



TRANSFORMING MANUFACTURING OPERATIONS WITH INDUSTRY 4.0



TRIVISTA

Industry 4.0

Technology is creating new opportunities in manufacturing. Digital advances across industry—in RFID, vision systems, cloud computing, robotics, etc.—are allowing forward-thinking leadership teams to transform their operations, thereby improving costs, enhancing velocity, and growing market share. This comes at an important time, with most manufacturers and distributors facing labor shortages and a variety of supply chain challenges that are increasingly present in today's world.

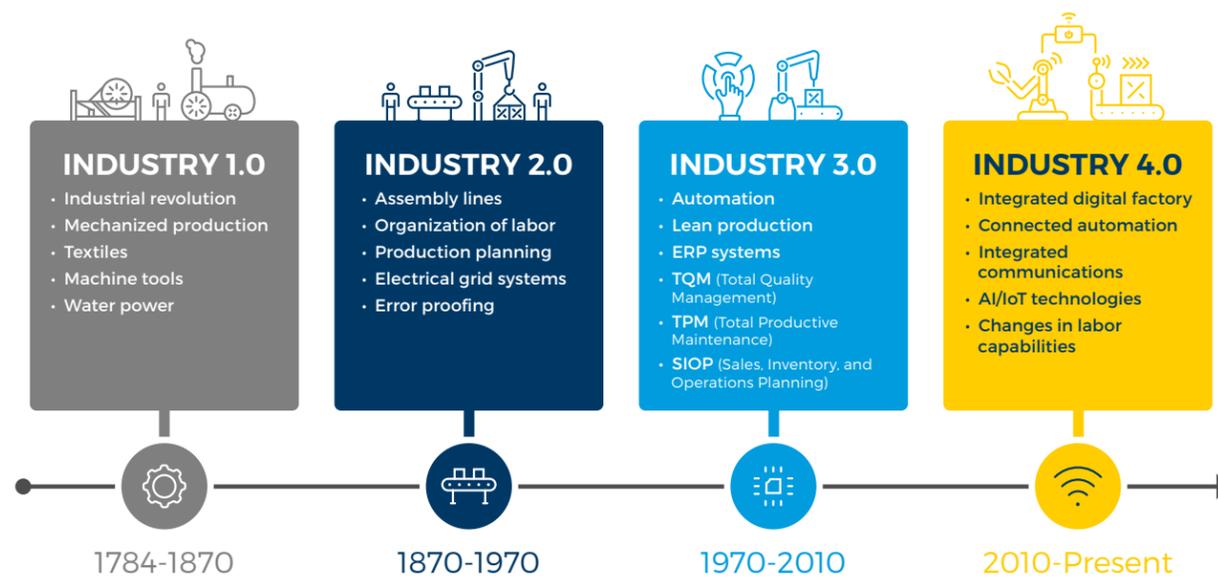
But investments in advanced technologies can be expensive, and they're often confusing to newcomers. More important, maximizing ROI (or even realizing it in some cases) is dependent on baseline operational capabilities such as KPIs, Visual Management, Optimized Layout, Preventative Maintenance, Lean, SIOP, and Quality Management. Without these foundational capabilities in place and functioning well, many benefits of Industry 4.0 transformations won't materialize.

This piece provides an overview of industry 4.0 and thoughts for manufacturers to consider in the coming years. It also explores the foundational operational requirements that will ensure a successful transition from Industry 3.0 to Industry 4.0.



Industry 4.0 accelerates factory transformations and financial results but requires strong operational discipline

The advances in technology over the past several years that are now commercially available—and increasingly affordable—to help improve your operation are remarkable. There's certainly nothing keeping any manufacturer from installing the newest and most advanced technology. However, that may not be the wisest business move, particularly as an immediate investment.



That's because, in order to fully recognize the gains on offer from these advances, you must first have critical operating fundamentals in place. These are basic practices and disciplines that maximize your organization's capabilities for ongoing assessment and improvement, and which will provide a solid foundation on which to build technological capabilities.

Fundamental to those is a culture of improvement, usually characterized by the application of Lean or related methodologies. But merely deploying such tools on the shop or plant floor doesn't imply success at the needed discipline. You should already have good flow and elimination of waste in all aspects of your manufacturing and supply chain operations. It's critical that people at all levels are empowered to drive continuous improvement in their parts of the business. In order for them to do so, it's also crucial to have established mechanisms to break your process down, from order taking to shipping, to identify bottlenecks, engage in problem-solving, design solutions, and implement them on a timely basis. Those mechanisms typically include Sales, Inventory, and Operations Planning (SIOP), Process Optimization, Total Preventative Maintenance, Quality Management, and effective Operations System Management, as shown in **Figure 1**. This process discipline will enable you to determine where your bottlenecks for each of your systems are, and what installing automation or other new technologies in a given part of your system could deliver for your business.

Despite the abundance of opportunities to improve your operations by implementing high-tech levers, you first must consider your baseline operational capabilities. For example, if you don't have a well-functioning SIOP process, you should correct that shortcoming before investing in capex to drive throughput improvements via automation. If those capabilities don't currently exist, then building them is the first task, and one that must be done before making big capital investments.

Other considerations as you assess the potential that new technology might have for your business are your upstream and downstream supply chain capabilities, and the technical capabilities of your workforce. If you expect new technology to deliver increased throughputs, it pays to ensure that both procurement and logistics are capable of handling the higher demands for raw materials and finished goods handling. It also requires operators and maintenance personnel capable of operating, troubleshooting, and repairing the more complex and technically demanding systems.

Figure 1
Foundational Requirements for Industry 4.0 Transformations

-  **Operations Management System**
-  **Lean Operations**
-  **Sales, Inventory & Operations Planning**
-  **Total Preventative Maintenance**
-  **Quality Management**

Figure 2

Industry 4.0 Building Blocks

AUTOMATION

Automating key process steps lowers labor costs, improves quality, increases equipment productivity, and optimizes WIP (Work in Process) inventory levels.

DATA ANALYTICS

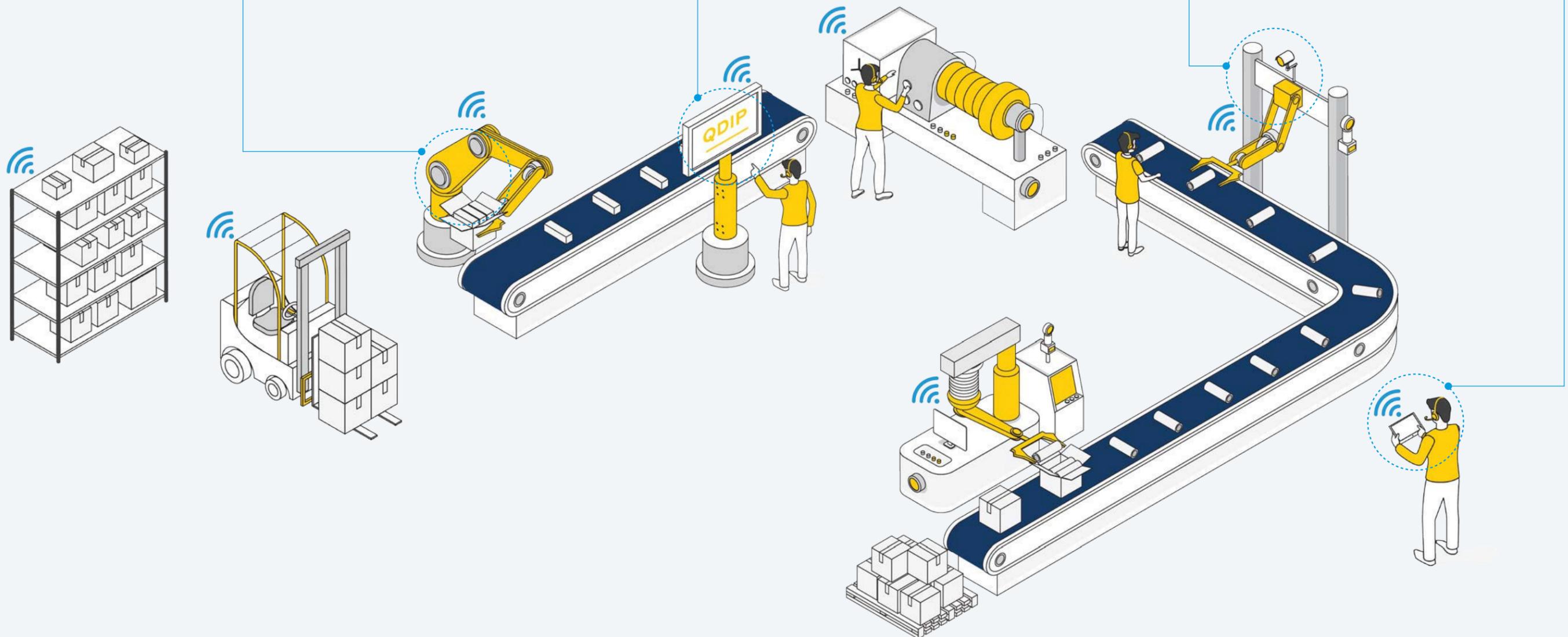
By bringing together data from across your organization, you'll benefit from real time information, establishing a business intelligence platform that truly enables your business.

ARTIFICIAL INTELLIGENCE / INDUSTRIAL INTERNET OF THINGS (IIoT)

Unlock the true potential of your operations by introducing intelligent sensors and cameras that can predict off standard processes – across people, equipment and inventory.

INTEGRATED COMMUNICATIONS

A connected factory ensures that corrective actions are addressed immediately, reducing waste and improving performance in real time.



Where to start your Industry 4.0 journey

Once you've ensured that your operating fundamentals are in place to support your next big technological leap, it's time to consider the key areas where Industry 4.0 technology might profitably be applied. As outlined in **Figure 2**, there are four key building blocks to consider when evaluating Industry 4.0 investments: Automation, Data Analytics, Artificial Intelligence, and Integrated Communications.

When you're considering where to invest your capital on the "next big thing" in manufacturing technology, first ask yourself where technology might make a significant improvement in your operation, and why technology is the answer. This is another area where operational discipline is critical, as it will clearly point to your bottlenecks and document their root causes, allowing you to make your business case for a technological solution.

Selecting the right technological solution is the key to maximizing your returns

Once you've determined the specific area of your operation where capital improvements are warranted, that root-cause approach will help guide you to the specific and most appropriate technology solution.

It could very well be that the best capital investment for your application is an Industry 3.0 solution. Straightforward unit operation automation such as servo-driven packaging systems or robotic palletizers, or automated inspection systems such as checkweighers, vision systems and X-ray units, still offer tremendous benefits to those for whom such legacy automation is new.

Should Industry 3.0 technology be your best option, however, you should implement those improvements with an eye toward Industry 4.0 capabilities. Including pre-designed functionality such as machine interconnectedness and centralized data collection, processing, and analysis, for example, even if only as potential additions, will pay dividends in the future.

Industry 4.0 applications that can take you beyond basic automation

AI-driven data collection and analysis

IIoT technology in simple cameras, coupled with AI capabilities, bring system and product monitoring into the digital age. AI-enabled cameras can "learn" proper machine function or product quality attributes, then monitor the operation and either give an alert or shut the system down when a problem is detected. Similarly, they can monitor human movements and analyze them with an eye toward safer work. Smart sensors can monitor machine or environmental attributes to prevent breakdowns or losses. All these can be either wired or transmit data wirelessly to a central computer. They operate 24/7 and never tire.

Advanced robots and cobots

Unlike legacy industrial robots, Industry 4.0 devices can use vision for guidance, can "speak" to one another and interact for efficient operation, and like the cameras described above, can use AI to "learn" the process. Cobots, meanwhile, use both sensors and AI to render them safe enough to work in conjunction with, and in close proximity to, human operators.

Machine interconnectedness and self-monitoring and -correction

IIoT and AI capabilities combined with central data processing and analysis are bringing us to self-correcting operating systems. Cloud capabilities enable the effective sorting of millions of data points, while AI offers constant

optimization of the central controller's "understanding" of how the process should run, allowing interconnected machines in a system to be monitored and corrected without human intervention.

System interconnectedness and remote operation

Similar to the machine interconnectedness above, entire systems can now be effectively interconnected—using those same capabilities, but for a whole production facility—and allow us to achieve the "dark factory" concept. An entire manufacturing operation can now function without a human presence.

AI and machine learning applications (hardware and software)

Coupling the IIoT data collection and centralized processing with AI and machine learning makes Industry 4.0 technology an active part of your continuous improvement efforts. On the hardware side, wireless sensors can help monitor critical system parameters, ensuring proper operation in real time and enhancing your Preventative Maintenance capabilities by helping predict failures and schedule planned maintenance. On the software side, generative scheduling, which runs thousands of iterations to determine the best schedules for both operations and maintenance, can prevent tremendous amounts of idle time and maximize throughputs.

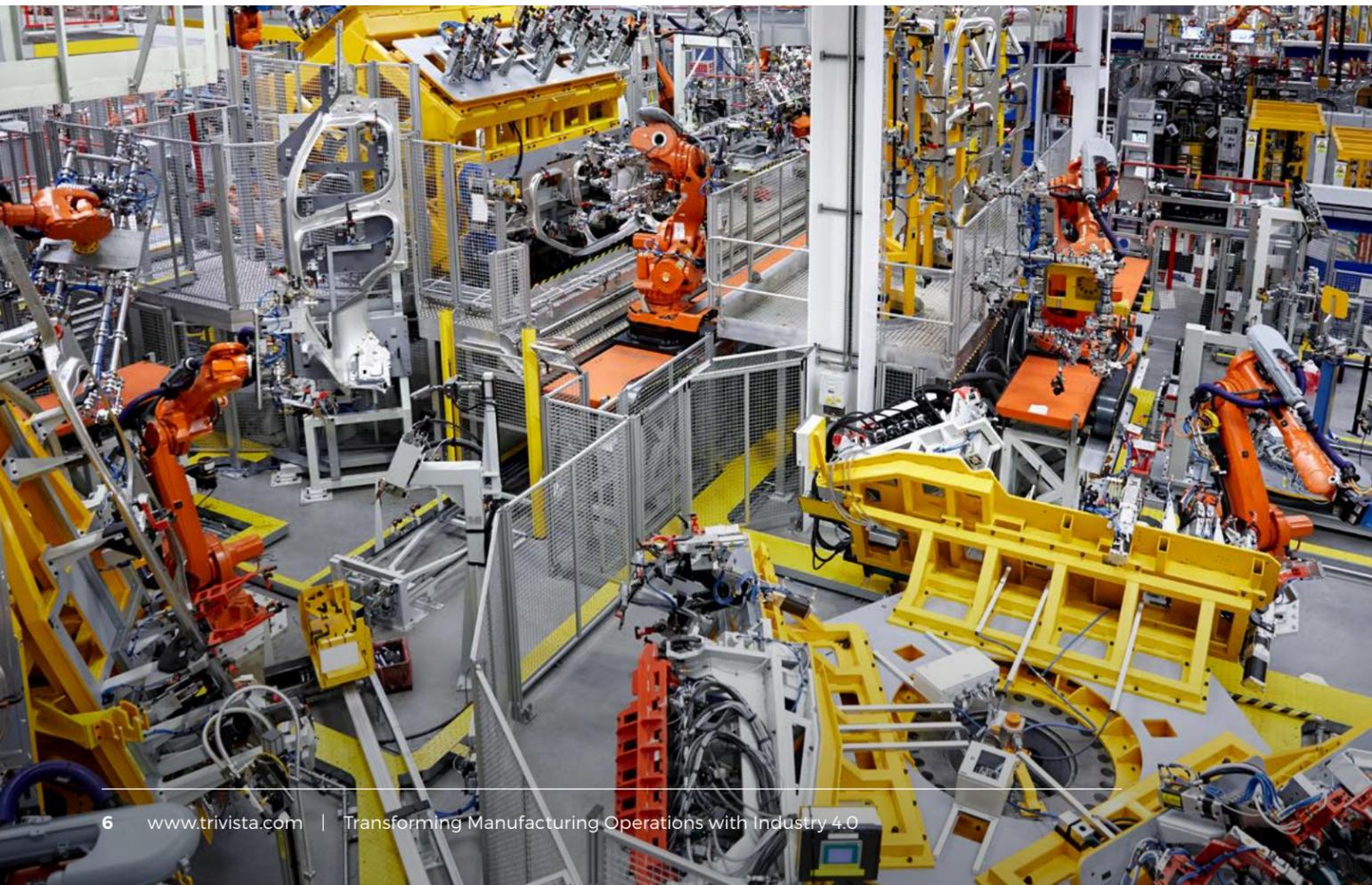
Machine-assisted, AI-enabled training and troubleshooting (AR/VR)

In addition to machine applications, Industry 4.0 is providing people-centric advances as well. New technologies are available to provide real-time assistance with machine troubleshooting. Training is being enhanced with augmented reality (AR), in which real-world training is enhanced with digital views, or virtual reality (VR), where complete virtual scenarios are displayed and the trainee is able to interact as though in the real-world situation.

AI-capable wearable technology

Wireless sensors can become part of your efforts to safeguard your workforce. Wearable technology can monitor environmental conditions and flag when a worker might be at risk. They can sense motions and prevent overuse injuries, trauma, or repetitive motion injuries.

We offer this word of caution regarding this particular area of technology: there is a natural wariness in people when it comes to being monitored by cameras or wearable technology. As with the operating fundamentals you must have in place before considering any Industry 4.0 technology solutions, in this case, you must have the trust of your workforce and credibility that the monitoring is for only positive purposes before attempting any such overseeing of your teammates.



IIoT and Industry 4.0 offer potential financial benefits in a number of areas

Potential benefits and savings from advanced technology vary widely. There are some general categories to consider as you evaluate your business case for investment. You can achieve simple cost savings with reduced material use from more precise and repeatable operations. Additionally, higher yields and less material waste are possible by preventing errors with better system monitoring. Productivity improvements are nearly always on offer, as machines take over from human operators and both speed and reliability of systems improve dramatically. In addition to it being right thing to do for your colleagues, prioritizing improvements in worker safety can offer tremendous financial benefits as well. Finally, greater flexibility and visibility across your supply chain can enhance your ability to serve your customers and increase the earning potential of your systems, while reducing risk and preventing crises from derailing your business.



Conclusion

Industry 4.0 and IIoT technologies offer the potential for great benefits, both operationally and financially, for manufacturers. To ensure the right solution for your business, and to prevent missteps and wasted capital, however, you must have strong operational discipline, use data to drive key investment decisions, and hold teams accountable to delivering results.

How do you evaluate your Industry 4.0 readiness?

- 1 Assess your operational maturity**
- 2 Develop a technology roadmap**
- 3 Prioritize using benefit/effort analysis**
- 4 Implement, measure, and hold teams accountable to achieving results**

These new technologies offer real promise for accelerating factory transformations and dramatically improving financial results. But it requires strong operational discipline to maximize their benefits, and proper strategy beforehand to make the right moves at the right times.

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