Simplifying Sourcing Series

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Optimizing Outsourced Electronics Manufacturing

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Optimizing Outsourced Electronics Manufacturing

By Curtis Campbell

In a perfect world, outsourcing electronics manufacturing would be as simple as buying a fabricated part. However, the complexity of outsourcing manufacturing is rarely a perfect world scenario. The added complexity of bills of materials (BOMs) with hundreds of parts, narrow process windows, variable forecasts and supply chain constraints drive the need for a much more aligned working relationship. This whitepaper looks at the outsourcing process and discusses key areas and points of value that teams outsourcing production should consider. Special consideration is given to the logistics challenges that may be present in the mass installation settings common in the large-scale renewable energy sector.

These areas include:

- Initial documentation
- Contract manufacturer improvement recommendations
- Price vs. total cost
- Specialized logistics considerations
- Evolving project requirements.

Initial Documentation

One of the key challenges companies new to outsourcing face is ensuring that all necessary information is ready for transfer. Internal production teams are often not as disciplined about documenting small changes that are made in products or a process over time. In analyzing potential suppliers, ask for a description of the process they have for transferring work out of companies who haven't outsourced previously. Ask questions about the supplier's ability to identify and address gaps in documentation. Also, discuss their process validation procedures.

Most contract manufacturers have some form of new product introduction (NPI) process. The NPI phase is the critical step in ensuring a smooth launch to volume production. This is the phase where qualification runs prove out design and process assumptions. It is also the point where critical transfer of knowledge needs to take place in both directions. At the EMS provider level, all information needed to successfully build the product needs to be identified and transferred.

At SigmaTron, the NPI process starts with the receipt of CAD files from the customer, along with the BOM and approved materials list (AML). If design for manufacturability (DFM) and product lifecycle management (PLM) activities have not been performed earlier in the process, they are performed during NPI.

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.

Contract Manufacturer Improvement Recommendations

Contract manufacturing is a margin-sensitive business and mistakes in manufacturing are often not reimbursable. This has driven a strong focus on building quality into products through DFM and process control. Supply chain management and logistics also play a role. On-time delivery requires accurate forecasts aligned with component lead-time requirements, an AML that includes alternates and an efficient test strategy. When a contract manufacturer suggests design modifications, the addition of new suppliers, changes to forecasting practices, or a test strategy aligned with the volumes being produced, they are simply trying to improve production outcomes. Adopting those recommendations can reduce defect opportunities, lower costs or improve delivery performance.

As previously mentioned, SigmaTron's NPI process is designed to identify potential manufacturing issues as part of the transition effort and communicate recommendations for improvements.

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 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 component packaging specified in BOM doesn't match the land patterns used in the layout.

In making its DFM recommendation, 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.

SigmaTron's team also works with its customers to determine the best options for cost effective test. Their core strategy focuses on four main points:

- Keep it simple
- Eliminate excess handling
- Standardize and automate where practical
- Minimize system-generated variation.

SigmaTron takes a two-part approach to PLM which involves both engineering and supply chain management resources.

Customer BOMs associated with longer life products undergo a lifecycle analysis at the quote stage. SigmaTron also uses an outside service to provide more detailed custom reviews, when agreed upon as an additional service. The analysis normally looks at the lifecycle stage of each component, how many years it has been in production, the anticipated number of years to end-of-life, available alternate components and links to datasheets. Identifying potential obsolescence risk and alternate sourcing

options early helps ensure the best and lowest cost range of options for proactively addressing the issue.

SigmaTron's experienced materials team also works closely with suppliers to identify potential availability and obsolescence issues as early as possible and recommend the most appropriate solution.

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 end 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.

Price vs Total Cost

Unit price represents just one dimension of the total cost of outsourcing with a specific contract manufacturer. Some costs, such as shipping, tooling, tariffs, etc. are measurable. Other costs are much harder to measure. These hidden costs can include:

- Extra staff time required to support the contract manufacturer
- Travel costs and time if on-site visits are necessary to address project issues
- Product availability issues if the contract manufacturer doesn't have the ability to navigate current supply chain challenges
- Cost of field repair if the contract manufacturer doesn't have adequate process control.

In short, unit price must be evaluated in conjunction with audit observations. Some questions to consider are:

- What is the contract manufacturer's track record with delivery performance during the last year in projects of similar size and scope?
- What processes are in place to address material constraints and logistics challenges?
- How robust is the NPI process?
- What continuous improvement methodologies are in place?

Specialized Logistics Considerations

Products that are sold in mass installation settings have unique challenges. Shipment timing is often driven by the end customer's installation schedule which can be impacted by delays in other areas of that project. There may also be specialized configurations unique to each project or region. Typically, end customers want the exact quantity shipped to arrive when they are ready to install. Storage space is often limited and a late shipment can delay other phases of the installation that occur after the product is installed. Neither an EMS provider nor their original equipment manufacturer (OEM) customer want excess raw materials or finished goods inventory building up should the end customer's schedule push out. Similarly, enough raw materials and correctly configured finished goods inventory must be in place to ship as installation projects need the products.

SigmaTron's systems and processes support these types of logistics. One example involves a project for a customer in the renewable energy sector. The products manufactured are control systems used in mass installation settings, with demand dictated by end customers' installation schedules.

SigmaTron uses a combination of proprietary and internally-developed systems for enterprise and shop floor management. All facilities utilize a common ERP system plus third-party PLM tools.

The combination of an industry-standard ERP software with an internally-developed iScore suite of supply chain management tools enables all stakeholders to track demand, material on order, inventory, work-in-process, finished goods and shipments. An MRP Share program provides suppliers with complete customer forecast visibility, plus current inventory and material on order.

On the supply chain side, this system enables the purchasing team to view consumption across the company on a given part or part manufacturer.

Customers can be given visibility into inventory status via the Score™ customer portal. Score gives customers the ability to track product through the manufacturing process with order, manufacturing and shipping status available 24/7.

In this example, the control systems are being built in SigmaTron's facility in Acuna, Mexico to support the customer's North American customers and SigmaTron's Suzhou, PRC facility to support the rest of the world.

To better address the needs of customers with this type of end market demand, SigmaTron created a Manager of Account Planning position who coordinates activity between Program Managers and Purchasing, ensuring that changes in customer demand, material constraints and excess material associated with end customer schedule changes are being reconciled on a weekly basis.

In the case of this customer, shipments are made in specified quantities directly to end customers based on a just-in-time schedule. A blanket purchase order is in place and several weeks of product is stored in a finished goods Kanban. Replenishment timing is based on customer pulls.

The Manager of Account Planning coordinates globally, so if there is a pushout in one region and demand increase in the other region, purchasing can redirect raw material shipments to the region needing the inventory. SigmaTron's real-time systems provide the necessary visibility to support this effort.

This approach has also helped in the transition of different product generations. When the next generation of product is ready, reports identifying excess and obsolete components are generated so that the new product can be cut in as existing raw material is fully consumed by the previous product.

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 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. As mentioned earlier, the Company also has engineering resources able to support product development 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 facilities in Mexico support both medium and high volume production. U.S. facilities support a range of project volumes, as well.

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.

Looking beyond an EMS provider's manufacturing capabilities to determine ways that supplier can closely align support with your team, will eliminate significant cost over the life of program. Internally analyzing longer term needs as well as current needs will help in identifying EMS providers capable of evolving their service mix with changing product needs.

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