ADDITIVE MANUFACTURING IN CHINA

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Additive Manufacturing (AM), often also referred to as "3D Printing", is an innovative manufacturing technology estimated to revolutionize production processes and value chains in the near future. "*In the coming years, 3D printers will be at the heart of full-scale production capabilities in several industries (…). Manufacturing as we know it will never be the same*", states for example Avi Reichental, former CEO of 3D Systems and one of the industry's pioneers and visionaries.

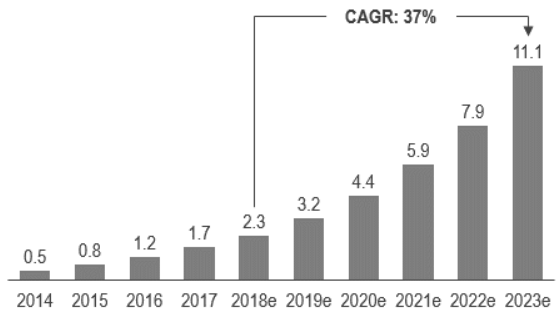
In fact, Additive Manufacturing and 3D printing are only umbrella terms for several different production methods in which an object is built up layer by layer, including for example Material Jetting or Power Bed Fusion. The main difference between AM and traditional manufacturing methods (such as casting in molds) is that objects can be produced individually, each with a highly complex structure and unique characteristics. Due to the consequently achieved high degree of design and engineering flexibility, completely new levels of lightweight solutions can be reached, offering strong levers for operational component improvement. Particularly for automotive, aerospace, healthcare and industrial tooling applications, AM offers unprecedented optimization potential and efficiencies for structural designs.

In recent years, these unprecedented possibilities have attracted numerous startups as well as established companies commercializing the technology by providing 3D scanners, printers, materials and services. Leading OEMs have started to gradually integrate AM into first their prototyping process and subsequently production value chains all over the world. This article sheds light on Additive Manufacturing industry developments and future trends in China, a hotbed for AM technology and one of

Additive Manufacturing in China – Status Quo

3D printing technology and associated industries are expected to experience strong growth in the near future. Global market volume of Additive Manufacturing is estimated to grow to 25.4 billion USD in 2030. While the US and Germany currently still have the technological lead, the APAC region (especially China and Japan) is catching up quickly and will become one of the main growth drivers. Especially China's AM industry has been expanding significantly in recent years reaching a volume of more than 2 billion USD in 2018. Although some experts saw a temporary growth plateau in 2017, the market is nevertheless forecasted to reach around 6 billion USD by 2021, reflecting an annual growth rate of more than 35 percent. In these figures, 3D printers (~50% of total volume), materials (~25%) and associated services and software products are taken into account.

Figure 1 | China AM Market Volume (billion USD)



Source: Forward Intelligence, Baumgartner & Partner

Being in its infant stage, the Chinese market for 3D printers is still relatively fragmented, with local player UnionTech as the market leader (share 16%). But foreign companies Stratasys, EOS, General Electric, and 3D Systems are following suit. Interestingly, almost half of sold printers are for industrial use with prices starting at 100,000 USD. The most common printing systems being Resin Curing and Material Extrusion.

One of the key market drivers is a resolute push by the Chinese government for smart manufacturing and a modernized industry base. After its economic rise having been mainly based on low-cost domestic production, traditional manufacturers in China are now facing increasing labor cost and stricter environmental standards. More and more multinational companies have therefore decided to move their manufacturing footprint towards Southeast Asia.

In order to stay competitive long-term, China is thus investing heavily in robotics, artificial intelligence and new manufacturing technologies. While increasingly relying on domestic know-how, foreign companies are also encouraged to set up branches and R&D centers in China to further foster local innovation. This strategy is backed both from a combination of a bottom-up private investment push and top-down political guidance. For example, as part of the *Made in China 2025* initiative, the central government has set far-reaching goals and laid out an action plan to support the domestic Additive Manufacturing sector.

Currently, the Chinese AM industry is very concentrated and mainly develops in four regional gravity centers: The Greater Shanghai Area, the Bohai Economic Area, Xi'an, as well as Guangdong. These hubs all tend to have a respective application focus, with e.g. Xi'an being very strong in aerospace or Shanghai in automotive, while Guangdong is traditionally focused on applications in electronics.

Initially, most companies had focused on serving one part of the value chain but are now increasingly offering complete solution packages to customers, including 3D scanners, printers, material and services. As a result, some local players have developed strong product portfolios and have become competitive also on an international level. These companies are not just "local champions" anymore, they are increasingly turning abroad to conduct business or research in Europe and the US. Even today, Chinese 3D printer manufacturers already have a remarkably high export share. Farsoon and Shining 3D recently opened offices in Stuttgart, Germany, while UnionTech has also already been active in Germany, Russia and the US for a few years.

Due to its mix of both foreign and sophisticated domestic companies, Shanghai can be considered as one of the main hubs for 3D printing in China. Many leading 3D printing companies have their main office or R&D center in the city or surrounding area, such as for instance EOS, 3D Systems, SLM and Stratasys, as well as Chinese players Farsoon, Techgine, Polymaker and UnionTech.

Moreover, the technology is also becoming more present in the city environment: In 2017, Shanghai opened China's first museum purely dedicated to 3D printing technology and culture. In addition, there are first model 3D printed bus shelters and bridges, as well as a 3D printed tea bar in the recently opened new Starbucks flagship store in central Shanghai. While these examples are primarily show-cases without a focus on high-tech industrial applications, they nevertheless portray the excitement and overall support for this new technology.

Figure 2 | Shanghai 3D Printing Cultural Museum

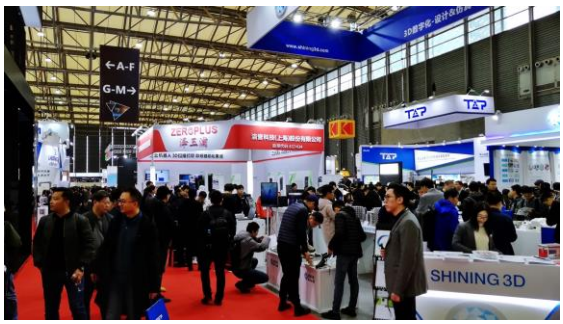
Source: EAC visit

Regarding industrial use cases, Chinese entrepreneurs have started applying Additive Manufacturing in various industries and are often already working together with international OEMs to develop effective solutions for cars, airplanes or manufacturing usage. For instance, Xi'an Bright Laser Technology has been cooperating with Airbus for years to supply metal 3D printed aviation parts in Asia and has even become a joint R&D partner developing new designs. A Chinese subsidiary of Flex utilizes metal 3D-printed structural components with width of just 1.5 mm to accelerate cooling ability of electric circuit boards by more than 20%.

Trends and Outlook

In order to find out about latest trends and get an overview of the global ecosystem, a convenient way is a visit to the TCT Asia Design-to-Manufacturing Innovation exhibition, one of the biggest annual events in the Chinese Additive Manufacturing industry held in Shanghai. The 5th edition in February 2019 attracted 16,000 visitors and 235 exhibitors. Its general atmosphere was perceived as optimistic and the amount as well as variety of attending companies impressive: from international giants like General Electric, Siemens, DMG Mori or Clariant, to very local Chinese firms.

Figure 3 | TCT Asia 2019



Source: EAC Visit

Several key players presented new technologies or services: Farsoon showcased its new ultra-fast *Flight Technology* for sintering nylon material, Dutch firm Ultimaker revealed a new cloud and service platform, Polish SMARTTECH3D premiered an upgraded 3D scanner, and Stratasys unveiled a voxel-level 3D printing solution. In addition, visitors could get a glimpse of what is already possible by looking at a 3D printed jet turbine, AM industrial printers as big as a small van, and highly complex and light parts designed for use on space stations or the human body.

In general, four high-level trends further shaping the industry can be observed: 1) Strong growth of the share of metal printing, which is a foundation for most industrial applications. 2) Shift from R&D and prototyping use cases to effective real-world applications. 3) Increased push for advanced new materials with unique characteristics and specifically developed for use in 3D printing. 4) Higher emphasis on implementation of AM technology in existing production and value chains instead of separate stand-alone services.

All in all, it will be interesting to see how the 3D printing industry globally but particularly in China will develop in the future. Can it achieve the desired impact or is this hype unjustified? Will local companies be able to compete on the same technological level as foreign firms? And when will 3D printed parts and components reach necessary quality and commercial characteristics to be able to fully replace traditional manufacturing?

Whatever the development might be, in fast-paced China you usually find out very soon.

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