The true cost of overseas manufacture: Could product design make U.S. manufacturing a more cost effective solution.

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Abstract

In the global market place today more and more companies are looking to the Far East for both assembly and manufacturing. Drawn in by the lure of extremely low labor rates, companies today seem eager to rapidly move manufacturing and assembly off shore. However many of these same companies rarely take the time to understand the true potential for cost savings during the design phase of their own products. Employing techniques like Design for Manufacture and Assembly can easily result in significant savings in terms of both part count and product cost. The question really then becomes is sending a current design overseas for manufacture really the cost effective solution or would companies in the U.S. benefit from taking the time to redesign existing products and keep manufacturing here in the U.S. while still seeing cost reductions? The authors of this paper will explore this question by developing a case study that uncovers the costs of manufacture and assembly under both these scenarios.

Introduction

The headline reads "Forrester Updates Offshore Job Numbers.[1]" Forrester in its research report finds 3.3 million jobs will leave the U.S. by 2015 for foreign service companies. These jobs are in software development and business process outsourcing (BPO). At the same time, Forrester and similar consulting firms claim that they can help guide firms through this difficult process. Job losses have been occurring for decades in the manufacturing sector. In the 1960s –70s this was because of cheap labor and automation in Japan. During the 1980s, manufacturing shifted to cheap labor in Mexico, and now in 2004, it is shifting to cheap labor in the Asia (China). Job migration is a complex issue with many multi-layered facets.

One of the things that is most interesting about observing U.S. manufacturing from the outside, as both the authors of this paper do in their daily lives, is that there is a lemming mentality happening when it comes to outsourcing manufacturing. Company A looks at the competition and sees that their products are now being outsourced and so they feel too that they must now outsource their manufacturing. What seems like the most dangerous part of this trend is that outsourcing overseas is being done with little or no understanding of what the true costs really are. We will uncover in this paper some of the tangible and intangible costs of overseas manufacture in order to provide a 'checklist' that will help companies realize the additional costs associated with outsourcing that need to be taken into consideration.

If you take a careful look and calculate the total cost of offshore outsourcing, the answer may surprise you. Often times the cost benefits are calculated solely on the incredibly low labor cost. The other costs, both tangible and intangible, are rarely taken into consideration because they are not allocated to the actual product, but are paid for by the corporation from various other buckets. Furthermore, firms also become myopic in the design process when they look only to outsourcing for cost reduction. By looking at your product from a design perspective using tools like DFMA, there often are simplified product structures that can invariably lead to cost reductions.

[1] "Forrester Updates Offshore Numbers", Jim Ericson, *E-Business News,* May 17, 2004.

Not all products are a good fit for offshore manufacturing even without taking the design of the product into account.

- High-automated products may not show significant cost savings.

- Weight and size of products also can affect offshore manufacturing. Shipping by either air or sea is costly, particularly for bulky products regardless of weight.

- Products that require scheduling flexibility are poor candidates. Waiting four to six weeks for sea shipments is not viable.

- With newly developed products, undergoing many ECO's and Revision changes, quality issues may arise. Also, inventory on the water may need to be reworked when it arrives.

- Firms with products protected by patents risk losing proprietary information by outsourcing overseas.

- Products that have high dollar equipment needed to produce them will find depreciation is the same worldwide.

We believe that the cost benefit analysis for moving manufacturing offshore sometimes shows a compelling case for keeping manufacturing jobs in the U.S. This requires that a firm redesign its product using the DFMA methodology to reduce part count and cost; as well as, fully accounting for the additional costs associated with overseas manufacture.

Current State of Overseas Manufacture

The U.S. Bureau of Labor Statistics publishes an International Comparison of Hourly Compensation Cost for production Workers in Manufacturing. The data is adjusted and mathematically modeled to be an apples to apples comparison between all the countries that are listed in the report. The last report USDL 03-507, September 2003 showed the following:

Country	Hourly wage in (U.S. $) 2002 yr.
United States	$21.33
Hong Kong	$5.83
Singapore	$7.27
Taiwan	$5.41

The above numbers represent the academic view of Chinese labor rates. The reality is that China has many laws governing the treatment of workers. There are minimum wage laws and laws governing overtime and overtime pay. As a matter of practice, these laws are ignored. The *New York Times* did a series of articles on workers in China, "The Worlds Sweat Shop." Each article focused on workers in a different industry and area of China producing product for the United States.

One of these stories was on the Kin Ki factory in Da King, an enclave outside of Shenzhen, near Hong Kong. Kin Ki is the factory where Ohio Arts Etch-A-Sketch product is made. Production starts at 7:30 a.m., breaking only for lunch and dinner, and continues until 10:00 p.m. seven days a week. Workers' meals consist of rice, beans, and boiled vegetables. Meat is served twice a month. The work is tedious and draining. Unlike the Ohio art factory in the U.S., the Kin Ki factory uses very few machines. Kin Ki requires four times as many workers to injection mold the plastic parts, paint the parts and attach the strings and rods of the of the product's internal mechanism. Workers are paid $85.00 per month. [2] The best day for the workers was when inspectors came to the plant. Most workers do not have legal contracts on file so they were ordered to stay home. The remaining workers were told to memorize false numbers for wages and working hours that would reflect compliance with Shenzhen regulation.

[2] "The World's Sweat Shop. Ruse in Toyland: Chinese Workers' Hidden Woes", *New York Times,* December 7, 2003.

Lack of reliable electrical power supply, water, and protection of intellectual property have relegated China to low-tech final assembly of high-tech products, like flat screen monitors and laptops. Many industries in Southern China that consume large amounts of electricity are required to take one day off a week due to electrical power generation shortages. Jack Hsu, financial controller for Taiwanese Computer peripheral maker, Benq Corporation, stated that he "admired anyone who is brave enough to make cutting edge products in China"[3] Weak infrastructure and political factors are behind China's failure to become a high-tech player.

Impacts of foreign currency

China has pegged the Yuan at 8.28250 to $1 U.S. since 1994. On October 30, 2004, the Bush administration claimed that China "is not violating the 1988 U.S. law against currency manipulation to gain unfair trade advantages."[4] This ruling came despite the complaints of U.S. manufacturers that China's low wages played a major role in the loss of 2.7 million manufacturing jobs in the past three years. The European commission has also warned the Chinese that the under-valued Yuan is giving Chinese manufacturers an unfair trade advantage.[5]

"Federal Reserve Chairman Alan Greenspan warned Congress that the global economy could suffer if China were to move now to allow its currency's value to be determined by financial markets", as some lawmakers and manufacturing associations have suggested. China's banking system is too fragile for the country to immediately abandon its policy of pegging the value of its currency, the Yuan, to the U.S. dollar. [6]

Partly as a result of the pegged Yuan, inflation, previously dormant, has begun to run rampant. In December 2003, it rose 6% over the previous month. The communist leadership is losing control over the economy. After 20 years of growth rates exceeding 9% annually, the government is trying to slow down the economy to try to keep inflation in check. Since the People's Bank of China is not an independent bank, with an authoritative policy board controlled by the communist leadership,[7] its policies are not tied to free market economics. Production costs are unlikely to decrease in the future.

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[3] "China's Tech Ambitions Stuck on the Assembly Line", Doug Young, *Reuters*, May 23, 2004.
[4] "U.S.: China Not Violating Currency Law", Martin Crutsinger, *AP News*, October 30, 2003.
[5] "EU to Complain to China about Currency Trade Balance", John Rega, *Bloomberg*, May 5, 2004.
[6] "Greenspan Backs Currency Peg", Nell Henderson, *Washington Post*, March 2, 2004.
[7] "China Rethinks The Peg Tying Yuan and Dollar", Charles Hutzler, *Wall Street Journal,* February 13, 2004.

Costs Associated with Outsourcing

The news is filled with stories of manufacturing jobs lost to outsourcing to offshore low wage countries of the Far East. Many companies are lured by tales of low labor cost and decide to transition their products to Asia, only to find the initially estimated savings were never realized. Before deciding to source overseas, a firm should analyze the total cost of offshore outsourcing. Many tangible and intangible factors should be taken into consideration.

Shipping Cost

Obviously, beyond the cost of production, one of the biggest costs is shipping to and from the Asia. A firm can either ship by air or sea. Most products shipped by sea are packed into cargo containers. These containers are loaded onto container ships and spend approximately three weeks on the high sea before arriving at port. Regardless of how full the container is, the cost remains the same. The trick is to pack the container as full as possible in order to lower the cost per unit for shipping. A container's cost averages approximately $2600 for shipping and duty. This figure excludes the cost of transport to and from the port in China and to customers or distributors within the U.S. The additional cost of these two land transports often equals the cost of shipping the product by sea. Often neglected, a proper NPV analysis should include an estimate for the cost of inventory carry while in transit. The entire process from land shipping in China, through unload and land ship in the U.S., can take 4 to 6 weeks. Unexpected delays, such as the dock strike of two years ago, can increase this time considerably. Issues around "Homeland Security" impact shipping schedules and these costs continue to unfold. Another important issue that many manufacturers encounter is discovering that the product has to be reworked once it is too late -- on the ocean. Products can't just be shipped back. In addition, a number of fees must be paid upon leaving and entering ports, depending your port of origin and arrival.

Another cost not routinely recognized is that many Asian companies demand payment when the door on the container closes. The U.S. firm carries four weeks inventory that it cannot actually sell. The firm must also insure the cargo against loss.

Every year approximately 10,000 containers fall overboard. Some famous spills include:

- 80,000 Nike Tennis shoes in Mid North Pacific Ocean
- 414 drums of Arsenic near New York City (recovered)
- 29,000 bath toys ducks, frogs, turtles, beavers [8]
- 34,000 hockey gloves
- 500,000 cans of beer into Pacific
- 5 million Lego plastic pieces

About 90 % of the world trade is moved by ship. With that much traffic, there is a risk of collision; such as, the recent collision South of Singapore between oil tanker Mt Kaminesan and car carrier MV Hyundai No. 105. The car carrier with 4000 new cars was sunk when the oil tanker created a hole 165 feet by 66 feet in the car carrier hull. There is also the increasing risk of piracy. In 2003, there were 445 attacks on commercial ships. Many attacks go unreported because shipping companies don't want their insurance rates to rise.

Firms may also ship a product by air. Products with small footprints that are lightweight can be shipped by air cost effectively. For these packages, costs range from $2.00- $2.50 per pound. Products that have large corrugated box envelope sizes, however, are expensive to ship by air and the number that an airplane can carry is limited. Shipping by sea remains the most viable method for transit. We estimate that 17% of product cost is incurred in shipping and logistics.

Travel / Time Zones

Travel to Asia is difficult. The 20+ hours of travel is tiring to say the least; therefore, a company representative wants to maximize his stay and accomplish as much as possible while there. The average stay is a week to ten days. Typically, starting up a relationship with a vendor and launching a product consumes at least three trips to Asia. Most companies allow for business class travel for such long trips. In addition, maintaining that relationship requires frequent contact. We estimate that 1% of product cost is incurred in travel communication and lost time.

[8] If you are walking along the Atlantic Ocean and find one of these floatable toys with First Years imprinted on it, note the time and location. You can call First Years at 1-800-317-3194. When verified as their product, they will pay you a $100 U.S. Savings Bond. The offer is also good in Canada and Iceland.

The time zone difference is 13 hours ahead (DST). This means that you need to communicate early in the morning or late at night. E-mail messages often left for the next day response don't get answered until after U.S. workers have gone home for the evening, thus losing a day's worth of time.

Vendor Selection

There are many ways to get started manufacturing in China from starter factories run by U.S. third parties for you, entering a joint relationship with a supplier, or selecting a vendor to just manufacture your product. Vendor selection is the most critical step in your outsourcing plans and takes a lot of time and effort. A high degree of due diligence to make sure the company that you select can do the manufacturing job is necessary. Multiple RFQ's must be sent to several vendors and their responses evaluated. These costs can run from 0.2 -2% of product cost.[9]

Quality Issues

Manufacturing quality of your product is an issue that requires constant vigilance. China's low labor rate exists because there is a plentiful supply of unskilled workers from the rural areas that are trying to make a better life for themselves. Since payment is often based on the number of units completed, any unit finished is a "good unit." Many a company has been surprised when the container is unloaded and a product sample is pulled to find a variety of quality issues. Inspecting all products before shipment is crucial. Our experience is that these quality defects can run between 1 - 8.0% of product cost. In our later analysis, we assumed an average defect cost of 4%.

Material Costs

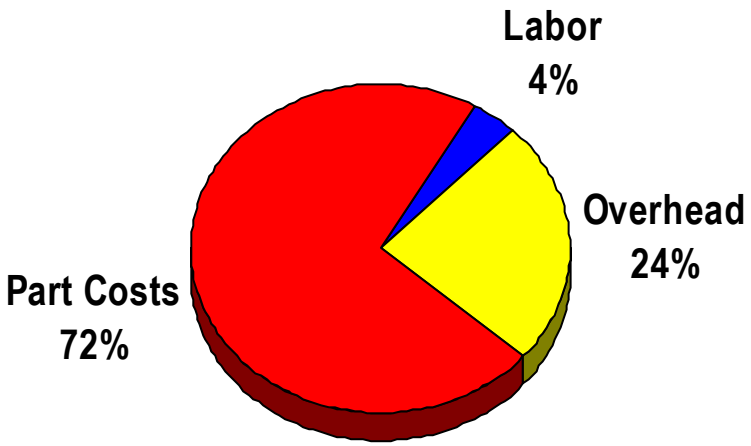
Material costs overseas certainly have different pricing than here in the U.S. In general, these cost differences are not usually significant and they are dwarfed by other costs associated with outsourcing. However, certain types of materials are not available in the overseas markets and these must be exported from the U.S. to the overseas supplier in order to produce the parts. It is imperative that a firm recognizes the source of all materials before beginning to outsource.

Labor Costs

We have already given a detailed discussion of the costs of overseas labor in the current state of overseas manufacturing section of this paper. However it does

[9] "The Hidden Cost of Offshore Outsourcing", Stephanie Overby, *CIO Magazine*, September 1, 2003

warrant mentioning again. It is important to recognize that often the significant part of the product's cost isn't in the labor. The chart below has been created from data gathered by Boothroyd Dewhurst, Inc. over the last few years and is based on costs from U.S. manufacturers[10]. The chart clearly shows that labor is generally the least significant contributor to cost.



Other Issues and Cost to Recognize

A full NPV analysis measures opportunity costs and side effects from a proposed project. In addition to the costs that we have identified in the previous sections, a number of others exist. Naturally, costs depend upon the product and industry structure. The list below details a few but is not all-inclusive:

- Legal Issues
- Theft/Piracy
- Shipping losses
- Cost of additional paperwork
- Cost of employee morale
- Cultural/Communication difficulties
- Loss of manufacturing control and flexibility
- Training costs
- Underestimation of startup costs
- Increasing labor costs once a vendor relationship is established
- Cost of transition
- Cost of layoffs and severance

[10] A typical product cost breakdown, Boothroyd Dewhurst, Inc., DFMA Training Guide, 2004

- Cost of inventory carry due to shipping
- Cost of managing offshore
- Cost of bringing a project back to the U.S.

Even though China has joined the WTO and agrees to abide by all the legal world organizational rules, in reality many laws are violated. Copyright laws, in particular, are not enforced and piracy of trademarked/copyrighted goods is ubiquitous. Many companies will not produce their product in Asia because they cannot protect the proprietary/patent/intellectual properties of a product or its manufacturing process.

Manufacturing in China prohibits the use of just-in-time inventory methods and runs counter to lean manufacturing. Because of the long shipping times, schedules are rigid and companies are less able to respond to changes in market demand.

Upper and lower bounds should be placed upon any cost estimates for producing in Asia. These should include some allowance for catastrophic events such as shipping accidents. In addition, the health environment of China, in particular, has economic costs. The first out break of SAR's occurred in China and its impact on southern China's economy was significant. The more recent outbreak of the Bird Flu has also had some impact, although not to the extent of SARs. Currently companies are beginning to quantify the cost of employees quarantined after trips to Asia.

If outsourcing to China should fail, and this has happened, the cost associated with bringing a project back to the U.S., is high. Typically products that are outsourced do not have the best in-class design. The cheaper manufacturing rates have taken a design in a poor state and made it economically manufacturable. However, how can this product now be brought back to the U.S. and produced competitively? The design must be reworked from scratch, reducing parts and materials in order to compensate for higher labor rates.

Although we believe that the figure is much higher, we have conservatively estimated that all of these miscellaneous costs of outsourcing to Asia add only 1% to the product cost. We feel justified in our assumptions since every product has a unique set of external costs and we feel that our case for leaving manufacturing onshore is strengthened by our conservative assumptions.

Conclusions About Overseas Manufacturing Costs

Together the aforementioned costs, both tangible and intangible, sum to 24% of total product cost as shown in the table below. This number has been calculated based on our experiences with various suppliers and product development companies. Again, this is a conservative estimate because we did not want to argue over particular intangible costs relevant to a particular product or firm. Keep in mind, however, that your analysis should quantify all of the relevant intangible costs for your product.

TANGIBLE	
Baseline Adder for Shipping and Logistics	17%
Finding a vendor	1%
Quality Issues	4%
Travel and communications	1%
All others	1%

Our results compare favorably with numbers that have been published by Gary Larson, Vice President of Sales and Business Development, Electronic Systems Inc., who estimates 15 to 20 percent for added costs of freight, customs, homeland security, logistics, inventory carrying costs and reduction in cash flow.[11] Not fully taken into account are quality, culture, travel and other costs that have been raised in this paper.

Additionally, a West Coast producer of industrial products, which does manufacturing in China, disclosed that a cost adder of 16 percent is needed to cover only the costs of shipping and logistics.

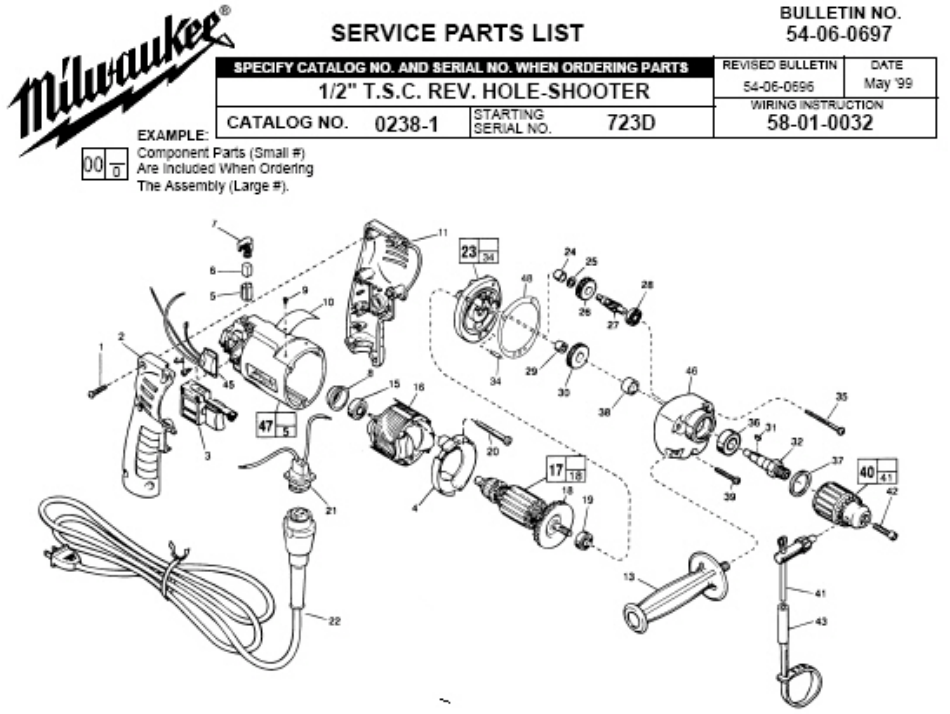
[11] "Calculating the Total Costs of Offshore Outsourcing", *Circuits Assembly*, Susan Mucha, June 2003, pp 28-30.

Milwaukee Electric Tool Case Study

Milwaukee Electric Tool ½ inch Drill Case Study

To lend credence to our general results, we present case studies that quantify all of the costs associated with manufacture in China for two products. In addition, we have applied DFMA to the existing design in order to quantify the potential savings associated with doing redesign on the product rather than producing in China. In particular, we detail the costs, cost savings, and potential cost of overseas manufacture on a Milwaukee Electric Tool power drill.

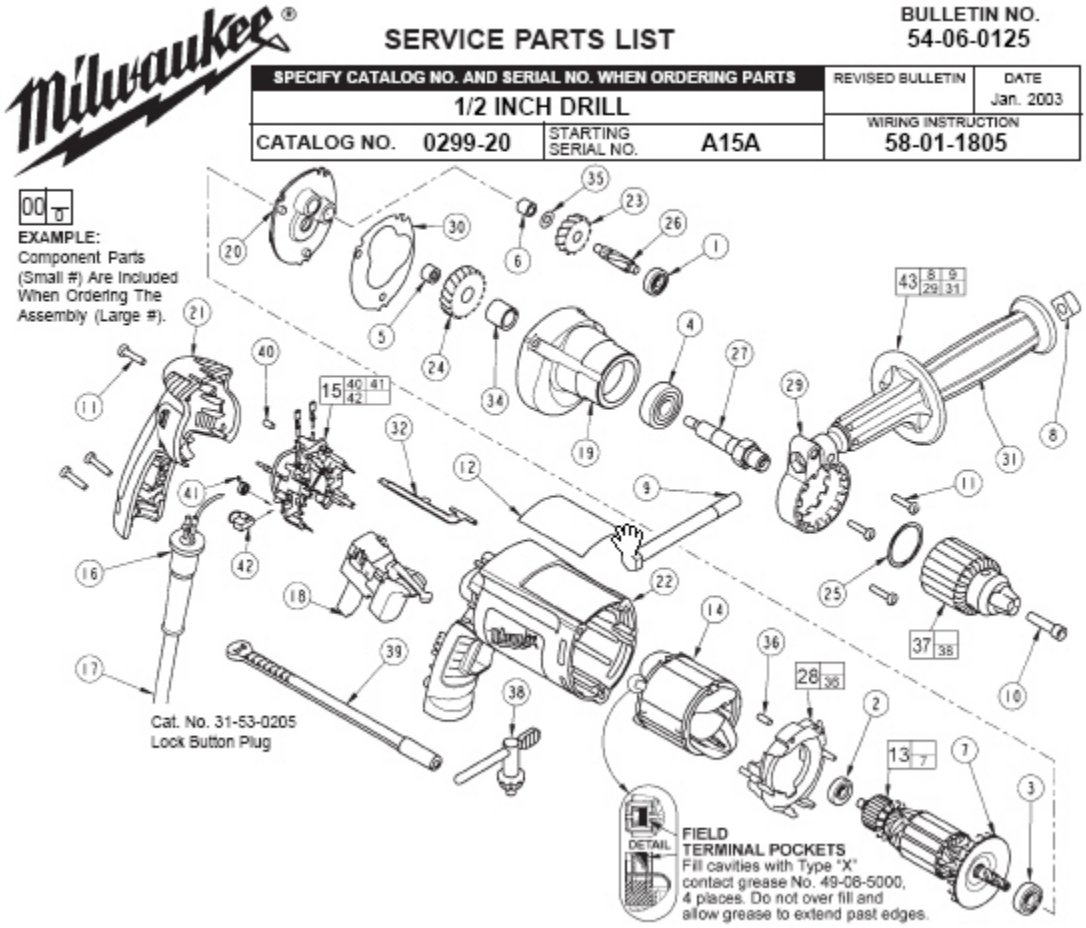
NOTE: *All of the cost numbers provided here have been altered to protect the confidentiality of the information supplied by Milwaukee Electric Tool*



The exploded view drawing above is of the 0238-1 drill. This product was manufactured in 2000 and had a cost breakdown as shown in the table below.

Material	Labor	Total Cost
52.26	41.38	93.64

This product then underwent some redesign using DFMA in an attempt to both improve the design and to reduce the cost. This resulted in the 0299-20 model that is produced today. This drill is shown in the exploded view drawing below.



The cost breakdown for this product is shown in the table below:

Material	Labor	Total Cost
61.25	31.34	92.59

It is important to note that there were several enhancements to this tool as a result of this redesign. This makes an apples to apples comparison of these two designs a little difficult. The data shows, nonetheless, that the old tool had a total cost of $93.64 while the new tool has a cost of $92.59, a savings of $1.05 even with some significant improvements to the features, including a new motor. One thing to note, also, is that the labor cost for the 0238 model is from 2000. Applying a rate increase in labor cost obtained from the Bureau of Labor Statistics, we can scale up the labor costs of the 0238 model to 2004 labor

numbers. Adding an average annual increase of 3.65% from 2000 to 2004 gives the following:

Model	Material	Labor	Total Cost
0299-20	61.25	31.34	92.59
0238-1	52.26	47.77	100.03

Now we see that the savings associated with the redesign effort results in a savings of $7.43 per unit while still supplying a better product than the 0238 model. This in itself would be a good story to tell. A product redesign in which you deliver more value to the customer in terms of quality and performance, and yet, do it at a lower cost than the old unit. However, the push now is to lower costs more and the lure of very inexpensive labor overseas is difficult to ignore. With $31.34 of labor in the current design, a labor rate in China that is significantly less is difficult to overlook. As we have attempted to point out in this paper, there are some significant costs that never hit the product bottom line. These other costs need to be traded off against the potential for cost reduction that still exists within the current tool from a DFMA perspective.

Applying DFMA to the 0299-20 model allowed us to come up with the following suggestions for redesign and their associated cost savings.

1. Change the gears in the drill from being machined from forged blanks to being made from Powder Metal. (a savings of $10.07 per unit)

2. Replace the roller ball bearings with Powder Metal bushings. (a savings of $0.99 per unit)

3. Change the side handle back to the 0238 design, where it is simply threaded into the gear case. (a savings of $1.82 in material and $1.18 in labor)

4. Remove two screws from the gear casing and replace them with two long screws from the back of the handle through the body to hold the gear case to the handle body. (a savings of $0.14 per unit)

5. Mold in the service nameplate and use a laser etching process to mark the serial number. (a savings of $0.25 per unit)

6. Mold a feature into the drill body to hold the chuck key and eliminate the separate part currently used to hold the chuck key. (a savings of $0.28)

By considering all of these savings together, within the design, there exist potential savings of $13.55 in material costs and $1.18 in labor.

The DFMA improvements would now make the cost of the 0299-20 product look like:

Material	Labor	Total Cost
47.70	30.16	77.86

We must still investigate whether sending the current design of the 0299-20 to China for manufacture could result in at least savings of $14.73. The answer might surprise you.

Based on our research, the $0.33 per hour labor is unrealistic. Because establishing relations with Chinese vendors is difficult without experience, setting up a first manufacturing project usually requires the services of a third party acting as a broker in the deal. These third parties charge overhead on the labor as fees for their services. This overhead can be significant; the true labor rate is about $5.10 when you have engaged a third party. Let's assume that there will be no change in the materials cost of the tool. This is unrealistic since the motor winding would have to be shipped to China in order to assemble this product, given the unskilled labor force and quality issues mentioned previously. Let's also assume no other costs involved in the outsourcing including shipping.

Given this labor cost of $5.10, the cost of making the 0299-20 in China would look like the table below:

Material	Labor	Total Cost
61.25	2.37	63.62

Compared with the cost of making the DFMA redesign here in the US of:

Material	Labor	Total Cost
47.70	30.16	77.86

The lure of cheap labor alone gives the illusion of savings of $13.74 per unit. Now, however we must make allowances for ALL of the costs involved in the outsourcing of this design. We add to the product cost our conservative estimate of 24% that takes into account both tangible and intangible costs. The Chinese costs now become:

Material	Labor	Total Cost	Total Cost (adder)
61.25	2.37	63.62	$78.89

The bottom line is that there is an actual increase in the cost of $1.03 per unit to produce this tool in China compared to applying DFMA and still manufacturing in the U.S.

Companies looking to outsource manufacturing to China will typically look for at least a 30% reduction in cost before they will consider it worth the "Leap to China". So even if you believe that the 24% adder that we have developed is an overestimate, take half that number and the cost savings of outsourcing to China become $7.63 or 9.70%. This is still well below the 30% usually required to pursue a venture.

You could also make the argument that our $5.10 labor cost is very high. If you use the same assumptions along with the state advertised labor rate of $0.33 per hour the numbers for making this tool in China become:

Material	Labor	Total Cost	Total Cost (adder)
61.25	0.16	61.41	$76.14

Here we see that the resulting saving for Chinese manufacture is $2.75 or a 3.5% savings over manufacture here in the U.S. This analysis assumes the 24% cost adder with a comparison to the DFMA redesign.

Consumer Goods Product Case Study

NOTE: *All of the cost numbers provided here have been altered to protect the confidentiality of the information supplied by this consumer goods manufacturer.*

An analysis was conducted on a major subassembly of a consumer goods product. The subassembly consisted of 26 electro-mechanical parts and a DFMA analysis indicated that the theoretical minimum part count was 9. Reducing the part count by 14 down to 12 parts is realistic and could result in a cost saving of 27%. Currently the costs associated with the production of this product are $53.28. The application of DFMA analysis indicated that we should be able to reduce this number to $38.89.

This consumer goods manufacturer was able to supply us with cost information for the production of this product in China. The manufacturing cost of the unit in China including only the costs of parts and labor is $35.41. If you now apply the conservative cost adder associated with overseas manufacture of 24%, the

actual cost of production in China for this product is $43.91. When compared to the cost implied by DFMA redesign of $38.89, outsourcing to China is no longer an attractive alternative.

Unfortunately, many organizations are myopic and focus only on the labor savings without adding back the external costs. Superficially, the quoted cost in China appears to be $17.87 below the U.S. cost of $53.28. However we know that the actual cost of Chinese manufacture needs to be increased to account for additional tangible and intangible costs (our 24% adder) resulting in the cost reduction only being $9.37. Now if we apply DFMA as we previously indicated, we will potentially see a cost for this unit as shown below:

Design Variant	Cost
Original Design in U.S.	$53.28
Original Design in China	$35.41
DFMA redesign in U.S.	$38.89
Estimated Cost for China (24% adder)	$43.91

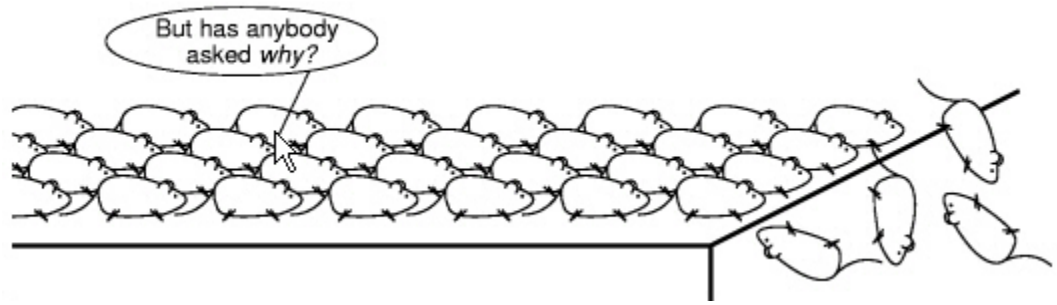
The data clearly show that it is imperative to consider all the additional costs associated with Chinese manufacture. Here applying DFMA to redesign the product and manufacturing within the U.S. is a more cost-effective solution.

Moreover, for this particular product the smallest corrugated packaging is rather large. Shipping and logistic costs are significant. The actual cost for shipping and logistics of this product is $10.15, a 22.2% adder. This is 5 percentage points more than our average estimate of 17% for shipping and logistics costs. This only worsens the picture for Chinese manufacture of this product, since it increases the adder to 29%, rather than the 24% that we assumed.

Conclusion

We believe that our analysis and the previous discussion show that you need to look at all the costs associated with manufacture in Asia. Even though many of these costs are not accounted for directly in the product bottom line, you need to understand their magnitude and include them into the analysis when deciding whether there are benefits to outsourcing in Asia. Our results show, albeit in a limited sample, that just blindly outsourcing a product to Asia for low labor rates is not always a good decision.

The obvious question is why not send the DFMA redesign to China and have it manufactured there? This is of course a good option. Our limited experience indicates that potential savings in the U.S. do not always translate to Asia because of shipping, labor skill, quality and material availability. Some of the issues previously outlined reduce DFMA estimates for manufacture in Asia. The one option that it does give you is the ability to bring the design back from China and still be able to manufacture it in the U.S. if the need should arise.



Look carefully before you leap!