

Cisco Industrial Intelligence: Winning in the New World of Manufacturing

A White Paper

Executive Summary

How do leading manufacturers thrive in today's intensely competitive global economy? In a new assessment, market analyst Mainstay Partners looked at the new realities confronting today's industrial enterprises and identified specific strategies and technologies embraced by the most successful of these organizations. The study examined the operations of top discrete manufacturers (including leading aerospace and automotive companies) as well as large-scale process manufacturers (including global mining and metals firms).

Facing economic headwinds and heightened competition, these market leaders chose to stay ahead by investing in a new generation of technologies and solutions that Cisco terms Industrial Intelligence. At the center of the solutions are IP-networks that "converge" industrial with enterprise systems and allow teams to communicate and collaborate at new levels of speed and efficiency. Empowered by the Cisco Industrial Intelligence solution, the world's best manufacturers have discovered how to more intelligently and responsively manage their industrial operations and gain a clear advantage in the new world of manufacturing.

The New World of Manufacturing

In the new global business environment, manufacturers are facing some of the toughest operational and strategic challenges in recent memory. Everything from surprise disruptions in global supply chains due to natural disasters, to volatile geopolitical events in key natural resource regions, to rapidly shifting market dynamics are forcing executives to rethink basic strategies and question long-held beliefs.

In significant ways, the new landscape of manufacturing reflects the culmination of trends that started years ago. As manufacturing has steadily globalized, customers – whether end consumers or industrial enterprises – are enjoying a wider range of choices, tipping the balance of power in their favor. That has emboldened customers to demand a lot more: more speed, better quality, faster delivery, and more personalized service.

One consequence of these trends has been higher market velocity, with production and time-to-market cycles continuing to shrink. Another has been greater market volatility, as competitors wielding new technology emerge from unexpected corners of our "flat world." These days, the impetus for product and process innovation can come from anywhere in the manufacturer's ecosystem—from customers to suppliers to partners.

Manufacturers that exploit these trends have put a premium on connectivity, on open, secure communications, and on new collaboration platforms. They are discovering that their industrial environments – a complex that spans factories, offices, warehouses and field operations – need to become better integrated, more responsive, and more intelligent. Another word for this imperative is “convergence” and the strongest manufacturers we studied are pursuing it with impressive vigor.

The key to making convergence happen, these manufacturers have discovered, is the network. It’s no surprise, therefore, that the new world of manufacturing has seen the rapid push of new networking technology into plants, assembly lines, and logistical networks. The move is empowering manufacturers with the means to confront the toughest challenges of the new global economy, from rising raw material costs and shrinking operational budgets to new pressures around environmental sustainability, climate change, and energy efficiency.

Industrial Intelligence: How Manufacturers Seize A Sustainable Business Advantage

All of these forces are likely to intensify in the years ahead. But while the challenges are formidable, companies that learn to successfully navigate the new environment can reap outsized rewards. This conclusion was borne out in our review of top global manufacturing firms across key segments. The review looked at discrete manufacturers, including the aerospace leader Boeing, and process manufacturers, including the mining company Anglo Platinum.

These enterprises proved they can excel in some of the most highly competitive and volatile markets in the world. They are succeeding – and growing profitably – through a combination of factors, including a predisposition to innovate and a commitment to product and service quality. There is another ingredient, too, and that is the decision to employ key technologies that empower manufacturers with better integration, communications, and collaboration capabilities. We call these capabilities “industrial intelligence.”

Industrial Intelligence

Simply put, industrial intelligence is the enablement of enterprises to more intelligently and responsively manage industrial operations globally. Traditional industrial automation tools, including shop-floor systems running programmable logic controllers (PLCs) and supervisory control and data acquisition (SCADA) systems, are only part of what constitutes industrial intelligence. Today, industrial intelligence extends beyond plant floor systems, connecting production environments to the rest of the business, and to suppliers and trusted partners in the broader industrial ecosystem.

In many deployments, industrial intelligence solutions use IP-networking to converge industrial with enterprise networks and allow system-wide communication and collaboration. According to Cisco, a leading supplier of industrial intelligence solutions, what these systems offer is a more intelligent platform for innovations that enables:

- Interconnectivity of all machines, actuators, drives, sensors, and controllers so that resources can be better measured, monitored and managed
- Operational processes that are intelligent, resilient, energy-aware, available, secure and responsive
- Operating assets that are integrated and self-aware of their state
- People in the environment who are knowledgeable, well-trained, empowered, connected, safer and able to improve operational performance
- And finally, systems and people that are continuously innovating, planning, designing, building, and managing the processes and outputs

At the heart of industrial intelligence solutions are ubiquitous, secure, resilient, standard IP networks – both wired and wireless. These IP networks work hand-in-hand with new cloud-based collaboration services that converge voice, video, and data streams on a common platform, giving workers tremendous new collaboration and decision-making powers, whether they're in the office or on the road.

Increasingly, industrial intelligence solutions will necessitate more virtualized and cloud-based applications and services through the richer, real-time data they deliver, as well as the capability to react to optimizing analyses performed in high-density compute/storage facilities. Indeed, experts say that the switch to cloud computing – where essential applications and services are delivered over the Web on demand – is a trend that will continue to gather momentum in the years ahead. Gartner, for instance, says that in as little as four years, 43% of companies will have most of their IT efforts running in the cloud.¹ Already, larger manufacturers are finding that they can control costs and complexity by building private clouds in virtualized data centers that deliver manufacturing applications and services to users at a fraction of the cost.

Manufacturing Priorities

When enabled by industrial intelligence and cloud-delivered solutions, engineers can troubleshoot problems in factories a continent away in real time. Managers can monitor industrial processes spanning dozens of plants and make instant adjustments to optimize product flows and boost asset utilization. More intelligent IP networks result in supply chains that are leaner and more flexible because companies and suppliers can synchronize production and logistics over a secure, shared network. What's more, the new networks are self-monitoring and self-correcting, which translates into higher availability and lower support costs.

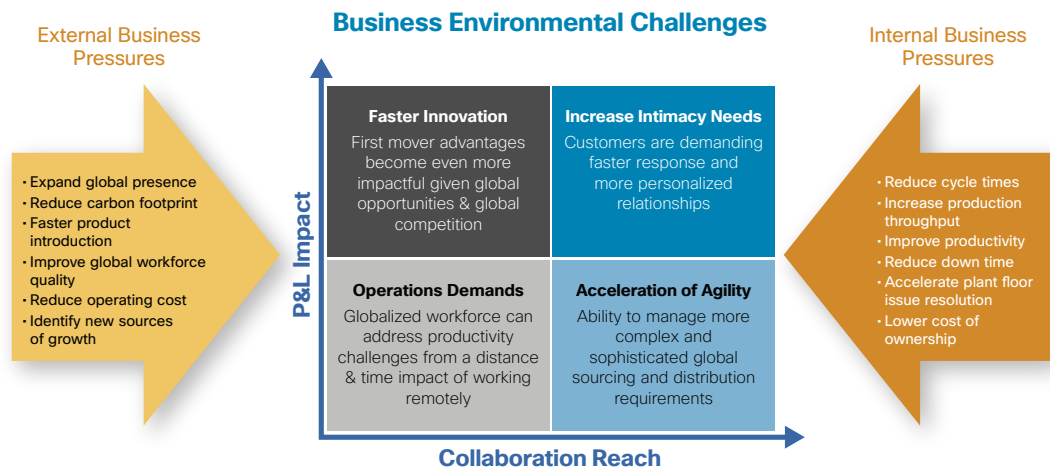
In our review, we found manufacturers focusing on a set of key priorities that drive competitive advantage in the evolving global industrial marketplace:

- **Operations Excellence:** Secure real-time access through converged IT, control and wireless networks, to enhance plant efficiency, throughput, safety, physical security and return on assets
- **Customer Intimacy:** Create a differentiated customer experience to grow revenue and gain competitive advantage
- **Continuous Innovation:** Reduce time to market, increase product pipeline success rate, and improve new product vitality while reducing R&D costs with enhanced collaboration between customers, engineering, manufacturing, sales and channels
- **Supply Chain Agility:** Provide one source of truth across the manufacturing enterprise with secure, real-time, multi-tier visibility that enables root-cause responsiveness and risk management

“Manufacturers must integrate product innovation with operations excellence to deliver complete customer value. An improper balance often leads to new products that are unprofitable to deliver or high-margin products that lack differentiation or strategic market impact.”

–AMR Research

1. From “Reimagining IT: The 2011 CIO Agenda,” by Gartner Inc., Jan. 2011.

Figure 1: Formula for Manufacturing Success: Optimizing Four Key Priorities

Measurable Results

Our research showed that manufacturers that embraced and deployed industrial intelligence (and the IT solutions behind it) created more value for the enterprise and the customers they serve. These manufacturers achieved tangible improvements across a range of operational, financial and strategic areas, seizing a clear and sustainable business advantage as a result. Among the business improvements realized:

- **Reduced time to market:** A major pharmaceutical company now launches products 4-6 weeks faster due to more effective collaboration among productive development teams.
- **Optimized R&D:** This same company reported that higher R&D productivity is saving \$2-3M per project.
- **Improved labor productivity:** A global automaker deployed a unified communications solution that boosted labor productivity by 18% and eliminated tens of thousands of unproductive hours per year.
- **Reduced travel costs:** A global electronics manufacturer saved \$1M per month by deploying a digital-media collaboration platform that helped minimize business travel.
- **Increased system availability:** Another global automaker deployed standardized network architecture across dozens of factories, speeding support response time and reducing downtime by 95%.
- **Higher production efficiency:** A leading tire maker deployed a wireless network with real-time location and automated WIP tracking capabilities to cut component tire losses by 20%.
- **Accelerated business processes:** A major industrial products company streamlined idea evaluation cycles with collaboration platform and can now run its “lean workout” process in half the time.

“Standardizing processes allows you to pool capacities across your manufacturing plants. This can give you flexibility and better responsiveness to changing marketplace demands.”

—Roy Wildeman, lead manufacturing analyst, Forrester Research

Industrial Automation Lexicon

Distributed Control Systems (DCS)—are common in power grids, traffic signals, water systems and process manufacturing. Uses controllers located throughout the system which are interconnected rather than one, central controller.

Process Control—is the use of measurements and feedback to control the output of a specific process.

Programmable Logic Controller (PLC)—reads inputs from the process, applies a set of logic statements based on this input and generates analog or digital outputs to control machines on the assembly or process line.

Supervisory Control and Data Acquisition (SCADA)—an industrial software and network-based visualization system using a central computer to monitor and coordinate a process such as those in factories, infrastructures or buildings.

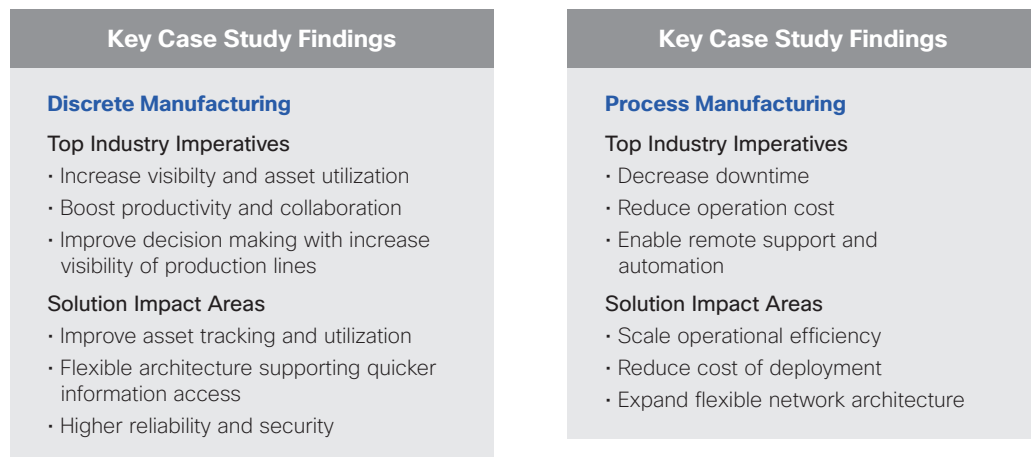
Human-Machine Interface (HMI)—presents data gathered from devices across the network to an operator at either a local, remote or centralized display location.

Remote Terminal Units (RTUs)—attach to sensors that convert their information into digital format readable by the supervisory system.

Industrial Intelligence In Action

How are manufacturing enterprises exploiting the power of Industrial Intelligence? To find out, we analyzed a cross section of global manufacturers. These organizations represent some of the largest industrial enterprises on the planet as well as some of the fastest growing and most innovative. The business imperatives of each type of manufacturer are not identical, but each is using industrial intelligence to achieve maximum impact in their segment, as shown in the following figures.

Figure 2: Manufacturers' top business imperatives



Discrete Manufacturers

In the most basic sense, discrete manufacturers transform raw materials into units that are easily identifiable and can be tracked with a serial number. Companies in this segment include businesses ranging from automotive, aerospace, and consumer packaged goods to industrial equipment, medical devices and high-technology. Two examples highlight how this segment is adopting industrial intelligence to become leaner and more competitive.

▪ Boeing Rolls out WLAN to Keep Track of Parts

At Boeing's Everett, Wash., jet-building facility – the world's largest – workers were struggling to rapidly locate crucial parts and tools needed during the assembly process, a situation that often led to redundant purchases and lost productivity. So a few years ago, as it ramped up production lines for its 787 Dreamliner, Boeing began installing a wireless location tracking system that puts RFID tags on thousands of parts, from whole fuselages to assembly-line tools, uniquely identifying each.² An industrial-strength WLAN uses triangulation techniques to pinpoint the location of each item in real time.

The new RFID system has virtually eliminated lost parts on the factory floor, helping Boeing reduce production delays as well as potential late-delivery fines from government customers. "It streamlines our production environment and makes it more efficient timewise and dollar-wise by not having to replicate tooling and pieces of gear," says Jim Farricker, chief network engineer and technical fellow at Boeing.

2. The Boeing solution included Cisco Secure Wireless Plant and Cisco RFID Asset Control

- **Continental Tires Cuts Component Tire Losses by 20% with Wireless Asset Tracking Solution**

This U.S. subsidiary of Continental AG produces more than 1,000 tire SKUs at its 60-acre facility in Mount Vernon, IL, supplying both the consumer market and top automakers around world. As demand soared in the last few years, however, Continental faced chronic production bottlenecks and delays. It traced many of these inefficiencies to a complex inventory management environment that required thousands of tire-assembly and material carriers to find and delivery parts just in time.

The solution for Continental: deploy a standards-based Cisco Unified Wireless Network covering the entire manufacturing floor, enabling forklift operators to quickly find and deliver components to the right assembly station based on specific customer orders and manufacturing schedules. Mobile computers and Wi-Fi tags installed on each forklift connect to the network and help operators find and coordinate the movement of parts and materials. The deployment quickly yielded results, enabling the factory to reduce costs significantly by cutting work-in-process scraps by 20%.

Process Manufacturers

Unlike discrete manufacturing, the products of process manufacturers are undifferentiated (think of products like oil, natural gas and salt). Process manufacturers include companies in the oil and gas, chemicals, food and beverage, mining and metals, and utilities industries.

- **Large Metals Manufacturer Streamlines with Flexible Single-Network Design**

This company is a joint venture that built and operates the largest aluminum smelting plant in the Middle East. With global competition intensifying, the company wanted to maximize plant efficiency, particularly with regard to energy consumption, which accounts for 70 percent of operating costs. The plant's production environment is incredibly dynamic, requiring sophisticated control systems to orchestrate multiple batch, semi-batch, and continuous processes. Integration of the firm's smelting-process data with its manufacturing execution system (MES) and corporate ERP network would provide the total control the company needed to achieve maximum efficiency.

The answer for this manufacturer was to team with Cisco and Rockwell Automation—among other partners—to deploy an Ethernet-to-the-Factory infrastructure that exploited the network edge, or DMZs, to protect control systems, boost uptime, and reduce capital and operating costs.³ The unified architecture also allowed business and manufacturing teams to work together to optimize production. “We have created a network for now and the future,” said Sylvain Boily, an automation manager with BBA, a consultant on the project. “It has everything we need to move information to where we want it. There is no limitation on what we can do. Redundancy, security, traffic control; everything is there.”

- **Anglo Platinum Gains End-to-End Production Visibility, Cuts TCO to Half Industry Average**

South Africa-based Anglo Platinum is the world's largest primary producer of platinum, with a 38% share of global output. The company's end-to-end production process moves materials from underground and open-cast mines to concentrators, smelters and refineries. Because these facilities (and their industrial control systems) were spread over remote regions and lacked standard network protocols, the sites were isolated – both from each other and from Anglo's corporate business network. As a result, the company had difficulty optimizing the overall production process and maintaining high asset utilization and output. And without centralized network management capabilities, Anglo faced chronic downtime, security, and maintenance cost issues.

3. The solution included: Cisco Ethernet-to-the-Factory, Cisco Catalyst 3750 and 6500 Series switches, Cisco Advanced Services, Cisco Unified Communications, Rockwell Automation controllers

Anglo overcame these challenges when it teamed with Cisco and began rolling out a standard multi-layered network architecture linking each facility and process-control system to the corporate network.⁴ Ethernet-to-the-Factory technology was crucial to integrating Anglo's plant and business systems. Managers now have a secure, dashboard view of production at any location, accelerating decision-making and cutting overall system maintenance costs. "Anglo Platinum's cost of ownership fell to one-half the industry average after the Cisco EttF deployment," said Theo van Staden, the company's head of infrastructure. "Now we can ensure the availability of systems and support from a central location and have comprehensive visibility and reporting."

Conclusion: Winning With Industrial Intelligence

Fast-evolving global markets, unpredictable supply chain disruptions, and tough new budget realities are forcing manufacturers to become leaner, more agile and better able to rapidly re-allocate resources on an international scale. It is a severely challenging environment that demands new strategies and tools to stay competitive and deliver value to customers and citizens.

Our study of leading manufacturers found that Cisco Industrial Intelligence solutions provide an effective response to the demands of this operating environment. By standardizing on Cisco's IP-based network architectures and solutions, companies have successfully converged operational and management networks, creating opportunities for improving efficiency, reliability, security and safety.

Moreover, companies adopting Cisco Industrial Intelligence solutions proved that the technology can power new platforms for collaboration, which in turn fuels innovation and accelerates time to market. These organizations have gained a clear, sustainable business advantage and are setting the standard for what it takes to win in a globalized, just-in-time world.

Appendix

Research Method

This white paper was based on interviews with business leads within the Cisco Enterprise Collaboration group, and a review of project deployment findings, case study reports, and other external industry literature. To more clearly understand the business benefits of Industrial Intelligence, Mainstay Partners studies more than 30 private- and public-sector organizations spanning a cross-section of the manufacturing industry and geographic regions.

- **Manufacturing Industries studied:** Discrete and Process Manufacturing
- **Regions:** North America, Europe, Asia Pacific
- **Company size:** Ranged from global multinational companies to state and regional organizations

About The Authors

Research and analysis for the study was conducted by Mainstay Partners LLC, the leading management consulting firm focused on quantifying and communicating the business value of technology. For more than a decade, Mainstay Partners has performed studies for leading information technology providers including Cisco, Oracle, SAP, Microsoft, Dell, Lexmark, HP, Siemens, EMC, and NetApp. Information contained in the publication has been obtained from sources considered reliable, but is not warranted by Mainstay Partners LLC.

4. Anglo Platinum's architecture included Cisco Wide-Area Application System (WAAS), Cisco Borderless Network Architecture, and Cisco Ethernet-to-the-Factory (EttF) solutions

Appendix: Additional Industrial Intelligence Case Studies

Discrete Manufacturers:

Samsung Standardizes on Ethernet-to-the-Factory to Speed Production

With multiple networks and topologies across its manufacturing environment, Samsung frequently ran into difficulties when it tried to troubleshoot issues and respond rapidly to customer requests. In fact, due to interoperability problems with industrial switching gear, it was nearly impossible to quickly change the manufacturing process to meet changing customer demands, including new product models. Samsung determined it needed to move from an unmanaged to managed network to gain production flexibility and reduce costs.

Solution: Introducing a Cisco EttF solution has enhanced manufacturing and IT processes at Samsung, allowing easy plant expansion through a standard Ethernet network. The move reduced costs by simplifying plant architecture (from vertical to horizontal) while supporting a new flexible manufacturing platform.

Products: Cisco Ethernet to the Factory and Rockwell Automation's STRATIX 8000 series products.

Toyota Slashes Unproductive Time with Unified Communications

Knowledge workers at the Toyota's technical administration division were performing about 200,000 hours of non-value-added work per year. To boost productivity, the division attempted to apply a range efficiency improvement measures, but with little success..

Solution: A Cisco unified communications tools helped the division streamline collaboration across teams and boosted productivity by 18 percent. As a result, the division successfully eliminated 61,000 unproductive hours. Today, Toyota is extending the solution to its R&D operations.

"I was searching for a way to stop our business from becoming bloated. I had tried a variety of measures to try to reduce operational waste, but I wasn't really pleased with the results. Then we learned about Cisco IBSG's advanced way of thinking and the practical solutions they champion. Their approach to decreasing operational waste was clearly understood by everyone."

—Kazuo Okamoto, Vice Chairman, Board Member, Toyota Motor Corporation

Owens Corning Protects Margins in Uncertain Economy with Industrial Intelligence Solutions

Owens Corning Corporation, the world's largest manufacturer of fiberglass and related products, had been struggling with a sharp downturn in one of the company's core markets (residential housing). Moreover, economy uncertainty meant that customers were more demanding, which forced the company to increase efforts to protect margins by improving manufacturing accuracy and plant efficiencies.

Solution: Owens Corning tackled the challenge by redesigning the wireless communications infrastructure at its plants and implementing an advanced collaboration network featuring high-definition video conferencing units and unified communications tools. The move led to a significant reduction in manufacturing error rates.

Products: Cisco UC, Cisco Wireless LAN, Cisco TelePresence, Cisco Digital Media Suite, Tandberg video units

Process Manufacturers:

Fosters Group Streamlines Communications across 160 Sites

This global beverage company with brewery and bottling operations on several continents was burdened by complex, fragmented legacy systems and inefficient, high-cost supply chains.

Solution: Fosters chose to implement a new network infrastructure across more than 160 sites with aim of consolidating and better coordinating multiple business processes. It also plans to roll out a Cisco Unified Communications platform across multiple contact centers, offices and production locations around the world. The new platform is expected to reduce costs, improve productivity, increase efficiency and simplify operations.

Products: Cisco ASA VPN, WAAS, Cisco Core and Edge across Data Centers, LAN and WAN, and Unified Communications

“We selected Cisco because they demonstrated to us that they could satisfy our communications needs cost effectively. Cisco’s solution is helping us improve communications, reduce spending, and quickly transition to an IP-based Unified Communications platform.”

–Andrew Leyden, chief information officer, Fosters Group Limited.

Coca Cola Boosts Factory Uptime with Standardized IP Platform

This global beverage leader was seeking to reduce factory downtime and accelerate the roll out of new bottling plants. Production downtime and new-plant delays were common because it lacked a standard factory-system design worldwide and because too much information was “locked up” in individual facilities.

Solution: The bottler introduced a new standardized design for its automation systems using an IP-enabled communications blueprint that fully integrated its IT and manufacturing architectures. The result: Coca Cola can expand and scale operations more efficiently and manage key operations from remote locations.

“Coca Cola was an ‘ABC’ shop (Anything but Cisco). Then Rockwell introduced us and Coke quickly embraced the Cisco-Rockwell manufacturing and enterprise solutions.”

–Mickie Beville, GAM, Coca Cola



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Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters

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The Netherlands

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