

THE IMPLICATIONS OF 3D PRINTING FOR THE GLOBAL LOGISTICS INDUSTRY

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'3D Printing', or 'additive manufacturing' as it is also known, has the potential to become the biggest single disruptive phenomenon to impact global industry since assembly lines were introduced in early twentieth century America.

New technologies which are currently being developed could revolutionise production techniques, resulting in a significant proportion of manufacturing becoming automated and removing reliance on large and costly work forces. This in turn could lead to a reversal of the trend of globalisation which has characterised industry and consumption over the last few decades, itself predicated on the trade-off between transportation and labour costs.

Globalisation has benefited shipping lines, airlines and freight forwarders enormously as vast quantities of consumer goods are moved internationally to Western markets from the Far East. Consequently any challenge to globalisation must be viewed as a threat to the global transportation industry. However, as with all disruptive technologies, it also offers opportunities. This briefing takes a look at the new technology, assesses the chances of its widespread adoption and examines its implications for the logistics industry.

WHAT IS 3D PRINTING?

3D Printing was originally developed as an automated method of producing prototypes. Although there are several competing technologies, most work on the basis of building up layers of material (sometimes plastic, ceramics or even metal powders) using a computer aided design. Hence, it is referred to as an 'additive' process; each layer is 'printed' until a three dimensional product is created.

The logic for using 3D Printing for prototypes is compelling. Traditional 'reductive' manufacturing techniques (where materials are removed) can take longer and are much more expensive. Mechanical parts, shoes, fashion items and accessories and other consumer goods, can all be printed for review by the designer or engineers, and revisions printed equally as easily. Whereas mass production is viable due to economies of scale, it is uneconomical for 'one offs' and prototypes. 3D Printing will remove this differential, where every item produced is an original (or perfect copy) and tooling for one is as cheap as tooling for many.

The final 3D Printed product also has other benefits. Products can be lighter, but just as strong. There is also less wastage. In comparison traditional reductive manufacturing is highly inefficient in the use of materials.

The way in which each product is individually manufactured means that it is ideal for 'mass customisation' techniques. Consumers will, in theory, be able to have a much greater say in the final format of the product which they are buying, and have it manufactured to their precise specifications.

CAN 3D PRINTING REVOLUTIONISE GLOBAL INDUSTRY?

There is obviously an enormous leap between a manufacturing process which can presently produce one-offs and one that can replace large scale manufacturing. However, in theory, there is no reason why advances in technology could not increase the speed of production and reduce unit costs.

If this were to happen there would be many consequences, bringing about relatively minor (and then potentially major) changes to the global manufacturing industry.

For instance, 3D Printing is already very good at producing products (even with moving parts) which previously would have required the assembly of multiple components. By eliminating the assembly phase there will be huge savings for the manufacturer in terms of labour costs, but also potentially in the removal of storage, handling and distribution costs involved in bringing together the relevant components.

However systemic change will only occur if the automation of production rebalances global supply chain costs. The falling proportion of total costs made up by labour in the West would take away the rationale for producing goods in remote, low cost markets (as relative transportation costs rise).

Instead these manufacturing facilities could be sited close to the customer in Europe or North America where there would be fewer quality control issues and more responsiveness to market needs. Lower batch quantities would consolidate these benefits.

3D Printing, combined with efficient manufacturing, will revolutionise the principles established in the first Industrial Revolution. Not only will local manufacturing re-establish itself close to end markets, but it will allow the flexibility to reconfigure in response to changing consumer demands. The nature of manufacturing will be very different from traditional models in which it takes established production plants months (or even years) to retool.

The philosophy of manufacturing in which products are made precisely to customer demand could have big implications in certain sectors. For instance, in the healthcare vertical small 'one-off' production runs of drugs/compounds will reduce inventory holding costs. But this capability will also enable the rapid transport of entire production plants to areas where large amounts of drugs may be needed in times of emergency (i.e. pandemics or natural disasters).

Looking even further into the future, some household products could actually be manufactured in the consumer's home, once the cost of 3D printing technology has become affordable. This would have even greater implications for the logistics industry – this time on a domestic rather than international basis. This is not as far off as may be thought. 3D Printers for consumers can already be purchased for just a few hundred dollars.

WHAT ARE THE IMPLICATIONS FOR THE LOGISTICS INDUSTRY?

The implications of this new manufacturing technology for the logistics industry could be massive:

- Potentially a proportion of goods which were previously produced in China or other Asia markets could be 'near-sourced' to North America and Europe. This would reduce shipping and air cargo volumes.
- The 'mass customisation' of products would mean that inventory levels fall, as goods are made to order. This would have the effect of reducing warehousing requirements.
- There would be fewer opportunities for logistics suppliers to be involved in companies' upstream supply chains, as manufacturing processes are increasingly re-bundled within a single facility. Tiers of component suppliers are done away with, as is the need for supplier villages, line side supply etc.
- Downstream logistics would also be affected. Build-to-order production strategies could fundamentally impact the manufacturer-wholesaler-retailer relationship. In the future the shopping experience could also be vastly different. In some sectors, retailers will either cease to exist or become 'shop windows' for manufacturers, keeping no stock of their own. Orders are fulfilled directly by the manufacturer, and delivered to the home of the consumer.
- A major new sector of the logistics industry would emerge dealing with the storage and movement of the raw materials which 'feed' the 3D Printers. As 3D Printers become more affordable to the general public, the home delivery market of these materials would increase.
- The Service Parts Logistics sector would be one of the first to be affected. At present billions are spent on holding stock to supply products as diverse as cars to x-ray machines. In some cases huge amount of redundancy is built into supply chains to enable parts to be dispatched in a very short timescale to get machines up and running again as fast as possible. It doesn't take much imagination to understand the benefits for a service parts engineer of being able to download a part design from an online library, 3D Print it and then fit it within a very short time window. This would make global and national parts warehouses as well as forward stock locations unnecessary to fulfilling customer needs.

THE LOGISTICS COMPANY OF THE FUTURE

The changing supply chain dynamics will lead to the evolution of a new type of logistics company resembling a '4PL', or service management company, as much as anything else. Their businesses will comprise a mix of software development, delivery services, partner relationship management, contract management and brainpower.

The new logistics company will design solutions comprising demand planning, manufacturing, delivery, market monitoring, service parts management and return and recycling services. In essence, they will become Product Life-Cycle Management service providers.

This is a big opportunity for the major industry players that have the resources to establish these new organisations.

The Service Parts Logistics industry will be either transformed or decimated by 3D manufacturing - or perhaps both! With small 3D Printing machines available, operations in remote locations – or even in an engineer's van – will only need electronic libraries of designs available to them on a local computer. They can then call up the design of the spare part required and immediately print it. Obsolete parts could simply be scanned in 3D, fixed in the computer's memory and the new part printed. The implications for inventory are clear.

CONCLUSION

If the new technology is to completely transform global industry, 3D Printing must be able to mass produce goods in the same volumes as traditional manufacturing techniques. At present the jury is still out on whether this is feasible. Some in the sector (such as GE) foresee a time when a whole engine, for example, could be printed. Others believe that at least in the medium term, hybrid solutions will develop, which combine new technologies with more traditional techniques.

However what 3D Printing is certainly not is science fiction. Its ability to create strong but light parts has been identified by the aerospace sector; components for the automotive sector are already being printed and the technology is being adopted by the mobile telecoms sector.

It has been estimated that in 2012 up to 30% of finished products already involve some kind of 3D printing. By 2016, this is expected to rise to 50% and by 2020 potentially up to 80%.

At the moment the following areas are in line for transformation:

NOW

- Production Prototypes
- Small manufacturing runs of High Value/High Complexity products
- Dental/Aural healthcare forms/aids

SOON

- Almost all service parts
- Complex high volume/high value forms
- Products related to fashion/trends that have a high volume/short lifespan profile

LATER

- Mass produced fast moving consumer goods

It is difficult to see that industry will undergo complete transformation for many years – probably decades – to come. What could happen, though, is that that some sectors are penetrated by the technology at a much earlier stage, such as the manufacture of spare parts. In this case, the most enlightened logistics companies could even become early adopters of the technologies – investing in the 3D Printers and providing facilities for engineers – rather than kicking against the progress. This would also provide a way of leveraging their capital and their own technological capabilities.

It is clear that if the larger logistics companies delay or ignore the implications of this trend, they are vulnerable to new kinds of organisations or associations that will match or leap ahead of their capabilities for very little outlay.

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