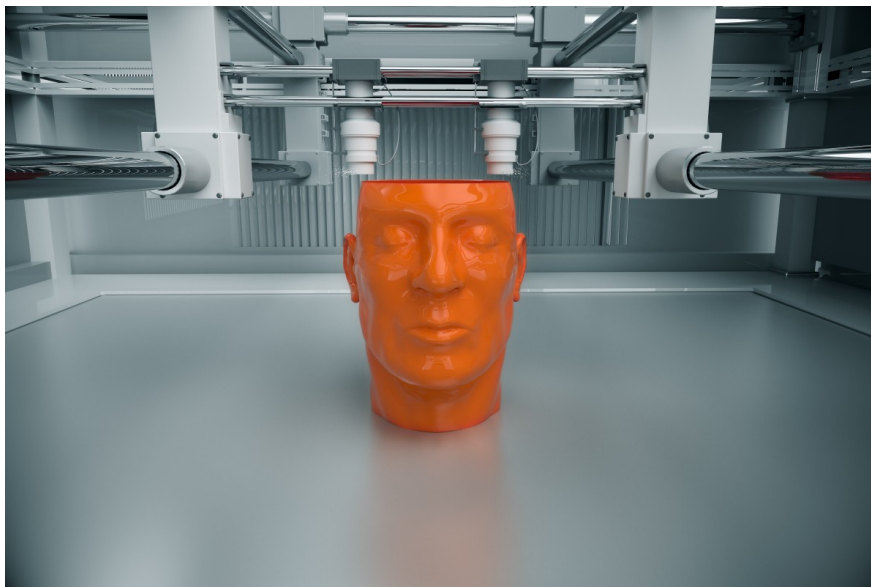


3D printing's potential

3D printing is the dominant production technique in some niche markets, but to become a widely used method in manufacturing, further technological breakthroughs are needed to drive down costs. There is no sign of that happening soon. But other drivers of growth make us believe that 3D printing could make up 5% of all manufactured products around 2040



A 3D printer makes a model of a human head

3D printing's weakness: Economics

The exact share of 3D printed goods in worldwide manufacturing isn't known. But for some niche markets, notably in dentistry, medical devices and hearing aids, we know that it amounts to 75 to 100% of total production. These markets are rather small, however.

According to [Wohlers Associates' annual report](#) on 3D printing, global revenue of the 3D printing business was \$12.8 bn in 2020, which is 0.1% of the global value-added of manufacturing. If we assume that raw materials used by the 3D printing business make up around 15 cents on every dollar of revenue in the 3D industry, the share of value-added of the 3D printing industry in manufacturing value-added terms is even a bit smaller at 0.085%.

No chance that 3D printing will become the dominant means of production any time soon

So, notwithstanding the dominance in some niche markets, the quantitative importance of 3D printing for total manufacturing is still very small. The three industry experts that we spoke to in researching this report all rule out the possibility that 3D printing will be the dominant production method in overall manufacturing any time soon. 3D printing designer Janne Kyttanen says, "it is difficult to imagine 3D printing beating high-velocity manufacturing technologies like laser cutting and injection moulding".

Joris Peels, 3D printing consultant, explains: "3D printers have to make products, also intermediates, layer by layer. It is unlikely that this will one day be faster than a traditional mould that can stamp out intermediate products at a very high velocity".

Many mass-produced products are still unsuitable for 3D printing

Terry Wohlers of consultancy firm Wohlers Associates, which has been collecting and analysing data on 3D printing on an annual basis for the last 26 years, points to the current limitations regarding the sort of products that are economically viable for 3D Printing. "The use of 3D printing for series production is most suitable when manufacturing volumes are relatively low, and product value is relatively high".

This makes many mass-produced products for the near future unsuitable for 3D printing. Wohlers expects that the number of applications will expand as machine, material, and operational costs are driven down. Kyttanen, however, adds that "although 3D printing can in some cases replace the current production method of existing products, we must realise that other technologies also develop, getting more automated and digitised".

Benefiting from the popularity of customised products

The success of 3D printing in markets like hearing aids shows that this production technique has a comparative advantage in making products with a complex shape. It also shows that 3D printing is well equipped to produce custom-made products. Contrary to traditional production methods, the costs of adjusting the product are very low. Customised products are, for example, to be found in footwear, eyewear and jewellery. These are attractive markets for 3D printing companies that produce products for third parties.



A 3D printed training shoe

Profit margins and customisation

Profit margins are much higher in markets with customised products than in markets for standardised products produced en masse.

The United Nations Conference on Trade and Development, UNCTAD, concludes in its World Investment Report 2020 that given the current state of 3D printing technologies, "the main limit to the disruptive power of 3D printing is its technical and economic feasibility". Looking forward, UNCTAD concludes that "unlike digitalisation and automation, which are expected to affect all industries to some degree, 3D printing in 2030 is likely to be still confined to selected industries or niche segments".

For Kytanen, the true gamechanger is that "3D printing enables the production of new products and services". It remains to be seen to what extent 3D printing can service notional demand for new products.

Untapped potential

Despite only a small chance that 3D printing will one day be the dominant production method in manufacturing, industry experts see a possibility that 3D printing will grow significantly in the years to come.

Terry Wohlers expects a yearly average growth rate of 27% until 2030, which would result in a market turnover of \$115 bn in 2030. That is ninefold the size of the market today and would be close to 1% of global manufacturing. Wohlers expects that one day 3D printing will be able to make up at least 5% of manufacturing. With a continuation of the yearly growth rate of 27%, it will take around 20 years to reach that point (2040).

The growth forecast of 27% is somewhat higher than the average growth in the three years preceding the crisis (25%), but we consider 27% plausible for various reasons:

- Threshold fear diminishing

Threshold fear has traditionally been an impediment to growth in 3D printing. We expect this to diminish significantly since 3D printing has proved itself during the pandemic, coming to the rescue during supply shortages. As we noted earlier, consultants have been noticing that customers are now in a 'fast forward' mood when it comes to integrating 3D printers into their production process. We think that the upward influence on investment in 3D printing from this tendency could even be more than two percentage points.

- **Lack of suitable materials is being overcome**

The lack of sufficient materials has been a bottleneck in the past but according to industry experts, innovations in construction and polymers are solving this problem. A wider range of materials is on its way and will incentivise more companies to work with the new technology.

- **New adopters are entering the market**

Our expectation that the share of 3D printed products in worldwide manufactured products will continue to increase is also based on the fact that we see many new companies and sometimes new industries starting to work with 3D printers. For example, the US military has started to use 3D printers to make shelters for missile launchers. The power and energy industry has also adopted 3D printers in recent years.

There is no good reason to expect that this will suddenly stop. The total amount of suppliers of industrial 3D printers has reached 228 in 2020, according to the Wohlers Report 2021. This is seven times as many as in 2012.

The same report shows that only three years ago, the eight largest suppliers still had a combined market share of 14%, falling to 9% last year, and in line with this, 2020 also showed a decline in turnover of the big eight while smaller suppliers delivered an increase in revenue. We see the increase of suppliers as an indicator for increased competition which usually results in more downward price pressure. This is positive for demand and hence the growth of the 3D printing market.

- **It's all about adaptability**

The fact that 3D printing can produce customised products much cheaper than traditional machines means that 3D printing will benefit from the rising popularity of customised products. About one in six consumers has at least once acquired a customised product.

Taking all this into account, we think that Wohlers' expectation of a future share of 5% of 3D printed goods in total manufacturing is realistic. We think that it could be reached by around 2040.

In our 2017 study on 3D printing, we looked at the possibility of 3D printed products making up one quarter to one-half of all manufactured products. This scenario can only become a reality if mass production with 3D printing becomes economically competitive. For now, however, there's no indication that we are close to such a breakthrough.

Reshoring a stimulus for 3D printing, but don't expect huge effects

The disruption of supply chains is not only a hot topic in boardrooms but also in public policy debates. In developed countries, calls from politicians to bring production home (reshoring) or moving production to countries nearby (nearshoring), have been increasing over the last decade. Covid-19 has only made those calls louder.

The ability to secure supplies of medical products has been a problem since the outbreak of the virus. But calls for reshoring should also be seen in light of the decreasing popularity of globalisation, the reduced support for free trade, and the new global geopolitical order which is characterised more by economic rivalry than international cooperation. While China and the US are at the heart of this rivalry, it has also stimulated calls for strategic autonomy and the protection of technological know-how in other Western regions such as the EU.

Reshoring is about more than economics

In the public debate, the issue of whether to reshore production or not is no longer purely an economic one dominated by cost-benefit analyses for companies. Other movements, like criticism of the contribution of cross border supply chains to global warming, effects on local employment and violations of workers' rights and tax evasion also add to the calls for switching from complex global value chains to more 'local for local' production through reshoring.

What does this mean for 3D printing? Well, 3D printing facilitates reshoring because printers use less labour and therefore increase the economic viability of reshoring production to developed economies where labour costs are relatively high.

Bring it home?

How big will the influence of reshoring be on the use of 3D printers? First, it should be stressed that although reshoring has been a buzzword for more than a decade now, actual reshoring has been very limited. According to Dachs et al. (2019), only 4.3% of the 2,450 firms surveyed in eight European countries were engaged in bringing activities back home between 2007-2015.

The pandemic could lead to an increase in interest in reshoring and 3D printing

Having said that, the pandemic could lead to a significant increase in interest in reshoring. Covid-19 has brought about widespread supply chain troubles. No fewer than 94% of the companies that Euler Hermes surveyed in six industries and five countries reported supply chain problems in 2020.

But it should be said that it is rather questionable whether reshoring is a solution for supply chain disruptions. After all, bringing production of intermediate products back home is, in itself, no guarantee that interruptions in the production process can be avoided. A pandemic or other natural disasters, such as earthquakes or floods, can happen back home, too.

So it comes as no surprise that, according to the Euler Hermes survey at the end of 2020, the percentage of the interviewed companies that are considering bringing production back home in response to recent supply chain troubles is less than 15%. This is a relatively low percentage given that more than half of the surveyed companies are thinking about moving their production sites or are looking for new suppliers. This could mean that companies are rather looking to diversify suppliers rather than bringing production back home.

In an overview of recent empirical studies, the economics department of the European Commission also stresses the small importance of reshoring thus far and points out that, although increasing, reshoring from China and other Asian countries has been less frequent than reshoring within the EU.

Protectionism a potential push for 3D printing

Reshoring might become necessary for companies if it becomes increasingly popular among politicians, leading governments to change the playing field. Tariff increases or increases of other trade barriers could change the relative costs of producing in developed countries and thereby force companies to relocate production sites back home or to countries that have a free trade agreement with the home country.

In response to the higher tariffs that the US imposed on imports from China, we have seen various companies relocating. Some of them back to the US, some of them to countries like Vietnam and Thailand, according to the Financial Times.

For now, the conclusion is that most companies do not consider reshoring as the best answer to supply chain disruptions. But the more they become acquainted with labour-saving production methods like 3D printing, the more it could become an interesting option, especially if politicians step up protectionist policies.

Thus, the development of reshoring plans will be important to watch.