

# REACHING THE TOP QUARTILE

## HOW AUTOMATION POWERS DIGITAL TRANSFORMATION



# INTRODUCTION



Dear Reader,

Manufacturers today are working in a pivotal time. The challenges arising from rapid technological innovation and a dynamic business environment grow larger every day. To succeed, it seems sometimes we must find a way to balance seemingly opposing challenges: How do we embrace innovation and new technology while leveraging our existing investments?

How do we evolve our businesses to be adaptable while maintaining tried-and-true practices? How do we help our organizations cope with rapid technology changes and evolve our personnel to the jobs of the future?

The challenges, at times, can seem overwhelming, but overcoming them is crucial for companies to reach and maintain operational and project performance in the Top Quartile, or top 25 percent, of peer companies.

Over decades of experience helping customers face and overcome these challenges, Emerson has identified the building blocks to navigate the digital transformation successfully.

It all begins with **business justification**—why should your business invest in the technology, and what goals will it help you achieve? Then comes identifying the **execution methodology**—the predictable, scalable plan and actions needed to implement digital technologies—and the right **technology platform** to bring the vision to life. And finally, to ensure success, companies must prepare their **people** and inspire **behaviors** needed to develop the workforce of the future.

Together, these elements, explored more deeply in this ebook, can help companies navigate the digital transformation and realize Top Quartile performance. Emerson will continue to work tirelessly in pursuit of tools, technologies and practices that help our industry partners and customers succeed.

I hope those outlined throughout this ebook are helpful and lead you and your company to the next level of success.

Sincerely,  
Mike Train  
Chairman, Emerson Automation Solutions

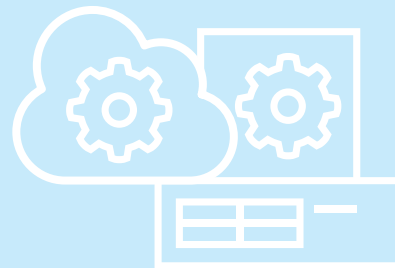
BUSINESS  
JUSTIFICATION



EXECUTION  
METHODOLOGY



TECHNOLOGY  
PLATFORM



PEOPLE AND  
BEHAVIORS



# HOW CAN MANUFACTURERS ACHIEVE TOP QUARTILE PERFORMANCE?



Industrial organizations today are under tremendous pressure to not only stay competitive, but also deliver greater value from their investments to shareholders. For many companies, the challenge to complete capital projects on time and on budget as well as achieve [Top Quartile operational performance](#)—performance in the top 25 percent of peers—often appears difficult, if not unattainable.

Too often, industrial firms overlook the transformative power and game-changing performance of new execution methodologies and technologies. When automation technologies—sometimes viewed as commodities or necessary but non-strategic—are treated as part of a broader business performance strategy, the result can be a tremendous improvement in value achieved.

Companies can attain Top Quartile performance in a variety of ways:



## PROJECT CERTAINTY

Traditional approaches to project engineering/execution can introduce project risk, extra cost and extended startup time. By focusing on automation early in the process, companies can reduce this capital project risk, eliminating cost and time overruns to save 20 to 30 percent on their investment. According to industry benchmarking data, Top Quartile performers have 54 percent lower costs and 49 percent shorter schedules than fourth quartile performers. Top Quartile performers in capital projects not only achieve schedule and cost goals, but also derive faster ROI, which improves shareholder value.

A proven approach to achieving these performance goals is to move strategic engineering decisions into the earliest project stages. Historically, some companies tend to make critical decisions in the later stages of a project, when there is the least flexibility to implement the changes, ultimately resulting in schedule disruption and increased cost. Successful project teams, however, engage an industry expert during the planning stages of project design and execution. It's important to work with partners that not only have a track record of global consistency of delivery, but also follow a proven methodology focused on completing projects on time and within budget.



Good front-end planning leads to as much as 20% cost savings and 39% schedule reduction for total project design and construction.

*Construction Industry Institute: Adding Value Through Front-End Planning. CII Special Publication 268-3*



### OPERATIONAL CERTAINTY

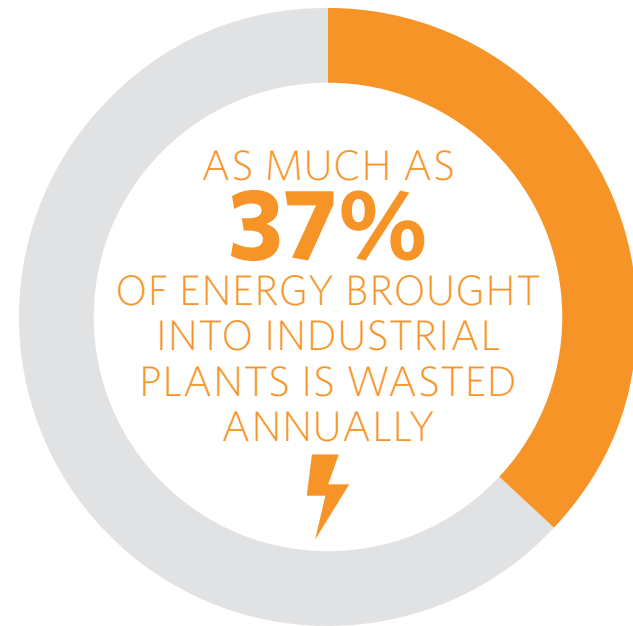
Achieving safe, reliable operations is critical to a company's success. Unplanned downtime—the loss of production availability—is one of the biggest causes of reduced profitability, not to mention safety and compliance risk. These unplanned outages result in excessive maintenance, repair and equipment replacement. This is just part of a performance issue that leads to more than \$1 trillion in operational losses across the globe. Having top operational performance can make a huge impact on a company's bottom line. In fact, according to industry benchmarks, bottom-quartile companies spend nearly four times as much on maintenance costs as Top Quartile performers that often leverage the power of predictive intelligence built into new technologies.

Companies that can all but eliminate these costly unplanned outages set the benchmark for operational performance. [Emerson's methodology for its Operational Certainty approach](#) can help customers pinpoint the causes of poor performance, prioritize actions that can yield the greatest improvement and establish a scalable work plan for moving forward.



### INDUSTRIAL ENERGY MANAGEMENT

Outmoded technologies and inadequate monitoring of process energy consumption result in unnecessary cost and wasted resources. Energy is one of the biggest operating costs in manufacturing, accounting for as much as 40 percent in industries like refining. According to a U.S.



Department of Energy study, as much as 37 percent of energy brought into industrial plants is wasted annually, and 15 percent or more of generated steam is lost. Among contributing factors, inadequate monitoring of furnaces and gas-fired heaters can cause excessive fuel consumption, increased emissions and added maintenance cost. Energy is also wasted as the result of leaks and process variability due to inadequate monitoring.

By delivering stable, reliable power, energy companies can reduce fuel consumption, waste, emissions and maintenance costs. In fact, studies show that an effective energy management information system can result in energy savings of 5 to 15 percent—translating to millions of dollars saved annually. Top Quartile manufacturers have energy costs among the lowest in their industry, despite maximum utilization of production facilities.



### PEOPLE PRODUCTIVITY

Standard maintenance practices are labor-intensive and inefficient. Through better training of personnel and modern automation technologies, industrial firms can safely improve workforce performance and productivity by 60 percent and give employees improved insight into process and equipment conditions—empowering them to make better-informed business decisions on the plant floor. Industry leaders typically operate with the leanest staff, seeking labor efficiency and the fewest safety incidents. Yet, traditional procedures such as routine walk-arounds and reactive maintenance result in wasted labor, poor prevention and increased risk. Conversely, companies that adopt progressive digitally transformed maintenance procedures see game changing improvements.

In the pulp and paper industry, for example, companies that have implemented preventive and predictive maintenance informed by advanced automation technologies have increased process efficiency by 20 to 30 percent and productivity among maintenance staff up to 66 percent. They have also seen reductions of safety incidents by two-thirds.

As these examples demonstrate, redefining performance expectations and taking a strategic approach to automation technologies can materially change the economic outcome of a company's plant operations or capital projects. Manufacturers that measure their industrial projects and plant operations against these new thresholds of performance typically expect no on-time or on-budget slippage on their greenfield projects or plant upgrades, nor any unscheduled plant or production equipment failures. ●





# THE FIVE COMPETENCIES OF DIGITALLY TRANSFORMED COMPANIES

For the past three decades, manufacturers have been focused solely on efficiency as the key to performance gains and technology integration, but this mindset is beginning to fade as ever-growing industry expectations and competition demand a new approach.

Modern manufacturers must reorient their business plans with an eye toward digital transformation and a laser focus on the resources that drive business performance: people. This transformation will require a digital workforce with the skills and know-how to leverage new technologies and innovation. Their success is critical for companies to achieve [Top Quartile performance](#) and stay among the top 25 percent of industry peers.

Change, while essential, is always a challenge—especially when we’re approaching a never-before-seen productivity era in manufacturing. Companies are understandably searching for answers on how to get today’s manufacturing workforce from Point A to Point IoT.

To help industry approach this transformational challenge, Emerson analyzed the organizational behaviors of Top Quartile industry performers and identified five essential competencies critical to realizing the value of digital transformation:

- **Automated Workflow:** Eliminate repetitive tasks and streamline standard operations to focus personnel on exceptions and other opportunities that require human intervention

- **Decision Support:** Leverage analytics and embedded expertise to provide actionable insights that reduce complexity and enable higher quality, faster decision-making
- **Workforce Upskilling:** Identify approaches that empower workers to acquire knowledge or experience faster and more effectively, and support higher level and collaborative decision-making
- **Mobility:** Provide secure, on-demand access to information and expertise regardless of location, enabling collaborative workflows
- **Change Management:** Strategies, processes, tools and expertise that, in the right combination, simplify and accelerate the institutionalization of operational best practices

These themes are not necessarily new, but the Industrial Internet of Things (IIoT) is bringing unprecedented opportunities to evolve performance in each area. Mastering these competencies can help manufacturers fully take advantage of evolving digital technologies.

To help the industry leverage these competencies to their fullest, Emerson created the Operational Certainty Consulting practice made up of Emerson planning, operations and engineering experts to help guide companies through digital transformation. Companies are eager to get there. In a 2017 study conducted by IndustryWeek and Emerson, manufacturing leaders from a variety of industries said they believe IIoT will bring new possibilities fueled by increased real-time information, a more tightly connected enterprise and improved analytical tools—but obstacles remain.

This group consistently pointed to personnel as the most important factor for success, identifying the need for companies to consider new ways to doing things, improve workflows and educate and upskill their employees to effectively leverage technology investments.

This new era of manufacturing is taking a familiar path: History textbooks will show the advent of new technologies transforming the status quo and disrupting the traditional nature of work time and time again. But you’ll also see the same disruption consistently presenting new opportunities and net employment growth, not loss. Companies that embrace the opportunities are the ones that come out on top.

BY IMPLEMENTING THE FIVE COMPETENCIES AND PROVIDING EDUCATION AND UPSKILLING OPPORTUNITIES FOR EMPLOYEES, MANUFACTURERS WILL BE BETTER POSITIONED TO ACCELERATE, INSTITUTIONALIZE AND SUSTAIN TOP QUARTILE BEHAVIORS AS PART OF THIS IIOT-DRIVEN REVOLUTION.

Today is no different. Companies and employees ready to adapt to the rapidly transforming digital landscape stand to achieve the greatest success. By implementing the five competencies and providing education and upskilling opportunities for employees, manufacturers will be better positioned to accelerate, institutionalize and sustain Top Quartile behaviors as part of this IIoT-driven revolution. ●





# OPPORTUNITY ABOUNDS TO BOOST OPERATIONS, BUT IT WON'T BE FOUND IN THE SAME OLD PLACES.

**A**utomation has been a pervasive focus of investment for decades, largely targeting core production equipment, and the industry is already realizing substantial efficiencies as a result. But the advance of automation has also created a new challenge for many companies: skills and work practices must evolve to keep up with more powerful technologies and highly complex facilities.

Technology has outpaced skills advancement in many cases, which is marginalizing the game-changing performance improvements that companies could realize. Additionally, many work practices in areas like reliability are based on decades-old processes that fail to take advantage of tremendous technology advances in sensors, communications and mobile applications.

Manufacturers must fundamentally upgrade their work processes to ensure they're able to produce effectively to turn a profit in this environment. Those who stick with the way things have always been done will be outmaneuvered by those who are seeking [Top Quartile](#) performance—performance in the top 25 percent of peers—in both capital projects and ongoing operations.

To achieve sustained profitability this year and beyond, it's time for the industry to think differently about these five long-standing practices:

**1. Stop "run-to-failure" scenarios.** Traditionally, plant maintenance crews spend most of their time scrambling to fix broken equipment. But today's monitoring and control automation capabilities provide real-time predictive intelligence. When teams are using this information

correctly, they can focus maintenance efforts on identifying and addressing potential issues before they result in breakdowns, as well as get early notice of unpreventable failures. That results in a dramatic reduction in costly unplanned outages, not to mention a reduced risk of safety incidents. Availability goes up and maintenance costs go down.

**2. End routine trips to the field.** Scheduled manual inspection of equipment for both safety and reliability is still common practice. However, broader online sensor coverage of both safety and reliability has become cost-effective to install due to nonintrusive, easy-to-maintain wireless sensors. Data from these sensors can

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be fed to remote experts who can monitor and manage operations at multiple facilities via remote integrated operations centers. Often, they can direct on-site crews equipped with video and audio tools, avoiding travel. Advances in prescriptive operations can empower equipment to "learn" what problems look like and take steps to address problems before they occur, preventing downtime and lost production. This dramatically increases the reach of valuable expertise and allows the experts to focus more time on their critical work.

**3. Look beyond noncore specialization.** Operators have historically maintained oil and gas facilities via in-house experts. Many of these experts work in areas that are not the core competency of manufacturers, such as specializing in certain types of equipment. The IIoT has opened a new model that enables secure, selective sharing of process, equipment and other operational data, which in turn enables operators to outsource select services to third-party experts. This paves the way for manufacturers to supplement in-house

expertise in areas where it's needed, while also taking advantage of third parties with important domain expertise.

**4. Dismiss "dis-integrated" data and systems.**

Typically, manufacturers will have a reasonably integrated view of the data involved in core manufacturing, such as automation systems, orders and inventory and current production rates. But fully optimized manufacturing productivity requires an integrated view of this data together with reliability, safety and environmental data and constraints. When it's time to make an informed production

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decision, all these factors need to be taken into consideration. Integrating all this data can be a challenge, but new software technology is helping bridge any gaps—and is worth the effort. Full integration, coupled with today's communication capabilities, enables informed

decision-making by the right experts—no matter where they are. Remote experts can access the same, real-time information to securely collaborate on best approach.

**5. Don't rely on outdated skills.**

To implement improved processes and make the most of new data-driven environments, additional skills and culture changes are required. Operators need workers with the right digital skills to succeed, trained on their new work processes. Training has been transformed, utilizing tools such as virtual simulation built upon "digital twins," enabling staff to train on an exact digital replica of a facility's processes. Much like flight simulators, digital twins allow for training and testing of new tools, work practices or even manufacturing changes before they are implemented in the real world. Providing these opportunities for next-generation workers to have hands-on training is crucial for success, especially with the industry expecting a skills gap that could result in 2 million jobs left unfilled over the next decade.

It takes executive commitment, willingness to change and dedicated change agents to drop these long-standing practices, but the payoff can mean the difference between profitability and constant struggles in today's operating environment. ●



# ROI FROM IIoT: PUTTING TECHNOLOGY TO WORK FOR YOUR OPERATIONS



Executives are hearing plenty these days about the promise of the [Industrial Internet of Things \(IIoT\)](#). While the technology enables connected devices to monitor, collect, analyze and deliver valuable information that should translate into smarter, faster business decisions, it's not always easy to establish a clear business case for making what could be a sizeable investment.

One reason for the cautious attitude on the part of many executives is that most scenarios for implementing IIoT programs paint a picture of complex data architectures and massive enterprise-wide investments, requiring extensive engineering and a long-term commitment. Executives facing these multimillion-dollar or larger investments are left wondering: How do I know I'm investing in the right approach? How do I measure the value derived from my investment?

The popular business mantra of "go big or go home" certainly has its place in time, but when it comes to implementing IIoT, the opposite route may be the preferred approach. Companies are helping customers find finite yet scalable options to lower the risk of adoption while still reaping the benefits of the IIoT.

Emerson, for example, is focused on helping industrial manufacturers gradually adopt technologies that strategically tackle a defined business problem, enabling customers to achieve

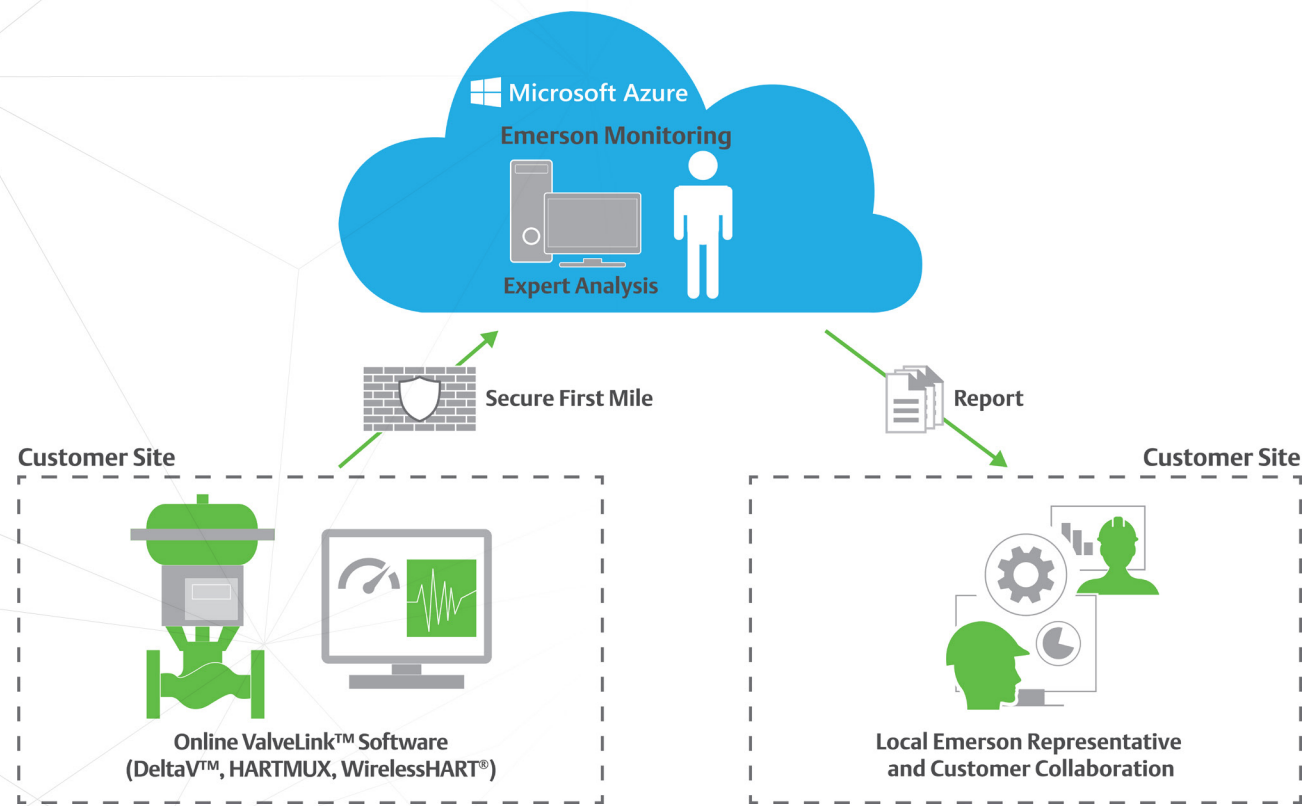
early performance improvement gains. The key to this approach is a flexible set of technology solutions called [Plantweb™](#) digital ecosystem, backed by Emerson's deep domain expertise.

Plantweb, a portfolio of interoperable technologies, software and services, helps customers realize measurable improvements in reliability, safety, energy management and overall operations. The digital ecosystem gives customers total flexibility and scalability in the way they adopt IIoT and puts them on the road toward digital transformation.

The key to success is connecting your technology to ensure the plant ecosystem works together. Many companies have already incorporated plant floor technologies—such as sensors and smart valves—that can monitor production lines and industrial processes in real time, tracking temperature, flow, pressure, valve openings and closings, and other factors that influence production. Both process and discrete manufacturers have also made significant investments in alarm systems designed to react to sensor data and shut down machines, if needed, reducing the risk of catastrophic failure and extended downtime.

[Innovative sensor technologies](#)—that measure vibration, corrosion or gas leaks, for example—help customers more easily and cost-effectively access real-time data pertaining to important operational domains such as safety, reliability, optimization and emissions.





By connecting these technologies across the workforce, customers can ensure data in existing systems reaches operational applications or the appropriate expert. Connectivity combined with new designs and architectural approaches

can enable the secure export of data to anyone, anywhere with the right permissions. An example of this capability is Emerson's [Connected Services](#) powered by the Microsoft® Azure™ IoT Suite. Through its Connected Services

offering, Emerson experts use connected devices to monitor assets, interpret the results and provide an actionable summary so companies can align maintenance and operational response with their business strategies.

This real-time visibility into operational performance as well as predictive analytical capabilities allows plant managers to access relevant data and make critical decisions about asset health and energy usage, thereby avoiding equipment failures and costly downtime while improving profitability. The ability to track asset health and be proactive in scheduling repairs and preventing unplanned downtime are key factors to achieve Top Quartile performance—defined as operations and capital performance in the top 25 percent of peer companies.

For instance, Emerson [reliability consultants](#) have found Top Quartile performers typically have more than 80 percent of their production

equipment monitored for vibration analysis, compared to just 35 percent for third quartile companies. Related, companies that depend on condition-based, planned maintenance have fewer equipment emergencies, resulting in 14 percent less downtime and 71 percent lower maintenance costs.

Through cloud technology, companies can leverage third-party resources—from anywhere in the world—to monitor process and performance data and recommend corrective actions. Emerson's Connected Services also provides remote monitoring and expert services.

These types of IIoT technologies, combining remote monitoring with [expert consulting](#) are delivering a new level of ROI to manufacturing companies. The momentum of IIoT remains undeniable; finding the most strategic and flexible path to take advantage of IIoT and gain measurable business improvement is much clearer today than ever before. ●



Emerson is a global [automation engineering and technology leader](#), propelling the world's premier industrial companies into benchmark-setting performance throughout the lifecycle of their investments. At Emerson, we call it Top Quartile.

For decades, leaders in oil & gas, refining, power, chemical, mining and other process industries have turned to Emerson's expertise and innovations to deliver predictable project success. Emerson has been called upon to provide services and technologies to the world's largest and most complex projects, helping customers eliminate unnecessary capital construction costs, reduce project complexity and restore schedule certainty.

Once an asset is up and running, our clients leverage Emerson's unparalleled automation technology portfolio to achieve Top Quartile operational performance through maximum production availability and throughput, lower energy costs and reduced safety risk. Emerson's leadership extends from pervasive sensing technologies and the most reliable control elements to the industry's most advanced software platforms for operations management and asset health.

Emerson's more than 74,000 employees in 150 countries around the world wake up each day ready to take on our customers' toughest challenges, turning "never been done before" into "consider it solved."