

DFMA and Reshoring: Synergistic Partners –May 2014

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Abstract

DFMA can play an important role in enabling reshoring. When changes in product and process design reduce the labor content of a product they make it easier to reshore the product by reducing the U.S. Total Cost vs. offshore. Once a product is reshored, innovation should be even more effective, leading to higher quality, more competitive products.

Intro

The reshoring trend is primarily driven by higher wages in China, higher global energy and freight prices (but lower natural gas prices in U.S.) and companies beginning to adopt total cost of ownership (TCO) analysis to make their sourcing decisions. When companies see that the total cost differential is very low, they can redirect their efforts internally to improve product and production design to make up any remaining cost difference.

Reshoring is based on the logic of local sourcing and applies equally to all countries. However, if all countries were to adopt localization practices, the U.S. would benefit the most because we have offshored the most. The U.S. also has the advantage of being the world's largest market. If we can make 90% of what we consume instead of 75%, we will stay the largest market for many years and thus offer companies an intrinsic advantage to manufacture here.

Reshoring momentum is growing

A variety of sources are reporting numbers that demonstrate the breadth of the reshoring trend.

- 54% of Billion \$ OEMs reported intent to move some production back in 2013, up from 37% in 2012 (Boston Consulting Group 2013)

- 40% of contract manufacturers reported having done reshoring (MFG.com 4/12)
- 76% of consumers more likely to buy U.S. product (Perception Research Services Intl. 7/12)
- 57% less likely to buy Chinese product (Perception Research Services Intl. 7/12)

One of the most important actions to strengthen the economy is to focus more on reducing imports relative to increasing exports. Replacing imports with U.S. made goods is more cost effective and more controllable than increasing exports because our U.S. companies are 30% to 50% more price competitive here in the U.S. than when exporting.

Reshoring of U.S. manufacturing is a significant factor in the current manufacturing renaissance. According to Harry Moser, founder/president of the Reshoring Initiative, we have already stopped the economic bleeding caused by offshoring. Since 2003, new offshoring is DOWN by 70% to 80% and new reshoring is UP by 1500%. The most important accomplishment is that the net-loss of 100,000+ manufacturing jobs each year has ended, resulting in the first neutral year of job loss/gain in the last 20.

Figure. 1

	Manufacturing Jobs / Year			
	2003	2013	% Change	Feasible 2016
New offshoring *	~150,000*	30-50,000*	- 70%	20,000
New reshoring	2,000*	30-40,000**	+ 1,500 %	70,000
Net reshoring	-148,000	~0	100%	+50,000

*Estimated / ** Calculated

Job creation is an important indicator of both reshoring and US economic recovery. However, while many jobs were lost to offshoring, some were/are lost as a result of greater automation and productivity. Current job growth being up despite ongoing automation illustrates that a balance is occurring, and shows the complexity of the relationship between job creation and an industry that is evolving toward greater automation. The nature of some manufacturing careers is changing. Reshoring due to automation and innovation is creating many new high-tech, good paying jobs. In addition to these jobs, the manufacturing multiplier affect remains high and will add many more jobs in other sectors as well. Industry and education sectors are scrambling to provide the skilled workforce required to meet the demands of modern manufacturers. The Reshoring Initiative sees skilled workforce recruitment as the biggest barrier to reshoring, and offers a plan on how to improve it at reshorennow.com/blog.

Data from the Reshoring Library currently shows that over 500 companies have reshored, and the number continues to grow. Based on analysis of the articles in the Library, the Initiative calculates that about 120,000 manufacturing jobs have been reshored in the last 3.5 years. That surge represents about 15% of the total increase in manufacturing jobs since the low in January 2010. If the current trend of increased TCO use is paired with other favorable trend factors, the potential for reshored jobs is estimated at up to 6 million in Figure 2. It will take years or decades to achieve this much reshoring due to transition delays at companies and the current lack of sufficient skilled workforce in the U.S., but it can happen.

Figure 2 Potential Impact of Reshoring: Four Cumulative Job Scenarios

Scenario Description	Source of the Scenario	Cumulative Number of Manufacturing Jobs Reshored*	Total Cumulative Number of U.S. Jobs Created**
Companies use total cost analysis tools in sourcing decisions	Reshoring Initiative	500,000	1,000,000
If Chinese wage trends continue at 18%/yr	Boston Consulting Group	1,000,000	2,000,000
Adoption of: better U.S. training; increased process improvements and automation; competitive corporate-tax rates	Federal Government's Advanced Manufacturing Partnership (AMP)	2,000,000	4,000,000
End of foreign currency manipulation	Almost all manufacturing groups	3,000,000	6,000,000

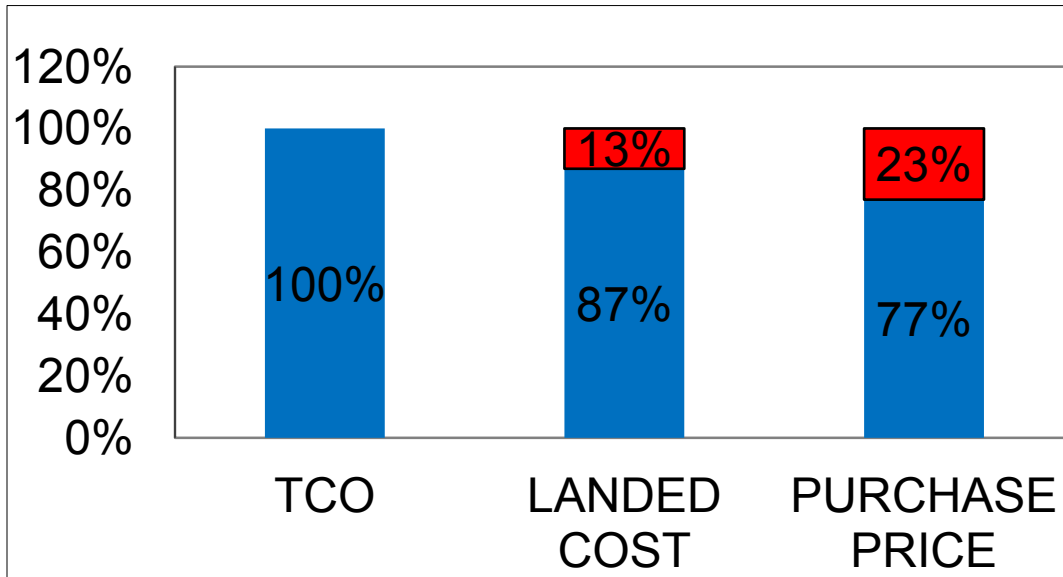
*# of jobs and scenarios are cumulative. ** Assuming a 1.0 multiplier effect

TCO and the Reshoring Initiative

The key to successful reshoring is for companies to use a comprehensive Total Cost of Ownership (TCO) analysis that calculates the true cost of offshoring. The non-profit Reshoring Initiative provides free TCO Estimator software. The Initiative also offers a database of 1200+ reshoring articles and a Case Studies feature where companies can share their real cases of reshoring. These resources are available on the website at: www.reshorennow.org/resources.

In the past, as many as 60% of companies made the decision to offshore based on miscalculations, never taking into consideration the total cost of ownership (TCO). Current research shows many companies can reshore about 25% of what they have offshored and improve their profitability. TCO makes the cost target transparent and achievable and allows a company to identify and implement sourcing choices based on best value.

Figure 3: Even landed cost misses a lot of TCO



TCO and DFMA

The reshoring trend's momentum is in part due to companies reevaluating product design from a manufacturing standpoint. Over the past few decades, offshoring has taken a toll on innovation because of the separation of product engineering and production. Companies have since learned that when manufacturing is moved next to design and design engineers are working closely with manufacturers, they can improve the design, eliminate waste, improve quality, increase productivity and make the product more easily and sometimes at a lower cost.

We can see the benefits of TCO in companies that have applied it. In 2011 GE reshored manufacturing of the GeoSpring water heater from China to Kentucky. They brought design engineers, manufacturing engineers and factory line workers together to optimize the product. Material cost went down, the labor required to produce it went down and quality improved. The retail price for the Made in U.S. water heater is 20% lower than it was for the Chinese sourced product. Time-to-market also improved because consumers are located near manufacturing.

DFMA often closes the cost gap needed to justify returning production from offshore sources. When companies reevaluate product design from a manufacturing standpoint they can often bring costs in line making it easier to reshore. Contract manufacturer Zentech in Baltimore, MD has had many client companies coming back from Asia, especially those companies that specialize in highly technical electronics, or biomedical diagnostic equipment, for which quality control and engineering collaboration are more significant factors.

Figures 4 and 5 show the positive domestic and negative offshore reasons cited in actual cases of reshoring. Note that three of the top eight reasons to reshore are tightly related to DFMA.

Figure 4

Positive Reasons to Reshore	Total
Skilled workforce	87
Image/brand	80
Government incentives	79
Automation/Technology/3D printing	57
U.S. energy prices	49
Re-design	41
Higher productivity	36
R&D	35
Lean	27
Eco-system synergies	22
Infrastructure	20
Customer responsiveness	14
Lower real-estate/construction	8
Labor concessions	7

Source: Reshoring Library, March 2014

Figure 5

Negative Offshore Issues	Total
Lead time	111
Quality/rework/warranty	109
Rising wages and Currency Variation	88
Freight cost	82
Total cost	49
Inventory	37

IP risk/ Supply chain interruption risk	29 each
Delivery	28
Communications	18
Green considerations/Loss of control	15 each
Travel cost/time	14
Price	5
Difficulty of innovation/product differentiation/Regulatory compliance	4 each
Burden on Staff, Emergency air freight, Political instability	2 each
Employee turnover, Strained offshore relationships, Natural disaster risk	1 each

Source: Reshoring Library, March 2014

As global manufacturing competition gets more intense, manufacturers are implementing more automation and taking advantage of DFMA practices. This trend affects both design and manufacturing engineers. It is imperative to adapt DFMA and lean practices early on in the product design phase to further close the cost gap, making reshoring an even more cost effective solution.

Lean manufacturing practices, automation and innovation are critical elements in production location decisions. The relationship between engineering and production is well understood: innovation works best if the two functions are together. Harvard Business School Professors Pisano and Shih have documented the negative impact of separating these critical functions. It is also in the self-interest of engineers to encourage domestic manufacturing, because if their companies offshore manufacturing, engineering is likely to follow.

Harry Moser and others believe that lean manufacturing and DFMA can help manufacturers' early on to make better design decisions that reduce costs. The larger costs are associated with materials and process. DFMA can guide you to eliminate unnecessary parts and processes resulting in significant cost savings.

Companies are reshoring because they are finding that having manufacturing near customers gives them better flexibility to respond to customers changing needs, eliminates higher shipping expense, minimizes supply chain disruptions and eliminates the larger production runs and inventories associated with long distance offshoring.

Figure 6 is a summary of TCO considerations. Those that are most relevant to DFMA have been highlighted.

Figure 6: Total Cost of Ownership Factors

1. Cost of goods sold or landed cost: This includes price, packaging, duty, and planned freight, such as surface transportation, fees, and insurance.

2. Other "hard" costs: These include other costs that have an immediate effect on cash flow or are calculable and highly likely to occur.

a. Carrying cost for in-transit product. Foreign and local suppliers often are paid on different schedules. For example, Chinese suppliers often are paid prior to shipment, typically three to six weeks prior to U.S. receipt of the goods. U.S. suppliers typically are paid two to three months after the shipment date, which essentially is the same as the receipt date. In such cases, the customer's cash will be tied up for three to four months longer with an offshore source.

b. Carrying cost of inventory on-site. At the simplest level, the amount of onsite inventory will be dramatically higher for product shipped by ocean freight from offshore than for shipments from a local, ideally just-in-time, supplier.

c. Prototype cost. Many companies prefer to source prototypes locally so their engineers and marketing organizations can work intensely with the suppliers during product development. Local suppliers typically charge less for the prototype if they also receive the production orders.

d. End-of-life or obsolete inventory. When demand dies down or a product is revised or replaced, a company will end up holding some obsolete inventory. With an offshore source, the amount of inventory in-house, en route, and on order will be higher than it would be with a local source, leaving companies that source offshore with more obsolete inventory.

e. Travel costs. The cost of ongoing auditing and problem solving is often overlooked, yet can have a notable impact on a product's total cost.

3. Potential risk-related costs: The cost impact of high-frequency risks, such as emergency airfreight, scrap, and rework, to name a few, can be calculated based on past experience with an existing supplier. New products or new suppliers will require estimates. Other risks tend to have a low probability but could still be devastating, so they should also be considered.

a. Rework. What costs incur when rework is required? These costs can be especially high

for custom products, such as molds or dies.

b. **Quality.** In addition to the cost of lost production and warranty-related payouts when the product fails, quality problems are costly in other, less tangible ways. Think of the profit impact of lost market share, permanent loss of customers, or the negative impact on brand image, and who pays for scrap?

c. *Product liability.* How do the supplier candidates compare in terms of accessibility, willingness, and ability to pay any product-liability claims? It can be difficult to sue a foreign company for damages, and even harder to collect.

d. **Intellectual property risk.** Approximately 5 percent to 7 percent of world trade consists of counterfeit or pirated goods, according to the International Anti-Counterfeiting Coalition.

e. **Opportunity cost.** What would be the cost of lost orders and customers when a supplier cannot respond quickly enough to changes in quantity or product specifications demanded by the market?

f. **Brand image.** What is the impact on brand image of the product's "country of origin" label? At a time when developed nations are continuing to experience economic instability and people are concerned about their jobs, consumers increasingly are buying locally-made goods as a way to help the economy and their neighbors.

g. *Economic stability of the supplier.* It is much easier to investigate and find accurate information about the stability of a supplier located in the home market than it is for a supplier overseas.

h. *Political stability of the source country.* It's not difficult to rate the stability of countries that are already in chaos. It's much harder to correctly assess those that are making good economic progress but whose populations may be destabilizing because of changing consumer expectations and demands.

i. *Exposure to another recession.* The larger inventory and on-order quantities associated with offshoring represent an exposure risk if there should be another severe business downturn. Four months of inventory on hand, en route, and on order could easily turn into much more in a recession.

4. Strategic costs: The following are just two examples of how sourcing decisions can

affect product strategy and value.

a. Impact on innovation. U.S. companies have frequently been urged to offshore most of their manufacturing and focus on innovation and marketing. However, separating manufacturing from engineering degrades the innovative effectiveness of both a company and its home country, according to Harvard Business School (HBS) professors Gary Pisano and Willy Shih.¹ Similarly HBS's Michael Porter has discussed the advantage for innovation of "clustering"—having suppliers, research universities, manufacturing, and others involved in product development and production located near each other.

b. Product differentiation and mass customization. Many companies in developed economies are shifting their focus from commodities to differentiated products through mass customization, producing small quantities of products that conform to the specific desires of the market but at costs approaching those of mass production. It is easier and less costly to make the move to mass customization with short, tightly clustered supply chains

5. Environment: Finally, for each product source, a company should measure the "cleanliness" of the electricity generation at each location, pollution from the production process, the carbon footprint of its shipping operations, the requirements for local warehousing, how it disposes of obsolete inventory, and other activities that affect the environmental impact of its supply chain. Once the "green" impact has been quantified for each source, the next step is to apply a dollar value to that impact.

Conclusion

The practice of applying DFMA is to identify, quantify and eliminate waste or inefficiency in a product design. DFMA is consistent with Lean Manufacturing – it makes the product less expensive to produce, reduces the Total Cost of Ownership, and makes it easier to reshore.

¹ Roger Thompson, "Why Manufacturing Matters," *Working Knowledge* newsletter, Harvard Business School, March 28, 2011.

Reshoring can improve the bottom line for companies and improve the economy as a whole. A strong economy means a healthy consumer market that will ensure the continued demand for local goods. As the reshoring reasons add up, they also grow exponentially in strength: the more manufacturing is reshored, the stronger are the forces that attract it. Adding manufacturing bolsters research and design, improves infrastructure, increases recruitment of and investment in skilled workforce, improves our competitiveness and quality of goods, and provides the synergetic ecosystem in which U.S. companies and industry will thrive.