WHITEPAPER

AEGIS SOFTWARE

# From Disruptive **to Productive**

## How Innovative Technology Trends are Powerfully Enhancing Workforce Productivity

As consumer demands increase and evolve, manufacturers must find new ways to increase their output accordingly. The rate of global manufacturing growth has slowed, according to the International Yearbook of Industrial Statistics 2019 published by the United Nations Industrial Development Organization (UNIDO). The slowdown in production in 2018 was observed in industrialized economies as well as developing and emerging industrial economies. The manufacturing value added (MVA) growth rate for industrialized countries rose by only 2.3 per cent in 2018, compared to 2.6 per cent in 2017. For the group of developing and emerging industrial economies, the MVA growth rate in 2018 was 3.8 per cent, down from 4.1 per cent in 2017.[1] **How can manufacturers efficiently and cost effectively drive productivity growth?**

Digital technology is proving to be the answer. While tech turnover is high, with refresh cycles currently occurring every four to five years, manufacturers have an opportunity to strategically adopt the right technology to drive lasting productivity gains for months and years to come.

**In this whitepaper, we'll explore key Frost & Sullivan insights into today's top trending technologies and the key manufacturing pain points they help alleviate. Finally, we'll identify and discuss the best digital technology investment manufacturers can make to encourage higher output and a more empowered workforce.**

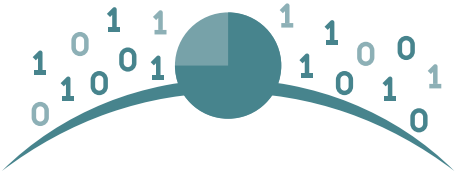
## Table of Contents

## Today's Technology Mega-Trends

**From cognitive machines to green technology, a wide range of transformative technology trends stand to define the future and make a wide-reaching impact on businesses, societies, economies, cultures, and personal lives. Frost & Sullivan identifies a few of these key trends that are particularly relevant to the development of the manufacturing industry—and the productivity of its workforce.**

### Embedded Intelligence at the Edge

75% of the data generated within the manufacturing industry is already being produced at the edge.[2] This means that a factory's distributed network of machines are generating data at the device level, presenting unprecedented opportunities for embedded intelligence, M2M connectivity, and an actionable flow of real-time data to optimize operations. These opportunities, however, have yet to be tapped by many manufacturers. In fact, today, just 6% of edge data is actually acted upon by the manufacturing community.[2]



**75% of the data generated** within the manufacturing industry is already being produced at the edge.[2]

### Computing Tools for Error Cognition

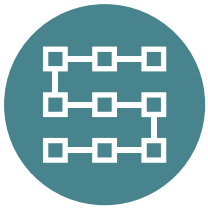
The massive amounts of data generated by edge intelligence require powerful computing tools in order to drive results factory-wide. Now, Artificial Intelligence (AI) and Machine Learning (ML) models are enabling data to make a real impact. With the added intelligence of AI and ML, manufacturers can begin to automate error cognition in the factory by analyzing edge data in a way that manpower alone never could—resulting in the proactive identification of patterns and potential problems that could negatively impact production.

## New User-Oriented Business Models

Finally, Frost & Sullivan foresees that future technology business models will not be focused on devices and products themselves, but on the value derived from these products and the business outcomes they enable. As a result, manufacturers will be less concerned with the "latest and greatest," and more concerned with which technology helps their workforce effectively drive production and strategically reduce the cost of quality.

# Major Market Shifts

**In addition to these manufacturing technology trends, key market shifts are taking place, as well, and are necessary to consider when evaluating productivity-related technology solutions. Over the next decade, Frost & Sullivan expects to see shifts in both industrial and business processes.**

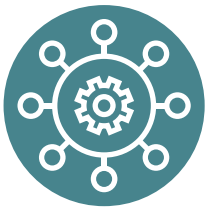


## Linear Manufacturing to Digital & Symbiotic Processes

On the industrial side of things, manufacturers are largely embracing digital. Now, linear manufacturing processes—the rigid format of selling, manufacturing, producing, and then testing products—are being transformed by real customer use lifecycles, which demand a flexible digital thread of product genealogy, traceability, and quality assurance.

This non-linear digital framework also serves to break down manufacturing data silos, allowing customer use data to be incorporated back into the next generation of manufacturing products to drive satisfaction and efficiency forward.

Over the next decade, Frost & Sullivan expects to see **shifts in both industrial and business processes.**



## Hardware Products to Productized Digital Solutions

On the business and process side of the equation, customers are moving away from buying products and hardware, and instead seeking out productized digital solutions, or "Products-as-a-Service."

Instead of buying a machine, users would rather simply subscribe to that machine in order to gain its value—all while keeping the capital cost of the machine off the balance sheet. This means customers are also shifting from CAPEX to long-term service contracts; not just 1 to 5 years, but 7 to 15 year contracts. These are holistic lifecycle services, not just product-associated services. Customers are looking at their entire system instead of a single product and focusing on production efficiency at scale.

## Manufacturing Technology Enablers

Finally, in addition to these mega-trends and market shifts, manufacturers should be considering the foundational technology enablers that make such innovations possible. Such enablers include:

**UBIQUITOUS SENSING**

**PREDICTIVE ANALYTICS**

**ADDITIVE MANUFACTURING**

**CLOUD COMPUTING**

**AI/ML, BLOCKCHAIN**

**DRONES**

**EDGE DEVICES**

**5G**

**ROBOTICS**

**IN-MEMORY COMPUTING/ DIGITAL TWINS**

**AUTOMATION**

**WEARABLE COMPUTING**

**As all of these trends, shifts, and enablers converge, new growth platforms will emerge—to enable more automated, predictive manufacturing that overcomes the key pain points today's factories face.**

# Manufacturing Productivity Pain Points

**It is evident that today's high-level technology trends are critical to the future of manufacturing productivity. However, there are a number of immediate productivity pain points that manufacturers seek to solve. These pain points require the assistance of achievable technology innovation.**

## Information Challenges

Without up-to-date instructions and operational input, employees cannot perform even basic tasks. **How can manufacturers ensure that workers have access to the information they need in a real-time, trustworthy format?**

## Equipment Maintenance & Upkeep

When equipment goes down, so does productivity—and it can take hours to restore operations to their previous pace. **How can manufacturers proactively avoid unplanned downtime due to machine failure?**

## Communication Challenges

The workforce relies on a consistent flow of communication to coordinate their operational tasks and ensure efficiency. **How can manufacturers keep teams of employees and machines connected across widespread industrial environments?**

## Ill-Fit Equipment

Complex manufacturing equipment requires expertise in order to operate appropriately. **How can manufacturers optimize equipment to reduce the complexity of employee changeover and ensure the proper usage of machinery?**

## Safety Hazards

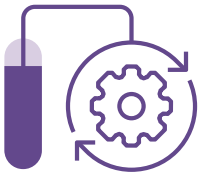
A push for increased productivity must always be balanced with the ongoing safety of employees throughout the factory. **How can manufacturers ensure the safety of their workforce and proactively protect worker well-being?**

# Disruptive Manufacturing Trends

As manufacturers struggle to deal with everyday productivity challenges, they are also faced with a number of disruptive trends that pose potential issues for the future of manufacturing operations. From the changing workforce demographic, to the push for mobility, to a significant rise in new exports, manufacturers must plan to address disruption on a number of fronts.

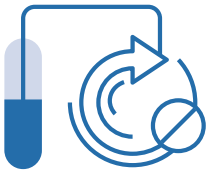
**75%**

of the global workforce will **be millennials by 2025.**[2]



**77%**

of CEOs surveyed said that **'operational efficiencies' was their top initiative to drive revenue growth** in the next 12 months with 'organic growth' coming in second at 71%.[3]

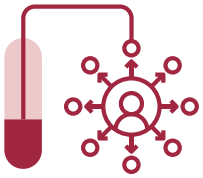


**55%**

of CEOs stated that the availability of key skills is **impeding their growth due to 'inability to innovate effectively'.**[3]

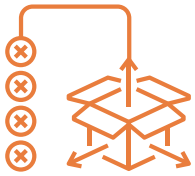
**46%**

of global CEOs responded that **'significant training/upskilling'** was most important to closing potential skills gaps in their organization.[3]



**39%**

of respondents stated that in 5 years they anticipated their factories having a **completely collaborative structure,** involving employees, customers and suppliers.[2]



**x4**

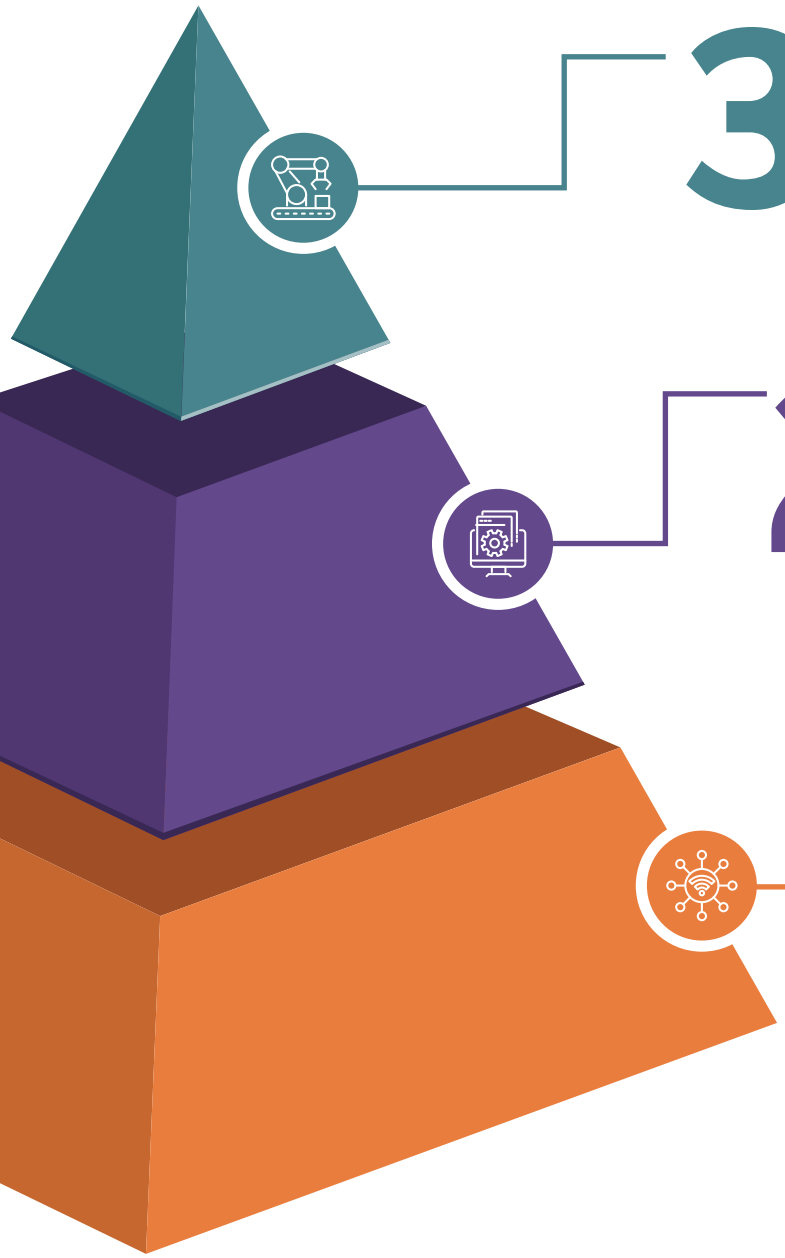
is the expected increase in **exports from emerging and developing countries** in the near future.[2]

**Finally, the fragmentation of the manufacturing value chain has a part to play as well**. In response to rising costs, the need to collaborate, and a call for greater consumer insights, manufacturers are moving from a linear to a more symbiotic, circular mode of manufacturing. This helps factories overcome traditional challenges with throughput variability, collaborative innovation, data silos, and a lack of customer communication. Ultimately, it introduces a new level of flexibility and customization that—like almost all of the key trends discussed thus far—relies on a constant flow of real-time data.

## Digital Disruption Transforming Workflows

**Now, the implementation of digital solutions across manufacturing environments stands to unlock the key technology trends discussed in order to alleviate the productivity pain points manufacturers are currently experiencing.**

**This transformative digital implementation begins with a foundational layer of connectivity that enables the Industrial Internet of Things (IIoT) and Industry 4.0 capabilities.** This layer serves as the foundation upon which innovative platforms and applications for manufacturing productivity rest.



### 3 Manufacturing Applications

Finally, a layer of manufacturing applications for quality, production management, operational effectiveness, and more are made available across the factory. This enables capabilities like autonomous intelligence, which, in turn, boost productivity.

### 2 Platform / Operating Systems

Upon this layer of IIoT/Industry 4.0 connectivity, manufacturers can build out a variety of digital platforms, operating systems, and AI models that collaboratively improve production and enable intelligent error cognition.

### 1 IIoT / Industry 4.0 Connectivity

This connected foundation is powered by a range of hardware devices such as sensors that enable true cyber-physical connection, factory-wide.

**This strategic, layered approach to digital innovation helps manufacturers overcome their critical productivity issues factory-wide, driving smarter, faster, simpler, and more responsive operations across their product flows, production flows, and data flows.**

## Data Flow

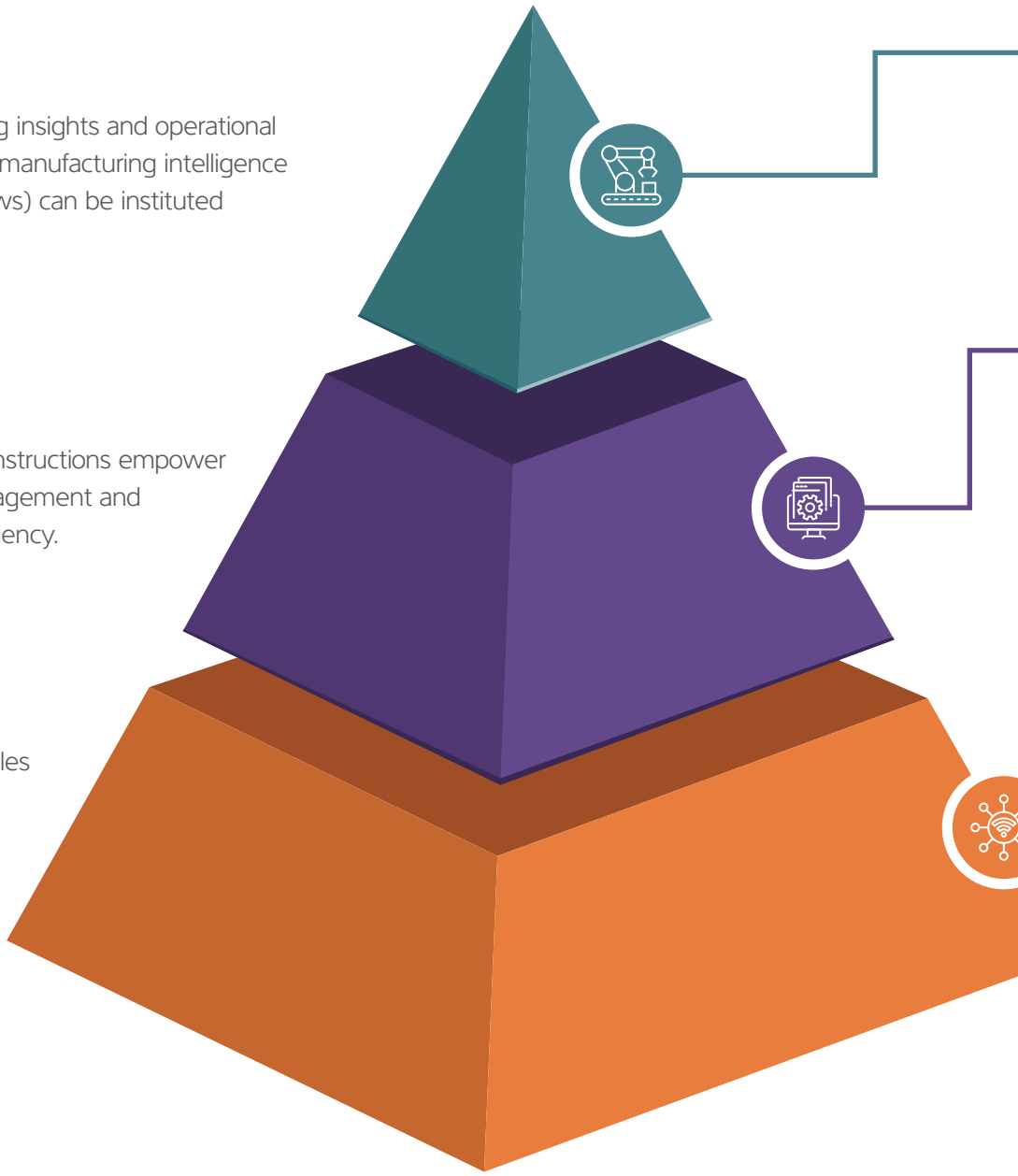
Employees have access to the training insights and operational data they need to be successful, and manufacturing intelligence (such as analytics, alerts, and workflows) can be instituted factory-wide.

## Production Flow

Interactive and dynamic visual work instructions empower employees, while lean materials management and adaptive planning ensure flexible efficiency.

## Product Flow

The IIoT/Industry 4.0 foundation enables real-time traceability to ensure the quality of materials and products.



# MES for Factory-Wide Success

**We've established that productivity pain points and digital disruption in manufacturing calls for digitized, cyber-physical systems for automated data collection and autonomous, intelligent decision-making. This data-driven approach means that factories are actually becoming more like mega data centers than ever before. A Manufacturing Execution System (MES) plays a critical role as the digital hub of information and Industry 4.0 connectivity for this influx of industrial data.**

## What is an MES?

An industrial MES solution enables intelligence gathering, both horizontally and vertically, from machines, devices, systems such as ERP, and people. It facilitates transactions, processes, and logistics seamlessly, collecting and analyzing data that can be leveraged by the entire enterprise. Its critical strength, however, is contextualizing big data, regardless of the data source.

**The right MES will enable the foundational, connective layer of IIoT/Industry 4.0 technology manufacturers need to truly begin optimizing and improving productivity.** MES packs in all of the power that manufacturers require to improve production, making it the foundational technology solution for long-term productivity gains.

## The Proof is in the Productivity

One manufacturer's MES-enabled Augmented Reality Training Platform resulted in an average of **15% time savings for each step taken** to complete a specific task.

## Proven Productivity Benefits of MES

**As a hub of factory data and industrial connectivity, MES brings to life the innovations that have been established as necessary for substantial manufacturing productivity improvements. MES drives proven productivity benefits for manufacturers as it:**

### Forms the Foundation of IIoT

When it comes to realizing the benefits of Industry 4.0 and IIoT, many manufacturers struggle with integration, security, and data insights—which is why the right MES architecture and standards play a crucial role in eliminating barriers between disconnected systems and devices while also removing reliance on custom integration.

Today, manufacturers can reap the benefits of MES solutions that integrate with open, accessible IIoT factory standards. Such standards normalize the data output of machines, systems, and human sources, enabling true connectivity and collaboration in the same language. They also serve to eliminate reliance on middleware, enabling manufacturers to realize the benefits of IIoT and Industry 4.0 without exorbitant costs or timelines. The result is a truly connected factory ecosystem that enables a new wave of opportunities in automation, optimization, smart manufacturing, and highly-adaptable, "on-demand" service models. In fact, by bridging the digital and the physical with an optimized MES solution, manufacturers enable possibilities such as remote monitoring, diagnostics, services and control; track and trace; energy management; and more.

## Delivers Interactive & Dynamic Visual Work Instructions

Work instruction delivery is another key productivity benefit of MES solutions. As the skilled workforce continues to shrink, the need to recruit, hire, train, and retain employees grows. This can be accomplished with rich, visually appealing guided instructions that optimize training and boost job satisfaction. While many workers still conduct manual processes on the shop floor—referring to written instructions and reference drawings delivered on paper or a computer monitor—this manual method induces a substantial cognitive load and a time drain on manufacturing processes.

When it comes to visual work instructions, the path to empowering employees should begin with a single scan. This simple task can unleash all of the information shop floor operators could possibly need in order to do their job effectively and efficiently—all via a well-configured user interface optimized for ease of use. The solution can pull the right revision of the document set based on an operator's location in the route, check the operator's certifications, and ensure they have the right tooling, chemicals, and parts to complete the job efficiently. Meanwhile, trace, control, visibility, and enforcement of the route is simply a natural byproduct of running the system.

## Enables Augmented Reality

When computer space isn't available for every operator on the factory floor, MES solutions that enable augmented reality (AR) present an opportunity to empower employees in a hands-free environment. As an extension of visual work instructions, AR data can be delivered to employees via wearables, like glasses, and offer an on-screen view of step-by-step task instructions and diagrams in the employee's direct line of sight.

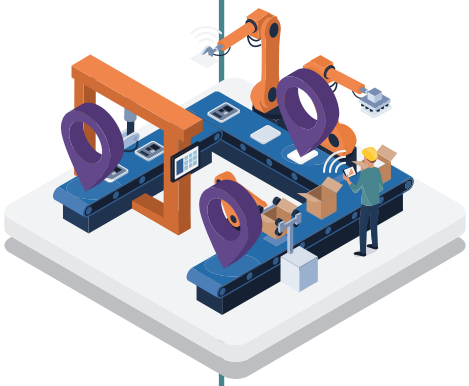
In addition to leveraging visual, voice, and touch commands to walk employees through instructions, MES-powered AR solutions can also utilize eyeglass cameras to scan barcodes at-a-glance. And, as an extension of an MES platform, the AR system can also actively develop a trace history record of manufacturing actions, ensuring that the right parts and actions are performed and delivered so that workers have what they need to complete jobs right the first time.

## Provides Lean Materials Management & Adaptive Planning

For any manufacturing operation to reach its full potential, efficient and effective production planning must be at its core. Adaptive planning reduces work-in-process inventory through timely order release, shorter lead times, and increased throughput. It goes hand-in-hand with lean materials management.

What is lean materials management? It offers a solution to the struggle many manufacturers face: the need to balance Operations, which aims to avoid downtime by having more materials on hand than are needed, with Finance & Purchasing, which wants to keep inventory costs low. A lean, 'pull-based' approach transforms shop floor materials dispatch, using MES to remain 100% aware of all materials, real-time consumption data, warehouse hours, predicted job completion times, and more. By leveraging a solution that takes this critical data into consideration, manufacturers can enable lean materials management to pull exactly what's need at exactly the right time, avoiding both material shortage and excess.

## Establishes Quality & Traceability



A robust MES solution—built with the need for granular data tracking—ensures that traceability becomes a natural byproduct of operations and can drive quality assurance and operational excellence when properly leveraged. This MES data can also flow back to R&D to improve future designs and drive real-time improvements by giving process engineers, operators, and managers a view into the reality of the manufacturing process.

Ensuring quality requires that manufacturers gain the ability to trace parts and products throughout the factory, from the loading dock, to the assembly line, to packaging. It means firewalling the factory from non-conforming raw materials, detecting and identifying production problems, repairing issues, recovering from defects found in testing, and much more. Administrative Quality Management helps document all of these processes for easy access on the part of auditors and customers. This not only makes the manufacturing enterprise better over time by supporting continuous improvement initiatives, but it also brings digital automation to labor-intensive and detailed processes involved in material review boards, corrective action, preventive action (CAPA, FRACAS), and more.

# Powers Manufacturing Intelligence—Analytics, Alerts & Workflows

Access to multi-directional data synthesized from ever-changing sources enables analytics to be communicated in real-time, driving process, quality, compliance, and innovation enterprise-wide—all while radically simplifying decision-making processes on a daily basis. But simply having "more" data isn't necessarily the answer. In fact, the sheer volume of data available today is burying the manufacturing workforce in a glut of information that they cannot leverage intelligently.

By contrast, the right MES solution enables anyone in the factory to get the information they need from the system that provides it, and quickly turn it into action-ready insight. Rather than burdening the IT department, this approach empowers engineers, quality teams, and other members of the workforce to instantaneously build, view, and interact directly with data in a relevant manner. Such intelligence is gained via real-time dashboards with drag-and-drop construction that allow access to a stream of standardized data that is accessible anywhere, anytime, in the same meaningful way. By informing operators of impending issues or process performance, sending condition-generated reports to mobile devices, offering detailed work-in-process monitoring, and much more, real-time dashboards, notifications, and alerts ensure that information between all impacted stakeholders is proactively communicated for optimized production.

# **Aegis** Factory**Logix**®

## A Single Investment for Factory-Wide Gains

**When it comes to elevating productivity, manufacturers must be willing to embrace the digital technology trends set to make a lasting impact on their industry—especially those with the proven ability to drive tangible benefits across manufacturing operations. Aegis' MES is a technology solution that is uniquely positioned to form a solid foundation of IIoT and Industry 4.0 capabilities on which platforms and applications for more intelligent production can be built.**


**Aegis'** Factory**Logix**® **MES is a holistic and modular manufacturing platform delivering leading-edge technology with easily configurable modules to support and execute a company's strategy towards Industry 4.0.** It manages the entire manufacturing lifecycle: from product launch, to material logistics, to manufacturing execution and quality management, to advanced analytics and real-time dashboards.

With Factory**Logix**, manufacturers can drive measurable productivity benefits across the enterprise while also promoting areas that help to elevate employee job fulfillment, keeping output—and satisfaction—at an all-time high.

Interested in learning more about how Aegis Factory**Logix** empowers employees and enhances productivity?
**Visit www.aiscorp.com.**

AEGIS SOFTWARE

**Email:** info@aiscorp.com
**Visit:** www.aiscorp.com
@FactoryLogix
linkedin.com/company/aegis-industrial-software

**Corporate Headquarters**
5 Walnut Grove Drive, Suite 320
Horsham, PA 19044
**Phone:** +1.215.773.3571

**European Headquarters**
Wetterkreuz 27
91058 Erlangen, Germany
**Phone:** +49.9131.7778.10

**Asia Headquarters**
Rm. 809, Dahua Hucheng Business Center
No 6, Lane 239, Dahua No. 1 Road
Putuo District, Shanghai, 200442, P.R. China
**Phone:** +86 2 1 5882 4882



**1.** International Yearbook of Industrial Statistics 2019 published by the United Nations Industrial Development Organization | **2.** Frost & Sullivan | **3.** 22nd Annual Global CEO Survey conducted by PwC