



# Accelerating the Manufacturing Evolution to Industry 4.0 and Beyond



**How Agile Integration Equips Manufacturers to Solve Operational Challenges and Capitalize on Emerging Technology**

Manufacturers are moving to embrace Industry 4.0 technologies such as IoT and AI, yet struggle with outdated data and application infrastructure that inhibits agility and innovation. Cloud-native integration can help manufacturers solve problems of the past while transforming for the future, including Industry 5.0-readiness.

# Table of Contents

3	<b>INTRODUCTION</b> Build a Strong Integration and Data Foundation for Your Digital Transformation
4	<b>Weak Links in the Manufacturing Value Chain</b>
5	<b>Manufacturers Are Turning to iPaaS for Fast, Flexible Integration</b>
6	<b>5 KEY TARGET AREAS</b>
6	<b>ONE:</b> Modernize IT and OT for Production, Supply Chain, and Logistics
7	<b>TWO:</b> Enrich Customer Experiences and Relationships
8	<b>THREE:</b> Innovate Products, Services, and Operations With AI, IoT, and Robotics
9	<b>FOUR:</b> Fuel Analytics and Decisions With Timely, Trusted Data
10	<b>FIVE :</b> Build Future-Proof Resilience and Agility
11	<b>Boomi: The iPaaS of Choice for Manufacturing Integration</b>

# Build a Strong Integration and Data Foundation for Your Digital Transformation

A smart home offers a wealth of advantages in simplicity, safety, energy savings, and entertainment. Done right, a smart home connects modern technology so you can easily adjust the temperature, see who's ringing the doorbell, or play a favorite song just by asking Alexa or Siri.

But a smart home doesn't make sense if your house is outdated or problematic. Before embarking on a smart home project, you'd want to repair that crumbling foundation, upgrade from a fuse box to a circuit breaker, and replace those leaky pipes in the cellar.

Fix those basic infrastructure items first, and you've got a solid base to advance to a next-level smart home experience.

The same is true of manufacturing as it moves toward emerging Industry 4.0 technologies and the prospect of smart factories, supply chains, and logistics that use the Internet of Things (IoT), artificial intelligence (AI), big data, robotics, 3-D printing (additive manufacturing), and more.

Industry 4.0 in manufacturing digitizes and automates traditional processes, from shop floor production to warehousing and distribution. A key element is integration between traditional IT and operational technology (OT) such as cyber-physical systems in which algorithms semi-autonomously control equipment.

And futurists are already looking at Industry 5.0, envisioning manufacturers bridging the gap between humans and machines with such innovations as collaborative robotics, voice-enabled digital assistants, wearable sensors, and simulation-based virtual reality training.

Italian university researchers call Industry 5.0 "an '[Age of Augmentation](#)' where the human and machine reconcile and work in perfect symbiosis with one another." But that perfect symbiosis seems like a far-distant future to many: Fewer than 30 percent of manufacturers have extensively adopted Industry 4.0, according to one [industry study](#).

What's missing is a strong data and application integration foundation that can help manufacturers optimize existing processes and progress to Industry 4.0 and beyond.

“ Patchy data and IT infrastructure is often a bottleneck **for scaling successful Industry 4.0 pilot projects**

[McKinsey and Company](#)

**Change enabled by Industry 4.0 can deliver big results:**

- Up to 40% unit-cost reduction for manufacturing overhead
- 65% labor-efficiency increase
- 200% increase in output
- 50% reduction in quality issues

[McKinsey and Company](#)

# Weak Links in the Manufacturing Value Chain

Integration weaknesses remain an obstacle for many manufacturers. Many deal with disconnected business applications, IT systems, and operational technologies that control equipment in development, production, and distribution.

The need for seamless and flexible integration is acute, as manufacturers have built out complex IT/OT environments often comprising hundreds of on-premises and cloud systems. These can range from enterprise resource planning platforms (ERPs) to applications for shop floor production, supplier management, warehousing, logistics, and more.

Integration across those systems is often brittle and limited. Over the years, many manufacturers have used custom coding, FTP and flat file integrations, and on-premises middleware to connect systems and exchange information. Such ad hoc approaches are not sustainable as manufacturers progress to Industry 4.0 and toward their goals of data-driven operations in volatile markets.

Subpar integration blocks the business and IT agility that your company needs. It means manual data work for operational staff that slows processes and costs money. And it burdens the IT team with high technical debt in maintaining and troubleshooting problematic integrations that may be based on outdated custom code.

Outdated integration also leaves manufacturers poorly prepared to innovate. As it is, a survey conducted by research firm Vanson Bourne on behalf of Boomi found that 50 percent of manufacturers say their organization is struggling to modernize, transform, and innovate quickly enough.

What's needed is an agile data and integration foundation that equips manufacturers to realize two key objectives:

- **Connect systems** to orchestrate processes, improve operational efficiency, and reduce costs
- **Use data** to unlock insights through analytics for informed decisions and enriched customer experiences

# 50%

of manufacturing leaders say their organization is struggling to modernize, transform, and innovate quickly enough

[Boomi / Vanson Bourne survey data](#)

# 80%

of manufacturing, supply chain, and service delivery leaders say data integration is critical to operations

[Forbes / Dresner Advisory Associates](#)

# Manufacturers Are Turning to iPaaS for Fast, Flexible Integration

Based in the cloud, integration platform as a service (iPaaS) has grown exponentially in recent years to replace traditional integration at thousands of organizations. That growth will continue at a 60 percent compound annual growth rate (CAGR) through 2023, to \$10.2 billion globally, [IT research firm Ovum forecasts](#). That far outpaces spending on new deployments of conventional on-premises middleware.

iPaaS helps manufacturers transform and innovate to deliver value. It brings people, processes, and technology together to streamline operations, reduce costs, enable smart decisions using data, and increase customer satisfaction. Characteristics of a true iPaaS include:

## CLOUD-NATIVE

A platform architected for the cloud can deliver all the benefits of the cloud, including scalability, high availability and built-in redundancy. "Cloud-washed" solutions can't provide the efficiencies and agility of a true cloud-native integration platform.

## OPEN

To effectively connect the myriad of current and emerging applications, data sources, and devices, iPaaS needs to be agnostic to applications and endpoints. Your iPaaS should not lock you into using applications or cloud platforms from specific vendors.

## LOW CODE

IT teams are pressured to do more faster and support never-ending requests. Speed is critical, and code-heavy approaches don't cut it. Low-code development slashes the time needed to integrate applications and data, delivering results faster.

## UNIFIED

While integration is core to iPaaS, a platform should also deliver holistic capabilities that eliminate the need for multiple solutions. Those include API creation and management, workflow automation, data cataloging and preparation, master data management, and EDI transactions.

## DISTRIBUTED AND MULTI-TENANT

An iPaaS has to integrate everything from on-premises and cloud applications to IoT and edge devices, as well as support exponentially growing data volumes. To do this effectively, an iPaaS needs to have a distributed, multi-tenant architecture.

# 46%

of manufacturers plan to use iPaaS to integrate cloud and on-premises applications by 2022

[Boomi / Vanson Bourne survey data](#)

# 7 OUT OF 10

executives believe long-term success requires integrating Industry 4.0 technologies into operations

[Deloitte Insights: The Fourth Industrial Revolution](#)

# ONE

## Modernize IT and OT for Production, Supply Chain, and Logistics

Manufacturing is modernizing IT with both cloud-based business applications and cloud platforms such as Amazon Web Services, Google Cloud, and Microsoft Azure. [IDG's 2020 Cloud Computing Survey](#) finds that 87 percent of manufacturers use the cloud to some extent.

Cloud systems are delivering greater speed, agility, and cost-efficiency, yet can't exist in a vacuum. They need to interoperate with one another, as well as OT systems, new IoT data sources, and legacy on-premises systems that remain in place. Making the most of IT modernization means that integration needs to be modernized, too.

That's especially true in core areas of production, supply chain management, and logistics. As it is, planning and operations in those and other areas are typically conducted in silos, with limited visibility across departments. Value chain optimization is difficult without end-to-end visibility across a manufacturing enterprise.

Modern cloud-native integration helps manufacturers streamline operations in a hybrid IT environment of disparate systems. That's a vital step in the evolution toward a more agile, productive, customer-centric, and data-driven business.

**Production.** Embracing iPaaS aligns with the waste-reduction principles of lean manufacturing. IT teams can quickly connect systems feeding the production engine, from sensor-based OT machinery on the factory floor to a new cloud app for raw materials procurement.

That's a huge step forward from the months required for integration with custom coding on in-house middleware. Modern integration also unlocks data for analytics on capacity, throughput, profitability, defects, and other key metrics.

**Supply chain and logistics.** Fragmentation remains widespread across the many disparate applications in a supply chain. iPaaS helps manufacturers choreograph processes across the supply chain, including external partner systems for sourcing, contract manufacturing, distribution, and logistics.

Manufacturers can improve inventory management, reduce working capital, speed delivery, and boost service levels with the right approach to integration. An integration platform with built-in electronic data interchange (EDI) gives manufacturers an edge in connecting and transacting with partners.

## 5 KEY TARGET AREAS

“

The objective is business innovation and transformation using technology to connect with our customers, be more efficient, and, create additional improvements throughout the supply chain. **Boomi is a fundamental part of making that shift and achieving our business objectives.**

[Raf Fonteyn, ICT Director, Contraload](#)

”

# 80%

of manufacturing, supply chain, and service delivery leaders say data integration is critical to operations

[Forbes / Dresner Advisory Associates](#)

# 52%

of global manufacturers are taking steps to improve their supply chains

[Ernst & Young](#)

# TWO

## Enrich Customer Experiences and Relationships

For many years, manufacturers could thrive by focusing on product and quality. Now they also need to strengthen relationships and brand loyalty among fickle customers in both consumer (B2C) and business (B2B) markets.

But that's not as easy as flipping a switch. It requires synchronizing processes and people across a broad range of technologies, from ecommerce websites to CRM, marketing automation, inventory, warehousing, and fulfillment.

These systems and others need to work in concert to meet the rising expectations of B2C and B2B buyers accustomed to the ease and convenience of Amazon and other top retailers. Digital-native companies have opened a sizable lead in delivering the interactive omnichannel experiences that today's buyers seek. Traditional manufacturers stand to lose competitive advantage if they can't keep up.

It's a business and IT challenge tailor-made for modern cloud integration. iPaaS equips your manufacturing company to enrich customer experiences, better anticipate and meet customer needs, and optimize inventory allocations and fulfillment.

**D2C ecommerce.** Seamless connections across ecommerce and ERP/inventory platforms let you quickly build or expand your direct-to-consumer (D2C) sales channel. Modern integration helps ensure a quality online shopping experience and eliminate manual data entry for operational personnel while also expanding on marketplaces such as Amazon and eBay.

**Customer insights and marketing.** Integration, backed by master data management, lets manufacturers aggregate customer data from ERP, ecommerce, CRM, and marketing automation into a single source of truth. A 360-degree customer view lets you better understand buyers, engage with targeted marketing, and personalize interactions to their unique needs.

**Inventory and fulfillment.** Manufacturers gain visibility into ideal inventory levels at multiple internal and partner warehouses with real-time integration between inventory and sales systems. That helps ensure accurate stock listings on an ecommerce site, reduce inventory holding costs and working capital, and execute fast, accurate product delivery to ecommerce customers.

## 5 KEY TARGET AREAS

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We use Boomi to fuel our growth. We can expand to a lot of different ecommerce systems, one for B2C, one for B2B... **without having to hire a lot more people.**

[Thomas Boogert, Ecommerce Specialist, Secrid](#)

”

# 209%

increase in direct-to-consumer (D2C) ecommerce between 2017-21

[eMarketer study](#)

# 76%

of manufacturers believe they must shift from product-centric to customer-centric business models to survive

[ORM/Acquia survey](#)

# THREE

## Innovate Products, Services, and Operations With AI, IoT, and Robotics

Industry 4.0 is introducing new intelligence and automation to manufacturing with technologies such as IoT, robotics, and AI, while Industry 5.0 promises to build on that with greater human-robot interactivity. The potential for innovation and transformation is immense in multiple use cases in every sector — consumer and durable goods, healthcare, electronics, automotive, and more.

For example, manufacturers can run smarter, cleaner, and more cost-efficient factories with IoT machines and AI. They can build “smart products” featuring AI and robot-human interaction. They can reduce downtime and cost with predictive maintenance based on sensor data, and are better able to adopt made-to-order production.

Importantly, manufacturers can open new revenue streams with “equipment as a service” (EaaS) — remotely monitoring and maintaining products installed at customer sites.

Manufacturing is aggressively adopting Industry 4.0 technologies such as IoT, with analyst firm IoT Analytics predicting that manufacturer IoT spending will reach **\$12.4 billion globally by 2024** — up 629 percent from 2018.

But IoT and other Industry 4.0 technologies are not plug-and-play solutions. Innovation initiatives will fall short unless your company has a solid foundation that can connect sensor-based devices and business applications, and capitalize on the volumes of real-time data they generate.

Integration is the not-so-secret sauce that lets manufacturing IT and OT pros innovate with emerging technologies and maximize value from Industry 4.0 investments.

**IoT automation and intelligence.** Integration equips your company to synchronize workflows and data exchange among the devices and applications of Industry 4.0, and to use IoT data for continuous optimization through analytics. It’s critical to better controlling raw material and inventory movement and building “smart” products with embedded intelligence for customers.

**Equipment as a service.** Manufacturers are offering outcomes, not assets, with complementary IoT-based EaaS subscription offerings that help ensure equipment is functioning properly and can provide early warning of maintenance needs. An integration platform collects monitoring data, which can also help manufacturers identify and correct any product issues that may affect other customers.

## 5 KEY TARGET AREAS

“ Adopting an IoT solution requires cross-functional coordination between business, operations, and security colleagues to identify critical dynamics such as **scalability, security, and back-end integration with ERP, CRM, or inventory systems.** ”

[Perficient](#)

**40%**

annual growth in industrial IoT platform spending in manufacturing through 2024

[IoT Analytics](#)

**35%**

annual growth in the equipment as a service (EaaS) market through 2025

[IoT Analytics](#)



# FOUR

## Fuel Analytics and Decisions With Timely, Trusted Data

A key principle of lean manufacturing is eliminating waste. Manufacturers seek to optimize the use of every asset, machine, and employee to run as efficiently as possible. Yet one vital asset — data — remains underutilized even as it grows in volume and velocity.

Manufacturers have made significant progress in applying analytics to production and supply chain operations, yet much remains to be done. The need for data insights is driving ongoing manufacturing investments in analytics, expected to grow 381 percent between 2019 and 2026, a [ResearchAndMarkets](#) study finds.

Data analytics can unearth new insights for informed decision-making in every aspect of the manufacturing value chain, from the C-suite to the factory floor. And now, AI is introducing breakthrough analytic depth and scope beyond what is possible with conventional business intelligence (BI) tools and data warehouses/data lakes.

But analytics and AI are only as good as the data they're based on. And that's the problem for many manufacturers. They lack the holistic data infrastructure needed to generate accurate, timely information for data-driven decisions. Common problems include:

- Data is fragmented across application silos
- Data is contradictory across multiple sources
- Data may be outdated by weeks or even months
- Analysts can spend 80 percent of their time rounding up data – with just 20 percent left for analytics

Today's leading unified data platforms offer manufacturers multiple capabilities to help turn raw data into insights. Core integration that's complemented with master data management, data preparation, and data cataloging help your company create a single source of truth with data aggregated from any number of sources.

With a 360-degree view of once-siloed information available to analysts, you make a leap in ability to apply analytics to spot issues and opportunities, react with speed and agility, better service customers, and improve profitability.

## 5 KEY TARGET AREAS

“

We're able to make decisions in real time with real data **by building a world-class data warehouse with Boomi.**

[Bruce Capagli, COO, Precision Medical Products](#)

”

# 54%

of business leaders pursuing Industry 4.0 anticipate big data analytics will profoundly impact their organization

[Deloitte](#)

# FIVE

## Build Future-Proof Resilience and Agility

The COVID-19 pandemic has highlighted the urgency of a resilient digital infrastructure that helps manufacturers quickly adapt to changing conditions. Whether the need is to scale up or scale back, manufacturers that have digitized operations internally and with partners are better able to respond to disruption.

That's true whether the disruption is a once-in-a-lifetime pandemic, or a natural disaster, labor strike, or political volatility that impacts a key supplier or the manufacturer itself. The increasingly tiered nature of the manufacturing supply chain — with tier 1 suppliers themselves relying on other suppliers — leaves manufacturers perpetually exposed to risk.

Agile integration helps address the challenge in several ways. Comprehensive, uniform data lets manufacturers better assess risk, refine business continuity planning, and calculate cost vs. benefits of difficult decisions. Integration also helps manufacturers pivot with agility — for instance, leveraging surplus raw materials in Brazil to meet a demand spike at a Southeast Asia factory.

Remote work is another area that can benefit with a proven iPaaS. Work-from-home models that manufacturers adopted in the wake of COVID-19 **are expected to remain prevalent** once the pandemic is over.

Agile integration bridges the gap between HR and IT systems to rapidly enable remote work, onboard and reboard personnel, manage location changes, and promote a positive employee experience. As many organizations have found, moving to remote work can be difficult and time-consuming with an outdated application and data infrastructure.

Building future-proof agility into a digital ecosystem isn't just about responding to disruption. It's also about capitalizing on opportunity. For example, companies in any industry can accelerate time-to-value from a merger or acquisition when technology and information assets can be quickly integrated.

Manufacturers also ready themselves to take advantage of emerging technologies of Industry 4.0 and 5.0 with modern integration. Integration is essential for an organization to evolve beyond yesteryear's manufacturing models to become, in a sense, a technology and data company that can transform and innovate ahead of the competition.

## 5 KEY TARGET AREAS

“  
Step by step, we're building integrations in Boomi to connect the entire business. Reaching 100 percent integration will allow us to become more than a food company.  
**We will, in a way, be a technology company, and the possibilities that opens up are quite endless.**

Paulo Gaspar, CIO, Lusiaves Group

”  
**93%**  
of supply chain leaders are planning to increase resilience

McKinsey Global Institute

**35%**  
of manufacturing leaders believe technology will dramatically impact how their organizations operate by 2029

Boomi / Vanson Bourne survey data

# Boomi: The iPaaS of Choice for Manufacturing Integration

More than 12,000 organizations around the world trust Boomi, the iPaaS market leader, to integrate applications, data, devices, people, and processes. Boomi liberates your manufacturing company from brittle ad hoc connections to maximize ROI from your investments in legacy systems, new cloud applications, and Industry 4.0 and 5.0 technologies.

Since pioneering the iPaaS market in 2008, Boomi has built out a unified platform with a full range of capabilities. The Boomi AtomSphere Platform comprises:

**Integration:** Connect applications and data with speed and ease. Break down data silos by integrating data and devices across your hybrid IT landscape.

**Master Data Hub:** Build a centralized hub among applications to ensure your data is synchronized, accurate, and up-to-date. Establish your golden record of data truth.

**API Management:** Centrally create, publish, and manage APIs and web services, extending access across your growing hybrid landscape of applications, platforms, and data.

**Flow:** Quickly build simple-to-complex automated workflows that streamline business processes and simplify data collection.

**B2B/EDI Management:** Easily exchange and automatically process information from your business partners through any kind of data network.

**Data Catalog and Preparation:** Discover, prepare, and catalog both known and unknown data for improving data management and visibility.

## About Boomi

Boomi instantly connects everyone to everything, anywhere with our cloud-native, unified, open, and intelligent platform. Boomi is trusted by more than 20,000 customers globally for its speed, ease-of-use, and lower total cost of ownership. As the pioneer at fueling intelligent use of data, Boomi's vision is to make it quick and easy for customers and partners to discover, manage, and orchestrate data, while connecting applications, processes, things, and people for better, faster business outcomes. For more information, visit [www.boomi.com](http://www.boomi.com).

### Get Started Today

Visit [www.boomi.com/manufacturing](http://www.boomi.com/manufacturing) or contact Boomi experts in your region to explore how our technology can help you create the speed, agility, and competitive advantage your organization needs in our fast-changing digital era.

For more information, visit: [boomi.com](http://boomi.com)

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The Boomi logo consists of the word "boomi" in a lowercase, white, sans-serif font. The letter "i" at the end has a small orange dot above it.