

# INTERNET OF THINGS FOR MANUFACTURING

SYMPOSIUM >  
NOVEMBER 10, 2021



The Industrial  
Internet of Things  
in 2021 – A  
Manufacturing  
Perspective

Alain Louchez

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(\*) CDAIT (pronounced “sea-date”) is a research unit of the Center for Advanced Communications Policy ([CACP](#)) within the School of Public Policy ([SPP](#)) at the Ivan Allen College of Liberal Arts ([IAC](#)) at Georgia Tech

## IoT currently is in its golden age and most of its potential yet to come

“2020 has been a crucial year for IoT and as we are approaching 2021, the technology is considering as a business imperative. **IoT is everywhere today**, making an impact on how we work, talk and engage with others. Reports show that there will be 35 billion IoT devices installed worldwide by 2021 and 75.44 billion by 2025. This relentlessly roaring amount of IoT will deliver more opportunities to enterprises to leverage smart technologies.”

Source: Vivek Kumar, “Top emerging IoT trends business should look for in 2021,” Fintech News, April 8, 2021 <https://www.fintechnews.org/top-emerging-iot-trends-business-should-look-for-in-2021/>

**“Exponential growth of IoT demand expected to continue over the next five years.”**

Source: Research and Markets press release, August 12, 2021 <https://www.businesswire.com/news/home/20210812005299/en/Global-Internet-of-Things-IoT-Markets-Report-2021-2020-Data-Estimates-for-2021-2022-2024-and-CAGR-Projections-through-2026---ResearchAndMarkets.com>



## Why IoT has failed to take off . . .

In this Q&A, Nick Earle, CEO of Eseye, discusses why he thinks **IoT has failed to take off** and the impact for the world when it does

Source: Nick Ismail, “Q&A: Why IoT has failed to take off and the impact for the world when it does,” Information Age, January 7, 2021 <https://www.information-age.com/why-iot-has-failed-to-take-off-and-the-impact-for-the-world-when-it-does-123493297/>

“The only thing that can be definitively said for the Internet of Things (IoT) is that no matter what set of figures you look at, the IoT is growing — or spreading — and is likely to continue to do so in the future. That said, **the speed of that [IoT] growth is less certain.**”

Source: David Roe, “7 Big Problems With the Internet of Things,” CMS Wire, April 13, 2021 <https://www.cmswire.com/cms/internet-of-things/7-big-problems-with-the-internet-of-things-024571.php>

# GLOBAL INDUSTRY ACCELERATING IOT ADOPTION IN RESPONSE TO COVID-19, NEW INMARSAT RESEARCH REVEALS

Industrial IoT in the Time of Covid-19 – finds rapid increase and high level of maturity in levels of industrial IoT in 2021 across global supply chains in agriculture, electrical utilities, mining, oil and gas, and transport and logistics

22 Sep 2021

*“According to the research, IoT adoption has seen huge progress from 2020 to 2021. More than three quarters (77 per cent) of the organisations surveyed have now fully deployed at least one IoT project, with 41 per cent having achieved this in the twelve-month period from the second quarter of 2020. Of the remaining 23 per cent of respondents that have not yet fully deployed IoT projects, all are either currently trialling it, or plan to deploy or trial at least one IoT project in the next 18 months. A further 84 per cent of respondents indicated they have accelerated or they intend to accelerate the adoption of IoT in response to challenges related to Covid-19.”*

Source, Inmarsat, press release about “Industrial IoT in the time of Covid 19,” Inmarsat website, September 22, 2021 <https://www.inmarsat.com/en/news/latest-news/enterprise/2021/industry-accelerating-iot-adoption-in-response-to-covid.html>

# IOT SET TO OVERTAKE CLOUD COMPUTING AS PRIMARY INDUSTRY 4.0 TECHNOLOGY, NEW INMARSAT RESEARCH REVEALS

14 Oct 2021

*“The emergence of IoT as an investment priority for businesses, and the increasing level of cost-savings they expect IoT to deliver in the years ahead, demonstrates how well-established a technology IoT has become across multiple industries.”*

Source: Inmarsat press release, “IoT set to overtake cloud computing as primary industry 4.0 technology, new Inmarsat research [Industrial IoT in the time of Covid 19] reveals,” October 14, 2021 <https://www.inmarsat.com/en/news/latest-news/enterprise/2021/iot-to-overtake-cloud-computing-as-primary-industry-technology.html>

More devices connected as manufacturers  
move to internet-based IoT protocols

01 Oct 2021  
Dr Jody Muelaner



Industry is increasingly moving to internet-based IoT protocols (Credit: Shutterstock)

Source: <https://www.imeche.org/news/news-article/more-devices-connected-as-manufacturers-move-to-internet-based-iot-protocols>

*“People sometimes talk about the Internet of Things (IoT) as if it simply means the networking of digital devices, but that type of machine-to-machine communication has been in factories for a long time.”*

***“Manufacturing remains the biggest adopter of IoT to date. It helps increase automation, provides visibility into the whole manufacturing operation, and reduces the time-to-market for innovations. If it’s possible to create a sensor for a certain parameter, it’s possible to apply IoT technology to improve a process.”***

Source: CalChip Connect, “How IoT Can Improve Your Manufacturing Operations,” IoT for All, October 15, 2021 <https://www.ietfforall.com/how-iot-can-improve-your-manufacturing-operations>

# 2021 IoT and Manufacturing

## Definitions

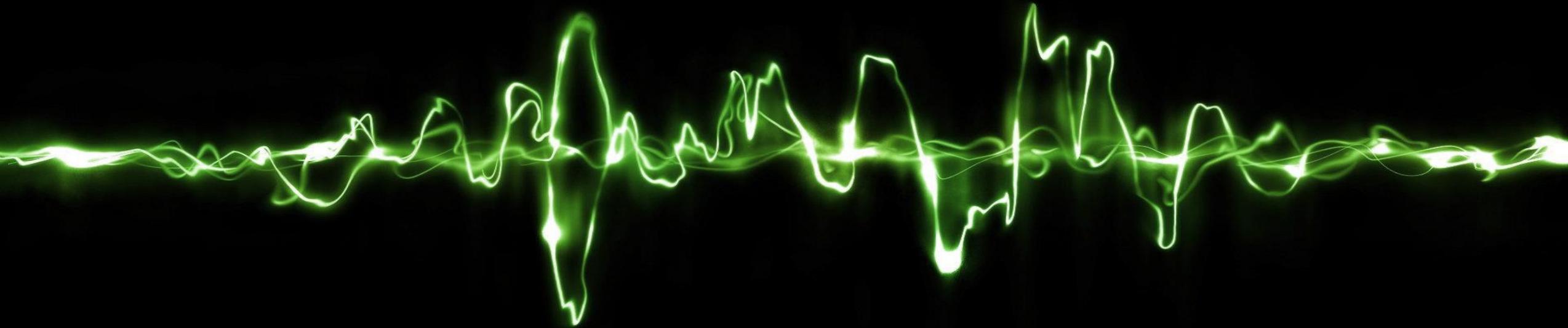
# The Internet of Things: What is it?

## = The Interconnection of Intelligent Things

*The expression Internet of Things (IoT) is best understood as a metaphor that encapsulates the immersion of almost anything and everything (previously "out of scope") into the communications space thanks to the timely convergence of scientific, technological, and societal advances and trends. Through embedded intelligence, it will transform the dimensions of the economy and society on a scale not experienced before.*

Nothing will be forever fixed: inert will become active; delayed, instantaneous; offline, online; and static, dynamic.

The **Internet of Things** will give rise to a world in constant change, i.e., a “**pulsating world**”. Why “pulsating”? Because things will continuously be sending and receiving data.



*"When wireless is perfectly applied the whole earth will be converted into a huge brain, which in fact it is, all things being particles of a real and rhythmic whole."*

*Nikola Tesla (\*)*

(\*) January 30, 1926 interview with Collier's magazine reproduced by Twenty-First Century Books, <http://www.tfcbooks.com/tesla/1926-01-30.htm>

IoT definition in the **Internet of Things Cybersecurity Improvement Act of 2020**, which became Public Law No: 116-207 on December 4, 2020 <https://www.congress.gov/bill/116th-congress/house-bill/1668/text>

“It is the sense that Congress -- consistent with the second draft National Institute for Standards and Technology Interagency or Internal Report 8259 titled “Recommendations for IoT Device Manufacturers: Foundational Activities and Core Device Cybersecurity Capability Baseline”, published in January 2020,

Internet of Things devices are devices that—

- (A) have at least one transducer (sensor or actuator) for interacting directly with the physical world, have at least one network interface, and are not conventional Information Technology devices**, such as smartphones and laptops, for which the identification and implementation of cybersecurity features is already well understood; and
- (B) can function on their own** and are not only able to function when acting as a component of another device, such as a processor.”



## The Industrial Internet of Things Vocabulary

An Industrial Internet Consortium Framework Publication

Version V2.3 – 2020-10-05

Claude Baudoin (IIC), Erin Bournival (Dell Technologies), Marcellus Buchheit (Wibu-Systems),  
Ruben Guerrero (Toshiba)

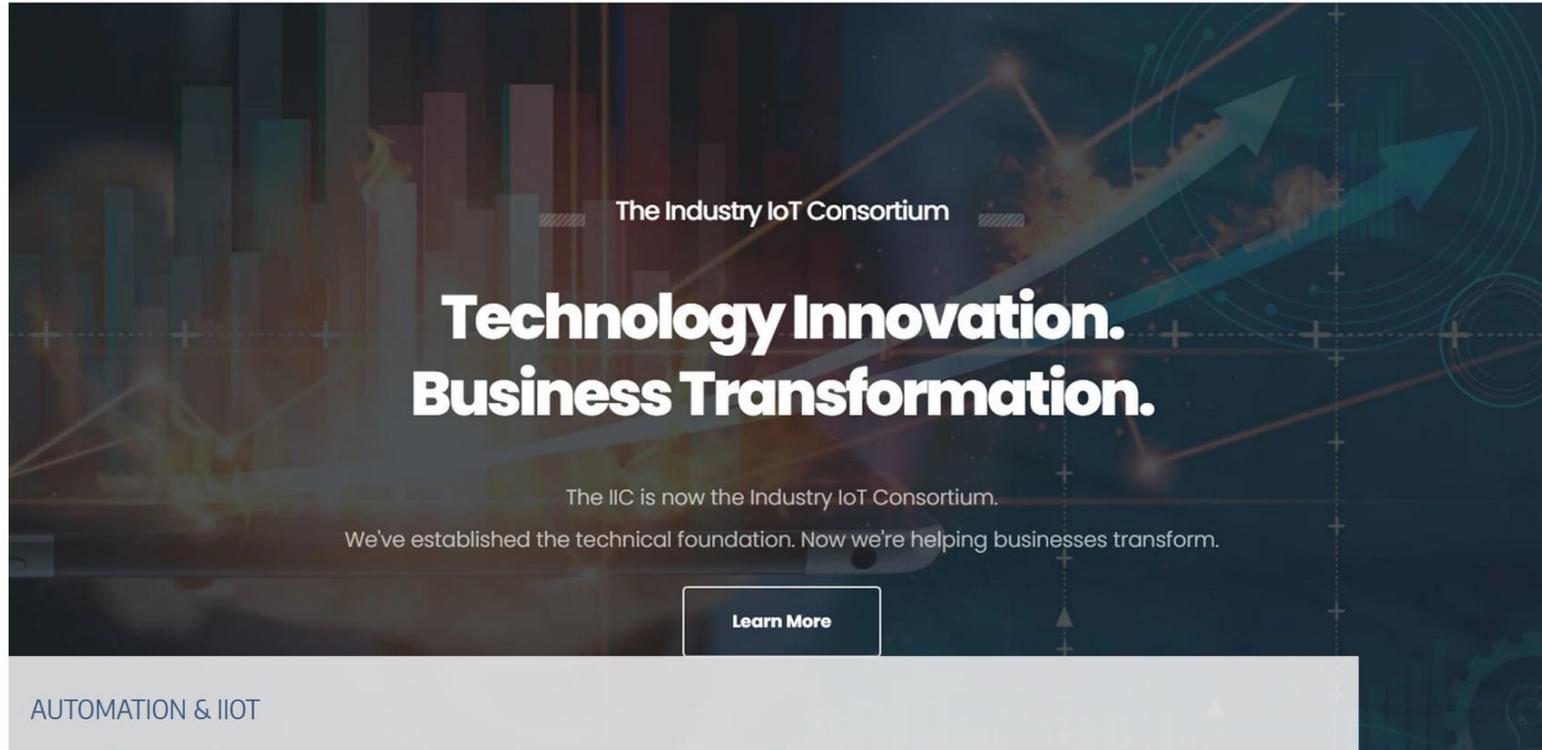


**Industrial Internet of Things (IIoT) system:** Internet of Things (IoT) system used in an industrial context

**Internet of Things (IoT):** a concept where components are connected via a computer network and where one or more of those components interact with the physical world

**Internet of Things (IoT) system:** system where the components are connected via a computer network and one or more of those components interact with the physical world

**IoT device:** endpoint that interacts with the physical world through sensing or actuating



AUTOMATION & IIOT

## Industrial Internet Consortium Rebrands to Tackle Tech Innovation

Aug. 17, 2021

IIC rebrands to Industry IoT Consortium and focuses on fostering better returns on IoT investments.

Rehana Begg



*“Due to the Industrial Internet of Things (IIoT), significantly more data are available from manufacturing processes, factories and enterprises. Such data can be utilized for process characterization, monitoring, control and decision making. IIoT enables user participation in design and fabrication, creating a new paradigm of personalized manufacturing.”*

Source: S. Jack Hu, University of Georgia (UGA) Foundation Distinguished Professor of Engineering and Senior Vice President for Academic Affairs and Provost, 2021 LeeAnn and Walter Muller Distinguished Lecture on “Industrial Internet of Things and Smart Personalized Manufacturing,” H. Milton Stewart School of Industrial and Systems Engineering (ISyE), September 23, 2021 <https://www.isye.gatech.edu/news-events/events/calendar/day/11284>

# IoT Bi-directional Impact



**Manufacturing x.0**

**IoT transforms manufacturing processes** (automation, tracing, tracking, and optimization) and human-enterprise interaction

**“IoT-embedded” manufactured products transform the socio-economic fabric** (marketing, sales, information management, business models, software-defined devices, etc.)

**Society x.0**

# Consumer IoT

**Consumer IoT device:** network-connected (and network-connectable) device that has relationships to associated services and are used by the consumer typically in the home or as electronic wearables

**NOTE 1:** Consumer IoT devices are commonly also used in business contexts. These devices remain classified as consumer IoT devices.

**NOTE 2:** Consumer IoT devices are often available for the consumer to purchase in retail environments. Consumer IoT devices can also be commissioned and/or installed professionally.

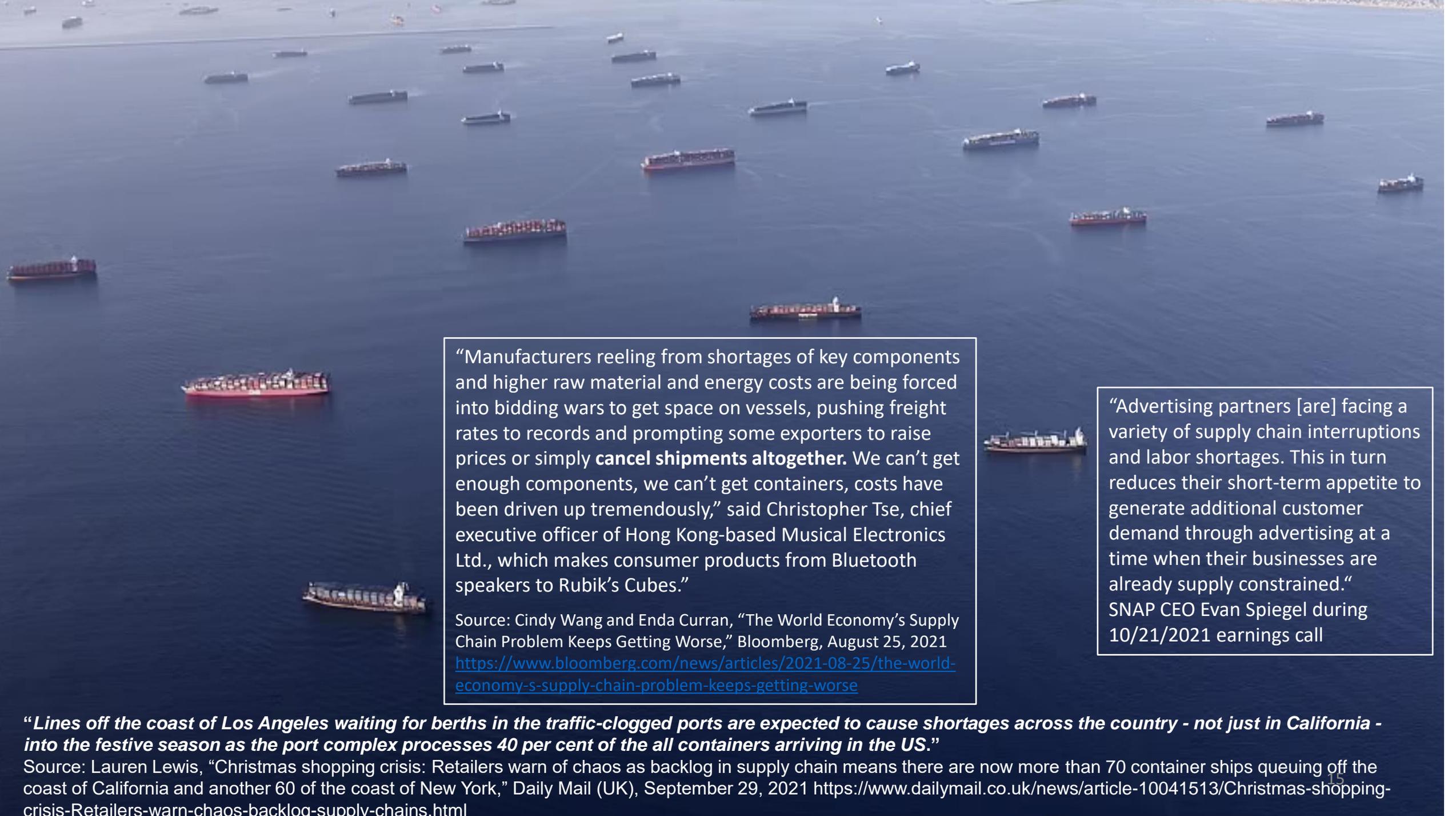
Source: ETSI [European Telecommunications Standards Institute] European Standard ETSI EN 303 645 V2.1.1 (2020-06) Cyber Security for Consumer Internet of Things: Baseline Requirements [https://www.etsi.org/deliver/etsi\\_en/303600\\_303699/303645/02.01.01\\_60/en\\_303645v020101p.pdf](https://www.etsi.org/deliver/etsi_en/303600_303699/303645/02.01.01_60/en_303645v020101p.pdf) See also ETSI press release, “ETSI releases test specification to comply with world-leading Consumer IoT Security standard,” ETSI, October 12, 2021 <https://www.etsi.org/newsroom/press-releases/1983-2021-10-etsi-releases-test-specification-to-comply-with-world-leading-consumer-iot-security-standard>

**“Research finds consumer-grade IoT devices showing up... on corporate networks - Considering the slack security of such kit, it's a perfect storm”** – *“Smart lightbulbs, heart rate monitors, gym equipment, coffee machines, and even smart pet feeders were all found on corporate networks during 2021 (Palo Alto Networks Survey)”*

Source: Gareth Corfield, “Research finds consumer-grade IoT devices showing up... on corporate networks,” The Register, October 21, 2021 [https://www.theregister.com/2021/10/21/iot\\_devices\\_corporate\\_networks\\_security\\_warning/](https://www.theregister.com/2021/10/21/iot_devices_corporate_networks_security_warning/)

# 2021 IoT and Manufacturing

## Supply Chain Strains



“Manufacturers reeling from shortages of key components and higher raw material and energy costs are being forced into bidding wars to get space on vessels, pushing freight rates to records and prompting some exporters to raise prices or simply **cancel shipments altogether**. We can’t get enough components, we can’t get containers, costs have been driven up tremendously,” said Christopher Tse, chief executive officer of Hong Kong-based Musical Electronics Ltd., which makes consumer products from Bluetooth speakers to Rubik’s Cubes.”

Source: Cindy Wang and Enda Curran, “The World Economy’s Supply Chain Problem Keeps Getting Worse,” Bloomberg, August 25, 2021 <https://www.bloomberg.com/news/articles/2021-08-25/the-world-economy-s-supply-chain-problem-keeps-getting-worse>

“Advertising partners [are] facing a variety of supply chain interruptions and labor shortages. This in turn reduces their short-term appetite to generate additional customer demand through advertising at a time when their businesses are already supply constrained.” SNAP CEO Evan Spiegel during 10/21/2021 earnings call

***“Lines off the coast of Los Angeles waiting for berths in the traffic-clogged ports are expected to cause shortages across the country - not just in California - into the festive season as the port complex processes 40 per cent of the all containers arriving in the US.”***

Source: Lauren Lewis, “Christmas shopping crisis: Retailers warn of chaos as backlog in supply chain means there are now more than 70 container ships queuing off the coast of California and another 60 of the coast of New York,” Daily Mail (UK), September 29, 2021 <https://www.dailymail.co.uk/news/article-10041513/Christmas-shopping-crisis-Retailers-warn-chaos-backlog-supply-chains.html>

# IoT-dependent (\*) Just-in-Time (JIT) Inventory Management in Question

“Disruptions proved the perils of a supply chain built around JIT [Just-in-Time]. Moving forward with a supply chain that can weather future disruptions also requires better alignment with strategy. It’s clear a laser focus on lean, and continuing trying to make JIT work, isn’t the way.”

Source: Wharton@Work, “Rethinking Your Just-in-Time Supply Chain,” Wharton, August 2021

<https://executiveeducation.wharton.upenn.edu/thought-leadership/wharton-at-work/2021/08/rethinking-your-supply-chain/> quote is from Gad Allon, Wharton professor and director of the Jerome Fisher Program in Management & Technology

“Internet of Things (IoT) technology has the potential to be used for acquiring data and information in real time to facilitate dynamic JIT manufacturing.”

Source: Yuchun Xu and Mu Chen, “Improving Just-in-Time Manufacturing Operations by Using Internet of Things Based Solutions,” *Procedia CIRP*, Volume 56, 2016, Pages 326-331  
<https://www.sciencedirect.com/science/article/pii/S2212827116310228?via%3Dihub#aep-article-footnote-id4>

IoT & Wireless

## Another chip shortage will halt IoT projects, analyst predicts

by Matt Hamblen | Sep 13, 2021 12:34pm



Counterpoint Research sees a 6% downturn in IoT chipsets and modules in third quarter as causing a halt to IoT project implementations globally.

*“Even if you weren't living under a foundry for the last year and a half, you probably noticed that there is a major chip shortage taking place across the globe. Prices on everything from electronics to autos have risen in response, given the tremendous demand for silicon and the lack of supply.”*

Source: Seeking Alpha, Wall Street Breakfast, October 8, 2021

📄 MUST READ: [DDoS attacks are becoming more prolific and more powerful, warn cybersecurity researchers](#)

# Developer burnout and a global chip shortage: The IoT is facing a perfect storm

A new report shows that IoT manufacturers need to revamp their development processes if they want to withstand the pressures of the next few years.



By [Daphne Leprince-Ringuet](#) | May 19, 2021 | Topic: [Internet of Things](#)



*“The (Forrester) research, which was commissioned by software company Qt, found that an overwhelming 80% of global manufacturers are currently facing challenges in producing digital products and services. Part of the problem stems from unprecedented demand for IoT devices. There are already more connected things than people in the world, and the trend isn't showing any sign of slowing down. In fact, it's quite the contrary: tech analyst company IDC recently estimated that there will be a total 41.6 billion connected devices by 2025.”*

## TECH

# Global Chip Shortage 'Is Far From Over' as Wait Times Get Longer

Nearly a year into the crisis, some customers are finding it is taking months more than expected to get needed parts

By [Stephanie Yang](#) in Taipei and [Jiyoung Sohn](#) in Seoul

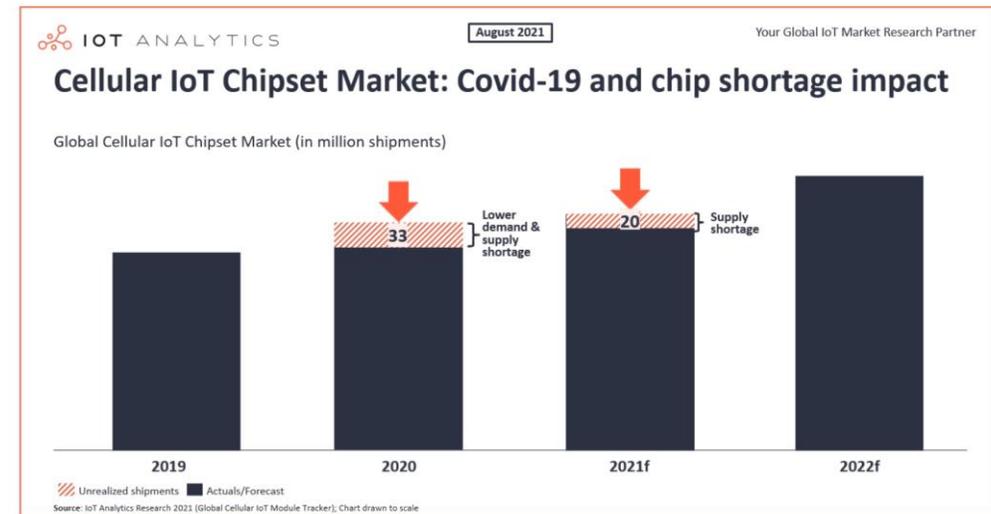
Oct. 28, 2021 5:30 am ET

- **Adjust production (e.g., build-shy strategy)**
- **Rethink entire supply chain**

**20 million cellular IoT chips missing in 2021 due to global supply shortage**

***“The market is expected to grow 9% YoY in 2021 but would have grown a lot more had there been no supply constraints”***

Source: Satyajit Sinha, “20 million cellular IoT chips missing in 2021 due to global supply shortage as Qualcomm continues to lead the market,” IoT Analytics, August 24, 2021 <https://iot-analytics.com/cellular-iot-chipset-market-2021/>



## ***“[Chip] Shortage Impacting IIoT?”***

*The shortages in more visible consumer-facing industries often get more publicity due to their products’ impacts on day-to-day life. Consumers who want to buy a new car might be aware that the price of new cars, and even used cars, are being driven up by the global chip shortage. Those same consumers are less likely to think about how the chip shortage may be impacting the development and creation of automated manufacturing equipment that helps build their cars. Industrial IoT is fundamental to the manufacturing, processing and packaging of products . . .”*

Smart Embedded Computing, “What Is IIoT and How Will the Chip Shortage of 2021 Affect It?” June 25, 2021 <https://smarterembedded.com/newsroom/chip-shortage-2021-impact-on-iiot/>

***“To keep future shortages at bay, the chip industry and auto executives need a more direct connection going forward so signals about supply and demand are clearer.”***

Source: Quote from Bharat Kapoor, lead partner, Americas, in the high-tech practice of global strategy and management consulting firm, Kearney in Samuel K. Moore, “How and When the Chip Shortage Will End, in 4 Charts,” June 29, 2021, IEEE Spectrum <https://spectrum.ieee.org/chip-shortage>

## ***“How the Internet of Things Could Help Solve the Chip Shortage***

*Avoiding Shortages -- By integrating IoT with business workflows and systems, IoT orchestration provides a unified view of end-to-end supply chain data. An industrial IoT platform achieves this by integrating heterogeneous systems, software and sensors into one centralized management view. This visibility allows chip manufacturers to make more sophisticated use of the information collected, analyzing and acting on multiple data elements that were previously in siloed applications. Analytics derived from the data provide detailed insights into the end-to-end performance. These can include insights into demand forecasts, production, scheduling and inventory along the entire supply chain.”*

Brandon Black, “How the Internet of Things Could Help Solve the Chip Shortage,” Supply Chain Brain, June 23, 2021 <https://www.supplychainbrain.com/blogs/1-think-tank/post/33243-how-iiot-can-help-solve-the-computer-chip-shortage>

# 2021 IoT and Manufacturing

**Coding made easy**

Nov 24, 2020, 10:10am EST | 14,686 views

# The Most Disruptive Trend Of 2021: No Code / Low Code



**Betsy Atkins** Contributor  
Markets

*I'm a board vet writing about corporate governance & business trends*

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Source:

<https://www.forbes.com/sites/betsyatkins/2020/11/24/the-most-disruptive-trend-of-2021-no-code--low-code/?sh=7d1e88ca6570>

## NO CODE PLATFORMS GEARING UP BUSINESS ENTERPRISES FOR INDUSTRIAL REVOLUTION 4.0

DIGITAL TRANSFORMATION LATEST NEWS  
by Analytics Insight / October 6, 2021

Source: <https://www.analyticsinsight.net/no-code-platforms-gearing-up-business-enterprises-for-industrial-revolution-4-0/>



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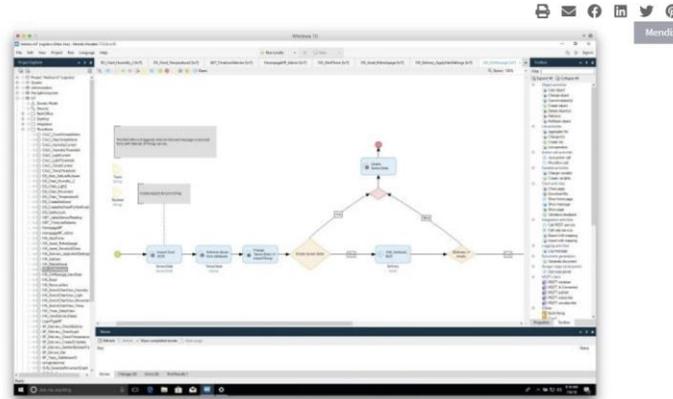
Tech

# Why Low Code for IoT?

By Ruth Taylor, Prescient Devices - September 13, 2021

Source: <https://www.masstlc.org/why-low-code-for-iot/>

## Programming Gains Speed As Developers Turn to Low-Code During the Pandemic



As pressures for programming increase, developers are turning to low-code programming to catch up.

Rob Spiegel | Oct 19, 2021

***“We’re seeing low-code in several categories. Some are using it for processes and workflow automation, for automating complex approval workflows, for onboarding, and for automating processes with Sharepoint, Excel, and email. Industrial users are utilizing it for IoT in the factory and device applications.”*** Sheryl Koenigsberg, head of global product marketing at Mendix

Source: Rob Spiegel, “Programming Gains Speed As Developers Turn to Low-Code During the Pandemic,” Design News, October 19, 2021 <https://www.designnews.com/automation/programming-gains-speed-developers-turn-low-code-during-pandemic>

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Home > Big Data > Why 2021 is The Year of Low-Code

### Why 2021 is The Year of Low-Code

January 9, 2021 by Editorial Team | 1 Comment

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Forrester analysts estimate 75% of all enterprise software will be built with low-code technology this year. As the pandemic's impact continues well into 2021, IT leaders will continue to rely on rapid, agile low-code software development platforms to roll out business critical solutions and expand digital channels. Platforms that integrate augmented reality, holistic multi-experiences, and easy enterprise data access will enable organizations to navigate continued economic uncertainty.

Source: <https://insidebigdata.com/2021/01/09/why-2021-is-the-year-of-low-code/>

Home / Internet of Things / 4 Benefits of Using Low Code in Industrial Manufacturing

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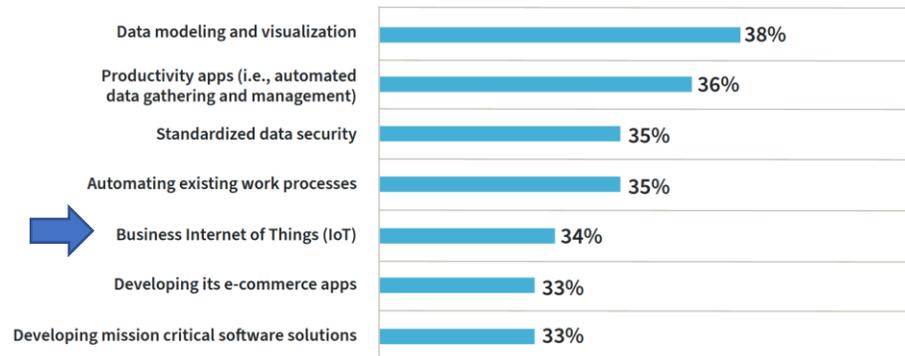
Learn More

4 Benefits of Using Low Code in Industrial Manufacturing  
By Salvatore Salamone | August 10, 2021

Source: <https://www.rtinsights.com/4-benefits-of-using-low-code-in-industrial-manufacturing/>

# IoT Application Development with a Low-Code Platform

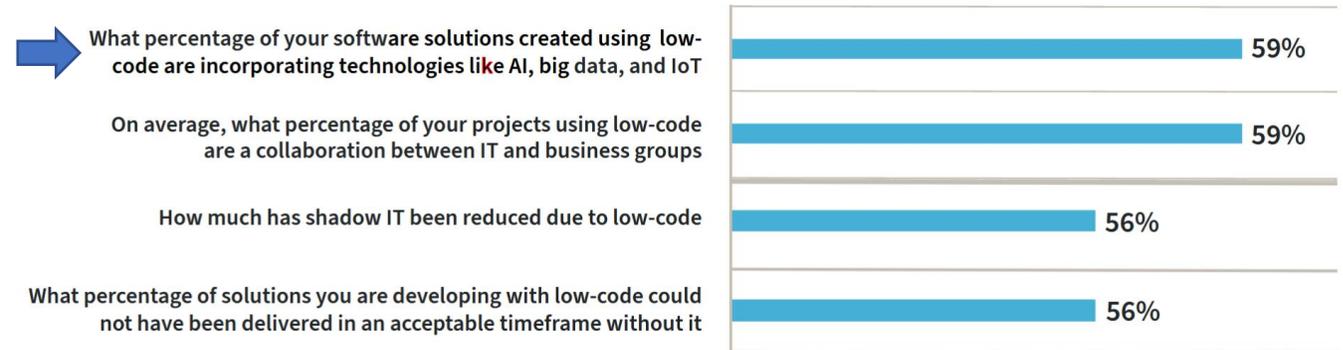
## Does your organization use low-code for any of the following applications?



## A new era of collaboration: coding moves outside the IT box

IT professionals report that most employees have now embraced low-code in their organization: it is positively accepted by IT decision-makers (92% say it has been accepted or enthusiastically accepted by IT decision-makers) and business users (79% say it has been accepted or enthusiastically accepted by business users).

## To what degree has your organization achieved the benefits of adopting low-code? (If using low-code)



At organizations where low-code is in use, 59% of low-code projects are a collaboration between the IT department and business users and incorporate technologies like AI, big data, and IoT (59%). A quarter (25%) report fewer shadow IT projects than before and claim it has been reduced by 56%.

Source: Mendix [a Siemens low-code software development platform business], "The State of Low-Code 2021: A Look Back, The Light Ahead," [https://www.mendix.com/wp-content/uploads/Mendix\\_2021\\_State\\_of\\_LowCode\\_Whitepaper.pdf](https://www.mendix.com/wp-content/uploads/Mendix_2021_State_of_LowCode_Whitepaper.pdf)

# 2021 IoT and Manufacturing

**Chips with increasing  
capabilities**



## IBM Unveils World's First 2 Nanometer Chip Technology, Opening a New Frontier for Semiconductors

May 6, 2021

### “50 billion transistors on a fingernail-sized chip

Increasing the number of transistors per chip can make them smaller, faster, more reliable, and more efficient. The 2 nm design demonstrates the advanced scaling of semiconductors using IBM's [nanosheet technology](#).

Its architecture is an industry first. Developed less than four years after IBM announced its milestone 5 nm design, this latest breakthrough will allow the 2 nm chip to fit up to 50 billion transistors on a chip the size of a fingernail.”

Source: <https://newsroom.ibm.com/2021-05-06-IBM-Unveils-Worlds-First-2-Nanometer-Chip-Technology,-Opening-a-New-Frontier-for-Semiconductors>

NEWS

## TSMC trumps IBM's “2nm” chip tech hyperbole with “1nm” claim

Elles Houweling | 18th May 2021 (Last Updated May 20th, 2021 11:55)

“It will likely take years before even 2nm semiconductors will become available in everyday devices. Today's leading chips are 5nm, for example, and are only just appearing in premium smartphones.

TSMC [Tawain Semiconductor Manufacturing Company] has updated its latest semiconductor [production roadmap](#) in which it plans to start production of 4nm chips this year, while mass production should be achieved in 2022. Production of the 3nm chip will start in the second half of 2022. As for the future of TSMC, the company said that it would continue the development of 2nm and 1nm semiconductors.

Source: <https://www.verdict.co.uk/tsmc-trumps-ibms-2nm-chip-tech-hyperbole-with-1nm-claim/>

Points of comparison: It is estimated that, on average, the **human brain has 86 billion neurons. A strand of human DNA is 2.5 nanometers in diameter**



# 2021 IoT and Manufacturing

## Industrial Internet Consortium Defines Trustworthiness for Cyber-Physical Systems

*Ensuring safety, security, privacy, reliability, and resilience in the context of application, industry*

<https://www.iiconsortium.org/press-room/07-15-21.htm>

BOSTON, MA – JULY 15, 2021 – The Industrial Internet Consortium® (IIC™) today published *IIoT Trustworthiness Framework Foundations*. This foundational

## Safety, Security, Privacy, Reliability & Resilience are key concerns and drivers

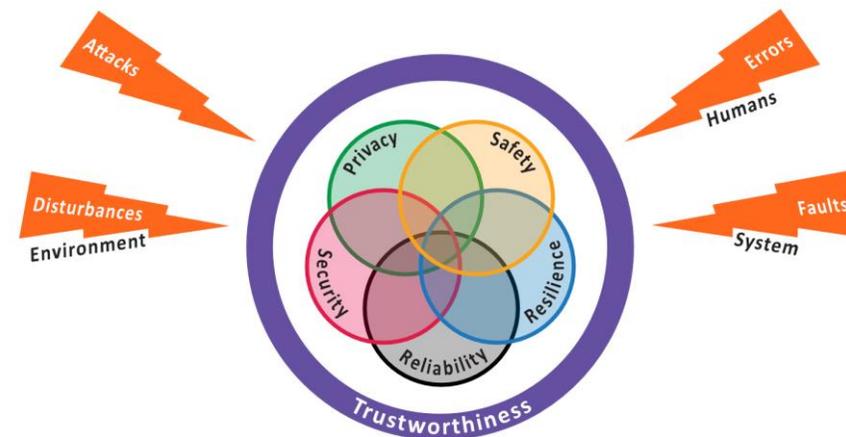


Figure 0-1: Trustworthiness characteristics and threats

Source: [https://www.iiconsortium.org/pdf/Trustworthiness\\_Framework\\_Foundations.pdf](https://www.iiconsortium.org/pdf/Trustworthiness_Framework_Foundations.pdf)

# Building IoT strategies around trust

IoT technology can improve operational performance, safety and security, but organizations must take steps to ensure the trust of employees and customers.

By **Brian Gilmore**

**GUEST CONTRIBUTOR**

Published: **19 Oct 2021**

*“Efficient safety management on manufacturing sites is a major driving factor for implementation of IoT technologies in the manufacturing industry.”*

The digital manufacturing market size was valued at \$0.27 trillion in 2020, and is projected to reach \$1.30 trillion by 2030, registering a CAGR of 16.5% from 2021 to 2030.

# 99% of security pros concerned about their IoT and IIoT security

Tripwire announced the results of a research report that assessed the security of connected devices across enterprise environments in 2021. Conducted by [Dimensional Research](#), the survey evaluated the opinions of 312 security professionals that manage the security of internet of things (IoT) and industrial internet of things (IIoT) devices across their organization.

*“The industrial sector is facing a new set of challenges when it comes to securing a converged IT-OT environment,” said [Tim Erlin](#), VP of product management and strategy at [Tripwire](#).*

*“In the past, cybersecurity was focused on IT assets like servers and workstations, but the increased connectivity of systems requires that industrial security professionals expand their understanding of what’s in their environment. You can’t protect what you don’t know.”*

Source: <https://www.helpnetsecurity.com/2021/04/06/iot-iiot-security/>

# 2020 REPORT: ICS ENDPOINTS AS STARTING POINTS FOR THREATS

ICS endpoint security has become more important as the interconnection between IT and OT continues to grow. Our research shares the status of global industrial systems in terms of security against both known and new threats that hound ICS endpoints.

June 30, 2021

*“The security of Industrial Control Systems (ICS) has been pushed into the limelight over the past few years due to the increasing interconnection between the business process on the IT side and the physical process on the OT side. While this interconnection improves visibility, efficiency, and speed it also inadvertently exposes ICSs to threats that have been affecting IT networks for decades.”*

**NOTEWORTHY:** “Legacy malware continues to thrive in IT/OT networks. Despite being relatively older types of malware, worms, such as Autorun, Gamarue, and Palevo, which propagate through removable drives, are still commonly detected in ICS endpoints.”

Source: Matsukawa Bakuei, Ryan Flores, Lord Remorin, and Fyodor Yarochkin, “2020 Report on Threats Affecting ICS Endpoints,” Trend Micro Systems, June 30, 2021 <https://www.trendmicro.com/vinfo/us/security/news/internet-of-things/2020-report-ics-endpoints-as-starting-points-for-threats>

*“IT folks often think only they know how to help modernize OT departments, by enabling the systems that allow the benefits of AI, the internet of things, and other digital technologies. True collaboration is a must, but the complexity of new technology and infrastructure merging with legacy machines prompts questions concerning investment, leadership, and governance.”*

# The way forward: Merging IT and operations

Digital transformation in any industry begins with bridging the gap between two traditionally separate teams.

By MIT Technology Review Insights

October 26, 2021

## Word problems

Many common terms used in businesses today have different meanings to IT and OT.

	 IT	 OT
TERM	WHAT IT HEARS	WHAT OT HEARS
ASSET	A company-owned computer, storage, networking, or other IT device	A piece of physical equipment that's not a computer
ARCHITECT	Someone who designs computer, software, networking, or other IT systems	Someone who builds buildings or plants
INFRASTRUCTURE	IT components such as computer and networking hardware	A bridge or building or other construction
SECURITY	Cybersecurity – protecting computer systems and networks	Physical security or security guard

Source: MIT Technology Review Insights; based on information from "Why We Need IT/OT Convergence," Hitachi Vantara, August 2019



***“There is a clear need to advance cyber visibility, detection, and monitoring capabilities, for the OT (operational technology) and IoT (Internet of Things) networks used by the control systems. Today, such networks and their assets are largely invisible to the IT cyber security teams responsible for preventing and detecting cyber security attacks. “***



### The Federal Government Needs to Address OT/IoT Security NOW



by Heather MacKenzie on October 12, 2021

The critical infrastructure of many countries is experiencing an ongoing escalation of cyber threats. As a result, federal governments need to address a new kind of cyber security – OT/IoT security – and they need to do it NOW.

# ISAGCA and ISA Security Compliance Institute Release Joint Study on IIoT Product Certifications

*In 2016, ISCI completed a rigorous study on the applicability of ISA/IEC 62443 to automation and control systems in smart building technology.*



By Homeland Security Today October 15, 2021

***“The report, the first in a two-part study, evaluates the urgent need for industry vetted IIoT product certification programs, with the goal of determining the applicability of the ISA [International Society of Automation]/IEC [International Electrotechnical Commission] 62443 series of standards and certifications to commercial off-the-shelf (COTS) IIoT components and gateways.”***

Source: Homeland Security Today, “ISAGCA and ISA Security Compliance Institute [The ISA Global Security Alliance (ISAGCA) and the ISA Security Compliance Institute (ISCI)] Release Joint Study on IIoT Product Certifications *In 2016, ISCI completed a rigorous study on the applicability of ISA/IEC 62443 to automation and control systems in smart building technology,*” Homeland Security Today, October 16, 2021 <https://www.hstoday.us/industry/industry-news/isagca-and-isa-security-compliance-institute-release-joint-study-on-iiot-product-certifications/>

See also: “Some think the **ISA/IEC 62443** set of standards is too detailed and complex. We at Cisco like it because **it gives IT and OT common ground to work together,**” in Antoine Amirault, “Securing industrial networks: What is ISA/IEC 62443?” Cisco Blog, March 12, 2021 <https://blogs.cisco.com/security/securing-industrial-networks-what-is-isa-iec-62443>

# Differential Privacy for Industrial Internet of Things: Opportunities, Applications and Challenges

Bin Jiang, *Member, IEEE*, Jianqiang Li, Guanghui Yue, and Houbing Song, *Senior Member, IEEE*

**Abstract**—The development of Internet of Things (IoT) brings new changes to various fields. Particularly, industrial IoT (IIoT) is promoting a new round of industrial revolution. With more applications of IIoT, privacy protection issues are emerging. Especially, some common algorithms in IIoT technology, such as deep models, strongly rely on data collection, which leads to the risk of privacy disclosure. Recently, differential privacy has been used to protect user-terminal privacy in IIoT, so it is necessary to make in-depth research on this topic. In this article, we conduct a comprehensive survey on the opportunities, applications, and challenges of differential privacy in IIoT. We first review related papers on IIoT and privacy protection, respectively. Then, we focus on the metrics of industrial data privacy, and analyze the contradiction between data utilization for deep models and individual privacy protection. Several valuable problems are summarized and new research ideas are put forward. In conclusion, this survey is dedicated to complete comprehensive summary and lay foundation for the follow-up research on industrial differential privacy.

**Index Terms**—Deep models, differential privacy, industrial IoT(IIoT), privacy disclosure, privacy metrics.

finally achieve the upgrading of traditional industry [12], [13]. In addition, a large number of industrial data are analyzed by cloud computing mode, so IIoT is essentially machine to machine (M2M) support that extends to the cloud and edge [14].

Rapid development brings unexpected problems. Under the background of increasing application types, how to protect industrial individual privacy has become an important topic in IIoT [15]–[17]. In current research, various privacy protection methods have been applied to IIoT technologies, and it has witnessed some effective algorithms [18]–[20]. Among existing technologies, differential privacy has been identified as the most attractive, especially in the process of individual data publishing for the group network. For IIoT, the application of differential privacy is still in its infancy and trial stage, but this topic is very valuable and there are also preliminary research results to be summarized and compared [21].

[cs.CR] 27 May 2021

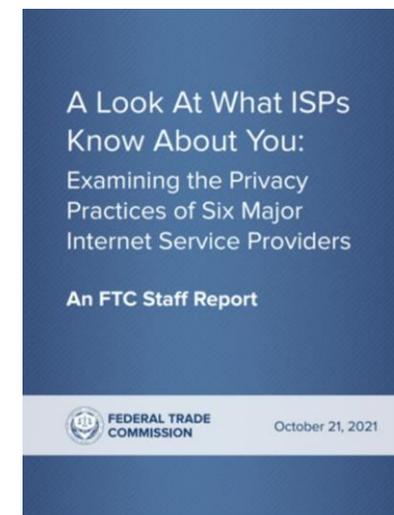
Source: <https://arxiv.org/abs/2101.10569>

**“Differential privacy is the technology that enables researchers and database analysts to avail a facility in obtaining the useful information from the databases, containing people's personal information, without divulging the personal identification about individuals.”**

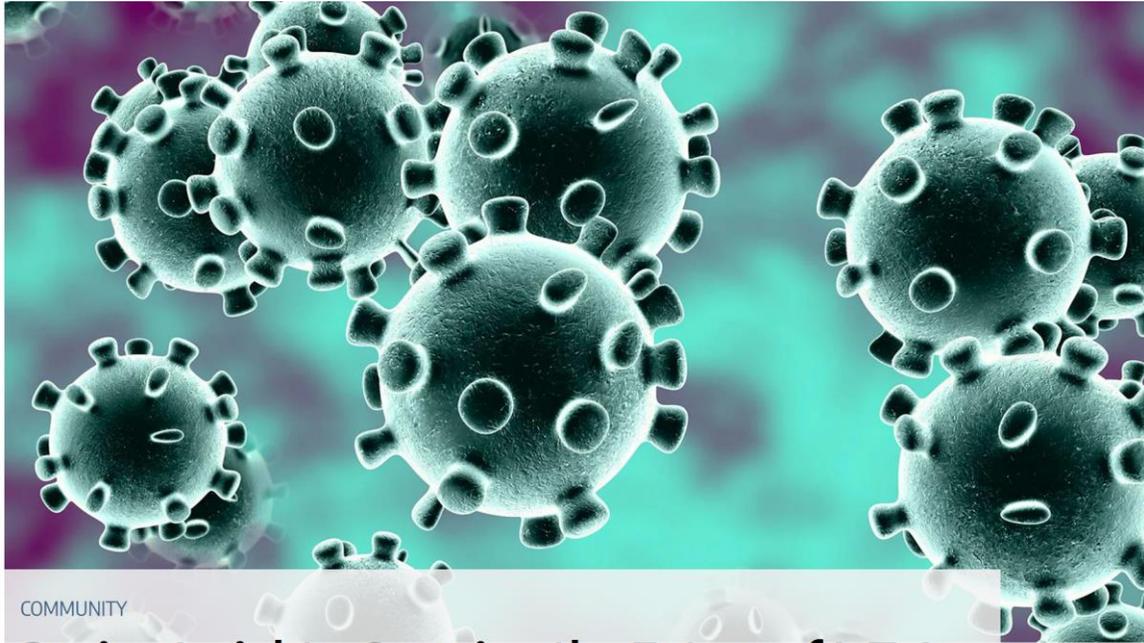
Source: Neelam Tyagi, “What is Differential Privacy and How does it Work?” Analytics Steps, May 17, 2021 <https://www.analyticssteps.com/blogs/what-differential-privacy-and-how-does-it-work>

*“Differential privacy has emerged as the de facto gold standard in protecting the privacy of individuals when processing sensitive data, because of its powerful formal guarantees. Several companies, including Google, Apple, Microsoft, have deployed differentially private tools, but barriers remain between such systems and full-featured privacy-preserving data analytics.”*

Source: Wanrong Zhang, “Privacy-preserving Statistical Tools: Differential Privacy and Beyond,” Dissertation in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the Georgia Tech College of Engineering H. Milton Stewart School of Industrial and Systems Engineering (ISyE), May 2021 <https://smartech.gatech.edu/handle/1853/64789>



Source (74 pages): <https://www.ftc.gov/news-events/press-releases/2021/10/ftc-staff-report-finds-many-internet-service-providers-collect>



COMMUNITY

## Design Insights: Securing the Future of IoT; In Search of Security, Reliability

June 10, 2021

A review of the day's top trending stories from Machine Design editors.

Bob Vavra

Source: <https://www.machinedesign.com/community/article/21166697/design-insights-securing-the-future-of-iot-in-search-of-security-reliability>

*There were two key themes [in the KPMG March 2021 Outlook Survey], according to Brian Heckler, national industrial manufacturing sector leader at KPMG U.S.*

*“The first is digital business—digital customer engagement, digital ways of collaborating and working within the workforce, and all the knock-on implications of that,” he said.*

*“The second is **reliability**—reliability of your workforce to be able to be safe, reliability of your supply chain to be able to deliver what you need when you need it, and **the reliability of your systems and processes** to be safe for your customer and for your people.”*

## Resilience in IoT Networks

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Deadline for manuscript  
submissions:  
**10 November 2021**



mdpi.com/si/80640

[https://www.mdpi.com/journal/electronics/special\\_issues/Resilience\\_IoT\\_Networks](https://www.mdpi.com/journal/electronics/special_issues/Resilience_IoT_Networks)

Special Issue

## Message from the Guest Editors

In this Special Issue, we focus on the resilience of IoT systems. Resilience can be defined as the ability of certain systems to recover and continue to function after being affected by an unexpected event. In IoT, resilience involves not only networking aspects but also the applications that facilitate deployment of the offered services.

We invite submissions related to resilient IoT solutions, including but not limited to:

- Reconfigurable sensor networks
- Opportunistic networks (OppNets)
- Delay Tolerant Networks (DTN)
- IoT based on OppNets and DTN
- Resilient in long-range and short-range topologies
- Security issues in IoT
- IoT without Internet
- Hybrid IoT infrastructures
- Smart vehicular networks supporting IoT
- Simulation and modeling IoT protocols
- Smart devices and services
- Novel wireless standards (LoRa, SigFox, etc.)
- Intelligent routing for IoT
- Green computing
- Fog computing
- Smart collaboration for IoT
- Autonomic computing for smart cities

***“Resilience can be defined as the ability of certain systems to recover and continue to function after being affected by an unexpected event. In IoT, resilience involves not only networking aspects but also the applications that facilitate deployment of the offered services.”***

## A Survey on Resilience in the IoT: Taxonomy, Classification and Discussion of Resilience Mechanisms

CHRISTIAN BERGER\*, University of Passau  
PHILIPP EICHHAMMER, University of Passau  
HANS P. REISER, University of Passau  
JÖRG DOMASCHKA, Ulm University  
FRANZ J. HAUCK, Ulm University  
GERHARD HABIGER, Ulm University

Internet-of-Things (IoT) ecosystems tend to grow both in scale and complexity as they consist of a variety of heterogeneous devices, which span over multiple architectural IoT layers (e.g., cloud, edge, sensors). Further, IoT systems increasingly demand the resilient operability of services as they become part of critical infrastructures. This leads to a broad variety of research works that aim to increase the resilience of these systems. In this paper, we create a systematization of knowledge about existing scientific efforts of making IoT systems resilient. In particular, we first discuss the taxonomy and classification of resilience and resilience mechanisms and subsequently survey state-of-the-art resilience mechanisms that have been proposed by research work and are applicable to IoT. As part of the survey, we also discuss questions that focus on the practical aspects of resilience, e.g., which constraints resilience mechanisms impose on developers when designing resilient systems by incorporating a specific mechanism into IoT systems.

[cs.DC] 6 Sep 2021

**The need for  
“Organizational  
Plasticity”**

Source:

[https://www.mdpi.com/journal/electronics/special\\_issues/Resilience\\_IoT\\_Networks](https://www.mdpi.com/journal/electronics/special_issues/Resilience_IoT_Networks)

Source: <https://www.semanticscholar.org/paper/A-Survey-on-Resilience-in-the-IoT%3A-Taxonomy%2C-and-of-Berger-Eichhammer/f1dcb4907dad375bcf35db1c1a8f0cf63f59dfaf>

***“A comprehensive IoT architecture should not only assume that IoT devices, systems, networks, etc. will be attacked, but also that their security measures will be defeated.”***

Source: Louchez and Rosner, “Internet of Things Security – The Case for Systemic Resilience,” Fierce Electronics, April 14, 20216 <https://www.fierceelectronics.com/iot-wireless/internet-things-security-case-for-systemic-resilience>

**OT for Resilience and Resilience for OT**

FEBRUARY 23, 2021 | ROBERT BERGMAN

Source: <https://bedrockautomation.com/ot-for-resilience-and-resilience-for-ot/>

# 2021 IoT and Manufacturing

**AI, ML and IIoT**

# Definitions

AI, or artificial intelligence, is the advanced intelligence engine that allows autonomous or semi-autonomous actions by the equipment itself.

Source: <https://www.machinemetrics.com/blog/digital-transformation-in-manufacturing>

“According to Andrew Moore, Former-Dean of the School of Computer Science at Carnegie Mellon University, **Artificial intelligence (AI)** is the science and engineering of making computers behave in ways that, until recently, we thought required human intelligence.”

**Machine learning (ML)** is a branch of artificial intelligence, and as defined by Computer Scientist and machine learning pioneer Tom M. Mitchell: “Machine learning is the study of computer algorithms that allow computer programs to automatically improve through experience.”

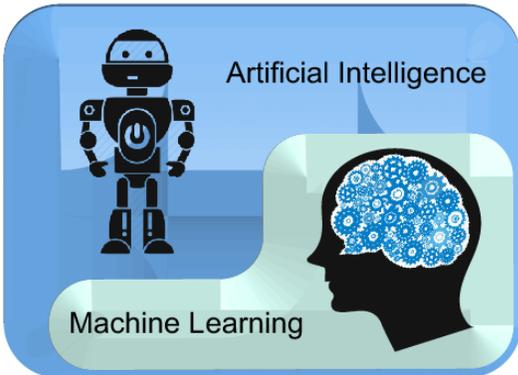


Image Source: <https://www.javatpoint.com/difference-between-artificial-intelligence-and-machine-learning>

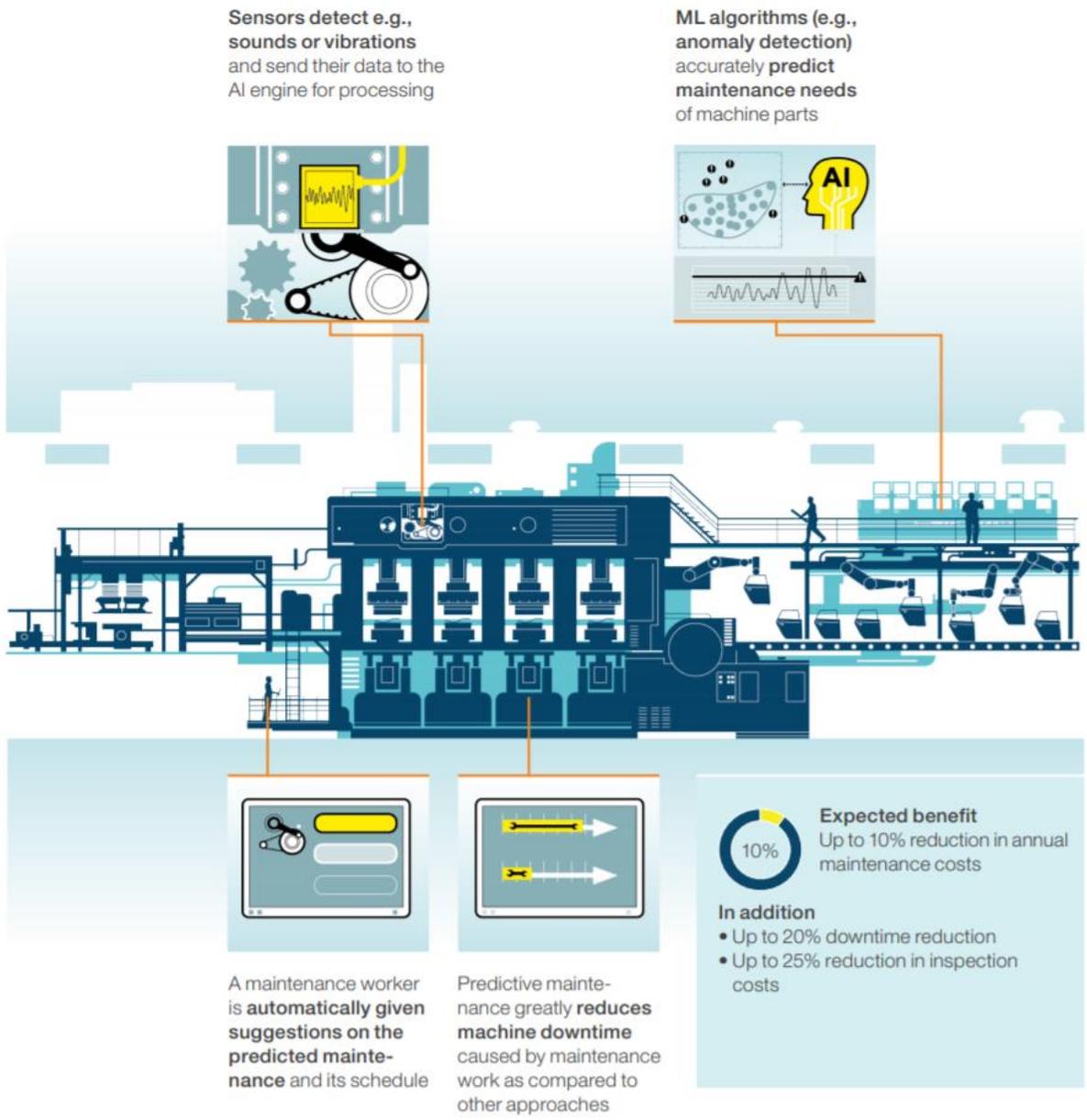
**Supervised learning** algorithms try to model relationship and dependencies between the target prediction output and the input features, such that we can predict the output values for new data based on those relationships, which it has learned from previous datasets.

**Unsupervised learning**, another type of machine learning, is the family of machine learning algorithms, which have main uses in pattern detection and descriptive modeling. These algorithms do not have output categories or labels on the data (the model trains with unlabeled data).

**Reinforcement learning**, the third popular type of machine learning, aims at using observations gathered from the interaction with its environment to take actions that would maximize the reward or minimize the risk.”

Source: Roberto Oriondo, “Machine Learning (ML) vs. Artificial Intelligence (AI) — Crucial Differences - Unfortunately, some tech organizations are deceiving customers by proclaiming to use machine learning (ML) and artificial intelligence (AI) on their technologies while not being clear about their products’ limits,” Medium October 15, 2018, last updated January 28, 2021 <https://pub.towardsai.net/differences-between-ai-and-machine-learning-and-why-it-matters-1255b182fc6>

Below graphics in [McKinsey's study Smartening up with Artificial Intelligence \(AI\) – What's in it for Germany and its Industrial Sector?](#)



MANUFACTURING

# Add AI into the IIoT mix to smarten up manufacturing ops

IIoT could generate US\$4-US\$11 trillion n economic value by 2025.

13 May 2021 | 8 Shares

Source: Joe Devanesan <https://techhq.com/2021/05/adding-ai-in-industrial-internet-of-things-iiot-for-more-intelligence/>

***“The key to getting more value from industrial internet of things (IIoT) and IIoT platforms is getting AI and machine learning (ML) workloads right. Despite the massive amount of IIoT data captured, organizations are falling short of their enterprise performance management goals because AI and ML aren't scaling for the real-time challenges organizations face.”***

Source: Louis Columbus, “Realizing IIoT’s potential with AI and machine learning,” VentureBeat, August 14, 2021 <https://venturebeat.com/2021/08/14/realizing-iots-potential-with-ai-and-machine-learning/>

Above: Using IIoT sensors to monitor stock and vibration of production equipment is a leading use case that combines real-time monitoring and ML algorithms to extend the useful life of machinery while ensuring maintenance schedules are accurate. (McKinsey)

## AIoT & how COVID is impacting adoption of industrial IoT technologies...

02 JUNE 2021

Author : Mark Gradwell | Editor | EPDT



AIoT & how COVID is impacting adoption of industrial IoT technologies

*“The infusion of AI in IoT systems can deliver the promise of predictive maintenance, rather than just condition monitoring, helping save organizations millions of pounds in support and maintenance of equipment.”*

Source: Mark Gradwell, “AIoT & how COVID is impacting adoption of industrial IoT technologies...” June 2, 2021 Electronic Product Design and Test, <https://www.epdtonthenet.net/article/185727/AIoT-how-COVID-is-impacting-adoption-of-industrial-IoT-technologies-.aspx#>

# **2021 IoT and Manufacturing**

**The continuing search for  
skills and talent**

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LATEST NEWS / Saudi Arabia Arab coalition destroys Houthi drone launched toward southwestern Saudi Arabia

Home / Japan to have shortage of 270,000 AI and IoT engineers by 2030

# Japan to have shortage of 270,000 AI and IoT engineers by 2030



While Japan has the fourth highest number of engineers in the world, it has a shortage of those specializing in cutting-edge technologies. (Shutterstock)

Source: Arab News [Saudi Arabia], "Japan to have shortage of 270,000 AI and IoT engineers by 2030," October 2, 2021

<https://www.arabnews.com/node/1940291/business-economy>

# Serious Talent Supply Shortage Deepens in Software Product Engineering, the Fastest Growing Segment of \$1.27 Trillion Global Engineering Spend--Everest Group

By Everest Group Oct 14, 2021 Updated Oct 14, 2021

DALLAS, Oct. 14, 2021 /PRNewswire-PRWeb/ -- Everest Group reports that although a shortage of talent exists across the overall engineering, research and development (ER&D) landscape, **the supply crunch is much more pronounced for emerging skills, such as cloud engineering, artificial intelligence and machine learning (AI/ML), internet of things (IoT), analytics, cybersecurity, and augmented reality and virtual reality (AR/VR).** According to Everest Group, the exponential growth in the adoption of these next-generation technologies **over the next couple of years** will cause a huge supply shortage in the software engineering world.

Source: Everest Group press release

[https://www.wfmz.com/news/pr\\_newswire/pr\\_newswire\\_technology/serious-talent-supply-shortage-deepens-in-software-product-engineering-the-fastest-growing-segment-of-1/article\\_c12b9bd1-cdfb-547c-9c98-e08c1df5512a.html](https://www.wfmz.com/news/pr_newswire/pr_newswire_technology/serious-talent-supply-shortage-deepens-in-software-product-engineering-the-fastest-growing-segment-of-1/article_c12b9bd1-cdfb-547c-9c98-e08c1df5512a.html)

# American factories are desperate for workers. It's a \$1 trillion problem



By [Matt Egan](#), [CNN Business](#)

Updated 3:31 PM ET, Tue May 4, 2021

“Even though US manufacturing activity surged to a 37-year high in March, the industry has more than half a million job openings. Factories are struggling to find skilled workers for specialized roles such as welders and machinists. Manufacturers are even having trouble hiring entry-level positions that do not require expertise. The talent shortage is not new — but it's getting worse and could have far-reaching consequences beyond the manufacturing industry itself. As many as 2.1 million manufacturing jobs will be unfilled through 2030, according to a study published Tuesday [May 4, 2021] by Deloitte and The Manufacturing Institute.”

Source: <https://www.cnn.com/2021/05/04/economy/manufacturing-jobs-economy/index.html>

## Sourcing skills for next-gen factories

10 August 2021



[Vision Yearbook 2](#)  
[skills gap](#)

“As the economic upturn gains momentum in the mechanical and plant engineering sector, companies are increasingly faced with a shortage of skilled personnel.”

Manufacturing firms must help inspire young engineers as production plants embrace digital technologies, [Matthew Dale](#) finds

Source: Matthew Dale, “Sourcing skills for next-gen factories,” IMV Europe, August 10, 2021

<https://www.imveurope.com/feature/sourcing-skills-next-gen-factories>

## What is an IoT Engineer?

“While an **IoT ENGINEER** doesn't have to be an expert in every part of the stack [front-end/back-end development], they need to at least be fluent in all of them. In general, an IoT engineer has deep expertise in one or two subdomains and basic competency in the others. The subdomains include: Mechanical Engineering; Electrical Engineering; Firmware Engineering; Software Engineering (embedded, cloud, mobile, etc.); Data Science; and UX Design”

Source: Jeff McGehee, “What is an IoT Engineer,” Very Possible, January 26, 2021

<https://www.verypossible.com/insights/what-is-an-iot-engineer>

## The Manufacturing Skills Gap: What Is It?

And how do we solve it?

“Companies need workers who understand robotics, the Internet of Things (IoT), artificial intelligence, and analytics.”

Aug 25th, 2021 | By Propel PLM

Needed Skill Sets

- **Manufacturing Experience/Know-How:** Previous work experience in the field or in a related area where skills are transferable
- **Physical Know-How:** Physical experience with manufacturing tools, such as welding and machining
- **Digital Fluency:** Having the aptitude for interpreting and using digital information
- **Programming:** Proficiency with computer programming languages and debugging tasks
- **Problem Solving/Troubleshooting:** The ability to process problems and find solutions
- **Big Data Analytics:** Understanding how to use advanced analytical techniques with large data sets
- **Soft Skills:** Consists of core or common skills, such as work ethic, communication, adaptability, teamwork, and leadership

Source: <https://www.manufacturing.net/labor/article/21627393/the-manufacturing-skills-gap-what-is-it>

# 3 Ways Digital Technology Can Overcome Staffing Shortages

“Implementing Industrial Internet of Things (IIoT) technologies to monitor equipment and processes can reduce the need for human oversight”

Shannon Gabriel · Jun 03, 2021

Source: <https://www.seifert.com/3-ways-digital-technology-can-overcome-staffing-shortages>

## Using IIoT to Help Solve Worker Shortage Challenges

July 26, 2021

Source: Ryan Carr, Industry Today <https://industrytoday.com/using-iiot-to-help-solve-worker-shortage-challenges/>

## Can Augmented Reality Finally Solve the Industrial Skills Gap?

Written By: [Brant Henne](#)

5/27/2021 · Read Time : 3 min

Source: <https://www.ptc.com/en/blogs/ar/can-augmented-reality-solve-industrial-skills-gap>

## Is digital transformation really the key to solving the talent shortage in manufacturing?

Submitted by [Jason Chester](#) on Tue, 09/14/2021 - 12:23

“Organizations that lead the way in digital transformation will be poised to position themselves as high-tech organizations filled with enticing career opportunities”

Source: <https://www.smartindustry.com/blog/smart-industry-connect/is-digital-transformation-the-key-to-solving-the-talent-shortage/>

# Industrial IoT Solutions To Manufacturing Labor Shortage Problems



Source: Swift Sensors <https://www.swiftsensors.com/industrial-iiot-solutions-to-manufacturing-labor-shortage-problems/>

*“Consistent with the Peter Principle, we find that promotion decisions place more weight on current performance than would be justified if firms only tried to promote the best potential managers. **The most productive worker is not always the best candidate for manager**, and yet firms are significantly more likely to promote top frontline sales workers into managerial positions.”*

Source: Alan Benson, Danielle Li, and Kelly Shue, “Promotions and the Peter Principle,” National Bureau of Economic Research (NBER), February 2018  
[https://www.nber.org/system/files/working\\_papers/w24343/w24343.pdf](https://www.nber.org/system/files/working_papers/w24343/w24343.pdf) [research used detailed microdata on sales workers in US firms]

*The Peter Principle: “In a hierarchy, employees tend to rise to their level of incompetence.”*

## Is Your C-Suite Equipped to Lead a Digital Transformation?

by J. Yo-Jud Cheng, Cassandra Frangos, and Boris Groysberg

March 12, 2021

*“But to truly succeed transformation also needs to happen at the very top – with the individuals who set strategy and allocate resources. . . Based on our study of search specs, most companies focused on just a subset of job roles in their digital transformation efforts, indicating that many had not been taking a broad enough approach in revamping their talent strategy. Successfully navigating this digital acceleration requires a shift and expansion of responsibilities across all roles throughout the organization. . . This dramatic shift in job responsibilities is creating **a skills gap in many companies’ leadership pipelines** that necessitates major changes to talent strategy. To find the right candidates, companies may need to rethink traditional promotion pathways.”*

Source: J. Yo-Jud Cheng, Cassandra Frangos, and Boris Groysberg, “Is Your C-Suite Equipped to Lead a Digital Transformation?” Harvard Business Review, March 12, 2021 <https://hbr.org/2021/03/is-your-c-suite-equipped-to-lead-a-digital-transformation>

# 2021 IoT and Manufacturing

**And now what?**

# 10 benefits of IIoT deployment:

1. **Production System Awareness and Monitoring:** At the core of IIoT solutions is constant communication between systems and machines, which ensures throughput is optimized and machine defects are identified in real-time.

2. **Manufacturing Process Optimization:** Machines and equipment enabled with sensors and managed with IIoT systems can monitor conditions, equipment and workflows—like machine performance, assembly line management, supply chain optimization, workforce safety or quality assurance processes—for optimization.

3. **Predictive Maintenance:** More than 75% of equipment and system failures occur without notice. With IIoT, preventative maintenance incorporates analytics to predict machine failures.

4. **Optimizes Quality:** It can address problems on the production line immediately and reduce downtime, lost productivity and product defects. IIoT equipment is programmed to monitor the quality of materials, analyze equipment performance in real-time, and measure and test finished products.

5. **Inventory and Supply Chain Management:** Data, analytics, insights and contextual intelligence makes inventory systems run seamlessly, which gives more accurate estimates of available material, the work-in-progress and the estimated arrival time of new materials—which helps optimize the supply chain and cuts costs.

6. **Customer Service Levels and Satisfaction:** Sensor-equipped production systems and inventory make it possible for customers to stay apprised of the progress of their orders in near real-time. Sensors offer insights about customer usage that can help manufacturers improve features, alert customers to problems and bottlenecks, and competitively differentiate their business.

7. **Worker Safety and Health:** Intelligent wearables allow managers to monitor the health and safety of production workers by tracking histories for illness and injury, absences, near-misses, machinery or vehicle accidents or life-threatening events such as gas leaks.

8. **Energy Management and Sustainability:** Industrial manufacturing is responsible for consuming 54% of the world's electricity. Manufacturers that use IIoT can significantly increase energy efficiency by optimizing energy consumption.

9. **Service Provisioning and Orchestration:** Field services delivery enabled by IIoT is a value-based approach based on factors provided, such as the timing, context and technical personnel involvement for a given service activity.

10. **Service Contract Compliance and Performance:** IIoT enables data visibility in real-time so both the Original Equipment Manufacturer (OEM) and the user are aware of the risks and issues as they arise.

# Six Digital Trends for Manufacturing

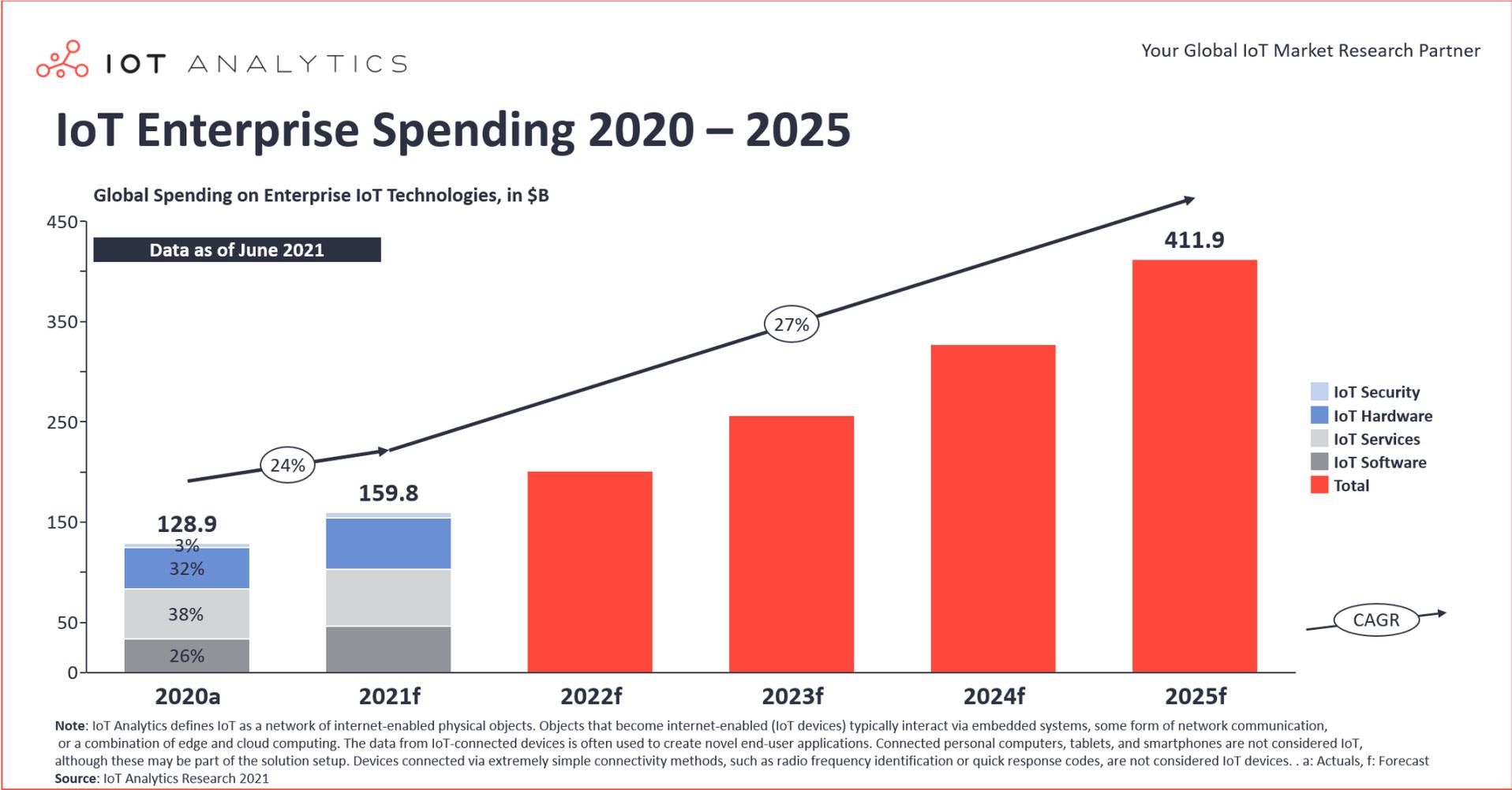
1. **The Internet Of Things Will Become More Prevalent.** More control over manufacturing automation enables you to make the whole manufacturing process safer, quicker, and more cost effective. Monitoring equipment from wherever you are offers a key safety benefit.
2. **Workplace safety.** Obviously workplace safety has always been important, but in light of the pandemic it has taken on even more significance. 'Now there's more to do to keep your staff safe, such as sanitization, social distancing, and so on' says writer Annalise Harmon from Elite Assignment Help. "Employers are now using new technology to help facilitate these new measures."
3. **Changing To B2C.** A lot of manufacturers are moving from a B2B model to a B2C model because new digital trends make it easier to work within this model. Potential advantages include a faster time-to-market timeline and better pricing control.
4. **Changes To ERP Systems.** Enterprise Resource Planning systems have been around for a while, but there have been major changes to them thanks to the pandemic. 'You'll see other systems being overlaid onto existing ERPs, so they don't have to do everything' says journalist Chris Winstone from Revieweal. "These are referred to as Power Apps, and they can do everything from track employee safety to creating back-to-work systems."
5. **3D Printing Makes Production Faster And Cheaper.** In recent years 3D printing has been becoming more and more of a fixture in manufacturing. In addition to producing prototypes, it's also become a good method for tooling - improving speed and cost controls.
6. **Remote Servicing Is Possible** Through VR And AR. Earlier we touched on how more work is being done remotely, in order to ensure staff safety. One way they've been doing this is through virtual reality and augmented reality. A manufacturer can send a customer a VR and AR enabled device that enables them to do some basic troubleshooting on their product. It can help you walk customers through the steps - making customer service safer and easier.

*“When the speakers asked the folks in attendance (at the August 26, 2021 [KORE webinar](#) on “Industrial IoT: Inside, Outside and On the Road,”) what the main things driving them to adopt IIoT solutions might be, the results were exciting telling: The most significant share was that **a third of all respondents said they were looking into IIoT to create new business opportunities and profit centers. This is a clear sign that the marketplace is only just beginning to explode, I think.**”*

“Also, it indicates that the IoT pros out there know that there is a lot to be found and still to be capitalized upon in IIoT implementation. There’s no surprise that the following three biggest categories, improved **operational efficiency, increased productivity, and decreased downtime**, combined for 57 percent of all responses, with efficiency making up almost half of those. These have been the mainstays for IIoT implementation since it began and remain some of the most important advantages for companies getting into the industry. The poll’s final option was to maximize the utilization of existing assets, and the 10 percent of the audience looking for that are in the right place and are likely also in the camp with folks looking into improved operational efficiency and new business opportunities.”

Source: Ken Briodagh, “The Digital Transformation of IoT and Manufacturing,” IoT for All, October 13, 2021 <https://www.iotforall.com/digital-transformation-of-iiot-and-manufacturing>

# “IoT remains a high-growth market with opportunities across the entire technology stack.”



Source: Philip Wegner, “Global IoT spending to grow 24% in 2021, led by investments in IoT software and IoT security,” IoT Analytics, June 16, 2021 <https://iot-analytics.com/2021-global-iot-spending-grow-24-percent/>



Source (48 pages): <https://op.europa.eu/en/publication-detail/-/publication/468a892a-5097-11eb-b59f-01aa75ed71a1/>

## “What is Industry 5.0?”

Industry 5.0 provides a vision of industry that aims beyond efficiency and productivity as the sole goals, and reinforces the role and the contribution of industry to society. It places the wellbeing of the worker at the center of the production process and uses new technologies to provide prosperity beyond jobs and growth while respecting the production limits of the planet. It complements the existing "Industry 4.0" approach by specifically putting research and innovation at the service of the transition to a **sustainable, human-centric and resilient** European industry.”

Source: European Union, January 7, 2021 [https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/industry-50\\_en](https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/industry-50_en)

## Simplify Manufacturer's Lives With Industry 5.0

POSTED 07/14/2021



“This desire for **mass personalization** forms the psychological and cultural driver behind Industry 5.0, which involves using technology to return value added by humans to manufacturing” – Esben H. Ostergaard, Founder of Universal Robotics

Source: Association for Advancing Automation (A3), July 14, 2021 <https://www.automate.org/news/simplify-manufacturers-lives-with-industry-5-0>

Jul 13, 2021, 08:10am EDT | 1,749 views

## How Industry 5.0 Will Transform Process Manufacturing As We Know It



Andreas Eschbach Forbes Councils Member  
Forbes Technology Council COUNCIL POST | Membership (Fee-based)  
Innovation

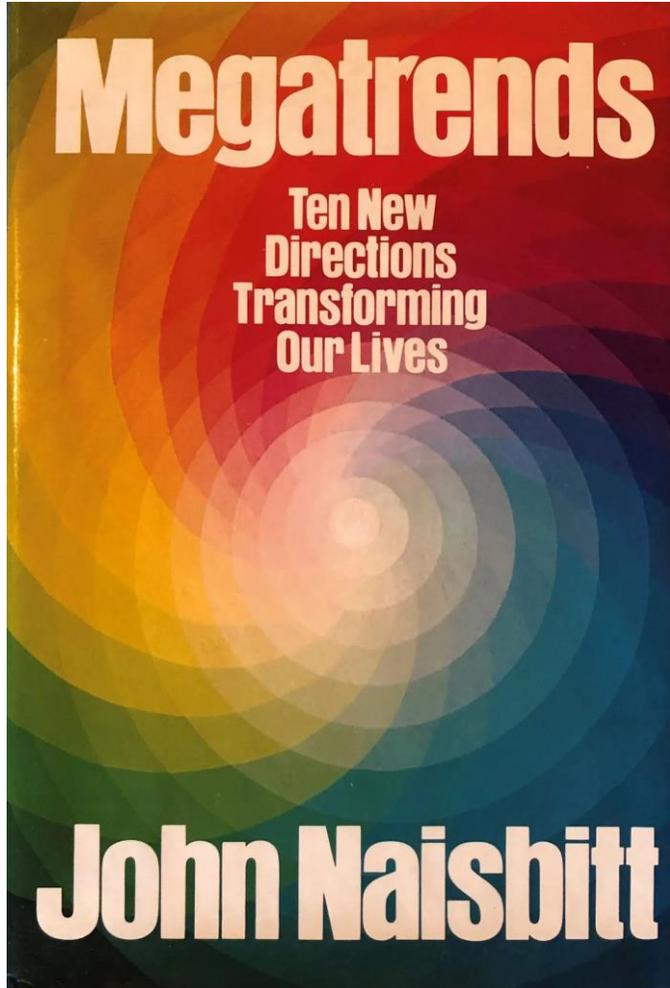
Source: Andreas Eschach, “how Industry 5.0 Will Transform Process Manufacturing As We Know It,” Forbes, July 13, 2021 <https://www.forbes.com/sites/forbestechcouncil/2021/07/13/how-industry-50-will-transform-process-manufacturing-as-we-know-it/?sh=3d8062642ad4>

See also: Peggy Smedley, “The Rise of Industry 5.0,” Connected World Blog, October 27, 2021 <https://connectedworld.com/the-rise-of-industry-5-0/>

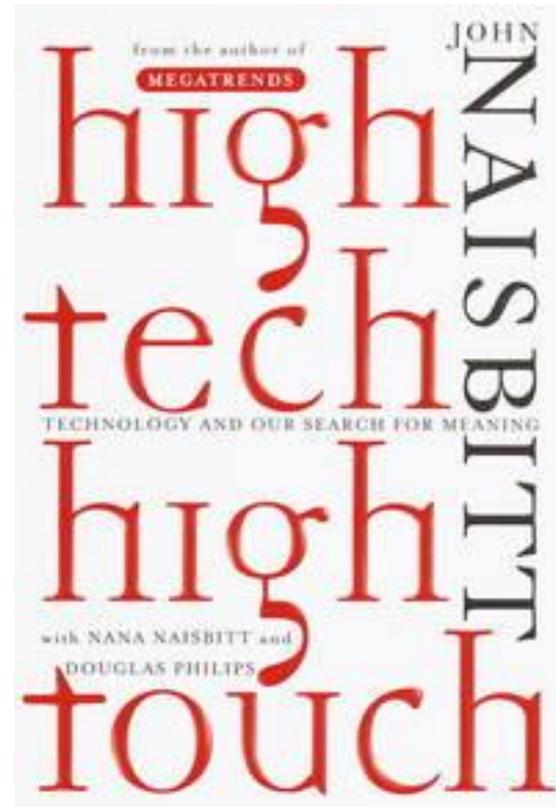
## “Industry 5.0 Enhances The Human Factor

The next step in the evolution of manufacturing processes is the notion of a machine-assisted human. This will involve today’s industrial IoT as well as the nascent industrial AI /.../ Industry 5.0 will deliver the recognition and acceptance that is needed to combine the speed and accuracy of technology with the creative and cognitive skills of people.” Andreas Eschbach

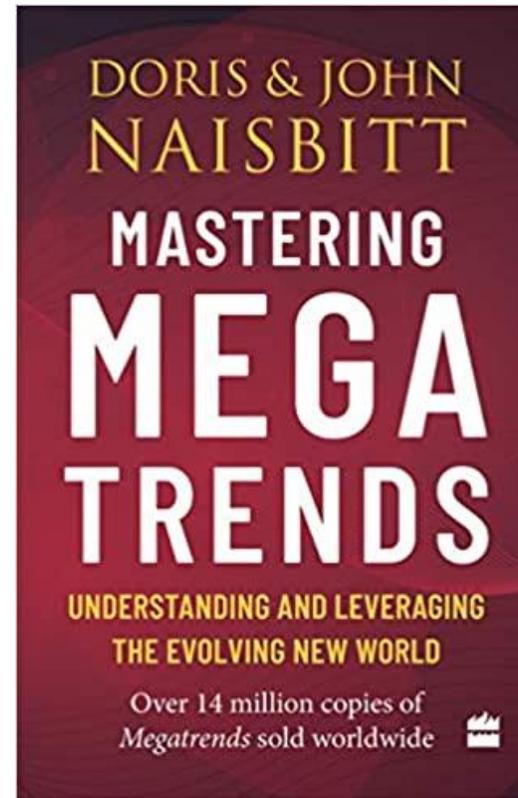
***“Trends, like horses, are easier to ride in the direction they are going.”***



1982



1999



2017



John Naisbitt (January 15, 1929 – April 8, 2021)

# Thank You!

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