

THE USE AND IMPACT OF 3D PRINTING TECHNOLOGY IN THE FUTURE

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Abstract – Three-dimensional printing process is revolutionary technique that uses computer assist design software and programming to fabricate three dimensional objects by arranging material on a substrate. It is an additive layer producing technique, where continuous layers of material are deposited to form 3d structure, that's why the process is also called as additive manufacturing. This paper is all about utilization and influence of 3d printing technology in the future.

Key Words: Three-dimensional printing, Substrate, Additive layer technique, 3d structure, Additive manufacturing

1. INTRODUCTION

3D printing has emerged out as a very crucial technological advancement in additive manufacturing which provides plethora of advantages over conventional manufacturing approach and due to this it has now become an indispensable part of modern industries and many research organizations.

Additive manufacturing is a process of create three dimensional solid objects from a digital source (eg. From a digital document). The construction of a 3D printed object is obtained by utilizing additive processes. In 3d printing process, an object is constructed by putting down continuous layers of material until the object is produced. Every one of these planes can be noticed as a narrow wedge transversion of the object. 3D printing is the adverse of subtractive manufacturing which is cutting of piece of metal or plastic (eg. Tapping, Milling, CNC turning, Drilling). 3D printing provides facilities to produce intricate shapes with very less material loss than any other traditional manufacturing methods. As 3D printing gaining more popularity it also creates some threats as well as there are some barriers for this industry: how to cut the manufacturing cost of 3D printed parts as machine for 3D printing cannot be used for the mass production. Moreover there is a chance of duplicity if this revolutionary technology expands with the current rate because this only require scanning of object and any of the objects can be made in short period of time. This document is template.

2. CONCERNED RESEARCH

3DP (3 dimensional printing) has been accessible since the late 1980s and has been employed in engineering and numerous medical and non-medical producing areas, including automotive, aerospace, and consumer goods industries. However except recent few years 3DP has only

been used to create prototype as it is very easy to make prototype and only takes few weeks compare to another prototype making methods which require months to complete it and some precisely measured dies and equipment as well. But with the rapid growth of 3DP technology it has now become an emerging manufacturing technology in various industry and human activities: research, computer industry, engineering, construction, fashion, military, education, medical industry, architecture, and many others.

A review of the industries in which 3D printing can be used in the future is presented as follows.

2.1 Medical

3D printing is expected to play a crucial part in the swing toward personalized medicine, via its use in customizing nutritional products, organs, and medicines. The use of 'personalized medicine' for the necessities will initiate digital revolution inside the drug delivery and healthcare. As the FDA (Food and Drug Administration) brace the evolution of complex dosage forms and the utilization of additive manufacturing approaches using science and risk-based approaches, this may rise the adoption of 3DP technologies in the healthcare. The acceptance of the 3D printing technology in the field of surgical, and prosthetic; biocompatible polymers and metals will allow healthcare professionals to create custom implants, tools, and bionic limbs to improve overall outcomes for a wide range of patients.

2.2 Space research

Additive manufacturing has capacity to affect human spaceflight functioning by allowing the in-orbit production of various parts and tools for replacement, which could reduce current requirements of logistics for the Space Research Organizations (SRO) and future long duration human space explorations and missions. It might be possible that space organizations build components and structures more rapidly than that is possible on earth. The dearth of gravity and absence of atmosphere enables opportunities for additive manufacturing in space, which is not available to ground-based instruments. The absenteeism of gravity may allow a 3D printer to do tasks on the "top side" and the "bottom side" of a body at a time. Air jets or electrostatic attraction may be utilized to hold on the enlarging body in position, or even to move it to the position more appropriate for printing.

2.3 Construction

There has already been many houses built by a construction company, through 3D printing in TEXAS, USA and company has also put this houses on sell and the company is also planning to come up with a mega project to make houses with the help of 3D printing technology. Currently NASA is working with this company to make launch pad, roads and

habitats on the moon. NASA is considering putting in place a lunar terrain vehicle, habitable mobility platform or lunar RV, and surface habitat on the Moon by the end of the decade. [6]

2.4 Manufacturing

Through the conventional method of manufacturing there is a huge loss of material in some specific manufacturing process and the material used in this process is also very costly to manufacture (eg. Titanium). So many companies throughout the world are trying to make components and parts through the 3D printing (eg. the airframe, blades, castings, discs, fastenings, and landing gear). Currently, it is hard to manufacture large or heavy products with 3D printing because of its limits in capital cost and equipment. In future, there will be large equipment and procedure to produce large products to surcharge heavy castings. In heavy ingots, there are severe macro-segregation problems. By 3D printing, each layer will have the same chemical composition so as to avoid macro-segregation and achieve uniform forging and performance properties in duty.

2.5 Education

As the 3D printing technology and additive manufacturing is increasing, educational institutions are scrambling to make sure that they make their position on the cutting edge of the new technology for education and research purposes. There will be chance of using 3D printers from professors printing objects for educational tools to teach with pragmatic approach to PhD students using the printers for research. 3D printers will serve a variety of purposes in colleges. Many colleges will take a great interest in teaching its students about emerging additive manufacturing technology.

■ Total additive manufacturing market growth (\$USM)

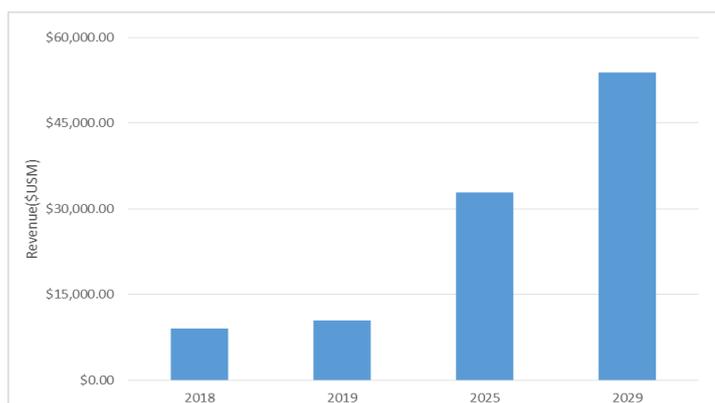


Fig 1: Predicated growth of additive Manufacturing

3. ANALYSIS OF IMPACTS OF 3D PRINTING IN FUTURE

The most important element that must be taken into account when analysing the influence of 3D printing on human life is the impact that the wide spreading of this technology has on the global economy and on the workforce requirements. In

this prospect, the most crucial effects worth to be taken into account are:

- The possibility of producing commodities on desire and at various places than when using conventional techniques, could lessen actual economic unevenness and could alter the present hierarchy of the economic powers.
- As the 3D printing is a computer-controlled technique, it diminish the necessary number of human labour and that is why it could lead to notable depletion in work force needs concerning the manufacturing, product delivery and production jobs for export industries, as the Additive Manufacturing technique enable manufacturing products on demand and closer to the customer's location.
- Whereas, the development and spreading of the 3D printing technology will result in bring about new professions, post and commercial enterprise associated to: the manufacturing of the 3D printers, materials, supplies and printing cartridges; the products 'engineering and design; the software industry. In addition, the Additive Manufacturing technology could use inexpensive recycled materials. Consequently, the costs of costly imports could be reduced.
- The AM's evolution will also exert influence on the construction materials, as it utilize various materials than other procedure, some of which could be locally available, without imports.
- Most urban areas would benefit from a high-end printer, asking consumers relatively low sums when they need something like a discontinued component of a machine. May be this is how the industry will expand, and manufacturing will become much more localized. Every community will have a minuscule fabrication store that can produce an enormous variety of products at a moment.
- Moving manufacturing to the consumer, to the end of the supply chain, is a major cultural paradigm shift that might take some time to displace the current mindset.
- Waste is near to zero or very low as it is an AM tech. So it will require less material for production and as a result less pollution will occur which previously was occurred to manufacture the material or to produce the materials from material resources. Thus the energy consumption is less and the environmental protection can be done through additive manufacturing technique.
- The production and distribution of medicine by pharmaceutical companies could imaginably be

superseded by emailing or messaging databases of drugs formulations to pharmacies for on-demand drug printing.[13]This would start current drug manufacturing and distribution procedure to change extremely and come to be more cheaper [13]. If most common drugs become readily available in this way, patients may be able to lessen their drug bill burden to one polypill every day, which would elevate patient attachment .

- The lack of laws and regulations regarding the 3D printing. For example, there can be printed guns, police handcuff keys (and this has already happened), military parts, parts for aircrafts, weapons, counterfeit parts for commercial or defence operations (designed for sabotage), drugs or chemical weapons. In addition, all of these could be achieved with ease, at reduced costs and very fast. Moreover, weapons could be very easy disguised in non-hazardous products. Thus, 3D printing can become a potential danger when used by criminals or counterfeiters. The declaration and registration of 3D printing devices become mandatory and also to restrict the blueprints ' dissemination. A part of the 3D printers 'manufacturers took into account mitigating these risks and therefore they introduced software limitations on items that can be printed.

4. CONCLUSIONS

Additive Manufacturing (AM) frequently mentioned as 3D printing is undergoing an unparalleled expansion. Some

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anticipate 3D printing might even take place of the conventional manufacturing someday. However, it is also predicted that the mass production type of methods will not be entirely phased out, but it will be complemented by the demand for mass customization. The 3D printing technology is utilized in Tissue Engineering followed by, mechanical, aerospace, tooling, automobile, robotics, prosthesis, food industry, construction, television, PCB, phones, watches, clothing, jewelry, scaffolding and toys. Incorporation of 3D printing will allow integration of functions, reduced material usage, shortening of manufacturing time and it will also reduce logistical and production efforts. Though 3D printing is not yet ready for mass scale production. Still many practitioners can envisage the benefits and possible effects of 3D printing. Many businesses are unassertive to incorporate it within their supply chain processes.

Advanced design such as open platforms with a good data management system would be feasible route to integrate 3D printing in the digital supply chain era. This will establish novel utilization of the Additive Manufacturing processes, instead common manufacturing. There is a requirement to keep safe the IP in 3D printing content. An online automated authorization platform, where data is IP guarded, should be proposed. The authorization platform could control licensed 3D printing by tracking data and product details throughout the value chain. The proposed platform should be supported by watermarking technology for 3D printing content.

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