

## Economic Diagnostics of Higher Education and its Model Indicators

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### Abstract:

The article provides information on the history of 3D printers, on the basics, types of work, capabilities, advantages and the basics of their operation.

**Key words:** 3D printers, lasers, 3D cars

Until now, we understood printers that print ordinary text as printing devices. Today, they include 3D printers, which are becoming increasingly popular. Scientific sources describe this device as a device that creates physical objects based on a digital 3D model.

Looking at the history of 3D printers

In the 90s of the last century, a complex and interesting situation arose in the world economy. Competing companies not only began to fight for consumers of products, but also began to fully meet any of their needs and desires. At the same time, in a short period of time, low-cost methods and means of production began to be developed, which also contributed to the creation of new types of 3D printing devices.

The first 3D printers based on stereolithographic technology were patented in 1986 under the name of Charles Hull. Charles Hull immediately founded his company 3D Systems, and in 1988 began mass production of 3D printers under the name SLA-250.

In 1990, Scott Kramp, the founder of Stratasys, launched the first laser 3D printers.

It is no exaggeration to say that the history of 3D printers in today's form dates back to 1993. The printers provided by Solidscape were able to create three-dimensional copies of objects. Created in 1995 by two students at the Massachusetts Institute of Technology, the 3D printer printed a large-scale image in three dimensions on a special container instead of the usual paper. Since then, the terms 3D printing and 3D printer have been widely used in practice.

The development of a technology called PolyJet, which prints on the basis of liquid photopolymer plastic, has made great changes in the field of 3D printers. In this case, a special handle draws the desired image on top of each other using a layer of photopolymer. Ultraviolet laser light cools and hardens it immediately.

This method has an advantage in many respects: its cost is relatively low, and the model to be created and its components are made with high precision.

Over time, the 3D printing industry has developed rapidly, many companies producing 3D printers have been established. In a highly competitive environment, as the quality and capacity of printers have increased, so has the size and price. The size and appearance of modern three-dimensional printers today is almost no different from conventional printers.

### Fast, cheap and high quality

3D printers are mainly designed to produce solids from different raw materials, such equipment

creates layers in two different forms: the first is laser stereolithography, in which a special liquid photopolymer plastic material is routinely placed on a pre-defined photodetermine pixel, and an ultraviolet laser cooled using light. As a result, the liquid polymer becomes a hard and durable plastic.

In the second method, the laser hardens and hardens the metal or plastic powder in the form of a body being created. In this case, the detail consists of many layers stacked on top of each other and glued together. When the item is ready, it cools slowly. The working chamber temperature is kept slightly lower than the raw material temperature in order to generate the power required for heating. In order to avoid oxidation, all work is carried out in an oxygen-free environment.

Bioprinters, on the other hand, are designed to print organs that are expected to be transplanted surgically in 3D using network (stem) cells. In this process, the division of cells, their size and functions continue to take place naturally.

At present, 3D printers are mainly used to produce a small number of products at low cost and in a short time. The production of much-needed but scarce products and spare parts in an industry is economically costly. Imagine how hard it is to build factories to make a spare part that only needs one or two, to employ tens, hundreds of people for it. Such complexities can be easily solved with the help of 3D printers.

Until recently, the self-printing of 3D printers was an unthinkable phenomenon. However, as a result of research conducted by engineers at the University of Bata in the UK as part of the RepRap project, 3D printers are currently printing almost half of their required parts.

The world-class advances in three-dimensional printing technology have led to the use of 3D printers in many fields. This modern technology can penetrate into almost all aspects of our lives, lighten our burden. Imagine: you type the name of the dish you want into the printer in your kitchen, and instantly the food you want will be on your table. Yes, this is not yesterday's sweet fantasy or unfulfilled dream. Solid Freeform Fabrication technology, developed by Cornell University experts, was one of the first practical results in this regard. In this case, the "paint" of the 3D printer is hydrocolloids, ie hydrophilic polymers, which are widely used in the food industry. Scientists have tried to print chocolate, biscuits, apples, cheese, marshmallows, bread, bananas and many other foods in this way. Although this device is currently in the process of testing, it is safe to assume that it will be widely used in the next 20-30 years.

Currently, 3D printers are a great help in the fields of architecture and construction, production and packaging, souvenirs and valuables, education and medicine, printing, advertising. In particular, in the field of architecture, 3D printers are widely used in the manufacture of models of buildings and structures. At the same time, printers print all the structures of entire settlements - houses, roads, lighting systems and trees in small volumes. The fact that the models are made of cheap gypsum, which serves to reduce their cost, will undoubtedly have a positive impact on the cost of buildings in the future.

### **Next is a 3D car**

Urbee 2 is the name of a car printed on a 3D printer. It has three wheels and two seats and weighs 550 kilograms. Equipped with a 7-liter engine, the car's most important task is to cover thousands of miles between the two U.S. ocean shores by 2015 with only 38 liters of fuel. His "brother" Urbee, released in 2010, with a 5-liter engine that consumed only 3.8 liters of fuel for the 321-kilometer journey, proves that the Urbee 2 can successfully accomplish its mission.

The new car is equipped with a hybrid engine, unlike the previous one. In the city, it is powered by an electric motor that can travel at 64 kilometers per hour, while on major highways, its internal

combustion engine can reach speeds of up to 110 kilometers per hour. It takes 2,500 hours for a 3D printer to print more than 50 parts of this car.

You say that making a product does not require many processes. On the plus side, the fact that so many people are boiling black after this work, it is impossible to ignore the fact that dust, noise and harmful emissions from factories and plants are harmful to nature and the environment. In this regard, it is unlikely that the ever-evolving 3D printers will make radical changes. Because such tools can still prepare any object or object in a short time, with quality.

In Colombia, children with disabilities now have access to prostheses at affordable prices. Christian Silva, an engineer at the National University of Bogota, has discovered the technology of printing prostheses on a 3D printer, reports RATA-TASS.

Silva uses a special polymer used in the automotive industry for prostheses. For this reason, prostheses produced on a 3D printer are distinguished by their rigidity and flexibility. In addition, in the production of a new category of prostheses, special attention is paid to reducing its cost. In particular, the price of a new "hand" is only 250 thousand pesos (about \$ 100).

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