

The Role of the Four-dimensional Product in Achieve Competitive Advantage

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Abstract

The research idea is based on developing the printed product in a self-time manner and the emergence of four-dimensional printing using the use of reactive polymeric raw materials in manufacturing. It helped to change the product itself when needed automatically. Modern manufacturing techniques are distinguished from traditional ones by adopting engineering, design and computer-aided manufacturing systems through advanced software packages in the field of engineering. As it is considered a key component of the manufacturing add-on system as a whole through design, analysis, manufacturing, operations and reduces the production cycle with the ability to add any design modifications and improve performance with the help of (3D CAD) by creating a database on which the process of engineering is based Inversely, unlike manufacturing in traditional industries, production is from the first step. Upon the final inspection of the product, if it does not conform to the specifications, all the previous operations were mainly wrong and ineffective and a burden on the company as it takes advantage of its best efforts to achieve the advantages above, but it wastes resources and is considered environmentally friendly in the case of cutting industry. Similar with little waste and lighter and stronger than traditional methods of production compared to manufacturing techniques in addition to the entire computer-managed to achieve time saving, costs and high quality, the research concluded that the development of the two-dimensional printer helped in the physical development of the printer Industrial by adding the third dimension (height) and adding the fourth dimension of time to be able to make a product.

Keywords: The four-dimensional product, Competitive advantage.

دور المنتج رباعي الابعاد في تحقيق الميزة التنافسية

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الخلاصة

تستند فكرة البحث بتطوير المنتج المطبوع بصورة ذاتية عبر الزمن وظهور الطباعة رباعية الابعاد باستعمال مواد خام مبلعمة متفاعلة في التصنيع ساعد بتغيير المنتج نفسه عند الحاجة بصورة تلقائية وتتميز تقنيات التصنيع الحديثة عن التقليدية باعتماد أنظمة الهندسة والتصميم والتصنيع بمساعدة الكومبيوتر من خلال حزم برمجيات متقدمة في مجال الهندسة اذ تعتبر عنصر رئيسي لنظام الاضافة التصنيعي ككل خلال تصميم، تحليل، تصنيع، عمليات وتقلل دورة الانتاج مع امكانية اضافة اي تعديلات على التصميم وتحسين الاداء بمساعدة (3D CAD) بإنشاء قاعدة بيانات تستند عليها عملية الهندسة العكسية خلاف التصنيع بالصناعات التقليدية الانتاج من أول خطوة وعند الفحص النهائي للمنتج إن لم يكن مطابقاً للمواصفات فان كل العمليات السابقة كانت بالأساس خاطئة وغير مجدية وعبئ على الشركة فهي تستغل أقصى جهودها لتحقيق المزايا اعلاه الا انها تهدر الموارد و بذلك تعد صديقة للبيئة في حالة صناعة قطع مماثلة مع القليل من الفضلات و تكون أخف و أقوى من الطرق التقليدية للإنتاج مقارنة مع تقنيات التصنيع بالإضافة المدار بالكامل بالكومبيوتر لتحقيق وفورات الوقت والتكاليف والجودة العالية، وتوصل البحث الى ان تطور الطباعة ثنائية الابعاد ساعد في التطوير المادي للطباعة الصناعية باضافة البعد الثالث(الارتفاع) واطافة البعد الرابع الزمن للتمكن من صنع منتج

الكلمات المفتاحية : المنتج رباعي الابعاد ، الخصائص، الميزة التنافسية.

1. Introduction

We are taking a new world today that will change the face of many countries' economies, as a technological industrial revolution that took place at the end of the twentieth century. It is considered to have deep, economic, social, demographic, and environmental impacts, and in the previous footsteps of a scientific methodology for traditional printing that suffers from many problems, including those related to environmental impacts, waste, and what relates to the technical aspect of production. Products that do not conform to the specifications, as well as the high costs of production, when the damage and incorrect production has an impact on that. Therefore, the industrial three-dimensional printing machine does the same method, but by adding the third dimension, the height during the jetting frequency or the precipitation of the raw material in a specific place to form or build a tangible physical product and the fourth dimension represented by time, reducing the time to start the process of design basic full product using templates models tools finishes used in the production of goods and are tools and intermediates it is that the use of printing. Quartet dimensional contributes to the Competitive advantage development should therefore clarify the concept of printing four-dimensional statement of historical development and the concept of Competitive advantage and its dimensions and operate Quartet printer dimensions. All-in-one with swivel spinning material By individuals and companies that have come to produce and use the printer to provide production services in which development is still ongoing, as it is one of the efficient technologies in terms of energy exchange and in making similar parts with little waste and is lighter and stronger than traditional methods of production and thus also reduces emissions Carbon dioxide, and because the

products are manufactured locally and there is no need to transport them around the world, so emissions are low.

1-1 Historical development of the four-dimensional product

The world cannot be imagined without industrialization, since the four-dimensional product was not in this name, but was preceded by several techniques, including three-dimensional printers, which appeared in the mid-eighties and at that time were it is called the rapid prototyping technology, because the processes are done quickly and at lower costs that have been developed for industrial use. It was clearly visible at the end of the eighties [3]. As the method of making solid objects was done by sequencing the ultraviolet radiation onto thin layers of additives sequentially one above the other, the user was able to build a tangible product from digital data after drawing a three-dimensional model taken from a two-dimensional image. Then he initiated it into industrial production programs As he founded Charles Hull a company 3D Systems 1988 his is not a product of industrial printing machines that were not known at the time (3D Printer) [9] 1989 While taking the diffusion hardening system, the laser printer that used the method of fabrication of materials by jetting and the method of modeling molten deposit and providing industries and rapid manufacturing services, 1992 produced the first machine that uses laser beams to solidify the liquid color materials during the creation of layer after layer with complex designs from the company (3D Systems) 1993, An institute of technology obtained a patent on 3D printing technology that is similar to the ink injection technology used in 3D printing, 1996 The first three (Genisys), (Actua 2100, Z402) printers that refer to 3D rapid prototyping machines were produced and introduced in 2001 Stratasys presented digital manufacturing

workshops using laser cutting machines and various types of 3D printers, 2005 Done Launching the first color printer for high-definition raw materials on the market in 2006. The open source project was hacked for public participation in developing the printer for software and machinery and opened the door for open source printing to the general public as (Rep rap) in Britain that had the ability to manufacture different pieces of materials and 50% manufactured by itself [14] Announced the launch of the first Rep model machine in 2010, it presented the first 3D printer that can manufacture fast products with a full function and was the beginning of industry democracy and the end of monopoly in 2011. The first laboratory in Switzerland that manufactured 3D printing was opened in 2013, the company launched 3D Systems The 3D Scanner can be linked to the mobile devices and the tablet to print the product in 2013 in cooperation with the Research and Development Department at 3D Systems and the Self-Assembly Department at the Institute of Technology. The fourth dimension (4 D printing) was developed by developing the change of the self-printed product over time, printing appeared t Dimensional use by using reactive polymeric raw materials in manufacturing, which helps to automatically change the product itself when needed. In 2015, Cloud 3D printing was launched. The demand for the acquisition and development of the comprehensive four-dimensional printer equipped with the scanner and the recycling of materials by individuals and companies that have produced and used the printer to provide production services in which development is still ongoing continues.

1-2 4 D product concept:

The product as a physical, life-like entity is able to change the shape and physical properties independently over

time. It is an evolving field of practice for product design and research associated with similar concepts across the range of programmable materials and 4D printing, however, it usually uses sensors and actuators to respond to environmental and human conditions, to modify the shape, color, personality and other physical properties of the product. In this way, products share similarities with responsive engineering, on the human scale associated with products [18] 4D printing uses the same 3D printing process as computer-programmed precipitation of materials in consecutive layers but adds the exciting fourth dimension of watching transformation over time. The process relies on stereo lithography and uses the optical polymerization to connect the concentrated layers with layers of layers to create a polymeric network before ultraviolet light processing once the printing is complete. The programmable material is used, i.e. the material that has the ability to change its physical properties in a programmable way based on user input or sensing Self. During 3D printing, the device is programmed to create a layering shape with a layer in 4D printing, and an accurate geometry symbol based on the desired angles and dimensions is also added. This gives shape and memory directions for how to move or adapt in certain environmental conditions. Here a product was created and configured based on the transformation, as the printed object must be 4 D trigger or stimulus; this may be water, heat, wind, or other parameters in the environment. For some processes, special materials interact, but some research teams are studying programming the required shape of the object in the exact structure of standard materials, which means that existing 3D printers and materials can be used in industry [1], resilient commercial products have received some attention. In 2005 Adidas released the Adidas 1 shoe, which was

able to adjust heel pressure properties with each step, and accommodate different foot requirements during various activities such as walking or running. More recently in 2016, Nike released the Hyper Adapt 1.0), which is able to hook itself up when a user puts his foot in it. Additional partial modifications could have been made using manual controls, however, designers claim long-term visibility of these products to come alive and respond in real time to user needs [10]. So basically four-dimensional printing is a renewal of 3D printing as special materials are printed to print objects that change post-production form. However, it may need some catalysts to start the transformation. Water can include heat, light, wind, electricity or other forms of catalysts [11]. The ability to transform arises from almost infinite configurations with micrometer accuracy and thus the creation of solids with geometric spatial distribution and an exceptional level of multifunctional performance. So he was defined as a manufacturing process that is supported by manufacturing technologies from virtual reality, computer networks, prototypes and a fast database, based on customer demand to analyze, organize and reassemble product information to implement product design and job simulations as well as rapid prototypes, and then perform rapid production to meet customer requirements and standards Quality [3] So he knew from a variety of perspectives the transformation of digital diagrams into physical objects by creating them layer by layer. 4D printing is based on this technology. With one big difference, it uses special materials and advanced designs programmed to demand a three-dimensional printing to change its shape. Executing design and manufacturing processes in one stage and not several successive stages, i.e. developing an integrated system of business concepts starting with early thinking, design, manufacturing, selling

and recycling to achieve a fast product with high speed machines in addition Achieve time savings, costs, and high quality technology that reduces product development time and cost as well as to address the need for customization, increased product quality, and a faster market response by using 3D digital design data to build a component in medicine Data by depositing materials.[14] The result of the process of integrating digital technology, information network technology, manufacturing technology, and the unavoidable result of digital operations in manufacturing companies, manufacturing systems, and production systems in device manufacturing. The process of spotting raw materials to make materials or products based on four-dimensional virtual data. By adding a layer on top of a raw material layer, the inverse of the reductionist manufacturing methodology.

<http://www.nap.edu/openbook.php?recordid=13274&page>

Production systems that employ in their work the addition systems with the method of accumulating raw materials by the used 3D printer No function of the industry [20] Manufacturing of full-featured products with printing machines faster than traditional industries, so the concept of rapid models emerged [7].The product was called a printer, a term that is usually used to describe a variety of operations aimed at the rapid creation of a product (four-dimensional physical) from the hypothetical three-dimensional product model (length, width and height) using automated machines for the purpose of building parts directly and obtaining the product within the limits of the accuracy of default operations [14]. Improve the quality of a 4-dimensional computerized tomography image by over-imaging the images in each interest and linking each image by analyzing the data retroactively and containing an engineering data set

with an interval of time. And used in reconstructive surgery, this technology is used primarily to evaluate blood vessels and blood vessels [3] In addition to the aforementioned from different perspectives, the concept may be explained by the factors that helped in its emergence: [2]

1-Information technology provides computers and the infrastructure of the Internet and its spread freely and exchange ideas between societies through direct communication between individuals.

2-The development of the two-dimensional printer helped in the physical development of the industrial printer by adding the third dimension (height) and adding the fourth dimension of time to be able to make a product that led to the replacement of the manufacturing process and factories with the traditional concept to the industrial nanoscale concept.

3-Increasing opportunities for digital production, not contracting products as a result of increasing human digitization and caring for digital image and audio files, which contributed to employing digital production and converting it to a tangible three-dimensional product

4-The collapse of the legal barriers resulting from the patents of the 3D printer, which helped spread it, decrease its prices and contribute to creating a new economy.

5-Availability of polymerized raw materials either from suppliers or through recycling of materials used by the printer itself.

6-Reduced costs of printing manufacturing due to the availability of remote open source printing, including its products (Reb rap), which is what motivated and found manufacturers from home and office.

7-Managing industrial innovation and stimulating the interaction between design, resources and manufacturing.

1-3 4 D product features

The new manufacturing process is represented by three basic stages, where special cameras work to capture different angles images of the object to be produced, as well as adding new objects entirely through special design programs as if you were drawing them with your hands, then followed by the stage of forming a digital stereoscope that special software works to analyze and formulate steps to manufacture it, so that the process ends with thoughtful movements from the arms of the automatic printer depending on the technique of layers, where the machines form the target body layer by layer, differ in their nature and function, and by placing the materials accurate in the place we want and then developing the current layer with another layer after it stabilizes its physical state, and here is the difference between this technology and the traditional manufacturing methods, because it simply relies on a complete synthesis logic of the layers of matter instead of the transformational logic that we have undergone in well-known manufacturing methods such as carving, cutting, publishing, methods, etc., and it is also largely sustainable, so there is no waste. Lost if you are working to manufacture precision items accurate, which means a significant saving in resources. You can also make millions of copies of the same purpose without being able to differentiate one from the other. It also dispensed with a large number of huge machines in large factories and replaced them with a small printer connected with your device Piotr y focused on the most important characteristics of Palate. [11]

1- Personalization

3D printing operations allow comprehensive customization, by the ability to add personalization of products according to individual needs and requirements even within the same

building room of the 3D printer, which means that many products can be produced, any additional process and economically.

2- Complexity

It was possible to design and print very complex shapes after the emergence of three-dimensional printing and design in a digital environment that was not possible to produce by traditional methods, where sophisticated applications are developed components to prove that this type of manufacturing is lighter and stronger than its predecessors than that made by traditional methods of manufacturing And, as is the case when using 3D printing in the aircraft industry.

3- Less tools

The manufacturing industry is one of the most costly processes and requires extensive time and stages of development and construction in production processes, including the production of tools for the manufacture of parts. For small and medium applications, three-dimensional printing can end the need for production tools such as molds, thereby reducing the cost and reducing the manufacturing time and the work associated with it. This is one of the reasons for the strong attraction of this type of manufacturing and so it can print so that you do not need to install the parts with some but rather a vehicle comes during its direct printing, so the cost of production is reduced due to the lack of installation workers.

4-sustainable - environment friendly

3 D printing is considered one of the efficient technologies in terms of energy drainage and thus environmentally friendly in the case of making similar parts with little waste and is lighter and stronger than traditional methods of production and thus also reduces carbon dioxide emissions and because 3D printing is done locally And there is no need to transport manufactured products around the world,

so emissions are reduced due to the lack of transportation.

1-4 Competitive advantage

The concept of competitive advantage has appeared specifically since the eighties and has begun to spread and expand after the writings of Michael Porter, and it has become the strategic element that provides essential opportunities for achieving economic unity and continuous profitability in comparison with its competitors. The distinction possessed by the economic unit that crystallizes in products and services that achieve a level of satisfaction and benefits to the beneficiaries greater than that provided by competitors and qualifies the economic unit to achieve several advantages, including obtaining high profit margin and applying low prices while maintaining a wide market share and staying as long as possible [16] while (Fahmy) indicates that it is the ability of the economic unit to formulate and implement strategies that make it in a better position in relation to other units operating in the same activity and is achieved through the better utilization of technical, financial, material and informational resources in addition to the capabilities and competencies that enable it to design and implement a competitive strategy [15], while Al-Dawi stresses the ability to produce goods and services With good quality, price and appropriate time, that is to meet the demands of the beneficiaries more efficiently compared to other units, and the competitive advantage represents the characteristics or characteristics that characterize the brand, which gives the unit superiority over its competitors. [19]

1-5 Distinguish competitive advantage

Competitive advantage is a goal and goal that many seek to reach and achieve because it has dimensions and determinants that distinguish it from others and are represented in the following: [17]

1-After the cost is one of the main pillars in the success of the units and their evaluation through being able to stand before other competing units and help them in reaching competitive prices that enhance their position as the reduction in the price of products and services contributes to the increase in demand and if they do not succeed in reducing them during the efficient use of production capacity, continuous improvement of quality in Design, perfecting the operations, as well as assisting the management in supporting and entrusting the unit's strategy may lead to a reduction in the expected profit margin.

2-The quality dimension is that the ability to provide products and services that match the different needs and desires of individuals and how to respond to them. Quality means everything, meaning that the production system should be developed to reduce the defects so that the production conforms to the pre-set specifications as well as there is no room for re-maintenance and repair of the product i.e. Meaning improving and developing processes and performance to reduce costs and control time to fulfill the desires and needs of individuals. Teamwork.

3-After flexibility, some describe flexibility as the basis for achieving competitive advantage during the rapid response to changes that occur in product design to suit various needs, meaning the ability that the economic unit possesses to provide products at the required time during changing the performance and method of operations to meet the desires of individuals and provide their requirements of product flexibility. Mix flexibility of size Flexibility of delivery.

4-After delivery is the main rule for competition during the reduction of time periods and speed in designing new products and presenting them in the shortest possible period. Therefore, there

are precedents for delivery. And the final design and rendering.

1-5 The role of the four-dimensional product in achieving competitive advantage

Over the past four decades, basic considerations have been assimilated in the formulation and implementation of strategies that make the economic unit seek to provide production systems that employ in its work systems of addition of raw materials accumulation methodology by a used 3D printer not to perform the function of the industry but to increase the social and environmental capacity to deal with change, and the ability to Preserving and expanding the options available to confront a natural and social world in permanent transformation (Gilberto, 2003: 20), as there are a range of situations that discuss, in varying degrees, the belief that solutions must be found to the negative economic, social and environmental impacts of capitalism by using the intelligence and creativity of society in general, such as improvements to friendly products. And rationalize the use of resources, and use the best means to evaluate projects to study and assess the environmental impacts of proposals and economic amendments [5], as many products can be produced during an additional process and economically, so the pressures that demand responsibility for the adoption of techniques have increased. Reducing waste and waste costs and improving product image. Where four-dimensional printing has reduced the manufacturing stages, in addition to reducing the time required for production, the product that needs a long time has become completed within 48 hours, and the challenge now is to reduce the time required for printing so that it becomes as little as possible [6] and proved to be less expensive. From the traditional industry, the costs are divided into two parts, the first is the cost of the printer, and the

second is the cost of the materials needed for printing, and it has been found that the cost of materials is much higher than the cost of purchasing the printer itself, and most of the investments are spent on manufacturing printing materials or related research. It is remarkable that the cost of traditional industry is It increases as the complexity of the required product increases, while the price of 3D printing will remain constant, because the printer can complete the required work regardless of its complexity within one stage.

While determining the accuracy of the print quality by the size of each layer in the model to be printed, the resolution is determined by determining the size of the material coming out of the print head, and it is measured in micrometers.

The resolution of the prints ranges from 100 micrometers to 0.1 micrometers in advanced printers, but this resolution will not be sufficient in the near future, depending on the size of the printed object and its characteristics, as some tiny models such as human body organs and electronic parts need a higher resolution to capture small details in them and based on this Work continues to improve the accuracy and quality of print, and the search for materials that preserve their properties and remain strong enough when printing with finer details and smaller sizes are continuing. They have reached a resolution of 200 nanometers, the highest resolution present while flexibility is reflected in the ability to keep pace with developments in the field of technology. And design products according to ever-changing desires Clear from what has been shown, 4D printing is considered one of the most efficient technologies in terms of energy expenditure and thus environmentally friendly in the case of making similar parts with little waste and is lighter and stronger than traditional methods of production and there is sufficient evidence to say the technologies

have great potential, but have not been adopted on a large scale. Wide

THE SECOND TOPIC

Indicate the stages of manufacture, clarify the environmental impacts, and manufacture according to quadruple printing.

Introduction to the factory sample

1-1 search

Al-Hakim Factory for Artificial Limbs is one of the formations of the Iraqi Ministry of Health and Environment, which is affiliated to the Baghdad Health Directorate, Al-Karkh, which represents one of the many factories affiliated to the Ministry of Health and Environment, which deals with an important matter in light of the conditions in which our dear country lives in repeated wars, which results in many people who cut off limbs.

1-2 Limb manufacturing stages

There are a group of stages through which the artificial limb is made, as follows

The first stage: - The evaluation stage

Through this stage, the patient's ability to use the prosthetic limb or his need for a rehabilitation program is known, as the causes (amputation) and the patient's medical history are identified and they are based on the following:

Evaluation objectives: - Patient's name, medical history, doctor's prescription, patient's functional environment, home environment and surrounding areas, cause of amputation, number of amputations.

Subject of evaluation: - All the information through which the patient is examined includes muscle strength, functional problems of the rest of the body (trunk, upper limb, and healthy lower limb), stump condition, skin condition, presence of protrusion or not, great projections, any sensitive areas

The second stage: - Take the template

According to this stage, measurements are taken for the stump and the mold, and according to the type of design determined in the evaluation stage,

also measurements are taken such as length and foot measurement in addition to the patient's knowledge and desire and the possibility to follow them.

Third stage: - Filled with mold and sculpture

At this stage, the mold is filled with plastic material (bork) and waiting for it to dry. During this stage, the specialized employee sculpts the template according to the measurements previously determined and according to the design that is to be done.

Fourth stage: - The manufacture of domes

At this stage the dome is made with regard to the type of design, the

Table (1) The types of artificial limbs and their prices

The sequence	Type	Price
1	Hard foot	\$ 80 - \$ 60
2	Moving foot	\$ 120 - \$ 80
3	the leg	\$ 60 - \$ 40
4	The joint	\$ 400 - \$ 240
5	Keep quiet	\$ 150 - \$ 100
6	Chant	\$ 50 - \$ 40
7	Alfot	\$100 - \$ 75

Preparing the researchers based on the factory data

From the data of the above table clarifies the types of artificial limbs and their prices and by identifying the stages of manufacturing and the images obtained (see Appendix 1) it is clear from the manufacturing processes that there is significant damage and parts that are not usable again and these wastes greatly affect the environmental side by throwing them In rivers or sanitary landfills because of their toxic emissions that greatly affect the life of living organisms. The Ministry of Health bears significant costs in compensating the Ministry of Environment for the waste thrown in the Tigris River from the city of medicine, which is estimated in 2013 at (23,500,000) dinars. This is what It was obtained from one of the managers in the Ministry of Health and we did not obtain the sums spent from the artificial limbs factory

weight of the disease, and the problems that the patient suffers from.

Fifth stage: - paving the table

Through this stage, the prosthetic limb, leg, leg, foot and joint are combined if the amputation is through the knee joint or higher, taking into account the proper leg length, foot measurement and heel height that the patient desires.

Types of limbs in the factory sample

1-3 search

There are many types of parties that are manufactured by workers at the factory, depending on the cases mentioned in the factory, and that covers multiple regions and as a result of the events that the country is going through.

Achieving competitive advantage by relying on 4-D printing

There is a set of dimensions that have been addressed in the theoretical rooting of the research, which are represented by the dimension of low cost, high quality, flexibility and speed in delivery. The two researchers worked very hard to obtain information by contacting the directorate and we were directed to contact the factory directly and this was done in obtaining some private data through The number of workers, whose number is (14) workers, with an average monthly wage of (950,000) dinars, and the raw materials used in the manufacturing processes are highly diversified as a result of the diversity of products that are relatively available. By looking at the CVs of the workers, the researchers found a group of workers who were dispatched to

Japan. Specifically, the company (VORUM), which focuses in its work on the (CAD / CAM) system and three-dimensional and four-dimensional machines (see Annex 2), which has many advantages, including the low cost in the long term and the speed of delivery of products, especially as they are products related to human life as one can achieve dimensions of the competitive advantage and the production of products that are free of appendages and that are in conformity with the specifications and are not harmful to the infected person and there are other features that greatly explain how to achieve The competitiveness advantage cannot be mentioned, and the delegation explained that four-dimensional machines are distinguished from three-dimensional machines by the element of time, as time is added with other elements, so the cost of four-dimensional machines is at prices ranging (\$ 60,000 - \$ 200,000) and with a productive life of (25) years at a cost of zero rubble. If we adopt the average price of the machine (\$ 130,000) i.e. $((60,000 + 200,000) / 2)$, the annual depreciation premium is (\$ 5,200) $((130,000 - Zero) / 25)$, which is equivalent to (6,500,000) dinars, especially since this cost It represents the cost of the machine, in addition to the cost of materials and the cost of wages, and currently the factory produces (84) parties, with workers suffering from failure to complete the parties on time, as well as the production of non-conforming parties to the measurements by (100%) but at an acceptable rate, as well as environmental waste, which represents a challenge in our time. Because the world is moving towards clean energy.

The four-dimensional machine works with two systems (CAD, CAM) through computer printing that determines the dimensions very accurately and determines the required part. The results of the manufacturing process according to

four-dimensional printing have multiple features that contribute to the production of environmentally friendly parties at a low cost and in an excellent manner and there are no defects or shortages In the process of using it and achieving social welfare, especially as it serves a segment that provided the dear to the dear country.

The two researchers faced great challenges in dealing with this vital topic through its theoretical and practical sides, the first in the lack of resources and the topic in terms of the medical aspect and there is no accounting or economic study, and in the second no three-dimensional printing was applied. Accurate for its reliance on the highly discretionary side, and the matter that represents the most difficult thing is what the whole world is going through through the outbreak of the Corona pandemic (covid 19), which disrupted all work and the researchers were unable to repeat the visit to the factory, the research sample due to the current sanitary condition.

Conclusions and Recommendations

Conclusions

1- 4D printing is a renewal of 3D printing, as special materials are printed to print objects that change the post-production form, but they need some incentives to start the transformation

2- Improving the quality of the computerized four dimensional tomography image by increasing the imaging of the images in each subject of interest and linking each image where the data is analyzed retroactively and contains an engineering data set with a time interval.

3-One of the technologies that are efficient in terms of energy drainage and thus environmentally friendly in the case of making similar parts with little waste and thus be lighter and stronger than traditional methods of production.

Recommendations

1-The 4D product should be paid attention as it achieves a faster response through the use of 3D digital design data to build a component in layers by depositing the materials.

2-The need to pay attention to the environmentally friendly technology that achieves time savings, costs and high quality, and lowers product development time.

3-The belief that solutions to negative economic, social and environmental impacts should be found using the intelligence and creativity of society in general in rationalizing the use of resources, and using the best means to evaluate projects to study and estimate the environmental impacts of economic proposals and amendments

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Appendix 1



Appendix 2

