

2023

ADDITIVE MANUFACTURING STARTUPS & SME LANDSCAPE

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India aims to add US \$1 Bn to the GDP through Additive Manufacturing by 2025. There is tremendous scope for further growth in manufacturing sectors like heavy industries, electronics and healthcare among others to make India AtmaNirbhar. This can be made possible through concerted and collaborative efforts by the industry, academia and government.

Shri. Alkesh Kumar Sharma.

**Secretary of Ministry of Electronics and Information Technology,
Government of India**



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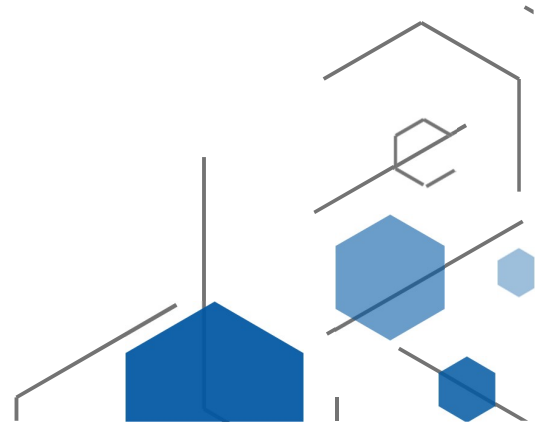
This Centre is a significant milestone for Telangana and India, as it is a first of its kind National Centre for cutting-edge technologies dedicated to additive manufacturing, that will meet the evolving needs of various industries, spur innovative Startups and transform manufacturing in India.

Shri. Jayesh Ranjan

**Principal Secretary Industries & Commerce and ITE&C,
Government of Telangana**



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CEO'S MESSAGE



As the CEO of the National Centre for Additive Manufacturing India, I am delighted to see the growth and development of this industry in our country. The potential for AM technology to transform various industries, from aerospace to healthcare, is immense and we are excited to be at the forefront of this revolution.

Over last decade, we have seen a significant increase in the adoption of AM technology across various sectors in India, and we anticipate this trend to continue in the coming years. We are proud to see Indian companies, SMEs and startups, leading the way in developing innovative solutions and products using AM technology.

As we move forward, we are committed to fostering a supportive ecosystem for the AM industry in India. This includes investing in research and development, promoting collaboration between industry players, and providing government support and initiatives to encourage the growth of the industry.

We are also focused on addressing some of the challenges facing the industry, such as the shortage of skilled workforce and the need for more advanced post-processing solutions. We are working closely with educational institutions to ensure that the next generation of professionals is equipped with the knowledge and skills needed to thrive in the AM industry. We are confident that the AM industry in India has the potential to be a major player in the global market and we are committed to supporting its growth and development. We look forward to working with all stakeholders in the industry to help realize this potential.

Thank you for your continued support, and we look forward to working together to shape the future of the AM industry in India.

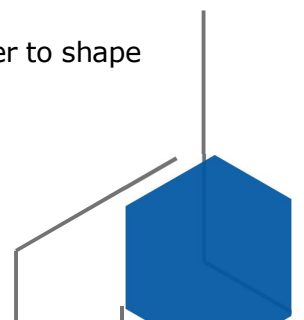
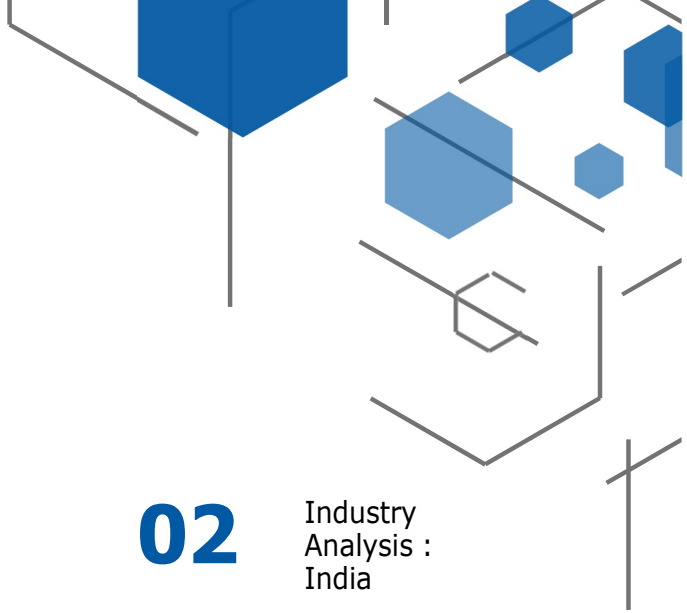


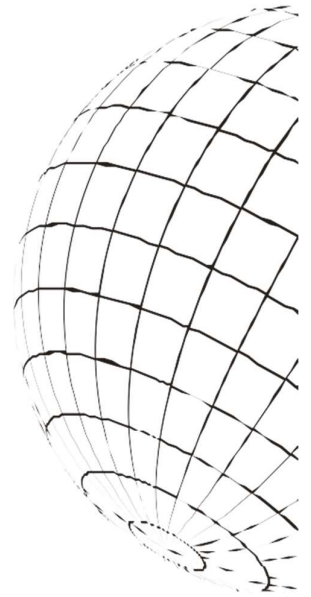
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EXECUTIVE SUMMARY



Outlook of Additive Manufacturing Industry in India



As additive manufacturing is gaining momentum in the country, the stakeholders like OEMs, MSMEs, Startups and Institutes are gearing towards new possibilities.

AM Startups & SME Landscape Report is important in communicating to stakeholders the India's commitment to contributing to the Global AM Industry; claiming accountability and responsibility to take the necessary actions; and measuring progress over time.

As currently there are more than 300 AM Startups & SMEs working in India represented in this Landscape Report which cater to a variety of audiences, ranging from Aerospace, Defence to Healthcare and AM enthusiast. This Report aims to serve the purpose of educating audience on the recent advances of current status of Additive Manufacturing Industry in India. It would also be a helpful resource for those trying to understand the major driving forces in the adoption of Additive Manufacturing Technology. We have also shed light on the challenges we face and catalysing a dialogue for industrialising Additive Manufacturing.

As one of the challenges is the discrete nature of Additive Manufacturing Industry, NCAM's effort is to bring together the parts of the eco-system to form a collective driving force for the adoption of Additive Manufacturing Technologies.

Creating a good Landscape report means being transparent with your audience and backing up your claims with credible relevant data but also diving into detail when it comes to qualitative and quantitative evidence.

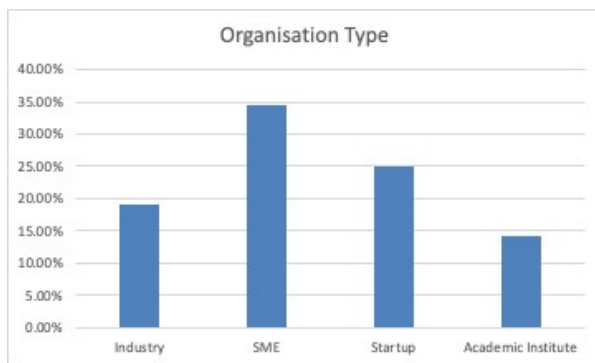
While the limitation of the surveys also applies to the methodology such as sample size for the survey. We have made our best efforts to minimise such impact on the report by fact-checking from different sources for the credibility of the data.

***Please Note** : this report is a combination of primary and secondary research done in the context of AM Industry. The primary research data has been provided by the IAMF Survey.

INDUSTRY ANALYSIS : INDIA

India's AM Market: a crucial factor for Make in India Initiative

As South East Asia is known to be the manufacturing hub of the world; it is imperative to adopt the Industry 4.0 revolution



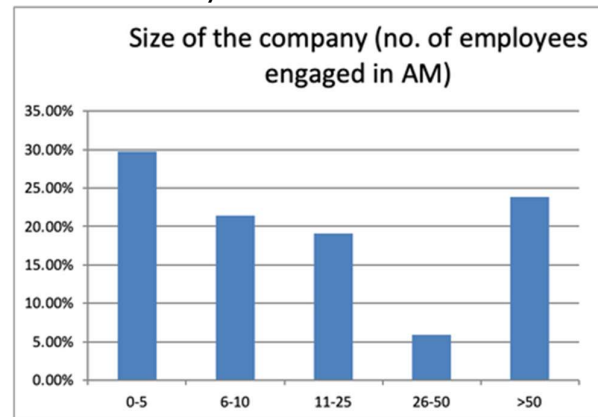
1.1 Organization Type - Source - IAMF survey

Being one of the most diverse markets in the world; India's AM Industry resonates with the diversity of type of business in the Market.

SME being one of the largest stakeholders with respect to the volume of the industry. It highlights the role of uprising micro businesses in the driving of Additive Manufacturing Technology.

Additionally large number of startups are foraying into the AM Industry with new innovation and differentiated products and services.

The first movers in the Indian AM industry have now evolved into sizeable industries with decades of learning and experience in the sector. These businesses are investing in developing advanced systems and software for the industry.



1.2 Size of the company - Source - IAMF survey

The number of employees employed by the company talks at large about the growth of the company and of the industry thereof. As we see a varied size of the companies operating out of India; one striking feature is new incubate with small teams are in large numbers.

The MSMEs are mid-sized businesses operating in services mostly with an employee count ranging from 10 to 50. The MSMEs play a crucial role in adoption of AM as their services end up educating the clients about the Additive Manufacturing Technologies and their potential for businesses.

While the Academic Institutes and Research centers are few in number, the increasing intent of universities to include Additive manufacturing curriculum would provide supply of skills and talent to the industry.

To summarise; each stakeholder has a significant and crucial role to play in the ongoing adoption of Additive Manufacturing.

INSIGHT ON AM HARDWARE

The hardware segment is expected to hold the largest share of the market, driven by the increasing demand for 3D printers.

According to a report by Mordor Intelligence, the market is expected to reach \$1.6 billion by 2027, growing at a CAGR of 27.3% during the forecast period from 2020 to 2027. The growth is attributed to increasing adoption of 3D printing technology in various industries, such as aerospace, automotive, healthcare, and education.

There are a number of companies in India that manufacture and supply additive manufacturing hardware, such as 3D printers and related equipment. These companies range from small startups to large established firms.

Additionally, there are also many small and medium-sized companies in India that specialize in additive manufacturing hardware, such as 3D printers, 3D scanners, and related equipment. These companies often focus on specific industries or applications, such as aerospace, automotive, healthcare, and education.

Reference : ADDITIVE MANUFACTURING AND MATERIALS MARKET - GROWTH, TRENDS, COVID-19 IMPACT, AND FORECASTS (2023 - 2028)
Content No. 6.4.3.3 India

There are a number of new additive manufacturing technologies and machines being developed in India by various companies and research institutions. Some examples include:

- **Fused Deposition Modeling (FDM):** One of the most popular technologies in India with number of startups & OEM developing products on the basis of FDM.
- **Stereolithography (SLA):** One of the oldest technologies globally has found its foot in Indian market with majority of services businesses in 3D Printing.
- **Selective Laser Sintering (SLS):** SLS has been developed in few reputed educational institutes as well as OEMs.
- **Directed Energy Deposition (DED):** Laser based DED machines has been developed indigenously by Reputed Educational Institutions.
- **Digital Light Processing (DLP):** This technology is also been used for specific applications requiring surface finish of highest standards.
- **Powder Bed Fusion (PBF):** This technology uses a laser or an electron beam to fuse metal/polymer powders to form a solid object. Many global OEMs have installed base of these machines in India for Low-scale & prototyping requirements.

These are some of the most common machines being developed in India, but it's worth noting that this field is always ongoing.

Overall, the Indian additive manufacturing hardware market is still in the developing phase, and the industry is still dominated by international players. However, with the increasing adoption of 3D printing technology in various industries, it is expected that the number of domestic manufacturers will also increase in the future.

INSIGHT ON AM SOFTWARE

According to a report by Mordor Intelligence, the AM software market in India is expected to reach \$44.2 million by 2027, growing at a CAGR of 22.5% during the forecast period from 2020 to 2027.

The software segment is expected to hold a significant share of the market, driven by the increasing demand for AM software solutions such as CAD, CAM, and simulation software. These software solutions are used to design, prepare and optimize 3D models, as well as to monitor and control the AM processes.

India is known for having a large pool of talented software professionals, and this applies to the field of additive manufacturing (AM) software as well. There are many software engineers and developers in India who have the skills and expertise to develop software solutions for AM.

Many Indian companies and startups that specialize in AM software have built teams of skilled software professionals who are experienced in developing software solutions for AM.

Additionally, there are also many universities and educational institutions in India that offer courses and programs in AM software development. These programs provide students with the knowledge and skills they need to pursue careers in AM software development.

However, it is worth noting that the field of AM software development is relatively new and the talent pool is still developing. While there is a growing number of professionals with relevant skills, the industry is still dominated by international players, which might limit the availability of certain specialized software engineers and developers.

Several companies in India are offering DfAM services, which provides design and engineering services for AM, helping customers to optimize their designs for AM, reducing costs, and improving performance.

To meet the growing demand for AM software talent, companies in India are investing in training and development programs for their current employees, and also hiring talent from other industries with transferable skills to build their teams.

The government of India also has initiatives to promote the use of AM technology, which will create more opportunities and drive the development of the talent pool.

The NCAM Skill Development and Awareness Drive is one such example of addressing the challenge of Talent pool for the AM Industry.

Reference : ADDITIVE MANUFACTURING AND MATERIALS MARKET - GROWTH, TRENDS, COVID-19 IMPACT, AND FORECASTS (2023 - 2028)
Content No. 6.4.3.3 India

INSIGHT ON AM MATERIALS

The additive manufacturing (AM) material market in India is growing along with the AM hardware market.

The plastic segment is expected to hold the largest share of the market, driven by the widespread use of plastic materials in AM for prototyping and small-scale production. However, with the increase in demand for metal AM, the metal segment is also expected to grow at a high rate.

India is making significant efforts in the development of new additive manufacturing (AM) materials. There are several companies and research institutions along with startups in India that are working on developing new AM materials however there are several challenges to the Materials Development

Some of the main challenges include:

- **Lack of knowledge and expertise:** Many companies and research institutions lack the knowledge and expertise needed to develop new materials for AM. This can make it difficult for them to compete with more established players in the field.
- **Limited research and development resources:** Many companies and research institutions in India lack the resources and

- funding needed to support the development of new AM materials. This can make it difficult for them to invest in the necessary equipment and facilities to develop new materials.
 - **Lack of infrastructure and standardization:** The AM industry in India is still in the developing phase, and there is a lack of infrastructure and standardization to support the development of new materials. This can make it difficult for companies and research institutions to access the information and resources they need to develop new materials.
 - **Limited market and customer base:** Due to the newness of AM technology in India, the market and customer base for AM materials is still relatively small. This can make it difficult for companies and research institutions to generate revenue and achieve profitability.
 - **Intellectual property rights:** Companies and research institutions may also face challenges related to intellectual property rights, particularly when it comes to protecting their inventions and innovations.
- To overcome these challenges, India will need to invest in knowledge and expertise, research and development resources, and infrastructure and standardization. Additionally, the government of India could play a role by providing financial support, promoting research and development, creating policies and regulations that favor the AM industry and collaborating with international partners to encourage the growth of the industry.

INSIGHT ON AM POST- PROCESSING

The additive manufacturing (AM) material market in India is growing along with the AM hardware market.

There are several challenges that companies in the additive manufacturing (AM) industry face when it comes to post-processing, including:

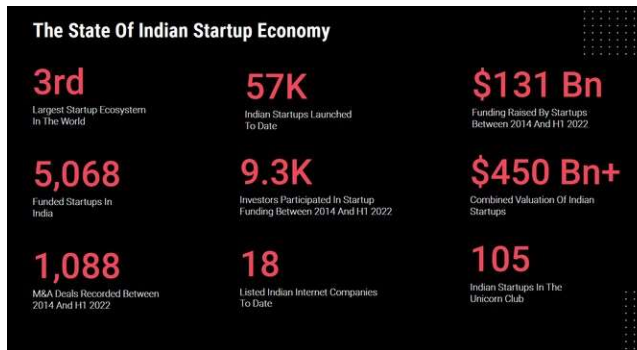
- **Complexity:** Post-processing can be a complex and time-consuming process, especially for parts that require multiple steps and specialized equipment.
- **Lack of standardization:** There is a lack of standardization in the post-processing techniques, making it difficult for companies to determine the best approach for a given part or application.
- **High costs:** Post-processing can be costly, both in terms of the equipment and materials required, as well as the labor costs associated with performing the post-processing steps.
- **Limited capabilities:** Many companies lack the necessary equipment and expertise to perform all of the required post-processing steps in-house, which can lead to delays and additional costs.
- **Quality control:** Ensuring the quality of the final product can be difficult, as it is hard to predict the final outcome of the post-processing steps, especially for parts that require multiple steps.

There are several ways that companies in the AM industry can solve post-processing problems. Some of the main solutions include:

- **Automation and Robotics:** Automating post-processing steps can help improve efficiency and reduce costs. Robotics can be used to perform tasks such as sanding, polishing, and drilling, and automated systems can be used to perform tasks such as cleaning and degreasing.
- **In-Process Monitoring:** Implementing in-process monitoring can help to identify and address post-processing issues early on, reducing the need for additional post-processing steps later on.
- **Materials and Process Optimization:** Optimizing the materials and processes used in the printing process can help to minimize the amount of post-processing required, and can also improve the quality of the final product.
- **Training and Development:** Investing in training and development programs to build the skills of employees and attract talent with the right skills can help improve the efficiency and effectiveness of post-processing operations.
- **Collaboration and Sharing of Knowledge:** Collaborating with other companies to share knowledge and expertise can help companies to stay up-to-date on the latest post-processing techniques and technologies, and to identify the best solutions for their specific needs.

Overall, companies in the AM industry can improve their post-processing operations by implementing automation and robotics, implementing in-process monitoring, optimizing materials and processes, investing in training and development, collaborating and sharing knowledge.

STARTUPS: NEW FRONTIERS FOR AM



Source : Page6 - The state of Indian Startup Ecosystem 2022 by Inc42

According to sources like DPIIT registration, there are more than 250 startups in/using additive manufacturing Technology. Roles of Startups in Indian AM Market :

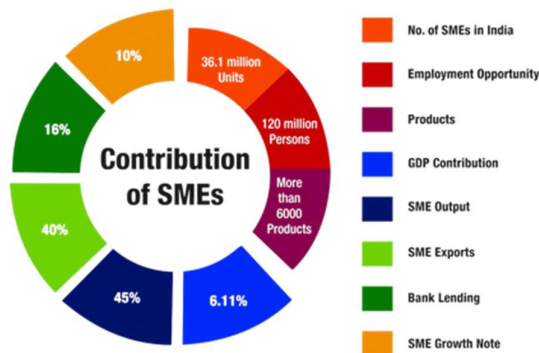
- **Providers of AM services:** Many startups in India offer AM services, such as 3D printing, design, and engineering. These services can help other companies to adopt AM technology and to improve the performance, cost-effectiveness, and sustainability of their products and operations.
- **Manufacturers of AM products:** Startups can also manufacture products using AM technology, such as aerospace, automotive, and healthcare products, which can provide new opportunities for these companies to expand and diversify their businesses.
- **Providers of AM software:** Startups can also develop AM software to support the design, engineering, and production of 3D printed parts and products.

A strong startup ecosystem includes a range of elements that support the development and growth of startups, such as:

- **Access to funding:** Startups need access to funding to develop their ideas and bring their products to market. This can include venture capital, angel investment, and government grants.
- **Mentorship and support:** Startups need guidance and support from experienced entrepreneurs and industry experts to navigate the challenges of starting and growing a business.
- **Networking and collaboration opportunities:** Startups need opportunities to network and collaborate with other startups, as well as with larger companies and organizations in the industry.
- **Access to resources and facilities:** Startups need access to resources and facilities, such as labs and workshops, to develop and test their products.
- **Education and training:** Startups need access to education and training opportunities to build the skills and knowledge they need to succeed.
- **Government policies and regulations:** Government policies and regulations can have a significant impact on the growth and success of startups. Governments can support the development of a strong startup ecosystem by creating policies and regulations that favor the AM industry.

To develop a strong startup ecosystem for the AM industry, NCAM has come up with technology specific incubation and support system to handhold budding entrepreneurs. Furthermore governments, private organisations, and educational institutions can work together to provide funding and resources, create mentorship and networking opportunities, and develop policies and regulations that support the growth of the AM industry.

SME : PUTTING INDIA ON MAP



Source : Importance of small and medium businesses in India by SKTuli Group

SMEs in the AM industry can play several roles, such as:

- **Providers of AM services:** Many SMEs in India offer AM services, such as 3D printing, design, and engineering.
- **Manufacturers of AM products:** SMEs can also manufacture products using AM technology, such as aerospace, automotive, and healthcare products.
- **Post-processing and finishing:** SMEs can also specialize in post-processing and finishing.
- **Providers of AM software:** SMEs can also develop AM software to support the design, engineering, and production of 3D printed parts and products.

SMEs can play a key role in the development of the AM industry in India, by fostering innovation, creating jobs and promoting economic growth. Furthermore, the government of India has been promoting the growth of SMEs through various initiatives such as providing financial assistance, creating policies and regulations that favor the SMEs and collaborating with international partners.

Some of these specific challenges include:

1. **Capital Investment:** SMEs often have limited financial resources, which can make it difficult for them to invest in expensive AM equipment and technology. This can limit their ability to produce high-quality parts and compete with larger companies.
2. **Limited Scale of Production:** SMEs often have limited production capacity and may not be able to compete with larger companies on price or quantity of production.
3. **Lack of R&D capabilities:** SMEs often have limited resources for research and development, which can make it difficult for them to innovate and develop new products and processes.
4. **Limited access to global markets:** SMEs may face challenges in finding customers for their AM-produced products, as they may not have the resources to market their products globally.
5. **Lack of Skilled workforce:** SMEs often have a shortage of skilled workforce, which can make it difficult for them to operate and maintain AM equipment. This can limit the ability of SMEs to fully benefit from AM technology.
6. **Limited Access to Government Support:** SMEs may face challenges in accessing government support and benefits that are available to larger companies.
7. **Quality and Standards:** SMEs may face challenges in meeting industry standards and certifications which can be required to meet the need of customers.

Overall, SMEs in the AM industry in India face several specific challenges that can make it difficult for them to compete with larger companies. The government and industry are working together to address these challenges and create a favorable environment for SMEs to benefit from AM technology.

R&D : WINDOW INTO WHAT IS NEXT

Research and Development (R&D) institutes play a critical role in the additive manufacturing (AM) industry by driving innovation and new technologies.

Some of the key ways in which R&D institutes contribute to the AM industry include:

1. Developing new technologies: R&D institutes are responsible for researching and developing new AM technologies and processes.
2. Providing technical expertise: R&D institutes often have a team of experts with specialized knowledge in AM technology.
3. Facilitating collaboration: R&D institutes often have partnerships with industry and other research organizations. These collaborations can help to speed up the development and commercialization of new AM technologies.
4. Providing training and education: R&D institutes often offer training and education programs to help companies and individuals acquire the skills needed to work with AM technology.
5. Standardization and certification: R&D institutes are responsible for developing standards and certifications for AM products and processes.
6. Providing consultancy services: R&D institutes provide consultancy services to companies and organizations to assist them in implementing AM technology in their operations.

By fostering collaboration, providing technical expertise and training, and conducting research, R&D institutes can help companies adopt AM and stay competitive in the industry.

There are several challenges that the R&D in additive manufacturing (AM) technologies faces in India:

- Lack of infrastructure: India currently lacks the necessary infrastructure to fully support AM R&D. This includes a shortage of advanced AM equipment and a lack of dedicated R&D facilities.
- Limited access to funding: R&D in AM technologies requires significant financial resources. However, in India, funding for R&D is often limited, which can make it difficult for researchers to access the resources they need to conduct their work.
- Lack of skilled workforce: There is a shortage of trained professionals in AM in India. This makes it difficult for companies to find the skilled workers they need to develop and implement AM technologies.
- Limited awareness: In India, awareness of AM technologies is still relatively low. This can make it difficult for researchers to find partners and collaborators for their projects, as well as for companies to find customers for their products.
- Intellectual property issues: India's intellectual property laws are still not fully developed and are not always in line with international standards. This can make it difficult for companies to protect their intellectual property, which can be a deterrent for R&D activities.

Despite these challenges, R&D activities in the AM industry in India are expected to continue to grow in the future. The government, industry, and academia are working together to address these challenges and create a favorable environment for the development and implementation of AM technologies in India.

AM: A MATURING INDUSTRY



10.1 Product & Services Offered - Source - IAMF survey

Additive manufacturing (AM) companies in India are currently serving a variety of industries. Some of the key industries being served by AM companies in India include:

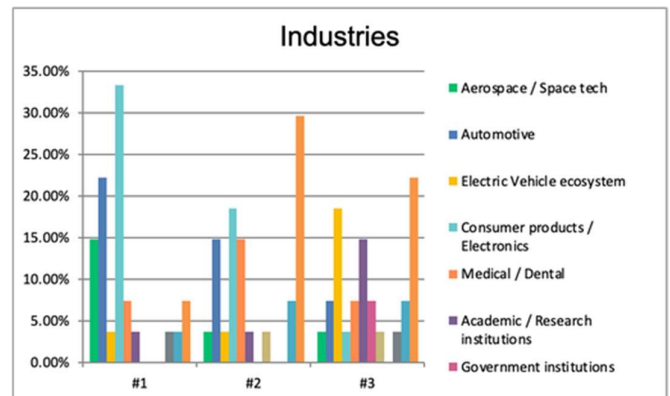
1. Aerospace: AM is being used to produce lightweight, high-strength components for aircraft and satellites.
2. Automotive: AM is being used to produce customized parts for cars and other vehicles, such as engine parts and exhaust systems. Automotive companies in India are using AM for prototyping and small-batch production.
3. Healthcare: AM is being used to produce medical implants and prosthetics, as well as for the production of customized orthotics and other medical devices.
4. Industrial: AM is being used in a variety of industrial applications, such as the production of tooling, molds and dies, and other specialized equipment.
5. Education: AM is being used in educational institutions for providing hands-on experience to students in the field of engineering and design.
6. Consumer Electronics & Products : AM is being used to develop new devices.

The additive manufacturing (AM) industry in India is still considered to be in a nascent stage of development. While AM technology has been around for several decades, its adoption in India has been relatively slow.

There are a number of factors that have contributed to this slow adoption. One major challenge has been the lack of awareness and understanding of the technology among Indian companies and industries. Additionally, the lack of skilled workforce and infrastructure has also been a hurdle.

However, the situation is changing in recent years, as more and more companies and organizations in India are recognizing the potential benefits of AM technology. The government is also actively promoting AM through initiatives such as the Make in India program, which aims to encourage companies to manufacture in India.

As a result, the AM industry in India is beginning to grow and mature. R&D activities in the field are increasing and new applications are being developed for various industries such as aerospace, medical, and automotive.



10.2 Industries Served - Source - IAMF survey

However, compared to developed countries, the industry is still in its early stages, and there is still a long way to go before it reaches maturity. The government and industry need to work together to address the challenges that are hindering the growth of the industry and to create a favorable environment for the development and implementation of AM technologies in India.

AM STARTUPS OUTLOOK

The 3D printing industry has seen significant growth and evolution over the past decade, with many startups emerging to take advantage of the technology's potential. Here are some key developments in the startup evolution of the 3D printing industry:

- **Early-Stage Startups:** In the early stages of the 3D printing industry, startups focused mainly on developing and improving the technology itself. Many startups emerged to create new types of 3D printers or to develop new printing materials. Examples include Formlabs, which developed a desktop stereolithography printer, and Carbon, which developed a high-speed, continuous liquid interface production (CLIP) technology.
- **Application-Specific Startups:** As the technology matured, startups began to focus on specific applications for 3D printing. For example, medical device companies such as Oxford Performance Materials and BioBots emerged to develop 3D-printed implants and tissue engineering technologies, respectively. Other startups focused on developing 3D-printed components for aerospace, automotive, and other industries.
- **Service-Based Startups:** With the increasing availability of 3D printing technology, startups began to focus on providing 3D printing services to businesses and consumers.

These startups often offered online 3D printing services or operated local 3D printing shops. Examples include Shapeways, Sculpteo, and 3D Hubs.

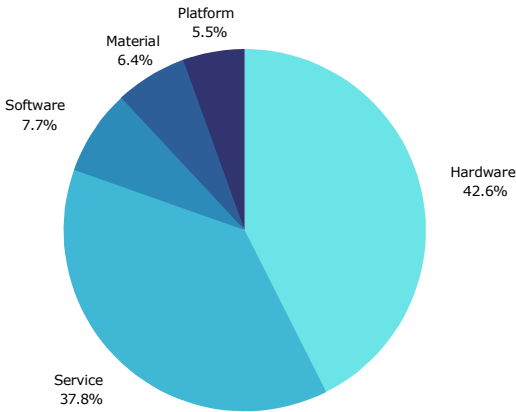
- **3D Printing Marketplaces:** Some startups have also focused on creating marketplaces for 3D printing designs and services. These marketplaces allow designers to upload and sell their 3D-printable designs and allow consumers to connect with local 3D printing services. Examples include Thingiverse, MyMiniFactory, and MakeXYZ.

Overall, the startup evolution in the 3D printing industry has been characterized by a focus on improving the technology, developing application-specific solutions, offering services to businesses and consumers, and creating marketplaces for 3D printing designs and services. As the technology continues to mature, it is likely that we will see further evolution in these areas and the emergence of new types of startups in the 3D printing industry.

AM KEY PLAYERS

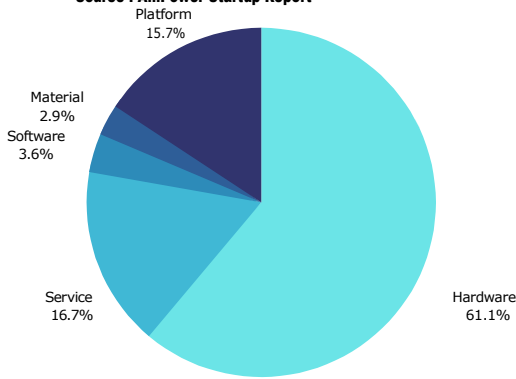
	International Brands	Domestic Brands
Hardware		
Material		
Software		
Service		

AM STARTUPS IN NUMBERS



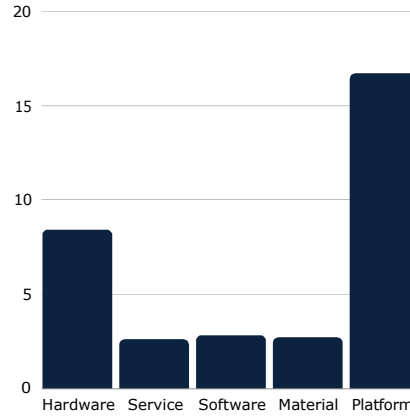
• Table 14.1 : Cumulative Global Data of Number of Startups

• Source : AmPower Startup Report

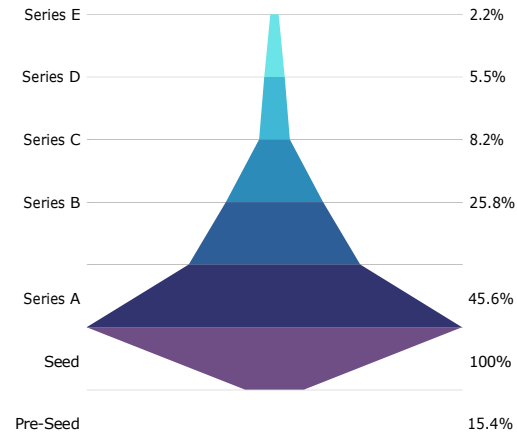


• Table 14.2 : Global Data on startup funding Categories

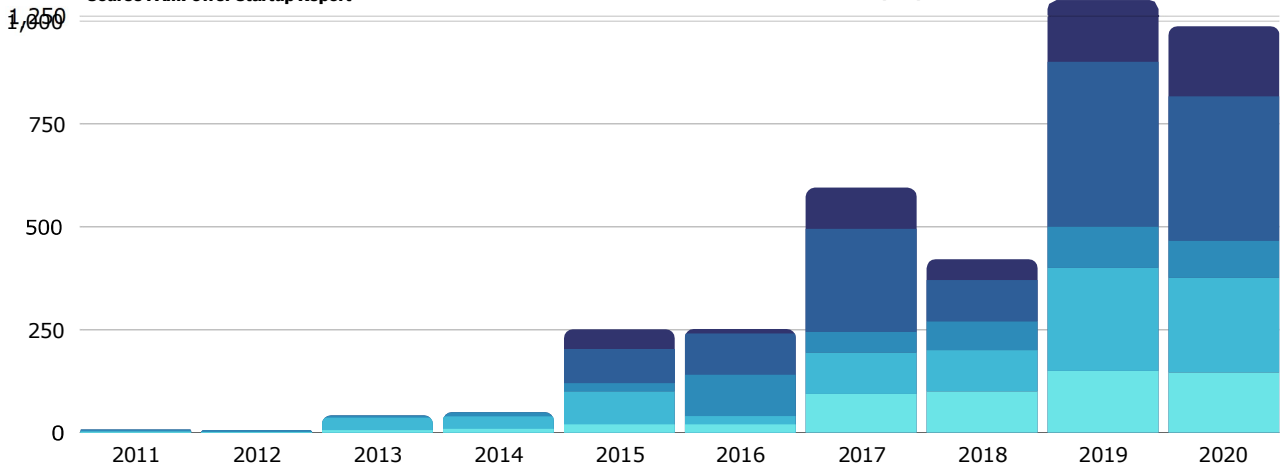
• Source : AmPower Startup Report



• Table 14.3 : Average Funding million EUR
• Source : AmPower Startup Report



• Table 14.4 : Investment Round distribution of Global Startups
• Source : AmPower Startup Report



• Table 14.5 : YoY Cumulative Global funding in Additive Manufacturing (EUR million)
• Source : AmPower Startup Report

ACKNOWLEDGEMENTS

We would like to extend our thanks to below entities committed to the projects, such as

Indian Additive Manufacturing Forum

AMTech India Report

Indian 3D Printing Network

Ms. Anjali Manda

Industry Survey Participants

We thank you for your continued support in our efforts to contribute to the AM Industry.

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