

Domestic Versus Offshore PCB Manufacturing

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The component costs of offshoring have increased along with the risks that go along with it, challenging established manufacturing trends.

Overview

It had long been accepted that as products move through their life cycle towards standardization, manufacturing migrates offshore. Eventually, even leading edge products are also produced overseas with the help of new technology and an increasingly symbiotic global economy. But circumstances have changed. The component costs of offshoring have increased along with the risks that go along with it, specifically threats to domestic intellectual property.

For this reason, PCB manufacturing is returning home. Recent events indicate companies are re-examining decades old paradigms and even reversing established manufacturing trends. In 2012, Sony UK Technologies enabled process automation by adding just two holes to one of their PCB designs. They then resumed manufacturing the board domestically after offshoring it for years in China.

If you are sending your PCB manufacturing off shore, what factors weighed heaviest in your decision making? How do you know if offshore manufacturing still makes sense for you? This article considers both simple and complex ideas for cost-benefit analysis to help guide your decision process.

The Trend Away From Offshore PCB Manufacturing

Larger manufacturing industry trends are beginning to take hold in the PCB world. With high volume manufacturers like General Electric profitably 'reshoring' large scale production, PCB manufacturers are taking note and challenging old paradigms. PCB design complexity is increasing and production volumes are dropping, and many manufacturers are finding that the realized savings from offshoring may not offset the risks associated with it.

A growing list of factors is tipping the scales back in favor of domestic PCB manufacturing. Three basic elements from this list underpin a simple cost-benefit analysis. They are:

- Rising wages abroad
- Persistent high overseas transportation costs
- Limited improvement of speed to market

In the case of low volume, single-run PCB manufacturing, a simple measure of the cost delta between domestic and offshore production illustrates dwindling savings. The average manufacturing wage abroad is increasing 18-20% per year while domestic worker productivity continues to improve, adding to the appeal of home grown manufacturing. Overseas shipping remains expensive just as cheaper domestic energy is lowering the cost of production here in the US. Delays have always cost money, so the additional time still required for an offshore vendor to manufacture and deliver a PCB becomes a bigger issue. As the cost differentiators narrow or even reverse with changing conditions both here and abroad, the trend toward reshoring is gaining momentum.

Rejecting the “Take What You Get” Philosophy

Problems with Quality Assurance (QA) are helping to accelerate this reshoring trend. Quality issues occur frequently and are usually preceded by an absence of transparency. Collaboration with offshore manufacturers is inherently limited, and the loosely-coupled relationships foster a ‘take what you get’ transactional paradigm. This leaves the product manager to hope and assume his PCB is properly manufactured to design while offshore.

Offshore quality control issues are expected to fuel the return of at least \$2.5 billion in electronics manufacturing to the US over the next three years. PCBs represent a significant portion of that amount, meaning projects requiring small to mid-level PCB volumes can no longer settle for offshored product that *almost meets* – or fails to meet – design requirements.

Your Intellectual Property Won’t Protect Itself

The same PCB designs not being manufactured to spec are increasingly at risk of piracy. GE reshored its Geospring water heater in 2012, even though they had already initiated production abroad. The move was motivated by the need to protect the company’s intellectual property. If the intellectual property of one of the world’s largest corporations is fair game, what is the risk to a PCB design from a company with fewer legal resources?

Online PCB chatter about reverse engineering in Chinese facilities illustrates the frustration felt by product managers who send production abroad to save money. The money saved offshore is promptly lost if you suddenly find yourself competing with a cheaper version of your own design.

Domestic manufacturing becomes more appealing with the average wage abroad increasing 18-20% per year.

Exploring the Benefits of Domestic PCB Manufacturing

At Sunstone, we have found that asking the right questions leads to the best outcomes when considering offshore versus domestic PCB manufacturing. Lower volume PCBs face greater relative risk to the bottom line, so risks of offshoring can help make domestic manufacture more appealing for this type of product.

Reshoring may even be the preferable — though not obvious — choice for higher volume PCB manufactures. With larger production volumes, even modest per-unit savings can appear attractive on the surface, suggesting that offshoring is the right choice. However, those savings paint only half the picture. Our experience tells us that less easily quantifiable factors pose greater obstacles to offshoring than rising Chinese wages or high crude oil prices.

When weighing the pros and cons of offshore manufacture, we advise two critical actions:

- Carefully consider the less apparent problems associated with offshoring.
- Ask questions aimed at challenging both options.

Offshoring Production Can Onboard Problems

As easily identifiable costs associated with overseas PCB manufacturing rise and gain attention, you should also consider less apparent complications. If you plan to off-shore PCB manufacturing, carefully examine the impact to your domestic operations.

Offshore Manufacturing Does Not Automatically Equal Savings

We encourage our customers to avoid evaluating the potential costs of offshore PCB manufacturing along only two dimensions. Rising transportation fees and overseas wages tell an incomplete story. There are real, indirect costs that may be minimizing or even eliminating savings from offshore manufacturing.

If you carry more inventory than necessary to optimize your transportation buy, the real expense of overseas shipping also includes the costs to store, handle, and insure excess supply. An offshore supplier unable to support your Just In Time (JIT) inventory requirements translates into unfulfilled orders and lost business. When offshore PCBs come close — but fail to meet — design specifications, the resources required to re-tool the boards or adapt the product to accommodate them masks the real cost of low yield.

Once these potential hidden costs are considered, the net savings from offshoring may not justify the risk to your overall operation.

Risk Can Unleash Additional Costs

Offshore PCB manufacturing does incur risk, and mitigation of that risk places burden on your domestic team. This creates additional hidden costs that can quickly add up to offshore manufacture actually being more expensive than domestic. How much time and effort do you spend coordinating and policing offshore PCB manufacturing?

An overseas manufacturer in a time zone ten to fourteen hours different from yours literally builds your board while you sleep. Unfortunately, if you need to collaborate about the project with someone on the offshore team, one of you will be getting up in the middle of the night to do so. Disruptions to routine like this come with a cost. Cultural differences can lead to miscommunications, misunderstandings, and expensive mistakes.

In order to ensure an offshore PCB build is properly executed, some measure of domestic resource must be diverted to focus on it. The critical question is, “how much?”.

Ask the Right Questions

To be fair, offshoring can also save significant amounts of money if it is a good fit for your needs. From our experience, once you measure the true cost drivers of offshore production and identify its impact on domestic operations, the answers to a few more key questions will illuminate what choice will create the best results for you.

Does Your Volume Justify the Journey?

Volume is one critical factor in determining whether to use a domestic or offshore manufacturer. Offshoring favors established PCB designs requiring high-volume runs with long lead times. The larger potential aggregate savings better insulates your bottom line against less apparent offshore manufacturing costs.

The return on offshore manufacturing investment diminishes quickly when dealing with lower volume or prototyping production. Offshore production manufacturers are optimized for large runs and will not deviate from process to devote additional attention to non-conforming projects. This QA risk alone should give lower volume producers pause.

A domestic resource offers more transparency to the manufacturing process, and collaboration happens faster and with less effort. Issues resolve quickly, which minimizes risk to yield and PCB quality.

Depending on your annual volume, even a single trip to Shanghai or Chennai to address quality issues could reduce or eliminate potential savings from offshoring. Overseas site visits really guarantee nothing. If your product requires a more agile process that includes design conception or prototyping, you make yourself vulnerable to a wide range of new variables and pain points.

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Excellence is Relative

During prototype design, you need effective communication and coordinated effort to succeed. Transition plans, phase-ins, phase-outs, and revision control demand immediate attention that is sometimes unavailable because of time zone differences or language barriers. Respected PCB fabricators in the US build their businesses by excelling in these areas, while offshore vendors simply aren't structured to provide the responsive support often required in such situations.

Even if you have an established PCB design to manufacture, unless you are prepared to overstock to accommodate your offshore vendor, larger production runs will take precedent over yours. This widely accepted practice impacts scheduling and can ripple through your supply chain, adding up to significant delays in getting the finished product out the door. Domestic manufacturers are structured for better flexibility, able to provide real time support, and more likely to better meet the needs of low volume production. If you operate on a JIT basis, fabricators located in your hemisphere also pose less of a scheduling risk.

In cases where offshoring fits volume and scheduling needs, be prepared to deal with cultural differences in business paradigms. What you may consider a problem with scheduling or quality may be your offshore vendor's idea of premium service and products. Does your offshore supplier share your vision of good customer service? If your foreign PCB supplier does not buy into or understand your expectations, no amount of intercontinental oversight will bridge that chasm.

Are You Getting What You Paid For?

Once your boards arrive from the offshore fabricator, yields become your next concern. We again encourage multi-dimensional analysis of the production. Instead of targeting a percentage yield and checking a box, also consider consistency of yields over time along with the board's functional reliability in the end product.

Long term reliability is a key measure. Counterfeit components routinely find their way into PCBs manufactured offshore. Some substandard parts are easy to spot, others not so much. A Rolex knock-off purchased from a Hong Kong street vendor requires some time before the cheap internal parts fail and the faux precious metal tarnishes. Likewise, counterfeit components in your offshore PCB may stand up to initial testing, then fail after your product is in use. Counterfeit components impact product performance, end customer satisfaction and eventually your reputation in the marketplace. This makes for a high price to pay, but a difficult cost to measure

Are potential savings worth the risk to intellectual property?

Your intellectual property is at greater risk once it moves offshore. The threats to your IP are complex, vary from country to country, and require substantial financial commitment to combat. Domestic patent, trade secret, and mask work laws are antiquated and provide minimal protection. Little or no motivation exists in places like China to protect US corporate intellectual property. Their laws aimed at protecting foreign IP are mostly toothless and carry limited enforcement effort with them.

As we pointed out, even GE chose to reshore its product rather than spend financial resources battling the threat to their IP in China. Smaller companies realistically have few options for securing their IP. Thoroughly vetting partners to determine reliability can help, but most companies are making a leap of faith when they send their IP offshore.

Conclusions

Offshoring no longer guarantees a lower cost of production. Threats to intellectual property in countries like China have heightened interest in reshoring. As a result, trends indicate PCB manufacturing is returning home.

Making the right decision about domestic versus offshore PCB manufacturing depends on a thorough cost benefit analysis. Your results will vary depending on volume and design requirements. We encourage our customers to look for hidden costs of offshoring and seriously consider its less quantifiable pain points, like the impact on inventory management and burden on the domestic operation.

When you remove hidden assumptions and question offshoring paradigms, the answers you find will guide you toward better outcomes. You might find that a domestic manufacturer that specializes in low volume, high-mix manufacturing provides a viable alternative to offshoring your project.

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