



Do you like news and articles like this?

Then, get it from the **ORIGINAL** source ... **PCB UPDATE** ...
the semi-monthly e-mail newsletter produced by **Circuits Assembly**
and **PCD&M** and circulated to over 40,000 readers.

[CLICK HERE TO READ THE ARTICLE YOU REQUESTED](#)

在承包制造业，预测失准引起了很多问题。如果涉及到很多供应商，如初始设备制造商、承包制造商和经销商，问题就更多了。长期库存是一个主要的担心。有一个承包制造商采用基于每天和每周的产品生产，避免了预测失准的问题。其制造操作实时使用劳力和材料，其供应链管理系统几乎可立刻发送材料。因为每天的生产进度按期完成并交货，同供应链有时发生的变化无关，所以预测已几乎废弃不用了。

The Flaws and Obsolescence of Product Forecasting

Randall Sherman

One EMS provider has defined a new model that competes against low-cost, offshore suppliers by being more efficient in all aspects of production.

Bad forecasting has been the cause of many headaches in companies within the electronics manufacturing services (EMS) industry. Indeed, the latest economic bubble might be easily blamed by it—that is, errors in market demand by too many self-reinforcing suppliers with optimistic expectations. Bad forecasting naturally happens when false assumptions creep into the mix, and the problem can be magnified if numerous suppliers are involved, as is often the case when original equipment manufacturers (OEMs), contract electronics manufacturers (CEMs) and retail or commercial distributors are all part of the supply chain. Forecast error in these situations often becomes multiplied through the supply network since each link forms a series of exaggerated expectations. The hot potato is inventory, and the company holding it the longest naturally gets burned—often resulting in considerable red ink and inventory write-downs.

Supply chain management (SCM) tools are supposed to reduce the complexity of the supply network and streamline the process of procurement, assembly and product distribution. When erroneous forecasts occur or market conditions change, organizations can theoretically react

instantly to redistribute materials and eliminate excess product. While this concept has great appeal, it rarely is the case in practice. The ones who purportedly manage the supply chains—CEMs and, more recently, contract design manufacturers (CDMs) or original design manufacturers (ODMs)—do not always have the ability to manufacture on a real-time demand basis.

Most suppliers organize their operations to manufacture and procure components in a batch mode—buying parts direct so they can gain cost advantage and then producing all of the finished goods as fast as they can. Running an operation on this basis requires weeks of advanced forecasts and schedule planning with no changes allowed. If substantial variances occur to the forecast or spend, penalties are charged to the OEM for the change, unless the CEM has purchased inventory independently. This practice, though, can later result in significant inventory write-offs, and SCM tools may only exacerbate the problem.

Most likely, the problem of bad forecasts will never go away since it is inherent to the current manufacturing paradigm. Simply, too many custom and specialized parts exist that are difficult to acquire without getting in line through forecast allocation. The majority of CEMs cannot structure their operations to work without them, requiring four to eight week lead times to obtain materials and to produce products.¹

The best guess approach to predicting product demand and procuring/scheduling/manufacturing has served to establish a level playing field for the EMS industry, with CEMs/CDMs vying for the slightest competitive edge in operational effi-

ciency. It has also exposed many of these firms to tremendous risks in the long lead times on work in process and finished goods inventory, as well as liability on obsolescence and quality issues. Given this situation, one might ask: Has anything fundamentally changed from the days of OEM manufacturing besides CEMs perfecting the technique of 23-hour equipment utilization and high velocity manufacturing?

A Unique Method

One CEM, Electronic Product Integration Company (EPIC, Rochester Hills, MI), has avoided the pitfalls of forecasts by producing product orders on a daily and weekly basis—in other words, it has no firm production scheduling. This CEM's manufacturing operation is able to scale in resources such as labor and materials in real time, and its supply chain management system can deliver materials almost instantly. Such an environment provides the biggest advantages for products that are low-to-medium volume and high mix.

Forecasts are practically obsolete since every day's production schedule is met and shipped independent of the variances. This practice naturally suggests a very dynamic environment that requires special cooperation and organization of suppliers, manpower and manufacturing equipment. Yet, once in place, this system yields extraordinary results in production metrics not found in most manufacturing operations. For example, at EPIC, inventory turns average approximately 14 a year, whereas most CEMs average four to six turns and only eight in special situations. (Inventory turns are a highly misquoted metric within the EMS industry). Since product assembly does not occur until the customer generates actual demand, the obsolescence risk is greatly mitigated. Product cycle time usually occurs in just one day, and on-time delivery by the company exceeds 98%.

The company has developed a manufacturing process technology that runs without advanced forecasts and with only daily/weekly schedules, yet provides its customers with what is wanted when it is actually needed. This CEM has an end-to-end lean manufacturing system² that



EPIC's headquarters in Rochester Hills, MI.

achieves a new benchmark in terms of flexibility, productivity and turnaround time. And it has achieved these results for nearly all of its customers who give the company high marks for its quality, speed and cost-competitiveness.

How Did EPIC Do It?

The first step was to develop a pull system within the EMS operations. The company had to conduct extensive layout changes to establish a cellular-based flow to improve capacity utilization and increase equipment and process flexibility.

Through these changes, the company increased component placement activity by three times without adding additional equipment. Ultimately, the company developed and implemented a revolutionary approach combining synchronous flow manufacturing with a lean operating system. According to Jochen Lipp, VP of operations, some of the breakthroughs include:

- A significant reduction in set-up/changeover times of 15 minutes average vs. greater than two hours normally. The company is able to conduct multiple product changeovers per shift with very small transfer quantities.
- Increased first-pass yield at in-circuit test and functional test through the transfer of very small quantities, which permits real-time feedback vs. large batch processes.
- Reduce the average production cycle time to less than one shift from five days in a high-mix environment (producing up to 50 assemblies simultaneously in

ADVERTISER INFORMATION: To learn about the advertisers in this issue, go to www.circuitsassembly.com and select "Advertiser Information" in the Magazine section of the home page menu. This will provide you with direct links to the home or product pages of each advertiser in this index.

Company	Page No.
Additive Services, Inc. www.additive.com	23
Assembléon www.assembleon.com	13
Dage Precision Industries www.dageinc.com	23
DEK USA www.dek.com	C4
Digi-Key www.digikay.com	C2
ESSEMTEC www.essemtec.com	23,37
Henkel Corporation www.locite.com/electronics	2
HMS Compounds www.hmscompounds.com	29
Integrated Ideas & Technologies www.integratedideas.com	19
Kester Solder Company www.kester.com	15
Metro Nozzle www.metro nozzle.com	3
NEPCON East www.nepconeast.com	33
New Venture Research Corporation www.newventureresearch.com	42
PCB Basics www.pcdandm.com/pcdmag/resource/pcb_basics.shtml	31
PCB Design Conference West www.pcbwest.com	C3
Powell-Mucha Consulting www.powell-muchaconsulting.com	41
Rockwell Automation-Anorad www.anorad.com	25,27
Samsung Techwin Co. Ltd. www.dynatechSMT.com	9
Siemens Dematic www.siplace.com	4
South Bay Circuits	45
Speedline www.speedlinetech.com	11
TechSearch International www.techsearchinc.com	42
Universal Instruments www.uic.com	17
V.I. Technology www.vitechnology.com	45
Vitronics Soltec www.vitronics-soltec.com	7

Advertising Sales

North America: UP Media Group, Inc.
2018 Powers Ferry Road, Suite 200
Atlanta, GA 30339

National Sales Manager:
Susan Jones, (404) 822-8900
email: sjones@upmediagroup.com

Europe: **Star Media:** Steve Regnier, Tim Anstee
+44 1732 366 555
email: sales@starmediaservices.co.uk

Asia: Jan Vardaman, TechSearch International
Inc., 512-372-8887
email: jvardaman@upmediagroup.com

Korea: Young Media, 82 2 756 4819
email: ymedia@chollian.net

each work cell), with work-in-process of less than one shift within the system. This benefit also reduces obsolescence risk associated with engineering changes.

The next step was to get cooperation from the company's materials suppliers—principally distributors such as Avnet, Arrow, Future Electronics and TTI—to provide components through an in-plant warehouse store that is replenished on a weekly basis. Standard electronic data interchanges (EDIs) are used to order materials, and, since the company only requires what it needs for the week ahead, virtually no scrap or obsolescence occurs. This flexibility saves money because it eliminates inventory and bulk procurement costs. Long lead times in procurement and product turnaround cycles have many hidden costs. Some of the company's distributors, such as Future Electronics, provide materials on a consignment basis, which allows EPIC to pull materials in real time.

The biggest hurdle by far is on the operations side, which required a complete restructuring. EPIC is headquartered in Rochester Hills but has plants in Norwalk, Ohio, and Juarez, Mexico. Wally Johnson, VP of supply chain management, said, "Going to China is the only choice many OEMs think they have to get competitive costs. We had to create a new and dynamic organization that was fast, flexible and competitive. A lot of people talk about lean manufacturing, but most stop short of a full lean program. The difference in our system is with our execution."

To facilitate this new model, EPIC has perfected a Kanban³ system in its operations. Cooperative distributors are pivotal to providing the necessary component response time for their factories to execute and give its comparative cost advantage. Because the model lacks the overhead associated with traditional materials resource planner systems and production scheduling, the company is frequently able to offer a more competitive total solution to its customers—even when competing against much larger first- and second-tier EMS companies.

This new model requires a dedicated and highly trained workforce. Most EMS

operations have people coming in on fixed shifts and completing specific, task-oriented production schedules. At EPIC, what makes this situation unusual is that everyone is trained to operate any piece of machinery and for any task on the floor. The entire work force is, then, a fully independent and mobile asset available to tackle any given problem. As such, people flow to the area of most urgent need such as when demand increases or when replenishment is needed.

A simple but straightforward colored-coded card system alerts workers to daily production requirements. Green indicates business as usual—produce the next pull quantity; yellow indicates a higher priority such as an upside order and red cards are the highest priority—such as two bins are empty.

Manufacturing equipment is streamlined and made flexible so that it can handle any assembly needed, making utilization high and the cost per assembly low. For example, state-of-the-art soldering machines and vapor phase reflow ovens are utilized, which enable very rapid changeovers on-the-fly.

A Satisfied Customer Base

How well does the company's manufacturing service work in practice, though? "EPIC has done an outstanding job in meeting our lean manufacturing initiatives and helping to support our Kanban system to meet customer demand," stated Travis Cline, electronics commodity manager at Respironics, Inc. (Murrysville, PA).

Respironics sought out suppliers that would achieve its lean internal manufacturing goals and selected EPIC on a number of performance criteria. "As a company, we only want to keep minimum inventory, and, as a bin goes empty, they get it replenished very quickly. This is all part of our Demand Flow Technology™ manufacturing setup," noted Cline. Respironics uses EPIC's Norwalk and Juarez facilities for production and finds that these sites allow for a faster response than offshore options.

Another customer, Ingersoll-Rand, runs a lean procurement operation in which EPIC maintains a minimum stocking level but responds to actual demand



Inside EPIC's new streamlined, flexible facility.

with replenishment planning. Michelle Stark, supply chain manager, calls this program SOMI (Supplier Owned and Managed Inventory), whereby the inventory is owned by EPIC until the point of disbursement to the factory from the SOMI warehouse. EPIC closely monitors Ingersoll-Rand's disbursement rate to get a true sense of demand and feeds their replenishment accordingly to maintain the minimum stocking level.

"The SOMI program gives our operations a lot of flexibility," stated Stark. "Ingersoll-Rand no longer has exposure to expediting fees or inventory liability, but the supplier gets quicker payment terms in exchange for the reduced liability and improved inventory turns. Payments are processed weekly from a disbursement record. The process is paperless because we don't provide a purchase order and the supplier doesn't provide an invoice."

Attention to detail has emerged as one of the key success factors for EPIC and in its ability to execute at a high level. "Take a look at our cash conversion cycle, which is probably the lowest in the industry," stated John Sammut, president and CEO. "Most CEMs typically are in the 50 to 60 day cycle, whereas we are in the low 30s."

This performance has translated into growth over the last several years in a period when the overall EMS industry is contracting and consolidating. Revenue

for the company grew at greater than 25% compounded annually over the past four years, and the company has business on the books to sustain this rate into 2004, according to the director of business development, Todd Baggett. Moreover, the company has achieved a respectable return on invested capital, bucking the trend that EMS is only an anemic, low-margin business that cannot be competitive in North America.

Conclusions

What conclusions can we draw from this success? First, that innovation and profitability are not dead in the EMS business. EPIC's customers are obviously getting good value from its lean manufacturing service offering; otherwise, they would do it themselves or go to another supplier. EPIC has found a way to give its customers performance, turnaround time and a low-cost product offering—yet still make an attractive return on its sales.

Secondly, EMS production does not need to go offshore or into China to be competitive. This is a zero sum game in which suppliers are engaged in a feeding frenzy for fractional pennies. The winners will be the ones who can survive on the lowest margin, and many ambitious Chinese CDMs are willing to play this game to the death.

A solution in North America has come from people willing to break away from

the old paradigm of batch-oriented manufacturing and purchasing. EPIC has defined a new model that gives EMS providers a way to compete against low-cost, offshore suppliers by being more efficient in all aspects of production. While this model may not suit every customer and every product situation, the fact that at least one company in the industry has found a unique way and methodology to succeed is heartening. Necessity has once again shown to be the mother of all invention. ■

Endnotes

1. Ordinarily, lead times vary based on products, materials and customer requirements. Benchmarks performed on the CEM industry indicate that most CEMs require between four to eight weeks to purchase materials and assemble a product. A typical lead-time structure that a contractor might use is as follows:
 - orders can change 100% (up to 90 days before delivery date)
 - orders can change by 50% (up to 60 days before delivery date)
 - orders can change by 25% (up to 30 days before delivery date)
 - frozen time period (the last 30 days).
2. George Koenigsacker, president of Lean Investments LLC and former president of the Hon Co., believes that less than 5% of U.S. manufacturers are substantially lean, and most of these are greenfield startups from Japan.
3. Kanban is a manufacturing system principally developed by Toyota that uses a very simple two-bin system that keeps only enough inventories on hand to fill the backup bin. The size of bin is based on a bin planning tool that calculates the customer's historical demand, expected upside desire and customer service level. Once a bin runs out, it gets replaced by the sibling bin, triggering an order by an employee to place the now-empty bin.
4. The cash conversion cycle (CCC) represents the number of days a company needs to purchase a raw material, convert it into a finished good, sell the finished good to a customer and receive payment from that customer for that product. The CCC has three components: days sales outstanding (DSO), days inventory outstanding (DIO) and days payables outstanding (DPO). The CCC is a companion to the three most important parts of the *flow ratio*: accounts receivable, inventory and accounts payable. The lower a company's CCC is, the better.

Randall Sherman is president of New Venture Research Corp., Nevada City, CA; (530) 265-2004; email: rsherman@newventureresearch.com.