Microsoft

Digital Operations Signals

Industrial IoT Solution Spotlight

July 2023.

Digital Operations Signals—Background

The **Internet of Things (IoT)** is rapidly changing the world around us by transforming a huge range of physical objects through digital intelligence. The transformative power of IoT is revolutionizing the way companies do business—helping them become faster, smarter, safer, and more efficient.

Digital Operations Signals (previously called IoT Signals) is a series of impactful thought leadership content curated by Microsoft to inform the community about the latest developments and technology trends in the IoT world.

For this **fifth edition**, Microsoft and IoT Analytics have developed a report focused exclusively on **Industrial IoT (IIoT) solutions**. IoT Analytics surveyed 300 decision makers working primarily in manufacturing, in addition to other sectors such as energy and buildings. We also conducted in-depth interviews with executives in the IIoT ecosystem.

This **Digital Operations Signals** report aims to uncover fresh learnings about the successes and challenges in the varied approaches that industries adopt for IIoT solutions. We hope that industrial decision makers will apply these findings to their IIoT projects to accelerate time-to-value.

IoT Signals is now Digital Operations Signals

Our **rebranding to Digital Operations Signals** reflects our expanded coverage that goes beyond IoT technology. We now encompass the business outcomes that our customers are pursuing to unlock the next level of improvements in efficiency, agility, and sustainability in their physical operations, utilizing artificial intelligence (AI), machine learning, digital twins, 5G, and more. With this publication series, our goal is to be the go-to resource for cutting-edge ideas and thought-provoking perspectives from industry peers and practitioners as they implement AI-powered digital operations to stay ahead of the curve.

Why read this paper?

To distinguish their companies in today's competitive landscape, manufacturers must aggressively adopt digital technologies to enable smart operations, products, and supply chains. These projects draw upon concepts and technologies such as digital transformation, Industry 4.0, IoT, IT/OT convergence, AI, digital real estate, and a digital-first culture. This paper presents insights from companies that have successfully implemented IoT projects. We explore the five main stages organizations go through, the three main project approaches (BUY, BUY-AND-INTEGRATE, or BUILD), and look at the challenges to successful deployment. This paper intends to present learnings that will serve as a guide to the best practices of successful IIoT implementation.
Read this paper to understand what is behind the following six key findings:

1. **Industrial IoT is becoming mainstream**
   - 65% of organizations are now executing an IoT strategy.
   - IIoT projects today have a 14% higher success rate than five years ago.
   - Projects have a median break-even time of 20 months, compared to 24 months five years ago.
   - Fewer organizations report the need to develop an upfront business case.
   - The challenges relating to budget availability, project complexity, and data management have diminished by approximately 50%.

2. **Companies are increasingly looking to BUY off-the-shelf solutions**
   - Approximately two in five IIoT projects today are custom-BUILD solutions.
   - The share of IIoT projects for which companies BUY an off-the-shelf solution increased from 9% to 30% in the past two years.
   - When a BUY solution is available, the median time to break even decreases by 40%.
   - In many cases for which no off-the-shelf product is available, BUY-AND-INTEGRATE remains a popular option.

3. **There are good reasons to use each project approach: BUILD, BUY-AND-INTEGRATE, or BUY**
   - The **BUILD** approach provides a unique freedom to customize the entire solution according to specific needs and does not lead to lock-in with any vendor.
   - The **BUY-AND-INTEGRATE** approach combines proven technology and product support with the freedom to customize the solution.
   - The **BUY** approach is the most cost-effective and allows for a quick return on investment (ROI) with few integration challenges.

4. Large companies prefer to BUILD; electronics and machinery companies prefer to BUY-AND-INTEGRATE

Who uses the **BUILD** approach:

- **Key sectors:** buildings (89%), automotive (56%), and retail (56%)
- **Key use cases:** smart operations in general (54%) and production planning and scheduling specifically (66%)

Who uses the **BUY-AND-INTEGRATE** approach:

- **Key sectors:** electronics (57%) and machinery (52%)
- **Key use cases:** smart supply chain in general (48%), AI-based predictive maintenance (61%), and augmented reality-assisted operations (60%)

Who uses the **BUY** approach:

- **Key sectors:** pharmaceuticals (31%)
- **Key use cases:** sustainability footprint optimization (27%) and plant/operations network optimization (30%)

5. Strong IoT vendor ecosystems speed up time-to-value

Vendors are teaming up in partner ecosystems to optimize the end-user experience, with the goal to provide a nearly off-the-shelf solution that accelerates time-to-value. Some of the initiatives that reduce time-to-value include:

- **Out-of-the-box solution components.** Solution providers do significant upfront work, creating preconfigured data models and digital twins or providing various architecture components that are built to work natively with each other.
- **Dedicated technical and business case support.** Solution providers help their customers by participating along the journey—for example, by providing technology best practices, offering business case calculation support, and providing a dedicated contact person.
- **Harmonized cybersecurity.** Vendors are aligning their solutions with the same security paradigms, which makes it easier for the solution to traverse different layers of firewalls in a proven fashion.

6. Budget constraints have faded, while cybersecurity and knowledge gaps have become key pain points

- Implementation challenges and budget restrictions have dropped by 30 and 13 percentage points, respectively, as key concerns compared to five years ago.
- Cybersecurity, in the same timeframe, has emerged as a new challenge. In the previous IoT Signals Manufacturing Spotlight report (August 2022), challenges such as securing the OT network (43%) and securing the cloud (41%) were identified as top technical issues.
- The talent and knowledge gap has also increased, with 24% of the respondents citing it as an operational challenge.

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Methodology

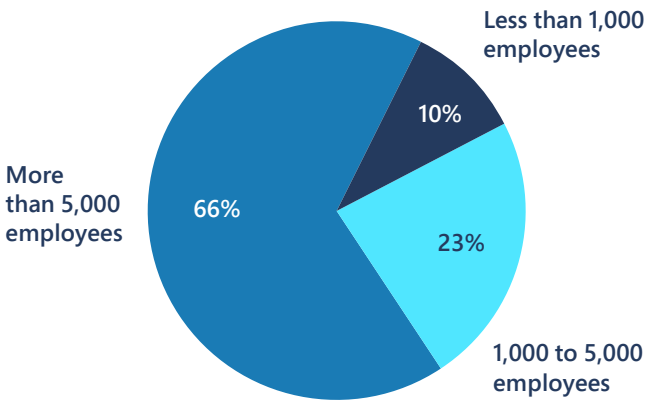
This document was developed by Microsoft in close collaboration with IoT Analytics, a boutique market research company focussing on IoT, AI, Cloud, Edge, and Industry 4.0.

The centerpiece of this research is a survey conducted between October and December 2022 with a total of 300 respondents worldwide. The respondents are key stakeholders in their employers' IIoT initiatives on smart operations, smart supply chains, or connected products. They represent a variety of industrial sectors, including manufacturing, energy, and buildings. They are equally distributed across North America (33%), Europe (33%), and Asia-Pacific (33%). They work at a large corporation with more than 5,000 employees (66%), a medium-sized manufacturer with 1,000–5,000 employees (23%), or a smaller company with less than 1,000 employees (10%).

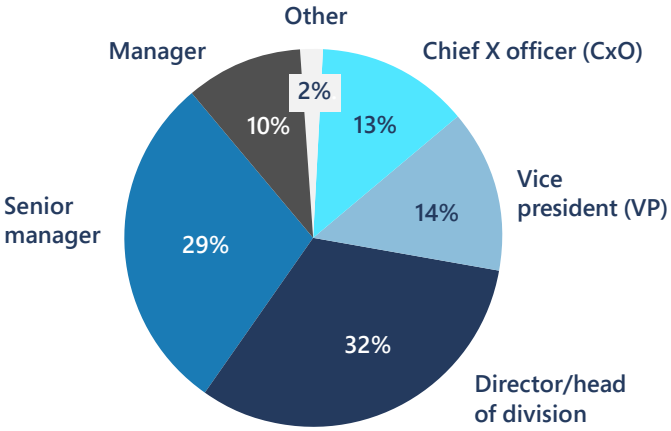
In addition to the survey, this research also delves into the solution provider (ISV/SI) ecosystem and its role in the IoT industry. IoT Analytics conducted in-depth expert interviews with solution providers, exploring their solutions, challenges, and successes in the market. The study also explores novel approaches for customers to adopt in their IIoT projects. Participants in the interviews were selected by Microsoft based on their expertise in IIoT and their track record of successful IIoT project implementation, ensuring a diverse range of perspectives from different types of companies.

Overview of n=300 survey participants

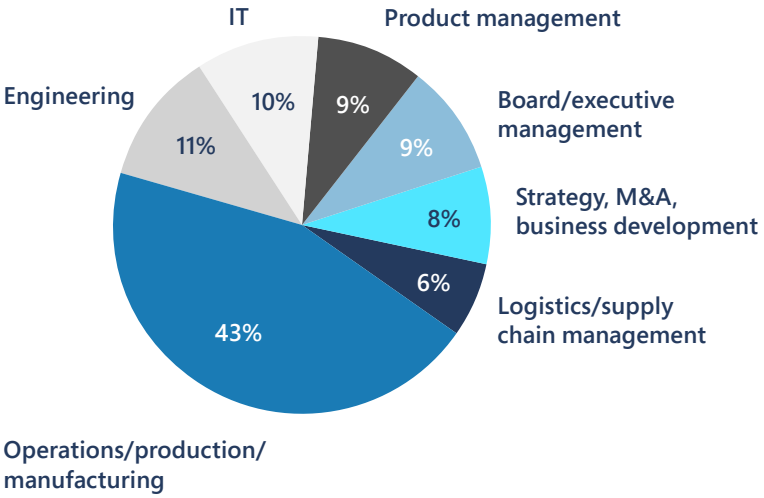
How many employees does your employer have?



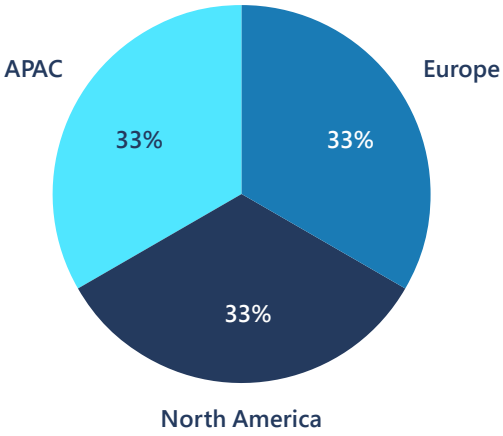
What is your level of seniority within the organization?



What department are you working in at your organization?



Where is your work primarily based?



N=300, Respondents from APAC are mainly based in China and Japan.

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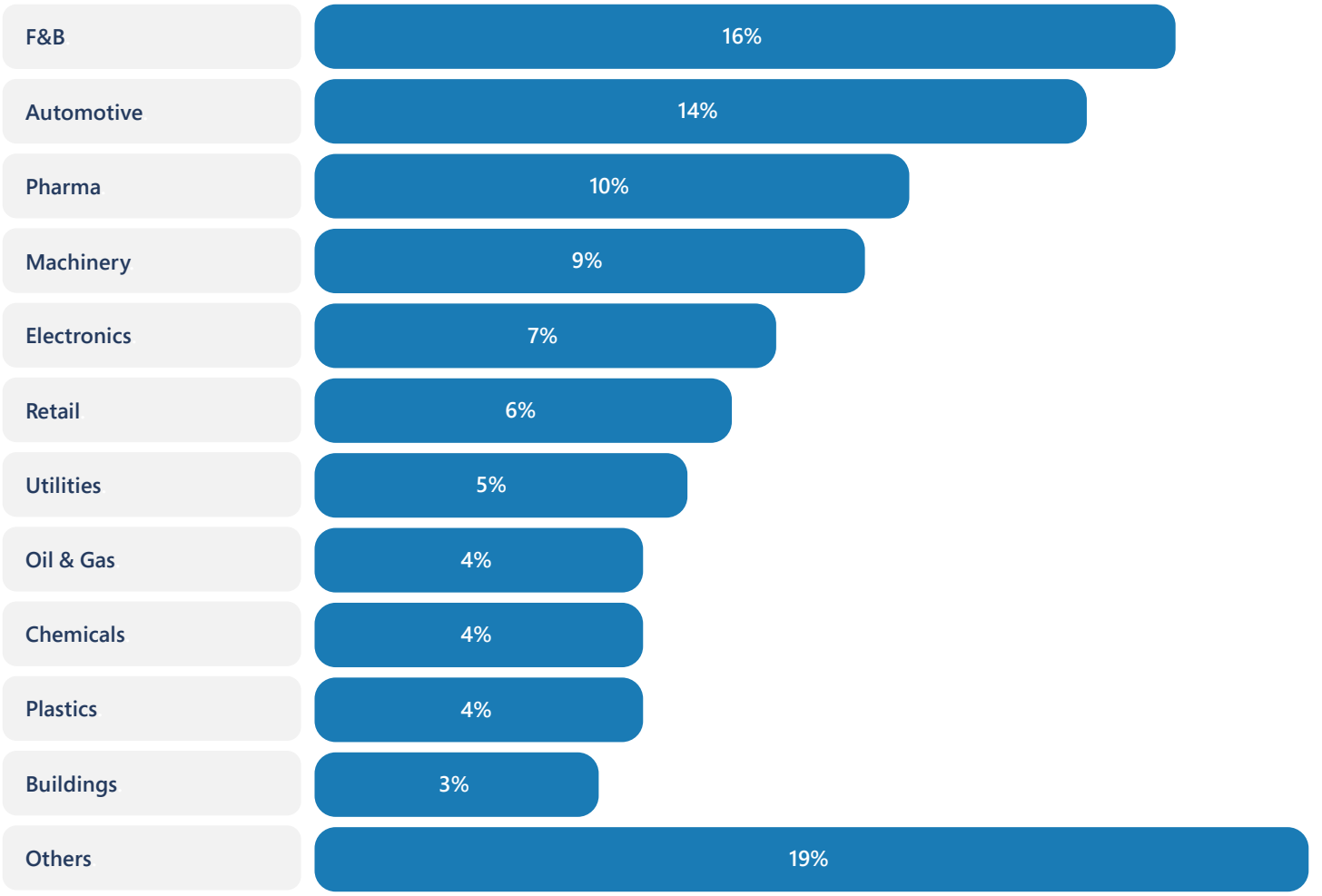
Which is the primary industry focus of your employer (ISIC classification)?



Share of initiatives by type

N=300, Question: Which group of use cases did the IoT initiative target?
Please first choose what group of use cases the initiative mostly belonged to.

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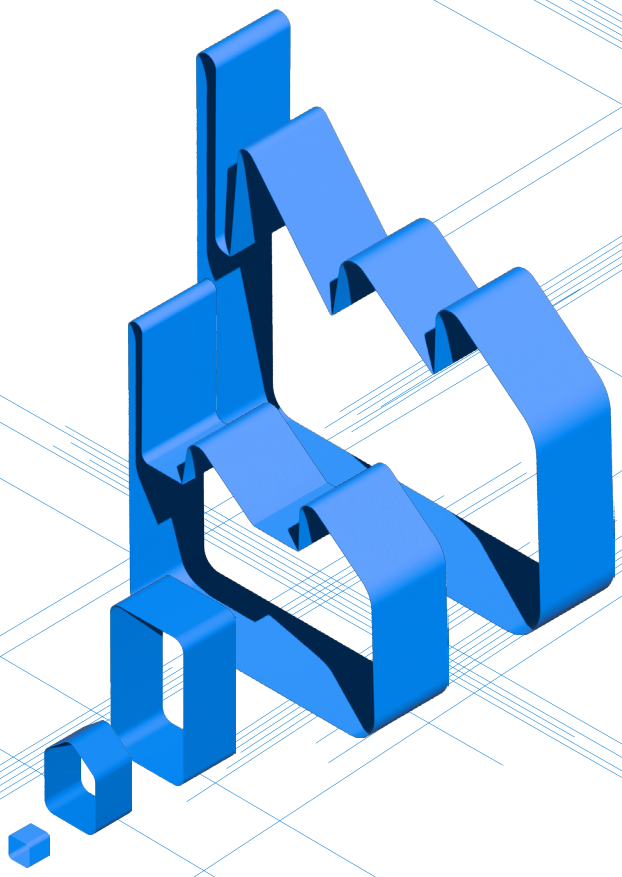
1 Introduction



Industrial IoT is starting to cross the chasm

The previous IoT Signals report (published in August 2022) showed the enormous momentum that IT/OT integration is enjoying across industries: 79% of manufacturing assets are now connected in some form, and 65% of manufacturers have partially or fully implemented IoT strategies. The report also highlighted the emergence of new challenges around developing new software applications and filling skill gaps (especially in data science, AI, and cybersecurity). The study underscored the fact that in spite of the challenges, manufacturers had recognized the imperative to use digital technology to transform their operations and products.

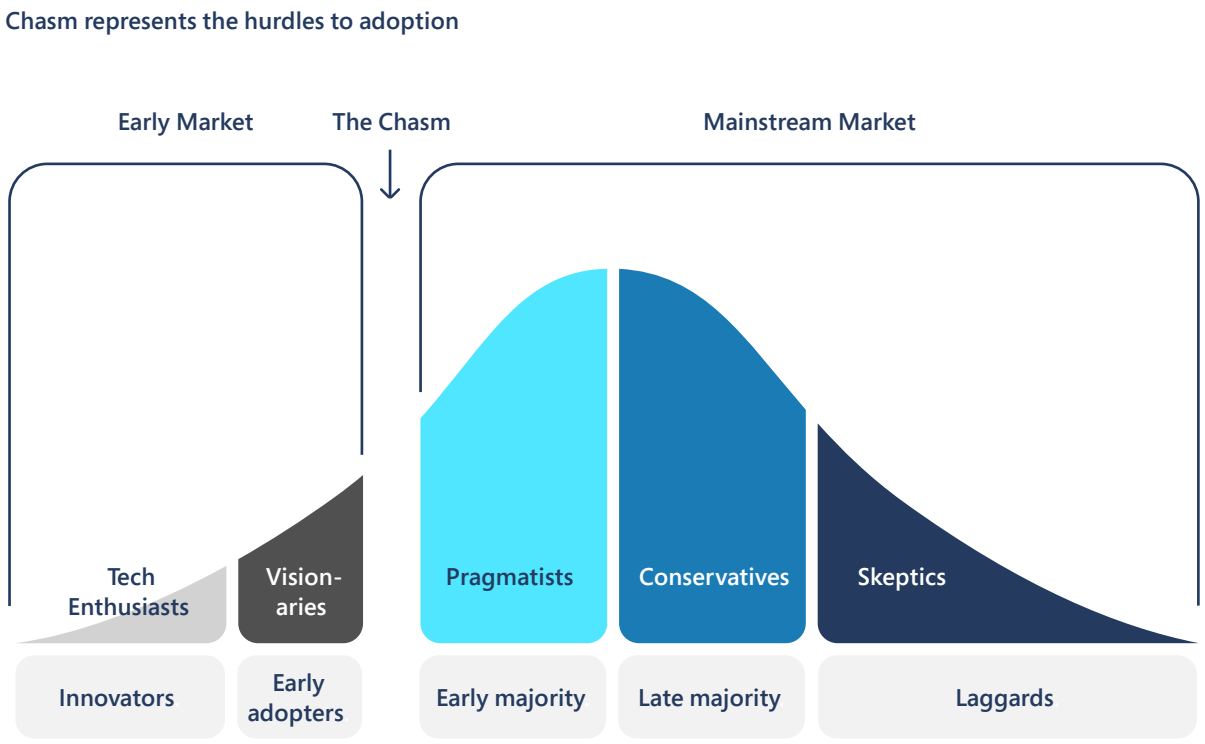
In today's ever-changing business landscape, businesses in the industrial sector are facing several uncertainties and pressures to optimize their processes and reduce costs while maintaining high standards for quality and safety. IoT solutions provide a powerful set of tools that enable businesses to become more efficient, agile, and sustainable. With IIoT, businesses can monitor real-time data, predict maintenance needs, optimize their supply chain, and enhance team collaboration—providing them with a competitive advantage and reducing downtime and waste. Additionally, IIoT can help businesses address critical environmental and social issues, such as reducing carbon emissions, promoting sustainable practices, and improving worker safety. Ultimately, IIoT is not just about adopting new technology but also about transforming business operations and creating a better future for all, even in uncertain times.

As we discuss in the following pages, this report confirms that the adoption of IIoT technology has advanced to a point that it is crossing the chasm that typically exists between a small set of early technology adopters and the larger group of potential users. Indeed, IIoT technology has reached the broader uptake and acceptance that characterizes the "early majority" stage of adoption.

What does it mean to cross the chasm?

"Crossing the chasm" is a marketing theory introduced by Geoffrey Moore in his popular 1991 book Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers. The theory hypothesizes that a chasm exists between the early adopters of a new technology or product and the mainstream market. The chasm represents the obstacles that new products or technologies must overcome to gain widespread adoption. Companies must tailor their product, marketing, and sales strategies to bridge this chasm to appeal to the specific needs and concerns of mainstream customers.

Technology adoption life cycle stages from the popular Crossing The Chasm theory



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The early adopters of IIoT technology were risk-takers motivated by its potential to transform business. Many encountered challenges, and some failed or got stuck in proof-of-concept (PoC) or pilot projects. A 2018 McKinsey report coined the term "pilot purgatory" with respect to digital manufacturing, while a 2017 Cisco study claimed that nearly 75% of IoT projects failed. A significant majority of the market did not manage to cross the chasm owing to challenges with technology maturity or culture, funding, and security. There are notable examples of manufacturers struggling or failing to cross the chasm. For instance, a US-based Fortune 100 heavy-equipment manufacturer faced challenges in scaling its IIoT initiatives due to difficulties in integrating its IIoT solutions with legacy systems and processes. A large US-based automotive OEM also faced challenges with data security and privacy and with integrating IIoT technologies across its different brands and models.

The landscape in 2023 appears to be vastly different, with both large and small organizations now making bold investments in IIoT to transform their operations, supply chains, and products, forming a formidable group of early adopters that have successfully crossed the chasm. Companies such as Walmart, Mercedes, Toyota, Coca-Cola, DHL, Delta Electronics, and Schindler Elevators are leading the way with major IIoT projects that involve hundreds of people and millions of connected devices already online and scaling rapidly.

At the same time, advancements in connectivity, the availability of hundreds of modular cloud (infrastructure) services, developments in edge hardware and orchestration capabilities, and strong security standards point to a maturation of IIoT technology. The proliferation of IIoT-enabled controllers and field devices, smart sensors and edge devices, and protocol converters supporting connectivity protocols (such as OPC-UA and MQTT) are alleviating the challenges of accessing industrial data. Industrial security frameworks (such as IEC 62443 and NIST SP 800-53) provide the necessary guidance and frameworks for industrial security compliance.

In the remainder of this chapter, we aim to deepen the context for the report by introducing key concepts and definitions. Specifically, we will define the stages of an IIoT project, the approach to implementing one, and the different categories of such projects. These definitions will be useful in understanding the survey results and insights generated from interviews with solution providers.

The five stages of IIoT initiatives

Many organizations use a five-step framework when rolling out their IIoT solutions. While this framework has limitations—it simplifies reality, does not account for all the challenges, and suggests a fully linear process—it has served as a valuable guide for IIoT practitioners.

The five stages are briefly described below, including the median time to completion in the projects implemented by our survey respondents.

1. **Business case development (median time: 8 months*):** Typically, a cross-functional team prepares the business case for IIoT, which is then approved by business line executives or even the board of directors. Although developing the case can be a straightforward process, companies frequently face issues related to insufficient collaboration across different disciplines while calculating the potential benefits.

2. **Build versus buy and vendor evaluation (median time: 6 months*):** After establishing what the solution must achieve, most companies must make a decision—do we build it in-house, do we find an external solution partner, or do we use some combination of both approaches? (The section below titled "Three types of IIoT initiatives" describes these three approaches.)

3. **Proof of concept (median time: 6 months*):** The purpose of the PoC phase is to validate a few key points rather than every detail. Best practice suggests starting with one to five scenarios or feature designs that are most relevant to the user's business. Although it is important to "think big," starting small during the PoC phase (for instance, testing in part of a production line) allows companies to experiment rapidly and iterate continuously.

4. **Initial pilot rollout (median time: 7 months*):** After the concept has been proven, the next step is to refine the scenarios and ensure that the IIoT solution can be integrated into the broader organization, including implementing the necessary training and process changes. During this phase, the solution can be rolled out to a wider implementation scope (for instance, rolling out the solution to the production cell during daily operations or, potentially, to the entire line), allowing for a more comprehensive evaluation of its effectiveness and impact.

5. **Commercial deployment (median time: 9 months*):** At this stage, the IIoT solution is deployed to thousands or even millions of devices (for instance, the solution can be scaled to the entire site or even multiple sites). Ensuring the manageability and scalability of the overall system becomes crucial for its success. It is equally important to implement seamless organizational changes and new processes to encourage users to recognize the solution's benefits.

The significance of the business case and the time it takes to break even along the five-step process can serve as indicators of an industry's maturity. In Chapter 2, we examine these two factors along with a few other distinguishing characteristics of practitioners on either side of the chasm.

*** = The median of all 300 IIoT projects covered in this research**

Three approaches to IIoT projects

We distinguish three approaches to IIoT projects:

BUILD

In the BUILD approach, the end user builds most of the tech stack for the IIoT solution, either by itself or with the help of an external services company. It may buy infrastructure and foundational platform services or components (for example, data ingestion, analysis, or visualization).

BUY-AND-INTEGRATE

In the BUY-AND-INTEGRATE approach, the end user buys an entire software product from a software vendor or a number of pre-built components/ services that require moderate modification and integration into their IT/ OT environment. It does this by itself or with the help of an external services company to deliver on the business outcome.

BUY

In the BUY approach, the end user buys the entire IIoT solution—often both hardware and software together. The solution is plug-and-play, with very minor effort required for configuration and integration to deliver on the business outcome.

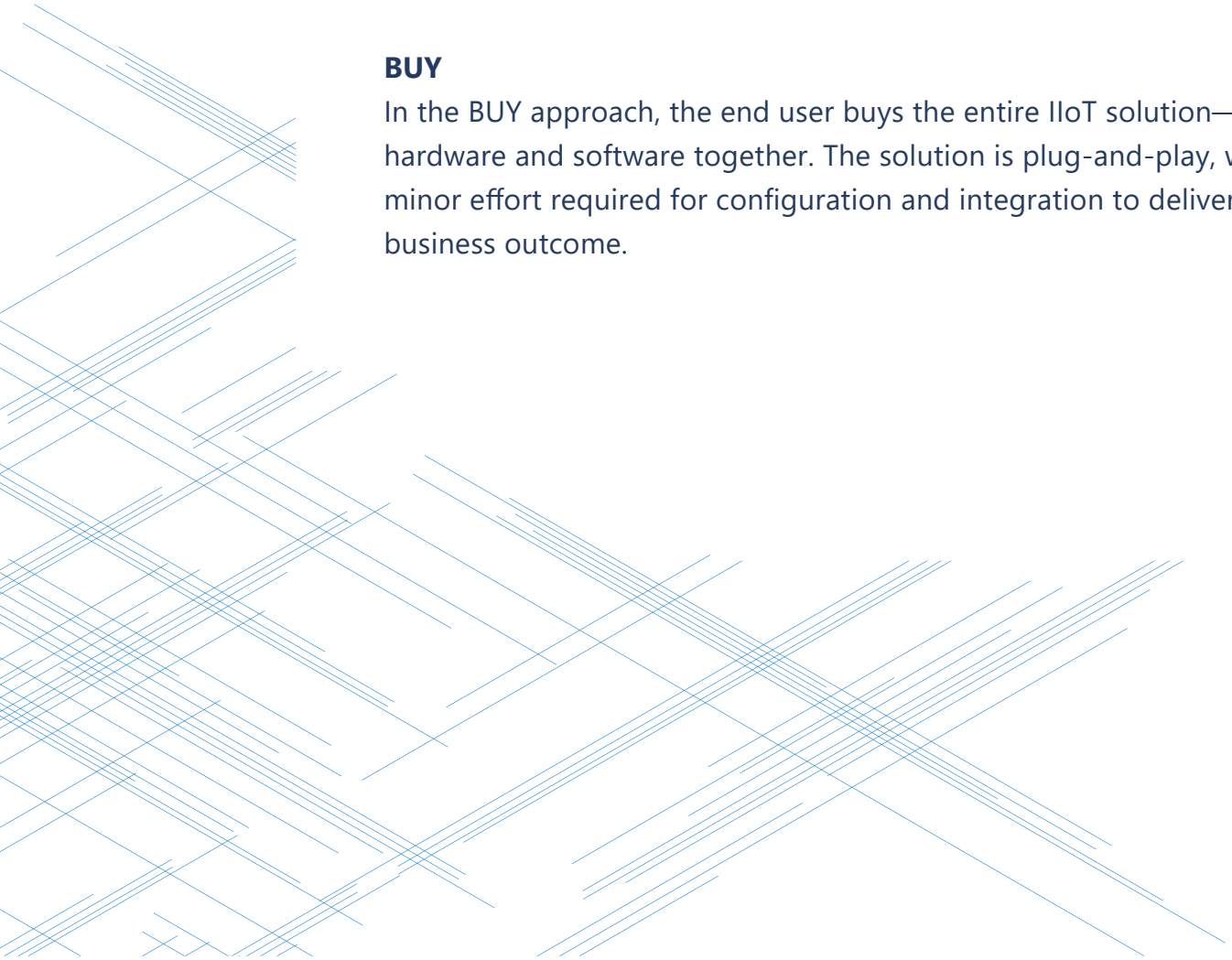
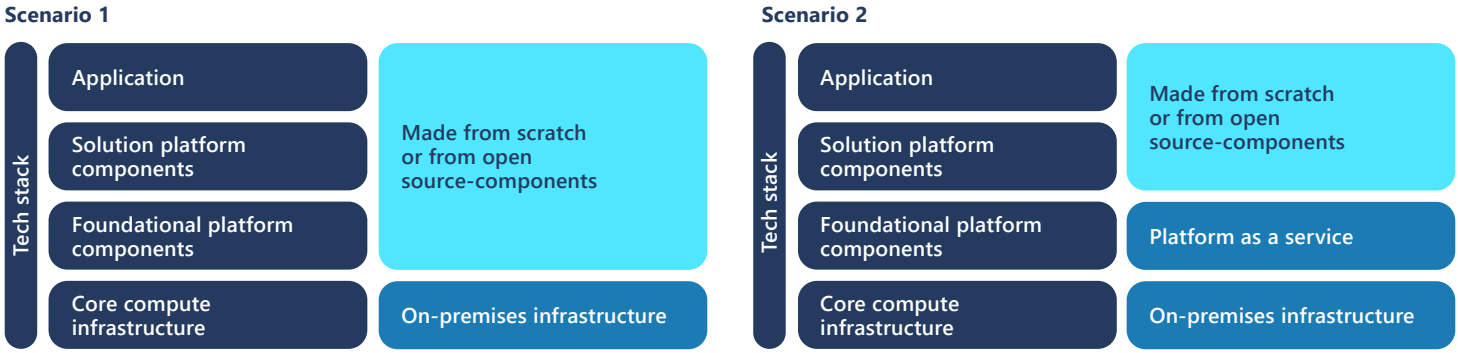


Exhibit 1: The 3 main approaches for developing IIoT solutions

A solution could be developed following any of the three approaches

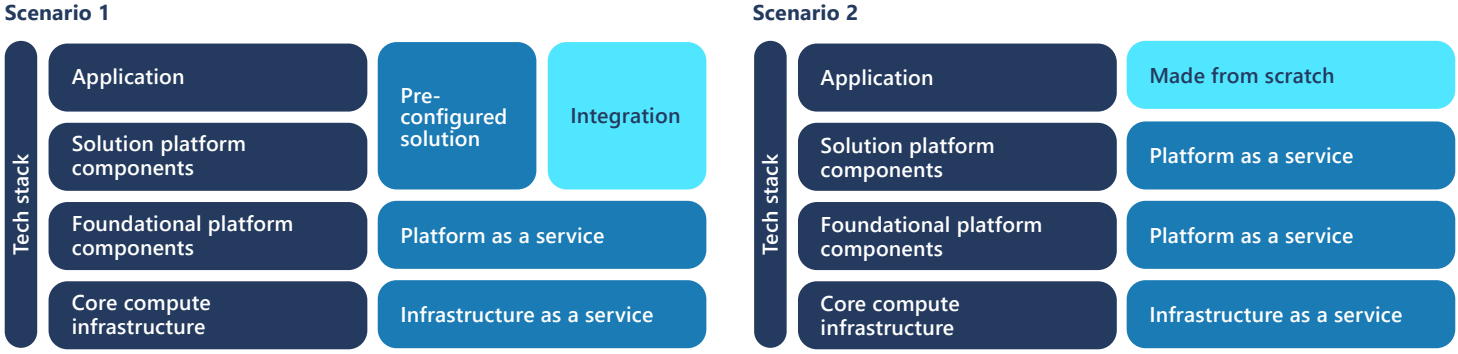
1 Custom-build approach

The end-user **builds the majority of the tech stack** for the IoT solution (either by themselves or with the help of an external services company). Infrastructure components may be bought.



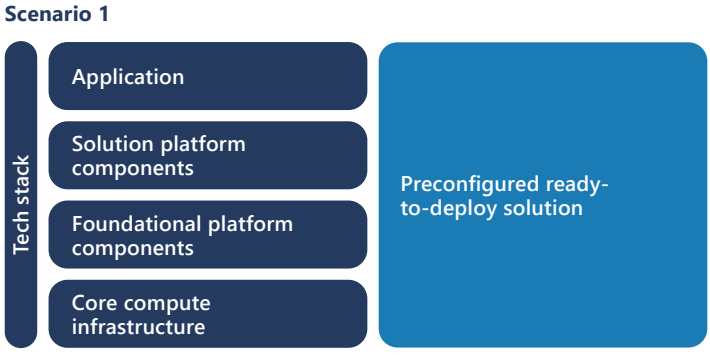
2 Buy-and-integrate approach

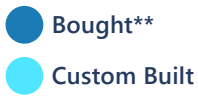
The end-user **buys individual platform components or a partial application** for the IoT solution and integrates it (either by themselves or with the help of an external services company).*



3 Buy approach

The end-user **buys the entire** IoT solution which is plug-and-play with very minor integration effort required.





Source: IoT Analytics Research 2023*= The integration effort as part of the "Buy and integrate" approach may also include coding specific smaller elements from scratch (not purely integration).
**=Typically bought from a software vendor

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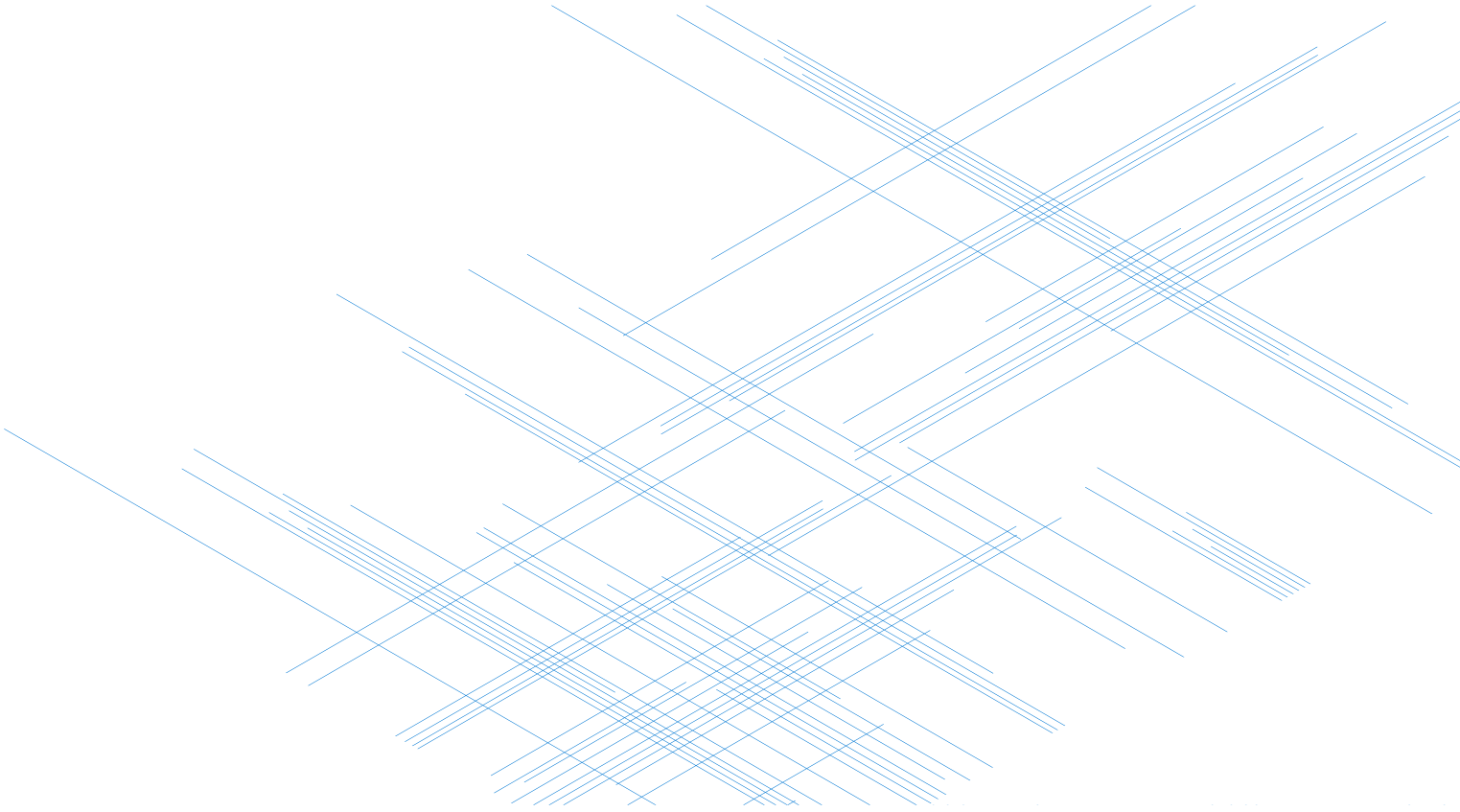
The tech stack shown in Exhibit 1 has three components:

- **Core compute infrastructure:** The infrastructure and computing resources, such as servers, storage, networking, and virtual machines.
- **Platform components:** The tools and services that manage data from assets—such as data management, device management, analytics, and data ingestion—serve as the basis for end-user applications. In scenarios that use the public cloud, one can distinguish between foundational and solution components. Foundational components are not part of the infrastructure but provide crucial services, such as data ingestion and data normalization. Cloud or hyperscaler companies mostly provide these foundational components alongside their infrastructure. Solution components are often specific to the use case at hand and are, in many cases, provided by independent software vendors (ISVs); however, they could also be provided by cloud or hyperscaler companies.
- **Application:** Software that serves a specific purpose or solves one or many needs, such as including a user interface and the ability to manage or configure the application.



Different types of IIoT projects

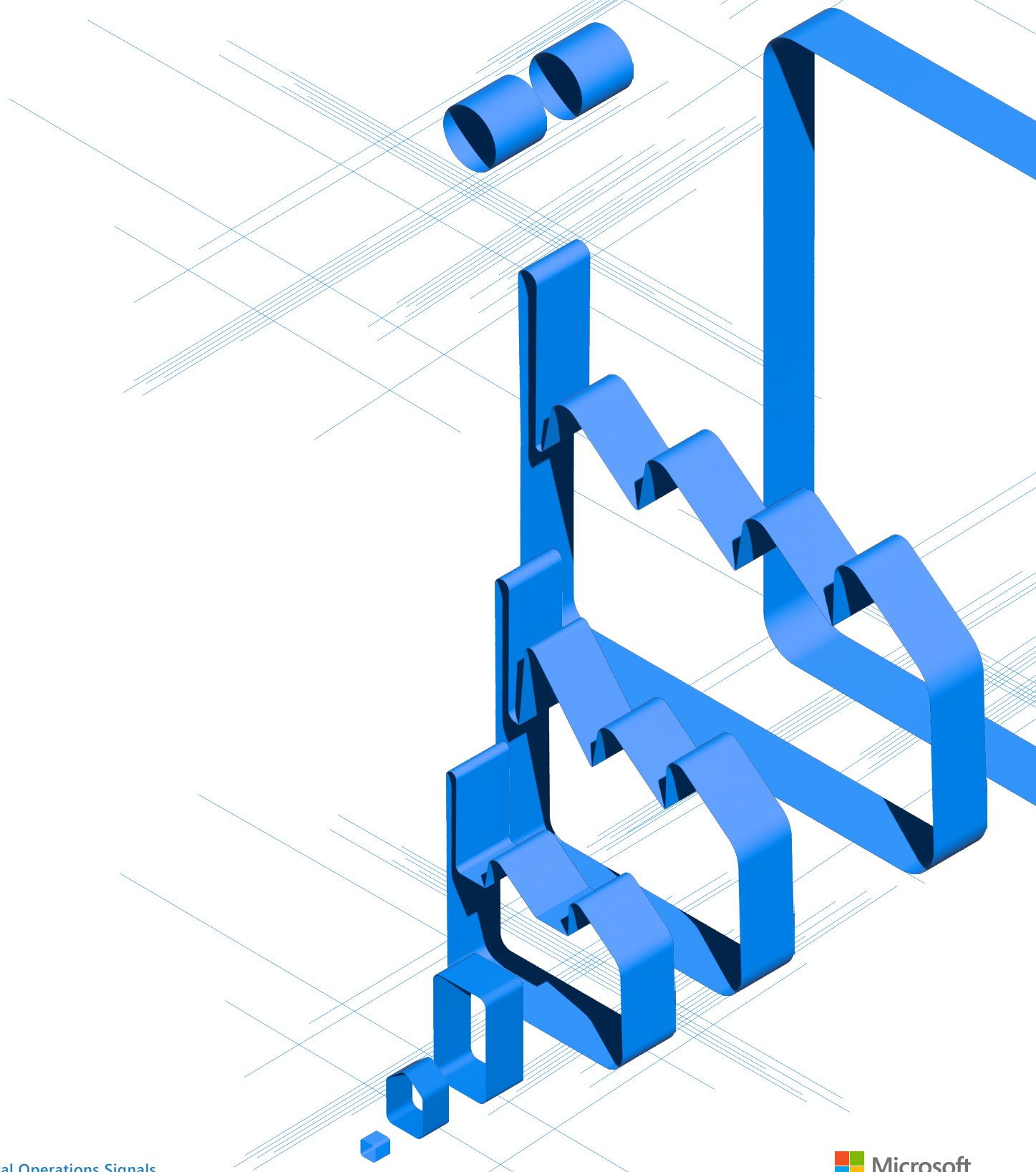
There are many ways to group industrial IIoT projects. In this study, we consider three different types:

1. **Smart operations:** These projects aim to enhance the efficiency of a company's internal operations, energy management, and safety protocols, such as those within a factory (in manufacturing companies), store (in retail companies), or building (in real estate companies). Examples of typical smart operations IIoT use cases include remote asset monitoring and control, process optimization, quality control, and developing an operational digital twin.

2. **Smart supply chain:** These projects focus on improving the efficiency of supply chains. Examples of typical smart supply chain IIoT projects include track and trace of goods in transit and smart connected warehouses.

3. **Connected product:** These projects aim to increase the value of a product that has been sold to a customer and reduce associated costs (such as servicing or downtime). Examples of typical features implemented through IIoT projects include remote service capabilities, IIoT-data-based product usage optimization, and condition monitoring.

2 State of Industrial IoT



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How the EARLY MAJORITY Differs from the EARLY ADOPTERS of Previous Years

As industries cross the chasm, several distinct shifts are noticeable between the visionary "early adopters" of IIoT—some of whom began their IIoT initiatives more than 10 years ago—and the "early majority" of more recent years.

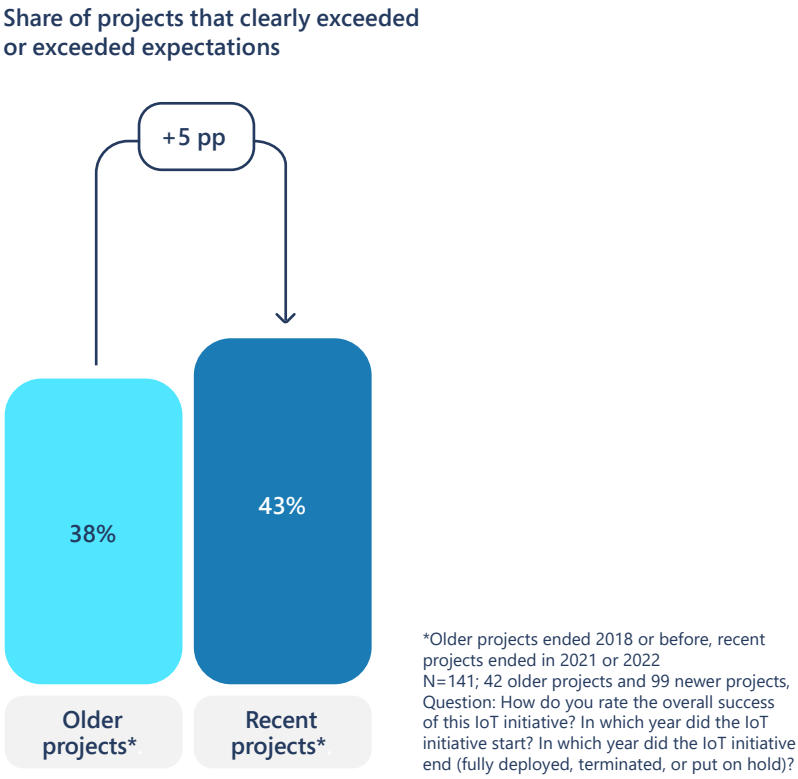
1. **Projects have become more successful**
2. **Time to break even has decreased sharply**
3. **Companies are faster to develop the business case**
4. **BUY solutions are on the rise**
5. **Implementation is becoming less challenging**

Projects have become more successful

Practitioners who have recently completed an IIoT project are more likely to report that their project exceeded expectations than those who completed their projects a few years ago. Specifically, 43% of respondents say that their recent projects exceeded expectations, compared to 38% having that view of older projects.

Exhibit 2: Share of projects that exceeded expectations

Recent projects are more likely to exceed expectations



*Older projects ended 2018 or before, recent projects ended in 2021 or 2022
N=141; 42 older projects and 99 newer projects,
Question: How do you rate the overall success of this IoT initiative? In which year did the IoT initiative start? In which year did the IoT initiative end (fully deployed, terminated, or put on hold)?

The typical outcomes that survey respondents achieve with IIoT projects to consider them successful include: increased operational efficiency; improved asset utilization; reduced downtime; improved product quality; better supply chain visibility; and increase in revenue via improved production throughput, sales, or customer satisfaction.

Example: A performance management project improves operations at a manufacturing facility.

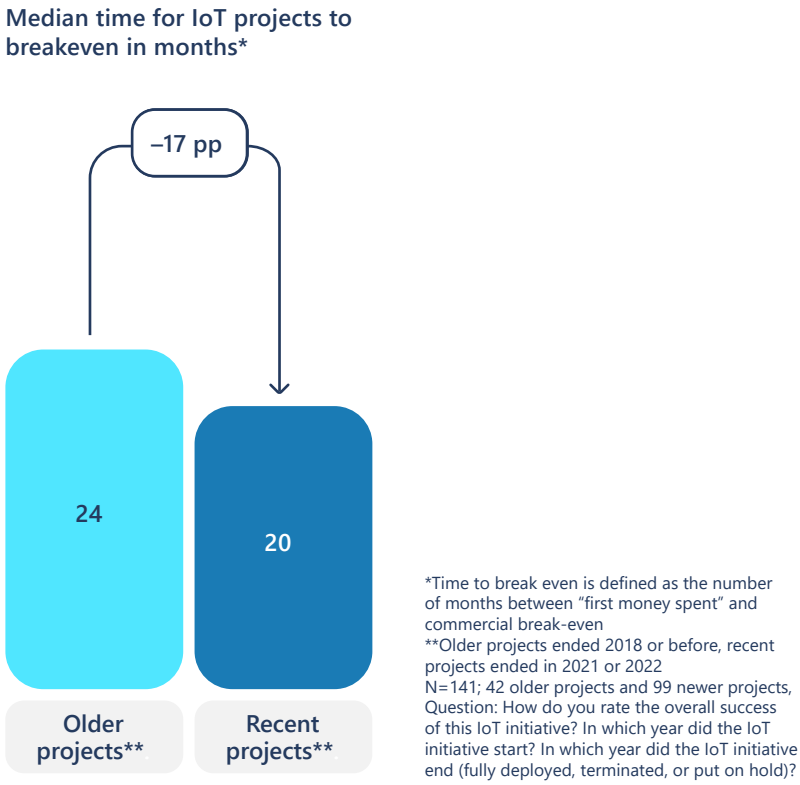
A digital transformation project by a Microsoft partner specializing in IIoT solutions led to significant operational improvements at a manufacturing facility. The project included condition-based monitoring and a prescriptive approach to performance management. The outcomes were impressive: a 10% improvement in overall equipment effectiveness (OEE), a 20% to 30% reduction in unplanned downtime, and a 40% reduction of unproductive time for workers on the shop floor.

Time to break even has decreased sharply

Business initiatives are driven by the promise of an ROI in technology. Projects need a clear ROI to get the green light. Similarly, when industry peers achieve a clear ROI, it encourages others to follow suit. The median number of months between the first dollar spent on an IIoT project and the realization of ROI has decreased by four months for projects completed in the past two years compared with those completed in 2018 or earlier. This represents approximately a 17% reduction in time to break even.

Exhibit 3: Time it takes for IIoT projects to break even

The break-even time for IIoT projects is decreasing



*Time to break even is defined as the number of months between "first money spent" and commercial break-even
**Older projects ended 2018 or before, recent projects ended in 2021 or 2022
N=141; 42 older projects and 99 newer projects, Question: How do you rate the overall success of this IoT initiative? In which year did the IoT initiative start? In which year did the IoT initiative end (fully deployed, terminated, or put on hold)?

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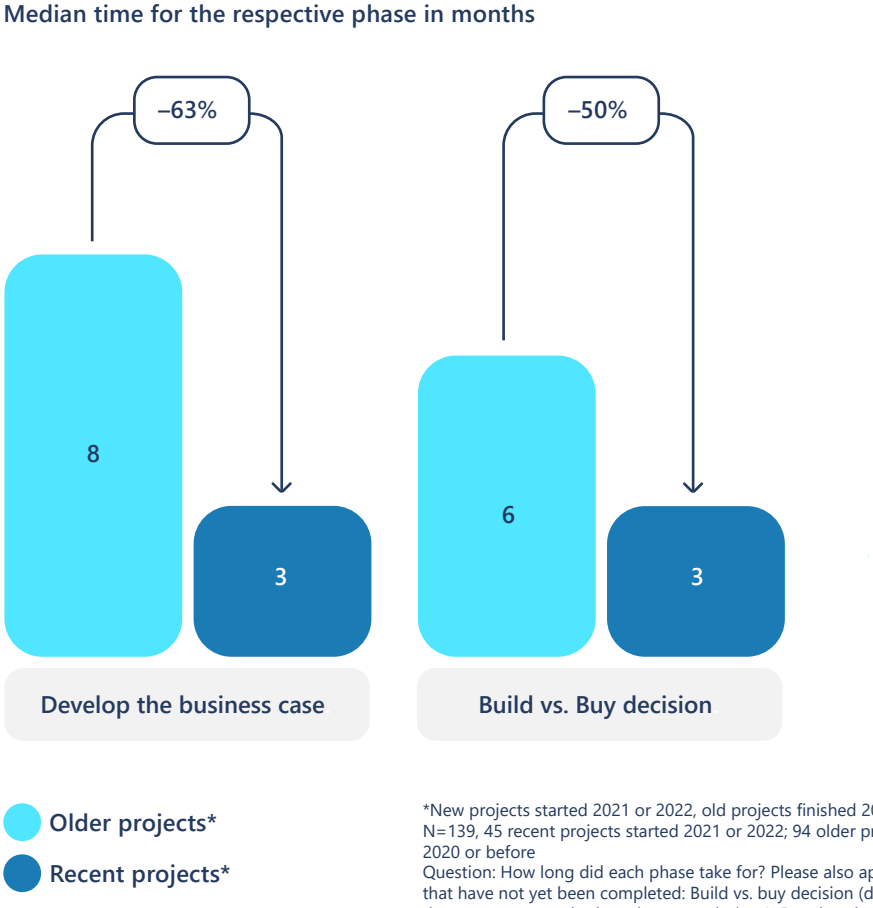
The decrease in time to break even can be attributed to the reduction in time spent on the initial phases of IIoT projects. The first two stages of the five-stage process have seen a significant decrease:

1. **Business case development:** The time required to conceptualize, discuss, debate, and articulate a business case has decreased from eight to three months, a significant reduction of 63%.

2. **Build vs. buy and vendor evaluation**: The internal deliberations on whether to build, buy, or use a combination of both have decreased by 50%, from six to three months.

Exhibit 4: Time it takes to develop the business case and decide on build vs. buy

Companies are developing business cases and making BUY-vs.-BUILD decisions faster



*New projects started 2021 or 2022, old projects finished 2020 or before
N=139, 45 recent projects started 2021 or 2022; 94 older projects, finished 2020 or before
Question: How long did each phase take for? Please also approximate phases that have not yet been completed: Build vs. buy decision (decide to what degree to use standard products or solutions); Develop the business use case (calculate the ROI, set go and no-go criteria for the following phases); In which year did the IoT initiative start? In which year did the IoT initiative end (fully deployed, terminated, or put on hold)

Practitioners perspective: Success of IoT solutions in delivering ROI and scalability. US-based Iconics has been providing software solutions to industries such as building automation, renewable energy, and manufacturing for 37 years. Kyle Reissner, Director of Product Management with Iconics, explains: "On the building side, the value of our solution promises a 20% reduction in energy costs, and on the manufacturing side it is a 15–20% reduction." Roberto Vercelli, Senior Software Architect at Iconics, adds "For a particular customer project, we started with three very big buildings. It took approximately three months to gather the data and create all the dashboards. Now, we are planning to onboard 66 buildings in one year. So, you can imagine that going from zero to one might be complicated, but from the first one you have all the dashboards, so the application is built. Then, you can onboard more and more buildings quite easily."

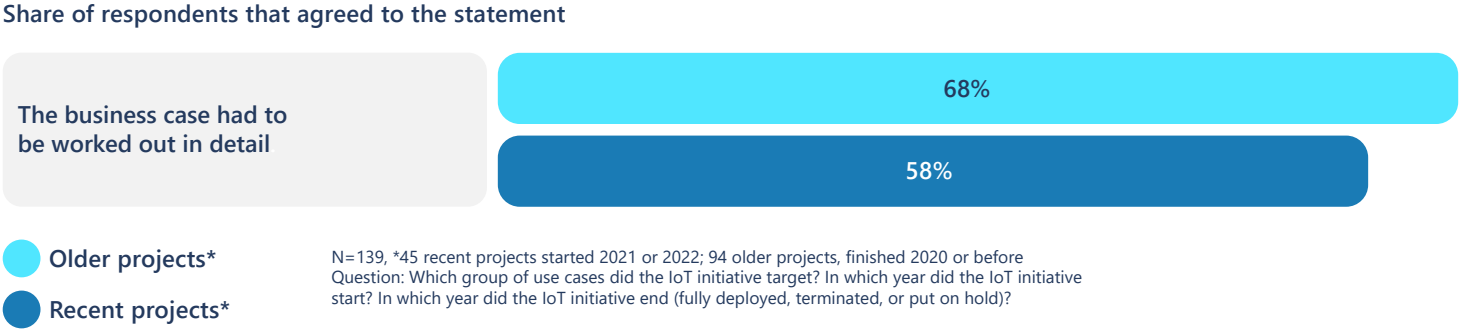
Companies are faster to develop the business case

Although ROI calculation remains a crucial step for most companies, there is a noticeable decrease in the importance given to the development of a business case. Traditionally, upfront articulation of a business case has been considered a critical first step before launching into any initiative. It ensures that due diligence has been done, the absence of which could lead to significant wasting of time, effort, and money. However, the amount of time spent on this step can be debatable—spending too little time may be detrimental, while spending too much time may not yield any marginal benefits.

58% of early majority respondents consider it necessary to create a detailed business case, compared with 68% of early adopters. This shift may be due to the growing confidence in the IIoT ecosystem among those initiating new IIoT projects.

Exhibit 5: Importance of the business case

Companies see less need to develop an upfront business case



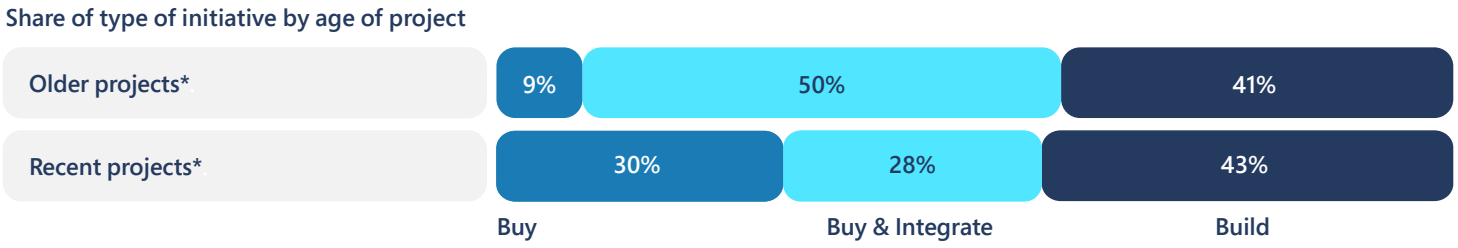
N=139, *45 recent projects started 2021 or 2022; 94 older projects, finished 2020 or before
Question: Which group of use cases did the IoT initiative target? In which year did the IoT initiative start? In which year did the IoT initiative end (fully deployed, terminated, or put on hold)?

BUY solutions are on the rise

The preferred approach for IIoT adopters is still to build IIoT solutions from scratch, either internally or with the help of a third party. According to the survey, 42% of all projects, including old and new ones, were implemented in BUILD mode. However, a growing number of mainstream adopters are shifting to the BUY approach. In fact, 30% of the early majority prefer the BUY approach, compared with 9% of early adopters. This increasing preference for the BUY approach is at the expense of a reduced preference for the BUY-AND-INTEGRATE approach.

Exhibit 6: Types of IIoT initiative

A growing number of mainstream adopters are using the BUY approach

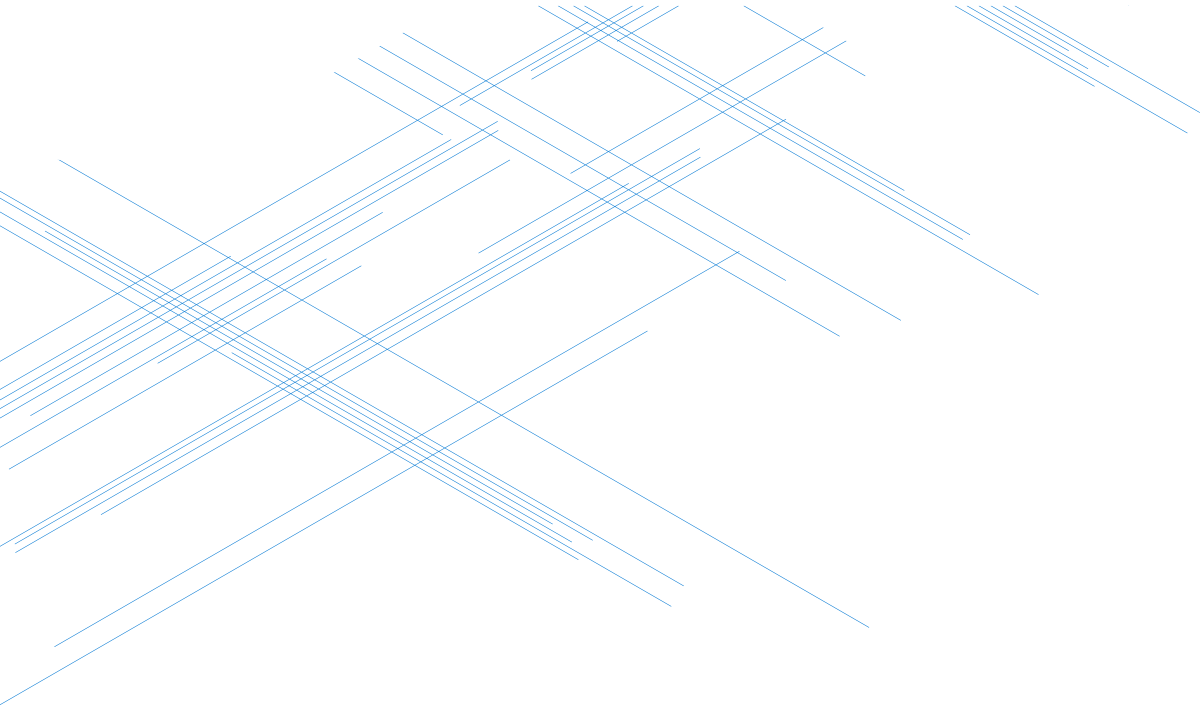


N=141, *47 recent projects started 2021 or 2022; 94 older projects, finished 2020 or before
Question: Which group of use cases did the IoT initiative target? In which year did the IoT initiative start? In which year did the IoT initiative end (fully deployed, terminated, or put on hold)?

Microsoft

Many survey respondents highlighted a shortage of BUY solutions that would allow IIoT adopters to get started with only minimal coding and integration. However, data relating to recent years show a clear trend of vendors targeting niche use cases and problems with tailored solution packages. Given that leading IoT vendors are strongly focusing on selected customer problems and end-to-end ecosystem development, the shift toward BUY solutions will likely accelerate in the future.

Practitioners perspective: Challenges with custom-BUILD may not be initially apparent. US-based Uptake has been helping customers realize IoT solutions for nine years. David Shook, Chief Data Officer, explains: "We clearly see a trend that people prefer proven standardized solutions rather than building something from scratch. A number of IoT adopters we have seen start building from scratch achieved successful first results in just a few months, but then they realize that it takes an enormous effort to make the solution industrial strength. One issue is to ensure the system handles all major exceptions correctly. Another important consideration is that maintaining custom code can become very expensive compared to a purchased solution that that updates for free."



Implementation is becoming less challenging

Among the respondents who completed their IIoT projects recently, only 22% reported implementation challenges, compared to 52% for older projects. Similarly, this group reported budget restrictions as a much lower challenge at 16%, compared to 29% for older projects.

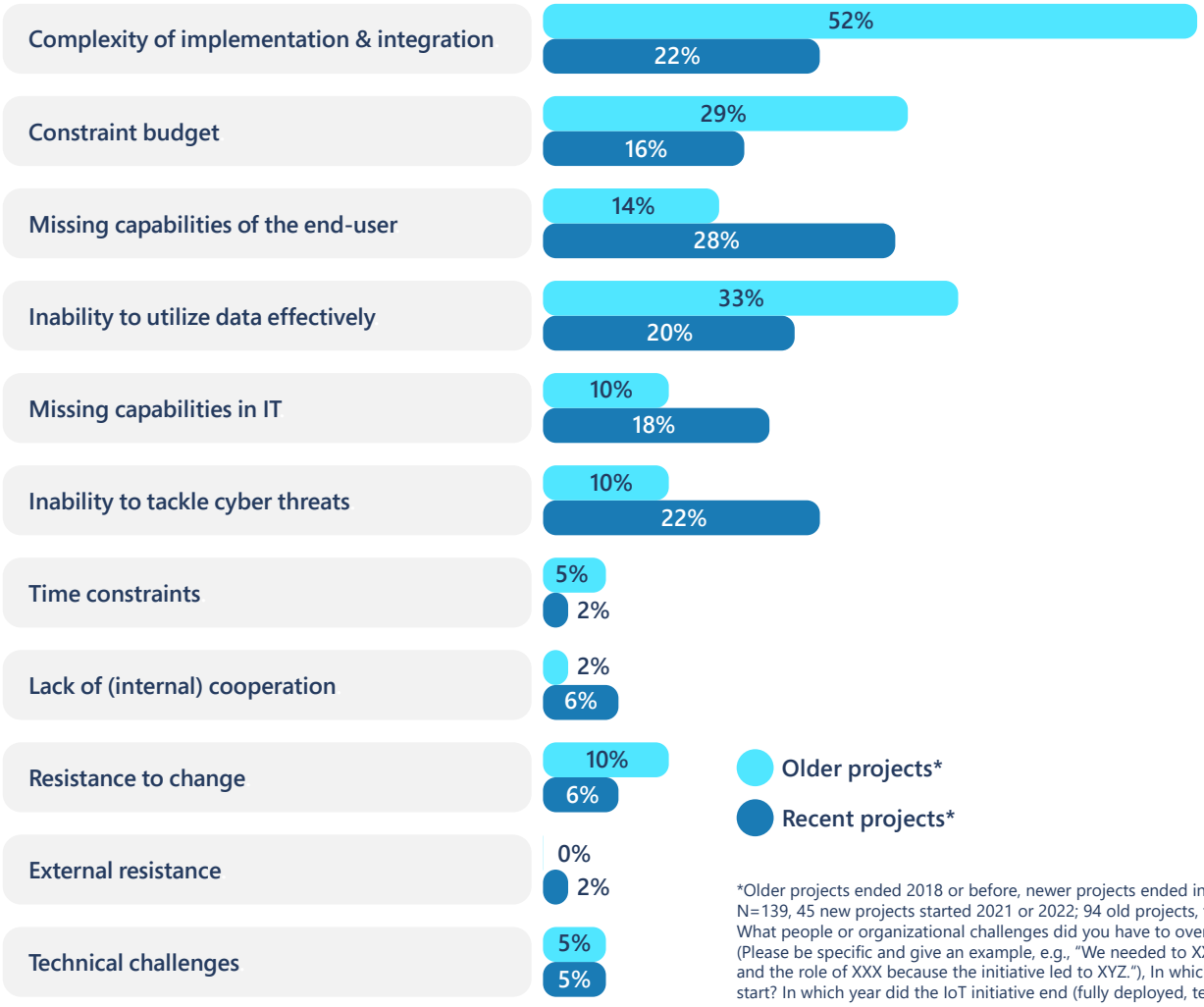
The IoT Signals Manufacturing Spotlight report (August 2022) closely examined the technical implementation challenges that hinder the scaling of smart factory projects. The three top technical challenges reported by respondents were developing new applications (49%), securing OT networks (43%), and interfacing with enterprise applications such as ERP or MES (42%).

At the same time, other challenges have increased. Most notably, the lack of end-user capabilities and skills is more of a challenge for practitioners now (14% vs. 28%). The 2022 IoT Signals report provided solutions for companies to tackle the skill-gap challenge. The most widely used tools and strategies to mitigate skill gaps were additional investments in training (64%), buying more complete digital offerings (54%), and increasing reliance on existing partners (53%).

Exhibit 7: Key IIoT challenges

Complexity of implementation and budget constraints have become less challenging

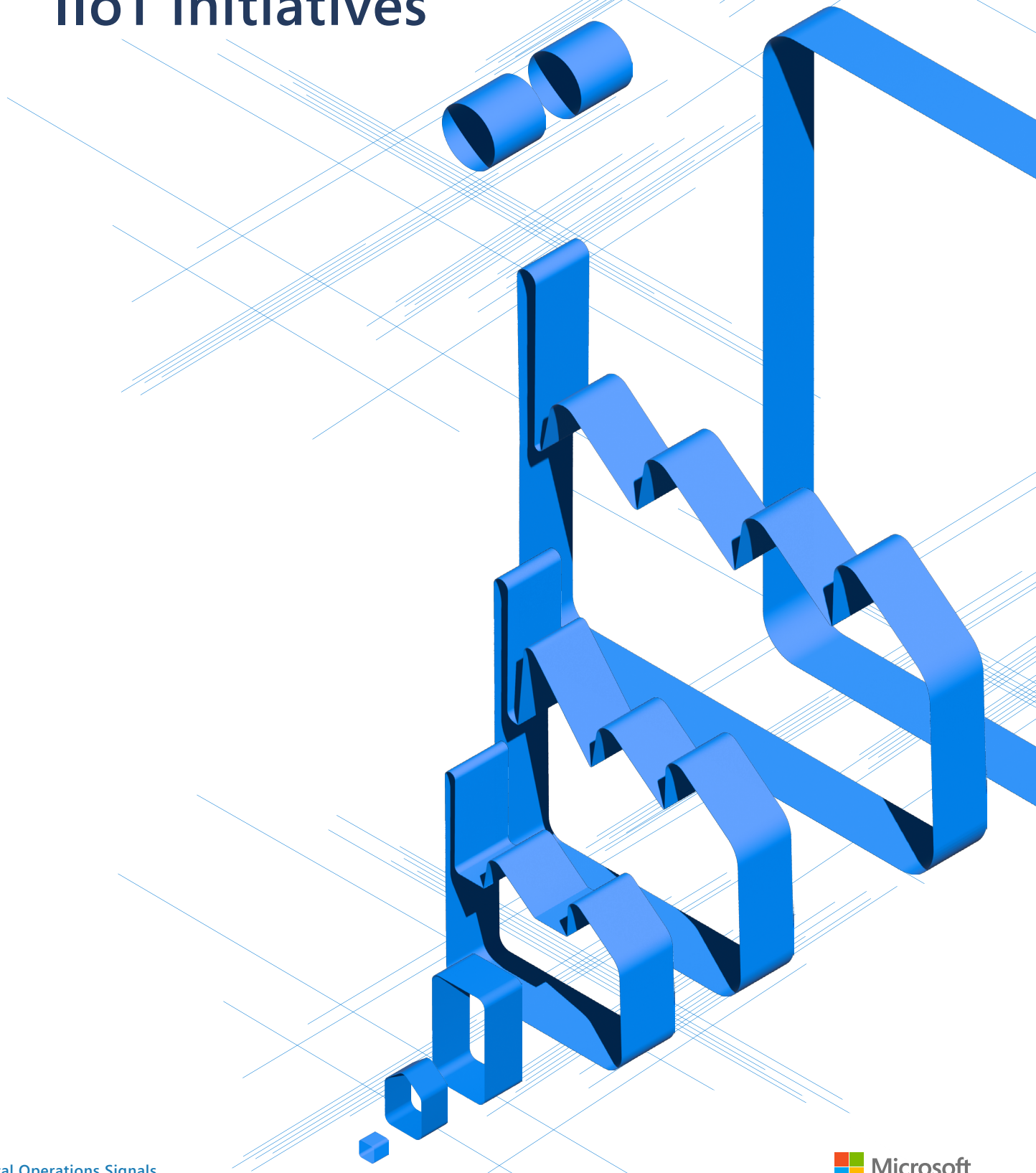
Share of projects that faced respective challenges



*Older projects ended 2018 or before, newer projects ended in 2021 or 2022
N=139, 45 new projects started 2021 or 2022; 94 old projects, finished 2020 or before
What people or organizational challenges did you have to overcome during the initiative? (Please be specific and give an example, e.g., "We needed to XXX the department of XXX and the role of XXX because the initiative led to XYZ."), In which year did the IoT initiative start? In which year did the IoT initiative end (fully deployed, terminated, or put on hold)?

Practitioners perspective: IT and OT convergence makes implementation easier.
US-based PTC has been helping customers realize IoT solutions for 38 years, long before the term IoT became fashionable. James Zhang, VP of Market Development, IoT Solutions, explains: "We still see a gap between IT and OT people, though I do feel that things are improving. I think the gap between IT and OT personnel is by nature—these people are from totally different backgrounds, with different mindsets and skill sets. With a realization that they need to work together for the organization's IoT projects to succeed, these groups are now beginning to find common ground."

3 Best practices when implementing IIoT initiatives



Microsoft

In this section, we will examine the three distinct approaches to IIoT projects to shed light on the best practices for implementing IIoT initiatives. (For a summary explanation of each approach, please see "Three approaches to IIoT projects" in the Introduction, page 15.)

BUY vs. BUILD vs. BUY-AND-INTEGRATE: key considerations

None of the three IIoT approaches is universally the best. Each has pros and cons that potential adopters should carefully consider before deciding which to use.

Overall, our survey found that companies are generally satisfied with their IIoT projects—89% of respondents reported that their initiatives met or exceeded their expectations. Both the BUILD and BUY-AND-INTEGRATE approaches received similarly high ratings, with 40% of respondents saying that their projects "exceeded their expectations." For the BUY approach, only 13% of respondents reported that their project exceeded expectations. Although a low share of respondents expressed a "positive surprise" with the BUY approach, a significant portion (70%) said the approach "met expectations." This indicates that BUY approach projects achieve very predictable outcomes. It is also notable that the BUY approach allowed for the quickest time to amortize the investment, with a median of 12 months.

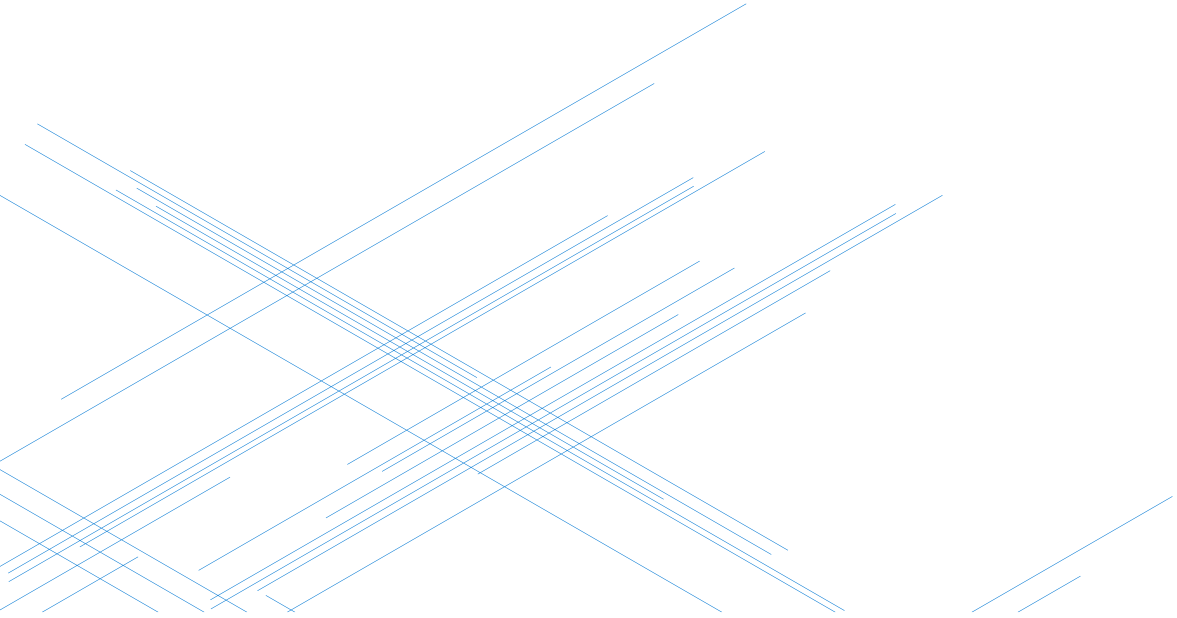


Exhibit 8: Pros and cons of the 3 approaches

Each approach has pros and cons

1 Custom-build approach

Share of initiatives exceeding expectations	40%
Median time to amortize investments	20 months

Pros
- **Provides freedom to customize entire solution**
- **Does not generate lock-in with any vendor**
- Provides the opportunity to develop a unique solution that may provide a competitive advantage

Cons
- **Requires major in-house (IT) capabilities or a reliable partner**
- **Typically leads to unpredictable costs**
- Typically has the longest project timeline (from start to large-scale roll-out)

2 Buy-and-integrate approach

Share of initiatives exceeding expectations	40%
Median time to amortize investments	24 months

Pros
- **Allows to combine proven technology with freedom to customize majority of the solution**
- Is faster to set up (compared to custom- build)
- Allows for shorter time-to-market (compared to custom-build)
- Provides the ability to receive external support/maintenance for part of the solution

Cons
- **Requires management of multiple stakeholders (internal and external)**
- Leads to increased solution complexity (compared to custom-build)

3 Buy approach

Share of initiatives exceeding expectations	13%
Median time to amortize investments	12 months

Pros
- **Allows the usage of tested and proven technology**
- **Provides the ability to receive external support/ maintenance for the entire solution**
- Leads to predictable outcomes

Cons
- **Makes it difficult to integrate specific security requirements**
- Has limited customization options
- Does not provide ability to differentiate to gain a competitive advantage
- Is difficult to integrate into own IT/OT architecture

*Older projects ended 2018 or before, newer projects ended in 2021 or 2022
N=141, 94 new projects started 2021 or 2022; 94 old projects, finished 2020 or before
What people or organizational challenges did you have to overcome during the initiative? (Please be specific and give an example, e.g., "We needed to XXX the department of XXX and the role of XXX because the initiative led to XYZ."), In which year did the IoT initiative start? In which year did the IoT initiative end (fully deployed, terminated, or put on hold)?

Practitioners perspective: Why companies choose the BUILD approach.

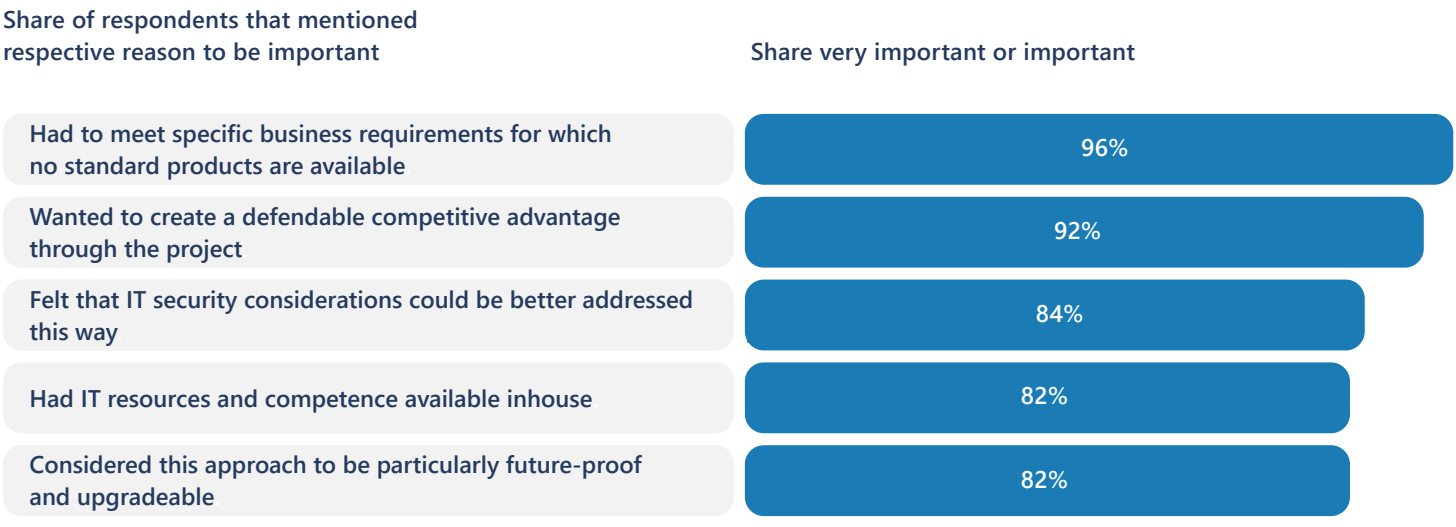
Three quotes highlight why some companies have opted for the BUILD approach for their IIoT solution:

- "If you build it, you own it. It is your IP, and you have the freedom to evolve your solution with your business and choose the cloud provider that fits with your current infrastructure." – VP of Cloud Practice, USA, cloud integration/advisory
- "The build approach allowed us the freedom to incorporate all important details into the solution." – QA Engineer, Italy, automotive
- "Through this, we are able to increase brand awareness and learn the importance of effective packaging." – VP of Strategy, Germany, textiles

The survey found that the top reason to choose the BUILD approach is the need to meet a specific requirement that is not being fulfilled by a standard product in the market, with 96% of respondents citing this as a key factor. Another leading reason is the desire to create a competitive advantage, with 92% of respondents believing that this goal is likely to be achieved through the custom-built solution.

Exhibit 9: Main reasons to choose a custom-build approach

Meeting specific requirements is the main reason for choosing the BUILD approach



N= 142
Question: If you chose a "custom-built" approach, i.e., ran a project to develop a system specific to your requirements, how important were each of the following considerations for your decision (for the initiative)?

Practitioners perspective: Why companies choose the BUY-AND-INTEGRATE approach.
Three quotes highlight why some companies have opted for the BUY-AND-INTEGRATE approach for their IIoT solution:

- "We did not have adequate in-house knowledge in IT or operations to consider building from scratch. We did not want to be entirely dependent on third parties for maintenance. A tailored solution was essential to ensure operator confidence, so a hybrid model was best." – CXO, USA, pharmaceuticals
- "Using this initiative, we are able to save a lot of time and unnecessary effort." – VP, Germany, textiles
- "It was hard to find an off-the-shelf solution and custom-build did not meet the ROI." – Director of Operations, USA, F&B

The top reasons to choose the BUY-AND-INTEGRATE approach are creating a competitive advantage through the project (82%) and promoting ease of use (82%).

Exhibit 10: Main reasons to go for a buy-and-integrate approach

Competitive advantage and ease of use are the main reasons for choosing BUY-AND-INTEGRATE

N=115
Question: For the initiative, if you chose an "intermediate" approach, i.e., based on multi-purpose products, how important were the following considerations for your decision?

Practitioners perspective: Why companies choose the BUY approach.

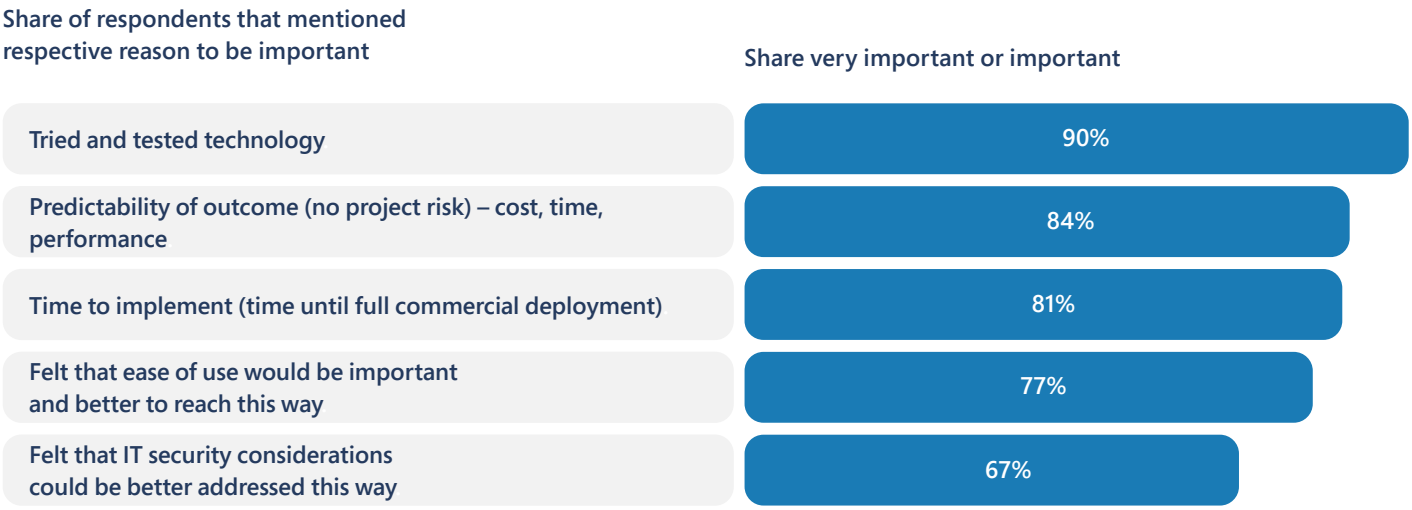
Four quotes highlight why some companies have opted for the BUY approach for their IIoT solution:

- "If we were to build from scratch, I believe it would have cost us a fortune and would not have benefited us in the first few years. That's why we chose a solution provider after much consideration." – Senior QA Engineer, Italy, automotive
- "We launched this initiative with the assistance of the solution provider. I believe that starting from scratch would have cost us more than purchasing a solution." – CXO, Italy, retail
- "It can save a lot of time if we buy a solution from vendor, and I think building from scratch requires a huge budget and resources." – Senior Manager IT, Spain, wholesale/retail
- "It is rarely necessary to go for a custom-made solution in the first stages of this journey, as we need to first learn and understand the customer needs. Starting with standard products accelerates the project and reduces the overall costs." – Director of Logistics, France, machinery equipment

The top reasons to choose the BUY approach are the comfort of relying on a tried-and-tested technology solution (90%) and the predictability in terms of cost, time, and performance (84%).

Exhibit 11: Main reasons to go for a buy approach

Companies seek a tried-and-true and predictable technology when choosing the BUY approach



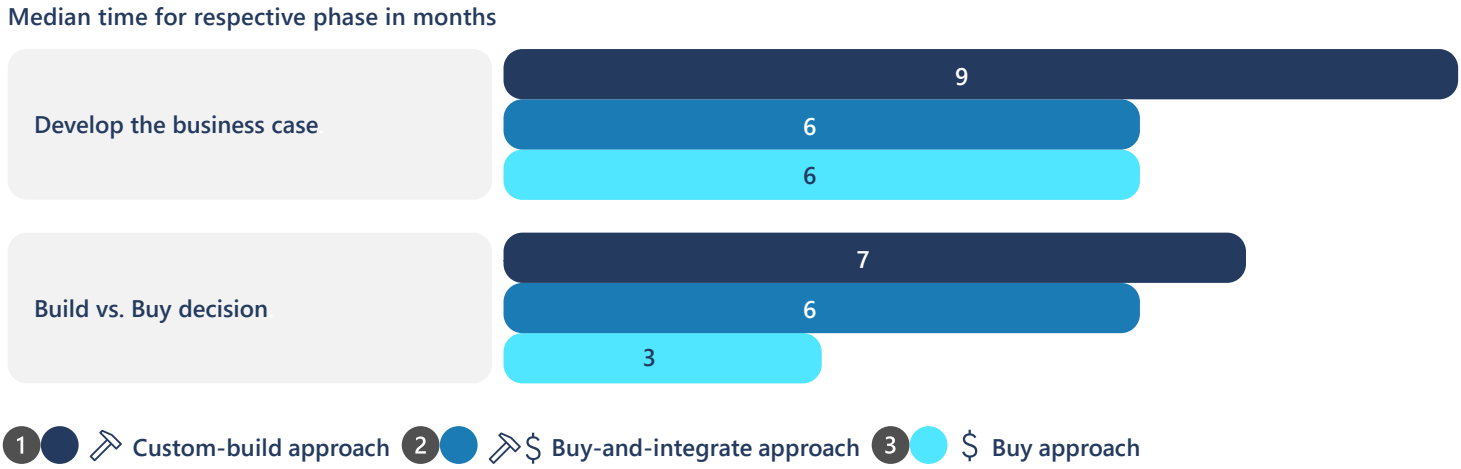
N=45
Question: For the initiative, what were the main reasons for choosing an "off the shelf" approach?

BUY vs. BUILD vs. BUY-AND-INTEGRATE: role of the business case

The survey found that the median time required to complete the first two phases of an IIoT project is 14 months. The BUY approach has the lowest median time for these phases, taking only nine months on average—that is, seven months less than the median time required for custom-built approaches.

Exhibit 12: Time needed for each phase of the initiative

The BUY approach is faster for the initial phases of an IIoT project



N=300
Question: How long did each phase take for? Please also approximate phases that have not yet been completed. Develop the business use case (calculate the ROI, set go and no-go criteria for the following phases)

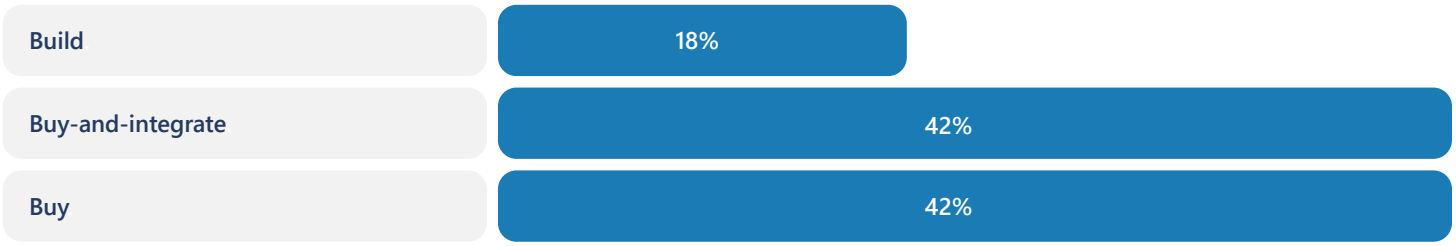
The BUY approach is often quicker in the initial phases of an IIoT project because a detailed business case is not necessary (most likely due to the lower investment required). In fact, 42% of respondents for both the BUY and BUY-AND-INTEGRATE approach indicated that a rough cost–benefit analysis was sufficient to get started without the need for a detailed business case upfront.

Microsoft

Exhibit 13: The importance of the business case to start the PoC

For BUY and BUY-AND-INTEGRATE, a rough cost-benefit analysis is often sufficient to get started

Rough cost-benefit analysis was sufficient to start PoC, the results of which were or will be needed to calculate a sound business case



N=114
Question: What role did the business use case play when getting the IoT initiative started (Phase 1)?

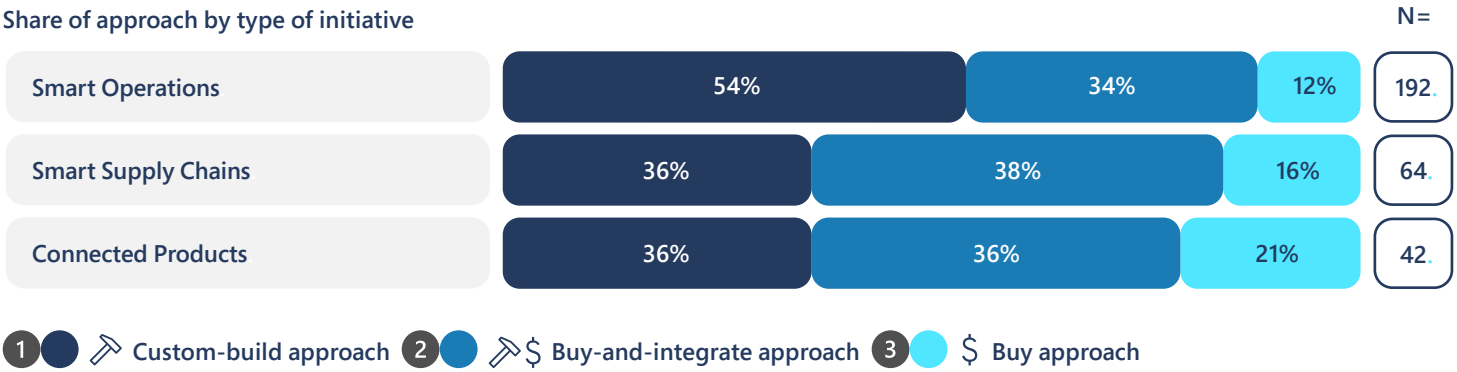
BUY vs. BUILD vs. BUY-AND-INTEGRATE: role of the use case

The type of the initiative and the actual use case(s) that companies implement are significant factors in deciding upon the ideal approach. The number of use cases is also relevant—projects implemented using the BUILD approach serve a median of three use cases, while BUY-AND-INTEGRATE solutions serve a median of five use cases.

Exhibit 14: Approach used by type of initiative

BUILD is the most common approach for smart operations, while BUY-AND-INTEGRATE is most common for smart supply chains and connected products

Share of approach by type of initiative



N=298
For your, which group of use cases did the IoT initiative target? Please first choose what group of use cases the initiative mostly belonged to.
Where was your IoT initiative on a build vs. buy scale? Which of the following best describes your approach considering the initiative?

Smart operations use cases

Smart operations projects are primarily implemented using the BUILD approach, with 54% of all such projects choosing this option. Only 12% of projects in the dataset opted for BUY solutions.

The top three BUILD use cases for smart operations are production planning and scheduling (67%), AI and modern machine vision-based quality control and management (54%), and remote asset monitoring and control, including remote service and maintenance (53%).

For BUY-AND-INTEGRATE solutions, the top three use cases for smart operations are predictive maintenance of equipment AI (61%), AR-assisted operations (60%), and remote or smart service and maintenance (56%).

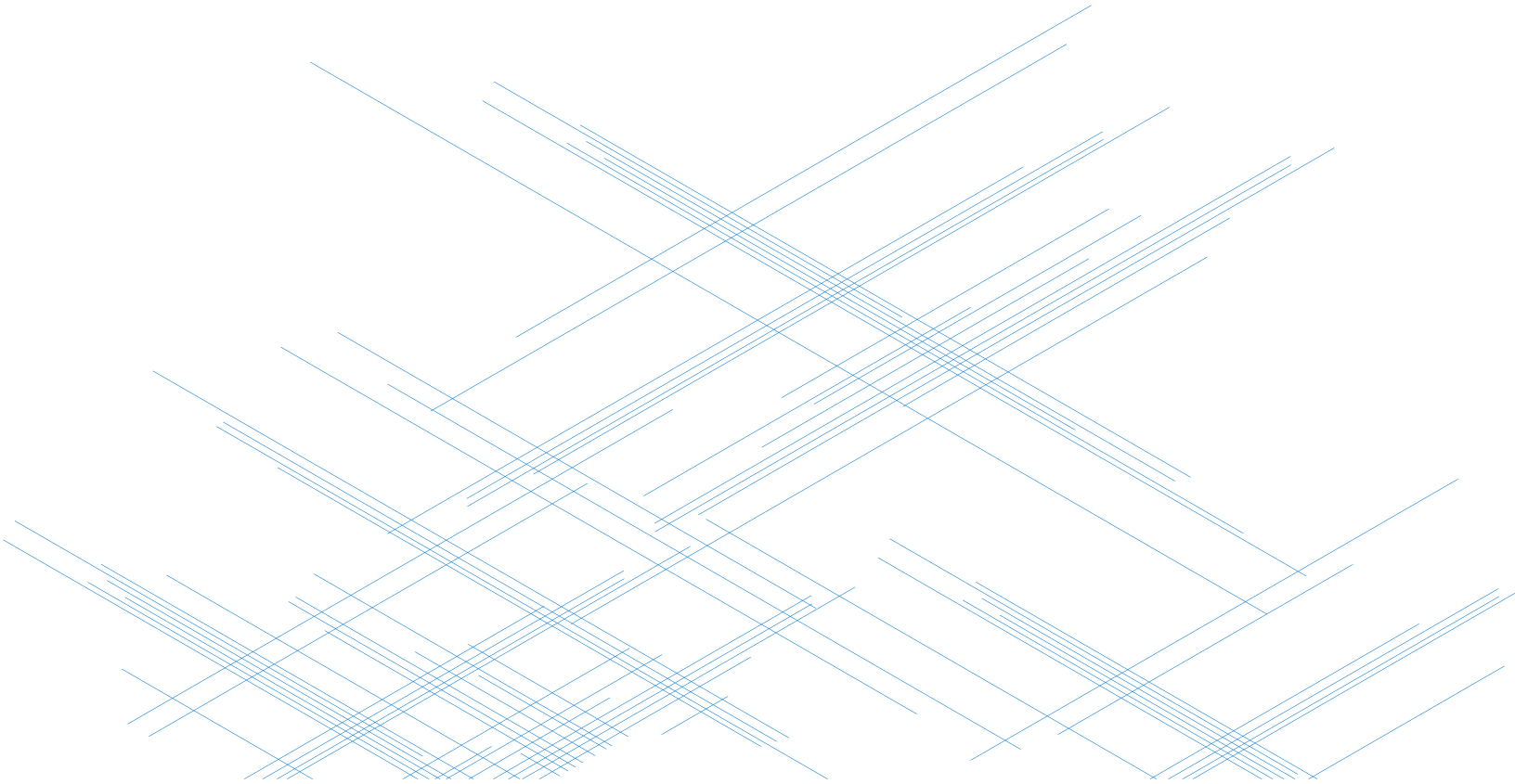
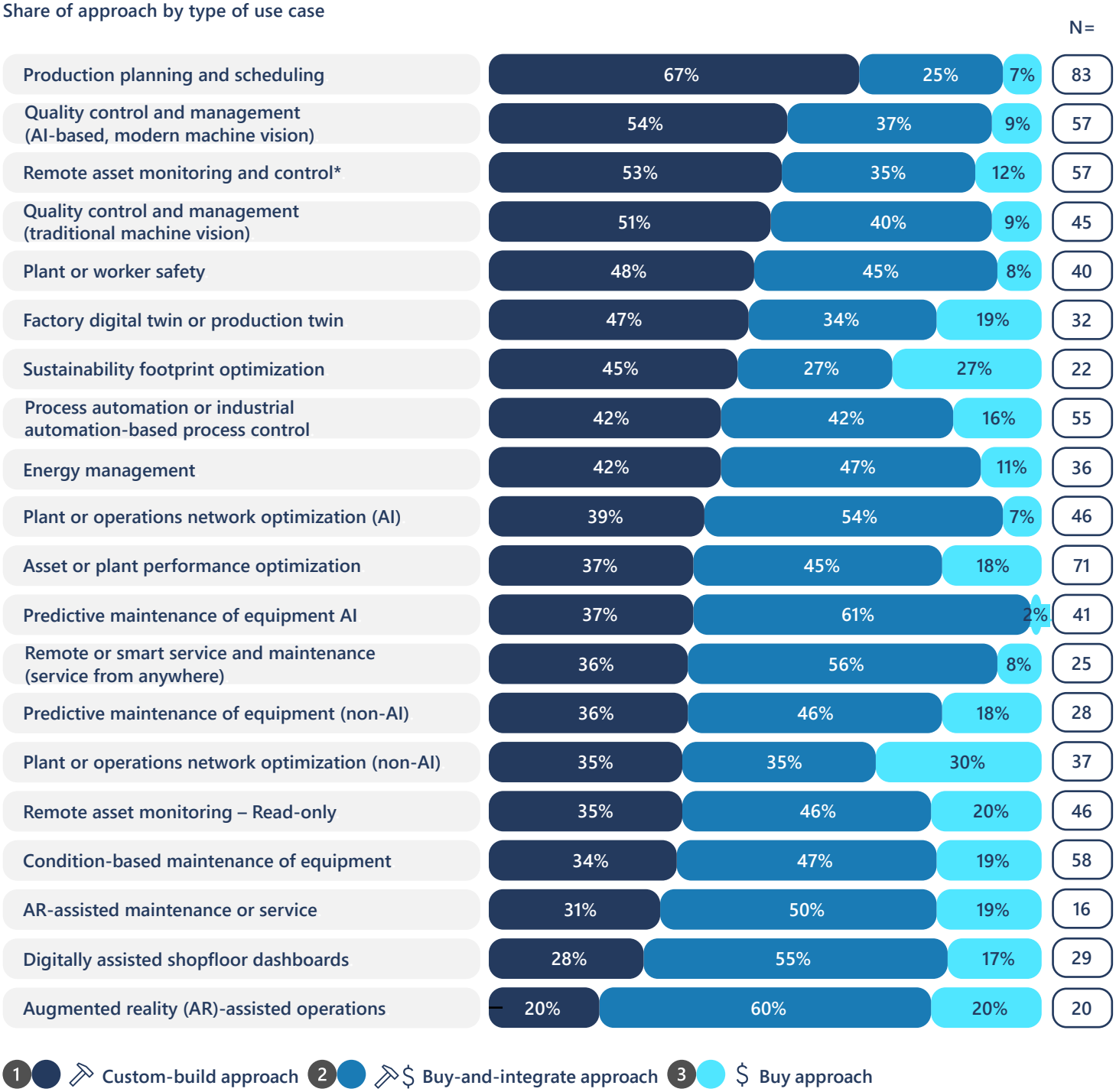


Exhibit 15: Approach by type of smart operations use case

BUILD and BUY-AND-INTEGRATE solutions are most commonly used for smart operations

Share of approach by type of use case



N=192
Questions: What specific use cases did the initiative target? Please first choose what group of use cases the initiative mostly belonged to. Where was your IoT initiative on a build vs. buy scale? Which of the following best describes your approach considering the initiative?

Microsoft

The implementation of IIoT solutions for smart operations has shown promising results in increasing productivity, reducing downtime, and improving quality control. For example, the use of AI and modern machine vision-based quality control and management is expected to reduce scrap and rework while increasing production yields. Additionally, remote asset monitoring and control solutions have allowed companies to improve their service response times, reduce the need for on-site visits, and increase equipment uptime.

Smart supply chain use cases

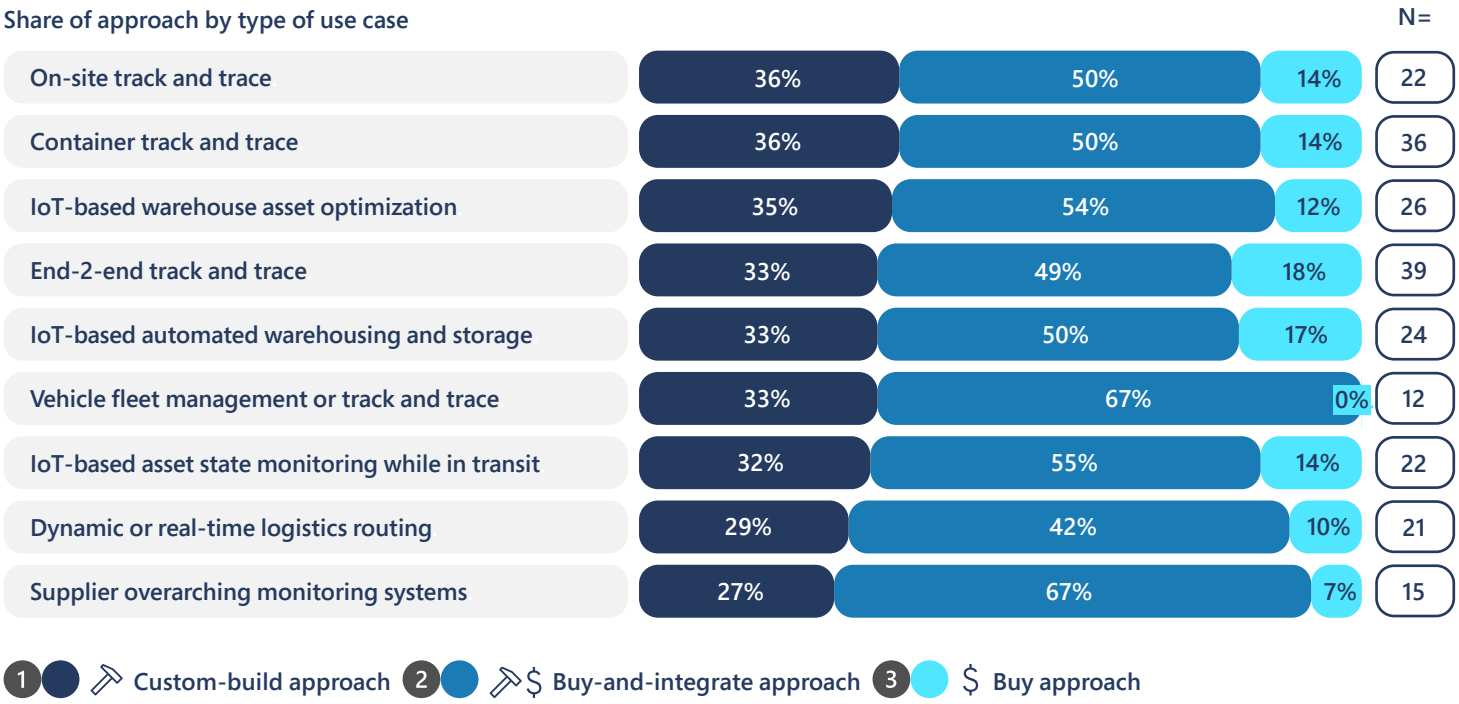
Smart supply chain projects are primarily implemented using the BUY-AND-INTEGRATE approach, with 48% of all such projects choosing this option. Only 16% of projects in the dataset opted for BUY solutions.

The top three BUILD use cases for smart supply chain are on-site track and trace (36%), container track and trace (36%), and IoT-based warehouse asset optimization (35%).

For BUY-AND-INTEGRATE solutions, the top three use cases for smart supply chain are vehicle fleet management or track and trace (67%), supplier overarching monitoring systems (67%), and dynamic or real-time logistics routing (62%).

Exhibit 16: Approach by type of supply chain use case

Smart supply chain projects are primarily implemented using the BUY-AND-INTEGRATE approach



N=64
Questions: What specific use cases did the initiative target? Please first choose what group of use cases the initiative mostly belonged to., Where was your IoT initiative on a build vs. buy scale? Which of the following best describes your approach considering the initiative?

Smart supply chain IIoT solutions have helped companies optimize their logistics operations, reduce transportation costs, and improve delivery times. For instance, implementing real-time logistics routing has enabled companies to make better and faster routing decisions, leading to more efficient and cost-effective transportation.

Connected product features

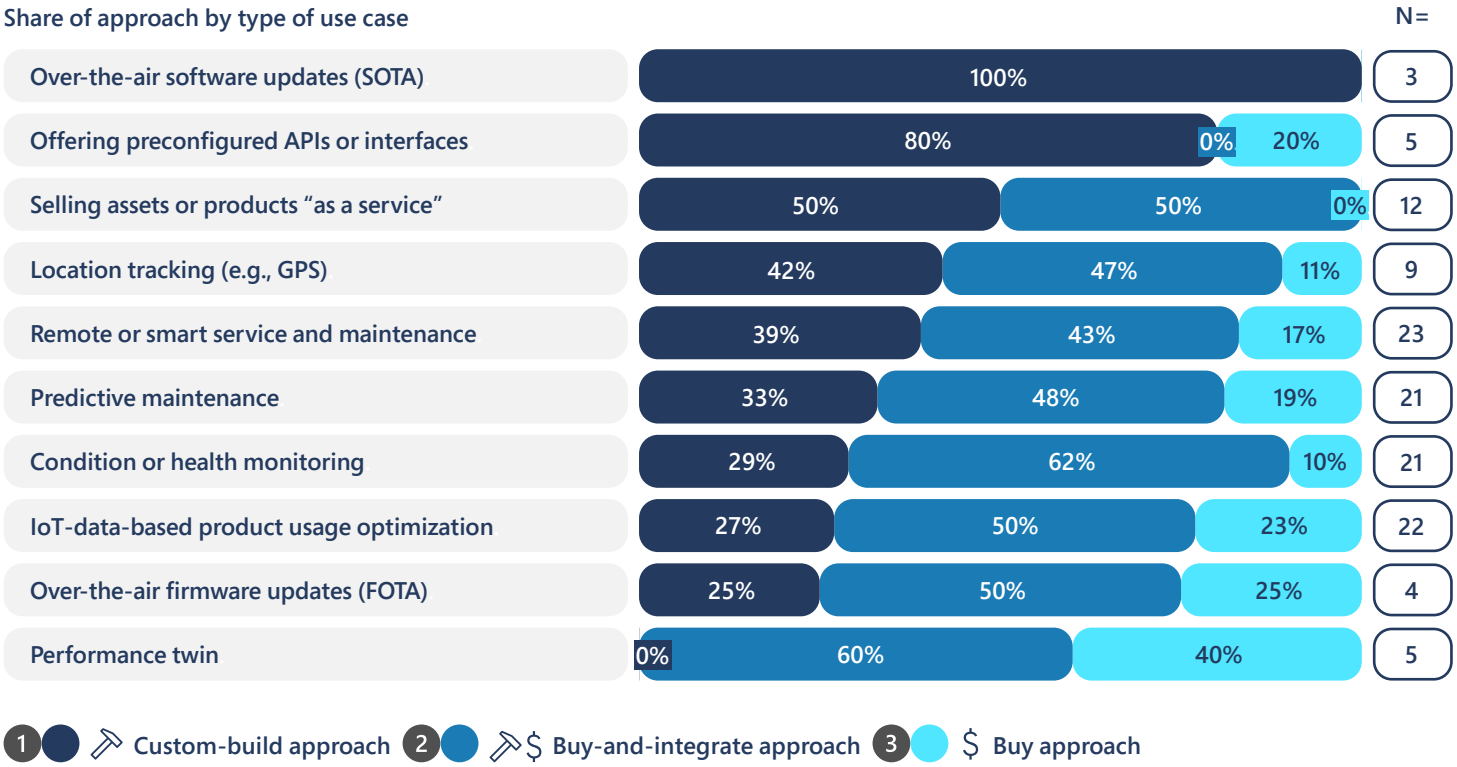
Connected product projects are primarily implemented using the BUY-AND-INTEGRATE approach, with 43% of all such projects choosing this option. Only 21% projects in the dataset opted for BUY solutions.

The top three BUILD features for connected products are over-the-air software updates (100%), integrating preconfigured APIs or interfaces into the solution (80%), and selling assets or products “as a service” (50%).

For BUY-AND-INTEGRATE solutions, the top three features for connected products are condition or health monitoring (62%), performance twin (60%), and IoT data-based product usage optimization (50%).

Exhibit 17: Approach by type of connected product use case

BUY-AND-INTEGRATE is the leading approach for most connected product use cases



N=42
Questions: What specific use cases did the initiative target? Please first choose what group of use cases the initiative mostly belonged to., Where was your IoT initiative on a build vs. buy scale? Which of the following best describes your approach considering the initiative?

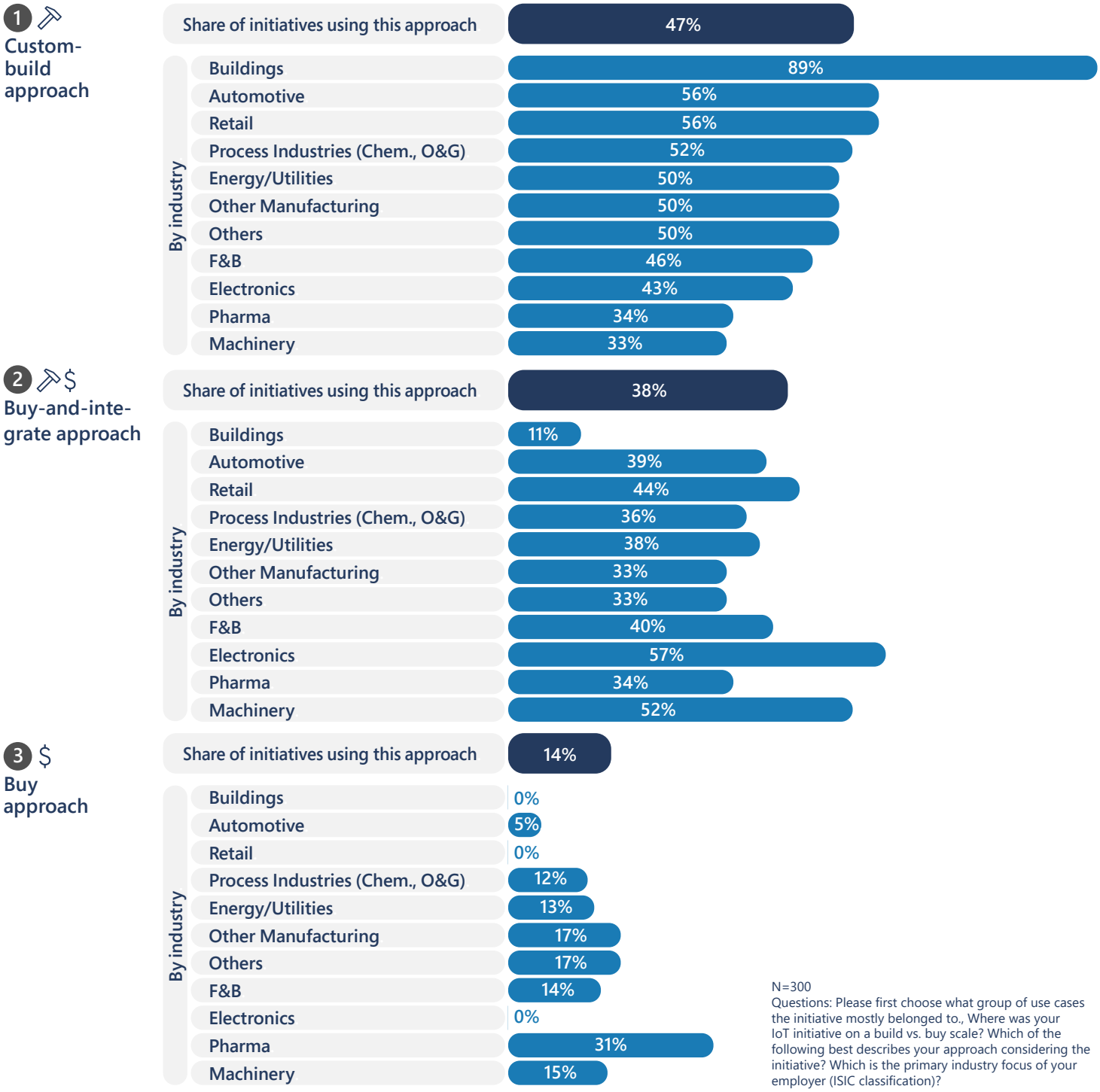
In connected products, IIoT solutions have enabled companies to provide better after-sales services, optimize product performance, and increase customer satisfaction. The use of condition or health monitoring solutions has allowed companies to proactively identify and address product issues before they become major problems, leading to increased customer satisfaction and loyalty.

BUY vs. BUILD vs. BUY-AND-INTEGRATE: role of the industry

The user's industry is also a significant factor in selecting an approach.

Exhibit 18: Share of approach by type of industry

A user's industry has an important role in determining the approach selected



N=300
Questions: Please first choose what group of use cases the initiative mostly belonged to., Where was your IoT initiative on a build vs. buy scale? Which of the following best describes your approach considering the initiative? Which is the primary industry focus of your employer (ISIC classification)?

Microsoft

BUILD

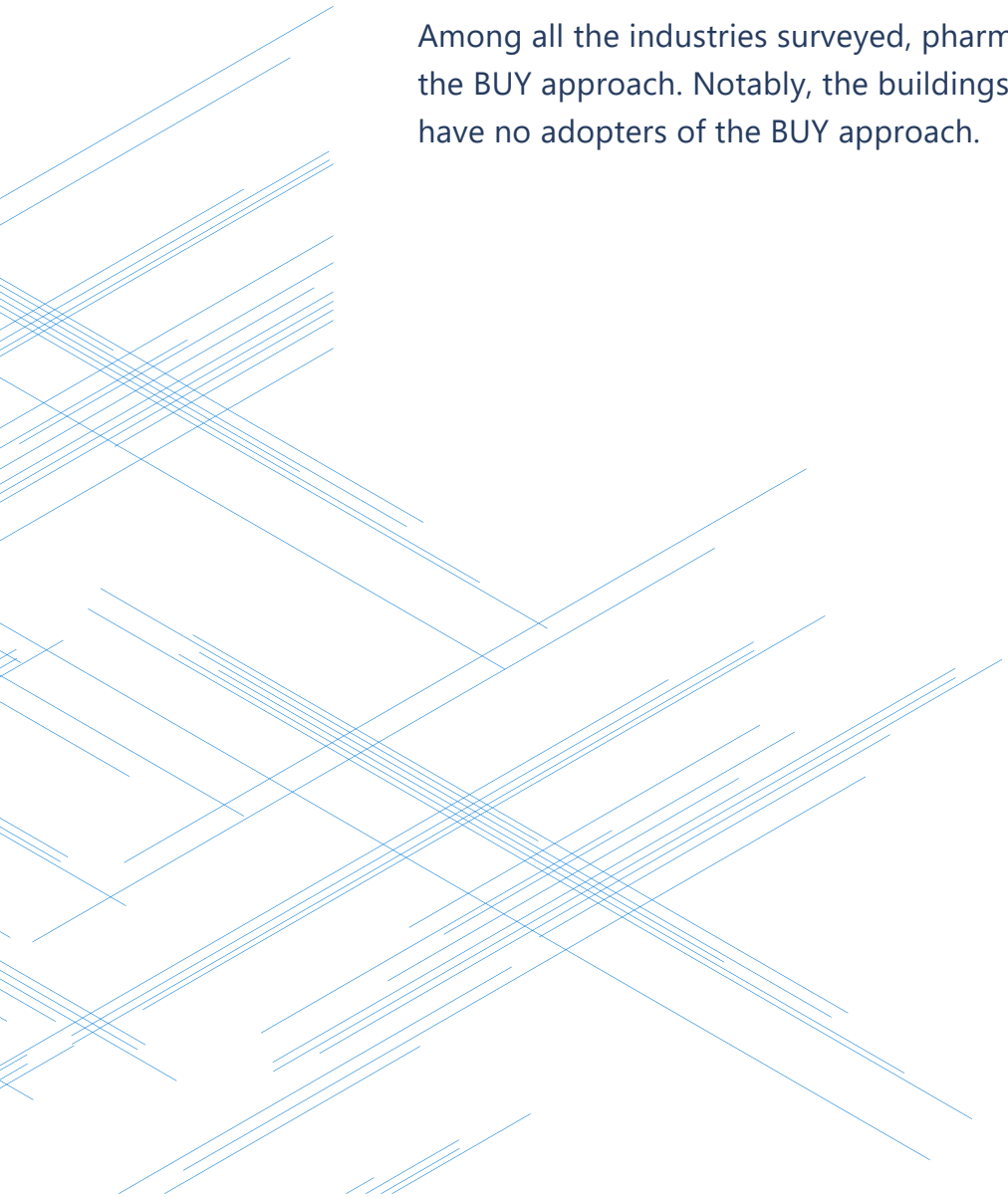
BUILD is by far the most preferred approach in the building sector (89%). More than half of automotive, retail, process, and energy and utilities industries implement their projects in BUILD mode.

BUY-AND-INTEGRATE

BUY-AND-INTEGRATE is the preferred approach in the electronics (57%) and machinery (52%) sectors. This approach has an approximately 40% preference in almost all the sectors, with the exception of buildings, where it has a very small share of 11%.

BUY

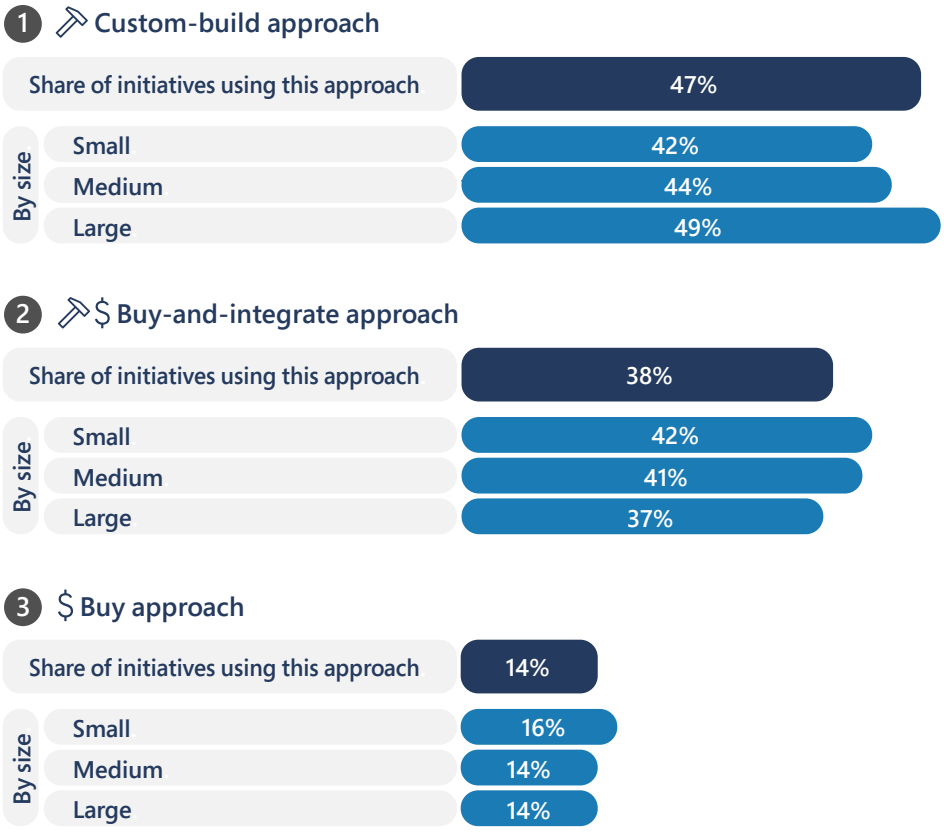
Among all the industries surveyed, pharma (31%) is the biggest adopter of the BUY approach. Notably, the buildings, retail, and electronics industries have no adopters of the BUY approach.



BUY vs. BUILD vs. BUY-AND-INTEGRATE: role of the organization size

Exhibit 19: Share of approach by size of company

Company size is less influential in determining the approach



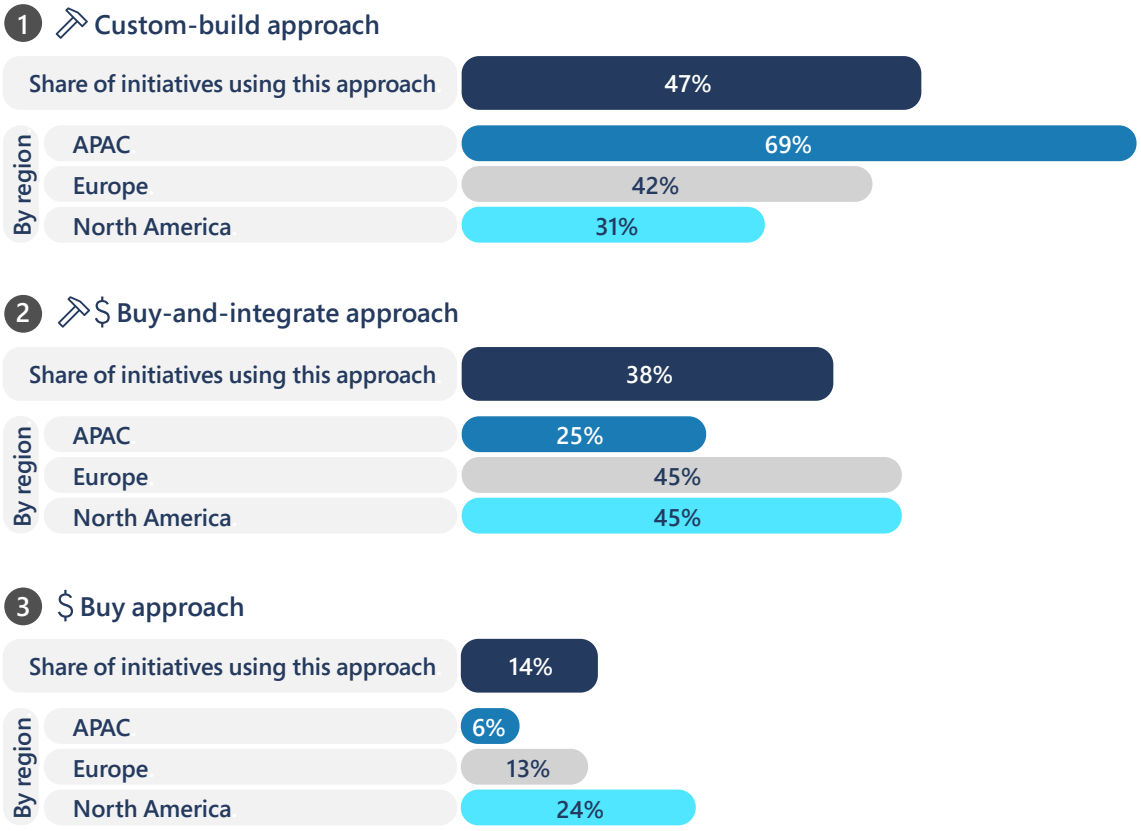
N=300,
Small: Less than 1,000 employees; Medium: 1,000 to 5,000 employees; Large: More than 5,000 employees
Questions: Please first choose what group of use cases the initiative mostly belonged to., Where was your IoT initiative on a build vs. buy scale? Which of the following best describes your approach considering the initiative? How many employees does your employer have?

Larger companies have the greatest preference for the BUILD approach, with 49% using this approach. Small companies prefer the BUY-AND-INTEGRATE approach, with 42% opting for this approach.

BUY vs. BUILD vs. BUY-AND-INTEGRATE: role of the project location

Exhibit 20: Share of approach by region

Regional preferences are apparent, especially for APAC



N=300, Where is your work primarily based?
Questions: Please first choose what group of use cases the initiative mostly belonged to., Where was your IoT initiative on a build vs. buy scale? Which of the following best describes your approach considering the initiative ? How many employees does your employer have?

BUILD

APAC has the strongest preference for the BUILD approach, with 69% of the region's manufacturers adopting it. Within APAC, Japan and China are the leading adopters. In contrast, North American manufacturers show the lowest preference for the BUILD approach. Among advanced economies, Germany has the lowest preference for this approach.

Microsoft

BUY-AND-INTEGRATE

The BUY-AND-INTEGRATE approach is the most preferred approach in North America (45%) and Europe (45%). German manufacturers have the highest preference (75%), followed by Singapore (69%). Japanese companies use this approach the least among all advanced economies.

BUY

Among all the regions, North America (24%) is the biggest adopter of the BUY approach. France and the US have the biggest share of manufacturers opting for the BUY approach. No respondents in Japan, South Korea, and India used this approach.

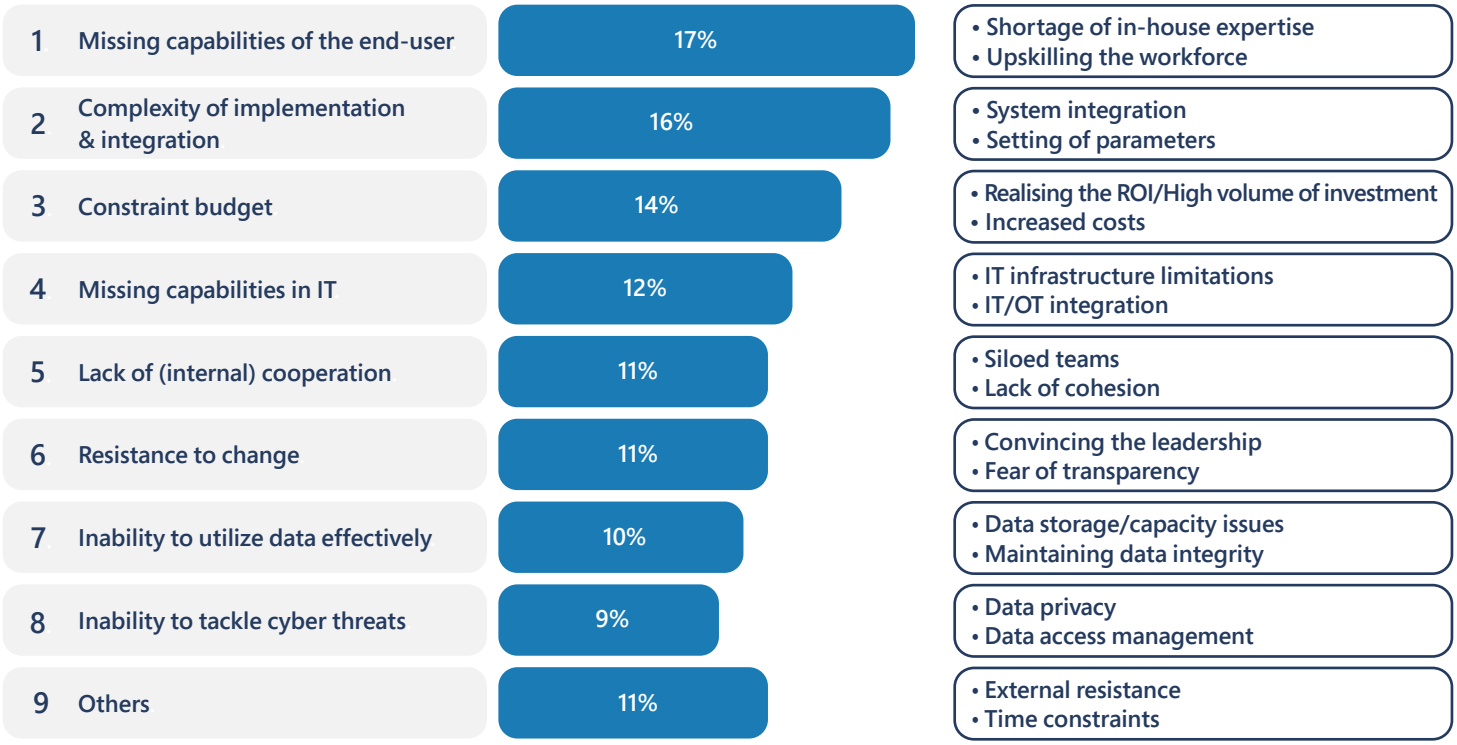
BUY vs. BUILD vs. BUY-AND-INTEGRATE: key challenges for each

The top challenge respondents reported during their initiative was "missing capabilities of the end user" (17%)—for example, the end user having a shortage of in-house expertise or facing challenges in upskilling its workforce. The next most frequently cited challenge was "complexity of implementation and integration" (16%)—for example, integrating the solution into the existing IT landscape or doing proper testing. This was followed by "budget constraints" (14%)—for example, funding the project.

Exhibit 21: Key challenges to overcome during the initiative

Capability gaps and complexity are the biggest challenges

Share of projects that faced respective challenge



N= 246, Notes: Respondents could name more than one challenge, therefore total is above 100%
Question: What people or organizational challenges did you have to overcome during the initiative? (Please be specific and give an example, e.g., "We needed to XXX the department of XXX and the role of XXX because the initiative led to XYZ.")

Practitioners perspective: Internal alignment can be difficult without the right incentives.
An FMCG manufacturer in the US implemented a project to track cardboard return percentage by location. The manufacturing director explains: "We faced cross-functional alignment issues with two departments because they have no skin in the game."

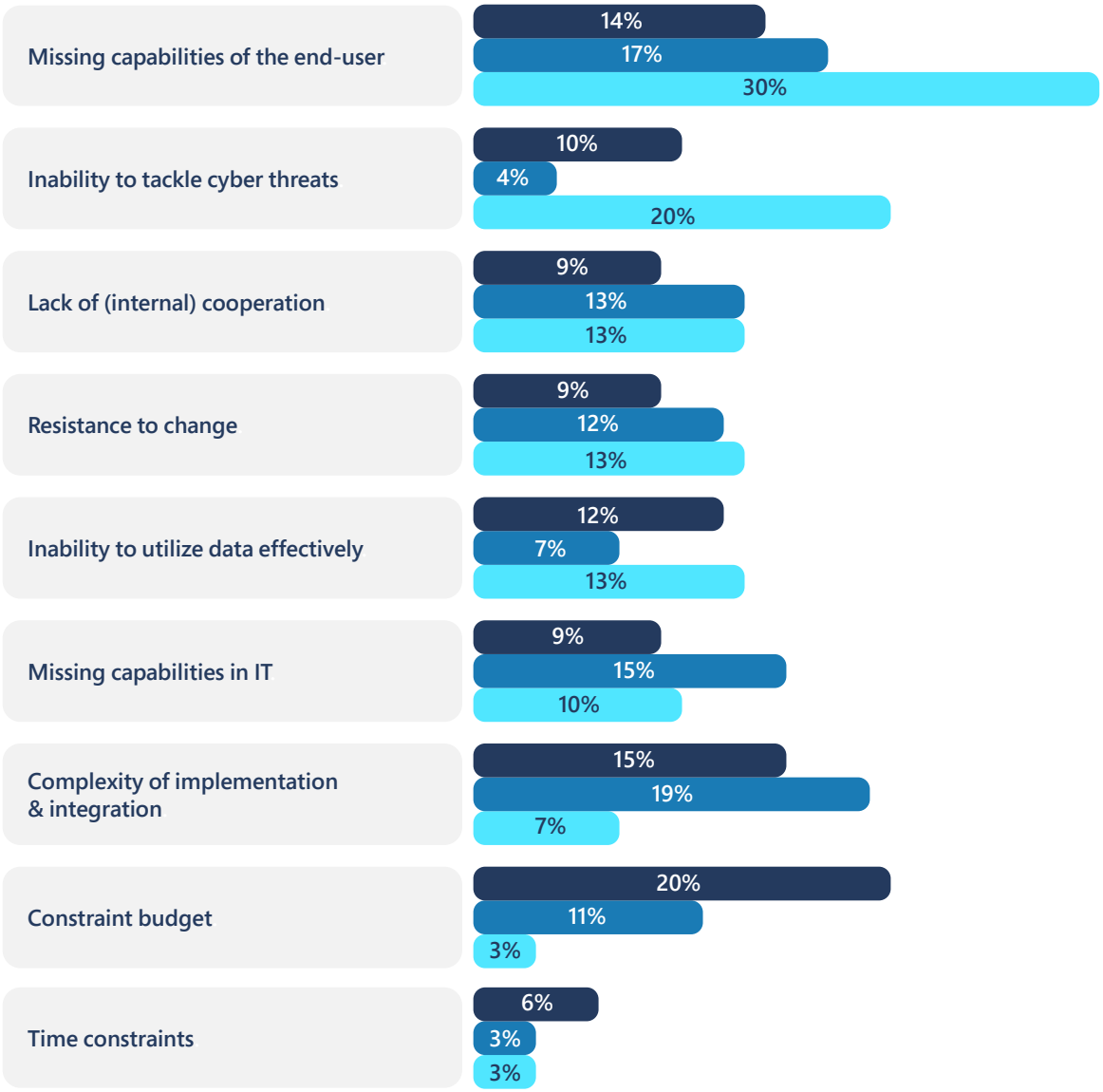
Practitioners perspective: Security considerations can become a major hinderance.
An FMCG manufacturer in the US implemented an asset maintenance monitoring project to predict equipment failure. A senior manufacturing manager explains: "The major challenge with this initiatives has been gaining IT security approval and requesting the vendor to meet our standard for protocol and utilization of our cloud services."

Each of the three approaches have a different set of key challenges

Exhibit 22: Key challenges to overcome by type of project

The key challenges are different across the approaches

Share of projects that faced respective challenge



N= 246,
Notes: Respondents could name more than one challenge, therefore total is above 100%
Question: What people or organizational challenges did you have to overcome during the initiative? (Please be specific and give an example, e.g., "We needed to XXX the department of XXX and the role of XXX because the initiative led to XYZ.")

Microsoft

Challenges during the BUILD approach

The key challenges for those opting for the BUILD approach are budget constraints (20%) and the complexity of implementation and integration (15%). A lack of internal cooperation, IT capabilities, and end-user capabilities are comparatively less significant challenges in the BUILD approach.

Practitioners perspective: Collecting funds for BUILD initiatives can delay the project.
A Spanish electronics company opted to use the BUILD approach for a smart grid project to enable automated outage management and faster restoration. The strategy director explains: "Huge funds were required for this initiative, and it took a long time for us to collect such a large sum of money."

Challenges during the BUY-AND-INTEGRATE approach

The main challenges for those opting for the BUY-AND-INTEGRATE approach are complexity of implementation and integration (19%) and missing capabilities of the end user (17%).

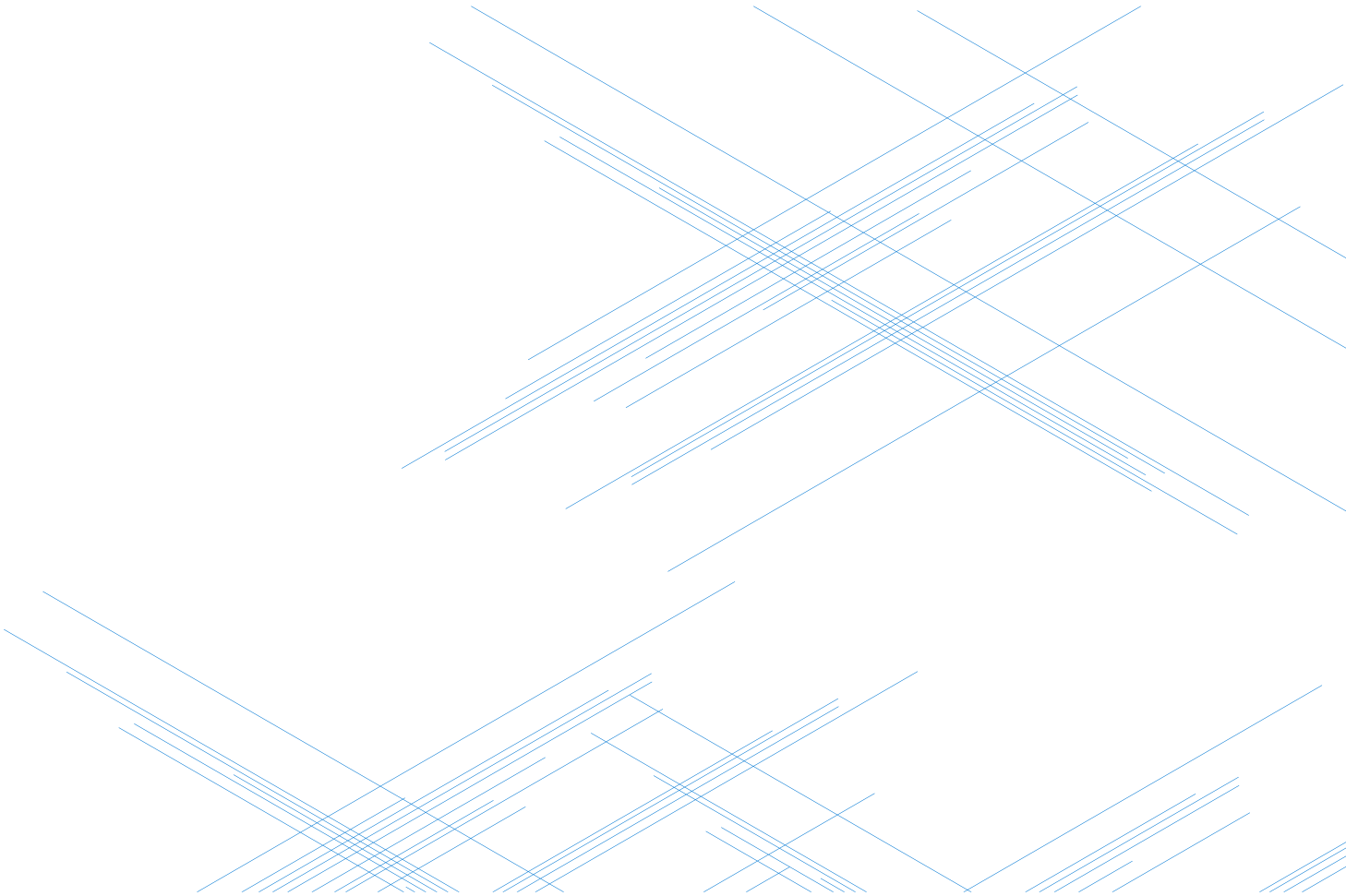
This approach seems to be effective for tackling cyber threats and effective utilization of data.

Practitioners perspective: Many devices and various software tools can lead to sync issues.
An FMCG manufacturer in Singapore opted for the BUY-AND-INTEGRATE approach for its smart robotics project for predictive maintenance and repair. The company integrated a number of different commercial software tools for the overall solution. An engineering manager explains: "Because the size of our plant is too large, it became really difficult for us to sync our machines with the various sensors and software tools in use. Initially, there were a lot of confusions and issues."

Challenges during the BUY approach

The key challenges for those opting for the BUY approach are missing capabilities of the end user (30%) and the inability to tackle cyber threats with the solution (20%). This approach is considered the least challenging with respect to the complexity of implementation and integration and budget constraints.

Practitioners perspective: Training was required for the users of the solution.
A German chemicals company opted for the BUY approach for a process monitoring tool in which it replaced the traditional sensors with Wi-Fi/LTE-enabled sensors. A senior engineering manager explains: "To support the maintenance team for IoT devices, the change management team had to do several hands-on trainings."



General learnings from IIoT projects

Learnings from the approach selection exercise

When asked what they learned during their IIoT initiative regarding buying a solution versus building from scratch, respondents mentioned three key lessons:

1. **Involve stakeholders early on (13% of mentions).**
2. **Plan the technology specifications well (13% of mentions).**
3. **Define the business case clearly (11% of mentions).**

Exhibit 23: Key learnings on the degree of buying a solution vs. building from scratch

Key learnings for the approach selection process are early stakeholder involvement, spec planning, and business case clarity

Key learnings on the process of deciding what approach to use

Involve stakeholders early on

13%

- "... Must get **upper management** buy in before going too far ..."
- "... Participation of all the **upstream and downstream stakeholders** ..."
- "... Ensuring that the initial scope of the project is clear **with buy in from all stakeholders** ..."

Plan the tech specifications

13%

- "... these initiatives are **vulnerable to data risks**; therefore **thoroughly researched, estimated, and tested** for any unwanted issues after final deployment ..."
- "... test for **compatibility and proper operation**, as a malfunction could cause losses ..."
- "... build more lead time for hardware and **make sure network signals can get through** densely packed lines at facility ..."

Define the business case clearly

11%

- "... The **business case must be aligned with the company interest**, in this case due to the high cost of the electricity any solution to reduce variable cost of electricity is well justify ..."
- "... Define **business process first.** Do not focus only on the technology ..."
- "... **calculate all costs** to prevent surprises in the future.

N=83
Question: What were some of the key learnings you drew from this IoT initiative concerning the degree of buying a solution vs. building from scratch?

Microsoft

Practitioners' perspective: IT and OT teams are often not aligned.
Canada-based e-Magic has been helping customers realize IoT-based digital twins for decades. Dale Kehler, VP of Business Development, highlights the importance of stakeholder involvement within its customer organizations: "One of the most critical things to have a successful project is getting that buy-in and stakeholder alignment with various OT and IT teams who often have very different needs and biases. For us as a vendor, it starts with building deep relationships with the client and having conversations with IT to transparently show that we are not just trying to plug an ethernet cable into the machine and put it up into the cloud."

Learnings about working with external professional services firms
42% of the survey participants worked with external professional services firms as part of integrating or configuring the solution. The top two criteria for the selection of the external services firm were "solid IT security track record/reputation" (100%) and "proven track record in both OT and IT" (94%). An OT and IT track record is considered an important factor for selecting the solution vendor and the system integrator.

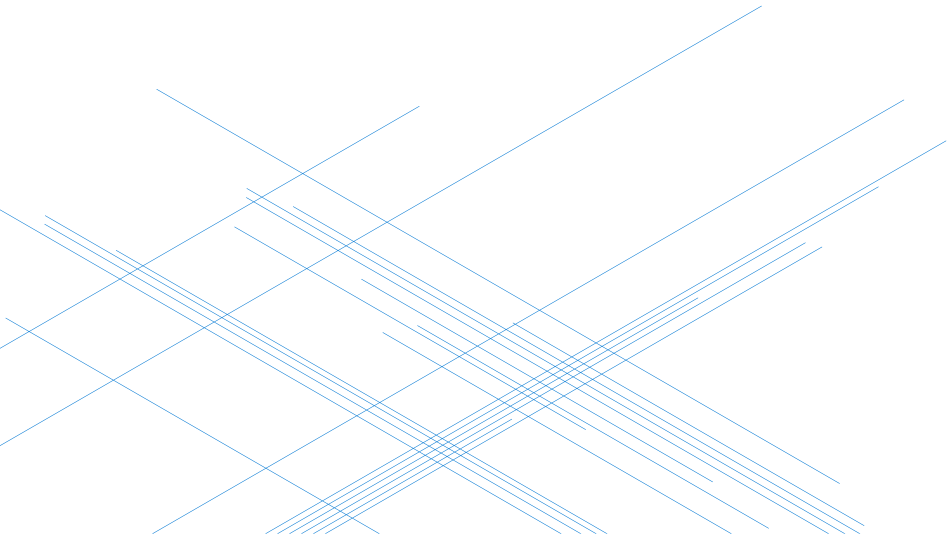
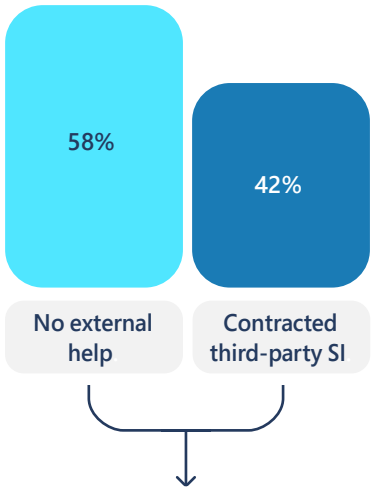
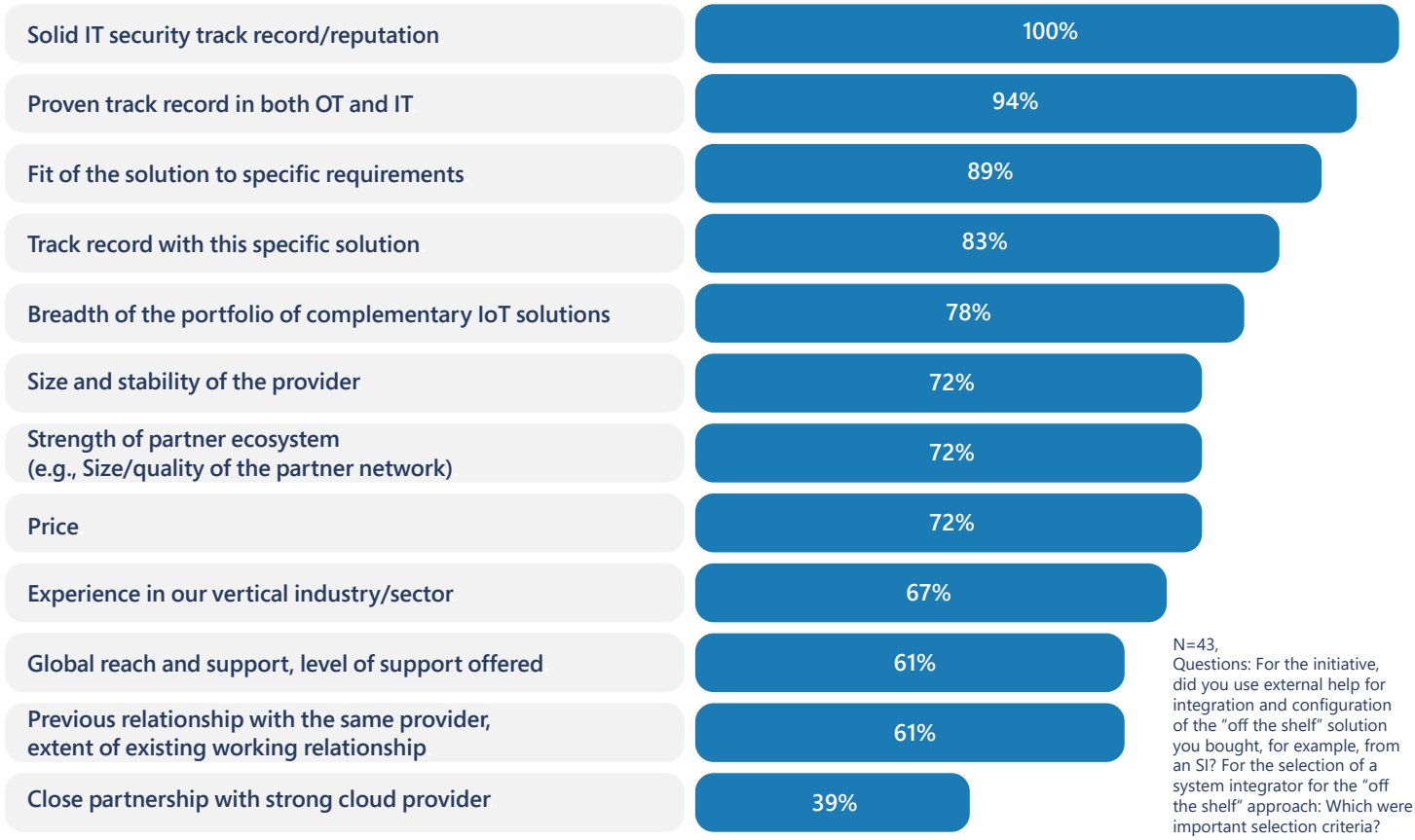


Exhibit 24: External help for system integration and configuration

Many companies seek external help for integration and configuration, emphasizing experience in security and OT and IT

Share of respondents that used the buy approach and contracted a system integrator





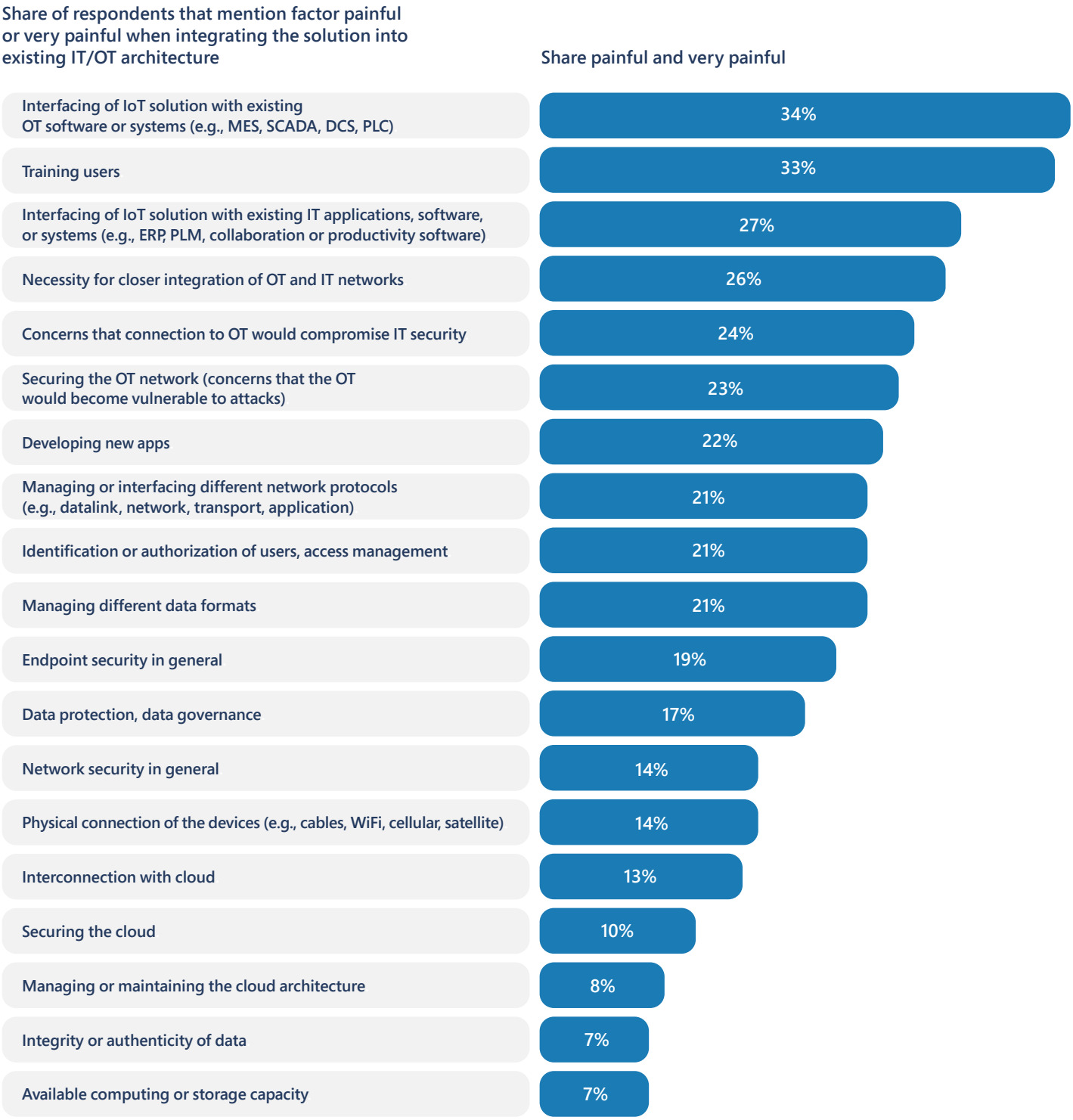
N=43,
Questions: For the initiative, did you use external help for integration and configuration of the "off the shelf" solution you bought, for example, from an SI? For the selection of a system integrator for the "off the shelf" approach: Which were important selection criteria?

Microsoft

Learnings when integrating the solution

Exhibit 25: Most painful aspects when integrating an IIoT solution

Integration and interfacing are the most painful aspects of implementations

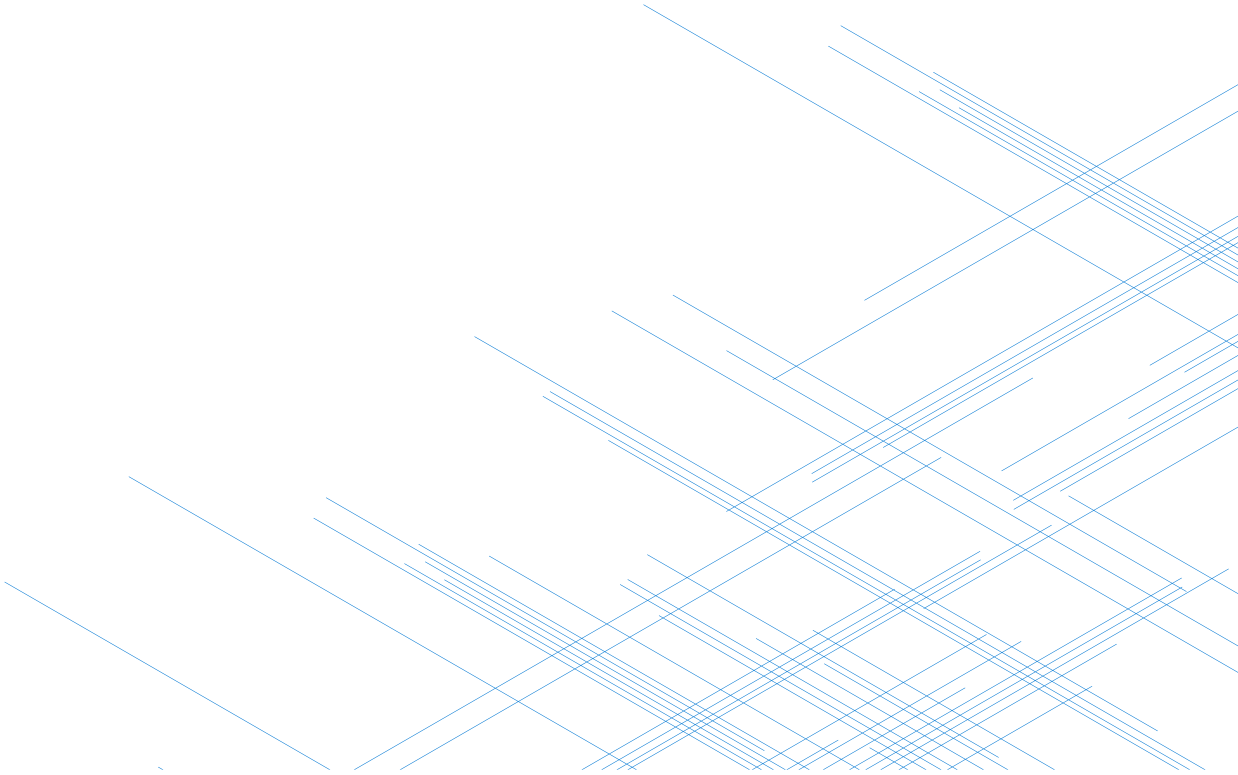


N=43,
Questions: For the initiative, how painful were the following aspects when integrating the solution into your existing IT and OT landscape?

Microsoft

The most challenging aspects of implementing IIoT solutions are integration and interfacing issues, which include integrating the IIoT solution with existing OT (34%), integrating it with existing IT (27%), and integrating IT and OT with each other (26%). The primary obstacles to successful integration are existing OT and IT software systems, the installed base of controllers, and proprietary network protocols and data formats. Additionally, training users of the eventual solution (33%) and addressing security concerns related to IT and the OT network (23%) stood out as significant pain points.

Surprisingly, the physical connection of devices (14%) is relatively low on the list of pain areas. Although 76% of manufacturing assets are now connected, practical challenges and on-site efforts to connect assets still exist. These challenges could be related to wiring and cabling issues or dealing with legacy hardware for which there are no readily available connectivity solutions in the market. Interview participants often told us that the physical connection of devices is not considered part of the IIoT project and is addressed separately. However, almost all interviewees indicated that the logical connections (that is, mapping physical assets to logical devices) entail a fairly manual and labor-intensive exercise.



4 Deep-Dive: The BUY approach to IIoT initiatives

Microsoft

With 30% of all IIoT projects initiated since 2021 choosing the BUY approach and strong momentum toward further adoption, this approach warrants an in-depth examination:

Types of BUY solutions

The survey data show that many organizations do not opt for a BUY approach simply because no ready-to-use solution is available in the market. In fact, 96% of respondents that chose the BUILD approach said that there was no standard product available.

When looking at the solutions that companies bought, three types stand out:

1. **An end-to-end solution for a specific use case**. Track-and-trace logistics solutions, for example, were mentioned several times by survey participants. These solutions come with ready-to-use hardware, preconfigured connectivity, and software and dashboards designed with the user in mind.

2. **An add-on to existing OT infrastructure**. Organizations that have standardized their operations on specific industrial automation hardware or a specific machine or asset report that they find it easy to add a BUY solution—for example, a new tool to analyze the energy efficiency of a specific asset that has been used for years.

3. **An add-on to existing IT infrastructure.** Organizations that have standardized their IT infrastructure on a specific cloud find it easy to add a BUY solution—for example, new software to perform better data operations that is pre-integrated with the specific cloud.

Example: Buying an IIoT solution for automating key operations at bulk liquid terminals
A US-based company that operates liquid bulk terminals for the oil and gas and chemicals industry sought to reduce operational costs, improve monitoring capabilities, prevent incidents, and reduce inventory. In 2018, the company embarked on an IoT project and opted to purchase hardware and software tailored to the exact needs of operating such terminals. This included the automation of common terminal workflows, such as product receipts, gate access monitoring, and providing remote control capabilities.

After 10 months of building the business case and another six months of weighing the BUY versus BUILD options, the company ultimately decided to buy a solution in the market that met its requirements without requiring it to build components internally. The company focused instead on configuring key workflows and alarms and notifications. In retrospect, the project manager estimates that using the BUY approach allowed the company to break even approximately three to four times faster compared with building a significant part of the solution themselves. Due to the project's size and the various stakeholders involved, the PoC phase took an additional six months to complete, but it was regarded as highly successful. It resulted in a reduction of spill incidents and potential incidents, among other benefits, leading to the decision to fully roll out the solution.

Why the BUY approach is gaining ground

BUY solutions seem to be a reliable choice for users, with 70% of them reporting that their project met their expectations. Additionally, the time it takes from the first project-related expense to reach commercial break-even is significantly shorter for BUY solutions (12 median months) compared to other approaches (20 median months).

Organizations are motived to buy IIoT solutions for three main reasons (see Exhibit 11):

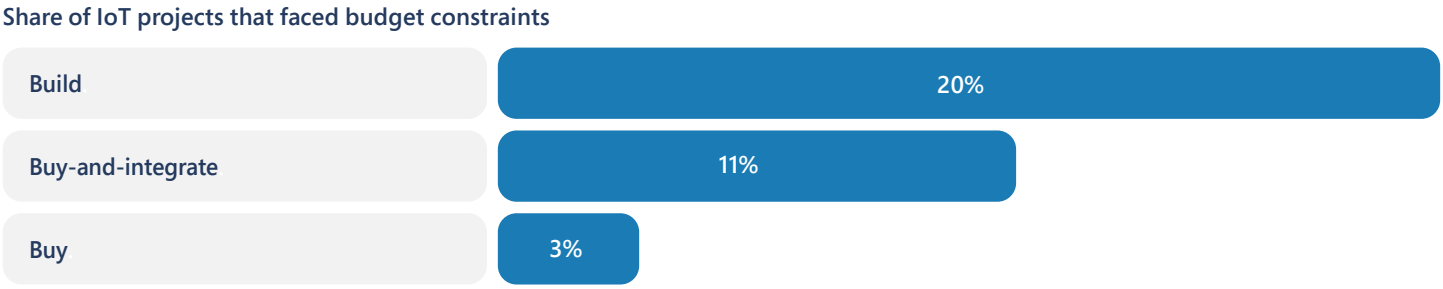
- **The use of tried-and-tested technology**
- **Predictability of the outcome in terms of cost, time, and performance**
- **Quick time to implement**

Only 3% of respondents reported budget constraints when using the BUY approach.

Microsoft

Exhibit 26: Share of projects that faced budget constraints

Very few companies face budget constraints for the BUY approach

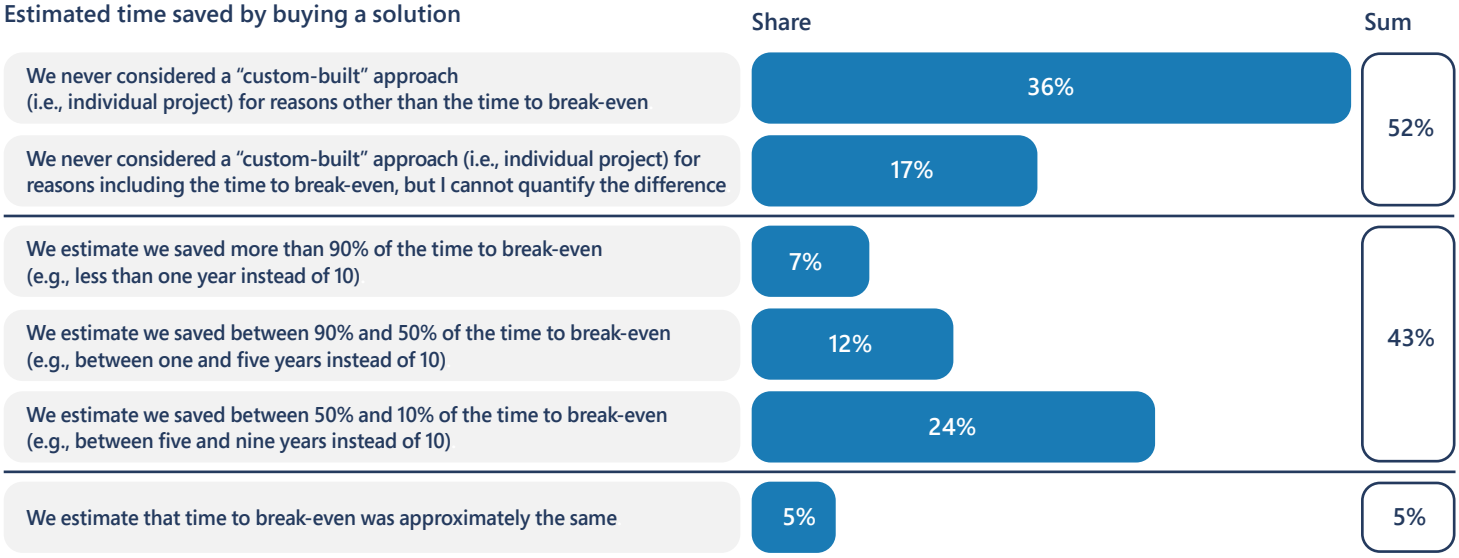


N= 246,
Notes: Question: What people or organizational challenges did you have to overcome during the initiative ? (Please be specific and give an example, e.g., "We needed to XXX the department of XXX and the role of XXX because the initiative led to XYZ.")

Moreover, 43% of the respondents who chose the BUY approach reported reducing time to break even by a considerable amount: 7% of the respondents said they reduced the time by 90%. This time savings is in line with what we see when comparing the figures for time to break even for overall projects (median 20 months) and BUY projects (median 12 months).

Exhibit 27: Time saved with a buy compared to a build approach

Companies have reduced time to break even using the BUY approach

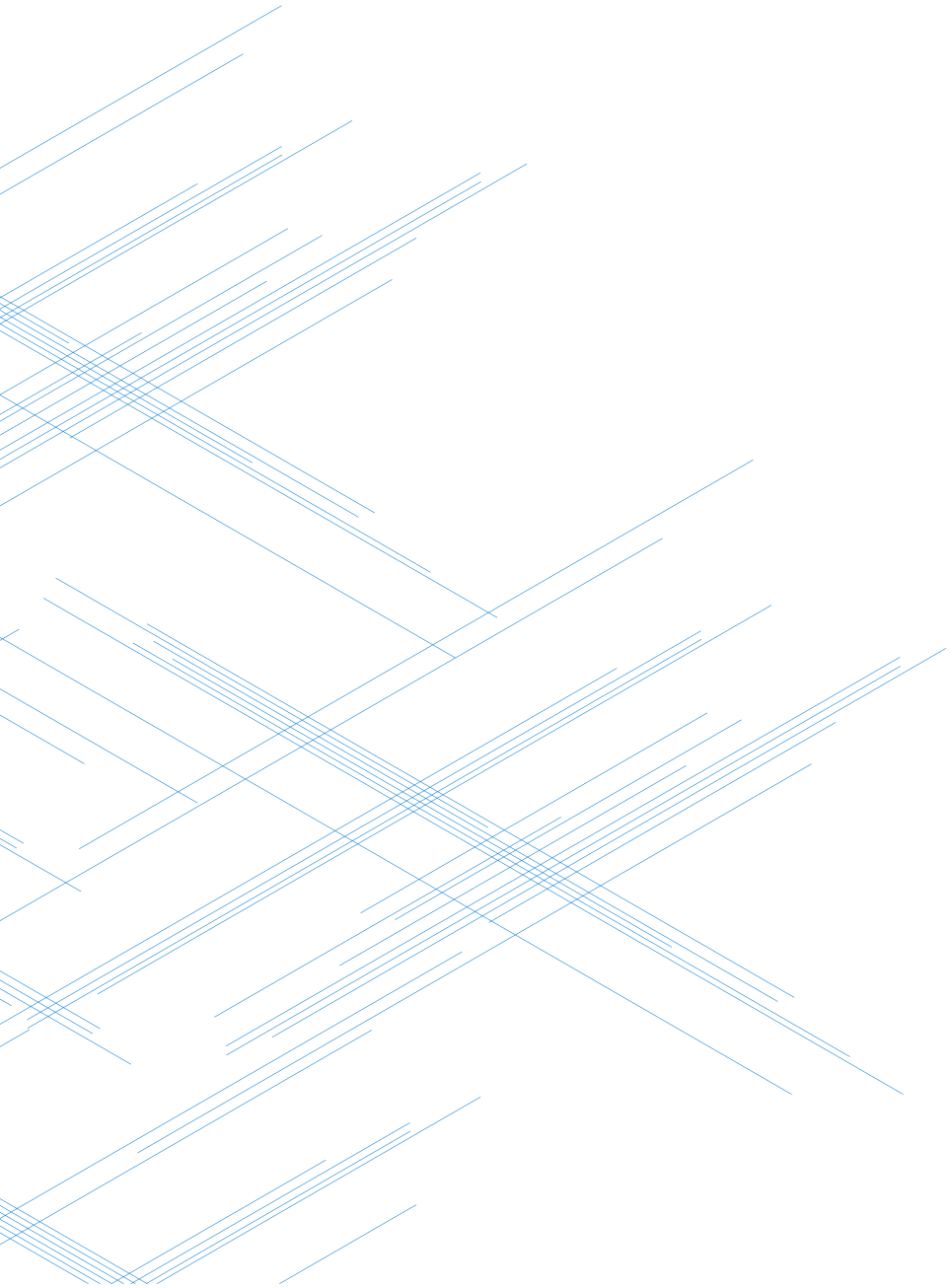


N=43
Question: Assuming "time to break-even" was one of your reasons: Can you estimate how much time you could save by buying compared to building, i.e., compared to a hypothetical individual project? Definition of Time to break-even in the context of this question: Time from when first money is being spent (usually the start of Phase 3-Proof of Concept) to when savings and additional revenues have fully paid back expenses and investments (usually well after the end of Phase 5-Commercial Deployment)

Microsoft

How to choose the right BUY solution

Drawing on the survey responses discussed above, we examine the factors new adopters should consider when choosing a BUY solution. Because these factors are based on the responses of practitioners who have successfully implemented BUY solutions, they provide valuable guidance to new adopters. We will discuss both solution-related and vendor-related factors.



Decision factors when selecting a BUY solution

Exhibit 28: Importance of factors when selecting a buy solution

Reliability, ease of setup and use, and scalability are the leading factors when selecting a BUY solution

N=43
Question: Which factors are important in selecting this specific "off the shelf" solution-other than price and a fundamental match between functionality and your requirements?

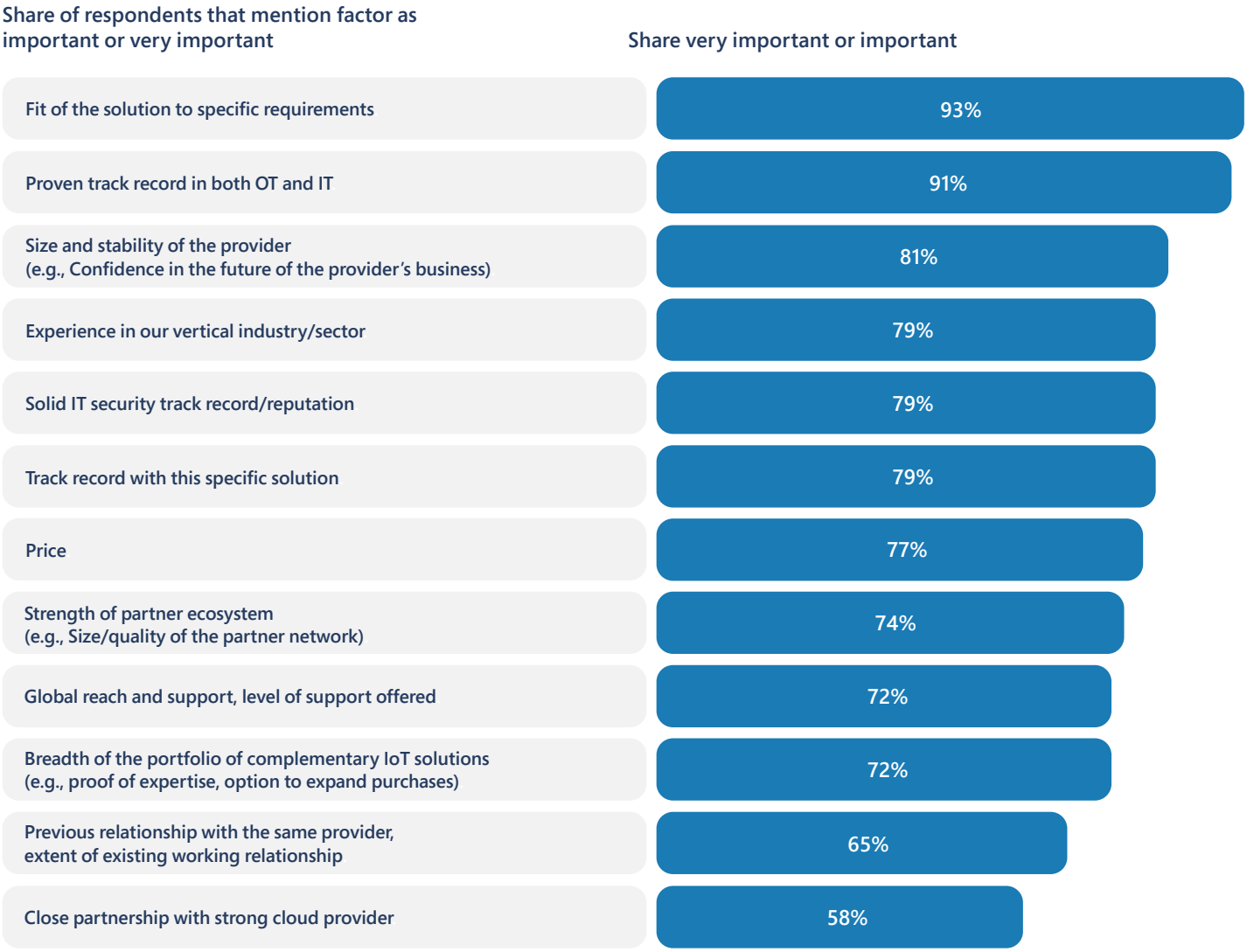
Microsoft

The most important factors influencing the BUY decision are a solution's reliability (98% of respondents rate it as important or very important), ease of setup (93%), ease of use (91%), and easy maintenance (88%). Scalability is also important, indicating that most users see the risk of choosing a software that is quick to show results but turns out to be too inflexible to be used companywide. Data sovereignty (79%) and the degree of vendor lock-in (69%) are cited by more than half of the respondents, although they do not make it into the top half of factors considered.

Selection criteria when selecting a BUY vendor

Exhibit 29: Importance of factors when selecting the solution provider of a buy solution

The solution's fit and the vendor's experience in OT and IT are leading vendor-selection factors

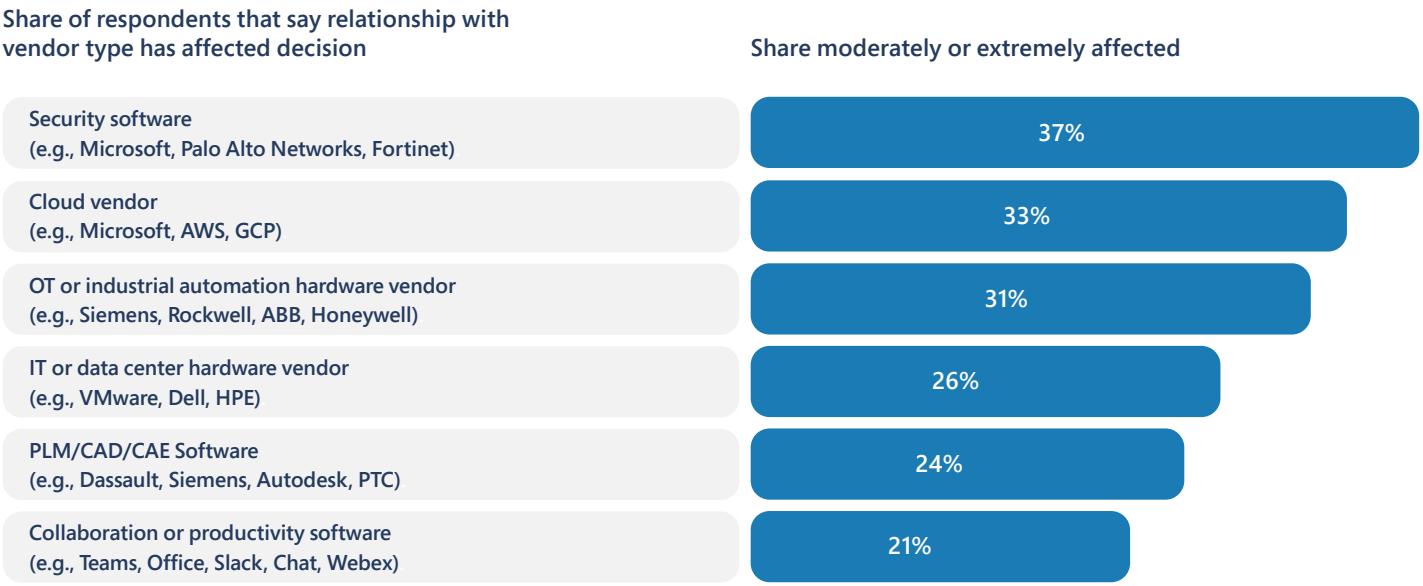


N=43
Question: For the selection of a solution provider or an independent software vendor for the "off the shelf" approach: Which were important selection criteria?

When selecting a vendor for a BUY solution, the fit of the solution to specific requirement is the most important factor (93%), followed by a proven track record in both IT and OT (91%).

Exhibit 30: Importance of existing relation with vendors when choosing a solution provider

Existing vendor relationships are most important for security software



N=43
When you selected the "off the shelf" solution provider for the initiative, how much did your employer's existing relationships with the following types of vendors affect that decision?

Existing relationships with vendors are only moderately important when selecting a BUY provider. However, respondents consider existing relationships with security software and cloud providers to be the most significant.

When selecting a solution and vendor for a BUY project, it is important to keep in mind the desired outcomes for the project. Whether the aim is to improve operational efficiency, increase production capacity, reduce downtime, or enhance the customer experience, the right solution and vendor play a crucial role in achieving these goals. For instance, selecting a reliable and scalable solution with easy setup and maintenance ensures that the IIoT system operates smoothly and provides the necessary data and insights to optimize processes. Additionally, choosing a vendor with a proven track record in both IT and OT allows for leveraging their expertise to design and deploy a system that meets specific requirements and integrates seamlessly into the existing infrastructure.

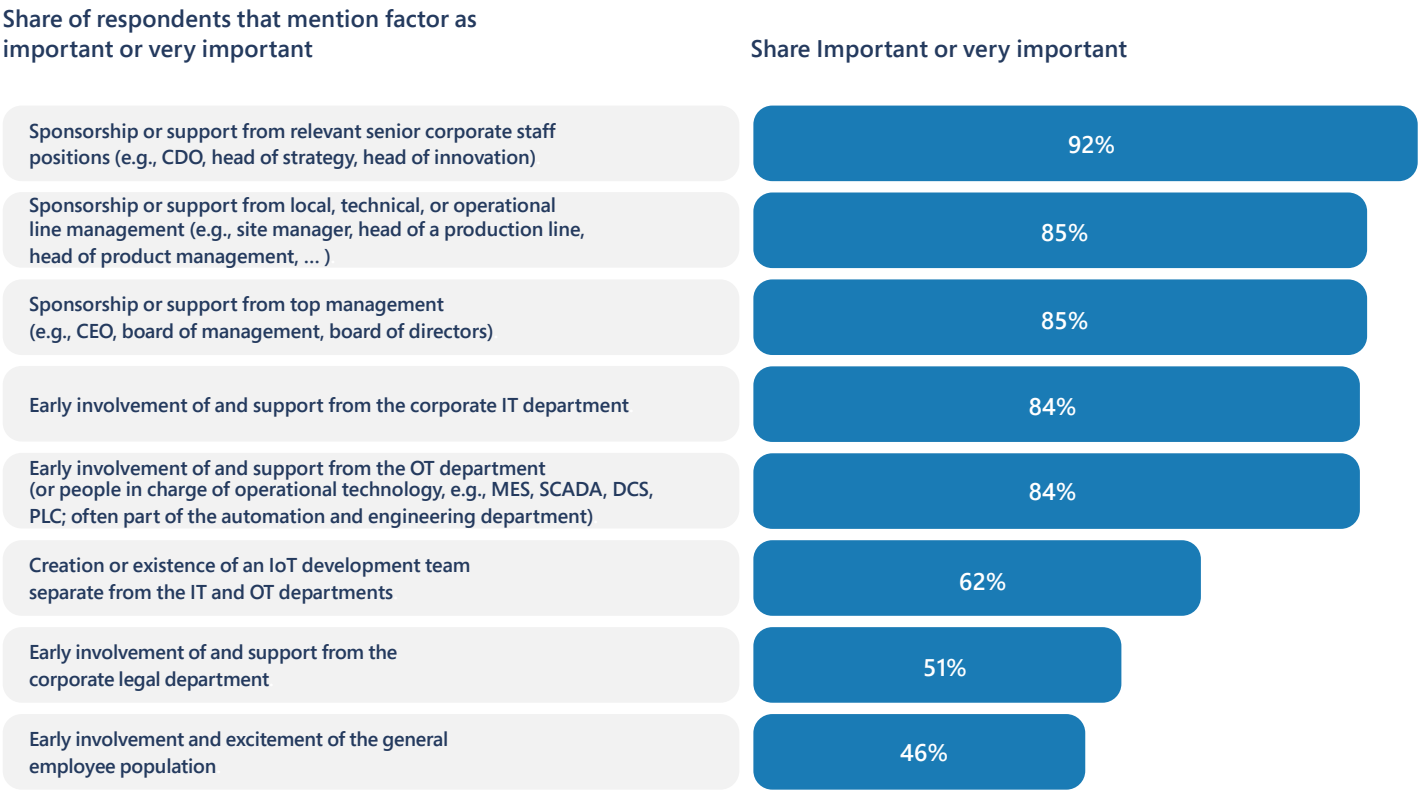
How to make BUY initiatives a success

Several factors within the organization play an important role in the success of the BUY solution implementation.

Involvement of key internal groups

Exhibit 31: Importance of involvement of key groups to get IIoT initiative started

Support from senior executives is considered most important for starting an IIoT project



N=300
Question: For the initiative, how important was the involvement of the following groups of people to get this IoT initiative started (Phases 1 and 2)?

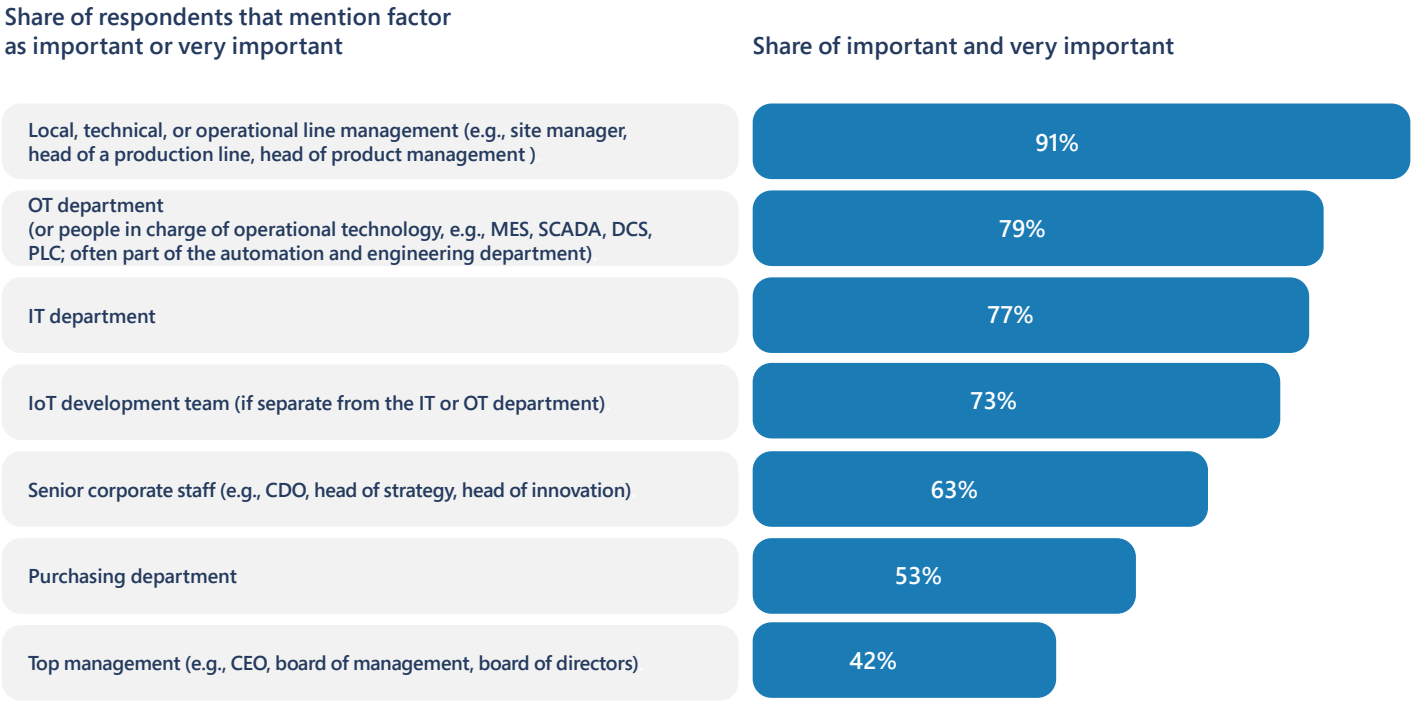
The support and involvement of senior people in the organization (92%), including the corporate management (85%) and the technical management from the plant floor (85%), is considered important to get projects started. IT and OT departments are, unsurprisingly, also an important group (84% each).

Microsoft

Relationships that the vendor should foster

Exhibit 32: Importance of relationship with key contacts in the client's organization

Vendors should focus on relationships with line managers and OT and IT departments

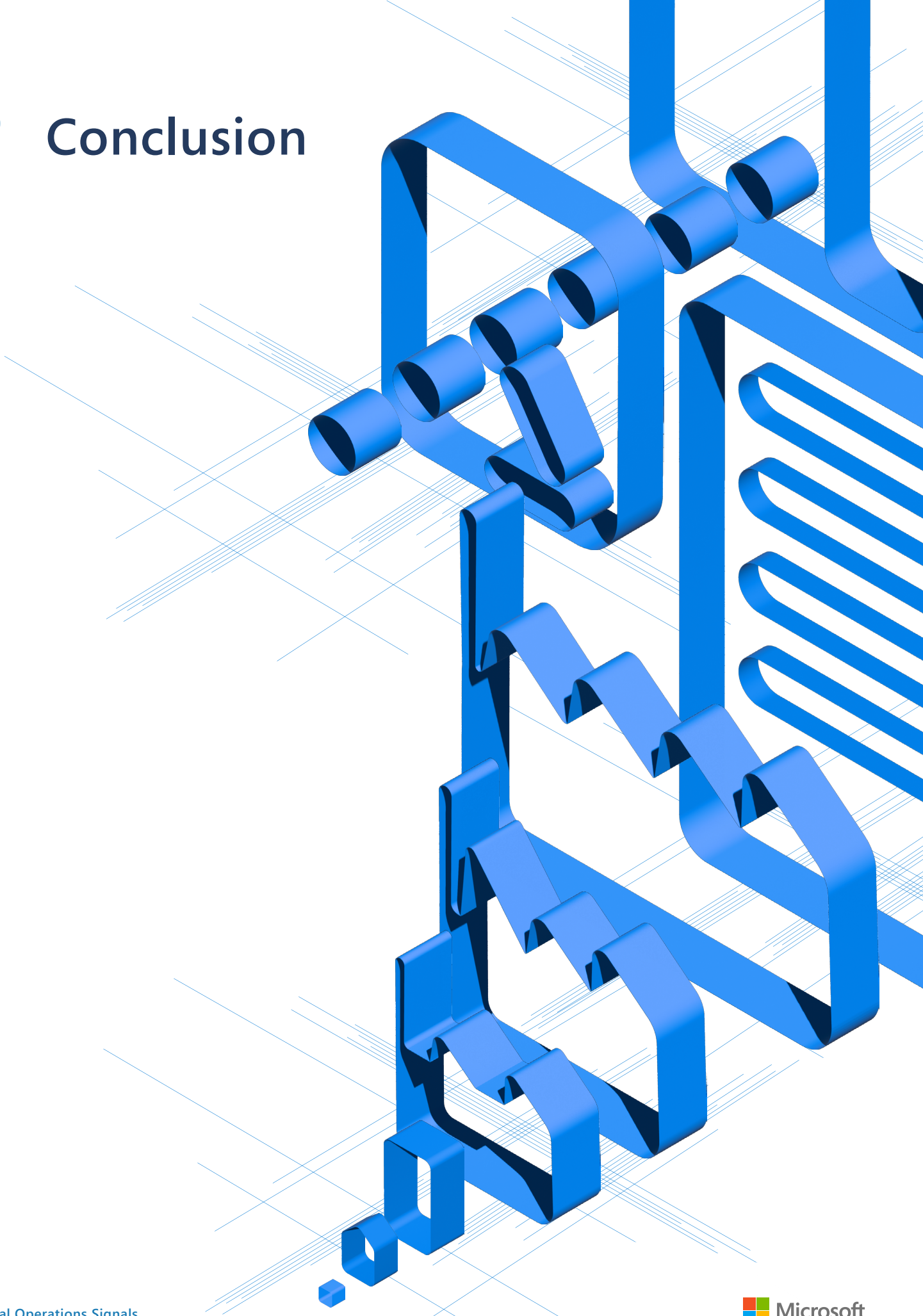


N=43
For an "off the shelf" solution provider that wants to sell an IoT Solution, how important is it to establish relationships with the following key contacts in your organization?

The top management of the client is rated the lowest (42%) in importance among all the groups that the vendor should focus on. The relationships that are considered most important for the vendor to focus on and nurture are with people on the floor, such as the technicians, site managers, and people from the OT department.

Microsoft

5 Conclusion



Microsoft

Putting the insights into action

With IIoT having crossed the chasm, our study highlighted the differences in the three main approaches to realizing the related initiatives: BUILD, BUY-AND-INTEGRATE, and BUY. These approaches have distinct adoption trends across different industries, uses cases, and even geographies.

As more companies decide to BUY IIoT solutions, strong IIoT vendor ecosystems can accelerate time-to-value and address adopters' cybersecurity challenges and knowledge gaps.

Adopters should consider how to utilize the insights from this study to accelerate their efforts. As a starting point, they can evaluate their current efforts and test the strength of their planning by answering the following 12 questions, which are linked to the survey results.

1. **Have we clearly defined our IIoT path going forward, or are we among the 35% that is not yet executing an IIoT strategy?**
2. **Have we determined why we would rather BUILD, BUY-AND-INTEGRATE, or BUY our IIoT solutions?**
3. **Is an off-the-shelf solution available in the market that can meet our requirements or at least help us get started?**
4. **How much external vendor support will we need throughout the project? Have we communicated those requirements to the vendor(s)?**
5. **Have we evaluated key vendor selection criteria (such as reliability and ease of setup) and the vendor ecosystem to ensure that our vendor(s) of choice can continue to support us as the project progresses and its scope expands?**

6. **Will we outsource some of the work to a professional services firm? If so, have we established selection criteria such as the service firm's IT security track record and ability to integrate OT and IT?**

7. **Have we anticipated potential hurdles, such as stakeholder alignment, budget constraints, cybersecurity requirements, and internal skill gaps?**

8. **Are the internal teams who will participate in the project and/or interact with the vendor adequately informed about the project?**

9. **How will we train the internal team after the project is deployed?**

10. **Is our infrastructure (cloud and on-premises servers) capable of handling the load for year one and expandable to accommodate the load for years three to five, or do we need to plan for upgrades?**

11. **What security requirements related to the existing IT network and systems and OT network and systems must this project comply with?**

12. **Who will be the stakeholders and domain experts from our organization responsible for labor-intensive project-related tasks, such as data normalization, data model creation, and other data-related activities?**

Appendix

Microsoft

Spotlight on five IIoT solutions

How solutions were selected

The selection of partner solutions included in this report is based on several factors. As we saw above, surveys were conducted to gather insights from solution users regarding the challenges and learnings along the various stages of the project. The survey responses helped create a comprehensive understanding of IIoT project implementation. To gain a deeper understanding from the perspective of solution builders and implementers, we shortlisted a pool of Microsoft partners based on their expertise in IIoT and their track record of successful project implementation. The aim of including partner solutions is to provide a more practical and qualitative understanding of the challenges encountered during the implementation process and to uncover insights that can help users scale their projects effectively. By including the perspectives of these implementers, we hope to provide a more well-rounded and actionable report for IIoT project stakeholders.

Uptake Fusion for OT data management

About the company

Name	Uptake Technologies Inc.
Headquarters	Chicago, Illinois, USA
Founded	2014
No. of employees	375
IoT solution in focus	**Uptake Fusion**: Microsoft Azure-based application to extract, organize, and provision OT data for analytical tools
Value proposition of the solution	Acquisition and contextualization of granular operations data

1 About the solution

Uptake Fusion is a cloud-native industrial data analytics hub that moves and contextualizes data locked in historians, IoT sensors, and OT systems to the cloud using specialized connectors for OSI, Ignition, Rockwell Automation, GeoSCADA, SQL, OPC, and other software platforms. It curates those data for analytical tools via APIs for Microsoft Power BI, PowerApps, Azure Synapse, and other cloud-based services, facilitating self-service dashboards, reporting, and monitoring. Uptake Fusion supports Azure-native services such as Azure IoT Hub, Azure Data Explorer, and Azure Digital Twin. The platform is targeted mainly to process industries, including oil and gas, power generation, chemicals, mining, and pulp and paper.

2 Typical buy elements

Uptake Fusion provides quick central access to granular industrial operations data from multiple sources for experimentation and analysis by data scientists and operators across the enterprise.

3 Typical integrate elements

After buying the platform, customers need to

- Configure the connectors to link to the OT assets
- Configure the platform to meet the project's requirements
- Import and utilize existing asset hierarchy and data models

4 Typical benefits versus building the solution from scratch*

- **Quick time-to-value:** Kick-off to installation requires one to six weeks, and installation requires a few hours to one day
- **Data feeds and their full contex**t are automatically maintained and can be used for self-service analytics and reporting
- **Ability to use pre-built monitoring tools** for key business metrics, including:
  - Cost of operations
  - Operational flexibility
  - Shutdown time
  - Return on assets
  - Labor efficiency
  - Worker safety and retention
  - Energy costs

5 Typical challenges that require customer–vendor cooperation*

- **Aligning on the software deployment process**. The IoT vendor needs to ensure that the IoT solution is deployed using the standard software deployment tools the customer has adopted in its organization and IT processes
- **Securing OT and IT network.** The solution should control all aspects of secure data transport and data sovereignty
- **Ensuring existing workloads are unaffected.** The solution must be designed in a way that does not overload operational servers for their routine tasks. This is often a challenge for huge projects with millions of tags

e-Magic TwinWorX Digital Twin for facilities

About the company

Name	e-Magic Inc.
Headquarters	Toronto, Ontario, Canada
Founded	1998
No. of employees	75
IoT solution in focus	**TwinWorX®:** A platform that integrates facility telemetry data into a 3D digital twin
Value proposition of the solution	Provides an independent data layer for a single pane of glass visualization that enable monitoring, analysis, control, and optimization of assets

1 About the solution

e-Magic TwinWorX® is a platform that integrates facility telemetry data into a 3D digital twin for monitoring, visualization, control, and optimization of the facility assets. The solution is targeted to the buildings, infrastructure, and manufacturing facilities sectors. A key capability is to create digital twin models using Digital Twins Definition Language (DTDL) and industry-specific ontologies, such as Real Estate Core (for buildings), NGSI-LD (for cities), and CIM (for energy grids).

2 Typical buy elements

The key element is the TwinWorX® platform, which is the central application to ingest the facility data and create the digital twin. The platform includes TwinWorX® Explore (a 3D facility and asset visualizer), TwinWorX® Insights (an analytics engine to detect issues, raise alerts, and predict operational states), TwinWorX® Designer (a tool for creating, designing, and managing digital twins), and TwinWorX Voilà (a mobile app for facilities and tenant experiences). TwinWorX® is built with Microsoft Azure native services, including Azure IoT Hub, Azure Digital Twins, and Azure Machine Learning.

3 Typical integrate elements

The platform comes bundled with over 500 system and equipment connectors, enabling it to acquire data from the various assets typically found in a facility. Getting the application up and running for the project primarily entails:

- Architecting the system, with the help of e-Magic experts and the customer's domain experts
- Connecting it to a variety of assets and data sources
- Building the model of the facility assets (the complex exercise to build the digital twins entails using open, industry standard languages and ontologies, including DTDL, RealEstateCore, and CIM)
- Configuring the single pane of glass visualization

4 Typical benefits versus building the solution from scratch*

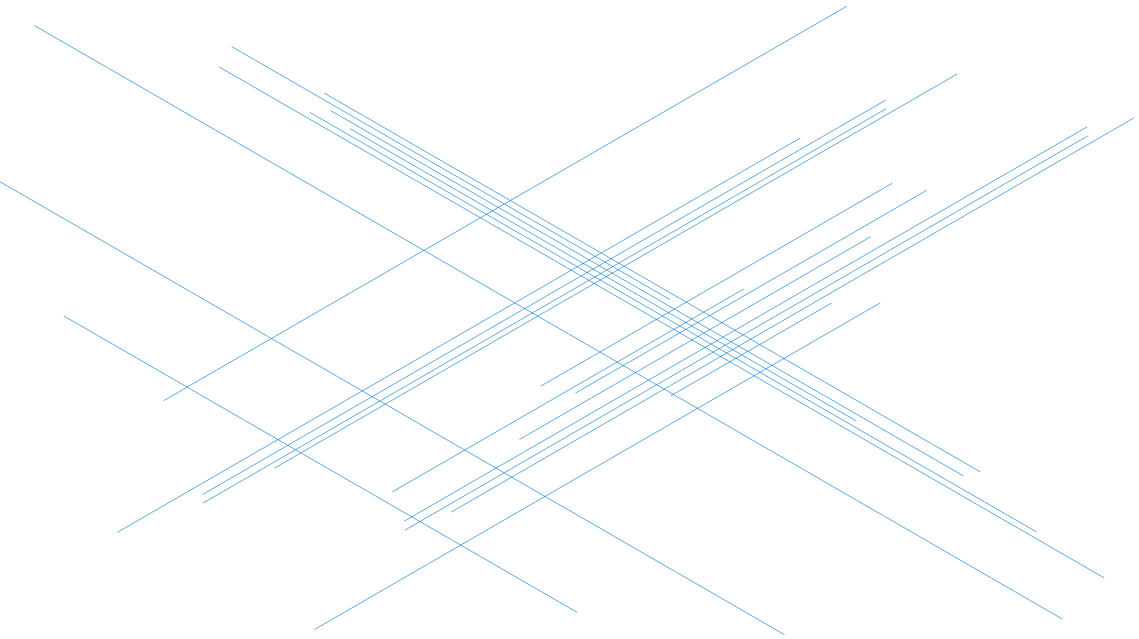
- **Reducing the cost and effort of integratio**n by leveraging experienced e-Magic engineers with deep domain understanding
- **Ensuring the solution is protected against cybersecurity threats** by air-gapping OT systems as a practice
- **Accelerating time-to-value** by getting to insights and operational improvements faster

5 Typical challenges that require customer–vendor cooperation*

- **Creating data models**. There is no automated way to normalize all the data to make them usable
- **Security considerations for command and control.** Establishing the desired level of security requires a deeper conversation between all the stakeholders

Customer case study

e-Magic's Customer	The University of Colorado Boulder's utility and energy services department
Requirement	To help the university achieve zero carbon emissions by 2050, the department wanted a system that would provide detailed energy insights for all of the campus's 52 buildings. This required building a digital twin of the energy flows on campus
Solution	• Phase 1: Created water, steam, and electric energy meter infrastructure to report the data to e-Magic TwinWorX application. Completed in 18 months • Phase 2 (ongoing): Implement digital twin for the chilled water plants Completed in 12–24 months for the initial set of 25 buildings • Phase 3 (future): Model the entire energy infrastructure (cooling and heating) of the campus
Benefits	• Scalable and secure solution architecture for the entire campus • Understanding of Energy Use Intensity (EUI) of individual buildings and the correlation between the energy consumers, facility, and utility suppliers • Potential to achieve huge energy cost savings • Moving closer to sustainability goals and zero carbon emission by 2050



PTC ThingWorx Digital Performance Management

About the company

Name	PTC, Inc.
Headquarters	Boston, Massachusetts, USA
Founded	1985
No. of employees	6,500
IoT solutions in focus	ThingWorx Digital Performance Management (DPM) delivers the insights manufacturing organizations need to make digital transformation possible It provides focused, real-time, closed-loop problem-solving capabilities that empower production teams with timely insights about bottlenecks, root causes, and the improvements that their initiatives deliver. DPM empowers teams with an out-of-the-box solution that accelerates digital transformation at scale
Value proposition of the solution	Boost production efficiency, increase revenue, and reduce expenses by analyzing performance and bottlenecks to improve service levels and maximize production outcomes

1 About the solution

PTC ThingWorx is an IIoT solutions platform that allows users to create solutions to meet their specific requirements. The platform includes pre-built applications for common use cases and is composed of building blocks that include connectors, domain model, business logic, and UI elements.

Digital Performance Management (DPM) is a closed-loop solution built on the ThingWorx platform. It identifies, prioritizes, and addresses the manufacturer's most significant loss challenges. It provides insights into bottlenecks and root causes to improve efficiency, operating expenses, and service levels.

2 Typical buy elements

The key components of the DPM solution are:

- **Production dashboard:** To gather, aggregate, and store production data (automatically and through manual input) for analysis
- **Action tracker:** To manage the process of implementing improvements based on the data collected
- **Performance analysis dashboard:** To confirm that the improvements make a difference in the OEE

3 Typical integrate elements

DPM is a very specific solution, pre-built for bottleneck analysis. Most of the effort to get DPM up and running entails integrating the connectors with the OT assets or setting up the manual data input. During operation, the action tracker and the performance analysis dashboard provide insights to implement and track the improvements.

4 Typical benefits versus building the solution from scratch*

- **Using the PTC value-centric customer engagement** playbook that helps quantify the value derived from the project in the business case-building phase
- **Faster time-to-value,** with initial results in as little as 90 days
- **Scaling to many facilities quickly** once the model for the first facility is in place

5 Typical challenges that require customer–vendor cooperation*

- **Ensuring the customer's middle management can perform the necessary change management adequately**
- **Establishing practices to bridge skill and cultural gaps in the customer's organization.** A different mindset is required to succeed with digital compared to the traditional pen-and-paper approach
- **Addressing the customer's cyber security needs**

ICONICS Smart Buildings for asset fault detection and diagnostics

About the company

Name	ICONICS, Inc. (Mitsubishi Electric group company)
Headquarters	Foxborough, Massachusetts, USA
Founded	1986
No. of employees	112
IoT solution in focus	**Smart Buildings by ICONICS:** Solution to model the relationships between people, places, and devices using a semantic data digital twin of the physical environment in facilities/real estate
Value proposition of the solution	Provides asset visibility, improves space utilization, reduces energy costs, and streamlines equipment maintenance

1 About the solution

Smart Building by ICONICS is an IoT solution that correlates the usage of assets such as chillers, air-handling units, heat exchangers, boilers, and heat pumps to improve space utilization, reduce energy costs, and streamline equipment maintenance. It provides fault detection and diagnostics to identify underperforming equipment and suggests probable causes. The solution is built using other ICONICS software offerings, including:

- **GENESIS64™** is an HMI SCADA with OPC, BACnet, Modbus, and database connectivity support. It enables creation of desktop and mobile dashboards and provides fault and alarm management. It can run on Microsoft Azure as a VM
- **IoTWorX™** provides edge connectivity to automation equipment via protocols such as OPC UA, BACnet, SNMP, Modbus, databases, and web services. It also provides edge analytics by leveraging Fault Detection and Diagnostics (FDD) technology. It can function in a distributed manner in docker containers

2 Typical buy elements

The main buy element is the Smart Building solution built using the GENESIS64 platform and a suite of AnalytiX software solutions. IoTWorX software enables universal connectivity and data collection at the edge. The following ICONICS tools aid project implementation:

- **Network Discovery Tool** for automatic discovery and data ingests from devices on a network
- **Bulk Asset Configurator** configures assets by mapping an Excel file to asset templates
- **AnalytiX** software provides visualization and insights of building data

3 Typical integrate elements

Typical activities during project execution include:

- Architecture design and software configuration to meet customer requirements
- Understanding the structure of data from the various assets
- The Bulk Asset Configurator is used to accelerate deployment by mapping assets to data templates

4 Typical benefits versus building the solution from scratch*

- **Reduce setup time** to minutes by deploying ready-to-use VMs
- **Quickly generate dashboards and reports** by leveraging sustainability-specific monitoring and reporting tools
- **Quick efficiency and savings insights** from building data

5 Typical challenges that require customer–vendor cooperation*

- **Establishing practices to elicit clear project requirements**. Customers are clear that they want to digitize, but there is some ambiguity across stakeholders about what that means
- **Removing on-site instrumentation gaps** that hinder data acquisition by utilizing IoT gateways.
- **Creating data models.** The disparity of operational systems makes it difficult for vendors to optimize specific hardware and equipment
- **Helping show the financial benefits** to management early in the project

Capgemini Reflect^{IoD} for smart modeling and augmented maintenance

About the company

Name	Capgemini SE
Headquarters	Paris, France
Founded	1967
No. of employees	358,400
IoT solution in focus	**Reflect^{IoD}:** A digital twin platform for augmented asset operations that optimizes data access and integration and fosters operational excellence.Industrial assets such as buildings, factories, and networks produce streams of siloed data that operators can now use to gain a 360-view of data, perform effective analysis, and understand threats and opportunities
Value proposition of the solution	Provides custom visualization and analysis, augmented maintenance capabilities, and overall access to data

1 About the solution

Capgemini Reflect^{IoD} is a cloud-native, Azure-based digital twin platform that helps organizations transform their operations and maintenance by federating data from multiple systems and formats into an asset digital twin. The platform integrates IoT data, along with 3D/BIM, GIS, MMS, documents, and other relevant data sources. It is built on top of Microsoft Azure services, such as Azure Digital Twins, Azure Video Indexer, Azure Cosmos DB, Azure Cognitive Search, Azure Tables, and Azure AD B2C. The platform is targeted to the linear infrastructure (utilities and railway operators), buildings, and manufacturing sectors.

2 Typical buy elements

The key buy element is the Reflect^{IoD} platform, with its integrated connectors and digital twin module. A specific accelerator, called Manufacturing Performance Platform (MPP), can also be purchased to accelerate certain manufacturing-specific projects. MPP provides multiple features, including shop-floor monitoring, OEE calculation, inline quality monitoring, condition-based monitoring, planning and scheduling, and predictive analytics.

3 Typical integrate elements

After installation, the effort to customize the Reflect^{IoD} platform focuses on the following steps:

- Configuration of the platform and the Azure technologies to meet the customer's requirements and then reuse the components
- Data collection and validation using 60+ types of data formats available in the platform
- Integrate 3D models with Andy 3D (Capgemini's remote immersive assistance platform) and other 3D platforms, as needed
- Configure the native integration for enterprise asset management (EAM) systems to meet customer requirements

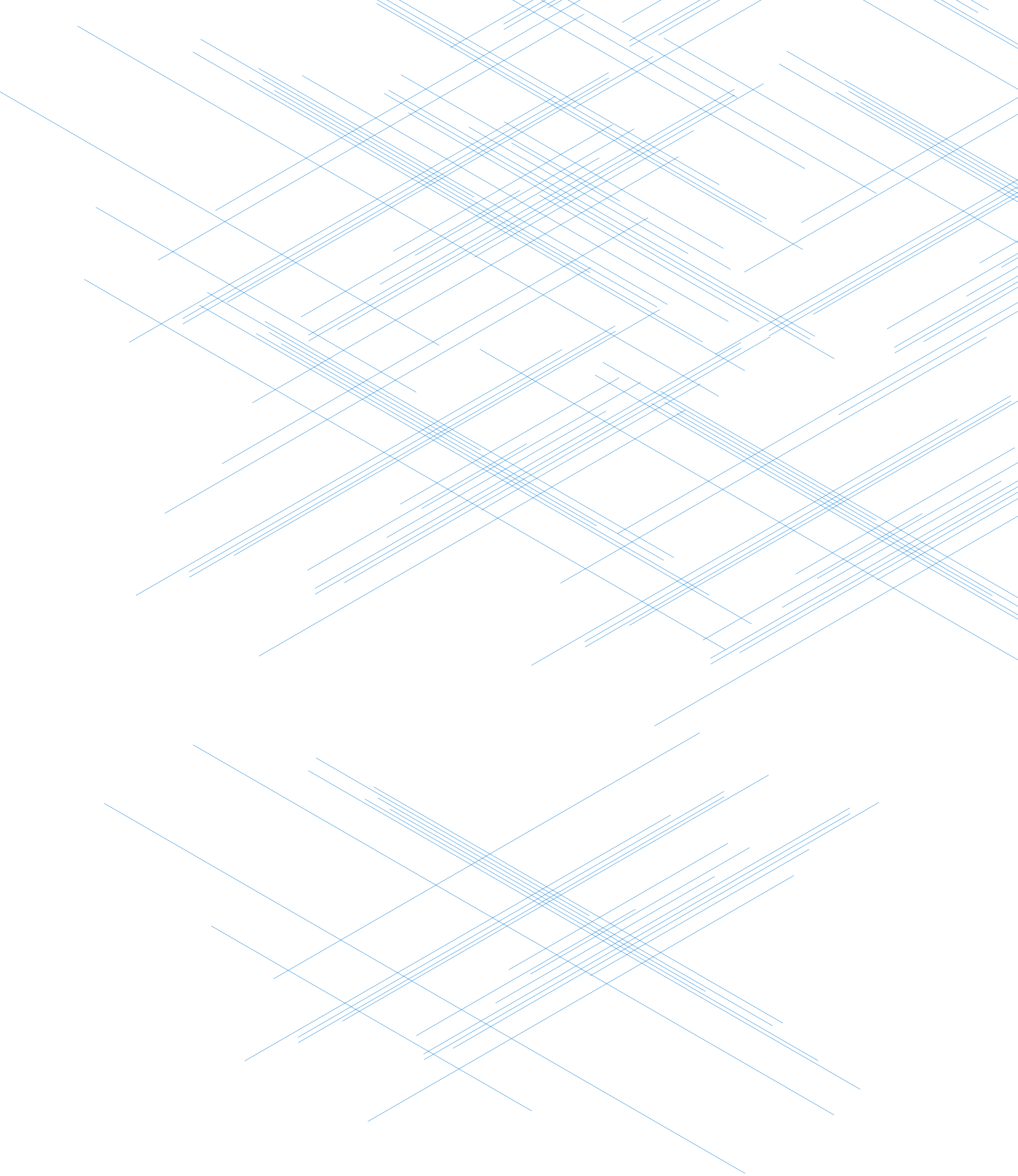
4 Typical benefits versus building the solution from scratch*

- **Faster proof of value:** Eight to 10 weeks for assessment and pilot. Scale-up and deployment can be completed in six to 12 months
- **Acceleration:** Pre-built set of features and services to choose from
- **Utilizing a proven approach to scale projects**, including a portfolio of use cases that enable faster implementation
- **Relying on a systems integrator with a global footprint** and dedicated cloud experts worldwide, if needed

5 Typical challenges that require customer–vendor cooperation*

- **Complying with evolving regulations and industry standards** and documenting sustainability measures
- **Adapting to changing levels of experience, expertise, and organizational capability.** More and more customers now come prepared with a clear idea of what they want and are looking for a partner to help achieve their vision
- **Addressing connectivity issues** with legacy devices and other assets on the floor
- **Managing disparate data sources** with diverse data formats and large volumes

*** = Based on vendor interview**



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