

4D Printing - Market Share Analysis, Industry Trends & Statistics, Growth Forecasts 2019 - 2029

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Report description:

The 4D Printing Market size is estimated at USD 0.45 billion in 2024, and is expected to reach USD 2.85 billion by 2029, growing at a CAGR of 44.75% during the forecast period (2024-2029).

The advancement in bio-fabrication technology will drive the 4D printing market in the forecast period.

Key Highlights

- When external energy sources, such as pressure, heat, energy, etc., are brought in contact with this 3D printed smart material, it alters based on the instructions in the previously given program. In this way, 4D printing technology enables the printed objects to self-transform over time.
- The technological advancements in 4D printing are resulting in the development of technologies in the medical and defense sector. For instance, to minimize the procedures involved in carrying out the surgery, doctors use 4D printing to put self-transforming components into the patient's body.
- Furthermore, in military applications, 4D printing has more significance. Soldiers can have a camouflage that can adapt to different environments and metals. This is increasing the performance of tanks and trucks, according to the changes in the environment. Owing to their benefits in producing guns, machinery, and other defense technologies, 4D printing is being increasingly explored by the military.
- In the United States, the USAF and the US military are investing in 4D printing to bolster infrastructure and posture American airpower for continued dominance into the future.
- With the outbreak of Covid-19 industries, particularly healthcare will employ more advanced technology to manufacture and meet the requirements of various medical devices and equipments. For instance, Leitat Technology Centre designed the ventilator by incorporating 3D technologies and incorporating other parts found on the market. Assembly is very fast, so currently about 100

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ventilators can be produced per day.

-A major challenge for 4D printing technology is the structural design that includes both the hardware section and software section. To design the hardware part, special measures need to be addressed.

4D Printing Market Trends

Increase in Demand for Industry 4.0 and Emergence of Industry 5.0 to Drive the 4D Printing Market

- Additive Manufacturing, also called 3D printing, is a part of Industry 4.0. Lately, there have been many funding activities which are led to developments in this technology. For instance, previously Essentium, a 3-D printing firm, raised USD 22 million in a Series A round, led by Materialise and Genesis Park.
- Additive manufacturing technology is still developing rapidly so companies have realized that 'manufacturing as a service' is a smart approach. Also, the future of additive manufacturing is the ability to produce personalized products with lower costs, less energy consumption, and less material waste, which is what exactly Industry 5.0 has to offer.
- Industry 5.0 will encourage 4-D printing since it will help in concentrating on the design process, rather than the manufacturing process. The freedom of design will lead to the creation of products that are more bespoke and personal.
- Industry 5.0 is projected to push the boundaries of physics in design. For instance, in the creation of next-generation aircraft, there is a constraint in manufacturing capabilities when it comes to Industry 4.0. On the other hand, with Industry 5.0, the manufacturing process would be better automated, since humans will mainly focus on the design of the aircraft.

North America to Account for Largest Market Share in 4D Printing Market

The North American region, particularly the United States, is among the lead innovators and pioneers, in terms of adoption, for additive manufacturing. It is expected to retain its position as the market leader, over the forecast period.

- US- based Autodesk previously launched ADAPT, which is an additive manufacturing consortium that identifies visionary research, scalable education platforms, actionable strategic insights, and academic-industry ecosystem as the basis of its platform.
- EnvisionTEC in Michigan, is one of the leading manufacturer and distributor of patented 3D rapid prototyping and manufacturing solutions for global organizations. Due to their strong customer and partner base in automotive, aerospace and medical industry, the company is planning to introduce 4-D printed prototypes in near future.
- According to OECD, The healthcare expenditure of the United States, as a percentage of GDP, is higher than any other country. 4D scanners can be brought into use in healthcare in developing 4-D models for human body parts, which can then be used for producing prosthetics.

4D Printing Industry Overview

The key profiles of the leading suppliers of 4D printing technology are self-assembly lab: Massachusetts Institute of Technology, Hewlett Packard Corporation, Autodesk Inc., Stratasys Ltd, ARC Centre of Excellence for Electromaterials Science (ACES), Exone Corporation, and others. The market is highly competitive without any dominating players. Companies in additive manufacturing and 3D printing are expanding their capabilities by investing in R&D for 4D printing. Therefore, the market is fragmented.

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- March 2023 - A 4D printer with potential in the biomedical sector has been developed by researchers at Universidad Carlos III de Madrid (UC3M). The material's response can be programmed to change shape in response to an external magnetic field or to change its electric characteristics in response to mechanical deformation. These additional functions can be controlled by this machine.

- May 2023 - The I-Seed is a 4D-printed robot that can assess the quality of the air and soil. These biodegradable robots were developed in cooperation with Trento University in Italy. The robot-seed can determine the temperature and humidity of the soil and air, according to the project's experts. Additionally, it would be able to detect the presence of contaminants like mercury or the atmospheric CO2 levels. To develop and create the robot that resembles a seed, the researchers took advantage of the biomechanical parameters. The robot, according to the researchers, was created using 4D printing.

Additional Benefits:

- The market estimate (ME) sheet in Excel format
- 3 months of analyst support

Table of Contents:

1 INTRODUCTION

- 1.1 Study Assumptions and Market Definition
- 1.2 Scope of the Study

2 RESEARCH METHODOLOGY

3 EXECUTIVE SUMMARY

4 MARKET DYNAMICS

- 4.1 Market Overview
- 4.2 Industry Value Chain
- 4.3 Industry Attractiveness - Porter's Five Forces Analysis
 - 4.3.1 Bargaining Power of Suppliers
 - 4.3.2 Bargaining Power of Consumers
 - 4.3.3 Threat of New Entrants
 - 4.3.4 Threat of Substitutes
 - 4.3.5 Intensity of Competitive Rivalry
- 4.4 Market Drivers
 - 4.4.1 Increase in Demand for Industry 4.0 and Emergence of Industry 5.0
- 4.5 Market Challenges
 - 4.5.1 High Development Cost and Lack of Skilled Professional
- 4.6 Patent Analysis
- 4.7 Assessment of the Impact of COVID-19 on the Market

5 MARKET SEGMENTATION

- 5.1 Type of Programmable Material
 - 5.1.1 Programmable Carbon Fiber
 - 5.1.2 Programmable Textiles
 - 5.1.3 Programmable Bio material

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- 5.1.4 Programmable Wood
- 5.2 End User
 - 5.2.1 Medical
 - 5.2.2 Aerospace and Defense
 - 5.2.3 Automotive
 - 5.2.4 Other End Users
- 5.3 Geography
 - 5.3.1 North America
 - 5.3.2 Europe
 - 5.3.3 Asia-Pacific
 - 5.3.4 Rest of the World

6 COMPETITIVE LANDSCAPE

- 6.1 Company Profiles
 - 6.1.1 Autodesk Inc.
 - 6.1.2 Stratasys Ltd
 - 6.1.3 Hewlett Packard Enterprise Company
 - 6.1.4 CT CoreTechnologie Group
 - 6.1.5 EnvisionTEC, Inc.
 - 6.1.6 Organovo Holdings Inc.
 - 6.1.7 Materialise NV
 - 6.1.8 Dassault Systemes SA
 - 6.1.9 The ExOne Company
- 6.2 Major Initiatives by Research Agencies

7 INVESTMENT ANALYSIS

8 MARKET OPPORTUNITIES AND FUTURE TRENDS

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