How to get started with business intelligence in manufacturing

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WELCOME

How to get started with BI in manufacturing

FACING INCREASING pressures from globalization and a sagging economy, manufacturers are between a rock and a hard spot. And many of them see business intelligence (BI) as an escape route. As one observer puts it, "A lack of information is what got us into this mess in the first place, so we had better start converting raw meaningless data into meaningful and actionable information so we can get out of this mess sooner rather than later."

But does BI hold the answers for every manufacturer? How does BI differ from manufacturing intelligence? How can a manufacturer calculate the ROI from a BI implementation? How important is the quality of the data the BI system is parsing? There are many BI tools out there; how does a manufacturer know which are the right ones?

This eBook will answer these questions:

- Can business intelligence software help manufacturers improve efficiency?
- How should manufacturing organizations make the case for business intelligence?
- How should manufacturers get started with business intelligence software systems?
- What are the best practices for evaluating BI tools for manufacturing?

CHAPTER 1

Can BI software help manufacturers improve efficiency?

MANUFACTURING ORGANIZATIONS are facing more pressure than ever before, and the pressure just keeps rising. Globalization and new competition, in addition to weak economies, are forcing manufacturers to run leaner and meaner, while they must produce a greater number of types of products, if not custom products, as well as maintain increasingly difficult standards.

How can manufacturers ensure that every order is efficient and profitable while saving money or even taking on new business?

Does business intelligence (BI) for manufacturers hold the answers?

"I think most leading thinkers correctly believe a lack of information is what got us into this mess in the first place, so we had better start converting raw meaningless data into meaningful and actionable information so we can get out of this mess sooner rather than later," said Boris Evelson, principal analyst of BI for Cambridge, Mass.-based Forrester Research.

UNDERSTANDING MANUFACTURING AND BI

When it comes to manufacturers, though, there are really two kinds of intelligence—manufacturing intelligence (a.k.a. enterprise manufacturing intelligence) and business intelligence for manufacturers.

"Business intelligence and manufacturing intelligence are related in the sense that BI is all-encompassing, covering everything from weather forecasts to consumer behavior," said Dan Miklovic, vice president of manufacturing industries advisory services at Stamford, Conn.-based Gartner Inc. "Manufacturing intelligence focuses in on the manufacturing value chain from ideation through after-delivery service, even to retirement and recycling in some cases, but with a real sweet spot of manufacturing itself."

More specifically, manufacturing intelligence (MI) tends to be more about analyzing what's happening on the production floor in real time or near real time.

"What is happening on the conveyor belt? How does it compare to yesterday? Are there errors? Are things getting stuck somewhere? Is everything flowing according to plan?" Evelson illustrated, noting that this kind of operational intelligence is designed to eke out efficiencies in the manufacturing process. If you're talking about measuring and tracking machine state performance, odds are you're looking at manufacturing intelligence.

FROM SHOP FLOOR TO TOP FLOOR?

"If you want to look at the higher level of product and process performance, understanding how certain materials work at certain times or understanding how a process will affect the supply chain, that's the crux," said Simon Jacobson, a research director for Boston-based AMR Research. "The point you begin integrating the data with the supply chain, it becomes a broader architecture where you start to involve multiple data sources and multi-site performance to track how well manufacturing is or isn't performing."

The idea, of course, is to connect MI types of data with traditional enterprise data—after all, companies that manufacture have something to sell, and how can executives make the best decisions with data that shows only a portion of what's going on? More importantly, what if we're talking about companies with multiple manufacturing plants?

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>
> —SIMON JACOBSON
> Research director, AMR Research

"The competitive advantage that we're seeing manufacturers try to achieve is to holistically manage their manufacturing operations across the global network—the large manufacturers that have 90 to 100 plants," said Matthew Littlefield, a senior research analyst for Boston-based Aberdeen Group.

"If they are able to evaluate and manage those plants with a common set of metrics for each plant, that's really viewed as a competitive advantage for those manufacturers. One of

the traditional problems is the silo approach, where each of their facilities has [its] own set of metrics, [its] own set of processes, and manages those processes in [its] own way," Littlefield explained.

"If you have a solution that can normalize across those manufacturing facilities that are generally distributed globally, that's viewed as a competitive advantage that can be achieved by these systems," he added.

For BI implementations, a manufacturer needs to have at least three to five good-sized facilities before it will see much return on investment in manufacturing BI initiatives, he said, though any manufacturer can benefit from highly focused MI solutions that can be implemented at lower price points.

Still, is there room for intelligence in well-running plants?

"More advanced companies are now taking a next look and are saying, 'We have our production line in control, we know what's happening there, we have the system alerting us. So now, what can we do with that data? How can we use the data and use the information to compete and conquer our competitors?'" Evelson explained.

And teasing out competitive advantage is key in today's small, commoditized world. Whether a company is producing a commodity or not, are there some key advantages manufacturers can uncover by using BI strategies?

"At the higher BI level, it ranges from better demand forecasting—by [better] identifying customer needs, for example—to improved sourcing through a better understanding of supplier performance," Gartner's Miklovic said, noting that common use cases for BI in manufacturing include R&D productivity/innovation and warranty/quality areas.

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In addition, if management has a clear understanding of how difficult or risky it is to produce a given product, they might not sign contracts that appear profitable on the surface but really aren't the smartest moves. For example, if a high-volume, big-contract sale requires changes in supply chain orders and plant floor labor, the profitability of that big-ticket order may plummet. In this scenario,

it may be more profitable to take on a lower-volume, lower-ticket order that ironically carries a much higher profit margin—but you need data and tools to help you measure the pros and cons.

DOES BI FOR MANUFACTURING OFFER EVEN MORE OPPORTUNITY?

All manufacturers, no matter what products come off their assembly lines, share common areas of opportunity. A good place to start is understanding customer needs and buying behavior to reduce costly inventory. Can you change operations in a plant or multiple plants so you can take on even more business?

"If you drive this level of information integration and availability that shows the tradeoffs at the supply chain level with what's going on in manufacturing, you can start shifting capacity—or make better decisions around capacity—but you can also really gain [insight] into multiple site performance," Jacobson said. Basically, opportunities that are blurry when looking at a single plant can become clear when you're looking at several.

The million-dollar question: Can BI tools magically uncover gold in hard times?

"No," Littlefield said. "Technology is not the answer; it's just a tool."

If a company tries to apply BI without a strategy, it could end up causing harm, and if the information revealed by BI tools isn't acted on, it's just a big waste of money.

"The key to success is getting the strategy and philosophy right, then applying the right tools to get the data to make the necessary decisions," Littlefield explained. "And finally, you have to use the tools to validate that the corrective actions taken have yielded the results you desired—and expected." ■

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Senior research analyst, Aberdeen Group

CHAPTER 2

Making the case for BI in manufacturing

BUSINESS INTELLIGENCE (BI) in manufacturing environments is emerging as a worthwhile investment for many savvy companies. These firms are starting to realize that the gap between manufacturing intelligence designed to keep assembly lines running smoothly and their traditional BI systems is more like a chasm.

How does what happens on the production floor affect sales? Profitability? Can small changes driven through many manufacturing sites deliver large returns for the company as a whole?

If companies with significant manufacturing operations want to beam light into the dark, they have to make a case for implementing BI that's capable of creating meaning from manufacturing activity.

MAKING THE CASE FOR BI IMPLEMENTATION IN MANUFACTURING

Building the BI business case begins with a number of questions, including: Where do you start? How do you calculate business intelligence ROI? Who needs to be involved? Who drives the BI projects?

"Depending on the characteristics of the company, who's driving it determines what it [the BI project] looks like," said Simon Jacobson, a research director for Boston-based AMR Research. "You can see anyone from VPs of the supply chain demanding this just for information integration, or you can see this from a chief financial officer who's looking at how to compensate plants, especially throughout manufacturing as a P&L, where the [goal] is to free up as much working capital as possible—you have to understand how these plants are performing."

Alternatively, a vice president of supply chain might want to understand what performance capacity looks like so he can better map where to drive response based on global demand, Jacobson added.

1. Make sure you have a driver for BI in manufacturing

As with any road trip, drivers have the

steering wheel, but that doesn't mean they don't get navigational assistance from their passengers. IT may end up taking over the wheel at various points of the project, but organizations need more than just executive-level buy-in. They need executive-level ownership.

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"Traditionally, a business guy says, 'I need this type of information,' and an IT guy figures out how to collect and present it," said Boris Evelson, principal analyst of business intelligence for Cambridge, Mass.-based Forrester Research. "IT would be architecting, building, delivering, and buying BI solutions—that's the traditional approach."

"But that doesn't work," he said. "A business person has to step up and say: 'Not only do I need information, but let me tell you exactly what kind, and let me be the owner of the initiative. It's my budget, my data, it's my neck on the line before my CEO, so I'm going to own the products.' When we hear CEOs, COOs and CMOs talk like that . . . that's when we see successful implementations."

Clearly the person who's driving the initiative has the power to determine the direction and course of action. But organizations should make sure they don't have a driver who's soliciting different destinations from everyone and ends up pulling over in a state of confusion.

2. Find your pain points that BI could solve

A company needs to know its pain points and address them quickly during the implementation.

But, at the same time, even if companies fix their existing pain points, they may be ignoring far greater opportunities—and this knowledge cuts both ways.

"Realize you are going to want to be able to do some analysis on your entire global manufacturing network—so for a large manufacturer, it's probably a very large project," said Matthew Littlefield, a senior research analyst for Boston-based Aberdeen Group.

And large projects carry expense and risk.

"It is risky in not having a clearly defined goal and not understanding where you're going to derive your value from," Littlefield explained, adding that trying to do too much is a common mistake.

3. Clearly define your goals for BI

If an organization doesn't have easily identifiable pain points—or they don't seem to justify the cost of a manufacturing-focused BI system—that doesn't necessarily mean there's little to gain. Smart organizations will want to see whether there's information they can deliver to decision-makers that can help them meet company goals or align corporate priorities with business metrics.

THE CRITICAL IT ANGLE IN BI FOR MANUFACTURING IMPLEMENTATIONS

Meanwhile, even with business-focused stakeholders and clear executive support, IT remains critical in any manufacturing-focused intelligence rollout.

"You need to have a mature IT department within the manufacturers, so you need to have a relatively large size company to have that," Littlefield said.

An underpowered or inexperienced IT staff will have to be addressed right away. In addition, even in an IT department packed with super brains, organizations need to be able to connect three critical groups: IT experts, manufacturing experts and business experts.

"It's tough to do, but we do see that best-in-class manufacturers are considerably more likely do that, and steering committees and cross-functional continuous improvement teams are two ways we see that coming together," Littlefield said.

A steering committee helps direct the vendor selection process and initial project implementation, and once they're up and running, a cross-functional continuous improvement team will ensure that the organization continues delivering new business value.

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UNDERSTANDING THE ROI OF BI FOR MANUFACTURERS

Determining ROI can be the hardest part of any large-scale business intelligence initiative. Even with pain points and clear goals, business intelligence projects are notorious for sliding out of scope, breaking budgets, and passing deadlines. With large

projects that can take months, if not years, a reasonable ROI calculation can be difficult to determine.

Focused BI efforts can often show ROI, but many of those cases also line up with manufacturing intelligence systems that are focused on a portion of a plant's performance—with very little connection to the broader business. Figuring BI ROI is a difficult proposition, and often a bit of a gamble.

"Can you prove ROI in two years? Nobody can prove that today," Evelson said. "You [must], unfortunately, be a believer that this is the future and you can't survive without it."

He weighs spending $100 million to revamp an organization's BI environment against spending the same amount of money to buy another factor. "Which will give you more ROI? I don't think anybody can come to you and answer this question."

However, savvy manufacturers tend to invest in constant improvement and optimization. That will inevitably lead to a tradeoff down the road when companies that invested in more plants are facing competition from companies that invested in making themselves smarter.

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> Principal analyst, Forrester Research

The key is creating short-term goals with long-term investment. ■

CHAPTER 3

Getting started with manufacturing BI software systems

GETTING STARTED with business intelligence (BI) software systems can be particularly challenging for manufacturing companies. The problem faced by many organizations with multiple manufacturing units starts close to home—they've probably grown themselves into something barely recognizable.

"Say, for example, that my company became large by acquiring 10 different manufacturing companies, and they all have their own customer list, their own product naming conventions," said Boris Evelson, principal analyst of Business Intelligence for Cambridge, Mass.-based Forrester Research. "How do I make sure I am not stepping on my own toes? How do I know my factory is calling the same product by the same name as my factory in another country?"

The answers lie in your business intelligence data—and data preparation, it turns out, is critical.

BUSINESS MUST OWN THE DATA

No intelligence tool can work without data, and if the data isn't accurate and specific, the tools used will only spew more meaningless data. Surprisingly, the first step isn't building a data warehouse or creating specialized databases. No, the real preparation starts far sooner than many expect.

"We always say the very first step is to admit that what you do as a CEO or COO—in addition to owning widgets and factories—is that you own data," Evelson said. "When business owners look at their data problems as a technology problem, they say, 'My data is all over the place. It's not synchronized. What is my IT doing wrong?' That, to me, typically is the first indication that a company isn't going to be successful doing business intelligence."

After ownership is defined and embraced, the steps become clearer.

1. Define your data

"IT is there to help you, but you have to come up with the definitions. What is a widget? What is a customer contact?" Evelson said. "Try getting two or three people in a room to define a product or customer profitability metric... you have to understand how profitable each customer is. Tracking revenue from each customer is easy, but understanding how much you're spending on a customer is a very difficult task. You can calculate your cost over raw materials, but electricity, real estate, work force... that's not attributable to a single customer. How do you allocate all of your costs across your company? You'll get different opinions."

"A business has to have a very clear understanding of what they are going to measure and how they are going to measure it, and then, and only then, can they hand it off to IT," Evelson added.

2. Aggregate your data

Many traditional BI software systems start with a dedicated data warehouse. But as tools get better at accessing data from various source systems, data warehouses are becoming less necessary.

"It doesn't matter what you call it, but you need some kind of integrated way to have all your data in one logical place—not necessarily physical—but it has to be brought together so you can, for example, relate your financial data to chart data, or relate North American data to European data," Evelson said. "You can build a virtual data warehouse."

Companies can evaluate new technologies designed for BI, he said, as opposed to older relational databases that may have been designed decades ago and augmented over the years.

"There are some new technologies that came from the ground up specifically for data warehousing—things like columnar databases or inverted index databases, which are especially useful for any company looking to analyze structured and unstructured data," Evelson said.

Clearly, companies will need to map out their data architecture early.

3. Clean your data

Meanwhile, manufacturing-focused companies need some sort of master data management plan to ensure that their BI data is accurate—they simply can't make decisions based on faulty data.

"All this data aggregation, data synchronization, and data cleansing is a very tough exercise—that's the bulk of the difficulty in BI environments. Once you get the data in one place, and it's clean, you can start using it," Evelson said. "That first part is huge, and that's what companies are spending millions of dollars on."

PRINCIPLES FOR BI SUCCESS FOR MANUFACTURERS

Of course, in any major undertaking, the rules are rarely hard and fast.

"There are no strict, well-defined methodologies—the whole process is much more an art than a science," Evelson said. "It's all about lessons learned, not repeating someone else's mistakes. You can't really buy a strategic Business Intelligence 101 textbook."

Still, there are solid principles for success. Here are some important ones:

Call in the consultants: While it may be theoretically possible for an organization to create its own manufacturing-focused business intelligence system, it's going to be much more difficult if it doesn't hire consultants.

One best practice, according to Evelson, is "to work with consultants who have done this before, who know best practices, who have already accumulated a long list of potential pitfalls, so when they come to you, you pay them so you don't repeat the same mistakes."

Don't try to boil the ocean: Manufacturers have to take small steps, and plan waypoints into their journey.

"Pick a metric you can implement in a few weeks," Evelson said. "Try to show your key stakeholders something tangible, because if they don't see something tangible within a few weeks, people lose interest, lose focus, and business requirements change. You can't have long-term strategic planning without still delivering something tactical every few weeks."

From KPIs to real-time data—use only what you need: Manufacturing intelligence that's focused on the production line can be particularly useful if the data is real-time or near real-time. But for strategic analysis and decisions, data that's a few days old may be of little use. Real-time dashboards are impressive, but a company has to consider the metrics it's measuring—in some instances, it might not be worth the cost of managing real-time data. Still, if the goal is to better understand manufacturing performance, "the further you go away from a line or process, arguably the less valuable your data becomes," noted Simon Jacobson, a research director for Boston-based AMR Research.

Build flexibility: "One of the problems with large BI rollouts, if you build your system without flexibility, and it takes a year to roll out a cross-functional system, then something is going to change," said Matthew Littlefield, senior research analyst for Aberdeen Group.

Buy some BI and data management tools: Organizations shouldn't reinvent the wheel, but rather buy some tools. They may be bolt-on products from the enterprise manufacturing system or the ERP system, or a com-

bination of the two with some best-of-breed solutions thrown in. There's no way around it, though: Selecting applications from vendors is going to take a lot of time.

"There's two major places we've seen people using BI—one is to analyze and connect production data to corporate performance, and the other is to connect maintenance and downtime data and then to analyze that data," Littlefield said. "So on an asset maintenance side, if you're looking to find trends and reliability—reduce downtime—very often that downtime data is stored in ERP or data warehouses, and the analysis tools that come with the BI system can help you do that."

It all depends on the metrics an organization is using, and it will want to make sure that the possible vendors have tools that have been used in similar situations with similar types of data.

WHERE TO START WITH BI FOR MANUFACTURERS—GETTING YOUR HANDS DIRTY

The last three key lessons learned are strategic rather than tactical, and they ensure that a company navigates toward the areas that will reveal the best return on investment.

Look for variability: Many organizations get stuck finding the best places to start, but there's a simple rule of thumb that always helps: "It's a matter of attacking the biggest point of variability and getting visibility into that," Jacobson said.

Find points of leverage: Where to start will always depend on a combination of factors that will vary by company, industry and geography. Market factors create opportunity, too.

"When crude oil was $150-plus, logistics and supply chain efficiency were critical, but that's less so now," said Dan Miklovic, vice president of Manufacturing Industries Advisory Services with Stamford, Conn.-based Gartner Inc. "In general, the best advice is—after a few pilots to validate you know how to use the tool and build some credibility—go after the areas with the greatest leverage. If labor is a major contributor to cost, use business intelligence to improve labor productivity—i.e., increase volume or lower cost or both. If energy is a major factor, go after that."

Change your philosophy: To use BI tools and principles successfully in dynamic, global manufacturing environments, companies may need to tweak their basic worldview.

"Adopt a philosophy of continuous improvement," Miklovic said. "It really is making a cultural shift and not just implementing a tool." ■

CHAPTER 4

Seven key questions for manufacturing BI tools evaluation

A LOT GOES into developing a business intelligence (BI) software system for manufacturing organizations—data aggregation, cleansing, and synchronization, plus defining metrics and creating specific targets for analysis. At the heart of any system, however, are the software and hardware that do the heavy lifting. Choosing the wrong tool guarantees a costly mistake.

For instance, there's manufacturing intelligence that focuses on real-time or near-real-time data and is designed to ensure that manufacturing processes run as efficiently as possible. Then there's more traditional business intelligence that focuses on historical transactional data that rests in various databases, which is then cubed and analyzed. And there are varied connections of everything in between.

"Certainly, the vendors in this space are trying to confuse it—a lot of BI vendors are trying to go down to the shop floor and deal with real-time data, and it's not necessarily their traditional strength," said Matthew Littlefield, senior research director with Boston-based Aberdeen Group. Conversely, some manufacturing intelligence solution providers are looking to provide tools to help manufacturers connect and analyze their data with more business-focused systems.

There are, however, lots of tips for cutting through the hype—here are several questions buyers will want to answer as they begin the BI tools evaluation process:

1. Should you write an RFP for manufacturing BI systems?

The writing of an RFP isn't the only way to solicit bids and buy solutions, but the act of writing one forces an organization to nail down what it really needs. That's a critical starting point.

"It's still good common sense that

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you really need to define your requirements very well—and nobody else can do that for you," said Boris Evelson, principal analyst of BI for Cambridge, Mass.-based Forrester Research. "You have to take the time to write the requirements."

2. Can the BI vendor address IT and manufacturing? Can the BI vendor speak the languages of IT as well as manufacturing operations?

"If they have that ability to talk and work collaboratively with both organizations, that's a start," Littlefield said. "I would only work with a vendor who had that ability to make those connections."

3. Does the BI vendor have experience in manufacturing or your particular industry vertical? When it comes to BI tools evaluation for manufacturing-related uses, how important is industry-specific functionality?

"On a scale of 1 to 10, about a 7 or 8," said Dan Miklovic, vice president of Manufacturing Industries Advisory Services for Stamford, Conn.-based Gartner Inc. "It clearly will speed up your implementation if the solution has templates using the terminology specific to your industry, and it is always good to have access to industry-standard practice.

"However, just because a vendor has limited or minimal experience in your industry, you should not rule them out," Miklovic said. "Proximity and fit with your overall architecture are two other factors that should weigh heavily on your choice," he added.

4. Is your EMS or ERP vendor the best option for BI?

"Clearly, fit with your architecture is essential, and if your ERP vendor offers a solution, it should be on the short list, but it should not be the de facto choice," Miklovic said. "ERP vendors are generally broad and cross-industry and so have breadth on their side, but not always depth."

5. BI can be expensive—is off-shoring a good option for manufacturing?

Aside from the politics of off-shoring, the initial stages of BI rollouts might not be a good fit for companies considering it.

"Unlike traditional software development where you can write your specification and hand it over to somebody that can be anywhere, take a couple of months and bring it back, with business intelligence, you have to be talking to a person face-to-face," Evelson said. "It's very hard to define requirements because there are multiple definitions. You have to be in the same room when business people are discussing these things. If you take notes and hand over a piece

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of paper, you just can't get the complete BI picture.

"Off-shoring for certain parts of BI doesn't work—you can off-shore maintenance, support, help desk; but all the initial stages, like rapid prototyping—these guys need to be sitting right in your office doing everything interactively," Evelson added.

6. What are the tradeoffs for manufacturers between larger ERP vendors and more focused BI vendors?

"It is always a challenge in that the larger ERP firms generally write good code but are not intimate with the processes," Miklovic explained. "Boutique vendors write great functionality into their products, but their software skills may not be the best."

At the same time, an industry-focused vendor might fit nicely but lack flexibility, while an ERP-based system might require more customization.

7. Is a BI pilot program necessary?

Odds are, companies are spending a lot of money on BI for manufacturing, and a test drive isn't just a routine tradition.

> "The best approach is a robust pilot,"
>
> —DAN MIKLOVIC
> Vice president, Gartner Inc.

"The best approach is a robust pilot," Miklovic said. "Make the pilot rich enough to validate the claims and broad enough to encounter the most likely issues. Only upon successful completion of the pilot [should you] commit to a rollout." ■

ABOUT THE AUTHOR:

Chris Maxcer has spent more than a dozen years reporting on everything from enterprise technology to consumer gadgets. While tech brings him great joy, there's something to be said for getting out in the wild and turning it all off—or most of it. When he's plugged in, you can reach him at chrismaxcer@gmail.com.

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