# Could 3-D Printing Change Global Trade?
# The Potential Effects of 3-D Printing on Global Supply Chains

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*Due to its high levels of customization and flexibility, 3-D printing affords many opportunities to industries that rely on long, complex supply chains. This EBOT is the third in a three-part series exploring global trends in additive manufacturing and outlines the potential effects of 3-D printing on global supply chains and the subsequent effect on global trade flows.*

**Advantages of 3-D printing**

3-D printing is a type of additive manufacturing that produces 3-D objects by building layers of material upon each other. This manufacturing process promises greater product customization, increased design complexity, and fewer wasted raw materials than traditional manufacturing. While traditional manufacturing requires a lengthy retooling process in order to alter production, 3-D printing can immediately alter production in order to adapt to a change in demand or a design update. Though 3-D printing does not easily allow for economies of scale, it does provide indirect savings due to high customization and flexibility. As these key advantages become more apparent, firms will likely incorporate 3-D printing into their production process.

**Potential Changes to Supply Chains**

3-D printing has the potential to alter supply chains through tightening and aggregation. In many traditional supply chains, firms manufacture components of a product in one location and transport them to another location for assembly. Because 3-D printing creates a product layer by layer rather than through assembling parts, the manufacturing and assembly segments of a supply chain would occur in one location. This change to the production process aggregates previously separate tasks which reduces the number of supply chain segments and tightens the overall supply chain. Firms would therefore have fewer suppliers and be able to avoid costs related to supply chain back-ups and delays in shipments. Less involvement with suppliers also gives firms more freedom to choose their manufacturing location, as they do not need to consider being close or accessible to other segments of their supply chain. Firms may then choose to move their manufacturing locations closer to their destination markets and use 3-D printing's high level of customization to tailor their products for the consumers there.

One example of this is the U.S. Army's installation of a Rapid Fabrication via Additive Manufacturing on the Battlefield (R-FAB) system in South Korea in 2018. The R-FAB system allows military forces to manufacture necessary parts directly at their location for immediate use in military field operations. In one instance, a soldier broke the butt stock for their M4 rifle and used the R-FAB system to print a new one in a few hours. The R-FAB not only allows the U.S. Army to avoid lengthy supply chains, but it also improves its logistical planning, as soldiers' locations no longer needs to be dictated by access to supply chains. The flexibility afforded by 3-D printing increases firms' control over their supply chains, reducing costs and vulnerability to potential supply chain shocks, which has led the private sector to explore the option as well (box 1). The ability to print goods on-demand decreases lead times and allows for rapid

responses to changes in supply needs. This also lowers the amount of inventory necessary, reducing storage costs and the uncertainty related to receiving inventory from suppliers.

**Impact on Trade**

In 2016, the five industries that were the largest buyers of 3-D printers and services made up 43 percent of global trade. In 2017, intermediate goods accounted for approximately 21 percent of all global exports. As 3-D printing reduces the need for intermediary manufacturers and parts, there may be fewer intermediate goods traded internationally. Instead, a greater share of trade may consist of electronic transmissions, (ET) such as computer-aided design files and 3-D printing software, 3-D printing equipment, and raw materials for 3-D printing such as metal powders and polymers.

As global trade changes, the regulations and agreements governing trade may evolve as well. With fewer goods crossing borders, trade regulations may focus more on 3-D printing equipment and raw materials, or even laws that prevent foreign firms from setting up 3-D printers domestically. For example, in 2019 France placed restrictions on foreign direct investment for R&D activities related to additive manufacturing citing national defense and security concerns. Trade agreements may concentrate on 3-D printing intellectual property or rights to set up 3-D printing factories in other countries. Additionally, 3-D printing could make it easier to determine the origin of a product, given that products will increasingly be manufactured in one location and in one piece. However, interpreting rules of origin for 3-D printing remains ambiguous, as the World Trade Organization does not have product specific non-preferential rules of origin. As a result members can currently determine their own rules when trading outside of any preferential agreement based on where the product was made or where the digital file originated. Although it is difficult to predict exactly how supply chains will evolve, advanced technologies like 3-D printing may challenge the existing global trade structure, and may lead institutions governing global trade to respond.

**Box 1. A New Kind of Factory**

Adidas, the German sportswear company, exemplifies the possibilities of 3-D printing with its new kind of manufacturing plant called a Speedfactory. The Speedfactory uses advanced and additive manufacturing to automate and digitize the shoe production process from start to finish. There are currently two Speedfactories, one in Ansbach, Germany and another in Atlanta, Georgia. This restructuring of manufacturing allows Adidas to reap many of the previously mentioned benefits of 3-D printing. Firstly, the Speedfactory aggregates supply chain tasks by producing a shoe entirely in one location, importing only raw materials and pre-knitted textiles. Secondly, these Speedfactories are located near destination markets. The current Speedfactories' locations allows Adidas to restock stores in Western Europe and the U.S. in weeks or days, versus months. The Speedfactory also affords Adidas flexibility when planning production. Previously, developing a shoe and getting it into stores required 18 months of planning. With the Speedfactory, Adidas can manufacture shoes in just a few days and produce in relation to demand, rather than overproducing a large volume of inventory upfront.

**Sources:** What is Additive Manufacturing? ; H.K. Chan et. al., The impact of 3D Printing Technology on the supply chain: Manufacturing and legal perspectives; T. Wohlers et. al., Wohlers Report 2019, Wohlers Associates, Inc., March 2019; E. Lopez, To support readiness, Army team demonstrates ability to make essential parts with 3-D printing; World Integrated Trade Solution, accessed September 23. 2019; I. Solel, Additive Manufacturing and the Supply Chain: Opportunities and Risks; R. D'Aveni, 3-D Printing Will Change the World; D. Thomas, How 3D printing is reshaping global production; M. Bain, A Germany company built a "Speedfactory" to produce sneakers in the most efficient way; A. Weiner, Inside Adidas' Robot-Powered, On-Demand Sneaker Factory; World Trade Organization, World Trade Report 2018; B. Jackson, France Extends Control Over Foreign Investment in 3D Printing and Other Technologies.