

## **Disruptive Innovations in Manufacturing – An Alternative for Re-Shoring Strategy**

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### **ABSTRACT**

*This paper examines the U.S. manufacturing re-shoring trend, argues its inherent limitations and discusses that there is no evidence implying significant impacts of such a renaissance on domestic employment since the organizational structure of manufacturing production has changed over the past years. This research proposes a different definition of disruptive innovation and introduces examples of disruptive innovation in textile and apparel manufacturing industry, based on mega trends by 2025. Finally, it recommends a studious focus on facilitation of disruptive innovation in manufacturing, rather than encouraging re-shoring policies, by more and consistent investment in research and development.*

*Keywords: Re-Shoring, Textile Manufacturing, Disruptive Innovation, 3D Printing, Advanced Materials and Internet of Things*

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### **Introduction**

In the past few years, the re-shoring of manufacturing production has been a popular trend among U.S. companies. Re-shoring occurs when firms decide to bring back offshored manufacturing plants to the United States. According to the Bureau of Statistics, close to six million manufacturing jobs were sent overseas from 1999 to 2009; however, since 2010, the trend has reversed by recovering 550,000 manufacturing jobs.

Indeed, the primary driver of rushed outsourcing during the 1980's was low unit price that could be achieved by offshoring production facilities to lower labor cost countries like China (Basu & Schneider, 2015) and afterward India. So, sectors in which

labor costs make up a significant proportion of overall costs were most likely to be offshored. On the other hand, one of the main advantages addressed as a driver of the decreasing gap between labor cost of U.S. and low cost countries, was automation in manufacturing which is a sign implicating that re-shoring will not be a sustainable trend, especially in terms of job creation for Americans.

In the following article, after a brief review of literature about re-shoring strategies and their inherent limitations, the disruptive innovation by itself has been explained with some examples of megatrends that are going to disrupt today's textile manufacturing. Finally, a studious focus on

facilitation of disruptive innovation in manufacturing, rather than encouraging re-shoring policies, is recommended.

### Re-shoring Strategy

“Re-shoring” or “back-shoring” is a term that has been used to define “moving manufacturing back to the country of [the firm’s] parent company” (Ellram, Tate and Peterson, 2013).

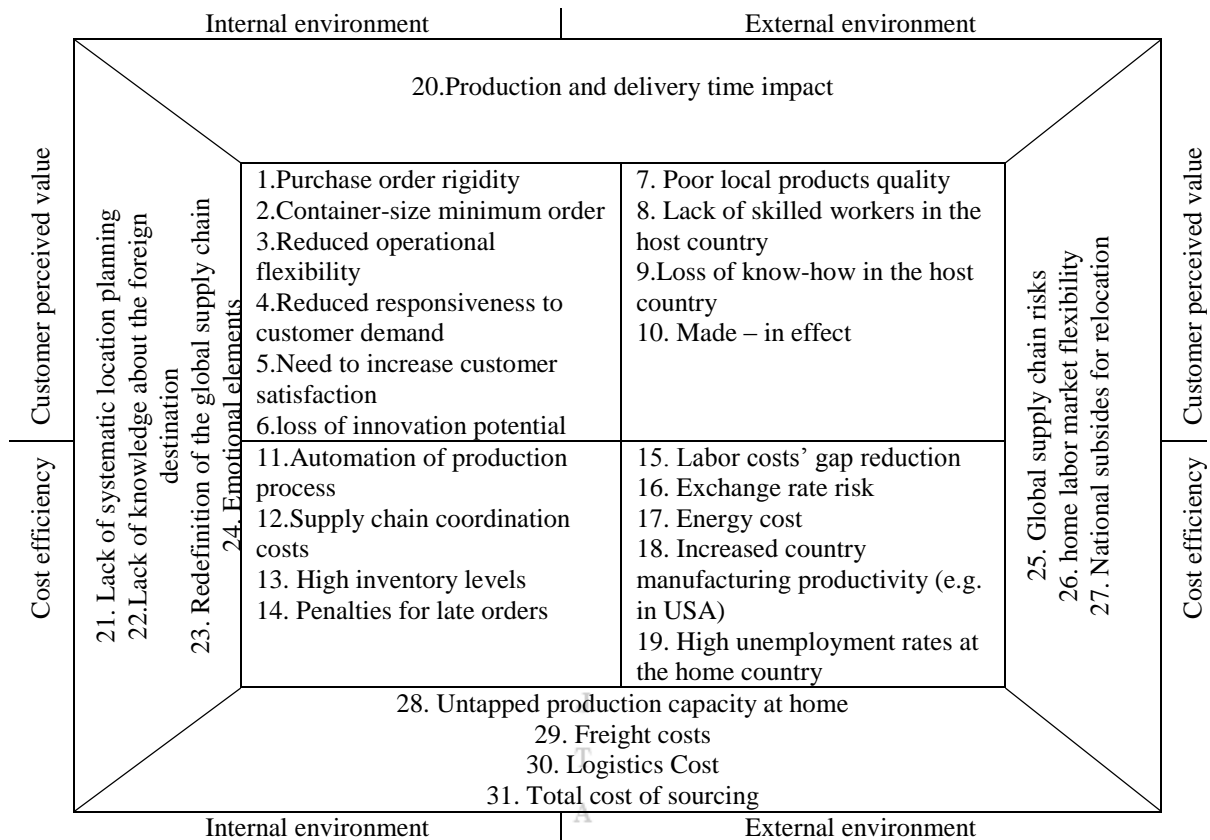
According to Fatocchi, Holz (2009) proposed the first academic definition of “back-shoring” as: “the geographic relocation of a functional, value creating operation from a location abroad back to the domestic country of the company” (Fatocchi, 2016). Therefore, based on Holz’ (2009) definition, the geographical aspect of reshoring really matters when such decision is made.

There are many studies about the drivers behind preferred manufacturing locations, some of which are referred to as follows:

- The rising cost of energy and transportation (The Atlantic, 2012).
- The rising wages in low-cost countries (The Economist, 2012; The Atlantic, 2012).
- Shorter supply chain (Sirkin et al., 2014)

- The improving ratio of U.S. labor productivity (The Economist, 2012; The Atlantic, 2012).
- The quick response time and delivery time improvement (Van den Bossche et al., 2014).
- Assuming faster recovery in the case of supply chain disruption (The Atlantic, 2012).
- Fluctuations in currency exchanges (Gopalan et al, 2012).
- Freight improvement and reducing shipping costs (Van den Bossche et al., 2014; Sirkin et al, 2014)
- Proximity to customers (Sirkin et al 2014; PWC Insourcing Survey, 2014 Van den Bossche et al., 2014)
- Total cost of ownership (Van den Bossche et al., 2014)
- Concerns toward theft of intellectual property in global regions (Gopalan et al, 2012).
- Quality and productivity improvement (Sirkin et al, 2014; Van den Bossche et al., 2014)
- Access to skilled workforce and talent and local control over manufacturing processes (Sirkin et al, 2014)
- “Made in U.S.A” brand considerations (Van den Bossche et al., 2014)

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**Figure 1. Motivations behind re-shoring as manufacturing location decision (Fatocchi et al, 2016)**

The interpretative framework summarizes motivations for re-shoring strategies, based on academic articles, reports edited by consulting firms (e.g., Boston Consulting Group, McKinsey & Co.) or published in international press (e.g., The Economist, TIME) until December 2014, introduced by Fatocchi (2016) is shown in Figure 1.

Based on the latest statistics of the Bureau of Economic Analysis (BEA), there are 2,243 U.S.-based, multi-national companies with more than 28,000 foreign affiliates and more than 37 million people employed across the world. Meanwhile, according to Van den Bossche et al., 2014, there were only about 300 cases of re-shoring to the United States in 2014, which was up from 210 in 2013, 104 in 2012, 64 in 2011, and 16 in 2010. As such, one can conclude that despite the publicity received by a few

high-profile cases, there is no evidence that re-shoring is a real trend among U.S. companies.

Also, it is very important that we consider re-shoring as a two-way discussion. Usually, promoters of re-shoring movements ignore the many firms that have expanded their off shoring simultaneous to highly publicized re-shoring efforts. For instance, “While General Electric added 10,000 jobs and set up new plants in the U.S. in 2011, the company also erected new factories in China, India, and a number of other places” (Mubin, 2013).

Even if we assume there is a real promising trend of U.S. companies that have decided to re-shore production back to the U.S., there is no evidence that implies significant impacts of such a renaissance on domestic employment.

De Backer, K et al (2016) based on OECD statistical data of Multi-National Companies (MNCs) conclude that there is no indication showing that the U.S. MNCs have employed more people in United States due to re-shoring activities over the past years; however, some evidence shows capital investments are more focused on the United States. The data shows mixed signals overall, challenging positive impacts of re-shoring activities on employment.

Today, we can see a substantial increase in professional and service based manufacturing jobs such as legal, business and financial, computer and math, and engineering occupations. Figure 2, calculated by the author based on the Bureau of Labor Statistics data, shows all occupational categories within manufacturing, ranked by the changes in their shares of total U.S. manufacturing employment over the last decade. Even within manufacturing categories based on classic definitions, the fastest-growing occupations are high skill ones such as professional, business and management occupations. On the other side, traditional production occupations have declined the most and now make up about 25% of total employment in the manufacturing sector. This shows that re-shoring movements which promote returning to the golden age of U.S. manufacturing, in which almost all production stages took place within the United States, ignore radical changes that happened in the organizational structure of manufacturing production over

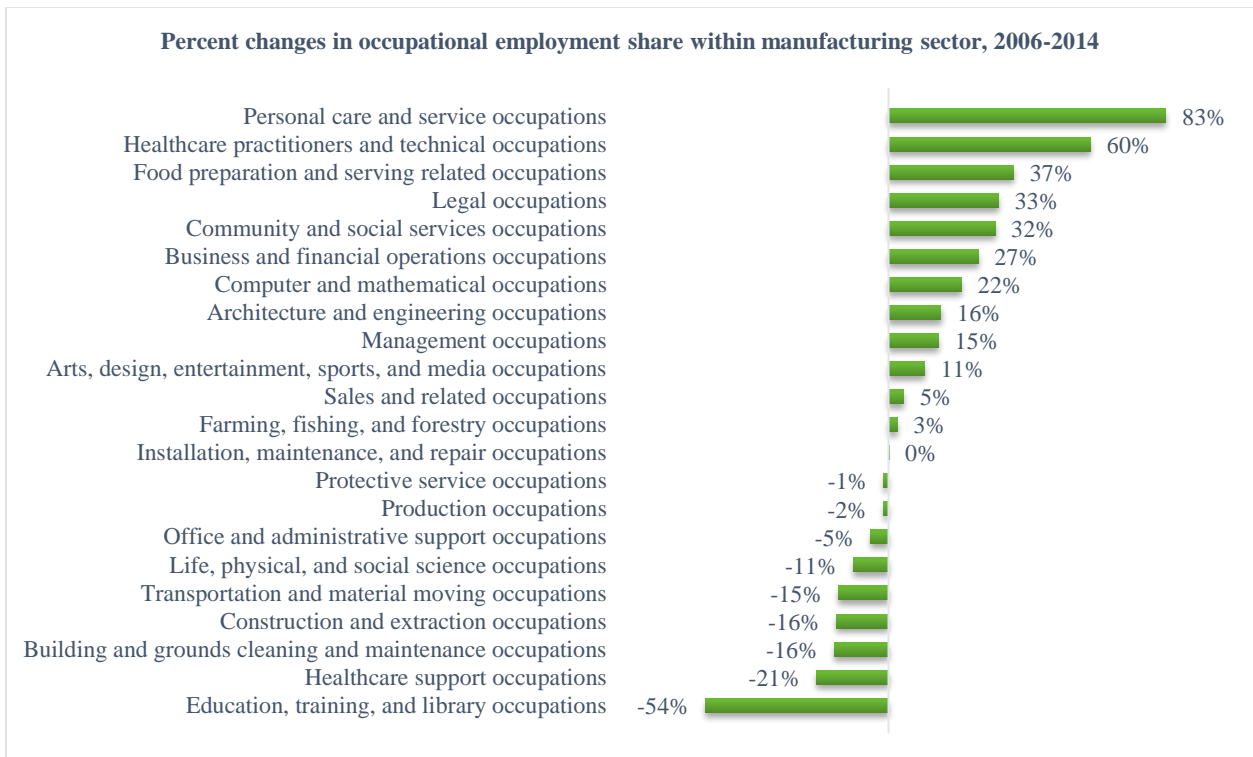
the past years. Nowadays, the word “manufacturing” is not anymore equal to assembly line workers putting together physical products.

While, the manufacturing sector accounts for only about 10.3 percent of total U.S. employment, traditional production occupations within manufacturing categories employ only about 2.5 percent of all U.S. workers. Therefore, re-shoring activities focusing on the classic image of manufacturing simply ignore promising areas such as disruptive innovations that will likely shape the future of the manufacturing workforce in the United States.

### **Disruptive Innovation in Manufacturing**

The term Disruptive technology coined by Clayton M. Christensen, describes a process by which a product or service takes root initially in simple applications at the bottom of a market and then consistently moves up market, eventually displacing established competitors (Bower and Christensen, 1995). Christensen in 1997 explained that disruptive technologies usually gain momentum by addressing different customer segments or emerging markets, which is potentially dangerous to incumbents. Since, in most cases, the track of performance of disruptive technologies outshines the track of the mainstream technologies, incumbents are not able to compensate the gap, so they are often replaced.

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**Figure 2. Percent changes in occupational employment share within manufacturing sector, 2006-2014 (Authors own, 2016)**

Later, however, Christensen (2006) asserted that disruptive innovation is not only about changes in technology, but it may also include refined business models or adjustments in core processes that propose additional or completely new values to customers.

Manyika et al. (2013) suggested four criteria that will narrow down the selective disruptive technology trends by 2025, including “rate of technology change”, “scope of groups, products, and resources that could be impacted”, “scale of economic value that could be impacted” and “potential for economic impact and disruption by 2025”. As a result, twelve technologies among one hundred, identified as the hot trends by 2025. Going through the list, *3D printing*, *advanced materials* and *internet of things expressed as smart textiles* could be considered as groundbreaking trends for textile and apparel industry.

3D printing represents additive manufacturing techniques to create objects by printing layers of material based on digital

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models. 3D printing was invented a long time ago, however, just recently it is to be considered as a disruptive technology since it has been forecasted to reduce the manufacturing costs up to 90% depending on application (Bughin, 2013).

Another promising trend is advanced materials that include materials designed to show extraordinary properties or functionalities such as lighter weight and higher strength or conductivity (Bughin, 2013). Advanced materials had been used commercially for Military purposes and high tech manufacturing like aerospace and even construction and car manufacturing. By focusing more on advanced materials to be used in textile structured material, different high end consumption will be defined in the future.

The last, but perhaps the most promising disruptive trend is smart textiles. The application of smart textiles has been introduced in sports and fitness, fashion and entertainment, military and protection, medical, transportation and architecture so

far. Military as the largest end-use segment accounted for over 25% of the market share in 2012. Different medical application of smart textiles like drug delivery are expected to grow at a faster rate. Other health related application known as telemedicine and sport health products have been marketed aggressively by sport wear producers like Adidas (Global smart textiles market size, market share, application analysis, regional outlook, growth trends, competitive scenario and forecasts, 2012 to 2020.2012) or Nike. There is a chance that other unknown applications adopted through further improvement in performance of this sector. take place. other different application could be adopted that might be unknown. Regarding the potential impacts of above trends, disruptive innovations can be pivotal to future U.S. manufacturing, especially textile and apparel industry. According to the findings of a study on European patenting companies by Van Roy et al (2015), technology innovation affects employment in high and medium tech manufacturing sectors positively, while it is irrelevant in the case of low-tech manufacturing and services.

Through studying variation in offshoring costs that originates in the countries to which U.S. firms are moving production tasks, Wright (2014) suggests that offshoring relocates only low-skill works while it generates considerable cost-saving. This enables U.S. firms to hire new high-skill workforce and invest on R&D helps them remain competitive against foreign rivals.

In order to take advantage of future opportunities, companies and policy makers should focus on preparing themselves to benefit the most from the coming age of disrupted manufacturing in which workforces equipped with new skills should handle new tasks and challenges aroused by likely expansion of business due to disruptive innovations in the United States.

They need to invest in STEM education, and workforce training as well as processes and regulation redesign to facilitate hiring high-skilled talents to compensate the lack of highly qualified workers in the meantime.

This research calls for a more intelligent approach towards the promotion of re-shoring policy. Rather than seeking re-shoring as a solution to the unemployment problem, there needs to be a clear priority for disruptive market-centered innovation that maintains the U.S. manufacturing competitive compared to price-driven rivals.

## Conclusion

While re-shoring has been frequently referred to as a prescription to save manufacturing in the U.S., there is no strong evidence to support this claim at least as a sustainable solution to the unemployment problem. Alternatively, relying on long tradition of innovation in the U.S. regarding disruptive technologies, focusing on specialized training aiming to equip workforces with new set of skills and consistent investment in research and development are recommended for making any policy to take advantage of future opportunities.

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