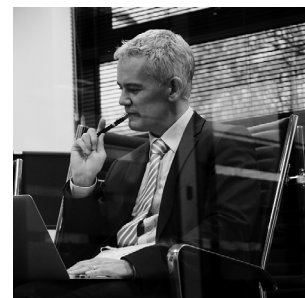
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