The Industrial Internet of Things in 2021 – A Manufacturing Perspective

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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.”


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


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

“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**.”


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.

“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.”

“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.”
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Definitions
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.”

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*Nikola Tesla (*)


“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.”
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.

Source: https://www.iiconsortium.org/pdf/Vocabulary-Report-2.3.pdf
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](https://www.isye.gatech.edu/news-events/events/calendar/day/11284)
IoT Bi-directional Impact

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.)

Manufacturing x.0

Society x.0

Source: Alain Louchez, “The Internet of Things and the Future of Manufacturing,” Presentation at the Georgia Tech Manufacturing Institute (GTMI), September 30, 2013
**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.


“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/)
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Supply Chain Strains
“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

“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.”

“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
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.”

“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
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.

“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.”

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

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 . . .”


“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.”


“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.”

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Coding made easy
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

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)

- What percentage of your software solutions created using low-code are incorporating technologies like AI, big data, and IoT: 59%
- On average, what percentage of your projects using low-code are a collaboration between IT and business groups: 59%
- How much has shadow IT been reduced due to low-code: 56%
- What percentage of solutions you are developing with low-code could not have been delivered in an acceptable timeframe without it: 56%

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%.

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Chips with increasing capabilities
“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.”


“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

“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/
Here's what 4.5 megabytes of data in 62,500 punched cards looked like in 1955.

“New technologies—from artificial intelligence and virtual reality to a proliferation of Internet of Things devices and self-driving cars—will demand better chips.”

“The industry will continue to shrink electronic devices of all types because they are critical to so many aspects of our future smart Cloud-enabled Internet of Things (IoT)-oriented society.”
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Industrial Internet Consortium Defines Trustworthiness for Cyber-Physical Systems

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


BOSTON, MA – JULY 15, 2021 – The Industrial Internet Consortium® (IIC™) today published IIoT Trustworthiness Framework Foundations. This foundational report defines the concepts and characteristics of trustworthiness, and highlights the need for a common understanding of the threats that can impact trustworthiness. The report also provides a framework for addressing trustworthiness in IIoT systems and applications.

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

Figure 0-1: Trustworthiness characteristics and threats

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/

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.”

“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.”
“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.

https://securityboulevard.com/2021/10/the-federal-government-needs-to-address-ot-iot-security-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.”


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 a 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) 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]–[29]. 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].


“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.”


“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: https://arxiv.org/abs/2101.10569

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 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 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.”
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AI, ML and IIoT
“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.”

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
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)

MANUFACTURING

Add AI into the IIoT mix to smarten up manufacturing ops

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

13 May 2021 | 8 Shares


“The key to getting more value from industrial internet of things (IIoT) and IoT platforms is getting AI and machine learning (ML) workloads right. Despite the massive amount of IoT 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.”

“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.”

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The continuing search for skills and talent
Japan to have shortage of 270,000 AI and IoT engineers by 2030

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

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

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.


Sourcing skills for next-gen factories

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.


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

The Manufacturing Skills Gap: What Is It?

And how do we solve it?

Aug 25th, 2021 | By Propel PLM

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

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

Using IIoT to Help Solve Worker Shortage Challenges


Can Augmented Reality Finally Solve the Industrial Skills Gap?

Written By: Brant Henne
Source: https://www.ptc.com/en/blogs/ar/can-augmented-reality-solve-industrial-skills-gap

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


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/
“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.”


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

“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.”

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And now what?
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.

Source: Emily Henry, “6 Digital Trends Impacting Manufacturing - With the move towards Industry 5.0, here are some of the top digital trends to consider,” Manufacturing.net, October 25, 2021 https://www.manufacturing.net/technology/blog/21796402/6-digital-trends-impacting-manufacturing
“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.”

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

“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.”


“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.”


“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


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