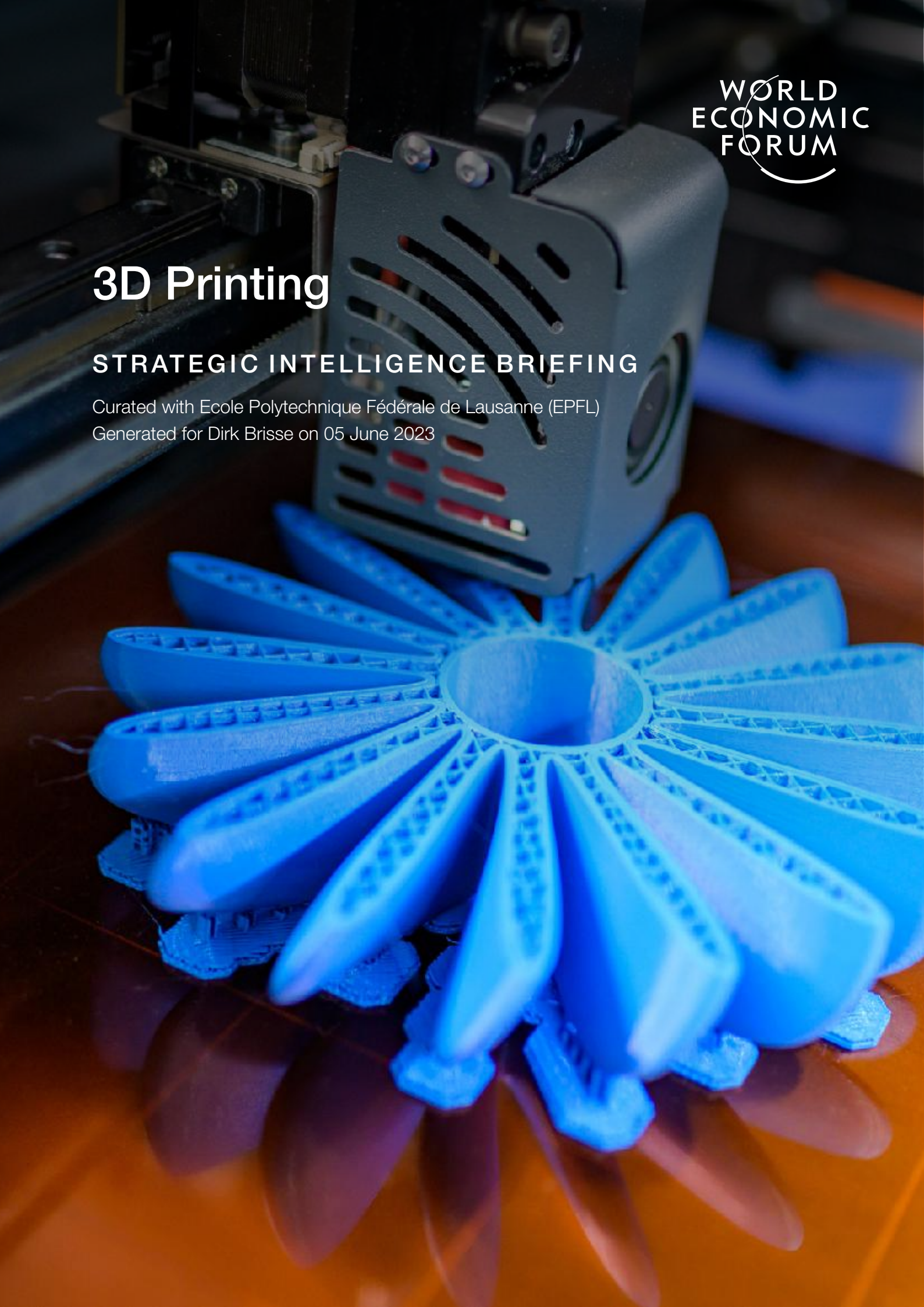

3D Printing

STRATEGIC INTELLIGENCE BRIEFING

Curated with Ecole Polytechnique Fédérale de Lausanne (EPFL)
Generated for Dirk Brisse on 05 June 2023

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Executive summary

Explore the interactive version online

3D printing has already revolutionized the ways that parts are designed and manufactured. Other applications of the technology - bioprinting human organs, printing affordable housing, and the on-demand production of potential future habitats on the Moon and Mars - were until only recently the stuff of science fiction. Now, breakthroughs are being achieved in all of these areas, and 3D printing is showing promise as a means to solve many of mankind's most pressing issues.

This briefing is based on the views of a wide range of experts from the World Economic Forum's Expert Network and is curated in partnership with Roland Logé, Associate Professor, Ecole Polytechnique Fédérale de Lausanne (EPFL).

The key issues shaping and influencing 3D Printing are as follows:

3D Printing and the Environment
The technology has shown promise in terms of helping cut energy use, waste and emissions

Design for Additive Manufacturing
3D printing is creating new possibilities, and presenting new constraints, for designers

3D Printing for Construction
The technology could help address the global shortage of affordable housing

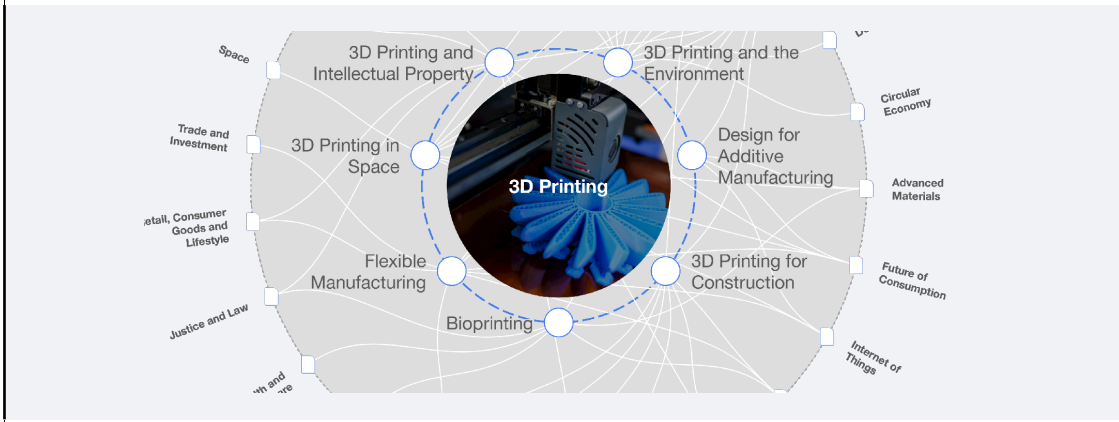
Bioprinting
People die every day waiting for donated organs, and 3D printing could provide a solution

Flexible Manufacturing
3D printing is enabling more customized production

3D Printing in Space
The technology is poised to provide everything from space station spare parts to Moon colonies

3D Printing and Intellectual Property
If all we need to create a product is a digital file, will rampant piracy follow?

Below is an excerpt from the transformation map for 3D Printing, with key issues shown at the centre and related topics around the perimeter. You can find the full map later in this briefing.



1 Latest insights

A synthesis of the most recent expert analysis.

Below are your latest updates on the topic of 3D Printing spanning 12 different sources.

1.1 Current perspectives

aPriori

Actionable Digital Transformation Strategies for Manufacturing

11 May 2023

Key Takeaways: Get digital transformation examples across the product development lifecycle Learn how digitalization applies to product design, manufacturing processes, […]

The post Actionable Digital Transformation Strategies for Manufacturing appeared first on aPriori .

Singularity Hub

From Autocycles to Flying Cars, the Wild Mobility Solutions on Display at CES 2023

05 January 2023

In the not-too-distant future, we're going to need new ways to move. Cars are convenient and relatively affordable, but they're also one of the world's biggest sources of emissions, not to mention the traffic, noise, and accidents that come with them. So how might we get from point A to point B in more efficient, Earth-friendly ways?

There are plenty of options on display at this year's Consumer Electronics Show (CES) in Las Vegas. From autonomous shuttles to personal aircraft to three-wheeled "autocycles," it seems there'll be no shortage of alternatives to the combustion-engine cars that fill our roads today.

MIT Sloan Management Review

Managing the New Tensions of Hybrid Work

13 December 2022

Managing the New Tensions of Hybrid Work

Leaders are meeting employee demands for more flexible work arrangements amid concerns over the impact on organizational culture and innovation capability.

Developing corporate culture and inspiring innovation were tough three years ago, when everyone sat in adjoining cubicles all week, drinking coffee from the same pot. Now that hybrid work appears to be here to stay, with many employees dividing their working hours between home and a company location, these challenges are magnified. New research shows that managers are deeply concerned about the downsides of hybrid arrangements for two domains that are, beyond most others, inherently social: Although evidence of damage to innovation and culture remains largely anecdotal, the potential threat is real.

INSEAD Knowledge

Should Companies Allow Returns of Customised Goods?

14 November 2022

In the age of mass production, the demand for customisation is increasing. Customers prefer products catered to their individual needs and preferences over standard items – albeit at a cost. Fortunately, recent advances in information technology, advanced manufacturing processes such as robotics and 3D printing, and logistics have enabled firms to customise products at scale at a lower cost.

In the highly competitive sportswear landscape, for instance, Nike and Adidas offer customisable shoes while Puma sells only standard shoes. But even though the two sportswear giants seem to see the

value of offering customised goods, their approaches to returns policy differ. At the time of writing, Adidas only allows returns of standard products while Nike accepts returns of both standard and customised products.

Returns of customised products is a tricky problem for businesses in practice. While standard products can be resold, it is usually not the case for customised products. After all, what is stylish to one may be outlandish to another. Moreover, who would buy a pair of sneakers embroidered with another person's name? In such cases, should firms allow returns of customised goods, and if so, under what conditions?

A three-dimensional problem

In deciding whether to allow product returns, dollars and cents matter. Put simply, companies need to balance the cost of product returns versus the potential increase in sales arising from allowing them....

The Conversation

We built a human-skin printer from Lego and we want every lab to use our blueprint

26 April 2023

Sourcing human tissue samples for biological investigations isn't always easy. While they are ethically obtained through organ donation or from tissue that's removed during surgical procedures, scientists are finding them increasingly difficult to get hold of.

It's not just because there's a limited supply of human tissue samples. There's also restricted availability of the specific size and type of tissue samples needed for the many projects taking place at any given time. That's why we decided to address the issue by building our own low-cost, easily accessible printer capable of creating human tissue samples using one of the world's most popular toys.

Ecole Polytechnique Fédérale de Lausanne

The Digitisation of the Panorama of Murten is about to start

25 April 2023

25.04.23 - After two months of conservation and restoration work, Louis Braun's monumental work, created in 1893 on some 1000 m2 of canvas, is about to being digitised. The process will generate the largest digital image ever created and will allow for unprecedented immersive and interactive viewing experiences.

Immersive experience par excellence, the art of the panoramic painting had its glory days in the 19th century. However, exhibiting these monumental works required dedicated buildings (rotunda). With the advent of cinema, this media form disappeared. Few panoramas survived. The situation is about to change with regard to Louis Braun's Panorama of the Battle of Murten, created in 1893. This 10-metre high and 100-metre long work, which shows in remarkable detail the battle in which the Confederates overcame the Duchy of Burgundy in 1476, has been at the heart of a project carried since 2022 by the EPFL's Laboratory for Experimental Museology (eM+) , in partnership with the Foundation for the Panorama of the Battle of Murten. After two months of patient conservation work, the painting is soon to be digitized. A specialized camera, sponsored by its manufacturer Phase One and equipped with a 150-million-pixel sensor, will be installed on a mobile structure developed for this purpose. It will capture approximately 127,000 images over three months of work. When assembled, this data will form the largest digital image of a single object ever created. "Augmenting" the...

Fraunhofer-Gesellschaft

New life for used electric bike motors

02 May 2023

An increasing number of people are riding electric bikes. Compared to cars, electric bikes are cheaper, more environmentally friendly, healthier for every-one and free up space in urban areas. The drawback is that there are often no spare parts for defective components such as motors or batteries, meaning they have to be completely replaced with expensive new components. A team of researchers from the Fraunhofer Institute for Manufacturing Engineering and Automation IPA demonstrated in a study with its partners that electric bike motors can be remanufactured in keeping with the concept of a modern circular economy. The researchers at Fraunhofer IPA will provide an insight into the remanufacturing of electric bike components in the RemanLab, a new learning environment for remanufacturing.

World Economic Forum

3D printing will transform architecture forever - here's how

06 April 2023

'Large-scale additive manufacturing', or 3D-printing buildings, is set to revolutionize architecture, says the director of the Institute for Smart Structures. Whether it's clay, concrete or plastic, the print material is extruded in a fluid state and hardens into its final form. While some roadblocks to the widespread adoption of this technology still exist, the future promises buildings which are built entirely from recycled materials or materials sourced on-site, he says.

Cities Today

Hybrid work options improve cities' ability to recruit, survey finds

24 January 2023

Embracing hybrid work will lead to a happier workforce and improve the resilience of US local governments, according to new research published by the Bloomberg Center for Cities at Harvard University.

Boston Consulting Group

3D Printing Helps Realize the Promise of Distributed Manufacturing

05 December 2022

Related Expertise: Industry 4.0, Manufacturing, Operations

Combining distributed and additive manufacturing mitigates supply chain risks by enabling fully digital interactions, better economics for producing small quantities, and flexible capacity.

Distributed manufacturing and additive manufacturing (also known as 3D printing) can be a powerful combination for solving supply chain challenges. Leading companies are managing supply risks by distributing production geographically, over time, or across the value chain. Unfortunately, this approach often faces limitations—including high costs, low asset utilization, long setup times, and stringent regulatory requirements.

The Conversation

Milestone developments at four years old help children tell lies, play hide-and-seek and read maps

13 March 2023

At the age of about four, children reach important milestones in brain development.

One of these is a leap forward in understanding others' thoughts and feelings. Another is in spatial thinking – understanding how objects are positioned and related.

New research with my colleague Catherine Sayer shows there is a leap at four years in particular spatial skills, indicating, for example, the beginnings of the ability to read maps.

We carried out a study with 175 two to five-year-olds to explore how children are able to use scale models to figure out where something is in the real world.

Fraunhofer-Gesellschaft

AI enables greater mobility: Personalized finger joint implants from a 3D printer

01 December 2022

The remobilization of finger joints that have been damaged by illness or injury is an emerging market in the field of demand-driven patient care. The FingerKIt consortium, which brings together five Fraunhofer institutes, uses AI to develop personalized 3D-printed joint implants so that these delicate finger parts can be replaced when necessary.

Robohub

Five ways drones will change the way buildings are designed - Robohub

02 January 2023

By Paul Cureton (Senior Lecturer in Design (People, Places, Products), Lancaster University) and Ole B. Jensen (Professor of Urban Theory and Urban Design, Aalborg University)

Drones are already shaping the face of our cities – used for building planning, heritage, construction and safety enhancement. As studies by the uk's department of transport have found, swathes of the public have a limited understanding of how drones might be practically applied.

It's crucial that the ways drones are affecting our future are understood by the majority of people. As experts in design futures and mobility, we hope this short overview of five ways drones will affect building design offers some knowledge of how things are likely to change.

Ecole Polytechnique Fédérale de Lausanne

3D printing with bacteria-loaded ink produces bone-like composites

23 February 2023

23.02.23 - EPFL researchers have published a method for 3D-printing an ink that contains calcium carbonate-producing bacteria. The 3D-printed mineralized bio-composite is unprecedently strong, light, and environmentally friendly, with a range of applications from art to biomedicine.

Nature has an extraordinary knack for producing composite materials that are simultaneously light and strong, porous and rigid – like mollusk shells or bone. But producing such materials in a lab or factory – particularly using environmentally friendly materials and processes – is extremely challenging. Researchers in the Soft Materials Laboratory in the School of Engineering turned to nature for a solution. They have pioneered a 3D printable ink that contains Sporosarcina pasteurii: a bacterium which, when exposed to a urea-containing solution,

triggers a mineralization process that produces calcium carbonate (CaCO 3). The upshot is that the researchers can use their ink – dubbed BactoInk – to 3D-print virtually any shape, which will then gradually mineralize over the course of a few days. “3D printing is gaining increasing importance in general, but the number of materials that can be 3D printed is limited for the simple reason that inks must fulfil certain flow conditions,” explains lab head Esther Amstad. “For example, they must behave like a solid when at rest, but still...

The Science Breaker

Floppy proteins and the hidden sequences they use to communicate

11 October 2022

Our cells are filled with proteins. These proteins usually have a specific structure which help them to make the specific interactions we need to live. But how do short, floppy regions of proteins make such tight and specific interactions despite lacking any structure?

World Economic Forum

Could 3D printing help solve America’s housing crisis?

24 February 2023

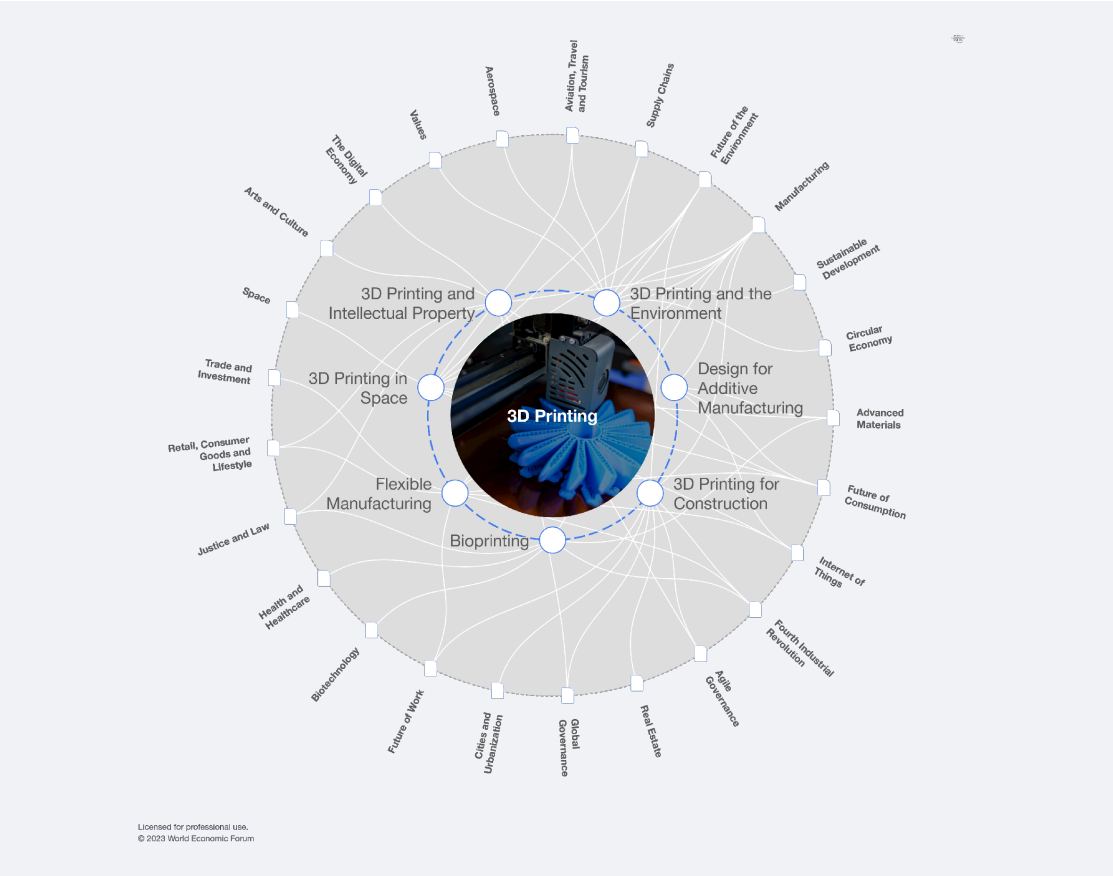
3D-printing robots are being used to build a 100-home housing development in the US state of Texas. Developers say the technology is cheaper, faster and more sustainable than conventional construction methods. 3D printing could help solve the nation’s housing shortage crisis, according to the US government.

2 Strategic context

The key issues shaping 3D Printing.

The following key issues represent the most strategic trends shaping the topic of 3D Printing. These key issues are also influenced by the other topics depicted on the outer ring of the transformation map.

FIGURE 1 **Transformation map for 3D Printing**



2.1 3D Printing and the Environment

The technology has shown promise in terms of helping cut energy use, waste and emissions

3D printing (or "additive manufacturing") is capable of significantly reducing the amount of raw materials necessary to make things. Conventional machining processes, for example, are based on the "subtractive" removal of material from larger blocks, until a final geometry is achieved. By way of contrast, 3D printing successively adds material in a layer-by-layer process, and selectively applies it only where it is needed - facilitating a "near net shape" technique that produces parts as near as possible to a final shape, and eliminates much of the need for finishing. The resulting lack of waste material is due to the fact that only a small amount of total material needs to be re-machined in order to achieve a desired surface roughness, or

to remove support structures. Meanwhile the 3D printing-related concept of Design for Additive Manufacturing enables the application of hollow, lighter-weight lattice structures and components, which further decrease the so-called "energy burden."

An ability to produce lightweight parts is particularly crucial for the aerospace industry. GKN Aerospace, for example, has said it has used 3D printing to significantly reduce its so-called "buy-to-fly ratio" such that only about 10% of material used in production ends up as scrap. Lockheed Martin has meanwhile managed to reduce the buy-to-fly ratio of its bleed air leak detector brackets all the way to 1:1 from 33:1 by using 3D printing, according to a report published by Deloitte. Another example is Airbus's work with design software firm Autodesk to develop a "bionic" cabin partition with more than 100 3D-printed parts for its A320 aircraft. According to Autodesk, installing the lighter partitions throughout an A320 would remove as much 500 kilograms of weight. The resulting decrease in fuel use would eliminate up to 166 metric tons of carbon dioxide emissions per aircraft every year - and, multiplied across thousands of A320s, could cut emissions by hundreds of thousands of tons annually.

Related topics: Values, Aerospace, Aviation, Travel and Tourism, Supply Chains, Future of the Environment, Manufacturing, Sustainable Development, Circular Economy

2.2 Design for Additive Manufacturing

3D printing is creating new possibilities, and presenting new constraints, for designers

3D printing (or "additive manufacturing") can produce lightweight structures with unprecedented, complex geometries, integrated sensors, and efficient, hollow and lattice structures. However, using 3D printing for parts can be challenging for designers. In the past, traditional guidelines for designers dictated that part shapes and features be kept as simple as possible, in order to reduce the number of required processing steps and the general cost of production. Entire generations of designers were trained to develop this mindset. Now, when designing for 3D printing, they are being advised to rethink traditional geometry and implement an approach inspired by lightweight, bionic concepts that can add significant value to a produced part. This requires an entirely new type of education (or re-education) in order to grasp all of the unique possibilities for using 3D printing to improve product functionality. Some related techniques include using dedicated software to reduce the weight of parts - which can be particularly useful in the aerospace and biomedical industries.

While 3D printing can add value to parts design, certain constraints have to be taken into account. Parts always need to be designed for production while keeping their "build orientation" (the direction in which a part will be printed) in mind. This is one of the most important aspects of 3D printing, because it determines the anisotropy (the differences in a material's physical properties when measured in different directions) of mechanical properties, surface quality, and the amount of support material that will be needed for the entirety of the printing process. The amount of support material should be minimized whenever possible, because it increases the total cost of material and lengthens the time required to remove material during post-processing. Large amounts of material usually add only a limited amount of engineering value to a part, and are also the main cause of increased residual stress (or stress that exists even after external force is removed). A study published in The International Journal of Advanced Manufacturing Technology in 2016 estimated that $667 million in value had been created by using 3D printing, equal to about 0.01% of total global manufacturing value added. Jabil, a US-based electronics manufacturing services firm, has reported that the use of 3D printing at one of its facilities led to a roughly 30% reduction in the cost of tooling, and an 80% decrease in the time required to make final tools and fixtures.

Related topics: Advanced Materials, Manufacturing, Future of Consumption, Internet of Things

2.3 3D Printing for Construction

The technology could help address the global shortage of affordable housing

The world suffers from a lack of housing. According to the World Resources Institute, the global affordable housing gap is expected to rise to 440 million households by 2025 - depriving roughly 1.6 billion people of an adequate and affordable home. 3D printing may be able to help. The technology enables new, significantly faster and more economical approaches to construction. Construction-related 3D printing processes differ slightly from traditional 3D printing, due to the size of the desired product; they involve a large, robotic arm that moves via railways that are installed around a building area as they extrude concrete, layer by layer.

These large machines are able to create complete buildings, use less material than traditional construction by producing honeycomb-structured walls with minimal density, and require lower-cost materials that can keep expenses to a minimum.

Before it can be made available broadly for commercial use, however, construction-related 3D printing must be further tested, standardized, and approved by regulators. Still, both startups and established construction companies are already developing related projects, achieving breakthroughs, and using new materials. For example, US-based startup Apis Cor famously managed in 2017 to 3D print an entire 38-square-metre house in 24 hours - at a cost of about $10,000. In addition to reducing time and costs, 3D printing has an environmental impact on construction, as less material is used and less waste is produced; it also reduces the risk of accidents, and enables the creation of complex architectural shapes. It may also stir greater competition within the construction industry, potentially leading to lower prices and greater rates of ownership. Overpopulated and fast-growing cities in particular stand to benefit from the technology. Dubai has announced that by 2025, 25% of its new buildings will be created using 3D printers - which could reduce the amount of required labour by 70%, and expenses by 90%. 3D printing can also help develop relatively inaccessible areas. The Italian company WASP, for example, has developed a 3D printer that works on solar or wind power and is able to print eco-friendly shelters using local materials in regions without electricity.

Related topics: Fourth Industrial Revolution, Agile Governance, Real Estate, Future of the Environment, Manufacturing, Global Governance, Cities and Urbanization, Future of Work

2.4 Bioprinting

People die every day waiting for donated organs, and 3D printing could provide a solution

While 3D printing (or "additive manufacturing") promises to revolutionize the manufacturing industry, it could also have a similar impact on public health. For example, 34,770 organ transplants were performed in the US in 2017, setting a fifth consecutive record yearly high, according to the US Department of Health and Human Services. However, there were also more than 114,000 people on the US waiting list for a transplant as of early 2018, and 20 people die in the country every day as they wait, according to the DHS, which notes that only about three out of every 1,000 people die in a way that allows for organ donation. Some countries and regions have considered and passed opt-out laws; in England, for example, a system where people will be presumed to have consented to donation is expected to come into force by 2020. Still, a shortage of donors is just one obstacle. Others include a need to develop more reliable organ preservation techniques, and a constant need for biological compatibility between donors and potential recipients.

Bioprinting could be the solution to these problems. The process of bioprinting organs uses 3D printing's layer-by-layer method, and consists of a medically designed 3D bio-printer and bio-ink - a substance usually made from stem cells. Depositing layers of bio-ink on top of one another leads to creation of tissue that can eventually form an organ. This organ, because it can be created using a patient's own cells, is much less likely to be rejected. That means that a patient would not need potentially dangerous immunosuppressant therapy, which can create susceptibility to diseases. Bioprinting could also be applied to drug discovery and toxicology. It could provide more reliable results than animal testing, for example, and would be safer than clinical studies. However, bioprinting is a time-consuming process and cells have to be kept alive throughout (tissues demand a constant supply of oxygen and nutrients). In this regard, vascularization, or the process of supplying blood through capillaries to living tissue, could help. In 2018, US-based company Prellis Biologics announced it had developed "pre-vascularized" tissue scaffolds that can be used to grow cells in 3D formats.

Related topics: Biotechnology, Fourth Industrial Revolution, Health and Healthcare, Advanced Materials, Manufacturing, Justice and Law

2.5 Flexible Manufacturing

3D printing is enabling more customized production

3D printing means that the cost of making something has been liberated from a need to make a lot of it. Traditionally, manufacturers have been bound by the principle that the more they produce, the more costs decline. 3D printing can alter this dynamic, by for example reducing or even eliminating the need for tooling - the process of developing series of moulds and dies needed for production (traditional injection moulding, for example, requires a series of precision-machined moulds in which to inject heated metal or other material). 3D printing can therefore drastically decrease the time needed to bring a new product to market, slash the

costs associated with making moulds, and lead to a situation where the cost-per-produced-part is not related to the potentially high overall cost of production including tooling and other elements. When a single 3D printing machine is able to produce complex parts requiring limited post-processing steps, the economy of scale associated with traditional large factories becomes obsolete - while more regional and local production becomes economically viable.

In late 2017, Daimler Trucks North America announced a pilot program for making 3D printed truck and bus parts on demand. The move was designed to slim down management and reduce the need to maintain inventory, while re-directing capital saved in the process to the development of new products (shipping time and related costs are also eliminated as part of this process). A similar approach could be widely applied in the automotive industry, where large stocks of spare parts for older vehicles can be eliminated. In addition, because a number of products can be manufactured in a single batch using the same 3D printer (if they are made out of the same material), that creates an ability to produce highly-customized parts at almost no additional cost. This has been the case in the healthcare industry, for example, when it comes to the production of customized implants and stents, and in the fashion and apparel industries, which place a premium on customization.

Related topics: Internet of Things, Manufacturing, Future of Consumption, Future of the Environment, Fourth Industrial Revolution, Retail, Consumer Goods and Lifestyle, Future of Work, Trade and Investment

2.6 3D Printing in Space

The technology is poised to provide everything from space station spare parts to Moon colonies

3D printing (or "additive manufacturing") has the potential to optimize space missions in the future, and transform the aerospace industry. In 2018, the world's first satellite with a 3D-printed exterior casing (printed at Tomsk Polytechnic University in Russia) was launched from the International Space Station - in order to test how such components behave in a vacuum. In addition, 3D printing technology is being used to build everything from rocket engines to support brackets for satellites. However, the biggest impact 3D printing will have on space missions will not be on the ground. Instead, it will arrive in the form of enabling manufacturing in space. Long-term space missions, for example, regularly need replacement parts that must now either be carried onboard or shipped from Earth as needed. This can be challenging; space missions have strict limits on on-board weight and cargo room, and a shipment blasted into orbit can cost $22,000 per kilogram of payload. A 3D printer could offer a faster and relatively inexpensive way to manufacture parts on-site, and on-demand.

After successfully testing a prototype in 2014, the US-based company Made In Space installed the International Space Station's first commercial 3D printer in 2016. The printer is operated from the ground, so that astronauts only need to remove parts from the print bed once they are completed. More than 100 plastic parts had been printed aboard the International Space Station as of early 2019, including tools and medical equipment. The printing of metal parts is expected sometime in the next few years. 3D printing may play a more crucial role in future missions, including long expeditions, and ultimately even in the potential colonization of the moon and Mars. 3D printers will be needed to manufacture large parts and entire habitats in the vacuum of space - probably using local materials like dirt or regolith (the inorganic material covering the surface of a planet). One such project, called Archinaut, is currently being developed by Made In Space in cooperation with NASA. In addition to printing new parts including satellite reflectors, Archinaut is designed to repair existing machines and structures while in orbit.

Related topics: Advanced Materials, Space, Supply Chains, Future of Consumption, Internet of Things, Aviation, Travel and Tourism, Manufacturing, Future of the Environment

2.7 3D Printing and Intellectual Property

If all we need to create a product is a digital file, will rampant piracy follow?

3D printing is revolutionizing manufacturing, and will probably become a part of our everyday lives. It is easy to imagine that just about every household will have a 3D printer at some point, and that everyone will be able to whip up physical products after downloading a digital file. However, the simplicity of 3D printing facilitates copying. Even if a product has intellectual property (copyright or patent) protections - whether it's the tablet that can combine multiple drugs developed at the National University of Singapore, or the dress 3-D printed for New York Fashion Week in 2016 - it is as theoretically liable to be pirated as a song or film.

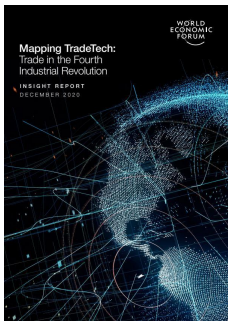
Manufacturers do not yet see consumer 3D printing as a threat, however, because the quality of what they can produce - at this point, anyway - is relatively inferior in terms of colours and materials, according to a report published by the UK Intellectual Property Office in 2018. However, it is important to consider whether current intellectual property protections will remain sufficient as the technology further develops.

At a first glance, both national laws and international conventions seem to cover most important aspects of 3D printing. There are protections for the external features of a product, its ornamental or aesthetic aspect, its shape and form, and its two-dimensional patterns and colour. Meanwhile copyright protections cover original "works of authorship" like literary creations or maps, as well as a creator's right to reproduce these works for extended periods. Copyright can protect the software used to operate a 3D printer, for example, and can also probably protect 3D digital files. Patents, meanwhile, can protect inventions and the technical functions of 3D printing, while trademarks enable creators to distinguish their goods or services from those of their competitors. Nevertheless, there are a few related issues that lawyers will have to tackle. For example: distinguishing the ownership of a product that was created by one person, digitally modeled by another, and printed by a third. In addition, mechanisms to better control digital piracy will have to be created. Perhaps the music industry could serve as inspiration in this regard, and the creators of 3D digital files will partner with sharing platforms that can make files publicly (and legally) available via an online marketplace.

Related topics: Agile Governance, Retail, Consumer Goods and Lifestyle, Justice and Law, Arts and Culture, Future of Consumption, Manufacturing, Global Governance, The Digital Economy

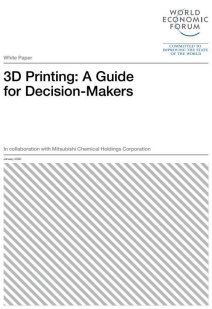
3 Further exploration

Explore the latest World Economic Forum reports related to 3D Printing.



21 December 2020

Mapping TradeTech: Trade in the Fourth Industrial Revolution



08 January 2020

3D Printing: A Guide for Decision-Makers

About Strategic Intelligence

Our approach

In today's world, it can be difficult to keep up with the latest trends or to make sense of the countless transformations taking place. How can you decipher the potential impact of rapidly unfolding changes when you're flooded with information - some of it misleading or unreliable? How do you continuously adapt your vision and strategy within a fast-evolving global context? We need new tools to help us make better strategic decisions in an increasingly complex and uncertain environment.

This live briefing on 3D Printing, harnesses the World Economic Forum's Strategic Intelligence platform to bring you the very latest knowledge, data and context from our 300+ high quality knowledge sources. Its aim is to help you understand the global forces at play in relation to 3D Printing and make more informed decisions in the future.

Each day, our Strategic Intelligence platform aggregates, distills and synthesizes thousands of articles from around the world. We blend the best of human curation with the power of machine learning to surface high-quality content on over two hundred global issues to our one million users globally. Our hand-picked network of content partners from around the world means that we automatically exclude much of the noisy clickbait, fake news, and poor quality content that plague the Internet at large. We work with hundreds of think tanks, universities, research institutions and independent publishers in all major regions of the world to provide a truly global perspective and we are confident that our data are well positioned when it comes to the intrinsic biases inherent to open text analysis on uncurated content from the Internet. For further context on our approach, you may be interested to read Strategic trend forecasting: anticipating the future with artificial intelligence and These Are The 3 Ways Knowledge Can Provide Strategic Advantage.

↓ A leading expert presenting a transformation map at our Davos Annual Meeting

Transformation maps

Our Transformation Maps are dynamic knowledge visualisations. They help users to explore and make sense of the complex and interlinked forces that are transforming economies, industries and global issues. The maps present insights written by experts along with machine-curated content. Together, this allows users to visualise and understand more than 250 topics and the connections and inter-dependencies between them, helping in turn to support more informed decision-making by leaders.

The maps harness the Forum network's collective intelligence as well as the knowledge and insights generated through our activities, communities and events. And because the Transformation Maps are interlinked, they provide a single place for users to understand each topic from multiple perspectives. Each of the maps has a feed with the latest research and analysis drawn from leading research institutions and media outlets around the world.

At the centre of each map is the topic itself. This is surrounded by its "key issues", the forces which are driving transformation in relation to the topic. Surrounding the key issues are the related topics which are also affected by them. By surfacing these connections, the map facilitates exploration of the topic and the landscape within which it sits.

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