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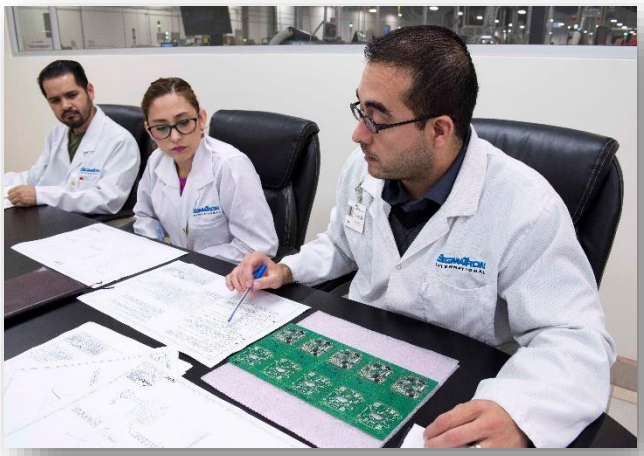

Four Ways to Reduce Project Transfer Cost

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Four Ways to Reduce Project Transfer Cost

By Curtis Campbell

Transferring projects from internal manufacturing or from one contract manufacturer to another have both measurable and hidden costs. Price differences, tooling and non-recurring engineering (NRE) costs are easy to measure. The costs of transferring supply chains from one region to another, the learning curve associated with working with a new partner or the added staff time that qualifying a new source requires are more difficult to measure.

The team at SigmaTron International regularly deals with project transfers, and the Company's systems and processes are designed with efficiency in mind. This whitepaper looks at four areas that drive project cost and ways to minimize that cost.

The four areas are:

- Project launch learning curve
- Manufacturability/testability issues
- Tooling/non-recurring (NRE) surprises
- Evolving project requirements.

Project Launch Learning Curve

One of the biggest cost drivers in transitioning a program from one manufacturing location to another is the new team's learning curve. There are a lot of reasons for cost surprises in the process. In some cases, the previous manufacturer may have made undocumented "fixes" to a product with design for manufacturability (DFM) issues that aren't conveyed in the transfer process. Quote assumptions may have assumed automation where only manual assembly is possible due to board clearance constraints. There may be errors in documentation, particularly when the project is transferred from one contract manufacturer to another. Cost surprises may also occur if the qualification process is not well understood by the new contract manufacturer. Teamworking relationships may take time to gel.

The key to minimizing the probability of these things happening is to select a contract manufacturer with a project launch or new product introduction (NPI) process designed to identify and fix these issues before they are generating cost surprises.

For example, at SigmaTron International, the NPI process starts with the receipt of CAD files from the customer, along with the BOM and AML. Other issues that can potentially impact production cost are also evaluated as the process flow is designed. This focus on developing the most efficient process flow is particularly beneficial for highly regulated products, where there may be limitations on process changes once the product is in production.

Once the process flow is approved, SigmaTron's use of leading edge software enables machine programming to be done using the CAD data. This cuts time and ensures accuracy.

Product and process validation is done based on customer requirements. Any issues discovered during NPI and pre-production runs are documented and provided to the customer. The result is that defect opportunities are eliminated wherever possible, improving first pass yields and eliminating non value-added activity. Equally important, the process is designed to convey information back to the customer in an easy-to-analyze and make decisions upon format. This level of communication also helps customer product engineering teams stay in the loop in terms of manufacturing considerations related to their product design strategies.

Manufacturability/Testability Issues

One of the keys to ensuring superior quality is eliminating defect opportunities before they happen. The DfX or design for excellence process assesses the product for a range of potential improvements related to manufacturability, testability and product lifecycle management (PLM). It helps eliminate defect opportunities caused by poor design, ensure an optimum test strategy is developed and helps identify any components with availability or obsolescence risk issues.

At SigmaTron, DfX assessments are performed during NPI when projects don't involve a product development engineering support element during the design phase.

As the last several years have demonstrated, PLM evaluation is critical in minimizing component availability risks. Companies with sole-sourced components on the AML are always at a greater disadvantage in a constrained materials market. Selecting newly released components or components near end of life cycle also increase material availability vulnerability. SigmaTron checks for these issues plus evaluates an AML against its experience base with suppliers. Other areas that may be evaluated include:

- Overspecification of parts (too many different resistor values, unneeded finishing on parts not seen by end users, etc.)
- Connector attachment options not robust enough for product use or maintenance
- Layout land pattern to component footprint mismatch
- Errors in panelization assumptions that waste PCB substrate material.

Design for manufacturability (DFM) evaluates the product for issues that make it more difficult to manufacture or create defect opportunities. DFM analysis is performed using a combination of Valor and proprietary software tools. The documentation review process also uses a Valor parts library (VPL) to verify the footprint of all components specified in the bill of materials (BOM) against the land patterns used in the layout. This helps eliminate both the opportunity for defects caused by manufacturability issues plus eliminates the non value-added time that can be spent reprogramming

machines or re-spinning the printed circuit board layout if the component packaging specified in BOM doesn't match the land patterns used in the layout.

In making its DFM recommendations, the engineering team utilizes a five-level, color-coded form that helps prioritize the criticality of each recommendation. The five levels are:

- Red/Critical: a major process/assembly issue
- Orange/Hot: yield improvement suggestion
- Yellow/Warm: minor concern
- Green/Cool: no immediate concern
- Blue/Ignore: no action required.

The color codes apply to both open recommendations and closed recommendations so once an Orange/Hot item is closed, it may be coded as Green/Cool or Blue/Ignore.

Design for testability and overall test strategy are also analyzed. SigmaTron's team has a track record of working with customers to optimize test strategy and test fixtures and equipment.

Tooling/NRE Surprises

When the entire design is owned by an OEM, tooling and NRE are generally consistent with originally quoted costs. However, sometimes Asian contract manufacturers amortize tooling costs for fabricated parts or quote an off-the-shelf product for a subassembly that isn't available if the product is transferred to another contract manufacturer. These shortcuts do reduce time to market and may lower development and/or tooling costs in the original build. However, they become golden handcuffs if the OEM's supply chain management team wants to move the project to a different contract manufacturer.

SigmaTron International has both engineering and supply chain management resources able to deal with this type of issue cost effectively. Its design engineering group offers a joint development model for companies needing product development support aligned with its design competencies as well as fractional engineering resources to support specific re-design needs.

A key benefit of this type of gap filling engineering capability is that it allows engineering resources to be customized to customer needs, in some cases providing "as needed" engineering support over the entire life of the product and in subsequent generations. The team's expertise with a wide range of communications and display technologies aligns well with the evolving nature of many consumer products and instrumentation applications.

Additionally, SigmaTron operates an International Purchasing Office (IPO) in Taiwan with the ability to identify a broad range of suppliers. This can be helpful in situations where an off-the-shelf subassembly or fabricated part won't transfer with the project. In addition to identifying best sources and monitoring trends in each commodity, the IPO team manages supplier quality in Southeast Asia, helping to ensure that new supplier recommendations reflect superior quality suppliers capable of meeting project requirements.

Evolving Project Requirements

Even the most efficient project transfer processes take significant time and generate a non-trivial amount of both measurable and hidden non-recurring cost. Project requirements will evolve and change over time. Consequently, finding an EMS provider capable of aligning its service solutions with changing project needs will save money over time. Companies outsourcing should internally assess how their needs are likely to change and whether the contract manufacturers under consideration will be able to adjust to those changes. Will a board-level project eventually be entirely outsourced at a box build level? Will there be advantages in migrating older margin-sensitive products to lower cost labor markets? Are any technology shifts on the horizon? Would it make sense to outsource repair depot or fulfillment on certain product lines? Is engineering support required?

SigmaTron's teams proactively focus on continuous improvement strategies, which benefits projects that evolve over time. For example, during its weekly Gemba walk, a team in SigmaTron's Tijuana, Mexico facility identified the potential for improvement in a program experiencing significant volume increases. The team then initiated a DMAIC (define, measure, analyze, improve and control) project to improve throughput and operator productivity.

The team utilized a SIPOC (suppliers, inputs, process, outputs, customers) diagram during the Define phase to create a high level process map of all inputs and outputs, similar to the mapping done in value stream analysis. They mapped the process and then created a current state production layout. This exercise did two things. First, it ensured a high level understanding of the scope of the production process they were evaluating. Second, it helped them identify process elements that could be improved. Time studies were performed on specific production steps to determine areas of line imbalance. A steady-state production layout was created that reflected an improved, better balanced production layout. In the current state layout, printed circuit board assembly (PCBA) arrays were separated into individual pieces prior to the conformal coating inspection step. In the steady-state layout, arrays were inspected prior to the depaneling step. As part of the DMAIC Control phase, electronic pacemakers were added to track units completed by hour to ensure that production operators were aware of output vs. goal on an hour-by-hour basis.

Takt time, or the average time interval between the start of production of one unit and the start of production of the next unit, was cut by more than half in the steady-state process, improving throughput and operator productivity. The entire project took less than a week.

In terms of supporting longer term changes in requirements, SigmaTron is able provide a tailored solution for its customers that can be as limited as PCBA manufacturing and as complex as system integration, fulfillment to end market and repair depot support, which works well with projects that evolve over time. As mentioned earlier, the Company also has engineering resources able to support product development or redesign activities.

This scalable solution approach offers customers the ability to build different product lines in different facilities when their requirements don't fit a single facility option. Forecasting and production layout is optimized for those projects. For example, SigmaTron's facility in Elk Grove Village, IL has a box build area that has been optimized for smaller volume box build production enabling unrelated products to share the efficiencies and economies of scale of a standardized work cell arrangement, even though project volumes don't justify a dedicated work cell. Workstations are designed for easy changeover and a dedicated team supports the area, ensuring correct materials are stocked point of use as needed and everything is in place to support the products being built that day. Conversely, SigmaTron's facilities in China and Vietnam have been optimized for high volume production. Its three facilities in Mexico support both medium and high volume production. Its two U.S. facilities also support a range of project volumes.

SigmaTron's support resources can be flexed among facilities, so choosing a facility in a lower cost region with minimal overhead does not translate to a loss of expertise. For example, a complex test requirement in Vietnam may be supported by a test engineering team in China or the US that has encountered similar challenges. This leveraging of expertise helps keep staff overhead at reasonable levels while ensuring that customers have access to the right level of expertise, regardless of the facility they choose. And if projects need to move from one region to another as requirements change, SigmaTron can quote costs and discuss transition activities so that there is detailed data to base the decision on.

Transferring outsourced manufacturing projects carries both measurable and hidden costs. Choosing a contract manufacturer with robust processes to mitigate unnecessary cost has significant benefit. This savings can increase when the chosen contract manufacturer also has the ability to evolve its solution as project needs evolve over time.

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