FROM SCADA TO SMART FACTORY

INTEGRATION LEGACY OT WITH MODERN IT SYSTEMS

Technology Research Report

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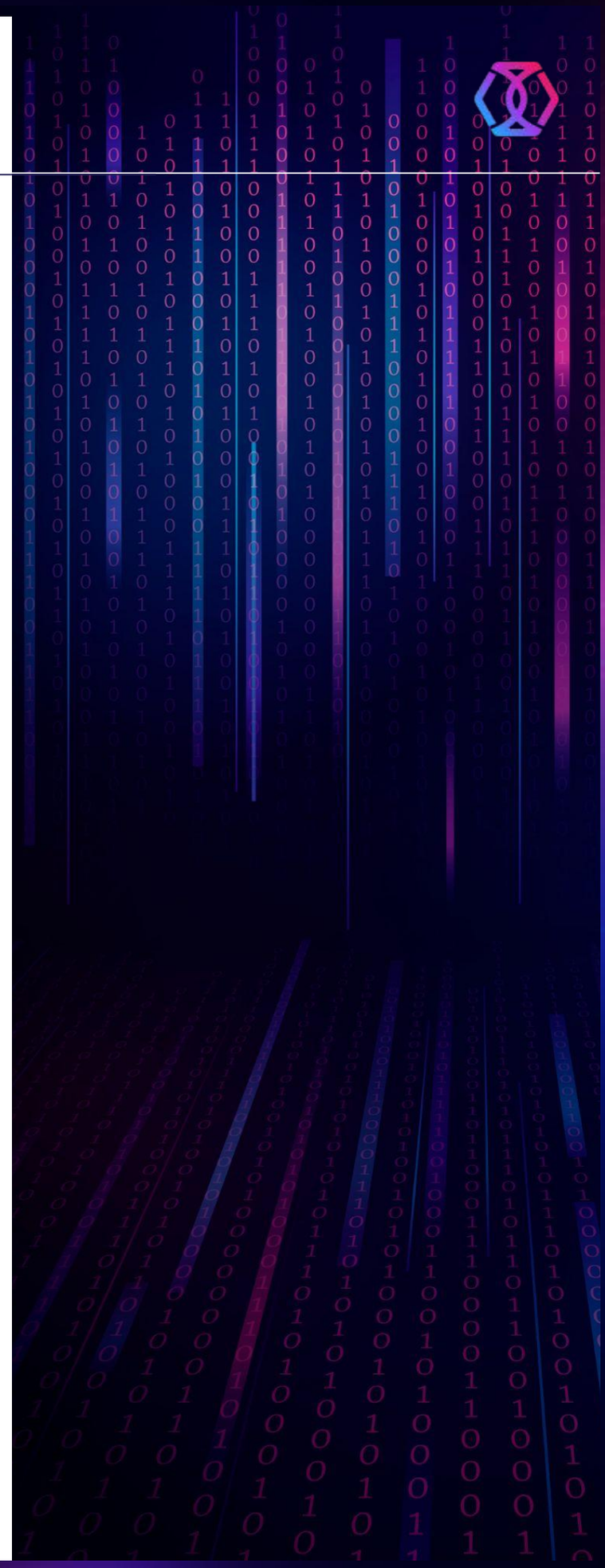
EXECUTIVE SUMMARY

In 2026, the shift from traditional Supervisory Control and Data Acquisition (SCADA) systems to fully integrated smart factories marks a major leap towards Industry 4.0 and beyond. The legacy Operational Technology (OT) infrastructures that were once the backbone of industrial operations are now struggling to keep up with the demands of modern Information Technology (IT), such as cloud computing, AI-driven analytics, and the Industrial Internet of Things (IIoT). Industry insiders are highlighting that over 70% of US manufacturers are fast-tracking their digital transformation efforts, with smart factory investments projected to reach a staggering USD 160 billion by 2030, all driven by the desperate need for higher efficiency and resilience.

This research paper takes a closer look at the practical ways of integrating legacy OT with modern IT systems. This paper explores key challenges such as cybersecurity risks and the complexity of achieving interoperability between disparate systems, and some emerging technologies like edge computing and digital twins — the paper also examines strategies tailored for specific sectors like automotive, aerospace, and discrete manufacturing. By examining real-world examples, potential return on investment, and U.S.-specific regulatory considerations, such as NIST frameworks, this paper will give decision-makers the tools to make real progress on achieving 20-30% operational gains, while minimizing downtime and associated risks. And by achieving successful OT/IT convergence, US manufacturers will build agile, intelligent factories that can thrive in a world where technology is changing faster than ever before.

THE EVOLUTION FROM SCADA TO SMART FACTORIES



- SCADA systems were introduced in the 1960s in the 1960s as a way to monitor and control industrial processes in one central spot, replacing manual operations with automated
- By the time Industry 3.0 rolled around, we had all these new technologies, such as PLCs, CAD systems, and CNC, that emerged to advance computer-integrated manufacturing (CIM), and at the heart of all that was SCADA.
- The shift to Industry 4.0 has us looking at cyber — physical systems that keep tabs on physical processes in smart factories built in modular sections, in other words, transforming SCADA-based shop floors into intelligent data-driven environments.
- This transition is being accelerated by the merging of Operational Technology (OT), like old SCADA, with all the IT bits like cloud computing and AI, giving us real-time analytics and predictive maintenance.
- Building smart factories usually involves applying an IT integration layer on top of existing SCADA without having to rip the whole thing out.
- Digital twins and self-teaching robots are popping up all over the place — it's a sign that we've finally reached a tipping point when it comes to industrial automation, and were leaving SCADA clearly outdated.
- Ultimately, all this is going to give US manufacturing the edge it needs to stay competitive as the world economy shifts and shakes.

CHALLENGES IN INTEGRATING LEGACY OT WITH MODERN IT

- The IT/OT stack can really get in the way of digital transformation efforts, especially when the two are operating in silos and don't have a clear plan in place for deployment and adoption.
- There are a lot of structural and cultural obstacles that stand in the way of IT/OT convergence — lack of joint governance being a big one, and not to mention a shortage of people with the right skills to do the job properly.
- The 'tech debt' that comes with legacy systems is basically eating up to 80% of IT budgets, which is just killing innovation and driving costs up in manufacturing environments.
- Companies face a bit of a dilemma when it comes to modernizing — do they update their tech first, or try to sort out their operations? Either way, it often leads to stalled transformations and a lot of frustration.
- There are two big factors holding back the adoption of new technologies alongside legacy OT processes — skills gaps and resistance to change.
- As it is, the security risks are ramping up fast, and that's all because the lines between IT and OT are getting blurred to the point where outdated systems are getting exposed to all sorts of breaches, which of course is exactly what 75% of OT attacks are coming from.
- And on top of all that, regulatory compliance is a real challenge, especially when legacy OT just can't meet up with standards like NIST, which is a huge problem in sectors like automotive and aerospace in the US.

KEY TECHNOLOGIES AND TRENDS: PART 1

By 2028, around 40% of top companies will have started running hybrid computing setups in the heart of their business operations — up from just 8% today. This will enable big AI supercomputing systems to mash up CPUs, GPUs, AI custom chips, and even brain-like computing to get all their IT and OT systems working together in manufacturing.

By 2028, nearly half of the GenAI models that big businesses are using are going to be specific to particular bits of industry, in this case, manufacturing, and will be tweaked to work with the sort of data that comes out of that, to make the IT/OT decision-making process better and more compliant.

By 2028, over 50% of companies will be using AI security software to protect the IT and OT systems that they've bolted together, from threats like people getting tricked into putting malicious code in and data getting leaked out of smart factories.

By 2030, AI-native development tools will mean that 80% of companies have downsized their big software engineering teams in favour of smaller teams working with AI. This will let them build OT/IT apps faster in the Industry 4.0 space.

By 2029, more than 3/4 of the work that gets done in dodgy infrastructure will be protected in real-time by confidential computing, so that sensitive IT/OT data in the manufacturing cloud doesn't get nicked.

By 2030, over 75% of European and Middle Eastern companies will have pulled their virtual workloads back in-house to get away from the risks that come with relying on infrastructure in other countries, which is up from pretty much zero in 2025. This will be a real game-changer for how OT/IT gets integrated in global manufacturing.

By 2027, 40% of GenAI solutions will be multimodal, up from just 1% in 2023, which will let them use all sorts of data from OT sensors to get richer integration between OT and IT platforms.

By 2032, private wireless networks, meanwhile, are going to be a big thing, growing to $32.86 billion at a 23% rate. This is going to make OT and IT a lot more secure in factories.

KEY TECHNOLOGIES AND TRENDS: PART 2

Global business will be spending a whopping $14 billion on GenAI models this year alone, which will support some really advanced OT/IT applications in manufacturing.

Right now, 78% of companies are already using AI in at least one aspect of their business, and that's driving OT/IT integration in smart factories through predictive maintenance and analytics.

92% of execs are planning to plough more cash into AI over the next few years, which will basically accelerate trends like agentic AI for autonomous OT workloads in manufacturing.

AI firms got a massive $124.3 billion in equity investment last year, and that's meant a 35% spike in job postings, which should help get the IT side of things up to speed with the OT systems in manufacturing.

We can expect demand for AI-ready data centre capacity to jump at 33% a year between now and 2030, and by that time, 70% of all data centre demand will be because of AI, which won't just change the way we think about cloud-edge hybrids for IT/OT.

Half the population of North America has 5G now, and this is expected to reach 89% adoption by 2030. Meanwhile, China has 88% coverage, which is going to really boost smart manufacturing connectivity.

Demand for data centre capacity around the world is looking like it will jump 19-22% a year until 2030, and in total, this will be three times what it is now — all because of AI in OT/IT integrations.

Investment in digital trust and security totalled $77.8 billion in 2024, although only a 7% increase in job postings; securing these converged OT and IT systems is going to be essential. The number of industrial robots that are in use is now over four million, with more and more getting installed every year, all of which is going to make OT and IT a lot more secure in smart factories.

Manufacturing and logistics are using more and more service robots, with numbers jumping 20-35% every year, all of which is making use of AI for this kind of OT and IT work.

ROI ANALYSIS

Smart factories that merge old OT systems with modern IT are in a position to see a 20-30% boost in operational efficiency thanks to the likes of predictive maintenance and having real-time access to data. — McKinsey puts it in perspective.

We should expect a major economic windfall in 2026, with global AI-driven value add of $17.1 — $25.6 trillion a year, splitting out a chunk of that to sectors in the US like autos and aerospace — Its really highlighted in recent research some of the research from HBR.

OT/IT convergence can reduce manufacturing operating costs by up to 15%, primarily through lower energy consumption and reduced downtime, as reported by McKinsey.

U.S. manufacturers investing in supply chain technologies, including OT and IT integration, are already seeing measurable benefits, with 80% reporting increased revenue shortly after implementation, according to recent SCMR research.

Using GenAI to modernize is looking like the way to go, particularly when it comes to cutting the costs associated with upgrading an old legacy system. We can expect a 70% saving here by 2027, which is going to mean that smart factory transitions will get ROI much faster. Gartner has some thoughts on how it'll all play out

The efficiency gains from getting OT and IT to work together with the help of AI are impressive — we're talking potentially a potential 10% increase in productivity, and 5-10% lower production costs thanks to being able to move a lot faster. SCMR has been able to get some solid data on this.

It's worth noting though that even in the US manufacturing sector its only about 31% of the expected revenue lift from these initiatives that's actually being captured, which leaves a lot of potential still to be tapped into. HBR recently touched on this issue.

BLUEPRINT FOR LEGACY OT

This blueprint lays out a practical road map for integrating legacy operational systems with modern IT platforms. The focus is on three key areas: control, continuity, and the ability to scale, so your teams can move from the often-messy reality of working in outdated systems to a streamlined OT — IT setup that supports the way you operate today and prepares you for what's coming next.

1

Establish the Brownfield Baseline

Capture how OT and IT operate today across systems, integrations, and manual dependencies. The outcome is a shared, factual view of the current state.

2

Align Governance and Decision Ownership

Set clear ownership across OT and IT, including decision rights, priorities, and coordination paths. Teams operate within one consistent execution model.

3

Define the Target Integration Architecture

Design how legacy OT connects to modern IT through integration layers, edge platforms, APIs, and IIoT services. Legacy systems gain external connectivity and flexibility.

4

Build Execution Capability

Prepare internal teams to run the architecture through skills development and selective partner support. Delivery capacity scales with system complexity.

5

Secure the OT-IT Interface

Apply structured security controls to access, data movement, and system interaction points. Operational continuity and compliance remain protected as convergence increases.

6

Execute Phased Rollout and Scale

Get started by piloting in a controlled way, then validate that it's working before expanding out to the next plant - and the next. The value will start to build up and your operations will stay stable.

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