



TECHNOLOGY FORECASTERS INC.

Information, Insight, Interaction for Effective Manufacturing Relationships

METRICS, CHAOS, AND RELATIONSHIPS IN ELECTRONICS MANUFACTURING OUTSOURCING

A Quarterly Forum White Paper

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METRICS, CHAOS, AND RELATIONSHIPS IN ELECTRONICS MANUFACTURING OUTSOURCING

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TABLE OF CONTENTS

Section 1— METHODOLOGY	4
Section 2— A FRAMEWORK FOR ANALYSIS	5
2.1 Seeing Through the Variability	5
2.2 Metrics, Chaos, and Relationships	5
2.2.1 Metrics and Benchmarks	5
2.2.2 Chaos: The Art of the Possible	6
2.2.3 Relationships	6
2.3 Table Stakes and Differentiators	7
Section 3— KEY CRITERIA	8
Section 4— REDUCING THE COST OF OWNERSHIP	10
4.1 The Size Factor	10
4.2 Overall Pessimism	10
4.3 Best Practice Summary	11
Section 5— GLOBAL SUPPLY-CHAIN CO-ORDINATION AND EXECUTION	13
5.1 Metrics	13
5.1.1 Visibility	13
5.1.2 Delivery	13
5.2 Chaos	14
5.2.1 Handling Failures	14
5.2.2 Handling Variances in Demand	15
5.3 Relationships	17
5.3.1 Importance of Relationships	17
5.3.2 Periodic Evaluation	18
5.3.3 Responsibility for Sourcing	19
5.4 Next Steps	19
ABBREVIATIONS, ACRONYMS, & TERMINOLOGY	20
ABOUT TFI'S <i>INDUSTRY REPORT CARD: ELECTRONICS CONTRACT MANUFACTURERS AND ORIGINAL DESIGN MANUFACTURERS</i>	21

Section One

METHODOLOGY

This White Paper is an introduction to and spin-off from a larger, ongoing effort that Technology Forecasters Inc. (TFI) has undertaken to assess and benchmark the performance of outsource manufacturing companies, both electronics manufacturing services (EMS) and original design manufacturer (ODM), worldwide.

While the ongoing effort looks at specific companies, the purpose of this White Paper is to lay out a practical framework for identifying and understanding “best practices” as they relate to electronics outsource manufacturing, without attempting to assess the performance of any specific manufacturers.

This is a long-term, cumulative, project, and it is designed to benefit from multiple interviews undertaken over time, in order to discern changes and trends in outsourcing practices. TFI is interviewing globally and including manufacturers of all sizes but is focusing solely on the original equipment manufacturer (OEM) perspective: What, from the perspective of OEMs, are the best practices of their outsourcing partners? What are the best practices OEMs employ to maximize the benefits of outsourcing? The value of this approach is that it allows OEMs that currently outsource to benchmark the performance and services of their partners, their internal manufacturing, and their in-house outsource management against the performance and services obtained by their competitors and peers. OEMs that do not currently outsource, or that may increase the scope of their outsourcing, can gain insight into services and the level of service available. EMS and ODM companies can compare their offerings with those of competitors and can identify areas of improvement or investment.

Companies and divisions interviewed so far and whose responses constitute the data for this White Paper, include:

- Capital Group
- Coherent
- GE (Mabe)
- Hart Intercivic (Corporate)
- Hewlett Packard (Computing)
- Hewlett Packard (Imaging)
- Lenovo (Corporate)
- Nokia (Corporate)
- Ruijie Networks
- Seagate
- Siemens Shanghai
- Siemens VDO
- Texas Instruments
- Whirlpool

Interviews focused on a series of different aspects of manufacturing, such as practices for lowering costs over the life of a product, for end of life management, for environmental compliance, and for managing excess inventory. Respondents were then asked to rate the relative importance of each issue. They were then asked more in-depth series of questions on their issues of greatest concern.

Section Two

A FRAMEWORK FOR ANALYSIS

2.1 SEEING THROUGH THE VARIABILITY

Specific practices in outsource manufacturing are highly variable depending on the type of product, volatility of the market, size of company, and other factors. When it comes to best practices, no single size fits all. But despite this variability, respondents judged nearly all specific activities, issues, and challenges, with respect to three touchstones. Together, these touchstones, or dimensions of outsourcing practice, constitute a framework for analyzing manufacturing partnerships. None of the dimensions operate in isolation, they are closely interrelated, and good practices in one generally correlate with good practices in the other two. But none of them alone captures the full value realized in outsourcing partnerships, and it is possible for partnerships to fail even when practices excel in one or two of the dimensions.

2.2 METRICS, CHAOS, AND RELATIONSHIPS

We're calling these three dimensions "Metrics, Chaos, and Relationships." Metrics are quantitative measure used to capture and benchmark performance. Chaos is the variable and unpredictable set of challenges that managers deal with on a day-to-day basis. Relationships are the trust, commitment, and cultural understanding that underpins efficient behavior in partnerships.

2.2.1 Metrics and Benchmarks

The first and most widely recognized of these dimensions involves quantifying behavior and applying metrics. One example might be contractual provisions defining on-time delivery. For example, a contract may define "on-time" as "no more than two days early or one day late."

It is a truism that the best contracts are the most specific. Contractual ambiguity is a lack of communication. If it is in a relevant area, it can easily lead to miscommunication, pressing for advantage, and disputes. However, contracts can also be unnecessarily specific. A contract that specifies on-time delivery from a standardized "best practice" perspective may actually detract from the total value of the overall relationship by imposing costs on the supplier that are not offset by benefits to the OEM client. If a delivery of materials is late by contractual provision but takes place before they are needed for processing, the cost to the OEM may be negligible; however, the value of that late delivery to the outsource partner, in lower shipping costs or in opportunity costs for processing other materials needed more immediately, may be considerable.

Best practices in this area revolve around creating, tracking, valuing, and negotiating specific provisions based on an accurate cost/benefit analysis by both parties.

2.2.2 Chaos: The Art of the Possible

Management has famously been defined as “the art of the possible.” The real world is forever throwing roadblocks up to impede the flow of commerce. The second dimension of best practices involves managing the unforeseen. In outsourcing, the unforeseen generally takes the form of inaccurate demand forecasts, shortages in materials supply, unanticipated changes in regulation or enforcement, and unpredictable acts of god or man such as storms, computer viruses, and transportation strikes.

Best practices in this dimension revolve around two issues: preparedness and agility. Preparedness (multiple suppliers, alternative manufacturing facilities, robust firewalls, catastrophe planning) can go far to keep chaos beyond the factory walls. Agility can minimize the impact when chaos does strike. In some cases, agile and flexible outsource relationships can take advantage of chaos. For example, one OEM reported encouraging partners to buy excess parts inventory when costs were low.

2.2.3 Relationships

Although the value of cultural matching and long-term commitments is hard to quantify, respondents very frequently cited this area as crucial. In pervasive ways, cultural matches lead to smoother relationships, fewer miscommunications, more effective rallying behavior in dealing with problems, and greater efficiency. In specific ways, these matches lead to institutional knowledge that can, for example, reduce ramp up times through better understanding of constraints within the supply chain. Good relationships free both parties to maximize the investment of their resources into their core competencies.

Best practices in this dimension involve balancing between the benefits OEMs realize from competition among outsource partners against the benefits of commitment. Sacrificing short-term gains for long-term benefits is theoretically attractive, but in the real world, short-term gains are often more likely to be realized, so this is a difficult balancing act. Best practices for market-driving, global companies may be different from best practices for smaller buyers.

2.3 TABLE STAKES AND DIFFERENTIATORS

The three dimensions of metrics, chaos, and relationships are factors, or sets of factors, that go into a good outsourcing relationship. Respondents make judgments about these factors in different ways. Some areas are amenable to being graded or measured on a scale. For many areas, though, OEMs are choosing among available alternatives and have to look at industry standards. Standards are a moving target. They define whether a particular practice is a “table stake” or a differentiating factor. A practice, for example an optical technology or use of an ERP system, may start out as a differentiator—working with companies that have made an investment confers advantages that are not otherwise available. As the practices become more widespread, they become table stakes—an outsourcing company cannot reasonably even bid on a project if they have not made these investments.

In the descriptions of best practices to follow, TFI uses respondent comments to identify whether particular practices are table stakes, which most CMs in most situations must “ante up” before they are considered for a project, or differentiators that really serve to distinguish them from peers.

Section Three

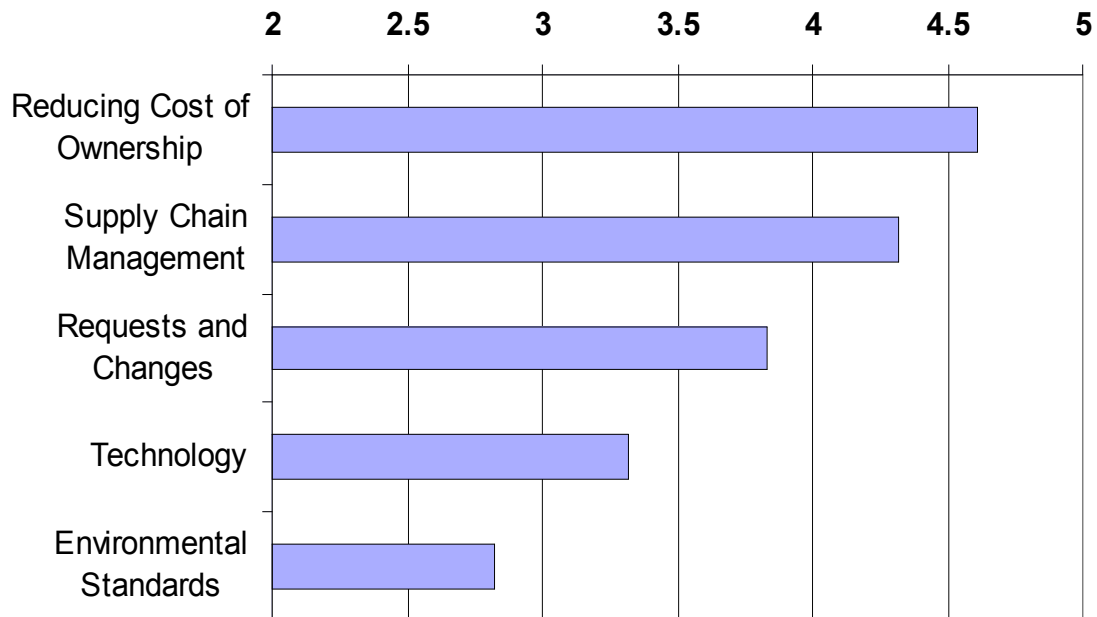
KEY CRITERIA

TFI began by assessing practices in five general areas:

1. Reducing cost of ownership
2. Responsiveness to requests and changes
3. Implementing environmental design and manufacturing services
4. Advancing technology to meet or exceed requirements
5. Global supply chain coordination and execution

Respondents were asked to rate each of these categories in terms of which ones were the most important considerations for selecting and retaining an outsource manufacturing partner. Ratings were given on a scale of one to five, where 1 = least important and 5 = most important consideration. Figure 3.1 shows the average and median scores for importance of these categories.

Figure 3.1
Importance Ranking of Categories



Reducing cost of ownership was the most important consideration, followed closely by supply chain management. Meeting environmental standards was the least important. This white paper will focus on the top two areas of interest, reducing cost and managing the supply chain.

Section Four

REDUCING THE COST OF OWNERSHIP

4.1 THE SIZE FACTOR

The most frequently mentioned drivers for reducing the cost of ownership were related to scale rather than to good practices. According to several respondents, a global outsource manufacturer can *“compare total cost everywhere and propose the best regional-mix solutions.”*

Scale also comes into play with respect to time-scale, or product life cycle. The longer a product’s life cycle, the more CMs can drive costs out. *“For mechanical products, there is always a significant ramp up cost. Accordingly, as we continue to place additional orders, they should be able to produce each additional unit at a reduced cost.”* Another OEM noted: *“Scale is everything. The most important thing for our company is to launch a successful product with a long life cycle. That allows us to manufacture greater volumes and thereby reduce various costs, including those of material purchasing and component outsourcing.* Additional time also gives CMs an opportunity to improve processes and quality control.

Finally, scale comes into play through consolidation of suppliers. Working with fewer CMs on larger projects enables OEMs to better amortize management costs and to command greater “mindshare” from CM management.

4.2 OVERALL PESSIMISM

Perhaps because most respondents saw scale issues, rather than practices, as the primary driver for lowering cost, respondents were generally pessimistic about better practices in outsourcing driving down costs. Typical comments were:

“We would like to see a more proactive approach to reducing cost.”

“No one laid out the red carpet offering price reductions; we have to push it.”

“None of the three above suppliers will take a proactive approach to cost reductions...this is always 100% driven by us.”

“We see no advantages in working with any ODM or EMS providers in terms of cost reduction.”

“In the past we used to hope our suppliers would find ways of reducing our costs. We rarely saw any success, so we now define the cost-reduction percentage in the contract and purchase orders.”

This general pessimism does represent an opportunity for CMs to differentiate their services by being more proactive about cost reductions, but OEMs may be correct that company size and product life cycle issues are more powerful drivers than improved manufacturing practices.

For the most part, respondents blamed their overall market conditions rather than their suppliers for what they see as failures in this area:

“It’s very hard to incentivize our suppliers to lower costs these days, as the product lifecycle has grown increasingly shorter.”

“Because the price of steel, plastics, and other raw materials has continued to increase these past two years, even on repeat orders our suppliers have not really been able to give us any reductions in cost.”

“I must admit the lack of initiative is caused by us. We have clearly stated they should only follow our instructions....”

Respondents did identify some practices as best-in-class or differentiating ways to lower costs:

“Our EMS suppliers are moving resources to ODM-type services; this is where we are seeing the best proactive efforts to reduce costs and add value....”

“[Our EMS suppliers’] knowledge of our supply chain allows for no issues and a much faster response time that impacts our profitability and ability to position our products in the market when we need it.”

“We are also seeing important proactive efforts to improve engineering resources for manufacturability, focused towards reducing cost.”

4.3 BEST PRACTICE SUMMARY

“Reducing overall cost” is an overall goal, reached by specific actions in specific areas. It is not surprising that respondents discussed it largely in abstract ways rather than through specific practices. The more specific practices they did

discuss are summarized in Table 4.3 below. In the next section, we will look at supply chain management issues and a more direct focus on practices.

Table 4.3
Specific Practices for Cost Reduction

Area	Action
Metrics	<p>Table Stake: Build cost reductions into contracts and POs. Don't depend on a good relationship and ad hoc cost-reduction opportunities.</p> <p>Differentiator: CMs should be proactive in looking for cost reductions. OEMs should incent suppliers to find cost reductions beyond contract requirements by sharing the newly captured value, not just through volume contracts but by using more immediate incentives, such as more favorable payment terms.</p>
Chaos	<p>Recognize the value of a close relationship that enables your supplier to become familiar enough with a product's supply chain to avoid or work around surprises.</p>
Relationships	<p>Table Stakes: Consolidate projects with fewer suppliers to reduce overall costs. There is a marginal opportunity here even when the costs for some products are higher than with a competing supplier.</p> <p>Choose suppliers with a global footprint that can tailor a regional mix solution for your needs.</p> <p>Differentiators: Encourage CMs to propose alternate solutions to shorten the supply chain, such as local sourcing.</p> <p>Encourage CMs to invest in engineering resources by trying to align areas you are willing to outsource with engineering investments that fit into their overall business model.</p>

Section Five

GLOBAL SUPPLY-CHAIN CO-ORDINATION AND EXECUTION

5.1 METRICS

5.1.1 Visibility

The gold standard in visibility includes these elements:

- Web-based portals and EDI communications systems with signaling and acknowledgement at points from initial receipt through transformation and shipment and receipt by the customers. The system should allow real-time access.
- Additional Web-based portals into documentation and engineering systems
- All systems facing both up and downstream, allowing visibility across the supply chain.
- Data to be pushed to the OEM as agreed by contract, often varying by product; pulled as needed.

Respondents cited three differentiators with respect to visibility:

- **Implementation.** Is the data clean and input properly? Do systems at different stages of the supply chain communicate?
- **Consolidation.** Does a CM's system allow the OEM visibility into products being manufactured by a different CM?
- **Participation.** Does the CM proactively make a business case and not only sell the visibility system to their OEM client, but also support them adopting it?

5.1.2 Delivery

Managing on-time delivery requires *defining, tracking, and responding* to lateness issues.

What defines "on time" and "late"? Many OEMs provided different time periods they used, ranging from two- to six-day windows. The early/late requirements also differed. They ranged from up to six days early and four days late, to zero days early and six days late.

One respondent told us that the best CMs don't define "on time" but let the customer define it.

A large OEM respondent told us that they had moved away from the concept of “on time” altogether:

“It’s all a matter of keeping local distribution hub inventories aligned with pre-determined maximum and minimum supply levels.”

Another large OEM reported good results with a similar approach:

“My best suppliers are those that take full responsibility over the supply chain and extend consignment and buffer programs across the production cycle.”

The best practices for tracking “on-time” performance involve systems that can take into account different on-time windows for different products (or seasons) and feed the performance data into a mechanism where the OEM can pull current data or a perform a periodic performance review process.

The most common practice for responding to lateness issues was to place new business on hold and scrutinize current business. The more sophisticated practice was to feed lateness data into an integrated performance review rather than respond to it as a sole driver of relationship issues. Also, at least one respondent reported good results with direct monetary penalties:

“In the case of a line stop scenario, all costs are passed on to the supplier. If a JIT engagement is in place, the delivery must be on the initial date requested; if no JIT engagement is in place, we allow for two days early and no days late. The penalty has had excellent results. Suppliers hate to see their profit erode and do not appreciate when we charge these penalties directly against open invoices. We see great improvements after the first penalties are charged.”

5.2 CHAOS

5.2.1 Handling Failures

Products fail, raising costs per unit, straining expensive help and repair systems, displeasing customers, and tarnishing brands. Failures are by definition unexpected, but nothing is more likely to impact a manufacturing outsource relationship, so nothing needs to be solved more rapidly and efficiently.

Many of the companies interviewed use the “8D” system, which one respondent described this way:

“The report has 8 steps:

- 1. Identify team members*
- 2. Describe the problem*
- 3. Address the interim containment implementation*
- 4. Define and verify root causes*
- 5. Verify the corrective actions*
- 6. Implement the solution*
- 7. Address how recurrence will be prevented*
- 8. Congratulate the team*

We give the team 48 hours to determine root cause, and 14 days to complete all steps.”

One OEM described a system that embedded the 8D program into a broader context.

“In addition to 8Ds, we track the ‘annual failure print’ that tells us how much the product fails and allows us to look at different failure modes: test, box build, and in the field.”

This was the only mention of a failure analysis system that proactively looked at failures in the field.

5.2.2 Handling Variances in Demand

Excess and obsolete inventories (E&O) stem from inaccurate forecasts. Best practices revolve around three issues: *flexibility* in responding to changes in demand, the best possible *forecasting* to minimize E&O inventory, and optimum methods for *apportioning* the liability for the remainder.

Flexibility. Requirements for flexibility in production volumes vary with the product. In general, the larger and more global OEMs saw less volatility in production schedules, because variable demand in different regions tended to cancel out swings. Similarly, larger CMs were able to be more flexible, particularly with inventory of commodity components, because they could use excesses in other regions or for other clients.

“Our EMS providers’ global operations allow them to better manage and balance their inventories. We have seen how excess inventories and shortages for commodity products are dealt with at a global level through their commodity teams. In the past the sites had less flexibility and limited resources. Today our EMS suppliers

are better integrated as global operations, from systems to the attitude their people have taken towards making their supply chain lean. Should there be a big swing in demand caused by us, we take full ownership and responsibility.”

OEMs nevertheless still depend on and highly value flexibility:

“I have found through the years that a 30% up or down in 30 days seems to be the rule that I have followed or have been asked to follow. This kind of frames for me the expectation. I would say better than that would be best in class.”

“Flexibility is a given—forecast and volumes change every day. A key differentiator for our... business is the inclusion of consignment hubs that has reduced response time to demand fluctuations. All of our EMS providers supply our distribution hubs under consignment agreements, incorporating buffer volumes.

Forecasting. The visibility systems described above are designed in part to support forecasting. OEMs commented that they used different periods for their forecasting cycles, correlating with differences in type of product. One company described using a rolling three-month cycle as a production guideline. They provided a general forecast for the third month out, a tight forecast for the second month out, and a PO for the coming month. Another company reported weekly rolling forecasts.

No single practice emerged as “best.”

Apportioning Liability. No matter how flexible the production and how accurate the forecasting, all respondents had to deal with some inventory imbalances.

The best practice approach appeared to be for suppliers to take liability for all commodity components while the OEM accepts liability based on its own forecasts for components that are application specific.

In the case of finished goods, OEMs frequently saw their responsibility to use sales, offer volume discounts, and liberally warranty replacement policies as ways of taking responsibility for reducing excesses.

“I would also say, active efforts to reduce any kind of excess or stranded inventory along with this would define best-in-class type of performance.”

5.3 RELATIONSHIPS

5.3.1 Importance of Relationships

Most of the respondents put a high value on relationships with their outsource partners:

"We prefer to develop long-term partnerships with a limited number of suppliers. One reason for this is that the first project a supplier does for us always requires a lot of getting familiar with and adjusting to each other. It's only after we've done several projects together that things start to work more smoothly."

"When we select a new outsourcing partner, we look to establish a long-term relationship with a supplier who can give us favorable treatment in a variety of areas."

Why are long-term relationships best practices?

"They are truly an extension of our company resources and place huge efforts to ensure all operations are seamless.... There is less explaining and justification involved within working with them. They understand our needs and are very familiar with our suppliers and what can be expected and how to obtain what we need."

"[Regarding responsiveness]...it really comes down to attitude. The best suppliers are those that really view the relationship as a cooperative effort and are more willing to accept changes first, and discuss costs later.... In the end, responsiveness also really depends on who's leading the business unit at the time. [Company], for example, changed management recently and, as a result, are less responsive than they used to be."

One question was whether OEMs were willing to pay a premium for a good relationship. One respondent did explicitly accept this approach:

"[CM] is by far our best EMS supplier. They are very much integrated into [our] culture and are very receptive to our needs. Their prices are not the lowest; this is because they are always working with our latest models that require more added value services."

For the most part, though, OEMs reward long-term relationships with continued or increased business. However, OEMs do sometimes afford favorable treatment to long-term partners:

“We’ll work with suppliers on excess materials at end of life, continue making the product, perhaps selling it at a discount, giving it to customers as a gift or as a replacement for defective products still under warranty, or we try to design new models that also utilize those [stranded] materials.”

There is a tension inherent in the “one-to-many” nature of the outsource manufacturing relationship. OEMs receive benefits:

“Our best supplier produces similar products with shared components for a lot of customers, and they have several regional factories, so they are less likely to run out of something.”

But also problems:

“...our suppliers extend all terms and conditions to [favored supplier] without any delays. Our other partners are always expecting to obtain benefits for their other customers.”

“We do not want to pass on our pricing benefits to anyone as this could be a competitive disadvantage.”

5.3.2 Periodic Evaluation

Relationships rest on trust and trust rests on verification. Nearly all OEMs interviewed reported that they used some form of periodic evaluation process. All of these processes are intended to be broad-based, evaluating delivery, quality, and a range of other contracted issues.

“We stay close to our suppliers...in some cases we become part of their internal processes and are involved in their supplier evaluation and development initiatives.”

The most comprehensive evaluation system we encountered was the TQRDC-E scorecard:

“[Company] has a scorecard process for each supplier called TQRDC-E that addresses the following in order of importance every six months with reviews and updates every quarter: T-Technology, Q-Quality, R-Responsiveness, D-Design, C-Cost, and E-Environment. We also look at Business and company stability as well as their experience in the market.”

Others used an annual review process that included many of the same elements.

5.3.3 Responsibility for Sourcing

In terms of sourcing, the best practices among respondents were for the CM to manage all sourcing except for specialized inputs where the OEM has a better deal with the supplier and either cannot share terms with its CM or considers its good deal a competitive advantage.

A differentiating factor would be for the CM to proactively design local sourcing solutions.

5.4 NEXT STEPS

The thesis of this White Paper is that practices or procedures in electronics outsourcing are best evaluated by looking at them in three different dimensions: metrics, chaos, and relationships. We have used this paradigm to look at two areas of concern to OEMs: lowering costs, and managing the supply chain. TFI has collected data on other practice areas, including engineering change orders, flexibility in general, technology, and environmental compliance. Expect to see analyses of this data in future Quarterly Forums.

***BEST PRACTICES IN SOME AREAS OF OEM OUTSOURCING
AND A FRAMEWORK FOR EVALUATING THEM***

Abbreviations, Acronyms, and Terminology

ad hoc	for this (Latin term meaning “concerned with a particular end or purpose”)
CM	contract manufacturer
EDI	electronic document interchange
EMS	electronics manufacturing services
E&O	excess and obsolete inventories
ERP	enterprise resource planning
ODM	original design manufacturer
OEM	original equipment manufacturer
“8D” system	Eight-step system for handling product failures



TFI's Annual Industry Report Card – Electronics Contract Manufacturers and Original Design Manufacturers

Successful outsourced manufacturing requires constant collaboration between the OEM customer and its suppliers. To help those engaging in these jointly managed programs uncover opportunities for improvement, Technology Forecasters Inc. (TFI) announces a groundbreaking new research study incorporating TFI's exclusive CM/ODM Evaluation Methodology. This comprehensive, industry-wide research is bringing a new dimension of insight into issues at the forefront of these relationships. We are currently issuing an invitation to select companies to participate in this important project.

TFI's seasoned industry analysts are interviewing up to 150 managers at OEM companies representing all the major end market segments. These are the people who are responsible for selecting, contracting and outsourcing projects with EMS and ODM providers. We are learning what is working and what is not working in these relationships and how their suppliers are keeping pace with today's swiftly changing global economic environment, and providing customers with continually improving services and business benefit.

Technology Forecasters' has brought trusted and objective industry expertise to the fiercely competitive global electronics manufacturing industry for over 18 years. Now this in-depth practical expertise is available through this important study to help OEMs better leverage their outsourcing relationships, and let CM/ODM suppliers know what their customers expect.

Technology Forecasters will offer clients two complementary ways of maximizing the benefits of this comprehensive study:

Complete Report on Industry-Wide Results

Here we will provide you with a thorough report on the results of the study including:

- Executive Summary highlighting the results
- Individual chapter analysis of the eight industry sectors defined by Technology Forecasters Inc. and used in our annual forecasts
- Individual chapter analysis by major geographical regions
- Evaluation of CM and ODM performance by size categories
- A complete industry analysis of the performance ratings for the CM and ODM sectors
- Technology Forecasters' consultants strategic recommendations

Company-Specific Customized Module for CM/ODM participants*

This optional analysis extrapolates from the broader data set, providing data that is specific to and pertinent to your company. This customized feedback that will include:

- A concise analysis of your performance against peer companies
- Technology Forecasters' consultant recommendations specific for your company
- A half day feedback and strategy session by our senior consultants with your management team
- Transcripts of comments by all respondents who evaluated your company **

* This feature is available for CMs and ODMs only. This feature may not be available for some companies depending of the level of involvement by their OEM customers. We will interview a sufficient number of OEMs to ensure at minimum the top 20 EMS and the major ODMs' evaluations will be covered in the research.

** The anonymity of the respondents and responding companies will be maintained. These comments will not be linked to any respondents or company. We will also scramble comments for each question we asked.



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