



SPONSORED CONTENT | WHITE PAPER

Market  
Pulse 

# Manufacturing and Retail Decision-Makers **Bridge the Divide Between IT and OT**

A new Foundry survey finds 98% of organizations will prioritize IT/OT convergence in 2023. The reasons why are clear: improved operational control and efficiency, higher-quality products, reduced risk, and sustainability, among others.

**CIO**

SPONSORED BY

**intel**®

Capgemini 

**T**oday's manufacturing and retail organizations face a bevy of similar challenges, spanning from

**supply chain to point of sale (POS):**

inventory management, quality assurance, and data security/compliance. Driving real business outcomes in this landscape requires new ways of handling data, environments, and users in concert with traditional applications and centralized data centers.

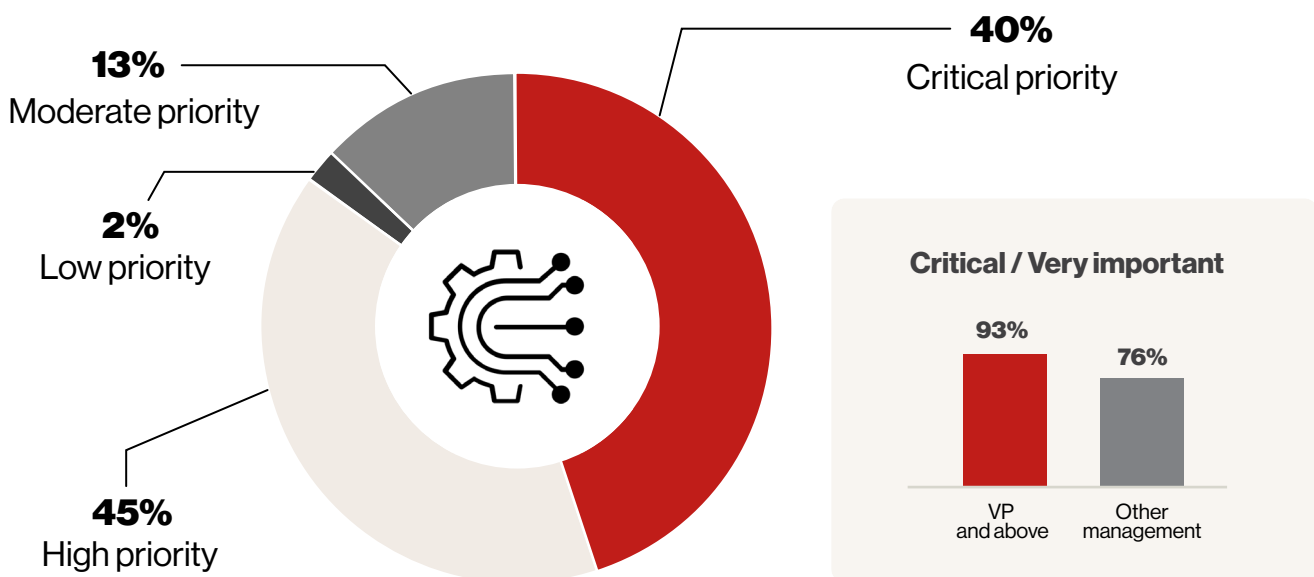
The resilience of any organization now depends on faster insights from a borderless digital strategy. First-movers have already seen strong positive results from converging information technology (IT) and operational technology (OT),

according to a new Foundry survey conducted on behalf of Intel and Capgemini. Nearly all (98%) organizations consider IT/OT convergence a priority in 2023 (see Figure 1), and key areas of investment include data lakes, digital twins, and robotics (see Figure 2).

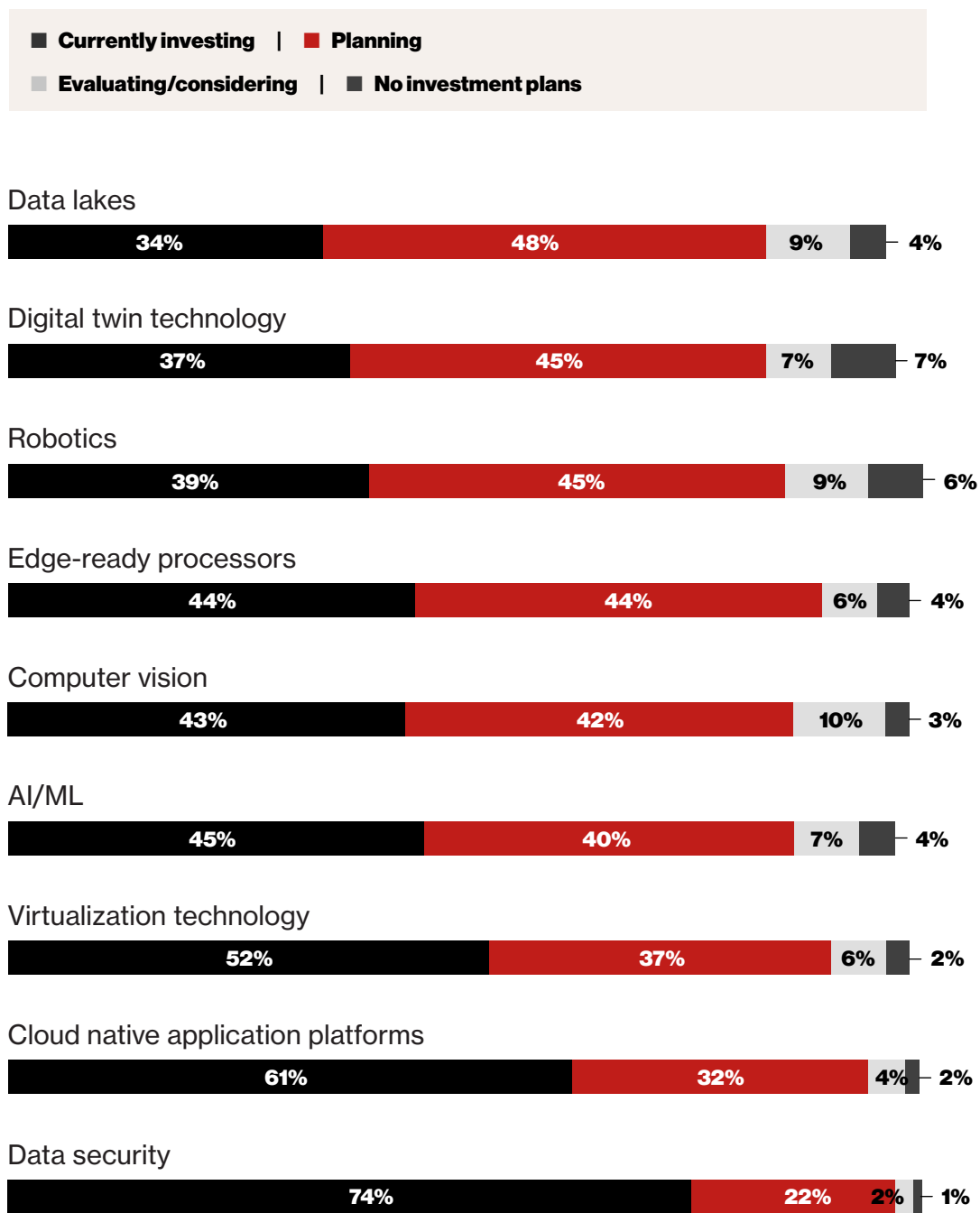
Although they represent traditionally distinct domains, IT and OT decision-makers agree on the benefits they expect from convergence. But true convergence is no simple task – it requires reconfiguring roles and overcoming integration challenges via a common data model. Eighty-eight percent of survey respondents have or will create dedicated convergence roles or teams to

SOURCE: FOUNDRY

**Figure 1 | Prioritizing IT/OT Convergence**



**Figure 2 | Key Areas of Investment Around IT/OT**



SOURCE: FOUNDRY

achieve anticipated business outcomes. Those outcomes include improved operational control and efficiency, product quality, security management, and sustainability (see Figure 3).

Many organizations are still heavily reliant on third-party customized legacy solutions. But the survey reveals that commercial off-the-shelf (COTS) products, such as software-defined solutions on general-purpose compute systems, are an effective option – paving the way for streamlined operations and an accelerated digital transformation.

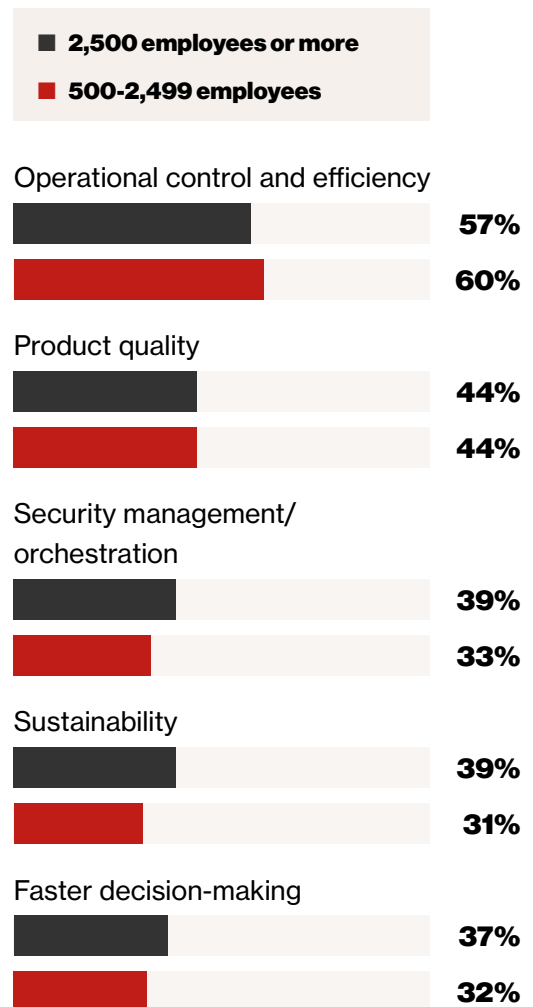
More organizations are storing operational data in public and private cloud environments to standardize the global IT/OT architecture. This approach also allows them to overcome traditional OT constraints such as performance, latency, and real-time decision-making.

### The current and future state of convergence

Though the manufacturing and retail industries are built on vastly different business models, they often experience many of the same issues around

**88% of respondents** will create dedicated convergence roles or teams **to achieve anticipated business outcomes.**

**Figure 3 | Top 5 Advantages of IT/OT Integration**



SOURCE: FOUNDRY

converting essential components into finished products and getting them to point of sale.

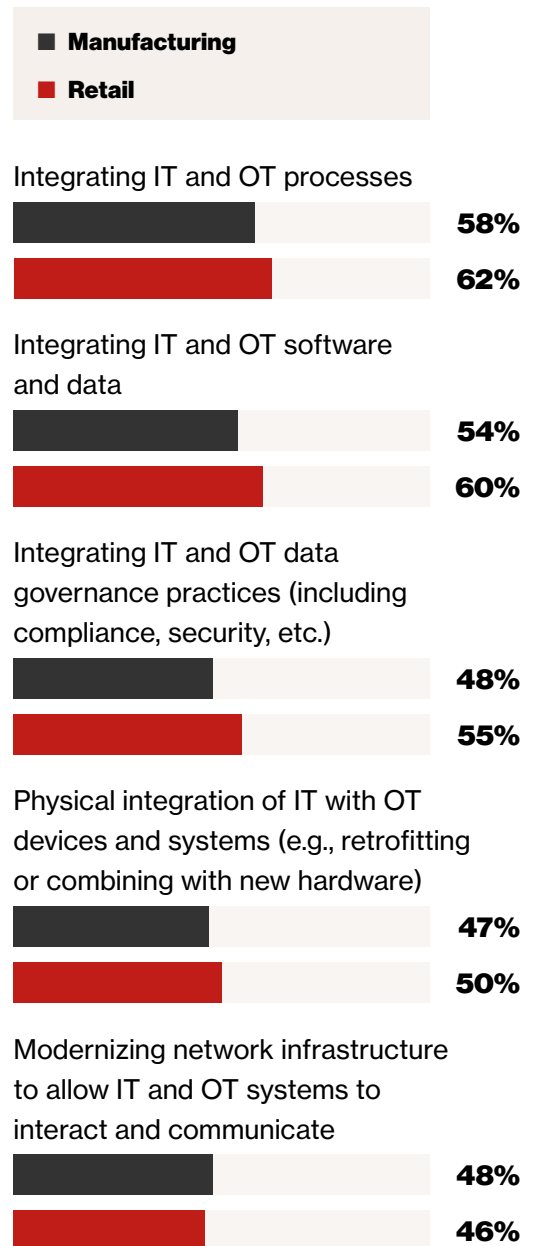
The integration of IT (the hardware and software that process data) with OT (the systems and processes that control industrial operations) has long been predicted but has proven elusive. The potential pay-off is clear: quicker uptake of digital transformation strategies, faster new product development, and better customer experiences.

Forward-looking retailers are processing millions of data points at the edge of the network. “Carrying out compute at the edge of the network processes real-time data immediately and returns intelligence quickly,” Vijay Anand, Senior Director, Technology, and Chief IoT (internet of things) Architect at Capgemini Engineering, says. Reducing data traffic from edge-to-cloud and/or data center-to-edge substantially reduces bandwidth needs and cloud costs.

Retailers and manufacturers face substantial technology and business challenges as they strive for greater integration (see Figure 4). Data is generated across vast distances and in different formats, starting from the supply chain and progressing

through manufacturing and quality processes, logistics, distribution, and product management activities.

**Figure 4** |  
**Integration of IT/OT by Industry**



SOURCE: FOUNDRY

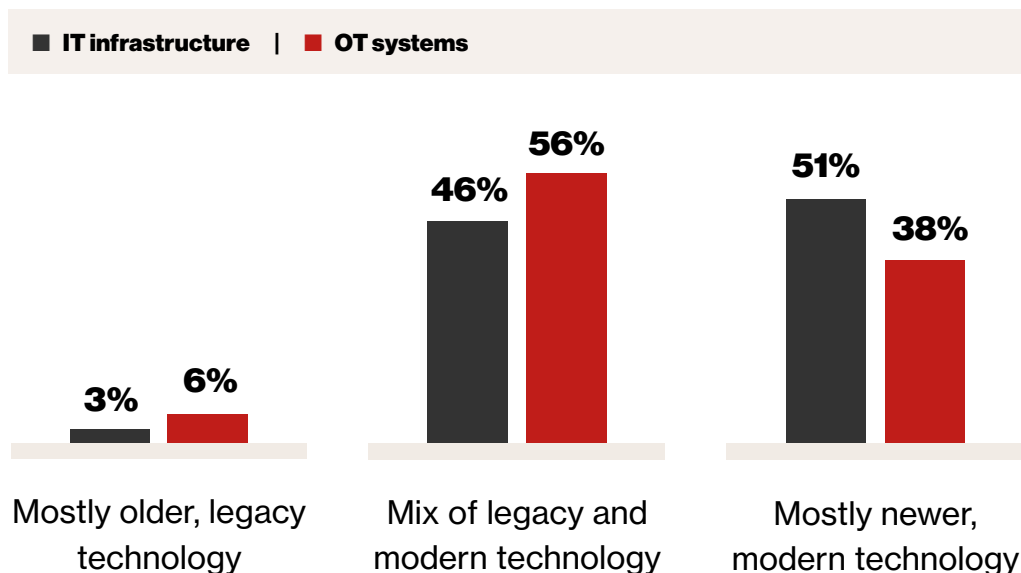
Various operations employ different OT and IT systems, and often rely on data streams from suppliers and partners, each of whom may depend on legacy systems and data formats particular to their own needs. Processes are historically siloed in ways that inhibit integration, with IT and OT systems unable to interoperate and fully leverage the wealth of data that flows through their operations (see Figure 5).

What's more, purpose-built devices and OEM (original equipment manufacturer) proprietary environments have created silos of OT technology

that hamper the growing reliance on automating workloads by complicating maintenance efforts. Programmable logic controllers (PLCs), programmable automation controllers (PACs), human-machine interfaces (HMIs), and industrial PCs (IPCs) are often installed and managed individually.

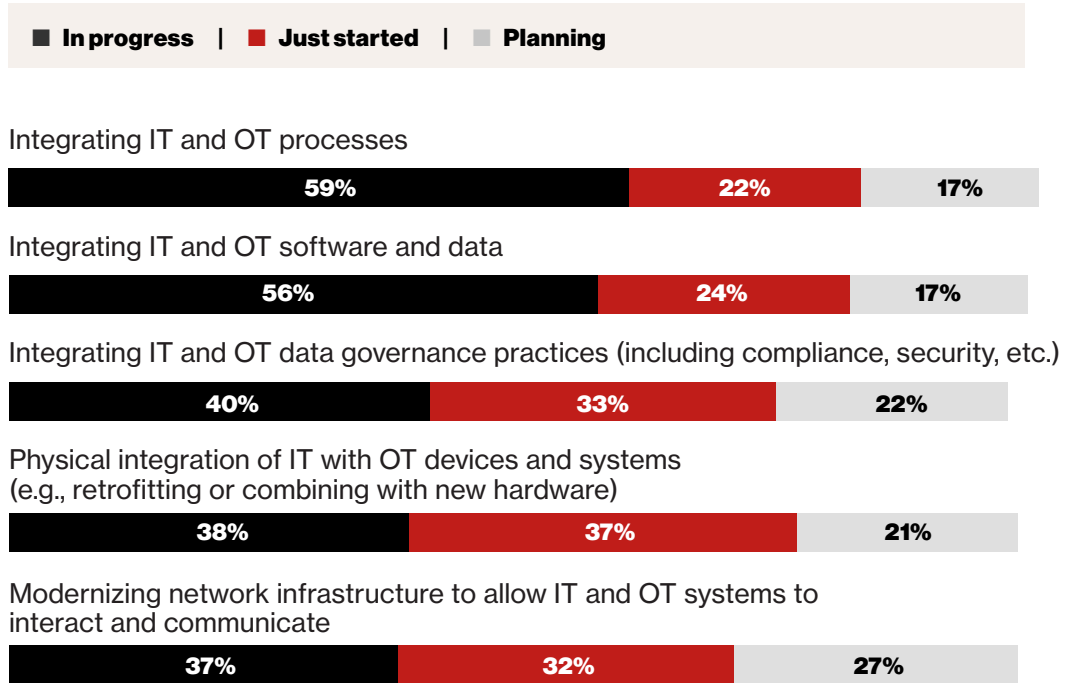
“Data collection and data aggregation – and getting to the point of extracting data across IT and OT – is hindered by the fact that each equipment vendor operates in its own data environment,” Richard Lisa, Director, Intelligent Edge Business Development at Intel, says. “Getting

**Figure 5 | OT Systems Lag IT Infrastructure Modernization**



SOURCE: FOUNDRY

**Figure 6 | Progress with Integrating IT and OT**



SOURCE: FOUNDRY

to an integrated data environment, a unified data environment, is a big part of where we're trying to get the industry to move."

That integrated data environment requires a converged data model (based on open standards) that can

describe the enterprise globally. Here, OT can build on the experience of IT organizations in virtualization of assets and develop a common information model and language.

Both IT and non-IT decision-makers see significant progress when it comes to process, software, and data integration, according to the Foundry survey (see Figure 6) .

"When pain becomes unbearable, change has to happen," William Watson, Senior Manager of Digital Manufacturing Alliance Marketing



**When pain becomes unbearable, change has to happen.**

– **William Watson**, Capgemini

for Capgemini, says. “New products require more specificity, have more advanced features, and involve more complex development processes. When the data that one group is using does not line up with another group’s data, it highlights the need to develop a single digital thread so that everyone is working from the same page in real time and avoiding problems with version control.”



PHOTO BY GROUND PICTURE

IT/OT convergence is a multistep process and survey respondents have progressed differently depending on the task: 59% have integrated processes, 59% have made progress on integrating software and data, and 38% have made progress physically integrating devices and systems.

The goal of manufacturers and retailers is a more integrated, interop-

erable, data-driven model enabled by new technology levers such as blockchain, 5G, and immersive, generative artificial intelligence (AI) and machine learning (ML). **From this they hope to realize the following benefits:**

- **Reduced operational and capital expenses**
- **Consolidation of many single-function devices into integrated systems that free up valuable floor space**
- **Higher uptime**
- **Greater scalability and agility**
- **Ability to secure and monitor converged IT/OT networks.**

“Where we see IT-OT integration beginning is in the area of the [digital twin](#), the virtual representation of real-world assets or environments,” Ricky Watts, Industrial Solutions Director at Intel, says. “That is really more about modeling the data from PLCs.”

Simulation is a key purpose of a digital twin. Organizations use simulations to, for example, predict the effect of physical changes on physical assets – saving time and a potentially



exorbitant amount of money compared to making the change blind and having it fail. Simulation provides deep visibility into not just assets but also systems and environments, and can automate situational awareness, monitor for anomalies, and use virtual spaces to drive optimization efforts.

### **Compelling business outcomes drive alignment**

IT investment in 2023 is being driven by initiatives such as increasing operational efficiency, improving cybersecurity protection, and transforming business processes (according to [Foundry's State of the CIO 2023 report](#)). These initiatives require greater integration of IT and OT.

While IT has often been perceived as disinterested with OT decision-making, the Foundry survey indicates that has changed. IT supports the infrastructure used by OT systems at all organizations included in the survey: 47% say IT supports all OT systems, and 46% say IT supports some OT systems.

Advanced manufacturing technology infrastructure is essential to navigate a digital transformation journey that harnesses data to create better busi-

IT supports some or all OT systems

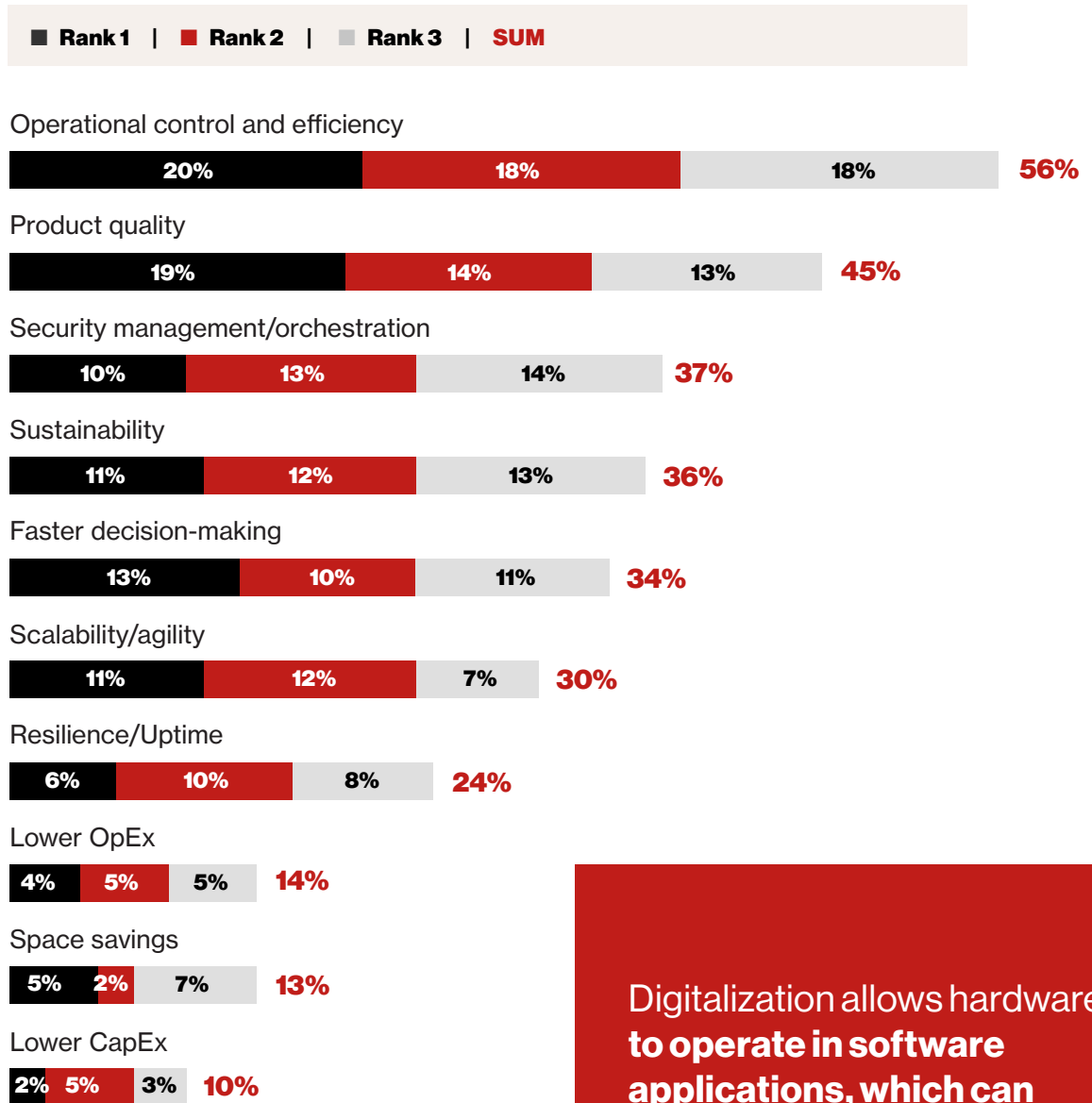
**93%**  
of surveyed companies

ness outcomes. Survey participants indicate that operational control and efficiency is the top expected benefit of integrating IT and OT, followed by product quality. Other anticipated benefits include security management and sustainability.

The following benefits are driving centralized investment:

- **53% of respondents say investment decisions for both OT and IT are made by a shared services organization or designated corporate function**
- **42% say investment decisions about OT systems are coordinated across multiple facilities, plants, and delivery systems through a shared services organization or designated corporate function**

**Figure 7 | Top Business Outcomes/Advantages of Integrated IT/OT**



SOURCE: FOUNDRY

**Digitalization allows hardware to operate in software applications, which can streamline processes and boost efficiency.**

Further highlighting the move to greater coordination, 88% of those surveyed say that a dedicated team or role supports IT/OT integration, most often reporting to the CTO (60%) or CIO (28%). Nearly all (11%) the remaining of respondents plan to create that role.

IT and OT convergence within consolidated systems can produce savings in OpEx, CapEx, space, and energy (see Figure 7). Digitalization allows hardware to operate in software applications, which can stream-

line processes and boost efficiency. Multiple single-function devices can be integrated on a versatile platform that runs them concurrently.

Convergence is essential to merge business and operational requirements. There are opportunities to rethink processes and architectures. IT stakeholders can define high-level guidance and standards, while OT stakeholders ensure applicability and on-site deployment.

Convergence also fosters OT adoption of IT best practices such as DevSecOps and virtual commissioning, enabling organizations to reduce their dependency on proprietary device and equipment suppliers.

IT infrastructure tends to be more modern, with OT infrastructure more reliant on legacy technology, according to the survey respondents. To overcome this, organizations are increasingly moving operational data to edge servers and the cloud.

“Organizations are deploying platform software that is constantly updated to new standards and are seeking to establish a single digital thread for data management across the entire PLM and operational life cycle for their end-to-end business ecosystems,” Charles E. Côté, Capgemini Director and Chief Architect, Application Development and Man-

agement Expert in Enterprise Architecture and IoT Solutions, says.

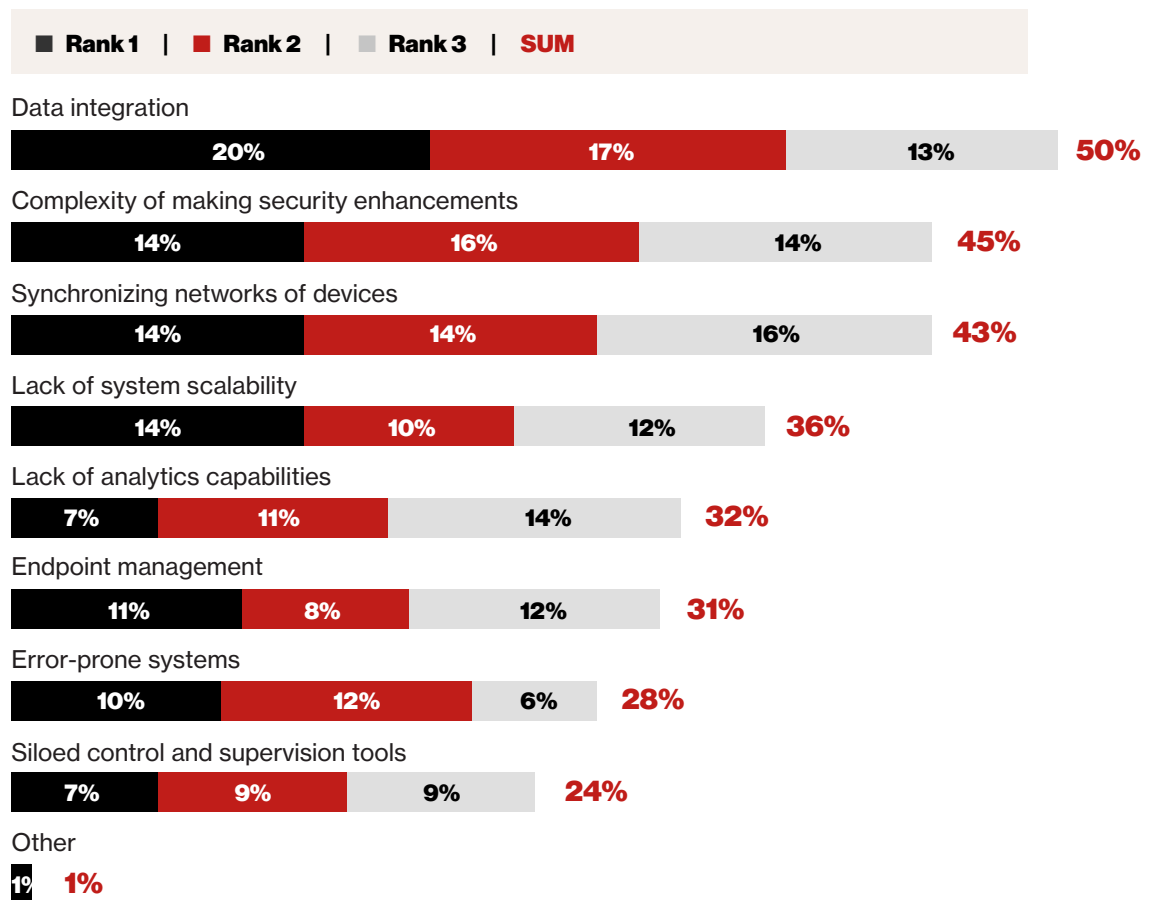
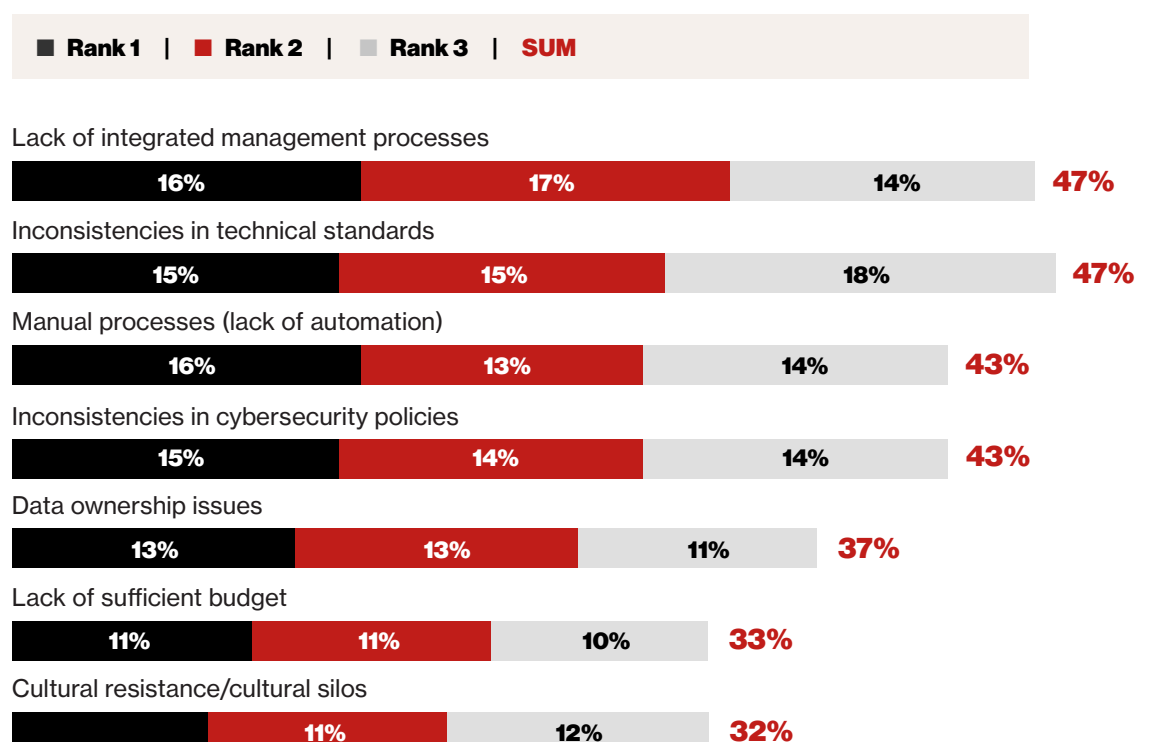
The [shift from standalone IoT platforms to IoT-enabled applications](#), for example, makes it possible to achieve concrete, measurable business outcomes through orchestration of the management of devices, data, analytics and applications, integration, and security.

## **The challenges impeding progress**

Digital transformation fueled by AI, edge computing, and cloud technology is driving new capabilities within manufacturing and retail sectors. But the legacy, siloed approach to factory operations creates challenges when incorporating modern capabilities into older and predominantly proprietary equipment.

Convergence plans must consider constraints including latency, different asset data models, and the volume and frequencies of time-series data. Data integration is most often ranked as the top technology-related challenge to integrating IT and OT (see Figure 8).

On the operational side, challenges include lack of integrated management processes and inconsistencies in technical standards (see Figure 9). OEM proprietary en-

**Figure 8 | Top Technology Challenges of Integrating IT/OT****Figure 9 | Top Operational & Management Challenges of Integrating IT/OT**

vironments make it harder to migrate and/or rip and replace existing systems with newer technology. However, industry segments are working on common information models.

Vendors are also making strides to apply the lessons of open systems to OT. Capgemini's Smart Services and XIoT platform, for example, leverages proven IoT technologies from Capgemini and Intel to enable businesses to deploy solutions to meet the widest range of use cases through intelligent edge technologies, open machine-to-machine communications capabilities, and big data/analytics.

The survey underscores that IT infrastructure is more likely to be

upgraded with newer, modern technology, while OT systems are more weighted toward legacy systems.

## Putting converged technology to work

True convergence involves connecting operational "dark data" from IoT devices to IT systems that can turn it into actionable information. Such efforts are complicated by the siloed approach to managing machinery technology that many organizations have taken.

The benefits of converged hardware and software that process data with systems that control industrial operations are too great to pass up. Once dark data becomes available, organizations can apply advanced analytics and ML techniques to draw valuable insights from it. Those insights can then be used to increase efficiency, improve productivity, boost agility, and improve sustainability.

"Sustainability is of paramount importance because industrial businesses have a large environmental impact by being among the largest contributors of greenhouse gas emissions," Sahar Ehsani, Manufacturing Segment Lead at Intel, says. "Bringing intelli-

**IT and OT leaders must be ready to convince business management that there is greater return on investment from change than from standing still.**

**Learn more** about Capgemini's [intelligent solutions](#) and [factory of the future](#).

## Figure 10 | Top Priorities by Industry Sector

Quality assurance is a top use case for integrating IT and OT at manufacturing organizations. Fraud prevention takes the top spot at retail organizations.

### Top Priorities – Manufacturing

Quality assurance	59%
Predictive system monitoring/maintenance	43%
Ensuring data is secure and compliant	40%
Inventory management	40%
Sustainable production	39%
Industrial robotics	39%
Workload convergence	38%
Facility management	38%
Asset tracking and optimization	37%
Modeling and simulation	34%
IIoT connectivity	33%
Machine vision	33%
Fraud prevention	26%

### Top Priorities – Retail

Fraud prevention	56%
Ensuring data is secure and compliant	52%
Inventory management	51%
Quality assurance	50%
Sustainable production	47%
Workload convergence	43%
Predictive system monitoring/maintenance	40%
Facility management	35%
Asset tracking and optimization	35%
IIoT connectivity	31%
Industrial robotics	22%
Modeling and simulation	21%
Machine vision	19%

SOURCE: FOUNDRY



gence to the edge and enabling IT-OT convergence will result in a more sustainable supply chain, helping to satisfy customer concerns over the environmental impact of the products they use.”

Line quality process monitoring can reduce rework and scrap, while machine vision can check for defects, read bar codes, and confirm the correct label positioning on products. Assembly line sensors can be networked to track equipment performance from edge to cloud

and inform preventive maintenance. Inventory management and sustainable production also rank highly with both manufacturing and retail companies (see Figure 10).

Automation is a de facto principle of OT systems. Using IT/OT integration, AI-enabled robotics can automate manufacturing and logistics to boost efficiency. PLCs can help workers maintain desired safety zone distancing by supporting virtualized control applications managed remotely from edge to cloud.

Converged IT/OT networks enable better security and monitoring, using data collected across systems to identify and mitigate potential threats. Convergence reduces infrastructure, which reduces the number of systems that must be maintained. This in turn lowers CapEx and helps organizations avoid future costs as new capabilities are added.

IT-like software-defined control systems enhance workload manageability as well as failover capabilities – without data loss. With public cloud, private cloud, and edge systems, organizations can scale compute, memory, and storage resources for existing systems quickly.

**Other key use cases for integrated IT and OT systems include:**

- **Energy consumption regulation and carbon footprint reduction**
- **Real-time process optimization**
- **Predictive maintenance**
- **Asset optimization**
- **Advanced and real-time planning**
- **Flow simulation and line balancing**

## **Changing technology priorities and strategies**

Organizations are eager to transform OT with the open systems and cloud technologies that have propelled IT to greater strategic value. At the same time, they are heavily reliant on OEMs and OT solution integrators.

PLCs, PACs, HMIs, and IPCs are typically installed and managed individually. This can lead to challenges when integrating modern capabilities with legacy equipment.

The good news: emerging standards will help simplify and harmonize the landscape. In addition, joint standards development allows products from different manufacturers to work and communicate with one another. Standards protect both manufacturers and consumers from the risk of product incompatibility.

Intel participates in over 250 standards and industry groups worldwide, including industry alliances, regional standards organizations, international industry standards groups, and formal international standards bodies. Intel technologies comply with critical standards for industrial technology solutions, such as the IEC 61850 international stan-

standard defining communication protocols for intelligent electronic devices at electrical substations.

The International Organization for Standardization (ISO) has developed the [ISO 23247 series](#), defining a framework to support “the creation of digital twins of observable manufacturing elements including personnel, equipment, materials, manufacturing processes, facilities, environment, products, and supporting documents.” Digital twin technology ranks second in the top areas of planned investment over the next 1-2 years among survey respondents.

Organizations are prioritizing the integration of processes, software, data, and data governance over physical integration and network infrastructure modernization. With hybrid environments from edge to cloud, organizations can extract greater value more quickly from the large volumes of manufacturing and retail data that are currently stored – and underutilized – at the edge.

The best underlying architecture simplifies IT/OT convergence by making it possible to design, scale,

PHOTO BY GORODENKOFF



and run separate functions on one united, cloud-like platform – even while supporting legacy machines. Industrial computing platforms built on open architecture enable integration of datacentric IT protocols into legacy machines through virtualized applications. Highly portable workloads can run on scalable, off-the-shelf hardware.

High-performance silicon enhanced for IoT is ideal for converging edge applications that would otherwise require multiple CPUs, GPUs, and accelerators. Capabilities can be added over several years without full reconfiguration. Intel® Edge Controls for Industrial makes it possible to consolidate motion and logic control and provides a local user interface to monitor processes and enable supervisory controls. Using advanced orchestration techniques, the Intel platform allows control execution to be managed as containerized microservices.



## Breaking down tech silos

Manufacturing and retail enterprises are eager to exploit the full value of IT and OT data. They need more integrated, interoperable technology solutions that use data generated across various company operations. With a converged IT/OT model they can achieve digital transformation.

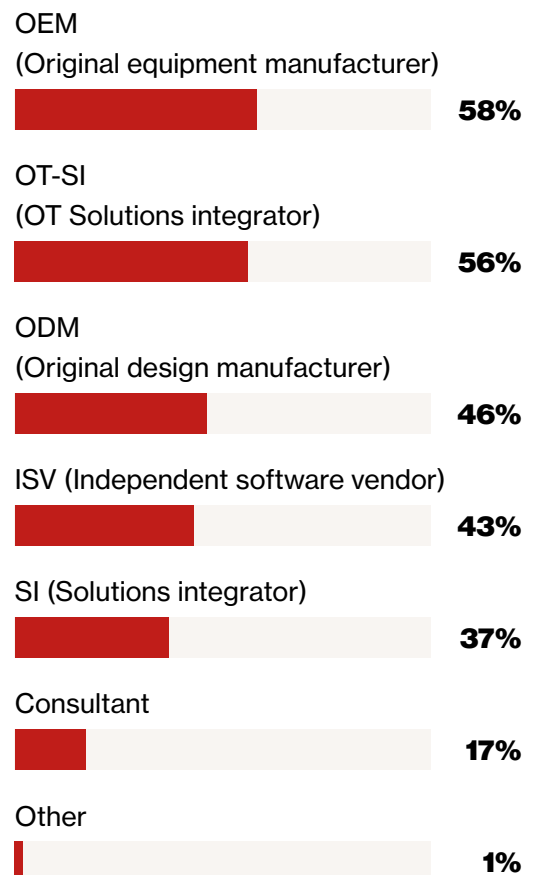
Converged edge solutions bring IT, OT, and communications technology tasks together to simplify device and workload management and enable new cloud-native capabilities. As has been the case with IT, scalable software platforms can replace or supplement OT hardware systems to optimize and securely run multiple applications. New capabilities, such as AI, can be added and modified over time – without risking downtime.

An open, fully programmable, standards-based system allows developers to reuse code across hardware targets and perform custom tuning for specific accelerators. Enterprises can avoid the need for disparate systems and the resources it takes to manage them.

## Strategic partnerships: key to success

Increasingly, reference hardware architectures and market-ready solutions are available through extensive partner ecosystems (see Figure 11) for easier integration

**Figure 11 | Key Partners Include OT Solution Integrators (OT-SIs)**



SOURCE: FOUNDRY

of new capabilities with existing systems. The key is combining all these solutions to create an end-to-end and fully functioning environment.

Organizations say they are realizing the benefits of COTS technology but look to vendors and OT system integrators to help implement these systems.

Software-defined solutions offer more flexible management and simplified deployment when compared to legacy OT solutions. By implementing an IT-like industrial control platform, companies can reduce reliance on a plethora of single-purpose, proprietary, custom-built hardware. They can also deploy and manage software remotely for cost and time savings.

## Best practices for successful IT/OT convergence

**Adopting a set of best practices helps organizations accelerate their learning curve and avoid costly mistakes.** Best practices for integrating IT and OT assets include:

- Develop a standard definition (data model) of the enterprise including IT and OT.
- Improve productivity with systems that provide predictive maintenance, allowing engineers to catch problems before they impact machinery or operational workflow.
- Accelerate adoption of digital twin solutions for virtual testing.
- Ensure low latency for critical and time-sensitive applications.
- Increase flexibility with software-based solutions that can adjust workflows quickly. Implement and/or extend software-defined networking and virtualization to incorporate OT networks.
- Provide operators and engineers with advanced monitoring and analytics tools for insight into machine health and real-time control of production processes.
- Adopt edge platforms that protect code and data.

[\*\*Learn more from Intel.\*\*](#)

[\*\*Learn more from Capgemini.\*\*](#)



PHOTO BY NDAB CREATIVITY

Market  
Pulse

## Next steps

The long-debated convergence of IT and OT systems and processes is accelerating as manufacturing and retail organizations seek greater control and visibility into the entire product life cycle, from supply chain sourcing to point-of-use.

Digital transformation at every stage provides organizations with greater insight, predictability and efficiency – and more satisfied customers – all of which paves the way to more profitability. ♦

## For more information

on becoming a more intelligent enterprise, or starting a consulting engagement, *visit* <https://www.capgemini.com/services/intelligent-industry>

*Or visit* <https://www.capgemini.com/about-us/who-we-are/our-brands/capgemini-engineering>

CIO