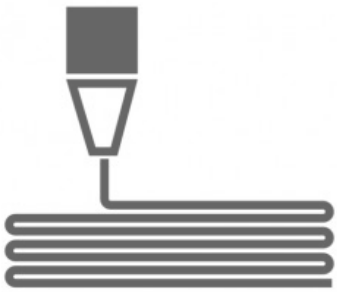

3D Printing | Additive Manufacturing (AM)

Overview

3D printing, also known as additive manufacturing (AM), refers to processes used to synthesize a three-dimensional object from successive layers of material. These objects can be of almost any shape or geometry, and are produced from a 3D model or other data source.

Applicable Industries

- Aerospace
- Automotive
- Chemicals
- Electronics & Embedded Devices
- Furniture & Home Appliances
- Healthcare Services
- Heavy Vehicle
- Equipment & Machinery

Medical Devices & Equipment

Rail & Metro

Renewable Energy

Applicable Functions

Product Development

Production - Manufacturing

Research

Market Size

Estimate A

$7.8 billion (2014, Global, Additive Manufacturing)

Source: ReportsnReports; PRNewswire

Estimate B

$3.1 billion (2013, Global, Additive Manufacturing), $12.8 billion (2018), $21.0 billion (2020)

Source: Wohlers Associates

Estimate C

$8.6 billion (2020, Global, Additive Manufacturing)

Source: Allied Market Research

User Viewpoint

Business Value

How does this use case impact an organization’s performance?

3D printing enables a more efficient development process through rapid prototyping. For manufacturing and maintenance operations it enables highly customized items to be produced on-demand.

3D printing has many benefits both to business and non-business environments, some of them are as follows:

1) Avoiding mass-production: With 3D printing, it is possible to economically produce low-volume batches down to a size of one, because the economics of making one are exactly the same as making 100 or 1,000.

2) Creating complex components: With 3D printing it is possible to create shapes that can't be made by moulding or machining.

3) Greener manufacturing: There are environmental benefits for 3D printing, which eliminates transportation costs and the fuel emissions.

Key Performance Indicators

How is the success of the system measured for users and for the business?

Quality of the product produced, production rates (cycle time), dimensional precision (high or low precision) and waste and scraps (zero to no waste) are KPI's measured on 3D printing.

System Capabilities & Requirements

What are the typical capabilities in this use case?

3D printers have many capabilities, including additive manufacturing, advanced assembly, automation and digital prototyping.

Performance Requirements: Detailed input data with all necessary information for the object to be printed.

Deployment Environment

Where is the ’edge’ of the solution deployed?

Research & development, manufacturing and maintenance sites.

Stakeholder Viewpoint

Investment Decision Makers & Influencers

Which organizations, departments, or individuals typically makes an investment decision and allocates budget?

Technology Viewpoint

Sensors	**What sensors are typically used to provide data into the IoT system, and which factors define their deployment?**
Analytics	**What types of analysis are typically used to transform data into actionable information?** It is possible to connect the 3D printer to big data by utilizing sensors in order to ensure quality control via Internet-of-Things.
Cybersecurity	**What factors define the trustworthiness of the solution?** There are risks associated to Cybersecurity in 3D printing, the biggest one is the fact that whatever is produced can be stolen by hackers because all the designs are stored inside the database.
Cloud & Edge Platforms	**What factors define the cloud and edge platforms used to integrate the solution?** A new batch of cloud-based services offer to do the 3-D printing for small businesses. Companies can work up a design and upload it to a cloud server, and the cloud business at the other end 3-D prints it. The cloud companies sometimes offer services such as packaging, shipping and billing as well—allowing small businesses to focus on core areas such as design.?
Connectivity	**What factors define the connectivity solutions used to provide both device-to-device and device-to-cloud communication?** Different connectivity options exist for 3D printers such as LAN or WIFI options. It depends on the exact nature of the business that the 3D printer is used for.
User Interface	**What factors define the interfaces available to the system users?** User friendly interface designed to help users.

Data Viewpoint

Data Sources

How is data obtained by the system?

Different and multiple data sources may be used to facilitate 3D-Printing and manufacturing. It depends on whatever needs to be manufactured.

Data Types

What data points are typically collected by the system?

Various data types depending on the project.

Data Volume

What volume of data is expected from each deployment, and from the system as a whole?

Data Requirements

What other requirements define data behavior?

Implementation Viewpoint

Business & Organizational Challenges

What business challenges could impact deployment?

There are various challenges for 3D printing adoption, some of these are:

- Equipment costs
- Limited materials available
- Post-processing requirements
- Manufacturing costs
- Lack of formal standards
- Data storage requirements
- Lack of expertise and/or training among workforce

Organizations might be hesitant to implement 3D printing because of the costs, lack of skilled workers and the fact that the entire manufacturing process might be in danger if results vary throughout the process.

Integration Challenges

What integration challenges could impact deployment?

In large scale production runs, 3D printing isn't a viable option over traditional manufacturing. 3D printing of a prototype must take into account the final production process during the design step.

If a component can be fabricated through 3D printing but the same results cannot be accomplished when the part goes into production, then the project is a failure. This is why designers and engineers must consider all aspects of the project.

Time is also a major challenge of 3D printing. At this point the time and cost required to make one part may not be sustainable for a full fabrication project. 3D printing is not a substitute for precision machining centers and machinery that produce high quality products in a timely manner.

Installation Challenges

What installation challenges could impact deployment?

Regulatory Challenges

What regulatory challenges could impact deployment?

As 3D printed products enter the mainstream markets, the issue regarding regulations arises. Since every product can be different, there aren't any regulations in place for manufacturers to follow. U.S. regulators who are responsible for products entering the market have a difficult time determining how to test products and explaining what requirements manufacturers need to meet.

This is especially important for products used in safety critical applications where 3D products must prove they are as safe as those products made through conventional manufacturing.

IoT ONE Use Case

Accelerating the Industrial Internet of Things

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