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### Why 3-Dimensional Printing is Better than Traditional Manufacturing

The growth of 3-Dimensional (3D) printing is revolutionizing the world of manufacturing. In order to fully understand the advantages of 3D printing, it is helpful to understand what a 3D printer is. A 3D printer is a machine that uses polymers, concretes, and occasionally metals to make 3D objects. It makes them by heating the materials up and placing them in the desired design created by the user from a CAD or other design. People are finding they can more easily transfer their ideas into reality with 3D printing. 3D printing is also far more effective than basic manufacturing due to several reasons. 3D printing is far more cost effective than traditional manufacturing because the materials required in initial development of a product is minimal as manufacturers are not required to fully machine tool components. Not only can they save more money, they can also save resources and conserve the planet. The ability to quickly produce full tools and replacement parts benefits the consumer market as well. Many materials can be used to produce diverse of products for industry and consumer users. These products can then better the process and output of goods and smaller parts. 3D printing is an additive manufacturing process which means that instead of cutting and creating waste, it deposits it out into the desired design or shape which minimalizes the waste of resources. Due to it being this type of manufacturing the cost to produce each product is drastically reduced. The flow of creativity onto the finalized product is less restricted with this type of manufacturing.

Overall the type, cost, time to produce, and amount of creativeness are more advantageous than the other types of manufacturing.

3D printing minimalizes the cost and waste of resources when manufacturing goods since it is additive manufacturing rather than traditional manufacturing. The type of manufacturing done with 3D printers is called additive manufacturing. This unique type of manufacturing allows for a minimum amount of waste. Compared to other types of manufacturing such as subtractive manufacturing. As stated by Andy (LNU) from 3D Printer Prices "Additive manufacturing, on the other hand, is the process of producing objects by adding only what is needed, along with any support material required" (Andy). The quote supports in that it states how well 3D printers are at preserving the materials for other parts. 3D printing is paving the way for less waste in manufacturing, Dennis Draeger stated directly in his article, "3D printing also means less waste. Traditional forms of machining often leave up to 90 percent of a slab of metal on the machining floor." Most of the material that is "wasted" for 3D printers is the material used for support. Meanwhile the waste created in metal machining is not for support and is drilled or milled from the original piece causing large amounts of waste that needs to be taken care of instead of the few little bits of material from 3D printing. 3D printers are also better because of less waste. The cost is also much less compared to subtractive manufacturing. David Yakos from a technology company called Salient Technologies stated how 3D printing is more advantageous than other types. Yakos stated in article about costs with manufacturing, "Prototyping injection mold tools and production runs are expensive investments. The 3D printing process allows the creation of parts and/or tools through additive manufacturing at rates much lower than traditional machining" (Top 10 benefits of 3D printing). Injection molds are more expensive than 3D printing, because of the fact that they require more steps. With 3D

printing the user just has one machine doing all the work from a simple file being uploaded into the machine. The printer themselves may be a little pricey, but over time the investment pays for itself. These machines have the ability to produce any item that you can create that fits within the boundaries of the printing area given by the machine. The way the machines work is through programs which allow the user to set the scale and materials used. If at any time the design goes wrong or the machine malfunctions it is not the end of the world. As stated by David Yakos in an article about 3D printing, "3D printing allows a product developer to make breakthroughs at early stages that are relatively inexpensive leading to better products and less expensive dead-ends." This article shows how mistakes are not as costly and that users can change up the design throughout the process and not have to worry about the cost of changes. With these changes being so inexpensive they can occur throughout the build resulting in better products to be mass produced and tested at an early stage. Not only are these machines made for the commercial scene but for the home as well. Due to the costs of 3D printers decreasing soon the average at home consumer can purchase one within their price range. They could create small replacement parts for appliances or even toys for their children. Dennis Draeger stated in an article he wrote about how 3D printers are changing the world that, "The prices are dropping as more companies attempt consumer-grade machines." More companies are trying to increase the number of buyers for 3D printers. The overall run cost of a 3D printer is immensely cheaper than subtractive manufacturing. A consumer model 3D printer requires less power than an average sized desktop. Overall, the advantages of cost and reduction of waste outweigh the cost and waste of traditional manufacturing.

3D printing is more effective due to the time to create products and designs. With the ability to rapidly produce and create whatever the consumer desires there is no question as to

which type of manufacturing is superior. The developments made in the 3D world are increasing every day. The biggest development is the efficiency of these machines. These machines allow for companies to decrease the time from design to production by allowing for prototypes to be created in a matter of hours. Traditionally companies would use injection molds but those are expensive and take a large amount of time to create and then operation comes into play as well whereas with 3D printers the company merely uploads the design from a CAD program, then it is uploaded into a machine. When comparing a 3D printer to an injection mold or a CNC machine the 3D printer is faster and can be changed as it is running. As long as the area of change has not already been created or passed in production of the part it can still be changed. The use of CAD programs also greatly increases the efficiency time of production. These programs allow for quick dimension creations and measurements in the production of products. Once completed the user simply saves and uploads to the printer and the printer goes on and creates the product. As stated by David Yakos of Salient Technologies, "3D printing allows ideas to develop faster than ever. Being able to 3D print a concept the same day it was designed shrinks a development process from might have been months to a matter of days, helping companies step ahead of the competition" (Top 10 benefits of 3D). The use of these printers as shown by Yakos means that production can start the same day. This is an enormous leap from traditional manufacturing where prototypes took weeks to be put into production while these are being started on the same day as the design was produced. Dr. DeSimone stated in an interview with a 3D printing group about how the printers will benefit production, "Using 3-D printing for production will be transformative, predicts DeSimone. 3-D printing speeds up product design, and it speeds up business." By decreasing the production time, the companies will flourish and be able to process better products for the consumers and for the companies themselves. This will

increase the production levels of better produce products for the businesses allowing them to better themselves along with the market with goods that can be designed and upgraded rapidly. The ability to put products on the assembly line within a matter of days rather than weeks or months is why the method of 3D printing is superior to traditional manufacturing. on top of that it also allows for products to be tweaked as desired throughout the design process.

People can express themselves in a more fluid and creative way with 3D printing rather than with traditional manufacturing. CAD stands for computer aided design, which means software and programs are used for design. Using programs such as these allows for greater ease of creation for the desired product. In an article from Business Insider written by Dylan Love which included an interview with Peter Weijmarshausen who is the CEO of a 3D printing company named Shapeways, stated just how fast 3D printers are, "Imagine if you only made what you need, or imagine if you are a designer and could bring your product to market in just days, not years..." (Love) The endless opportunities born from this speed is incomprehensible. with the ability to transfer over everything created in just one file to a printer and then just come back in the time stated by the printer to a complete product is an immense advantage compared to traditional manufacturing. Traditional manufacturing requires many sketches and then machines being programmed to billet or machine out the products. These methods are time consuming just to get from design to the first prototype production. Needing to stop and edit throughout the design and production process would take precious time away from the important prototype construction. With the ability to move products from design to production this quickly it allows for companies to produce a large range of products to put out on the consumer markets. In an article by Ben Redwood who is a mechanical engineer states a very useful fact about 3D printing, "Since components are constructed one layer at a time, design requirements such as

draft angles, undercuts and tool access do not apply, when designing parts to be 3D printed." The ability to create these difficult shapes that many traditional manufacturing methods cannot accomplish. This is a revolutionary ability. The design capabilities such as printing out a chain with all the links connected and being able to move freely is just one of the incredible achievements 3D printers are capable of. Traditional manufacturing simply cannot do what 3D printers do. The traditional methods are limited in their abilities of creation compared to the ways of 3D printing. This of course is aided by CAD programs which allow the users to create whatever it is that they are imagining. Users at home using their 3D printers are freed by these programs and the technology of the printers. They are able to create whatever fits the boundaries of their printer to aid them in their lives at home. For example, if a part on a TV remote or a toy for their child breaks; the technology is there for them to create the part. The opportunities for creation are endless when compared to traditional manufacturing techniques. With traditional techniques people would not be able to just create a new part for their TV remote like how they can with a 3D printer. The restrictions are very limited for 3D printers. David Yakos made a statement in his article for Salient Innovations about creativity with 3D printers, " one can now 3D print almost anything they imagine after drawing it up virtually." As long as the user has a computer and a printer then they are able to create. The advantage of design freedom is one of the biggest advantages 3D printing has over traditional and subtractive manufacturing.

As stated in the essay the argument proves that 3D printing is superior than traditional manufacturing for several reasons. The resources and cost reserved by the 3D printing is superior to the traditional manufacturing methods used from the past to today. 3D printing is more effective due to the time to create products and designs using the CAD formats which are far faster than traditional manufacturing methods that take longer to get from design to production.

3D printing is more effective due to the time to create products and designs over traditional manufacturing which requires far more steps to produce a product. The overall facts and evidence shown prove the argument that 3D printing is superior in these elements as opposed to using traditional manufacturing methods.

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