A whitepaper by Symphony Consulting and Arena Solutions

Manufacturing Outsourcing: Seven Common Pitfalls to Avoid

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whitepaper

Manufacturing Outsourcing: Seven Common Pitfalls to Avoid

Since the late 1990s, outsourcing has become a way of life for electronics manufacturers. Most original equipment manufacturers (OEMs) no longer consider manufacturing to be a core competency. Even in cases where some of this capability is retained in-house, there is an ongoing effort to evaluate more activities that can be offloaded to a contract manufacturer (CM). These CMs, whose role in the electronics industry was previously limited to assembling printed circuit boards, have transformed themselves into large-scale manufacturing powerhouses. Modern CMs provide their customers with a one-stop shop solution, providing excellence not only in manufacturing, but also in materials management, design and test services, order fulfillment, and logistics.

Despite the significant benefits that come with outsourcing, there are also risks and challenges for OEMs to consider. Outsourcing, by definition, leads to loss of control. Activities that would have traditionally been conducted within an OEM's four walls by the OEM's employees, and that would be visible on the OEM's internal information systems, are now placed in the hands of a manufacturing partner and managed through documented business processes, contractual agreements, and software tools. This new supply chain approach requires new thinking; adapting previous approaches without building new processes and infrastructure will lead to loss of control, and the benefits of outsourcing will be offset by newly introduced costs and risks.

Through our years of experience in working with electronics OEMs and CMs, we have observed seven common pitfalls that impact manufacturing outsourcing success:

1. **Selecting the wrong contract manufacturer**
2. **Quote-and-go approach**
3. **Negotiating a weak contract – or no contract at all**
4. **Poor NPI project management**
5. **Inadequate change management processes and infrastructure**
6. **Broken environmental compliance management**
7. **Ignoring the hidden costs of going offshore**

In each case, the impact on revenue, cost of goods sold (COGS), quality, inventory levels, and time-to-market can be easily measured. In this whitepaper, we will offer more insight on these seven most common mistakes and steps that can be taken to address them.

1. Selecting the Wrong Contract Manufacturer

Working with the wrong CM is at the root of many problems that we observe in outsourcing. An OEM selects a handful of contract manufacturers – or worse yet, a single CM – and starts discussing business without having a clear understanding of the appropriate selection criteria. Key inputs such as geographic location, technical capabilities, materials management capabilities, quality control, strategic fit, and financial health are overlooked or discussed too late in the evaluation process, as cost or schedule overrides all other concerns. Cutting corners like this is often justified in a variety of ways: by pointing to an existing operational problem; out of frustration with the current CM; in time for a new product launch; in response to immediate margin pressures; or a combination of these factors. While these are relevant issues to consider, a major undertaking such as establishing your CM relationship must be based on a robust strategic foundation.

Prior to starting any sourcing project, fully envision your idea of a successful contract manufacturing relationship. Critical sourcing projects are normally spearheaded by the operations/manufacturing organization. But be careful not to exclude major stakeholders such as engineering, product management, quality control, and finance. Outsourcing your manufacturing is not a traditional buy/sell arrangement, and it must be managed in a strategic manner. Your CM is an extension of your business and has personnel that must interact cross-functionally with your company. Determine what role such factors as size, technical expertise, financial strength, and brand name reputation play in your selection criteria.

For example, a tier-one CM may generally not be a suitable match for a start-up or small OEM merely based on size. The mindshare associated with an annual spend in the low millions of dollars is minimal for a large CM when compared to the hundreds of millions or billions spent on outsourcing by larger OEMs. However, some start-ups or small companies are in unique niche markets where a large CM is investing to become the contract manufacturer of choice. The potential revenue that the CM can realize as a result of this partnership may therefore overshadow the immediate revenue at hand. In that case, it may be worth pursuing a tier-one solution. Finally, get references from similar sized customers within a similar technology market. Keep in mind that every situation is different and requires thoughtful consideration of multiple factors.

Before making any decisions, spend time to develop a clear set of selection criteria, understand your short-term and long-term requirements, and cast a wide net to evaluate multiple options. Develop a clear plan and follow a methodical process until you have narrowed down your choices to at least two finalists. Refrain from awarding business until you have, at a minimum, finalized your key contract terms and agreed to how your products will be priced – now and in the future. Even if you are not planning on embarking on any new relationships, validate your existing solution from time to time to ensure ongoing alignment with the direction of your business or product roadmap. This will reduce the likelihood of a hasty selection process when the need arises.

2. Quote-and-Go Approach

The first formal exchange between an OEM and CM is typically the submission of a request for quotation (RFQ). Product specifications are provided via electronic or paper means, CMs go through their quotation process, and the output is a product price that is sent back to the OEM in order to make a decision. In our opinion, there are four potential problems with this "quote-and-go" approach:

Component pricing ambiguities. The OEM and sometimes even the CM do not clearly understand what assumptions are built into the pricing quotes. For example, what role has volume played in the pricing received from the component suppliers? How will purchase price variances be managed? Which component suppliers have been contacted to obtain pricing? What minimum order quantities apply to each component? Have any approved vendor list (AVL) or approved manufacturer list (AML) substitutions been made? Does the component pricing used in the CM quotation assume any one-time purchases from brokers? The best way to catch misquotes and inadvertent errors is to get the detail and look for discrepancies.

Lack of visibility to product pricing structure. Some CMs are hesitant to provide an accurate breakdown of cost to a detailed level that specifies material cost, cost of acquisition (or material mark-up), labor, test, manufacturing overhead, and profit or gross margin. But without clear visibility to the cost breakdown, how can you know what assumptions were used in quoting your product, or what cost improvement opportunities there may be in the future? What assembly and test times were used as input for determining the test and labor components of your pricing, and, more importantly, are these times accurate? What are the cost drivers in your bill of materials (BOM) so that you can plan for cost reduction initiatives? How are material mark-up and factory overhead allocated to your products, and are they are commensurate with the rates in the geographic region in which your products are manufactured? How will new products be priced in the future? Is the CM giving you a price they can sustain, or are they "buying" your business initially and expecting to raise prices when they have your business? Lack of price transparency is a lose/lose situation for both the CM and OEM, leading to a strained relationship between the two parties.

Unknown details regarding the supply chain model. Unless you have had the early discussions upfront on what your supply chain model will look like, your CM quote can increase or decrease substantially. As an example, what "inventory turns" were assumed during the quoting process? How is the CM using vendor managed inventory? How do they handle Kanban, including bin sizing, engineering change order (ECO) management, and buffers? How is the purchasing order policy being managed: through the traditional ABC categories, or by a more modern approach? At what point in the supply chain does the ownership of the finished goods inventory transfer? Are all transportation costs such as freight, taxes, and duties included, or will they be invoiced separately? All of these can have a noticeable impact on your product price.

No attention to non-price issues. Added to the acquisition price are a host of factors that can drive your cost up or down depending on how well your structure your agreement with your CMs. What is the scope of your CM's warranty, and for what period of time are your products covered? What is the cost structure for repairing products that are outside of warranty? Is the inventory for warranty repairs at a different location and under a different cost structure? How do quality-related metrics such as yield and part-per-million failure rates play into your total cost of ownership? Transportation, duties, tariffs, prototyping costs, engineering services, and RMA (return material authorization) services are among critical cost factors that are often overlooked.

As we noted above, the RFQ should be reserved for the short list of contract manufacturers that you have spent time educating about your short-term and long-term business requirements. Do not waste your time and resources analyzing quotes from more than a handful of CMs. You will not only create unnecessary work for yourself, but

in a turnkey manufacturing model, you also strain the resources of your component suppliers that are suddenly contacted by multiple CMs requesting information and pricing. Limit this activity to a subset of contenders that have demonstrated a strong willingness to earn your business. Allow yourself enough time to dig through the details in a quotation response, asking intelligent questions about the information provided to you. Make yourself available to answer questions and gauge each contending CM's thoroughness and attention to detail as it relates to your products. Finalizing price should not be based on information flow from the CM to the OEM; it is a collaborative effort by both sides to put a mutually agreed-upon framework of assumptions around the numbers.

3. Negotiating a Weak Contract – Or No Contract At All

Although contracts are tedious to negotiate, there are three key reasons why they are now more critical than ever before. First, corporate governance requirements such as Sarbanes-Oxley necessitate that companies apply much more rigor than before in reporting their financial numbers. The large dollar purchases associated with manufacturing outsourcing put your CM relationships on the radar screen for any financial auditor. Second, a well-structured contract forces discussion on important business terms that would otherwise be overlooked. In the absence of a contract, rarely do companies get into a detailed discussion of "what if" scenarios until crises occur. Finally, a contract negotiation and signature process itself serves as a vehicle to pull in senior level managers from both sides to build relationships. You will need these relationships from time to time as you navigate through the impact of fluctuating business conditions.

While most OEM-CM contracts are structured to offer adequate legal protection, we have found them to be generally light on important operational terms such as:

- Inventory liability definition and reporting, particularly at the component level;
- Supply/order flexibility and buffer programs for demand upsides;
- Price structure definition and adjustments;
- Warranty coverage and ownership/liability for epidemic failures;
- Intellectual property ownership, especially with respect to manufacturing process improvements initiated by the CM;
- Engineering change management, documentation, and transfer of product between CM facilities;
- Delineation of responsibility for compliance with environmental regulations, in particular the European Union's Restriction of Hazardous Substances (RoHS) directive;
- Post-termination obligations, particularly in relation to inventory liability, continuity of supply, and records retention;
- Reverse supply chain services and cost structure;
- Delivery commitments and remedy provisions for delayed deliveries;
- Cost structure for services such as design, fulfillment, repair, prototyping, and test development.

Prior to sending boilerplate contract drafts back and forth, spend time identifying your requirements, assign degrees of importance to the terms that you will negotiate, and quantify them in dollars wherever possible. This internal preparation will allow you to back up your requirements with a solid rationale. Think win/win and remember that "negotiation," by definition, means mutual compromise. Identify key players on both sides and hold them accountable for meeting the timeline that you jointly define. Establish a preliminary meeting with your contract manufacturer to discuss the key terms (such as those noted above) that will go into your contracts. Create alignment on what each side's obligations will be in those areas and begin mapping out a non-binding term sheet. Once you agree on the

content of the term sheet, use that as the baseline to create a contract that defines these and other terms in further detail. The goal is to spend enough time upfront, with all the right parties, so there are no surprises when your CM receives the contract draft from you. As you submit redline drafts back and forth, make sure each side clearly explains the reasoning behind the proposed changes.

We recommend that an OEM not award business, and, by the same token, that a CM not accept the business until the contract is signed. We are aware, however, that some business sectors such as the electronics industry move at lightning speed. If it is not practical to wait for all documentation to get finalized, be sure that at least the key terms are agreed to and documented on a term sheet.

4. Poor NPI Project Management

A key process faced by both the OEM and the CM is new product introduction (NPI). New product introductions are complex projects, incorporating numerous activities associated with multiple components and subassemblies under a product's BOM. A new product containing a hundred new parts involves a hundred sub-projects to design, source, qualify and release each one. And each sub-project involves coordinating activities of multiple functions, such as design engineering, component engineering, compliance management, sourcing, manufacturing engineering, and quality control. Most companies rely on "left-to-right planning", using a tool such as Microsoft® Project to get an idea of the high-level tasks, dependencies, and timeline. However, it's the lack of visibility into the various tasks related to each of the parts that often delays an NPI project. In an outsourced environment, coordination of these activities gets even more complex, and we regularly hear about NPI-related pitfalls such as the following:

> **Poor quality of product configuration and manufacturing data**. Incomplete or inaccurate BOMs lead to assumptions by the OEM about how and when certain tasks will be completed by the CM, while the CM may be finding their own solutions to work around the missing information.
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> **CM involvement in NPI "too little, too late."** This often occurs because the OEM doesn't give visibility to the CM regarding unreleased or work-in-progress information. CMs are discovering manufacturability, cost, or sourcing problems so late in the process that correcting them causes time-to-market delays.
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> **Poor communication of product change during NPI.** The CM can't seem to keep up with the numerous changes that occur, and may still be allocating resources to tasks that are no longer critical priorities.

Of course, a seasoned NPI project manager who has worked on various product introductions in your organization for a long time is priceless. But instead of relying on the knowledge and experience of an individual, you should also incorporate best practices through documentation, training, task list reviews, and proper supporting information systems.

As a start, set up a shared data management infrastructure to communicate the product configuration and associated files, all under revision control, directly with the CM and component suppliers. Integrate your systems to incorporate supply chain data and part/vendor preferences from your CMs to improve early design-in decisions. Open up your project task list to involve your CMs as integral members of the NPI project team, giving them overall visibility into status and potential risks.

Plan for – and follow up on – early and active collaboration between downstream functions in the product development process to identify manufacturing and testing problems. Build a process and infrastructure for rapid sharing of modifications made during the NPI process with your CMs and the suppliers affected downstream so that all levels of the supply chain are working together to incorporate changes. Finally, implement a process with supporting systems that efficiently capture and process feedback from your CMs and part suppliers.

5. Inadequate Change Management Processes and Infrastructure

Managing change within a company is a complex challenge that requires careful coordination. This complexity increases drastically in an outsourcing model, as the OEM and CM are following different but interlocked business processes and making use of different information systems. The challenge with communicating product changes to a CM during NPI is not so much the volume of data, but rather the frequency and complexity of change. Continuous design revisions, new manufacturing process instructions, and updated AVL/AML information all require the CM to react and often deviate from previously made implementation plans. It requires people to pay attention, assess the scope of the change, and determine when and how the change impacts their specific tasks. The financial impact of poor change management with your CM is simple: you either end up with too many of the wrong parts leading to excess and obsolete (E&O) inventory, not enough of the right parts resulting in shipment delays and potential loss of revenue, or, even worse, defective products shipped to your customers.

Even when an OEM has an internal ECO procedure, the CM is often not involved early enough to respond efficiently to the change. For small and medium-sized manufacturers, the common method to communicate BOMs and changes is still manual, utilizing phone, fax, or email. The fact that these manual ECOs are so arduous often drives people to cut corners in documentation, communication, or gathering input to evaluate the impact of the change. When this occurs, you risk the loss of early visibility into the effects of the change as well. In fact, recent research shows that a majority of OEMs inform their CM of changes only after the changes have been approved. It is critical to keep in mind that ECOs should provide direction in advance of change – they must not become accident reports.

The change process itself is one of the most critical factors in reducing time-to-volume. Once a product is in production, the largest impact to cost comes from issuing an ECO resulting in non-recurring engineering (NRE) expenses, increased component costs, inventory write-offs, and so forth. The change process has a high propensity for error due to the large number of people involved and in some cases, due to the technical complexity associated with the change. Here are some approaches you can consider to manage this process more effectively:

- Ensure that the complete product record is available to all involved in change implementation. When communicating a change, the change should be shown within the context of the full product record, and not just as a series of "bullets" that summarize the changes. Modern product lifecycle management (PLM) systems, for example, show changes as redlines within the actual BOM.
- Define and document a robust set of "change management" rules based on best practices such as form-fit and-function-based revision change. Ensure that these rules become a common language between the engineering team and the CM.
- Before implementing changes, involve your CMs and obtain their feedback on the change and its impact, as well as potential avenues to reduce any negative impact. Providing the CM visibility into the ECO while it still is under development enables a structured discussion. Again, modern PLM systems will allow suppliers to have this visibility into pending ECOs.

- Set up the change process to involve multiple tiers of the supply chain in the change, even beyond the CM. Changes to made-to-spec parts sourced from upstream suppliers, such as printed circuit boards in a printed circuit board assembly, should be reviewed by both the upstream supplier and the downstream CM.
- Build a change "audit trail," detailing exactly what change was approved, on what date, by whom, and what the disposition actions were per inventory location. This provides a strong basis for discussions around cost of change and any excess and obsolete inventory.

It is important to point out that effective change management will enable your CM to reduce the overhead cost structure associated with managing your products, thereby quoting you a more competitive price.

6. Broken Environmental Compliance Management

Although OEMs are required to take ownership for their products' environmental compliance and drive it throughout the supply chain, they often don't take the time to do so in enough depth. A cavalier approach to these regulations and the assumption that the CM "has it covered" puts you on the path to failure and your company at risk of non-compliance. As the owner of the design, you must assess, document, and manage the compliance of your product, or pay your CM or other outside resources to do this for you.

In an outsourced manufacturing environment, an OEM relies on its manufacturing partners to perform a range of activities, from procurement, inspection, and fabrication, to assembly, quality assurance, shipment, and sometimes even service. Several of these activities are part of the "compliance controls" that are necessary to minimize compliance risk. We have observed the following common mistakes that lead to a broken compliance process, and with that, an increased compliance risk:

- OEMs treat compliance as an isolated responsibility often delegated to someone in engineering, rather than as a series of controls across the entire design and manufacturing process;
- Compliance is managed as a "flag on a part number" rather than integrated into the configuration management processes. The people who are responsible for compliance are often left to their own devices when it comes to support systems. Without visibility into the larger compliance process, these controls are implemented in isolated spreadsheets that don't interact with other processes. In addition, these manual methods are not very scalable when it comes to emerging regulations, and can't handle the level of material declaration and exemption detail that needs to be managed.
- The OEM doesn't have one central, complete and accurate product record, and hasn't completely verified sourcing for all parts and materials in the full BOM. The CM may therefore be using old or gray market inventory for non-specified parts, or "open AML" parts that may not be compliant.
- Many OEMs are using manual systems like spreadsheets and file servers simply because those are the tools they've always used. Generating a compliance or due diligence report becomes a fire drill, especially for an earlier product build that has long been placed in the hands of customers. This approach is very disruptive and costly for the organization.

To conduct efficient tracking, documenting, and reporting on compliance, implement a compliance management solution that is directly integrated with your engineering configuration management system. Track the compliance status both by your company part numbers and/or manufacturing part numbers as well as by requirement (e.g. RoHS 5/6 or RoHS 6/6), which will facilitate efficient design reuse. Document the compliance rationale – i.e. why the

part is compliant – with corresponding documentation that serves as evidence. For off-the-shelf parts, this may be a combination of a certificate of compliance, a material declaration, and, for questionable parts, an independent chemical analysis report. For made-to-spec parts, this may be a requirement called out on the face of the drawing combined with material declarations for all materials used, and incoming inspection reports based XRF (x-ray fluorescence) testing. Manage compliance by part/assembly revision so that compliance can be demonstrated throughout a product's lifecycle. Independent of the build-date of the shipment under investigation, this level of tracking enables you to demonstrate that there are controls around product changes, and that the product has been kept in compliance from revision to revision. Verify and document the impact on compliance for all changes implemented by an ECO.

Once your internal data management structure has been established, perform a risk assessment on all outsourced activities to identify failure modes, implement the necessary controls, and include the documentation to generate an audit trail. Take the time to ensure that there is one complete and revision-controlled BOM that is shared in real-time with the CM. Set up a formal process to control the CM's use of substitutes on the BOM. Typically this includes an engineering change request process, and an ECO process to approve, document, and phase in the change. Include material substance testing, such as XRF testing equipment, at incoming inspection for high-risk parts. Implement controls around the repair of product that was built after July 2006, paying special attention to swap-pools, repair inventory, and repair tools, including solder paste.

7. Ignoring the Hidden Costs of Going Offshore

Transferring production offshore is not for everyone. There is no doubt that the lower cost of labor and overhead in Asian countries such as China, Malaysia, and Taiwan makes offshore manufacturing attractive, especially for OEMs that have a low mix of products with very high volumes, and that sell – or expect to sell – their products in the region in which they are manufactured. The "offshoring" problem in the electronics industry is that most companies hastily transfer production to or source from Asia before they have had a chance to back up their decision with numbers. This spells trouble for many small and mid-size US firms that lack a clear strategy, have little influence with the CM due to a smaller spend, have limited knowledge of how to do business in Asia, and have no access to local resources to manage the day-to-day operations.

Transportation and logistics are high on the list of challenges faced by companies that go offshore. Using ocean freight and thereby extending the lead time by four weeks reduces your flexibility to respond to demand changes on short notice. The use of airfreight reduces the lead-time, but is cost prohibitive for large or heavy products. Communication challenges due to different time zones and language barriers are not trivial and often cause frustration and delays. Cultural factors impact how business processes are executed, how pricing and terms are negotiated, and how conflicts are resolved.

Executed correctly, offshore manufacturing works best if you have done your homework and have robust business controls in place to manage it. Before you make any decisions about transferring to or launching production in China or elsewhere in the region, travel there and visit some suppliers that you have identified through trusted contacts. Leave the quotation and price negotiations for a later point in the discussions. The purpose of your initial visit should be to understand the region's capabilities, meet suppliers that can build your product, and build relationships.

As the numbers flow in, develop a cost model that focuses on the total cost of offshore sourcing rather than the

purchase price alone. In other words, your cost model should encapsulate not only the price you pay for the product, but also:

- The transportation strategy (air versus ocean) that you will employ based on your product lead time and demand profile;
- In the case of ocean freight, the cost of carrying inventory due to an extended lead time;
- The cost of supply buffers that you will need to put in place at various points in the supply chain in order to respond to demand upsides; and
- The overhead required to manage an offshore manufacturing partner.

Most importantly, however, do not lose sight of your increased level of inventory liability due to the long transportation lead time. In a recent consulting engagement for a set-top box manufacturer that built its products in China and ocean freighted them to the US, we found that the cost model showed parity in the landed cost when we compared Mexico and China. However, when we calculated the inventory liability based on the client's demand profile and upside requirements, we found that the liabilities were five times higher for China than for Mexico. Consequently, our client elected to transfer production from China to Mexico to benefit from a shorter lead-time. In another cost model we developed for a telecom equipment manufacturer, a simple calculation showed that when as few as 10% of the total units manufactured were shipped by air, all cost savings associated with offshore manufacturing would be completely eliminated.

If your cost model justifies going offshore, build a resource base on the ground in Asia, supplemented by US-based staff that can rely on sufficient travel budget to build and maintain relationships with their overseas counterparts. This allows you to use lower cost resources in the region to manage the operational activities with the locals, while creating a conduit to the staff in the US that makes the strategic decisions. Last but not least, be sure that your US staff is educated on the cultural sensitivities that will undoubtedly influence the mindshare you receive at your manufacturing partner. Your ability to effectively socialize and establish personal relationships in Asia will be as important as the dollars that you spend.

As you build your offshore partnership, keep in mind the time zone and communication challenges that are inherent in this new relationship. You may not have the option to pick up the phone to explain a product change or to drive across town to pick up the initial prototypes. It is essential to put in place the appropriate tools to collaborate effectively across time and language barriers, and the disciplined processes to ensure that hand-offs and changes are clearly communicated. This will become essential in the NPI phase of new products, and, once a product is in production, for managing the myriad of changes that are inevitable in fast-moving product development environments.

Conclusions

The emergence of the outsourcing model discussed in this whitepaper has enabled many OEMs, primarily those that are small or mid-size, to become more competitive based on economies of scale once available only to their large competitors. However, this business model carries risks that, unmitigated, can have a significant impact on a company's financial performance and long term success. Implementing solutions to these common mistakes is not trivial, cannot be rushed, and must be pursued with a strategy in mind. In the end, outsourcing can be successful if you have the right strategy, processes, people, and tools to maintain control of your business.

About Symphony Consulting

Symphony Consulting is a Silicon Valley-based company that provides strategic supply chain and manufacturing outsourcing expertise to help high technology companies reach their financial and operational goals. Symphony's strategic consulting services and in-depth workshops on advanced supply chain methodologies show companies how to enhance revenue potential, increase profitability, and reduce inventory liability. Contact Symphony Consulting at (650) 968-1930 or visit www.symphonyconsult.com.

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Arena Solutions is the leading provider of on–demand product lifecycle management solutions for manufacturing companies of all sizes. As the only true on–demand, secure Internet–based PLM service, Arena PLM provides a superior alternative to complicated, lengthy and expensive traditional PLM software deployments. Through its award–winning service, Arena enables product manufacturers and their global supply chains to streamline outsourcing, improve operational efficiencies, and speed time–to–market. Arena PLM has been adopted by more than 15,000 users across companies at all stages of development, including industry leaders Foundry Networks, Color Kinetics, Intuit, Sierra Wireless, Align Technology and more. Contact Arena Solutions at (866) 937-1438 or visit www.arenasolutions.com

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