

EVAN J. MILLER

TRIPPING
OVER
DATA

**How too much data
and not enough actionable
intelligence can torpedo your business**

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by Evan J. Miller

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About Tripping Over Data

Manufacturing companies have been struggling with too much data and not enough actionable intelligence for a long time. All too often, the most important knowledge is hidden in plain sight. It is hidden because it is locked up in stand-alone business systems. Key stakeholders struggle to connect the dots between all these systems in a timely manner. As a result, the drive to create a data-driven culture drowns in its own data.

Tripping over data explores this paradox. Framed around a fictional account of a divisional supply chain leader on a visit at his best performing plant, this ebook paints a picture of the data challenges manufacturers face and how they impact business performance. It will give your developing leaders a vocabulary for speaking about data and a simple path through the paradox.

“Tripping over data could be required reading for my team. It is well done and spot on.”

R. Joseph Benford, Corporate Quality Director, Mueller Company

“Tripping over data described our situation to a T. I hope you don’t mind that I passed it around to my colleagues.”

Rob Lancaster, Director of Operations, PLZ Aerospace Corporation

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Prologue – Alignment and Execution

It's been nearly a year since you last visited the Oakwood plant. As North American VP of Supply Chain with oversight responsibilities for Oakwood and 12 other foods packaging facilities, you like to visit each plant a couple of times a year. But this year has been crazy: your CEO saw to that by swallowing up a larger company that was in financial trouble. With that, you gained responsibility for one of those divisions, adding five plants to your fold. All of your travel the last six months has involved shuttling back and forth between the new plants helping them put out fires. Last month you consolidated operations and production, and closed one of the plants. The remaining plants have a firm action plan and you've stepped back to let the leaders in each plant take root and prove themselves.

With all that behind you, you're happy to get back to Oakwood. It has a special place in your heart because it is the plant you managed before your promotion. It isn't the biggest plant in your division, but it is the most successful. It took the lead on your watch, and you handpicked and developed your right-hand man, Brian, to be your successor. Brian is now the plant manager, and you know he has been a great steward because his numbers are way up – eclipsing even your performance. You're really proud of his accomplishments, and today you finally get to see them first hand. Of course he has shared some of the details of these successes in your weekly conference calls. But a conference call is nothing like the real thing.

You arrive early, before most of the office staff. You know Brian is an early riser and you expect you'll have a chance to talk a little before everything gets going for the day.

1. “Smile. It’s going to get worse.”

Recently a colleague of mine was telling me about his first job. It was part-time. He was in high school. When things didn’t go the way he expected, he grumbled.

His boss seemed ancient to him then. Whenever he started grumbling, his boss would say, “Smile. It’s going to get worse.”

There probably isn’t a manufacturing plant in the world that isn’t already swimming in data. From financial and accounting systems to process control sensors, and everything in between, the people who lead modern manufacturing facilities have data.

A recent study published by *The Economist* (“Manufacturing and the data conundrum - Too much? Too little? Or just right?”¹), evaluates the current state of manufacturing data. It finds that manufacturers have significantly ramped-up shop floor data collection in recent years. The effort has paid off with significant reductions in the Cost of Quality, but at a price. Here are some of the study’s key findings:

The vast majority (86 percent) of these reported problems with managing the data they were generating.

The good news is that the data that is being used is generating very positive results. Two-thirds reported savings of at least 10 percent on their total cost of quality.

Only 42 percent of manufacturers reported having what they consider to be a well-defined data-management strategy.

35 percent reported difficulty integrating data from multiple sources and formats.

Only 40 percent said they used data analytics to find solutions to production problems.

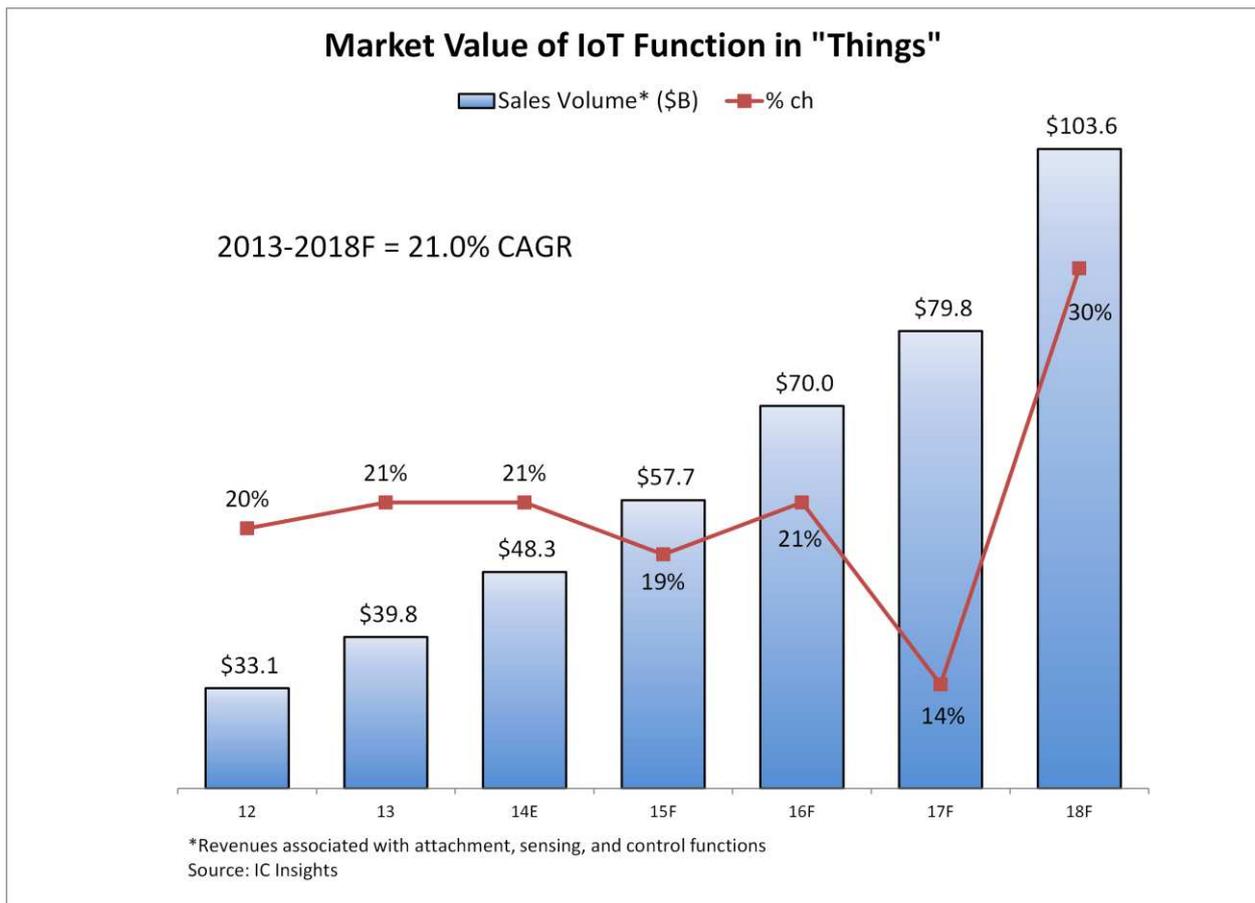
62 percent said they are not sure they can keep up with the large volume of data they can collect.

The concerns about these organizations’ capacity to keep up with increasingly large volumes of data are well placed, because, as my friend’s boss said: “It’s going to get worse.”

How the Internet of Things changes everything

According to market research analysts at IC Insights, the total amount of money spent on the Internet of Things (IoT) in the five-year period ending in 2018 is expected to have a compounded annual growth rate of 21 percent.²

Figure 1. Market Value of IoT Function in “Things”



According to Gartner:

The Internet of Things (IoT) is “the network dedicated to physical objects (things) that contain embedded technology to sense or interact with their internal state or external environment. The IoT comprises an environment that includes things, communication, applications and data analytics.”³

With that kind of growth rate, whatever problems managers have today with data will be exacerbated in the connected world of IoT.

The shifting balance of power between suppliers and customers

This is important because of a profound shift that is taking place in the relationship between manufacturers and their customers.

According to the information technology research and advisory firm, Gartner:

“Historically, these manufacturers have reached their end customers (or consumers) via a third-party channel — broker, distributor or retailer. Looking ahead, rather than just satisfy the needs of their traditional channel partners, many of these enterprises are trying to put end customers at the heart of their business because of the way the end customers are wielding power with social, mobile and other digital technologies. CIOs and business leaders are beginning to realize that this shift

will mean major disruptions to business models.”⁴

With customers wielding more power in the supplier/customer relationship, the supplier’s capacity to meet real-time shifts in demand with high-quality, flexible, and scalable production becomes essential. And more data coming on-line will stress already inadequate systems.

¹ http://www.economistinsights.com/sites/default/files/Manufacturing_Data_Conundrum_Jul14.pdf (Accessed on 24 March 2015.)

² <http://www.icinsights.com/news/bulletins/Internet-Of-Things-Boosts-Embedded-Systems-Growth/> (Accessed on 24 March 2015.)

³ Gartner: Four Best Practices to Manage the Strategic Vision for the Internet of Things in Manufacturing Ref #: G00263045 Analyst(s): Simon F Jacobson, November 5, 2014

⁴ Gartner: Agenda Overview for Manufacturing Industries, 2015. 05 January 2015 G00270719

2. Alignment and Execution

The first thing you notice when you walk into the Oakwood plant's office lobby is a new flat panel display hanging just outside Brian's door. The display includes several dials registering the current value for the [key performance indicators](#) that Brian sends to you each month. These include efficiency, uptime, quality, material cost, overpack cost, inventory, and sales. You notice that all of the indicators are green, and have been updated in the last few minutes. You smile as you realize that one of the secrets of Brian's success is right in front of you in plain view: up-to-date visibility into the critical metrics that you both care about.

The overhead light and computer are on in Brian's office, but he is nowhere to be seen. As you pause there, Sharon, the controller and IT guru passes in the hall and greets you warmly. She asks you about your flight and your kids, and you swap stories for a minute. She tells you that Brian is already out in the plant, and offers you the paper in her hands.

"You might be interested in this," she says. "Remember how you always wanted to know what happened overnight? Here is our new [Exception Report](#) that automatically shows up on my printer first thing every morning."

The report lists every hiccup that occurred in any production line overnight. It states exactly what changed, who responded, and what they did.

You don safety glasses and hearing protection, wash up, and head out to the shop floor to find Brian.

At the first production line you're surprised to see another flat panel display hanging from the ceiling at the end of the line. It looks a lot like the one outside Brian's door, but when you look at it closer, you see that it has only the things that are relative to the workers on that line. Efficiency, Productivity, and Cost of Overpack data are there, plus Quality and Uptime. But the data are only for that line. Looking across the plant you notice that similar panels are hanging over the other lines.

As you're taking all this in, you spot Brian in the first aisle hurrying towards Line Five. He waves for you to join him. When you catch up with him, he explains that he just got a text message about a shift in bag weights on Line five that he needs to check on. He points to the panel over that line that has a red indicator.

"The panel keeps the people on the line informed, but I get the text message anywhere, at any time. I love it and hate it," Brian laughs.

By the time you arrive at the operation, the senior quality engineer, the first shift production engineer, and the service rep for the customer are there. Your surprise about the quickly assembled group registers with Brian, who says, "We all got the message, and we come from wherever we are so we stay in the loop."

While he is conferring with the others and the machine operator, you take another look around and realize something is missing: It's all the scrap that was piled up in bins and on skids, waiting to be hauled to the landfill.

After a few minutes, Brian leaves the huddle to rejoin you. “Turns out that we have a new material lot that just came on line last hour. Quality was aware that it might cause a problem, and they were watching it closely. They’re making some adjustments based on the data, and we’ll be back up and running momentarily.”

“Brian, that’s great. I’m impressed with the speed of this response. A year ago we would have made scrap for most of a shift before anyone even noticed we had a problem. All this came about because of the text message?”

“No, it is way more than that,” he says, urging you toward a computer display.

“[Here we can see the data.](#) We were running great up until a few minutes ago. Then you can see the out of control point. And here is the data from incoming so we can see the key metrics on the new material lot. Based on this, we have a pretty good idea what we need to reset and we should see it come back towards target in the next few cycles. The text message just tells us that we better pay attention to it.”

He pauses for a moment and then adds, almost to himself: “But I guess the message is important because it goes to everyone at the same time. You know, this wouldn’t work nearly as well if it just went to one person.”

“Oh, I get that,” you say, nodding. “It’s all about people pulling in the same direction. Shared knowledge about what is happening in real-time makes that much easier to do.

“But what I want to know is what happened to all the scrap? I’ve been watching those numbers go down in your monthly financials every month, but it didn’t really hit me until a minute ago what that meant to the floor. There’s a lot of room out here that I don’t ever remember seeing.”

“Cool, eh?” Brian says, grinning. “We have a lot of catching up to do. I’ve been looking forward to showing it all to you.”

Brian glances at his watch and starts. “Where did the time go? I have to get to a meeting. Let’s walk and talk.”

You fall in step as he hurries out towards the conference room in the center of the plant. “One of our improvement teams is having a milestone meeting at 8:30,” he says. “They’ve invited me for a status report. You can sit in and hear first-hand what we’re up to.”

3. Six Ways data can torpedo your business

While devices and data are growing exponentially, we can summarize the problems manufacturers encounter in a handful of ways.

Too many data silos:

“I have lots of data, but it is locked up in a wide variety of disparate data systems.”

We sometimes refer to these disparate systems as data silos (<http://www.hertzler.com/2014/03/three-big-issues-big-data-manufacturing/>) because, like the silo storing feed on a farm, the contents of the data silo are protected, but not easily accessible. Data silos may contain a huge amount of data, but cutting through the clutter can be difficult and time consuming.

What people need is the ability to break down the walls between all these data silos, regardless of their size, so they can use the data to make better decisions.

Lack of data visibility:

“I can't see what is happening in my plant.”

A lot of information never gets properly recorded. Some of it gets written down on paper while a lot more of it is stored in databases. Regardless of where it's stored, it largely disappears, rarely to be seen again.

What leaders need is the ability to define and see the critical quality (<http://www.hertzler.com/2015/01/visibility-real-time-metrics-drives-performance/>) and performance metrics (like first pass yield, capability trend over time, throughput, and uptime) throughout the plant and across the supply chain.

The data behind those metrics needs to be clean, timely, accessible, and easy to see and understand. Each person who sees these metrics (line staff, middle management, and senior management) needs to see only those metrics that matter most to them, presented in the most understandable way.

Needed cultural change:

“My people want to do a good job, but we lack the nuts and bolts tools that help them perform.”

Most people do not come to work looking for a chance to make mistakes or cause problems. People want to perform well, but sometimes they don't have all the tools they need.

Leaders need to create an environment (<http://www.hertzler.com/2014/12/developing-high-performance-culture/>) where people care about quality and have the tools and resources to ensure and improve quality. We need to have better conversations about the real issues at stake. This requires using a common language of data to talk about what needs changing, how to make the changes, and whether the changes are working. When those pieces are in place, you've eliminated a significant barrier to performance.

No time:

“We have some metrics in place today, but the time and effort required to make good use of those

metrics makes them unsustainable.”

Most businesses run very lean on staffing today and cannot add more staff even as their business grows. With the ever-increasing volume of data arriving daily, leaders need to find ways to automate and optimize the use of data.

Business leaders need to create systems that are easy to use and sustainable (<http://www.hertzler.com/2014/10/automated-data-wrangling-for-easy-analytics/>).

Lack of real-time data:

“We’re usually driving from the rearview mirror.”

The impact of having data stuck in places where you can’t see it or react to it is that problems are discovered too late - often hours, days, or even weeks after they occur. It’s like trying to drive forward by looking through the rearview mirror. Besides increasing scrap and rework, it may also drive up costs of fixing problems. For example, if it takes four days to find out you have a problem, that might mean you have four days of production to recall. If you can find it in real time, then you’re dealing with a much smaller problem.

Leaders need to know immediately when they have a problem. And because nobody has time to hunt down problems, they need problems to surface automatically (<http://www.hertzler.com/software/features/real-time-data-entry/>). Speed puts you closer “to the scene of the crime” and increases the probability of resolving problems before they get out of hand.

No focus:

“There must be dozens of things we could do to improve this business, but we don’t have a way to prioritize and focus our improvement efforts.”

Too often, the person with the loudest voice or the most impressive-sounding title sets the operational priorities of manufacturing teams. Basing team priorities on politics sub-optimizes and undermines the team’s effort. It can also lead to a kind of organizational Attention Deficit Disorder where lots of projects get started and never finished, or organizational apathy where there is too much to fix and well-meaning people try to ride out proposed change initiatives with the hope that “this too shall pass.”

Leaders need to know where to focus the organization’s resources and energy (<http://www.hertzler.com/software/features/analyze-using-charts-draft/>). Real data bring clarity to decisions about where to focus team efforts, and provides a necessary foundation for sustaining your continuous improvement efforts.

Many manufacturing companies continue to struggle with too many data silos, lack of data visibility, needed cultural change, no time, lack of real-time data, and a lack of team focus. Unless these issues are addressed, they are only going to worsen as the sources of data proliferate in the coming years of the Internet of Things.

4. Alignment and Execution

“What you said about shared, real-time knowledge is spot on,” Brian tells you as you continue to make your way through the Oakwood plant shop floor toward the conference room. “You remember Carl Paulson, don’t you?”

Now it is your turn to grin. You remember Carl as a young, smart production worker. He should have gone to engineering school, but for some unknown reason had barely made it through high school. He was quick witted, and one of those guys you sometimes wished would respect authority a little more. But he had a knack for asking uncomfortable, but necessary, questions about some of the manufacturing processes. You had come to appreciate that he always called it as he saw it, and he usually saw it right.

“I remember Carl as a good guy,” you say. “Why?”

“A year ago he heard a presentation at our quarterly All Hands meeting about an appreciative kaizen event we ran in the baking department. He stopped me the next day when I was walking through his area in mixing, and told me he could beat their improvement if I’d just give him a chance. I remembered you always thought a lot of Carl, so I took him seriously. I asked him what he wanted, and what he thought he could do.”

Arriving at the conference room, Brian tells you, “Let’s finish that story later.”

You know most of the people gathered in the room, and they all seem genuinely happy to see you. You find yourself comparing that to your reception at the other plants where you’ve had to be the bad guy, the outsider who was sent in to clean things up. Compared to that, this is a welcome relief. By the time you’ve swapped greetings with everyone, Matt, the lab supervisor, is calling the meeting to order. The meeting moves quickly. Matt pulls up another [dashboard](#) on his laptop, projecting it on to the wall. Conversation focuses on the efficiency metrics. Individuals and small groups report on their research. In one case, Shift 3 had an Efficiency that was always eight or ten points ahead of the other shifts. The team had suspected bogus data, but when they investigated they learned that the data were accurate, and that one group of operators on third shift had streamlined their process so that it made a significant difference. The team had already begun documenting the better process, and shared their plans to train all the operators on all shifts in the new process.

In 30 minutes the group had agreed on their goals for their next meeting and was already filing out of the conference room. Brian had spoken little in the meeting, except to ask one or two good questions, and to congratulate and thank the team members for their work.

“I’m impressed with their focus,” you tell Brian as the room empties. “You’ve done a great job of giving them the tools they need, firing them up, and getting out of their way. That kind of energy comes from the top.”

“Thanks. I really appreciate that you see that. But that group is also exceptional. They have really stepped up to the job, and I’m glad you got to see the best of the best.”

5. The impact

Manufacturing plants have too much data, much of which turns out to be largely unusable. They also lack real-time data that is actionable. In other words, they lack actionable knowledge derived from the data they're collecting.

And all signs are pointing to these challenges getting a lot worse. But how does this impact the business's bottom line?

Better access to real-time actionable data can help manufacturers in these ways and more:

- 1 Increases revenues through improved customer satisfaction
- 2 Increases revenues through increased operational capacity
- 3 Grows operating margins through reduced material costs
- 4 Grows operating margins reducing non-valued added activity and increasing value-added activities
- 5 Reduces asset levels by improving inventory turns

Increase Revenue through improved customer satisfaction.

The Internet and social media ushered in a new age in the relationship between producer and consumer, and vendors and customers. In this new age, consumers search for product (and producer) ratings before ever contacting a vendor. And this isn't just in the business to consumer markets.

Real-time actionable data demonstrably improves product quality and improves customer satisfaction (<http://www.hertzler.com/2015/03/turning-field-failures-supply-chain-leadership/>). This higher level of satisfaction adds leverage to a company's sales and marketing initiatives.

But it goes beyond that. With instantaneous communication and social media, problem situations can rage out of control at the speed of Twitter.

Getting a major airline to sing a new tune

(Excerpted from the website DaveCarrollMusic.com.)

“Songwriter Dave Carroll wasn't the first person abused by an airline's customer service. But he was the first to show how one person, armed with creativity, some friends, \$150, and the Internet, could turn an entire industry upside down.

“United Airlines had broken Dave's guitar in checked luggage. After eight months of pestering the company for compensation, he turned to his best tool—songwriting—and vowed to create a YouTube video about the incident that he hoped would garner a million views in one year. Four days after its launching, the first million people had watched “United Breaks Guitars.” United stock went down 10 percent, shedding \$180 million in value; Dave appeared on outlets as diverse as CNN and The View. United relented. And throughout the business world, people began to realize that “efficient” but inhuman customer-service policies had an unseen cost—brand destruction by frustrated, creative, and socially connected customers.”¹

Can better use of real-time actionable data to improve customer quality and satisfaction help increase revenue? Here are some questions to help you answer that question:

- How sensitive are your customers to perceived quality?
- How important is social media, internet reviews, and word-of-mouth sales to your marketing mix?
- Have you measured and calculated the relationship between customer satisfaction and sales?
- If customer satisfaction goes down one percentage point, can you predict the impact on sales?
- What role does manufacturing quality (for example, compared to design quality) play in customer satisfaction?
- What is the relationship between manufacturing quality levels and customer satisfaction?

Increased revenue through increased operational capacity

In some situations, manufacturing capacity is a cap on revenue. If you've ever said, “I can sell everything I produce, and if I could produce more, I could sell more,” you've been in this situation.

In these situations, real-time actionable data can drive efficiency improvements in labor and assets. Improving efficiencies in labor and machinery increase output from a fixed level of resources, which can drive top-line growth.

Can you increase capacity thereby and thereby increase revenue? Here are some questions that might help you explore that more fully:

- Is manufacturing capacity a governor on revenue?
- Does demand for your product exceed your capacity to produce it?

- Is there a direct relationship between revenue and productivity, efficiency, or quality?
- Is rework (or regrind in plastics) an “accepted cost” of doing business because “it has always been this way?”

Real-time actionable data can help address all of these situations, and be a powerful tool for driving revenue up.

Grow operating margins through reduced material costs

Many industries have an “overpack” problem. Classic examples are filling operations where the package is sold by a predetermined label weight. Even small amounts of excess material in a package, when compounded by high volume production lines, can result in lost margin due to product giveaway (over packing).

Of course this isn’t just a packaging industry problem. It applies to any industry where “not enough” is a quality problem and “too much” is a cost problem. Other examples include blow-molded plastic bottles where excessive wall thickness uses too much plastic, or paint coatings that are too thick resulting in higher material costs and longer drying times.

Is your business doing too much of a good thing? Here are some questions that might help you answer that question.

- Does your product require a set minimum amount of material, and you overcompensate by adding too much to prevent ever being under the minimum amount allowed?
- What is the target volume of packages?
- What is the average amount of product you giveaway for each product, and how much does that add up to in a week, a month, in a year?

Real-time actionable data can help you reduce and control overpack (http://www.hertzler.com/portfolio_item/mccormick-flavor-division-reduces-overpack-and-material-costs-by-10-30/), and thereby increase operating margins.

Grow operating margins through reducing non-valued added activity and increasing value-added activities

While real-time actionable data may sometimes “cause belly buttons to walk out the door” as one business owner puts it, concrete reductions in work force are rarely the point. More often it is to eliminate non-value added work so that more value added work can be accomplished.

This can take a couple of forms, depending on the work being done and who is doing it.

Real-time actionable data is usually deployed through automated data systems that eliminate much or all of the administrative grunt work of collecting and reporting data.

Very often, when manufacturers deploy real-time actionable data systems they free up highly paid engineers (http://www.hertzler.com/portfolio_item/walking-the-talk-empowering-people-with-data-full-version/) from very advanced grunt work of building queries into multiple data systems, scrubbing disparate data sources, and eliminating duplicate data. Without such tasks, they can focus on

more productive activity, thereby improving labor efficiency. In these situations, these engineers may be the only people who have the knowledge to do the work, but their creative, problem-solving skills are being used just to get the data. It is not unusual for these engineers to spend hours on mind-numbing data scrubbing activities in order to get enough data for a study. The actual study takes only a few minutes.

If these same engineers had the data at their fingertips, their creative energies could have solved more problems in the same amount of time. This can help drive improvements faster in the business.

Here are some questions to help you evaluate whether you can reduce non-value added activity and thus grow operating margins:

How much time do your people currently spend:

1. Manually recording data on paper?
2. Compiling, sorting, massaging, or cleaning up data before you can analyze it or report on it?
3. Sorting suspect product because you don't have time to do timely in-process inspection? (For example, if you inspect twice a shift instead of hourly, an out of control alarm means that you must sort four hours of production instead of one hour of production.)
4. How much data gets filed in a filing cabinet (or in some database silo) never to be used again?
5. How often are inaccurate numbers recorded, causing false alarms, or a false sense of security?

Reduce asset levels by improving inventory turns

Real-time actionable data can help reduce production cycle times and positively impact inventory levels in Raw Materials, Work in Progress (WIP), and Finished Goods. An obvious piece of low hanging fruit is to determine how much inventory is tied up in WIP because of rework.

For example, an electronic equipment manufacturer had racks of parts in a queue waiting for touch up. The factory floor was cluttered with these racks. The line ran as Build to Order, so every hour the unit sat in the queue for rework delayed when the company could deliver and get paid for the order. It added up to a substantial amount of money. Real-time actionable data armed the team with what they needed to significantly reduce or eliminate rework. As they cleaned out the backlog, cash rebounded. Rework had been a huge drain on the company because of the impact on finished goods and receivables.

Real-time actionable data can make downtime more visible, even predictable. This allows you to schedule downtime for maintenance, which in turn increases productivity and throughput and increases asset utilization. Here are some questions to help you evaluate where real-time actionable data might impact asset levels:

- Is inspection, analysis, or reporting ever a bottleneck for releasing raw materials to WIP, or WIP-to-Finished-Goods Inventory?

- How much product do you have in WIP that is waiting for rework or repair?
- What is the impact on cash and receivables?
- What is the impact on your organization's credit rating?

¹ <http://www.davecarrollmusic.com/book/>

6. Alignment and Execution

“Okay, Brian,” you say. “I want to get back to talking about Carl. How about a cup of coffee and you tell me the whole story?”

“Sure,” Brian grins. “I’ve cleared my calendar, and I’ve been looking forward to sharing this story.”

“It turns out that Carl had signed up for a certificate course in manufacturing technology at Pine Creek Tech, all on his own initiative,” Brian tells you later over coffee.

“Evidently he didn’t know we sponsor related technical classes because he never even asked for tuition support. Anyhow, for one of his classes he was supposed to find an on-the-job improvement project. While he was telling me this, he pulled out a sheaf of graph paper and showed me that he had been writing down and graphing the numbers from the digital read-out on the automated mixers. He had been working on it for a couple weeks already at that time, and he showed me what he thought were trends and relationships in the data. I was really impressed – partially because his conclusions made sense to me, and partly because of his drive and passion for the problem.”

“Very cool,” you say. “I had a feeling he was a go-getter, but I didn’t think he’d do something like that. So what did he find? And what did he want from you?”

“I’m getting to that. He had a theory that the pass/fail system on the automated mixer wasn’t sensitive enough to detect shifts in the process. At the time we had fallout of about 14 percent after mixing, and Carl was pretty confident that a lot of it was because of variability in the mix. He felt that if he could track the raw data for all the ingredients on the right charts, he’d be able to spot any profound shifts or slow drifts in the process, reduce the variability, and improve yield. What really got my attention was that I had seen that yield coming out of mixing had been up the last couple of weeks. I had been so busy fighting fires that I hadn’t followed my instinct to check it out. But here was the answer to the question right before my eyes.”

As Brian talks, you’re doing the math in your head and realizing that improving yield at mixing by even a few percentage points had a huge impact on the bottom line.

“What he wanted from me,” Brian continues, “was to make it easier to get the data. He was trying to do it all by hand, and it was about killing him. It didn’t take an accountant to see that he was on to something, and that it was worth spending a little to see what he could do.

“Carl had some help from his professor, and some data collection and analysis software that the prof was familiar with. He set up a [demo unit](#) on a spare PC we had sitting around with a little help from the software vendor and automated his data collection. We had that running for two or three weeks and once we saw what it could do, we got a handful of licenses and more help integrating it with our other systems.”

“Hold on,” you interrupt. “You didn’t get those results because of some software package.”

“No, of course not. But it laid the foundation for everything that happened after that. Once Carl had the data, we could really see the cause and effect of the parameters. I remembered how you used to harp about looking for the best of the best, so I kept pushing him to look for the best and try

to emulate it. We were able to drill into the data and figure out the root cause of success really fast, and it just snowballed.

“That’s what really surprised me. I had an idea that we had data lying around that we weren’t doing much with, but I never dreamed how much was actually out there, or that we could make better use of it.”

“So this didn’t stop with Carl’s project?” you ask.

“Oh, heavens no. As yield in mixing took off, we pulled a team of people together to look at his success, and to pool it with success stories from others in the department. That gave everyone a common vision and I was surprised at how excited they got about it. We started publishing dashboards and teaching teams to go after the opportunities.

“Pretty soon other departments started nosing around, so we pulled them together with Carl’s department and once again went looking for the successes we already had going. We already had pockets of success, and as we turned our attention to those successes and building a vision in those areas. Pretty quickly we started looking at weight data, oven temperatures, lab data, cost of over-pack, up-time, line efficiencies... you name it. I even started thinking about my financials differently, and asked to see daily dashboards for on-time delivery, liquidity, working capital.

“It was pretty amazing how it took root. Once people had the data and the focus of finding the best, they took to it like ducks to water.”

You’re silent for a while, taking all this in. You saw the proof in the financials even before you walked in the door earlier this morning. Now, seeing firsthand how it actually came together, it was almost too easy.

7. The Hierarchy of Manufacturing Metrics

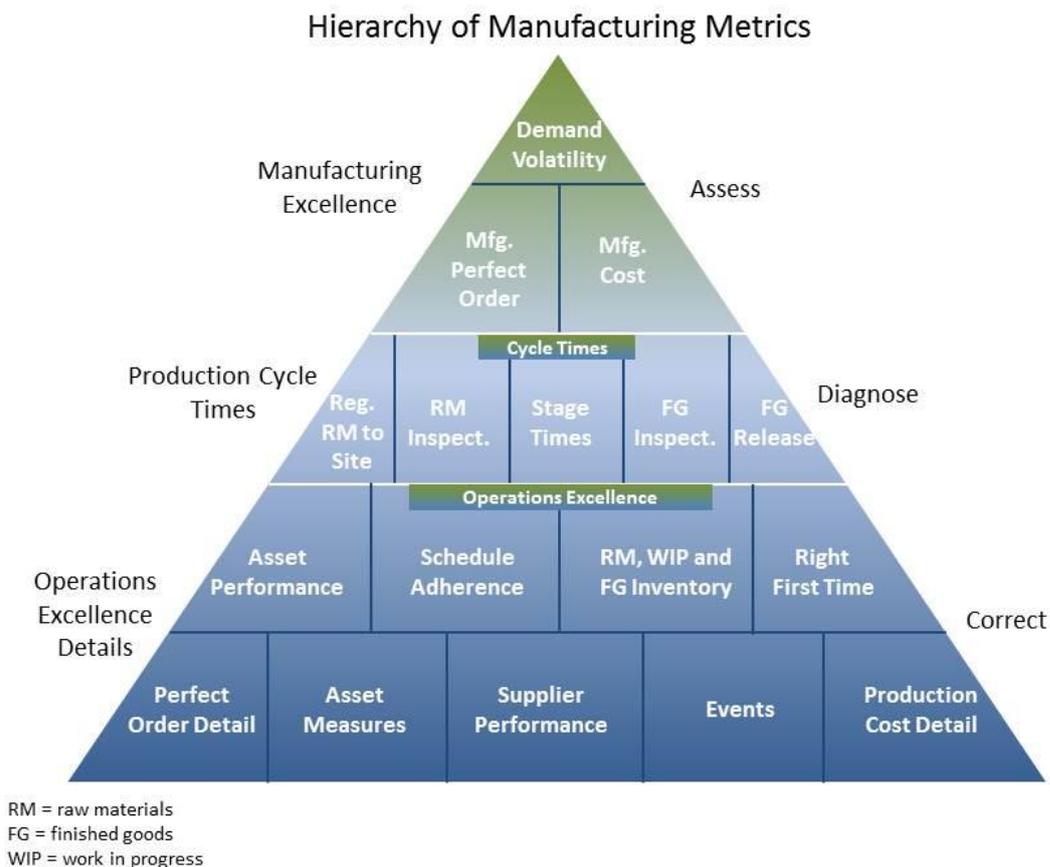
One of the reasons manufacturing is under a crush of data is because of a lack of clarity about what should be measured. With more and more data coming on-line and available, the easiest thing seems to be to take it all. The logic is that if real-time actionable data is a good thing, then a whole lot more is even better.

But like salt in a cookie recipe, too much can be overwhelming.

What is needed is a strategy – a heuristic – for answering the question: With all this data that **could** be used, what data **should** be used?

The analyst firm Gartner developed the Hierarchy of Manufacturing Metrics to help “*companies connect manufacturing and supply chain performance to increase responsiveness, quality and efficiency by understanding the trade-offs between delivering a perfect order out of the plants and keeping costs in line.*”¹

Figure 2. The Hierarchy of Manufacturing Metrics



Source: Gartner (May 2011)

According to Gartner, “*At the top of the hierarchy is demand volatility. It’s here not as an outcome of manufacturing performance, but as a driver. Our past research has shown that companies with better visibility into demand and demand changes carry less inventory, have stronger perfect order*

fulfillment and keep shorter cash-to-cash cycle times.”

To make the most of this kind of this approach, Gartner recommends the following steps:

- Identify the executive champion to define metrics and measure manufacturing performance.
- Limit confusion by deploying the fewest needed metrics to determine status.
- Assign the business responsibility for taking action on metrics before deploying.
- Metrics are only as reliable as the measurement system in place.
- Compare metrics across plants by achievement to target. That is, define targets appropriately by plant, and then review whether or not each plant has achieved its target.²

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¹ Aligning Manufacturing and Supply Chain Performance, Part 2: The Hierarchy of Manufacturing Metrics 05 May 2011, refreshed 13 March 2014 G00212706 Analyst(s): Simon F Jacobson | Debra Hofman

² Aligning Manufacturing and Supply Chain Performance, Part 2: The Hierarchy of Manufacturing Metrics 05 May 2011, refreshed 13 March 2014 G00212706 Analyst(s): Simon F Jacobson | Debra Hofman

Epilogue – Alignment and Execution

Finally you say, “I have two more questions.”

“Go ahead,” Brian says.

“First, I’m sure you know from the grapevine and official sources, what I’m up against with the new acquisition. Do you think the successes you’ve described at Oakwood would be transferable to my new, more challenging plants?”

“I don’t know,” Brian sighs. “I’ve got some amazing people here. But the tools and techniques work. With the right people I think it can work anywhere. But I don’t know for sure.”

“Fair enough,” you acknowledge. “Not everyone has your leadership skills, but maybe,” you say, pausing a heartbeat for emphasis, “we can develop them.”

“Thanks,” Brian says, getting your hint and slowly smiling. “I’d love to help. What is your other question?”

“Where is Carl?”

Brian laughs. “I wondered when you’d ask. I hope you won’t think I’ve gone too far.” He pauses, seeming almost worried, before continuing: “I sent him back to school. He is going full-time with an interesting combination of engineering and business courses, and working for me two or three days a week – more during school breaks.” Brian pauses again, and then finishes quickly: “I gave him a nice pay increase so he can afford to work less than full time, and I’m covering all his tuition. At the end of this semester he will just have a few more classes to finish off. I felt I owed him something after all he saved me.”

Brian still looks genuinely worried, so rather than string him along and feign disapproval, you smile and tell him what you really think: “Great move. Carl is a keeper, and well worth developing.”

Later in the day driving back to the airport in your rental car, you turn off the radio so you can mull over what you saw and learned. Brian’s success expanded your vision of what was possible in your other plants, and you and Brian had readily slipped back into the collaborative style that you enjoyed so much when you worked together on a daily basis. Together you had mapped out a plan for developing Brian’s replacement and bringing Brian up to the corporate team. Then you had strategized how you could propagate Oakwood’s success in the other plants. You were sure there were already pockets of excellence you could build on at each plant.

You’re surprised at your own energy and excitement, but reflecting back on your year of fire-fighting, you realize how drained you had become. Oakwood embodied your vision for the entire division, and you were delighted with the remarkable alignment between Brian and yourself, and, for that matter, with all of the staff at Oakwood. With the wild fires now under control, and a sketch of a plan in place for bringing the other plants along, you’re eager to start building the company of the future.

Appendix A: ROI Questions

Increase Revenue through improved customer satisfaction.

Real-time actionable data demonstrably improves product quality and improves customer satisfaction. This higher level of satisfaction adds leverage to a company's sales and marketing initiatives.

Here are some questions to help you determine whether this applies to you:

- How sensitive are your customers to perceived quality?
- How important is social media, Internet reviews, and word-of-mouth sales to your marketing mix?
- Have you measured and calculated the relationship between customer satisfaction and sales?
- If customer satisfaction goes down one percentage point, can you predict the impact on sales?
- What role does manufacturing quality (for example, compared to design quality) play in customer satisfaction?
- What is the relationship between manufacturing quality levels and customer satisfaction?

Increase Revenue through increased operational capacity

Real-time actionable data can help improve efficiencies in labor and machinery, and thereby increase output from a fixed level of resources. Can you increase capacity and thereby increase revenue? Here are some questions to help you explore that more fully:

- Is manufacturing capacity a governor on revenue?
- Does demand for your product exceed your capacity to produce it?
- Is there a direct relationship between revenue and productivity, efficiency, or quality?
- Is rework (or regrind in plastics) an "accepted cost" of doing business because "it has always been this way"?

Grow operating margins through reduced material costs

Can your business do too much of a good thing? Here are some questions to help you dive into that in more detail:

- Does your product require a minimum level of material, and is material over that minimal level given away to the customer? (Examples include any fill operation where the package is sold by a predetermined label weight, metal or paint coating, or ink coverage.)
- What is the volume of packages?
- What is the average giveaway?

- What is the total dollar value of the giveaway per year?

Grow operating margins through reducing non-valued added activity and increasing value-added activities

Here are some questions to help you evaluate whether you can reduce non-value added activity and thus grow operating margins:

- How much time do your people currently spend on activities such as:
 - Manually recording data on paper?
 - Compiling, sorting, massaging, or cleaning up data before you can analyze it or report on it?
 - Sorting suspect product because you don't have time to do timely in-process inspection? (For example, if you inspect twice a shift instead of hourly, an out of control alarm means that you must sort four hours of production instead of one hour of production.)
- How much data gets filed in a filing cabinet (or in some database silo) never to be used again?
- How often are inaccurate numbers recorded, causing false alarms, or a false sense of security?

Reduce asset levels by improving inventory turns

Here are some questions to help you evaluate where real-time actionable data might impact asset levels:

- Is inspection, analysis, or reporting ever a bottleneck for releasing raw materials to WIP, or WIP-to-Finished-Goods Inventory?
- How much product do you have in WIP that is waiting for rework or repair?
- What is the impact on cash and receivables?
- What is the impact on your organization's credit rating?

Appendix B: Sample project justification statements

Where is the low-hanging fruit in your organization? How do you connect the data problem you're trying to solve with the impact it has on the business? Here are five statements that connect different types of data issues to the underlying business need. Notice that while some have a direct measureable impact on the bottom line, others are not so clear cut. Each situation is different.

On-time delivery

An opportunity exists to improve our tracking of on-time delivery and thereby improve customer service and satisfaction. This effort will mine data from our order entry system and track individual orders through each major milestone from order entry through delivery to the customer. Detailed anecdotal information about problems will also be captured from process owners. Project teams will be chartered to reduce or eliminate bottlenecks identified by this information. While attaching a credible dollar value return on this investment is not possible, this is a critical enabling infrastructure required to meet our corporate objective of "Profitable Perfect Product On Time Every Time."

Downtime

An opportunity exists to reduce unplanned work cell downtime by capturing downtime events and the reasons for downtime, and using that information to prioritize and address chronic downtime reasons. A one tenth of one percent (0.1 percent) reduction in unplanned work cell downtime will increase capacity, and increase revenue by \$nn. These additional revenues will fall directly to the income statement. Our conservative estimate is that we can reduce downtime by x.x percent. This effort is important to work on now because production is not able to keep up with demand for our product, and unfulfilled demand create an opportunity for new competitors to enter our market and erode our long-term relationship with our customers.

Overpack

An opportunity exists to improve and reduce material costs by optimizing product weights beginning with the Fill operation and ending with the Packaging Department. This effort should result in an estimated savings of \$nn in the first three months of deployment, and an estimated \$nn per quarter thereafter. This process is important to work on now because material costs have become more volatile and margins are at risk. This effort is chartered on _____. Our goal is to complete this effort by _____.

Shadow IT

An opportunity exists to reduce the cycle time on continuous improvement projects and the time engineering staff spends on "shadow IT" work. By setting up automated data collection systems in production and test, and linking that data automatically to our MES system, our engineering teams can eliminate the hours they spend each week compiling, sorting, combining, and massaging data from various systems. The time they save will be directed to analyzing problems and supporting solutions. This project is important to work on now so that we can minimize the time to value for each of our continuous improvement projects.

Eliminating touch-ups

An opportunity exists to reduce WIP and increase inventory turns by reducing or eliminating touch up following solder. On average each cell has from three-to-five racks of product on hold following test for touch up and retest, and the racks turn over about every three days. Each rack contains \$x of material. Eliminating these touches will improve on-time delivery and days order to cash, and improve customer satisfaction. This effort will establish an improved data system for routinely capturing rework data so that project teams can better prioritize design and process improvements and systematically eliminate underlying causes.

About the Author

Evan J. Miller is President, CEO, and co-owner of Hertzler Systems Inc (<http://www.hertzler.com/>). Miller joined the firm in 1984 and held positions in sales, marketing, technical support and training. Miller became President in 1991 when founder Paul Hertzler retired from the firm.

Prior to joining Hertzler Systems, Miller taught technology education in Canada . He received his BA from the University of Waterloo (Ontario) and his MA from Ball State University (Indiana). Mr. Miller has served on the Goshen Hospital Board of Directors, including two years as Board Chair. He has also served on the board of the Maple City Chamber Orchestra. He currently serves as Board Chair of Pathways Retreat.

You can reach him at [ejmiller \[at\] hertzler \[dot\] com](mailto:ejmiller@hertzler.com). He blogs at The Data Heads Blog (<http://www.hertzler.com/blog/>). Connect to Evan on LinkedIn (<https://www.linkedin.com/in/evanjmiller>) and follow him on Twitter (<https://twitter.com/evanjmiller>).

About Hertzler Systems Inc.

Hertzler Systems is a leading provider of seamless, accurate, actionable manufacturing intelligence solutions that drive business value. Their customers experience:

- Increased revenue through improved customer satisfaction and increased operational capacity.
- Higher operating margins through reduced material costs, reduced non-value added activity, and increased value-added activities.
- Reduced asset levels by improving inventory turns.

Hertzler's clients include PLZ Aeroscience, Kiva Systems, Mueller Company, Crown Audio (Harman), McCormick & Company, Inc., Pactiv Corporation, Snyder's Lance, Textron Systems, BAE Systems, Dart Container Corporation, and Titleist & Footjoy Worldwide, just to name a few.

Hertzler Systems Inc.

2312 Eisenhower Dr. N.

Goshen, IN 462526

www.hertzler.com

info@hertzler.com

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