



# The Definitive Guide to Connected Manufacturing

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## INDUSTRY INSIGHT

Not since the steam engine have we seen game-changing technology like we are seeing today. While the steam engine might seem pretty low-tech, it changed transportation and trade forever. More recently, the Internet has become the most significant game-changer of all time, dramatically impacting the course of history, leveling the playing field, and allowing any company to develop a global presence and brand, creating unprecedented opportunity.

The Internet turned the world digital and created a digital economy, connecting manufacturers to supply chains and customers like never before, delivering access to massive volumes of data for decision-making. It brought on the Industrial Internet of Things (IIoT), enabling manufacturers to connect to—and make use of—even more data. It also ushered in the cloud, which provides manufacturers the connective tissue, data centralization and computing power necessary now and for the future—but only for those who've embraced the digital economy.

Are you a digital manufacturer? Have you been through a digital transformation that enables you to leverage the available tools and technology for improved visibility, communication and agility? Do you have the analysis tools to help you make sense of all this data? Can you respond to the accelerating pace of innovative new products, new ways of pricing and selling products and services, even entirely new business models? Is your business moving full steam ahead or are you still driving your business with the software equivalent of a horse-drawn wagon?

And yes, the difference **is** that dramatic, creating an increased level of urgency for digital transformation. The most successful manufacturers have learned to expect the unexpected. They have learned how to be agile. They have learned how to be connected.



CINDY JUTRAS,  
PRESIDENT, MINT JUTRAS

# 86%<sup>1</sup>

agree that embracing digital technologies is necessary for survival.

As a manufacturer, you are both forward-thinking and always evolving. That's the nature of what you do. You make an impact with the things you make.

You are also a pragmatist. When you make things, you try to do so as efficiently and profitably as possible. Efficiency, quality, cost savings, and customer satisfaction are key.

Technology then must have operational meaning, purpose, and application for you to make the investment. Perhaps you haven't thought much about the technology that runs your entire business, from shop floor to top floor and beyond, because you and your people make it work.

There are major shifts, however, in customer demand, the manufacturing industry, and business technology that are affecting what you do every day. Your tried and true methods may not be as flexible to this new world of manufacturing. Your systems may not be able to keep up with the demands on your business because like it or not, things have changed.

A 2012 report, McKinsey Global Institute, *Manufacturing the Future: The Next Era of Global Growth and Innovation*, states that:



Manufacturing is entering a dynamic new phase. As a new global consuming class emerges in developing nations, and innovations spark additional demand, global manufacturers will have substantial new opportunities—but in a much more uncertain environment.”

Whether you recognize these changes or not, you will need to respond to them—and it's how you respond that will set your business up for success or struggles. The Definitive Guide to Connected Manufacturing will help you identify opportunities in the significant changes and challenges you're facing right now.

## This guide will help you:

- **Understand** the benefits connected manufacturing will have on your business and how other manufacturing companies like yours are leveraging this model today.
- **Determine** what kind of system will support your manufacturing business and operations through this time of change, and in the future.
- **Make** an informed decision for your business and operations management system—and feel confident about it.





Why Connected Manufacturing?

## THE RULES OF THE GAME HAVE CHANGED

Manufacturing is evolving.

Products used to be more standardized, demand signals more consistent and predictable, and the underlying supply chains and systems were built accordingly. Efficiency and quality were enough to drive market leadership.

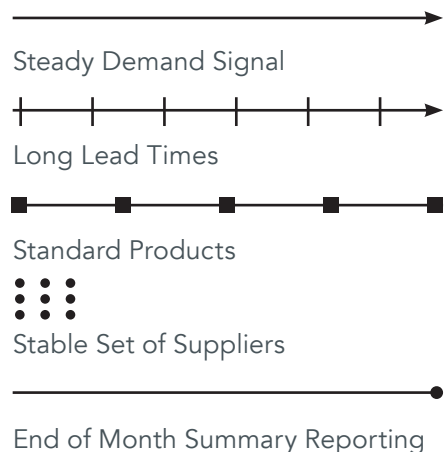
But not anymore.

As the world economy has become more interconnected and consumer tastes have become increasingly fickle, demand is more variable which is driving shorter product cycles and the need to deliver products to market more quickly.

The industry is also seeing new entrants capitalizing on these changes. These new entrants don't carry the baggage of how things used to be made.

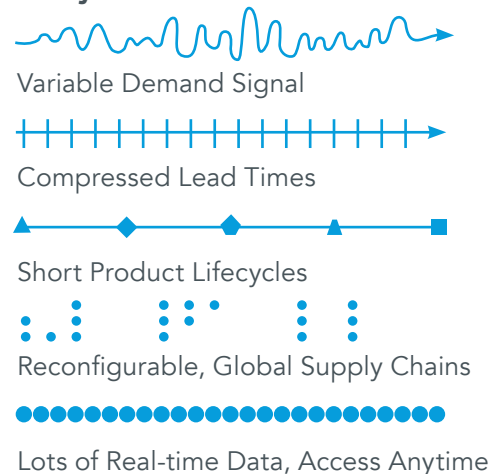
Now, in addition to efficiency and quality, agility, customization, and speedy response times are all becoming table stakes for manufacturing leadership.

### Yesterday's Business Model



VS

### Today's Business Model





## WHAT'S DRIVING THE CHANGE?

External market forces are converging, causing many manufacturers to rethink their operations and technology strategies, thereby creating more opportunities for business.

### Manufacturing Trends

Think about how your business is responding to the following industry trends:

- Lot Size of One (also known as mass customization)
- Industrial Automation (data generated by shop floor automation)
- Additive Manufacturing (also known as 3D printing)

### Technological Advancements

Consider responding to these technology evolutions that are changing the way manufacturers do business:

- Cloud Computing
- Mobility
- Analytics
- Industrial Internet of Things (IIoT)

Let's examine these trends and the opportunities they create for your business.



## MANUFACTURING TRENDS

### Lot Size of One

Today's technology-driven consumers expect more personalized products, and expect to receive those products quickly with high quality. This trend is about mass customization—producing products down to a lot size of one with the same speed and quality inherent in high-volume repetitive manufacturing.

#### Business Opportunity:

- Offering customers order forms directly from a website with eCommerce.
- Meeting demand where specific customer configurations turn into a product quickly and cost-effectively using robotics and automation that eliminate time-consuming retooling or assembly line adaptation.
- Gaining predictability and quality control at the individual product level.
- Ramping up automation, process control, and integrating new technologies into your existing production systems quickly.





## MANUFACTURING TRENDS

### Industrial Automation

Industrial automation is the natural evolution of manufacturing and technology innovation moving in concert. This leads to high levels of precision, with better data collected at the manufacturing moment, and lower costs based on real-time decision making. Some manufacturers are taking it to another level, for example with—‘lights-out’ manufacturing—an automated factory where raw materials enter and finished products leave with little or no human intervention.

#### Business Opportunity:

- Increases in machine learning and connectivity along with the proliferation of sensors and higher system communication create a smarter manufacturing environment.
- With the right technology and operational foundation in place, you can uncover opportunities to do more with the data you have.
- Consider systems that support technology advancements to support new, innovative business models.



## MANUFACTURING TRENDS

### Additive Manufacturing

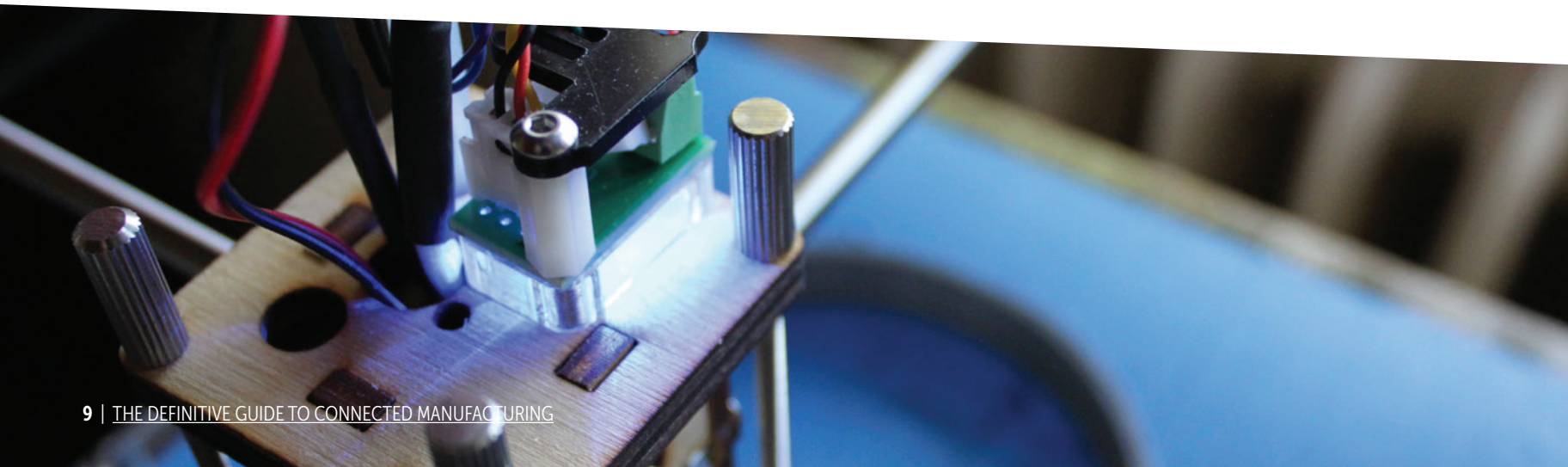
Additive manufacturing, or 3D printing, will have a major impact on manufacturing. A recent KPMG report stated that 25% of manufacturers surveyed have already invested in additive manufacturing.

#### Business Opportunity:

- Deliver rapid prototypes and product modeling, shortening development cycles.
- Produce the specialized tools and dies needed to create products without having to custom order them from outside vendors—and potentially produce replacement parts for production equipment on the spot, lowering unplanned downtime.
- Lower costs and increase efficiency by including additive manufacturing as part of your mainstream production processes.

**25%**<sup>2</sup>

have already invested in  
additive manufacturing



## TECHNOLOGY FORCES

### Cloud Computing

Cloud computing represents a seismic technology shift that goes beyond simple IT infrastructure outsourcing, and gives you the chance to get out of the IT business and focus on your core purpose – manufacturing.

#### Business Opportunity:

- Unify your business across diverse locations. As a result, many manufacturers are choosing cloud-based software to run their businesses and operations.
- Be assured of security, agility, accessibility, and scalability—so you can focus on growing and streamlining your business.
- By avoiding a large up-front capital expense followed by annual maintenance costs – the latest functionality of the platform becomes available to you without disruptions and downtime.

# 66%

of planned ERP deployments  
are in the cloud



## TECHNOLOGY FORCES

### Mobility

Mobility is assumed and expected today, and it is no different for manufacturing. Mobility empowers user freedom as well as extends visibility and control.

#### Business Opportunity:

- Improve manufacturing intelligence by providing data or production control from a smartphone or any browser-enabled device.
- Promote an untethered work environment where alerts and relevant system data are literally available at a user's fingertips, instantly.
- Leverage wearable devices, like smart glasses, as an inexpensive, hands-free experience to workers.
- Use sensors, beacons, Bluetooth and other technologies to deliver greater real-time visibility.



## TECHNOLOGY FORCES

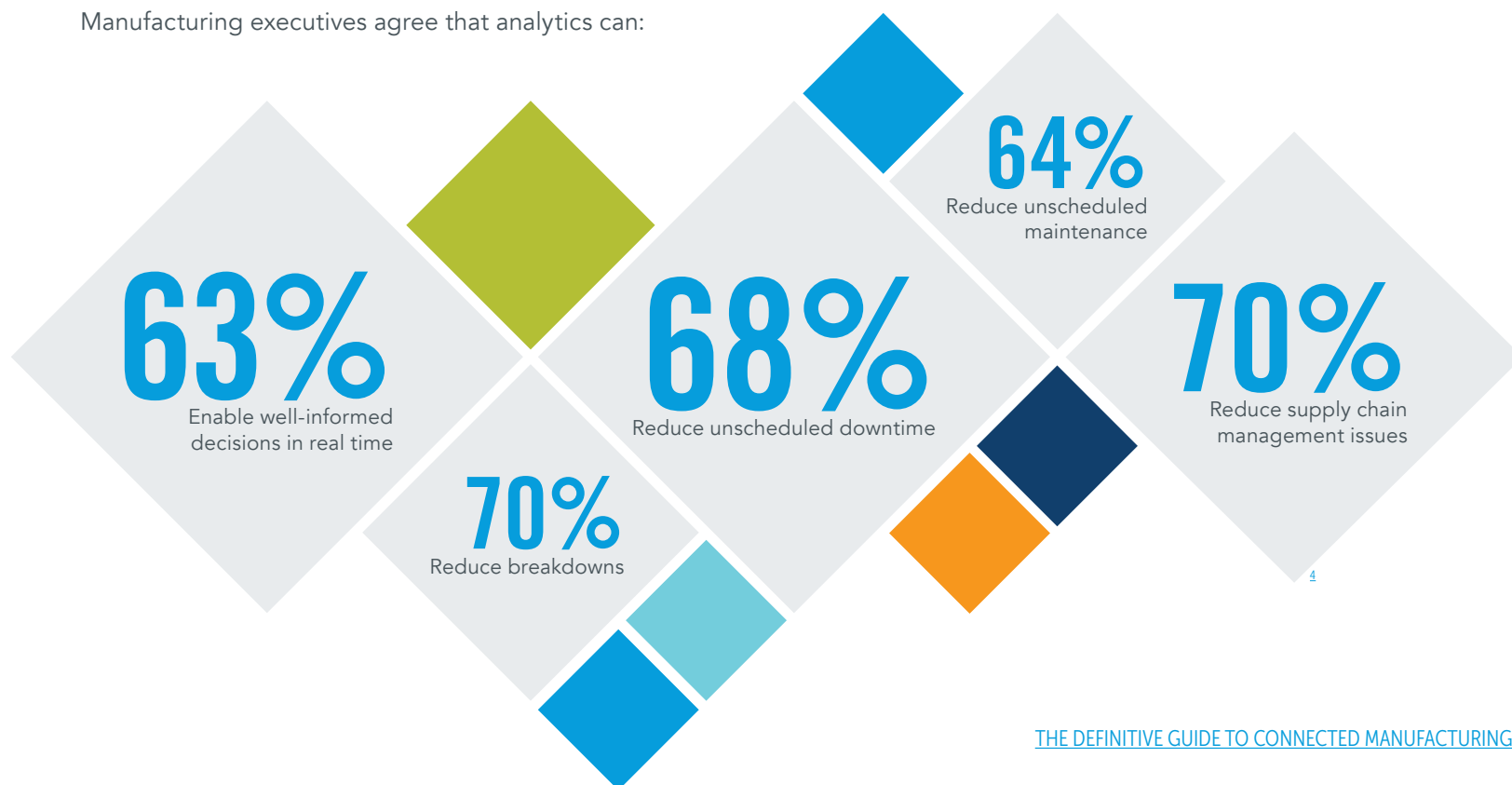
### Analytics

You may be like many manufacturers today in that you're not using much of the data you generate. But that data could be used to drive insights, autonomous decisions, and predictive behavior, creating higher levels of efficiency. Analytics deliver the ability to make that data meaningful and actionable.

### BUSINESS OPPORTUNITY:

- Enable higher engagement with actionable data for more effective executive decision-making.
- Facilitate big data management, critical to machine learning and driving prescriptive actions.

Manufacturing executives agree that analytics can:



# TECHNOLOGY FORCES

## IIoT and Smart Manufacturing

The Industrial Internet of Things (IIoT) is about connecting everything and everyone to data. What that means is better insight, confidence in the data, and faster decisions. IIoT is poised to change how you design, plan, make and service products.

### Business Opportunity:

- Improve equipment and process performance using data from connected sensors, smart devices and Internet-enabled machines.
- Provide input from end users and product usage to improve the way products are developed and serviced.
- Change interaction with the shop floor forever because information is available everywhere and from just about any endpoint.

IoT’s interoperability could deliver over \$4 trillion out of an \$11.1 trillion economic impact.<sup>1</sup>

The Internet of Things (IoT): examples of how interoperability enhances value	Potential economic impact, <sup>1</sup> 2025, \$ trillion
<b>Factories</b> —data from different types of equipment used to improve line efficiency	1.3
<b>Cities</b> —video, cell-phone data, and sensors used to monitor traffic and optimize flow	0.7
<b>Retail</b> —payment and item-detection systems linked for automatic checkout	0.7
<b>Work sites</b> —worker- and machinery-location data used to avoid accidents	0.5
<b>Vehicles</b> —equipment-usage data used in presales analytics and insurance underwriting	0.4
<b>Agriculture</b> —multiple sensor systems used to improve farm management	0.3
<b>Outside</b> —inventory levels monitored at various stages of the supply chain	0.3
<b>Homes</b> —data from household energy systems used to track time usage	0.1
<b>Offices</b> —data from building systems and other buildings used to improve security	<0.1

<sup>1</sup>Includes sized applications only; includes consumer surplus.

McKinsey&Company | Source: Expert interviews; McKinsey Global Institute analysis



## INDUSTRY CHALLENGES IMPACTING YOUR OPERATIONS

The changing nature of the manufacturing industry can expose some of your internal operational challenges. It's important to recognize these challenges so you can identify ways to address them:

Inventory Challenges	Production and Quality Challenges	Process and Workforce Challenges
<ul style="list-style-type: none"> <li>• Lack of real-time inventory visibility</li> <li>• Unreliable material and product traceability</li> <li>• Tedious and inaccurate cycle counting</li> <li>• Excess inventory and carrying costs</li> <li>• Too many inventory stock-outs</li> </ul>	<ul style="list-style-type: none"> <li>• Too much waste and scrap</li> <li>• Not consistently meeting customer commitments or quality expectations</li> <li>• Not meeting production goals</li> <li>• Quality assurance is tough to validate</li> <li>• High operational costs leading to lower profitability</li> </ul>	<ul style="list-style-type: none"> <li>• Too many expediting charges</li> <li>• Sub-optimal workforce efficiency</li> <li>• IT is keeping the systems running instead of innovating</li> <li>• Customer demand is hard to predict</li> </ul>
Systems and Process Challenges	Data Management Challenges	
<ul style="list-style-type: none"> <li>• Too many error-prone and inefficient manual processes</li> <li>• Trouble managing different systems for different parts of the business</li> <li>• Business systems don't communicate effectively</li> <li>• Slow responses to supply chain changes</li> </ul>	<ul style="list-style-type: none"> <li>• Audits are time-consuming</li> <li>• Recall management is challenging and expensive</li> <li>• Poor or outdated company data leads to delayed or uninformed decisions</li> </ul>	



Be ready to revise any system, scrap any method, abandon any theory, if the success of the job requires it."

HENRY FORD

## CHANGES AND CHALLENGES BECOME OPPORTUNITIES

Once you are aware of the forces of change and the operational challenges you're facing, where do you go from there?

You start by taking a realistic and practical approach by leveraging the forces of change to address the challenges. When you do this, you take out the trepidation and dread often associated with the word "change." Not all change is bad.

Look at these forces of change and your operational challenges while being mindful of your business holistically. The sooner you do this, the more prepared your business will be to take advantage of the opportunities these changes and challenges present—make no mistake, there are significant opportunities available to you right now.

There are four strategic responses that will lead you in the right direction:

1

Make Your Business  
More Agile

2

Increase Your  
Competitiveness

3

Simplify and Streamline  
Your Business

4

Drive Operational  
Efficiency

## 1. MAKE YOUR BUSINESS MORE AGILE

Agility is a must to adjust to the ebbs and flows of business. With increasing mergers and acquisitions as well as right-shoring decisions, you must ensure your infrastructure and business processes can scale with your growth aspirations. Ask yourself, “Is it easy for us to quickly and easily turn up new facilities to support market fluctuations?”

Growth can multiply complexity.

You will want to think about whether you have adequate reporting and analytics to make the most of your data to help you manage your company. You must also understand your organization’s ability to manage and adopt change so that new processes with new analytics aren’t short-lived.

Finally, you need to ensure a path to innovation and inclusion of new technologies. As machine learning and robotic intelligence grow while wearables, sensors, and other tools proliferate, you must be nimble enough to take advantage of new data signals.



## 2. INCREASE YOUR COMPETITIVENESS

Your competition is tough, but there are things that can separate you from them. Think how well you perform vis-à-vis speed, dependability, flexibility, quality, and costs.

If you're a low-cost vendor, you must ensure that you have a system that helps you lower your cost of delivery, reduce waste, carry the right amount of inventory, and more.

Can you deliver a higher level of quality than your competitors? Make sure you have a system delivering unparalleled quality assurance.

Are your customers and suppliers part of your planning and execution processes? Consider the benefits of enabling customers with visibility into your manufacturing flow, including the trust and partnership advantages you gain.



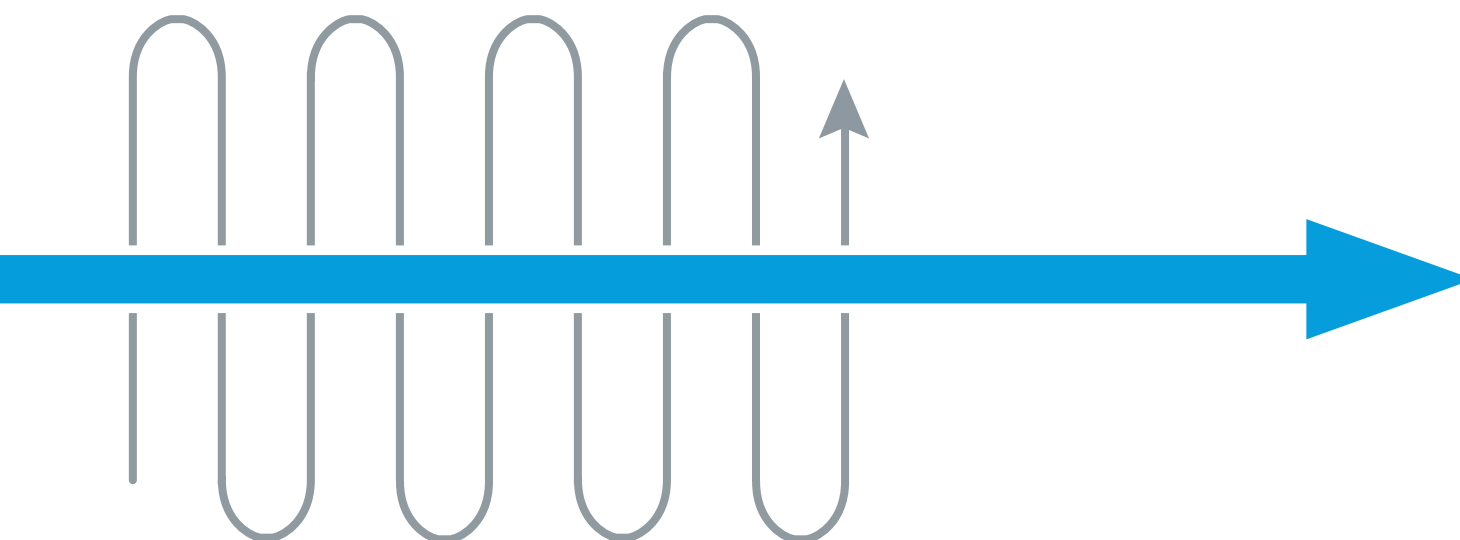
### 3. SIMPLIFY AND STREAMLINE YOUR BUSINESS

Your company may be using many disparate tools to run the business, creating data silos that make it difficult to access accurate, reliable, and consolidated information, preventing you from having one version of truth for decision making. This tangled web creates challenges with system communication and information access.

Are silos getting in the way of a consolidated view of the business? Is information easy to access, accurate, and timely? Do your customers get frustrated when they don't get a straight answer about their shipments?

The age of silos is over. You can't afford them. You want better information across the enterprise and for your supply chain participants with faster and more convenient access.

A streamlined supply chain is one of your biggest assets. Consider how to make your supply chain partners a part of your business, working together on a common set of data to meet customer needs. Modernizing and consolidating systems and data can produce major business benefits.





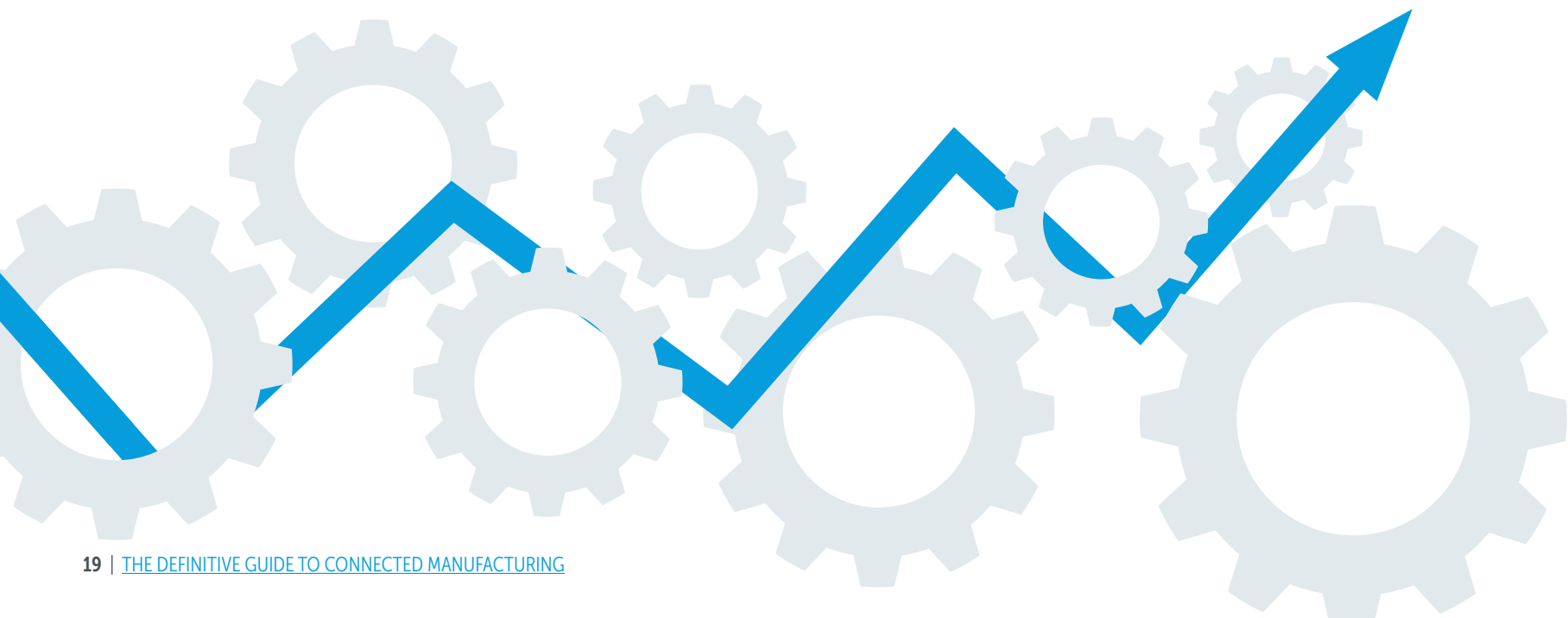
## 4. DRIVE OPERATIONAL EFFICIENCY

Your manual or paper processes and data entry mistakes cause errors that result in lost data, rework or inaccurate records. Think about the areas of your business where errors occur most frequently—accounting, inventory management, shop floor—and the benefits mistake-proofing those areas could deliver.

You realize that streamlined processes and workflow automation would create smoother, less error-prone handoffs and fewer bottlenecks. You want to ensure that your operations are not impacted by poor equipment effectiveness, unplanned machine downtime, high maintenance costs, and more.

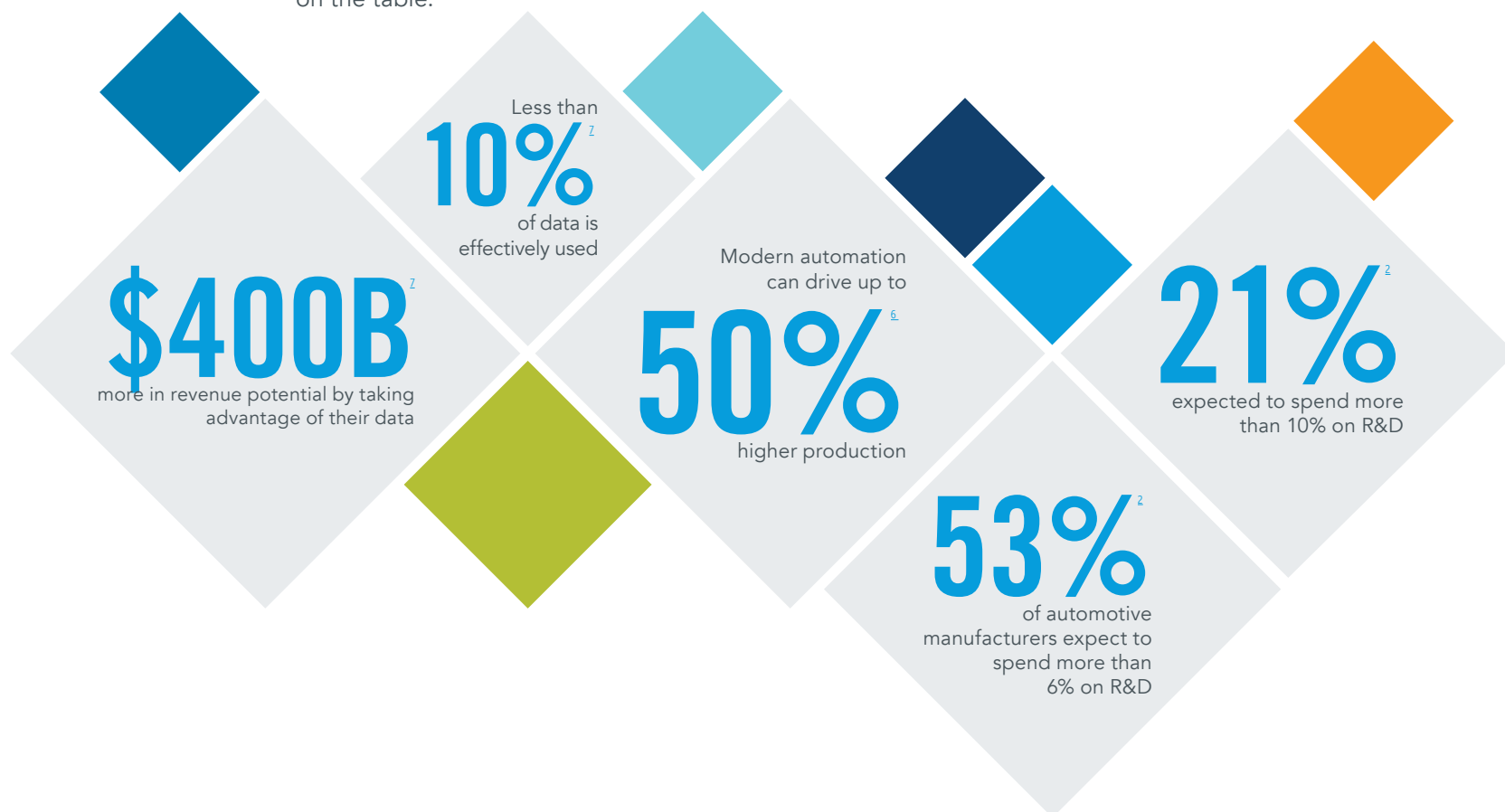
Your best people may be tied up today doing mundane tasks. The right solution would free up their time, enabling them to take on more value-added projects.

More automated systems create better workflow, reduce human error, free up valuable resources, increase data accessibility for better decision making, improve quality, increase production effectiveness, and deliver higher uptime for increasing overall equipment effectiveness (OEE).



## THE TIME TO ACT IS NOW

You'll need a system that helps you achieve your strategic responses, solves your operational challenges, and enables your business to be flexible enough to handle future changes and challenges. You can't wait or maintain status quo either because by doing nothing, you're essentially leaving money on the table:



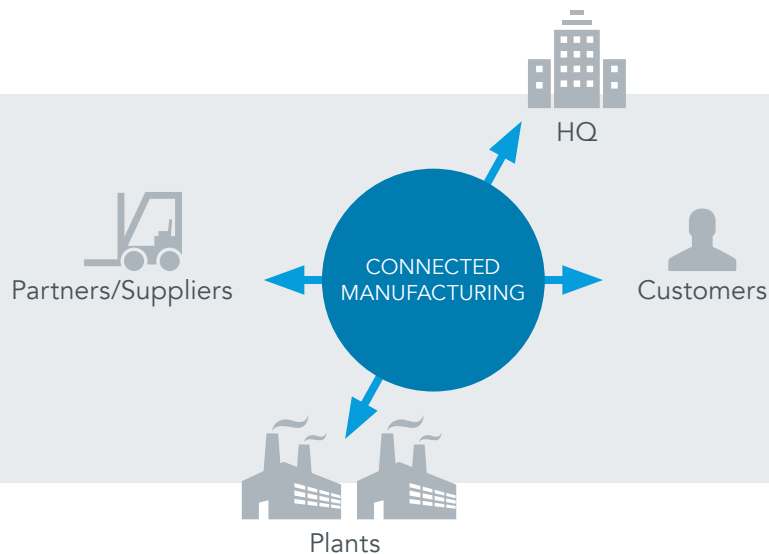
The longer you decide to wait out technology evolution, economic indicators, or even customer demand, the farther behind your business will be in the game—because the rules have changed already. The time to act is now.

## CONNECTED MANUFACTURING IS YOUR FIRST STEP

There is a way to address your challenges, improve your operations, and prepare for what the future brings. The answer is connected manufacturing.

It's the ability to provide the tools and processes needed to run your operation from one, always available, fully integrated and automated manufacturing system. It's the reality today.

- **Plan** across your global supply chain to execute your strategy—and react quickly if demand changes.
- **Control** shop floor operations and decisions anywhere, anytime using real-time data.
- **Connect** your machines, plants, processes, and people for a unified view of your business.
- **Unlock** the potential of your people to focus on high-value needs instead of mundane repetitive tasks.
- **Transform** your business and leverage the technology that's part of today's digital economy.



Decision Point:

## ARE YOU READY FOR CONNECTED MANUFACTURING?

Use this worksheet to determine if your company is ready for connected manufacturing.

For each category, select the appropriate number. If you strongly disagree, choose 1. If you strongly agree, choose 5. The numbers in between 1 and 5 correspond to your level of agreement, neutrality, or disagreement. Tally your score when you're finished, and follow the instructions at the end.



Face reality as it is, not as it was or as you wish it to be.”

JACK WELCH

Factor	Disagree 1 2 3 4 5 Agree
Our data is divided between multiple systems and disparate silos.	
Our company relies on manual processes and Excel-based analysis.	
We want to improve customer satisfaction by being more responsive.	
Data should drive almost every decision at our company.	
Operational control and visibility makes us more competitive.	
It takes us way too long to comply with audit requests and recalls.	
Our legacy business systems are slowing us down.	
We want to include cloud computing in our IT ecosystem.	
We are ready to take advantage of the changing industry and technology landscape.	
<b>Total</b>	

To interpret your results, tally your score.

- If you scored > 30 you're ready for connected manufacturing.
- If you scored between 15 – 30, you're moving in the right direction. You should consider getting started with connected manufacturing very soon.
- If you scored under 15, you may not be ready for connected manufacturing quite yet, but that doesn't mean you can't learn something that will put you on the right path.





What Does Connected  
Manufacturing Mean?

## EVALUATE YOUR BUSINESS HOLISTICALLY

To improve end-to-end outcomes, you need a holistic enterprise system that allows you to:

- Generate customer and shareholder value and encompasses your entire business.
- Address your biggest challenges at the root cause to ensure problems are solved.
- Enable you to address the changing needs of the market—because the status quo is not an option.
- Focus on key operational strategies: speed, dependability, flexibility, quality, and costs.



## ENABLING DIGITAL TRANSFORMATION

Connected manufacturing builds a digital backbone for your business.

Connecting your people, processes, and supply chains gives you end-to-end visibility and control. Shop floor automation delivers real-time insight, superior quality, and optimized utilization of resources. Using embedded, predictive, and prescriptive analytics enables you to make more-informed decisions and adapt as demand shifts.

To transform your business, you need to begin with a solid strategy.



**Plan**  
**+** **Control**  
**Connect**  
**Unlock**  

---

**Transform**

# PLAN YOUR STRATEGY

Your financial plan and analysis fuels your strategy, enables growth, and prioritizes investments. In turn, your strategy influences your financial and operational plans.

Your supply chain plan drives your materials requirement plan and your master production schedule, so you know when, what, and how much to buy and make. Sometimes customer expectations change however. There may be shorter order lead times, last-minute order changes, custom products orders, and perfect order deliveries. Keeping all this in mind, you need to plan how much inventory you are going to keep in your supply chain, and where to store it.



By failing to prepare, you are preparing to fail.”

BENJAMIN FRANKLIN

The key to responding to customers’ needs and keeping costs low is how well you plan your financial, supply chain, and production activities.

If you notice this issue:	This is likely the root cause:
Stock outs or too much inventory	Lack of demand visibility and planning
Poor customer service levels	Lack of supply visibility and planning
Costly expedites in the supply chain	No holistic planning process

Holistic financial and supply chain planning can address these issues and root causes.

## PLAN YOUR STRATEGY

Your plan won't be reliable if it's not based on historical data, planned strategic activities, confirmed and projected orders, external trend reports, and a bit of intuition. Make sure you get cross-functional input from:

- Sales for demand projections.
- Marketing for the 4 P's (product, pricing, promotion, and placement).
- Finance for strategic expansion plans including mergers, acquisitions, new manufacturing facilities, etc.
- Engineering for new product introductions, design changes, as well as sun-setting of products.
- Operations for capacity constraints.
- Upper management for strategic directions and business objectives.

The more connected and holistic your plan is, the fewer escalations and exceptions occur, which lowers your operational costs.

Organizations with a mature, digital, and integrated financial and supply chain planning process deliver world-class performance:





## PLAN YOUR STRATEGY

Bottom-line: planning is about a positive customer experience and operational excellence. Financial planning and analysis (FP&A) is a cross-functional initiative, allowing you to model outcomes and adapt more quickly.

Comprehensive supply chain planning (SCP) includes sales and operations planning (S&OP) distribution requirements planning (DRP), and master production scheduling (MPS)—which will be your competitive edge—whether you are a low-cost provider or a differentiating supplier.

To support your supply chain strategy, you need an integrated business planning system that allows you to collect and manipulate data for a holistic view of the business, helps you manage the planning process, and connects with your operational and financial management systems. Once you are a connected manufacturing company, you can augment and automate your plans using modern technologies such as predictive planning and artificial intelligence.

But planning alone is not enough.

A good plan needs to be combined with world-class execution. More importantly, the plan needs to be flexible to continually reflect the day-to-day progress for setting realistic expectations with customers.

### Functionality Checklist

Integrated Business Planning

Financial Planning & Analytics

Supply Chain Planning

Sales & Operations Planning

Demand Planning

Supply Planning

Capacity Planning

Inventory Planning

Distribution Requirements Planning

Material Requirements Planning

Master Production Schedule

Predictive Planning

Artificial Intelligence

## PLAN YOUR STRATEGY: CASE STUDY

### ASK Power Improves On-time Delivery to 99% with Sales and Operations Planning




ASK Power is a manufacturer of electrical power connectors for the transportation, military, telecommunications, and OEM markets.

#### Business Challenges:

- The current system couldn't provide the flexibility of S&OP the company needed to remain competitive.
- Forecasting done on spreadsheets was time consuming, out of date, and inaccurate.
- Could not get a realistic snapshot of work center loading, late jobs, lead times, or inventory.
- Could not provide high level of service to their top customers with two to three-month lead times.

With connected manufacturing, ASK Power achieved:

 **8%**  
Profit margin improvement

 **2 → 6**  
Annual inventory turns

Lead time down to  
 **2-3**  
weeks

 **99%**  
On-time delivery



On-time delivery is an important focus for us. In fact, a customer recently told me that four or five years ago we were not meeting expectations from a delivery point of view, and now we are exceeding expectations."

STEVE KASE, CEO

# CONTROL YOUR PLANT OPERATIONS

In today’s customer-centered economy, operational excellence is the key to differentiate, beat the competition, and gain customer loyalty. And it starts at the manufacturing moment. The shop floor is where material moves, product is created, and work gets done. You need to control higher quality, greater throughput, and lower costs but it’s difficult when information is on paper, in separate systems, or not available at all.

If you notice this issue:	This is likely the root cause:
<ul style="list-style-type: none"><li>• Not meeting production goals or reduced throughput</li></ul>	<ul style="list-style-type: none"><li>• Poor performance on OEE (quality, production rate, and up time)</li></ul>
<ul style="list-style-type: none"><li>• Customers complain about poor product quality, late or short shipments, or a recall</li></ul>	<ul style="list-style-type: none"><li>• Disconnected quality management and processes during production</li></ul>
<ul style="list-style-type: none"><li>• Inventory turns below industry benchmarks or too much/not enough inventory</li></ul>	<ul style="list-style-type: none"><li>• Lack of inventory visibility and traceability</li></ul>

A real-time manufacturing execution system helps address these issues.



I cannot always control what goes on outside.  
But I can always control what goes on inside.”

WAYNE DYER



## CONTROL YOUR PLANT OPERATIONS

Increasing customer demands, manufacturing complexity, and competitive pressures can quickly lead to shop floor chaos.

To manage these variables, your shop floor needs to be a well-conducted network of operators, machines, and materials all driving toward meeting customer demand. By capturing all shop floor activities and “digitizing” them and then automating operational processes, you create a connected shop floor that enables you to know what’s happening in real time. The more connected and automated the processes on your shop floor, the more visibility and control you have of your operations.

Manufacturers with integrated, digital operations deliver world-class performance:



## CONTROL YOUR PLANT OPERATIONS

A manufacturing execution system (MES) with shop floor sensor connectivity using Industrial Internet of Things (IIoT), delivers operational governance with up-to-the-minute manufacturing data. In addition, bi-directional machine connectivity delivers production flexibility and control. This powerful combination enables you to:

- Operationalize quality control plans and respond automatically to statistical process control (SPC) data for greater industry and customer compliance.
- Minimize operator errors to reduce scrap/waste and returns, increasing productivity.
- Proactively plan machine maintenance to maximize uptime and overall equipment effectiveness (OEE).
- Enhance inventory traceability and genealogy to reduce time for audits and mitigate the risk of recalls.
- Access accurate work-in-process (WIP) costing information with improved inventory visibility for higher inventory turns and lower inventory carrying costs.

By controlling your shop floor, you become more responsive no matter what manufacturing process you use—project-based, job-based, batch, repetitive, or continuous.

### Functionality Checklist

Product Lifecycle Management  
Manufacturing Execution System  
Industrial Automation  
Smart Robots  
Industrial Internet of Things  
Connected Smart Products  
Wearables & Connected Sensors  
Programmable Logic Controllers  
Supervisory Control & Data Acquisition  
Overall Equipment Effectiveness  
Statistical Process Control  
Quality Management System  
Maintenance & Tooling  
Time & Attendance  
Inventory Management & Control  
Inventory Traceability & Genealogy  
Real-time Product Costing  
3D Printing

## CONTROL YOUR PLANT OPERATIONS: CASE STUDY

### Floral Foam Products Increases Production with the Manufacturing Cloud



[FloraCraft](#) serves customers in the floral arrangements sector across the US as well as many other countries around the world.

#### Business Challenges:

- Wanted to be that 'go-to' supplier, and that reputation brought in new business over the last few years.
- Inventory wasn't serialized, leading to inaccuracies.
- Legacy systems were inflexible and information was difficult to obtain.

With a unified, cloud-based ERP and MES, FloraCraft achieved:

**99.7%**  
Increased fill rates

Accurate costing data down to

**1/10¢**

Higher revenue

**↑ 60%**  
without increasing labor



**100%**

UPC number accuracy every time



Wal-Mart Supplier  
of the Year status



The ability to dynamically schedule production allows us to ensure we have the right quantities of materials at the right time."

JIM SCATENA, CEO

# CONNECT YOUR BUSINESS

Flexibility, dependability, and speed depends on how connected and collaborative you are as an organization—both internally and with your extended supply chain. Do all your employees have access to a single version of end-to-end business data? Do they trust the accuracy of the data? Can your customers and suppliers securely and actively participate in your operations? The more connected and collaborative your value chain is, the more agile your organization will be.

If you notice this issue:	This is likely the root cause:
<ul style="list-style-type: none"><li>• Inability to commit to delivery times and communicate the reasons for delays</li></ul>	<ul style="list-style-type: none"><li>• Lack of real-time visibility of your operations—shop floor to top floor</li></ul>
<ul style="list-style-type: none"><li>• Data quality is not trusted</li></ul>	<ul style="list-style-type: none"><li>• Disparate, disconnected data silos that take too much time to aggregate and reconcile</li></ul>
<ul style="list-style-type: none"><li>• Suppliers complain about slow response time</li></ul>	<ul style="list-style-type: none"><li>• Poor supply chain collaboration or communication</li></ul>

Connecting your business, machines, and people helps address these issues.

“We are all now connected by the Internet, like neurons in a giant brain.”  
STEPHEN HAWKING

## CONNECT YOUR BUSINESS

As a connected business, your people and processes are more aligned and streamlined. You spend less time collecting and collating data from multiple data sources, and more time analyzing data to make better, more-informed decisions.

Connected manufactures deliver world-class performance:



## CONNECT YOUR BUSINESS

Like many manufacturers, you might suffer from lack of visibility of your operations and find that you're spending time and resources fighting fires instead of being proactive.

Your employees need to be connected to your operations. They need to have secure access to relevant information to respond to business demands. Your supply chain partners need to be connected either via EDI or self-service portals. Communication with your customers and suppliers can help you plan better and set the right expectations internally and externally.

Real-time connectivity from top floor (business management) to your shop floor (manufacturing operations) is critical to be proactive—and profitable. Over time, you might have invested in several departmental point solution applications and custom tools. You should make sure that your core system can connect (via iPaaS, APIs, ODBC, or import/export) with your existing IT applications, to protect your investments.

Connecting shop floor equipment, machines, sensors, and smart products opens the opportunity for real-time insight into how operations are performing. From there, you are able to drive quality, offer proactive maintenance, improve customer service, understand usage patterns, and influence product design changes—this is how you start to leverage the IIoT.

### Functionality Checklist

Application Programming Interfaces  
Integration Platform as a Service  
Office Integration  
Electronic Data Interchange  
Open Database Connectivity  
Customer Relationship Management  
Supplier Relationship Management  
Customer & Supplier Portals  
Multi-entity Management Systems  
Financial Consolidation  
Sales Order Entry and e-commerce  
Configure, Price, & Quote  
Purchasing & Procurement  
Warehouse Management System  
Logistics & Transportation  
Warranty & Service Management  
Financial Management System  
Cash and Bank Management  
Human Capital Management  
Payroll  
Fixed Assets System  
Blockchain

## CONNECT YOUR BUSINESS: CASE STUDY

### Metal Fabricator Reduces Machine Downtime with Connected Manufacturing

[Marwood Metal Fabrication Ltd.](#) is a multi-facility stamping and modular assembly supplier with an extensive range of components for the automotive industry.

#### Business Challenges:

- Antiquated ERP system as well as 10 disparate databases that didn't talk with each other.
- Need for management to track and update a lot of redundant data.



With connected manufacturing, Marwood achieved:

**50%**

Inventory turns improvement



Quality compliance with automated checksheets

**PMA**

Increased productivity, beating the Precision Metalforming Association index, in every single category



Leveraged PLC integration for real-time shop-floor visibility



Overall, we do the same amount of business we did before the economic downturn, and we're doing it with half the number of people."

STEVE SPANJERS, VP OPS

# UNLOCK YOUR PEOPLE POTENTIAL

A Gallup study shows that when organizations successfully engage their customers and employees, they experience a **240%**<sup>13</sup> boost in performance-related business outcomes, compared with those who don't. When your employees are equipped with the right information at the right time, they make decisions that are more effective for your business.

If you notice this issue:	This is likely the root cause:
Delayed information slows down operations	Siloed systems cause information gaps
Inefficient, sub-optimal workforce performance	Too much time spent manually recording or searching for required data
IT staff is overworked and overwhelmed	Repetitive non-value-added tasks, data gathering and compilation, or integration issues

Connected manufacturing can address these issues.



Ineffective people live day after day with unused potential.”

STEPHEN COVEY



## UNLOCK YOUR PEOPLE POTENTIAL

If your IT team is similar to those within most manufacturing organizations, they likely operate as a support organization focused on keeping your systems running and up to date. With connected manufacturing, you can free up your IT staff for more proactive analysis to identify trends, patterns, and correlations in your business data to offer insightful strategies.

Unified, connected manufacturing delivers a holistic and reliable view of your operations that instills confidence among your employees. They are not wasting time verifying the validity of the data and therefore are more responsive.

Organizations that enable their employees, with the right information at the right time deliver world-class performance:



## UNLOCK YOUR PEOPLE POTENTIAL

More modern manufacturing businesses rely on a mobile and/or remote workforce. Even if employees are in the plant, they may not be in front of their workstations. Connected manufacturing delivers the right information in the right format for untethered employees. Employees can access information from any device so operations will keep running instead of halting until people come back to their desks or workstations.

Connected manufacturing also breaks down information barriers and departmental thinking. Employees who tend to stay focused on what they do in their roles are often unaware of how their actions impact overall business performance. Business managers want to look at the numbers but can't easily get insight into what's actually happening on the shop floor.

When the top floor is connected to the shop floor, business managers are able to compute the costs of their operations with precision. At the same time operators can see the impact of their activities on the top/bottom-line for the business. With increased reliance on reliable data, connected manufacturing transforms your system of record to a system of engagement.

### Functionality Checklist

Manufacturing Intelligence

Visual Plant Telemetry

Business Intelligence

Ad Hoc Reporting

Data Warehouse

Big Data Analytics

Machine Learning

Real-time Reporting

Mobility

Alerts & Notifications

Multi-lingual User Experience

Role-based Processes

Workflow Automation

Document Management

Human Machine Interfaces and  
Wearables

Automated Data Acquisition

Extensible Business Reporting Language

## UNLOCK YOUR PEOPLE POTENTIAL: CASE STUDY

### American Axle Benefits from Real-Time Data for Timely Decisions Across the Connected Enterprise



[American Axle Manufacturing](#) is an automotive parts manufacturer and tier one supplier of driveline and drivetrain systems.

#### Business Challenges:

- Piecemeal and siloed information caused by multiple bolt-on point solutions.
- Needed a best-of-breed ERP solution that would communicate with their corporate ERP.
- Lack of visibility into operations caused workforce inefficiency and data collection issues.

With connected manufacturing, American Axle achieved:



Real-time information for machine downtime analysis



Ability to plan, forecast, and order materials 16-weeks ahead



Quality checks at every stage



End-to-end traceability from source to destination



Real-time enterprise-wide process tracking



Effective collaboration through supplier portal



One of the original business drivers for the new system was the need for a single view of the truth using real-time data.”

MICHAEL TRATHEN, SR. MGR.

## TRANSFORM YOUR BUSINESS

Digital transformation means different things to different businesses, depending on their technology adoption journey. For some, supply chain automation can be transformative, as the business improves efficiency, productivity, and response times. For others, bringing employees, customers, and suppliers onto one single system and executing like a well-oiled machine is transformative, as they share visibility and become more proactive.

There are still others who consider real-time machine-to-machine, machine-to-person, and machine-to-material communication transformative, delivering big data-based insights and machine-based algorithms influencing strategies and business models.

No matter what digital transformation means for your business, it must deliver a sustainable competitive advantage and practical benefits like lowering costs, ensuring consistent quality, increasing efficiency, and meeting customer demands. You are in a unique position to decide: initiate transformation as a proactive strategy or react when you are forced to because of outside pressure (such as industry shifts, customer demand and competitive pressures). Either way, you'll need an end-to-end connected enterprise system to support your digital transformation.



Transformation literally means going beyond your form.”

WAYNE DYER

## TRANSFORM YOUR BUSINESS: CASE STUDY

### Automotive Supplier Leverages Cloud Computing to Streamline Operations Across Multiple Facilities



[Accuride Corporation](#) is a leading manufacturer and supplier of wheels and wheel-end components to the North American and European commercial vehicle markets.

#### Business Challenges:

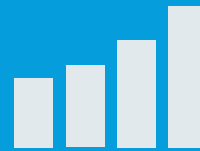
- Mergers and acquisitions resulted in different systems and processes that didn't integrate well across the enterprise.
- Company spent a lot of time and resources gathering, compiling, and looking at the accuracy of the data.
- Outdated data didn't reflect the reality of plant operations.

With connected manufacturing, Accuride achieved:

Replacement of  
**200+**  
applications with a single  
cloud-based solution



Enterprise-wide  
shop floor visibility  
in real time



Comprehensive analytics for  
more-informed decisions



Effective collaboration through  
supplier portal

Inventory shipments

**<3h**

across 20 different  
products lines



Processing and approvals of  
purchase orders in minutes



Because it's so connected, it's easy to make logical steps from MRO into maintenance and then quality into production and shipping, meaning our new system can rapidly transform how we work."

PAUL WRIGHT, CIO AND VP OF IT

## TRANSFORM YOUR BUSINESS: CASE STUDY

### Electronics Manufacturer Achieves Reshoring and 300 Percent Growth



[Firstronic, LLC](#) is an electronics manufacturing services provider serving automotive, aerospace, commercial, and industrial tier ones and OEMs.

#### Business Challenges:

- Goals included speeding time-to-market, providing premium quality workmanship, and minimizing costs.
- Needed to ensure quality levels met tier one supplier requirements while managing growth.
- Existing system was not able to provide the flexibility and control needed.

With connected manufacturing, Firstronic achieved:

**2X**  
Doubled their  
revenue in one year

Re-shored contracts  
**300%**  
growth

**\$\$\$**  
Higher inventory turns,  
maximizing cash flow  
and profitability

  
Effective collaboration through  
supplier portal and EDI



'Preferred Supplier'  
status on the  
new business



Our differentiators have become better shop floor controls, advanced technology, speed-to-market, and flexibility—all things that our new system helps to make possible.”

JOHN SAMMUT, CEO





## TRANSFORM YOUR BUSINESS

A system that enables you to capture shop floor operational data and share it with business managers and executives enables you to gain the visibility and control needed to make data-driven decisions, faster. It also allows you to optimize your supply chain because you have confidence that the data is accurate; no matter how much demand changes, you know exactly what is happening in your business. You can shift strategy, adjust to industry or economic changes, adapt to technology advancements—essentially, you're ready for the unexpected.

But your systems and people must be connected for this kind of transformation to happen. This means you must invest in technology solutions wisely and strategically.

When not done correctly, it costs you more than what it returns—and you're stuck with it for a long time.

Decision Point:

## HAVE YOU CONSIDERED THESE QUESTIONS?

- Have you identified areas of your business and operations that are negatively impacting the desired outcomes?
- Do others in finance, manufacturing, supply chain, IT, and executive management also share your concerns?
- Are you, as a group, aligned on the prioritization as to which pain points to address first?
- Do you have a holistic plan to overcome your business challenges—even if you intend to address them individually?

## START WITH A STRONG FOUNDATION

Since you're selecting a system as your foundation for digital transformation, you need to consider several key factors and learn about setting yourself up for success for the long run.

You want a strategic enterprise system supported by a platform that is:

- Modern and committed to supporting emerging technologies.
- Meets your current business needs while preparing for the future.
- Backed by other manufacturers who have had success using it.
- Open for expansion and extension.
- Secure and scalable for mobile access.
- Robust enough to be your manufacturing system of record, and engagement.
- Flexible enough to leverage your existing IT investments.



## TO CLOUD OR NOT TO CLOUD?

The question of whether to choose a cloud-based system or not is becoming outdated. Just like the question of getting a smartphone or a flip phone is outdated.

Cloud is an essential component of Industry 4.0. Modern manufacturers have adopted multi-tenant cloud as their primary computing platform going forward.

This is because on-premise, hosted, or private cloud platforms cannot keep up with the ever-increasing complexity and demands of modern manufacturing. Your IT team ends up spending most of their time ensuring that all users are on the correct version just to be able to use the functionality. How can you focus on responding faster to customer demands or adapting to supply chain issues if you have to deal with constant updates that disrupt business operations.

Choosing a cloud platform is not just a technology decision but also a business one. Software-as-a-Service (SaaS) cloud providers have a vested interest in your business continuity because their business models are based on renewals, thus winning your confidence each and every day. Your cloud service provider is responsible for a secure, reliable, available, and scalable service—their incentives are aligned with yours. For purposes of this document, further references to “cloud” mean “multi-tenant SaaS.”

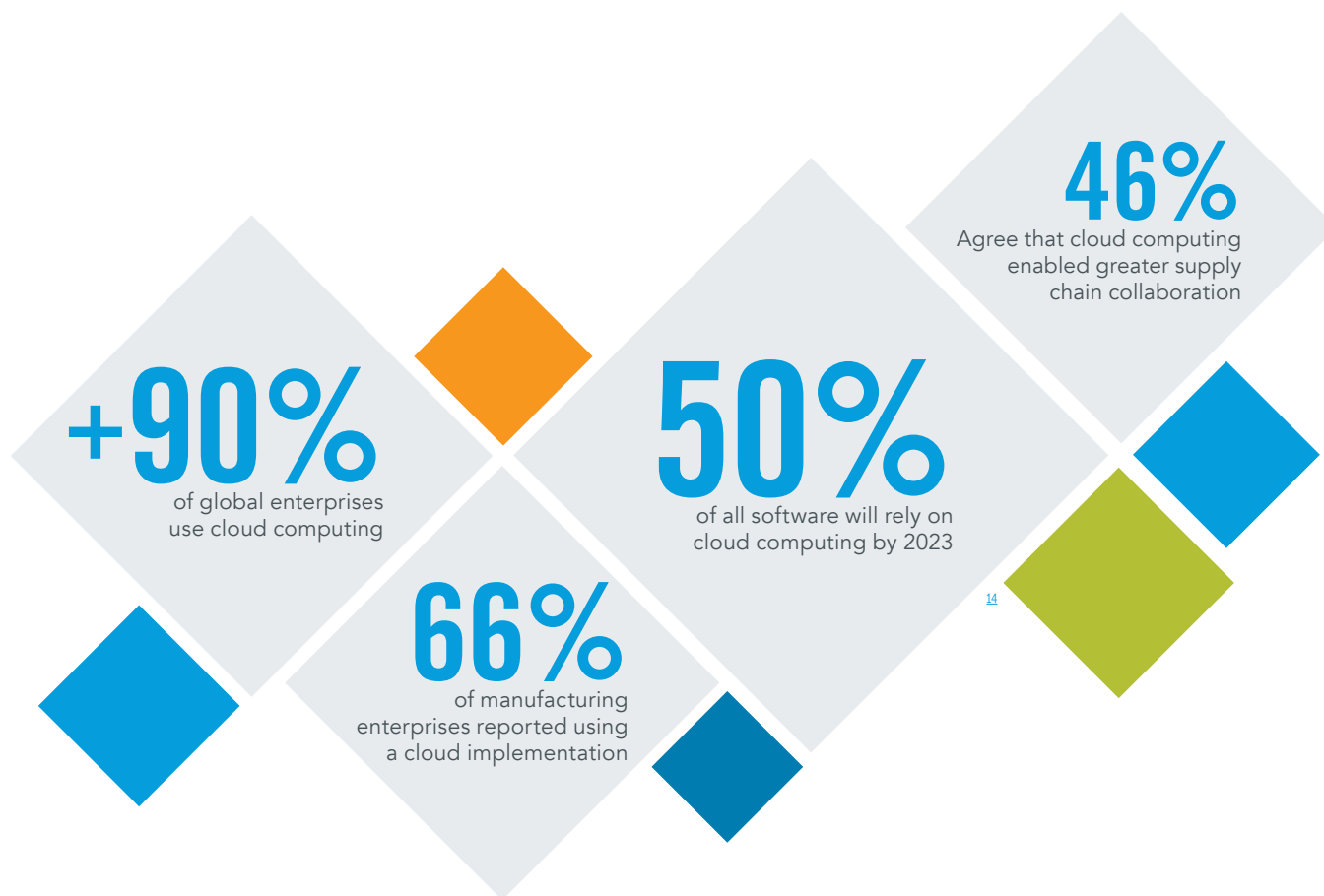
With a cloud platform, you become part of a large community of users, who are all on the same version, talking the same language, sharing common experiences, and benefiting from shared best practices. Their collective input enhances the customer experience and the product so everyone benefits.



Cloud computing is as inevitable and irreversible as the shift from steam to electric power in manufacturing.”

HARVARD BUSINESS REVIEW

Cloud computing is transforming virtually every facet of modern manufacturing. Whether it's how you operate, integrate into supply chains, design and make products, or how your customers use the products. Cloud computing is helping manufacturers like you to innovate, reduce costs, and increase your competitiveness. The question is not if but rather how soon can you get on the cloud computing bandwagon, because your competition may already be on it.



# COMPARING DEPLOYMENT COSTS

Investing in a cloud-based system has financial advantages. You avoid upfront capital expenditures and only pay for what you need as a subscription-based expense.

## SaaS Cloud

Application Software (Subscription)

## Private Cloud & Hosted

Backup and Disaster Recovery

Software Maintenance and Support

Software Customization and Integration

Fixes, Patches, Upgrades, and Version Control

Performance Tuning

Cost of Dealing with Multiple Vendors

Hosting/Leasing

## On-Premise Deployment

Application and Database Servers

Hardware Maintenance

Middleware and Operating System

Data Center Infrastructure

IT Support

Networking

## Common Costs

Client Devices and Operating Systems, Shop Floor Machine Integration, Data Acquisition Handheld Devices, Wireless Networking, User Training, and Implementation



## IS CLOUD CUSTOMIZABLE?

With traditional, on-premise systems, you can customize process, look-and-feel, reporting, integration, and more because not all manufacturing companies operate the same. And you don't want to lose some of that flexibility. However, often companies end up customizing their systems so much that upgrades become disruptive and expensive, as they need to re-implement customizations and then re-train users after every upgrade.

Because SaaS cloud systems are designed to serve multiple customers and industry segments with one code base, they are architected to support configuration, localization, personalization, and integration. This allows you to customize the system without modifying the underlying business logic so ongoing updates to the system don't impact your configurations.



CLOUD DIFFERENTIATORS

Scalable Deployment	Predictable Pricing	Always Current
Encourages sharing among as many users as possible	Typically, based on company or business unit revenue	Automatic updates without installing additional software
Ability to extend to suppliers and customers	Motivates cloud provider to empower your growth	All users are always on the same "version"
Mostly, non-restrictive "per site" licensing	No separate software maintenance costs (typically an additional 20%+)	No disruption to your business to use new functionality
With no generic user names, makes transactions and activities more auditable	Responsibility to maintain hardware is on provider—not your company	Leverage community best practices

# IS MULTI-TENANT CLOUD FOR ME?

What is a multi-tenant cloud, and why should you care?

Multi-tenancy is an architecture where a single instance of a system serves multiple customers. Each customer is called a tenant. A multi-tenant cloud system is designed for SaaS from day one, and is a response to collective demands of varied customers.

## Multi-tenant Cloud vs. Single-tenant Cloud/On-premise Deployment

Multi-tenant	Single-tenant Cloud and On-premise
Single source code, for frequent continuous improvements.	Multiple versions of the software, need separate patch and upgrade processes.
Versionless software offers opt-in, painless updates.	Users on different versions—doesn't allow best practices sharing.
Shared greener infrastructure.	Architecture doesn't allow sharing of resources.
Consistent user experience promotes stronger customer community.	Potential confusion for customer collaboration and support.
Scalable infrastructure with enterprise-level performance for every user.	Not scalable—performance degrades as the number of clients increase.



We can't ever forget that the Internet is just a staid utility. The exciting platforms are software applications that are very, very simple."

MARK CUBAN

## PLATFORM FOR THE FUTURE

The promise of connected manufacturing can only be achieved with a robust, proven cloud platform that is secure, agile, scalable, and extensible.

Your cloud platform should offer:

Security



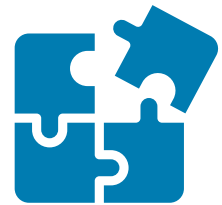
Agility



Scalability



Extensibility



## Security



Security is not an afterthought with a cloud system. Using the “defense in depth” model ensures data security not only at the physical level and during transmission but also to thwart known cybersecurity threats or to defend against new ones while solutions to mitigate those are discovered. You are assured of secure service continuity, while you focus on your business dealings.

- Data encryption
- IP-based white and black-listing
- Multi-factor authentication
- Identity access management (IAM)
- Single sign-on (SSO)
- Service organization controls (SOC) 1 and 2
- International traffic in arms regulations (ITAR) compliance

### What to look for:

- Business continuity, financial stability, and growth from the cloud service provider.
- Offers at least 99.9% uptime—annually.
- Disaster recovery plan and redundant data centers.

## Agility



Adapt business processes to changing needs rather than having the system enforce a certain way. You continue to use the system as you expand and adding new technologies becomes easier as they become available. This means less disruption to your business no matter how many changes occur within the industry.

- Multiple manufacturing modes
- Configurable user experience
- Multiple languages, currencies, and date formats
- Localized report formats
- Responsive mobile screen sizes

### What to look for:

- Configurable setting options, workflows, and document control systems.
- Supports IIoT and is open for new data sources and sensor signals.

## Scalability



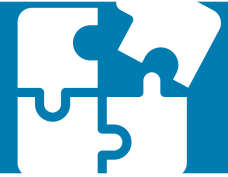
SaaS cloud offerings are designed so that even the largest global company with thousands of users, machines, and devices conducting millions of transactions can use the system with no degradation in performance. Cloud providers build the required infrastructure and the support organization to deliver on that reliability promise.

- Expands or contracts as your business requires
- Ability to add users, devices, wearables, and machines without degrading performance
- Support for multiple locations and regions, globally
- Unlimited data storage

### What to look for:

- Ability to handle big data analytics.
- Real-time machine telemetry on the shop floor.

## Extensibility



Connectivity to existing IT infrastructures and ecosystems means you can extend the system to coexist with other systems or add on as needed. Since no software can fill every need, you need the ability to link to external data sources or build an experience that is unique to your business.

- Application programming interfaces (APIs)
- Integration Platform-as-a-Service (iPaaS)
- Electronic data interchange (EDI)
- Open database connectivity (ODBC)

### What to look for:

- Ability to customize screens, reports, data queries, and analytics with no programming knowledge.
- Support for integration with other applications or systems.
- Availability of partner solutions for unique needs of your business.

## THE STORY OF MANY BOLT-ONS

Some vendors deliver systems with bolted-on, third-party capabilities. With this approach, you end up with:

- Multiple vendors and support contacts.
- Multiple license agreements and costs that each include separate negotiation.
- Inconsistent look-and-feel meaning longer training time for employees.
- Time-consuming and expensive integrations that need to be continuously maintained to keep up with upgrade cycles.
- Data silos with incoherent and inconsistent data structures.
- Costly, constant, and out-of-sync upgrade cycles.
- Heavy overhead supporting a complex IT ecosystem.

No software provider can deliver everything your organization needs to run effectively and efficiently.

The trick is to find a platform that will reduce the number of applications needed to as few as possible. The more applications included in the business and operations platform you choose, the more unified and consistent your experience will be—and the more confident you are on its data.

Your IT team will be free of integration and maintenance burdens and are now available to help you solve business problems. If you do need to add more applications to your core platform, choose a SaaS cloud option.



## MAKE INFORMED DECISIONS

A key question you might have at this point is likely:

“Can connected manufacturing and the system that supports it empower me and my team with the right information, at the right time, in the right format to make informed decisions?”

The answer is “yes.”

You want to make sure however, that no matter who is interacting with the system and how, they’re able to make decisions at their level—from strategy, to planning, to execution. These decisions directly or indirectly impact your top/bottom-line.

Your system shouldn’t be a burden or block your ability to make decisions, but should feel like an extension of individual job responsibilities. It should give you:

- Interactive screens and messages for corrective user actions.
- Programmable alerts for quicker response times.
- Automated processes for streamlined operations.
- Exception handling and escalations for unplanned business situations.
- Compliant processes required by your customers or industry.



Making good decisions is a crucial skill at every level.”  
PETER DRUCKER





## MANUFACTURING INTELLIGENCE AT ALL LEVELS

Obviously, not all data is the same.

Real-time data is critical for visibility into your operations. Enterprise-wide, aggregated intelligence lets you look at the big picture and do comparisons to spot trends and patterns, understand usage patterns of your products, analyze millions of data points for predictive and prescriptive analytics, and more.

You can only gain a holistic view of your manufacturing enterprise with a single, unified version of the truth, and this can only happen with connected manufacturing.

Once you connect your machines, shop floor to the top floor, people, and processes, you can then:

- Report on enterprise performance.
- Look at individual plant performance.
- Drill-down into a production line or machine performance.

A system that supports connected manufacturing and offers built-in role-based analytics, self-service ad hoc reporting and querying functionality, and data visualization enables you to leverage manufacturing intelligence—with no programming knowledge needed.

This is connected manufacturing.

## MODERN USER EXPERIENCE

One of the worst outcomes of a new system implementation is that users don't like using it, for whatever reason—too complex, not friendly, or archaic. You want to invest in a system that appeals to the next generation of employee and yet is intuitive and easy for experienced users.

A system that feels familiar and modern, and is tailored for various roles will go a long way toward ensuring successful user adoption, for accurate data capture and consolidation across your enterprise:

- Operators on the shop floor want speed and real-time interactivity that supports touch screen and works on industrial-strength mobile devices.
- Order entry clerks want robust performance configured for their needs.
- Executives want easy and quick access to dashboards of data that allows anytime, anywhere access and easy navigation.
- IT teams want universal consistency and industrial-strength design that runs well even on low-speed connections.



Design is the fundamental soul of a man-made creation that ends up expressing itself in successive outer layers of the product or service.”

STEVE JOBS



## MULTI-DEVICE EXPERIENCE

Your manufacturing system is going to be with you for years—even as you grow and adopt new technology.

That means it should support desktops, laptops, tablets, and mobile devices including handhelds in a browser or as an app. Your system should also communicate with wearable devices, sensors, machines, and robots.

Other must-haves include:

- Visual and other sensory alerts and notifications.
- On-screen messages.
- Vibration on a wearable device.
- Beep on the desktop/laptop, and more.
- Responsive and yet native to various screen sizes.



## INDUSTRY COMPLIANCE

To do business in some markets, you need to comply with government and customer requirements. Your system should make it easy to prove compliance, respond to audits, and enforce requirements during production. You'll also want end-to-end tracking and traceability built-in to reduce risk of non-compliance before there's a recall or return.

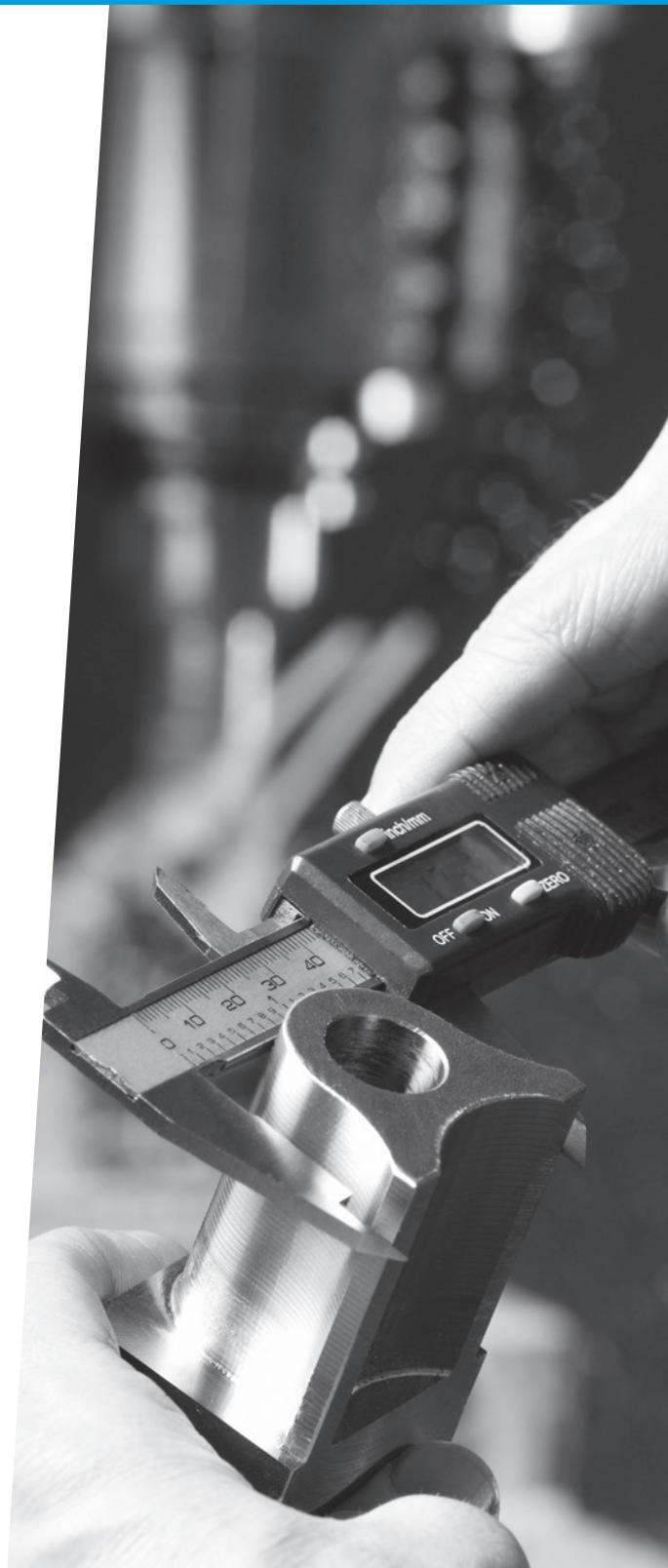
Paper-based checksheets and compliance documentation cannot scale. They also increase the risk of errors. During recalls and audits, you end up wasting a lot of valuable time and resources finding the right documents.

Invest in a system that helps you meet compliance requirements with ease, one that considers the nuances of the market segments you serve.



If you think compliance is expensive—  
try non-compliance.”

PAUL MCNULTY





## THINK GLOBAL

Whether your business is a startup or a large conglomerate, you're likely operating in multiple countries or plan to expand globally in the future. As certain markets consolidate, chances are your business will end up buying a plant in another country, or become part of a global operation with headquarters outside the U.S.

Doing business globally means more complexity—transactions in multiple languages, currencies, data/time formats, local taxes, EDI standards, and cultural differences. Your system needs to support these new facets of your business, or you'll spend more time trying to get things done instead of expanding.

Look for these global capabilities:

- Consolidated global financial reporting, for a holistic view of the business.
- Shared services for global operations to save costs and benefit from economies of scale.
- High performance despite differences in regional Internet infrastructure and distance of the user from the head office.
- Configurable to adapt to multiple regional regulatory and cybersecurity needs, such as dictated by the EU Data Protection Directive and China Cybersecurity Law.
- Centralized supply chain planning for key products and markets.



The world is flat.”  
THOMAS FRIEDMAN

## CHOOSE YOUR MANUFACTURING STRATEGY AND PROCESS

Your manufacturing strategies and processes depend on various factors including your products, key markets you serve, competitive pressures, your position in the value chain, and your in-house expertise.

You should be able to configure your system to suit your strategies and processes, not vice-versa.

If your system is not flexible enough to accommodate your current and future manufacturing strategies and processes, you might have to fill the gap by subcontracting some of your work or adding a new cloud application to your IT infrastructure. That could mean lost quality, time, and additional complexity. While no system is future-proof, you want to invest in one that is as robust as possible in functionality.



Almost all quality improvement comes via simplification of design, manufacturing...layout, processes, and procedures."

TOM PETERS

Decision Point:

WHERE DO YOU GO FROM HERE?



Alice: "I was just wondering if you could help me find my way."

Cheshire Cat: "Well that depends on where you want to get to."

Alice: "Oh, it really doesn't matter..."

Cheshire Cat: "Then it really doesn't matter which way you go.""

ALICE IN WONDERLAND

- Have you strategically partnered with your IT team in evaluating various application solutions?
- Are your IT leaders aligned with you on a unified platform approach for various business and operational applications?
- Can your current/planned application platform deliver on the promise of reliability, agility, scalability, and extensibility?
- Is SaaS cloud the core of your global platform strategy for all future IT investments?
- Have you identified the various regulatory and industry compliance needs of your business?



How Do You Navigate Your  
Buying Journey?



## YOUR PATH TOWARDS CONNECTED MANUFACTURING

Searching for a holistic system to support connected manufacturing can be daunting. You need to consider overall corporate strategies and the needs of the different functions in your business. You need to drive a collaborative, cross-functional decision.

Keeping the following three objectives in mind will make your journey toward connected manufacturing a successful one:

### Stay Focused on Outcomes

To connect the influencers and stakeholders who will be involved in the selection process, you must ensure that the key needs of each buying group are met but moreover, the desired outcomes for the business are achievable.

### Connected Manufacturing is a Team Effort

You may be a change-agent looking to drive improvements into your department, but deciding on business solutions—especially for connected manufacturing—is a team effort. According to the Corporate Executive Board (CEB), there are an average of 6.8 influencers involved in a typical technology purchase.<sup>15</sup>

### Understand Your Buyer's Journey

Following a prescribed pathway for your buyer's journey will result in a methodical approach to identifying and resolving the issues to be addressed. This will help your team make sound decisions toward buying the right solution for everyone.



## STAY FOCUSED ON OUTCOMES

Choosing a new system in the rapidly changing software landscape is complex and confusing. In fact, a CEB study of technology buyers concluded that 39% of the time, the buyers give up in frustration, overwhelmed by the effort to get everyone to agree on a solution.<sup>15</sup>

But it doesn't have to be this way.

Each of your buying groups need to satisfy their department's needs, understand holistic needs of their connected teams, and then drive towards a common goal of connected manufacturing for the company.

It's important to avoid the urge to focus on your own needs so much that you disregard those of your colleagues. Similarly, convincing your colleagues of the value of change may be difficult if they are happy with the status quo. When in doubt, consider how staying focused on the desired outcomes for the company could help you alleviate conflicts between the needs of the different influencers.



Individual commitment to a group effort—that is what makes a team work, a company work, a society work, a civilization work.”

VINCE LOMBARDI

## THINK OF CONNECTED MANUFACTURING AS A TEAM EFFORT

In general, you can expect the following teams to be the key stakeholders in your buyer's journey:

### Manufacturing Operations Team

#### Focus areas:

- Improving productivity throughout the various work streams across production.
- Managing inventory, planning, job scheduling, and quality assurance.
- Fulfilling customer expectations with quality and on-time delivery.

#### Challenges:

- Struggling to find skilled people.
- Enabling lean, quality, and regulatory compliance.
- Leveraging data produced “at the manufacturing moment” to support decision-making.
- Finding systems that are intuitive and easy to use by all skill levels.

#### With connected manufacturing:

Connected manufacturing enables your operations team to be more responsive to ever-changing customer demands with access to the data and tools they need for production control.



## Business Management Team

### Focus areas:

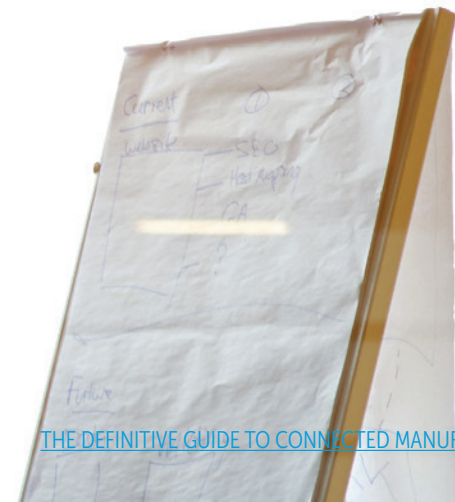
- Driving profitability and growth.
- Meticulously managing revenue and costs.
- Strengthening supply chains for responsiveness and predictability.
- Holistically planning across all facets of the manufacturing business.

### Challenges:

- Using manual tools like spreadsheets that are often out-of-date and error-prone.
- Too many different systems that use too many file formats.
- Reconciling disparate data and producing accurate reports
- Lack of predictability and visibility of supply chain and production operations.

### With connected manufacturing:

Finance leverages accurate, real-time transactional data for costing, accounting, and reporting. Purchasing focuses on minimizing supplier spend without starving production. Supply chain leaders develop long-term relationships with suppliers who can deliver expected schedules and quality. HR professionals hire and keep the best people. And everyone with appropriate access gains visibility across operations to support performance and efficiency for the manufacturing business.





## IT Team

### Focus areas:

- Ensuring security, performance, accessibility, and reliability of your infrastructure.
- Serving business customer needs for data reporting and analysis.
- Automating business and operational processes for timeliness and efficiency.
- Providing oversight and consultation for IT investments, integrations, innovations, and implementations.

### Challenges:

- Spending too much time managing software versions, maintenance, and updates.
- Keeping up with IT trends and new technology.
- Stretching budgets to fuel the needs of the company.
- Safeguarding current IT investments.

### With connected manufacturing:

Because connected manufacturing begins with a cloud platform that takes responsibility for the hardware and software, your IT team can move to more strategic roles within your company like supporting production operations or helping you become a more data-driven business.



## UNDERSTAND YOUR BUYER'S JOURNEY

Every company's buyer's journey is different. But where you start is usually the same: get your stakeholders on board early.

It's important for everyone involved to:

- Clearly communicate the issues and needs of your buying group and take the time to understand the needs of the others.
- Agree on milestones and gate reviews to work through before proceeding to the next phase.
- Reconcile points of alignment with points of disconnect.

The last point is especially critical because it's unlikely that you'll gain unanimous support for one solution (although it does happen). In case of an impasse, always take a step back to align around the more critically desired outcomes for the company.

You are now ready to dive into the issues of each phase to help you navigate the process without getting lost along the way.

# YOUR BUYER'S JOURNEY

Where are you in your buying process? You can start anywhere in the journey, if previous phases are documented and agreed upon.

A photograph of a car's metal body on an assembly line, overlaid with an orange gradient.

## 1. RECOGNIZE NEEDS

A photograph of two men in business attire looking at a computer monitor in an office setting, overlaid with a yellow-green gradient.

## 2. EXPLORE OPTIONS

A photograph of industrial pipes and machinery, overlaid with a dark blue gradient.

## 3. DEFINE CRITERIA

A photograph of hands working on documents and a calculator on a desk, overlaid with a medium blue gradient.

## 4. EVALUATE SOLUTIONS

A photograph of a smartphone, a pen, and documents on a desk, overlaid with a bright blue gradient.

## 5. VALIDATE & NEGOTIATE

## YOUR BUYER'S JOURNEY: RECOGNIZE NEEDS

The initial determination of “what do we need” may be the hardest and the longest phase of your buying journey as it may have been brewing for years before someone took the initiative to say “we need to do something now.”

Questions to consider:

- What does your business need?
- Are you able to execute on your strategy?
- Are you able to respond to market changes?
- Are you relying on the right technologies to compete in the market?
- Do your business outcomes match expectations?
- How do the needs of various departments impact other departments?





## Points of Alignment to Recognize Needs

### Manufacturing Operations

- Simplification of processes enables you to manage complexity while increasing productivity.
- Connecting people and departments with streamlined processes removes friction that saves time that can be used for continuous improvement.
- Investing in a comprehensive quality management system pays off, in predictable product quality as well as in repeatable production processes.
- Better visibility to production operations fuels the processes of the rest of the company.

### Business Management

- Utilizing technology to automate and innovate cross-departmental processes will enable your business, operations, and IT strategies simultaneously.
- Tools that improve supply chain collaboration, streamline processes, and reduce friction.
- Greater visibility and transparency are not only required for day-to-day operation, they expose opportunities for improvement.
- Real-time production data supports better business decisions versus relying on stale data.

### IT

- Automation of individual processes minimizes time to process and reduces unwanted errors. Once automated, cross-departmental processes are more predictable and repeatable.
- Fewer systems with fewer integrations enable smoother and more reliable data flow.
- Need to be confident with mobile and multi-device support for more effective and consistent user experiences.
- Market forces are driving cloud computing as the future-ready platform. Cloud is the way to connect the business to plants, people, processes, and partners.

## YOUR BUYER'S JOURNEY: EXPLORE OPTIONS

There are seemingly endless options to explore from individual point solutions for any one need to broader enterprise solutions that can address them all. Because a manufacturing business is so integrated, you will likely uncover solutions that have a ripple effect improving the functions somewhere up or down within the organization. You may find that an option you uncover can immediately support the needs of another group.

This phase of the journey has the tendency to incite conflict, as leaders sort out their priorities. But after considering the alignment opportunities, you'll quickly see that it results in enterprise-wide benefits that go beyond your initial expectations.

Questions to consider:

- How can you address the business needs?
- What functional solutions should you consider for your needs?
- Who needs to agree/decide?
- What are the drivers for this phase?
- What are the business considerations?
- What does success look like?



## Points of Alignment to Explore Options

### Manufacturing Operations

- MES delivers control on the production floor. Connecting it to business operations like planning and procurement removes friction and keeps on-time delivery moving.
- MES provides a clearer view of the state of operations with actionable data to support decision-making across the entire business.
- A comprehensive IIoT platform supports SCADA, MES, and ERP, and removes friction for reporting and growth.

### Business Management

- Obviously, a solution that supports all the key dimensions of the business including holistic planning, manufacturing operations, and business management is an ideal platform. It's usually best to seek these out.
- Most ERP solutions do not support manufacturing execution systems (MES) out-of-the-box. The more integrated and comprehensive the solution, the more connected are your operations. And there are times when you don't need a new ERP system, in such cases adding and integrating an MES may be the solution.
- Make sure that the solution connects the top floor, shop floors, and extended supply chains for connected manufacturing.

### IT

- Cloud computing transfers the IT burden from your company to the service provider which can free up IT to support better connecting your manufacturing business needs.
- A central database in the cloud becomes the single source of truth that everyone uses. When all departments work from a common foundation, connected manufacturing develops naturally.
- Bringing the data from production systems into a manufacturing system of record connects operations with the business supporting OT-IT convergence (the coming together of operational technology and information technology).

## YOUR BUYER'S JOURNEY: DEFINE CRITERIA

As you evaluate solutions, you'll begin to see that application providers tend to focus on specific issues rather than holistic ones. There are connected manufacturing solution providers but you'll have to find them. Keep in mind that a solution designed for manufacturers should include MES capabilities, as a minimum.

You may already have an established ERP with no plans to replace it. In that case, follow the same guidelines for selecting an MES or an SCP with special emphasis on the integration with your top-tier ERP.

Questions to consider:

- How will you decide on a solution?
- Do you have functional requirements from stakeholders?
- What is your buying criteria?
- Who should lead the process?
- Who will "own" the final solution?
- Do you have stakeholder support?
- Do you have a budget approved?



## Points of Alignment to Define Criteria

### Manufacturing Operations

- Ensure that demos address your specific processes, to validate that the solution will work for you. Keep an open mind, as application providers may have developed better ways to do things.
- Connected manufacturing relies on connected data. Make sure that the data will be available to everyone who needs it.
- Consider the big picture of standardization across your organization. However, it may make sense to phase your implementation and continue after validating an initial plant or two.

### Business Management

- Each group prioritizes their requirements differently. Look for commonality like data visibility and a unified single version of truth.
- Modern solutions deliver so much additional productivity, that your ROI essentially funds the technology change.
- Subscription pricing typical of a true cloud solution can be much easier to get approved than an upfront capital expense. Functional groups can each pay a share.

### IT

- Encourage each group to contribute their requirements and priorities for the evaluation checklist.
- Ensure that as many team members as possible can participate in the demos. Look for “connected” value propositions to build on each others’ requirements.
- Consider customer testimonials carefully. Existing customers are the best indicator of both positive and negative customer experiences.

## YOUR BUYER'S JOURNEY: EVALUATE SOLUTIONS

Armed with a clear understanding of the options available for a new software solution, you can engage with application providers to evaluate how they'll deliver value. Be cautious not to focus on the features and functions alone so that you miss the value of the overall solution. Different solutions do things in different ways, but focusing on how the capabilities enable a more connected enterprise will result in a much better solution for the needs of your business.

A collaborative approach that keeps each stakeholder focused on their short- and long-term strategies, while considering the cumulative impact of a connected manufacturing solution, is the primary goal here.

Questions to consider:

- How will you choose a provider?
- Will you do a request for proposal (RFP)?
- Do you have a prioritized/weighted solution wish list?
- Have you asked customers and/or suppliers?
- Have you evaluated demos, trials, benchmarks, etc.?





## Points of Alignment to Evaluate Solutions

### Manufacturing Operations

- Because production control involves data from other parts of the business (orders, planning, maintenance, etc.), you should sync with your relevant counterparts on required KPIs and how they will be reported.
- Modern MES solutions have built-in safeguards and error-proofing for many critical functions. These can assist in compliance to protect your business.
- Look beyond the features and on to how the solution can help you become a world-class manufacturer.

### Business Management

- Leveraging knowledge and experience from your business ecosystem is a great way to influence your decision. This may result in best practice sharing going forward.
- Compliance is a paramount business concern. Make sure that everyone can recognize how a compliant solution can protect your company.
- Make sure the solution supports your global business needs and/or their roadmap aligns with your expansion plans.

### IT

- Multiple, disconnected systems are roadblocks for achieving connected manufacturing. Some application providers have a value engineering team to help you find redundancies that you can eliminate by implementing the new solution.
- Understand the integration capabilities of and with the new system. Do you have resources to make the necessary connections?
- Consider an implementation partner or system integrator who can bring additional value such as process and program management as well as industry knowledge.

## YOUR BUYER'S JOURNEY: VALIDATE AND NEGOTIATE

As you get closer to deciding, you should be paying very close attention to risk assessment. If you've followed the process and identified the risk threshold for the company, your focus will be on mitigating those risks and delivering value to your business. Now is not the time to raise new and out-of-scope objections that might derail your work so far. Now is the time to validate the solution you've arrived at to ensure that it will deliver the expected value.

The application provider will want top dollar for the value that they are delivering. Pay close attention to these key points of negotiation that should help you finalize the deal.

Questions to consider:

- Have you performed an ROI/TCO calculation to see if the solution meets stakeholders' expectations?
- Have you evaluated the implementation time/cost, pricing model, etc.?
- Have you checked the references and visited other users?
- Could you get more value by deploying across multiple plants?
- Would you get a deeper discount for a multi-year commitment?





## Points of Alignment to Validate and Negotiate

### Manufacturing Operations

- Cloud applications can be configured and tested without interrupting your status quo. Work with IT to understand the process and timing for go-live.
- Upgrades are generally delivered automatically in the cloud, but make sure to understand the impact. Can you choose what new features can be turned on?
- Work with IT to manage shop floor integration issues. Connected manufacturing relies on visibility to the data from the shop floor.

### Business Management

- Each functional group should take responsibility for justifying their portion of the chosen application for board approval.
- References are key to validating application providers' viability and trustworthiness. Each group should provide opinions.
- There are many negotiable points to closing a deal. Don't look at price alone. You will ideally stick with your choice for many years so consider a multi-year subscription as a bargaining chip.

### IT

- Implementation, training, and go-live are all intertwined. Make sure that the timing jives with your business priorities and calendar.
- Cloud software is generally priced by subscription but may also be priced by site versus individual seat. Consider a site license that will allow more people to use and benefit from the application.
- Be sure to include what you need now and plan for future needs. Engaging with the application provider's roadmap gives a view of the future. Often, user groups can influence the roadmap.

## BUILD A BUSINESS CASE

One critical step is securing executive sponsorship, not only for the strategic application investment but also for the time investment necessary for the research and evaluation your team will have to undertake.

Your company may have guidelines or even a template for preparing business cases. Or you can choose to adopt a general guide and make it your own. Below is a set of best practices that will make your business case reflect the thorough buyers’ journey you will have completed.

Document Processes and Performance	Understand Business Needs	Identify Ideal Future State	Partner with Sponsor(s)	Build a Cost-Benefit Picture	Identify Soft Benefits
Assess current processes and their effectiveness.	Outline company strategy and how a solution can enable it.	Provide gap analysis between ‘As Is’ and ‘The End State’	Each department should have its own section in the business case.	Detail the costs of the current state and the ROI of a new solution.	Don’t limit yourself to dollars and cents. Many goals of a company strategy are “soft” in nature (e.g., higher customer satisfaction, technology differentiation, etc.).
Consider industry best practices such as from APICS, MESA, or AME.	Outline individual departmental strategies and how a solution can support those.	Detail your IT strategy—do you want a big internal team for support and maintenance or a team of internal consultants helping the business grow while the solution is in the cloud?	Each department should partner with others to deliver a cross-functional case.	Clearly outline the value to the business in a way the approvers (E-team, BoD, CFO, etc.) can relate to.	
Document connectivity from top floor to shop floor and in the extended supply chain.	Identify risks and how you will mitigate them.	Explain how a new solution will continue to support and advance company goals.	Make sure that each stakeholder agrees to the expected benefits and commits to the efforts in achieving the desired outcomes.	Include timelines for ramp up and phases of maturity – with clear milestones along the way.	Don’t forget to include broader organizational values like employee sentiment, training, and retention.
Make note of integrations and critical dependencies.	Prioritize this investment against other competing investments.				
List KPIs used to manage the business.	Socialize the needs and document support.				

## COMPUTE ROI/TCO OF THE SOLUTION

Validating the potential return on investment (ROI) is a best practice, if not already enforced by your CFO. An ROI calculator can give financial leaders an estimate of what to expect from the solution. Once you have an appropriate ROI estimate, the next question from your finance leader will likely be “What is the total cost of ownership (TCO) for us over time?” The purchase of software licenses is just the beginning. TCO with cloud solutions is based on subscriptions (OPEX) versus purchases (CAPEX), and are very different so it is worth comparing them.

Today, there are reliable tools you can use to prepare your own ROI with your own data. Use the Connected Manufacturing ROI/TCO Calculator at [plex.com/ROI](https://plex.com/ROI) to understand long-term costs to and returns for your business.



## CONSIDER GETTING SOME EXTERNAL HELP

**Technology Advisors** can help you navigate the complex process of determining requirements and become your “negotiator for hire.” Technology Advisors live on the forefront of the latest trends in technology with a strong understanding of what works and what does not.

**Systems Integrators** know the ins and outs of different technologies and have experience pulling them together to address manufacturers’ unique business and technology needs. Although specialists in leading technologies, they generally have broad market coverage and employ subject matter experts in many different disciplines.

**Industry Analysts** stay on top of, and in many cases, drive technology trends across multiple industries. This makes them true subject matter experts. Representatives from Gartner, Forrester, IDC, LNS Research, and others were practitioners in their fields before becoming an analyst.

“As an ex-Gartner analyst, an ex-PwC consultant, and now as adviser to many CIOs, I have helped buying organizations. I jokingly refer to myself as Jiminy Cricket to a customer’s Pinocchio – my job is to act as their conscience, keep their decisions objective and help them negotiate low-risk, high value contracts.”

VINNIE MIRCHANDANI,  
DEAL ARCHITECT

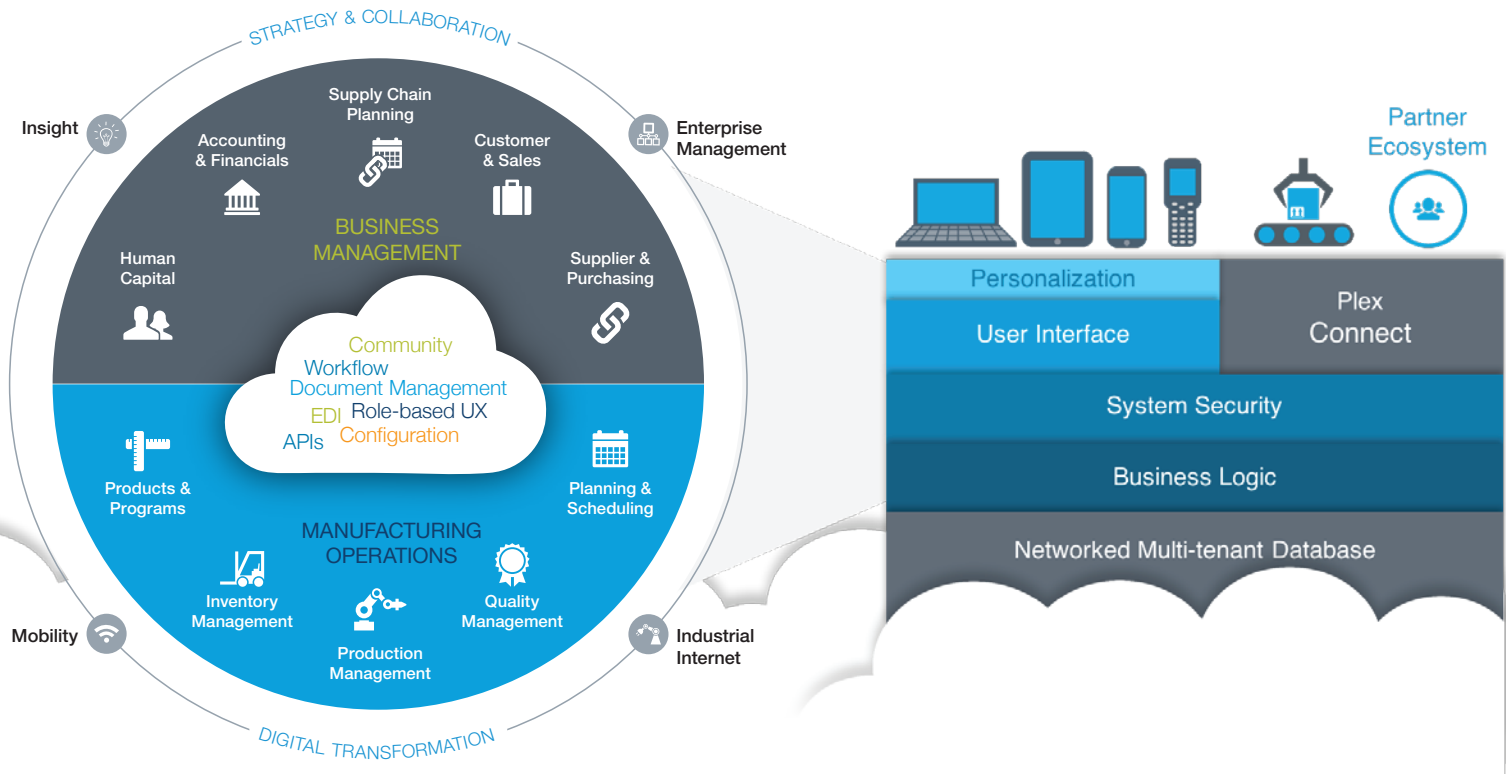
“System integrators leverage industry best practices and implementation experience to identify areas for operational improvements, help provide justification, and a proven methodology manufacturers can use to evaluate ERP systems.”

DOUG HOCKENBOCH,  
PARTNER, MANAGEMENT  
CONSULTING  
PLANTE MORAN

“By adopting best practices, developing thought leadership, and conducting in-depth workshops; industry analysts are trusted advisors on the Operational Excellence and Digital Transformation journeys.”

MATT LITTLEFIELD,  
PRESIDENT AND PRINCIPAL  
ANALYST  
LNS RESEARCH

## THE PLEX MANUFACTURING CLOUD



The Plex Manufacturing Cloud automates your shop floor and informs your top floor. Designed for discrete, process, and mixed-mode manufacturers to connect suppliers, manage materials, and control machines to drive production, quality control, improve productivity, and unlock your people potential. Built in the cloud, Plex provides centralized security, visibility, collaboration—and flexibility to configure the system to your processes and structure. The Plex Manufacturing Cloud is one, unified system that includes supply chain planning (SCP), enterprise resource planning (ERP), analytics, and a manufacturing execution system (MES) to ensure the highest quality, compliance, documentation, and performance of your operations.

For more information, please visit us at [www.plex.com](http://www.plex.com) or call us at 888-454-7539.

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"The most successful manufacturers have learned to expect the unexpected. They have learned how to be agile. They have learned how to be connected."

CINDY JUTRAS  
PRESIDENT, MINT JUTRAS

"For Digital Transformation to be successful it can't just be a technology project, it must be a business initiative that delivers a sustainable competitive advantage. Manufacturers are in a unique position to decide: initiate transformation as a proactive strategy or in reaction to competitors that are out-innovating you. Either way, you'll need an end-to-end connected enterprise system to support your transformation."

MATT LITTLEFIELD  
PRESIDENT AND PRINCIPAL ANALYST, LNS RESEARCH

"Connected Manufacturing is about putting the modern shop floor with its robotics, sensors, wearables and 3D printing at the center of your business universe. Doing so allows you to deliver much smarter products, delights your customers with highly personalized offerings and turbo charges your supply chain. In fact, most ERP systems are focused on administrative functions and lack the connection to the shop floor."

VINNIE MIRCHANDANI  
CEO, DEAL ARCHITECT AND AUTHOR OF SILICON COLLAR  
AND THE NEW POLYMATH