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FROM PROTOTYPING TO PRODUCTION – FACING THE CHALLENGES OF GROWING ADDITIVE MANUFACTURING IN CHINA

Additive Manufacturing is going to become increasingly relevant to many manufacturers in many sectors in China, but moving from prototyping to full production faces significant and unique challenges that need to be overcome.

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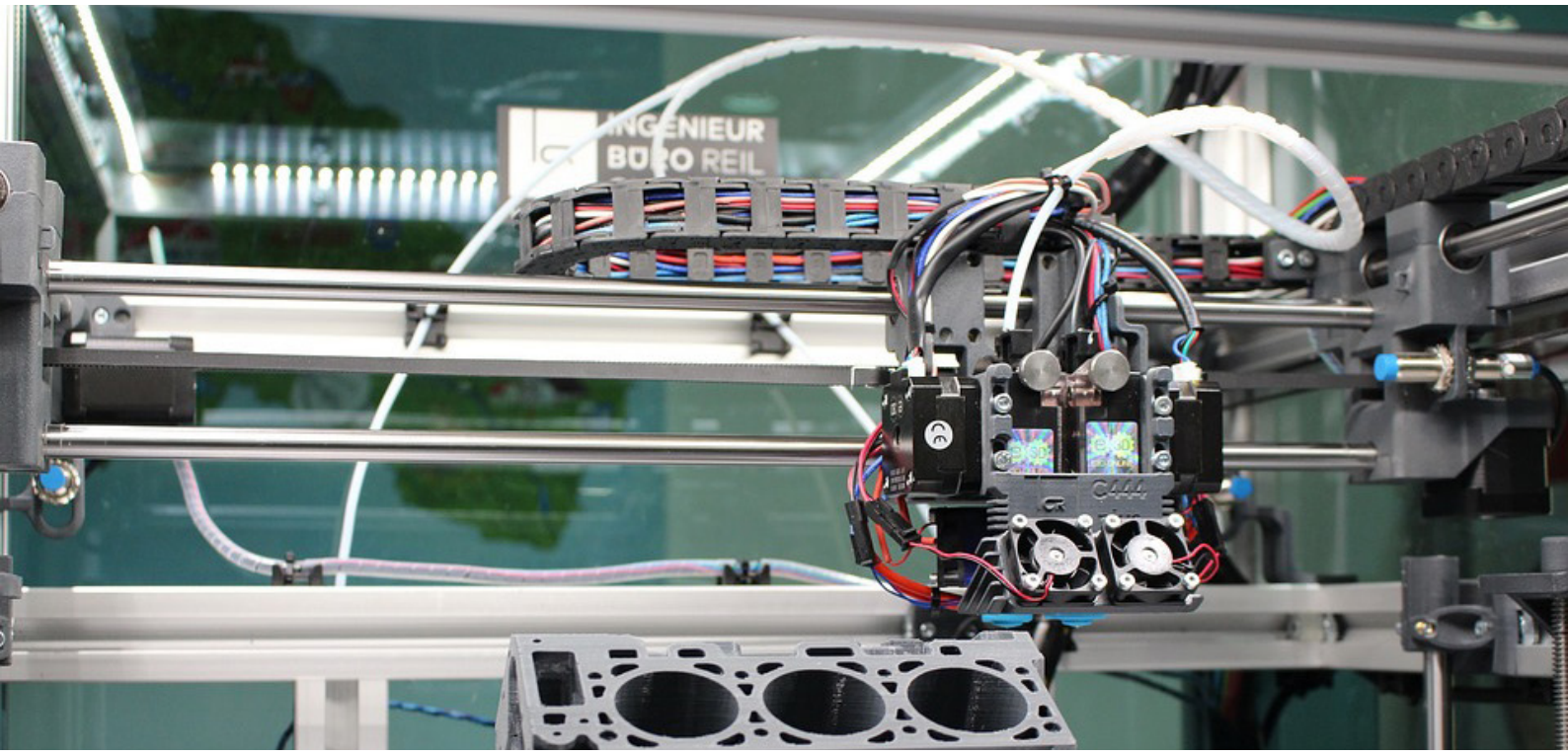
A bright outlook

Additive Manufacturing (AM), the building of a three-dimensional object from a computer-aided design model (often referred to as Industrial 3D printing), has been around in the West for a generation. But multinational AM equipment builders only started to enter the Chinese market in the new millennium.

At that time their priority was very much to extend their networks across China and simply sell as many machines as possible. However, what they found instead was that many Chinese customers were unwilling to embrace the technology, in part because of the high cost of materials such as metal powders, resins and filaments required for AM, but also because of a wider reluctance to change their methods of production.

Fast forward to 2020 and, compared to some Western markets, the penetration of AM across China remains fairly low. One of the chief reasons is that despite rising labor costs across China as a whole, the cost of labor is still relatively cheap compared to the investment required in AM.

Instead Chinese companies using AM technologies are still largely at the prototype stage and still often printing out one product at a time. As such, the big challenge is how these equipment users can make the step up from AM prototyping to production.



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Advanced manufacturing

The wider automation drive has also had a late start in China compared to the West and, at present, lacks a mature structure. For instance, local manufacturers still have much longer R&D cycles and generation life spans than Western companies.

But the direction of travel is clear. Although most international AM equipment manufacturers are still purely exporting to China, more locally focused products will be needed as the market evolves. Indeed, as advanced manufacturing markets become increasingly competitive, so import-only business models have limited sustainability, especially as manufacturing becomes more customized and relocated closer to markets. One of the great benefits of AM is also that it helps shorten the supply chain and allows potential AM users to offer tailored products more quickly to their end customers.

Market growth

What is clear is that we are now on the cusp of very strong growth in AM, not just in China but across the world. One reason in China is that home-grown AM equipment builders are now catching up very quickly with the offer of MNCs and not only providing viable product alternatives, but also capitalizing on their local advantage.

One example of a fast growing Chinese equipment builder is Xi'an Bright Laser Technologies, which in 2018 opened an Intelligent Production Center. Another is Shining 3D, a leading 3D scanning and printing system manufacturer which has carved out a particular role as a provider of 3D solutions to the medical sector.

However some MNC equipment builders are continuing to invest strongly in China too. For instance, Voxeljet recently opened an additive manufacturing hub in Suzhou which has more than 400 tonnes of annual 3D printing capacity. And 3D Systems acquired Easyway Design and Manufacture Co in China, a leading 3D printing sales and services provider.

Global market

In China the AM market is forecast to be worth anything between US$4bn and $10bn by 2025, while more aggressive estimates suggest the global market could be worth as much as $35bn by that date. Whatever the true figure, China is sure to have a significant slice of the global pie and see faster growth than most other markets given that its AM market is still relatively underdeveloped.

Another reason for such strong growth projections is that AM does not apply to any single industry or sector. Instead it is part of an eco-system which involves many different players from many different industries.

An AM strategy also forms an integral part of any company's wider approach to smart manufacturing and the adoption of Industry 4.0 technologies and the Industrial Internet of Things. AM is simply another process by which this much larger 'smart' eco-system becomes real.

Another reason for the growth in China is state support for companies wishing to invest in AM technologies. In recent years China has been investing very heavily in robots, artificial intelligence, and new manufacturing technologies, while it also plans to support the domestic AM sector through the Made in China 2025 initiative. China sees AM as an opportunity to evolve from traditional to advanced manufacturing and the government is strongly pushing AM development across a swathe of industries.

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Sector breakdown

So in which sectors are we likely to see the strongest growth in the adoption of AM? Markets such as automotive, healthcare, and aerospace top the list, with education, electronic and consumer markets also notable. Globally, the automotive industry is expected to see particularly fast growth with a CAGR of around 30-35% until 2025, closely followed by growth in the medical device and aerospace & defense sectors, which should both be above 20%.

In China the automotive sector offers particularly strong AM opportunities, especially because the average replacement cycle of vehicles is much shorter than in Western markets, with users typically replacing vehicles every two to three years on average (compared to five to seven years in the US or Germany). Suppliers may also increasingly use AM to engineer spare parts.

Overall, by 2025 it is forecast that more than half of 3D printing will be done in the automotive, medical and aerospace sectors, and we should expect similar projections in China. Unbeknown to many, AM is already widely used in some industries across China. For instance, it has been a pioneer in promoting AM in healthcare with the medical sector taking advantage of AM implants for patients, while the use of AM in the dental market is very mature.

Challenges

For companies looking to embrace AM and use AM solutions what are the issues then to consider?

Cost has always been a real hurdle to overcome when it comes to the adoption of AM globally, even if the long-term benefits clearly outweigh temporary costs. For an act of industrial production with AM, equipment cost will typically take up around two thirds of costs with materials (resins, filaments and powders) accounting for 15-20% of the operation.

The cost of labor and services can also be significant, especially when operations are first launched, as existing technicians in end users are unlikely to have the know-how required. Post-processing on AM products also has different requirements and can further add to the cost.

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IP concerns

The lack of in-house know-how also raises intellectual property concerns. Indeed, complicated IP issues have been blamed for the slow uptake of AM globally. Longer production timelines, a limited selection of materials, the quality of parts printed, and data storage requirements, all add to the list of challenges.

For many years customers have been particularly frustrated by the lack of standards in AM printing which are cited as one of the main reasons for them not purchasing machines again. Software development and capabilities, which should ideally be in synchronization with hardware development, often don't match.

These challenges are only further accentuated in the Chinese market which demands speed, quantity, and quality alongside innovation. Historically Chinese manufacturers are also used to 'turnkey' solutions which are used immediately once installed.

Savings

But these challenges have to be set against both the market opportunity and potential savings. With increasingly advanced printing technologies, more sophisticated software, cheaper materials, and more comprehensive services available, savings are not only possible but also very likely for most manufacturers using AM.

However making the jump is still a big one. For a business to switch from an existing CNC (Computer Numerical Control) system to AM is arguably one of the biggest decisions any company will ever face. The large initial investment may be considered extremely risky and simply too intangible to justify.

Take an automotive OEM or a tier one supplier. Their production process is so crucial that any disruption can be business critical. Decisions to improve the production lines have to be made with solid proof and without any room for doubt.

3DP as a service

For manufacturers thinking of using AM one answer to such challenges is to implement a 'test production' via 3D as a Service (3DaaS), a concept that has proven to be successful in other markets.

If you take the example of an automotive OEM (Original Equipment Manufacturer) it is not easy for the manufacturer to quickly switch a production line to AM, while the investment requirements can be restrictive. As such, a good alternative is to see if a particular operation works well in the first place by getting parts or components printed as a service, and then paying by usage or output. Ultimately, 3DaaS can be used as the initial proof of the AM concept, or as a permanent alternative utilization of AM.

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Multinational response

In the mid to long-run AM will inevitably become a crucial part of the whole drive towards advanced manufacturing in China, and that means it has big implications both for MNCs offering AM solutions and services, and also for those MNCs which will potentially use AM solutions on their production lines. How the latter group responds also has important consequences for Chinese companies in their supply chains which will be encouraged to further develop their AM capabilities.

Meanwhile Western AM equipment builders looking to grow their business across China will find particular challenges that are different from what they have faced in home and other markets, especially given the historic technological gaps in hardware, software and materials between Chinese companies and MNCs in general.

And as we have discussed in this article, Chinese AM equipment builders are catching up very quickly, from technologies to innovative business models, and capitalizing on their local policy advantages.

Localization

In order to successfully compete with local players in the near future, a top priority for MNCs which specialize in building AM solutions will be to localize their supply chain as quickly as possible.

This presents challenges such as IP concerns, level of ease in local partnerships, local market penetration and coverage, and the dynamics of a highly localized team, to name just a few.

However 3DaaS can help with the challenge of localization and act as a bridge to developing a presence in a market as customers need a low risk trial before investing capex. As such we also expect to see a number of specialist 3DaaS players emerge in the near future.

Ultimately, because the Chinese market is characterized by higher growth and speedier demand compared to most other markets, equipment builders need to discover routes to comfortable localization in order to more successfully compete with Chinese companies (and perhaps with other MNCs) and gain a footprint in the market and achieve retained growth.

Profitability becomes the priority once entry into the market is deemed successful. However achieving a sustainable balance of machine sales, material sales and service fees will always be difficult. The figure below summarizes the questions that MNCs offering AM solutions are frequently challenged by in China.

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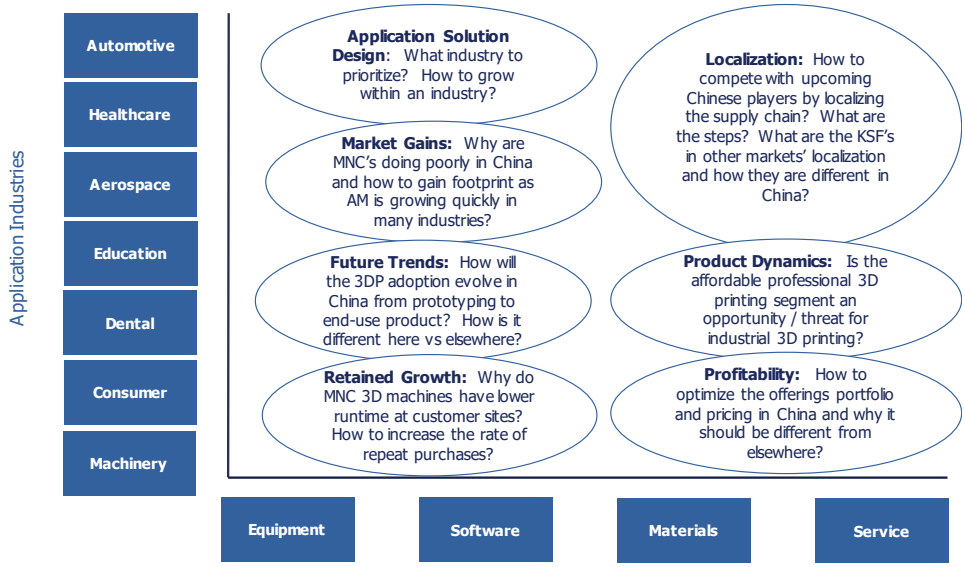
Chart #1

Additive Manufacturing (AM) at a Glance – Unique to China

Key elements of the AM industry and potential opportunities



Source:: InterChina Interviews & Analysis

Strategy

Meanwhile, what should Chinese manufacturers and MNCs looking to use AM be asking themselves in terms of their own shift from more traditional manufacturing technologies?

The starting point should be a thorough analysis of the advantages that they can gain in the mid to long run by adopting AM in their business. Advantages specifically in terms of RoI, and with respect to gaining traction with smart manufacturing and embracing 4.0 technologies. Given the investment required and costs involved from moving towards AM, an analysis of deploying 3DaaS makes an obvious starting point.

They also need to consider the challenge from start-up manufacturers solely using AM who will pose a disruptive threat to incumbents still reliant on CNC systems. Such challengers can be much more flexible in their operations and also benefit from having zero capex.

Solutions

Over many years InterChina has assisted a number of AM equipment builders in either acquiring or partnering with (JV) local companies, as well as helping them develop competitive strategies. The process may include research-driven estimation of the market size and the addressable portion, benchmarking with peers, market landscape and assessment, competition analysis, unique selling points (USP) analysis, and customer profiling, to name just a few.
What we have learnt is that there is certainly no universal solution for all companies' challenges. That's why we first help our clients prioritize their challenges and then design a process that can logically lead to a customized solution.

Ultimately AM in China is a very dynamic and fast-moving environment, and there is huge potential for all players to evolve their businesses accordingly.

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