OCTAVE

400 executives & senior leaders

1 key topic – digitalization

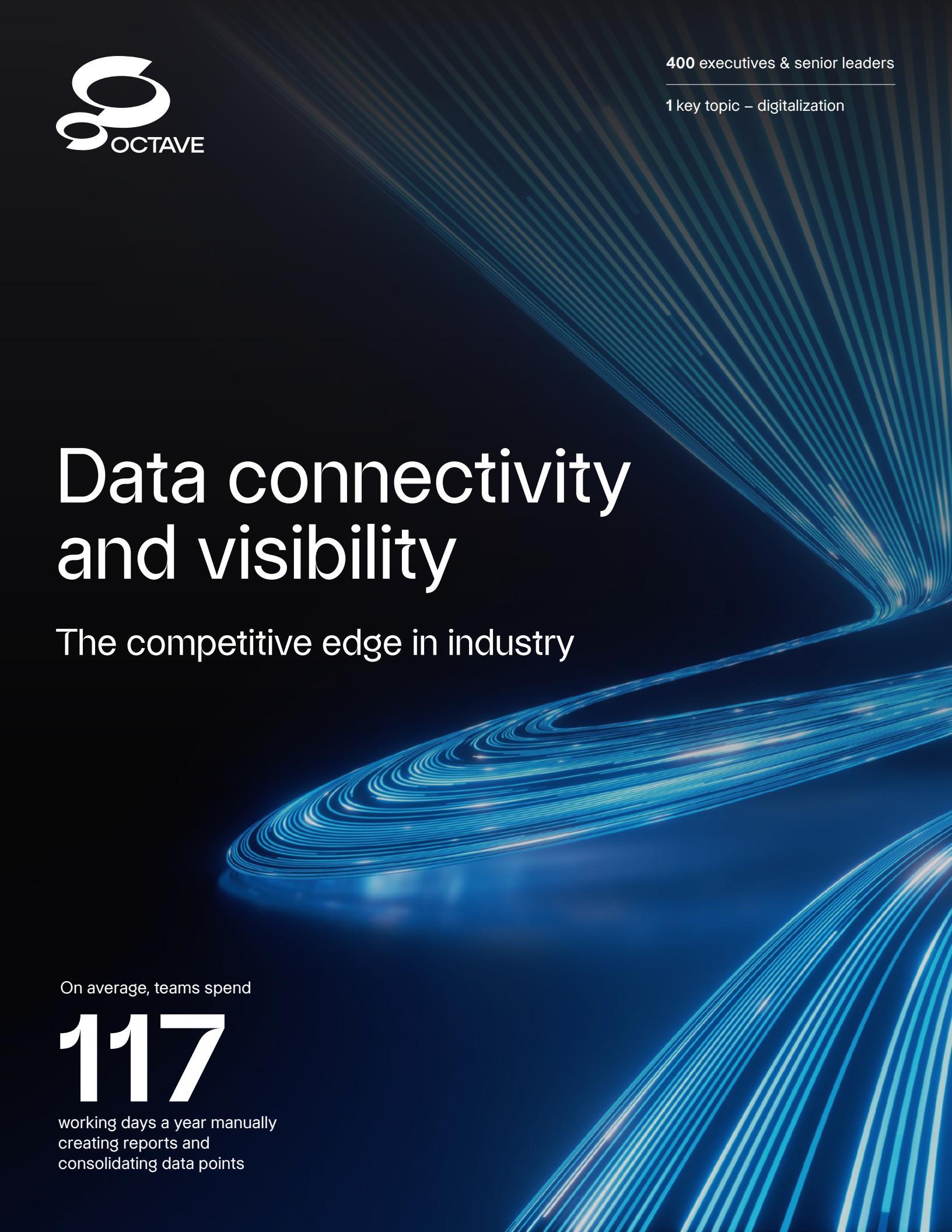
Data connectivity and visibility

The competitive edge in industry

On average, teams spend

117

working days a year manually creating reports and consolidating data points



Data visibility: an industry advantage and challenge

Vivek Mokashi
CTO, Octave

Driving transformation through enhanced data capabilities

Globally, industrial organizations are investing in digital transformation to make operations more efficient, resilient, scalable and sustainable.

Success depends on sharpened access to visualized data. Making contextualized data available to the right people, at the right time, is essential for decision-making.

But diverse landscapes of systems and processes can lock data into silos. This impedes decision-making and leads to disruptive challenges.

Industry leaders are seeking answers through innovations that provide visibility through connected data. Yet many are still struggling to successfully integrate data tools that remove challenges and provide a competitive edge.

For this report, we surveyed global C-suite executives and senior leaders from large industrial businesses. The result? A look into their biggest challenges and experiences of adopting data technologies to overcome them. We hope you find the research and accompanying best-practice insights valuable to your organization's goals.

We spoke to

400

global C-suite executives and senior leaders across the manufacturing, power, oil and gas, and chemical industries.

Contents

Executive summary

The decision makers surveyed for this study point to familiar cross-industry business challenges. These include **missed project deadlines, a lack of asset scalability and unplanned production downtime.** Key contributing factors include **skills gaps, manual processes and out-of-date information.**

The majority have increased investments in tools that provide enhanced data visibility. While some are enjoying success, many are failing to achieve the expected ROI from digital transformation. Some are yet to apply the best practices required to advance digital maturity.

This report examines business and technology challenges in detail. It also offers expert advice on overcoming the barriers to digital transformation. Organizations gain a competitive edge by becoming more efficient, resilient, scalable and sustainable.

We define a digital thread as:

Digital thread — an always-connected data flow from across an entire enterprise, providing continual intelligence on all operations and assets. This is made possible by a 'digital backbone' of platforms, tools and services that create a communication framework through which data flows.

What's holding organizations back?

The top three business challenges

70%
project milestones are missed

68%
assets unable to scale to meet demand

65%
unplanned production downtime occurs

The top three factors contributing to challenges

76%
skills/knowledge gaps

74%
manual processes

74%
delayed/out-of-date information

The response: rising data tech investments

7 in 10

leaders say their organizations have increased the number of digital tools and data sources they use over the past 12 months

Cutting Edge

76%

frequently or continuously use visualization dashboards

69%

frequently or continuously use digital threads

Legacy

66%

still frequently or continuously use paper-based information

The issue: digital transformation ROI is elusive

56%

of leaders agree "digital transformation efforts in our organization haven't yet returned the expected value"

57%

say the tools and platforms they use to visualize data lack connectivity to each other

117

working days a year spent manually creating reports and consolidating data points

The way forward

"Closing digital maturity gaps isn't just about having data—it's about having the right people and connected systems to make that data reliable and accessible. That means best practices, skilled staff, solid integration tools and quality processes that make sure teams can actually trust and use the information."

Lawrence Benson
Vice president of portfolio strategy at Octave

Todays's top challenges

Challenges affecting efficiency, resilience and sustainability

93%

are impacted by projects running over budget

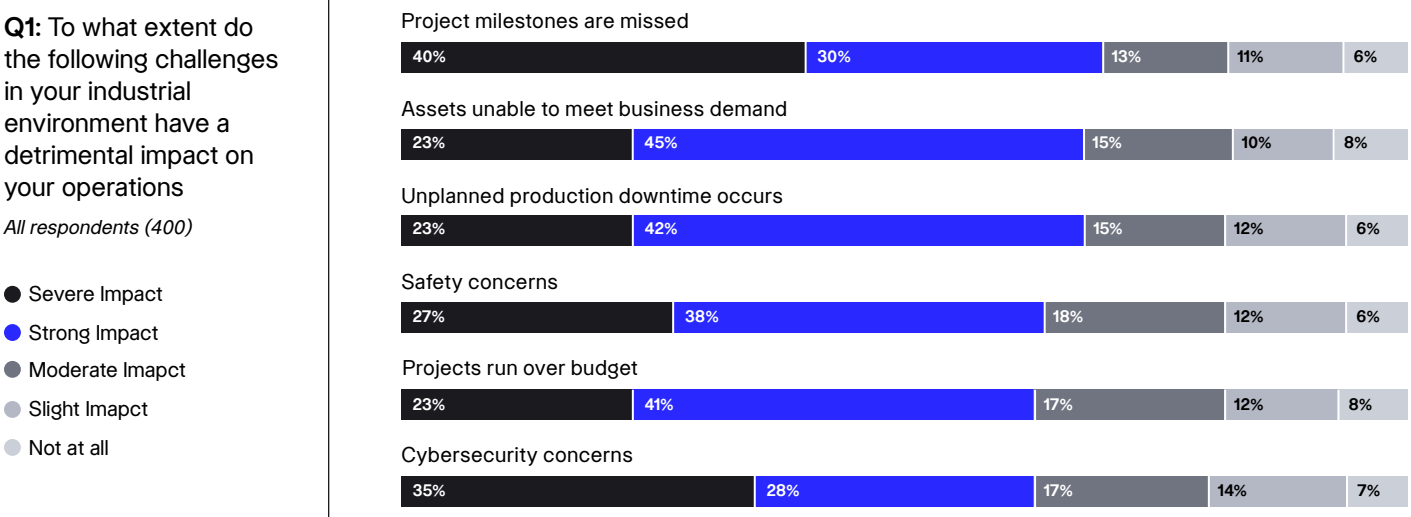
This report surveyed leaders at industrial businesses from across Asia-Pacific, Europe, Latin America, the Middle East and North America. Their organizations span the manufacturing, power, oil and gas and chemicals sectors, and all have revenues of over $1 billion and more than 1,000 employees. Executives surveyed confirmed that several key common challenges are holding their organizations back. 70% report a strong or severe impact from missed project milestones. 64% percent say they are being strongly or severely impacted by projects running over budget. 65% acknowledge a strong or severe impact from unplanned production downtime.

For 93% of leaders, the inability to scale assets and meet business demand has a reported impact, with strong or severe implications for 68%. Safety concerns (65%) and cybersecurity concerns (63%) also have a strong or severe impact for those surveyed.

The survey participants' challenges will likely come as no surprise to fellow executives from large industrial businesses. The contributing factors reveal the day-to-day realities organizations face as they pursue their strategic objectives.

Q1: To what extent do the following challenges in your industrial environment have a detrimental impact on your operations

All respondents (400)

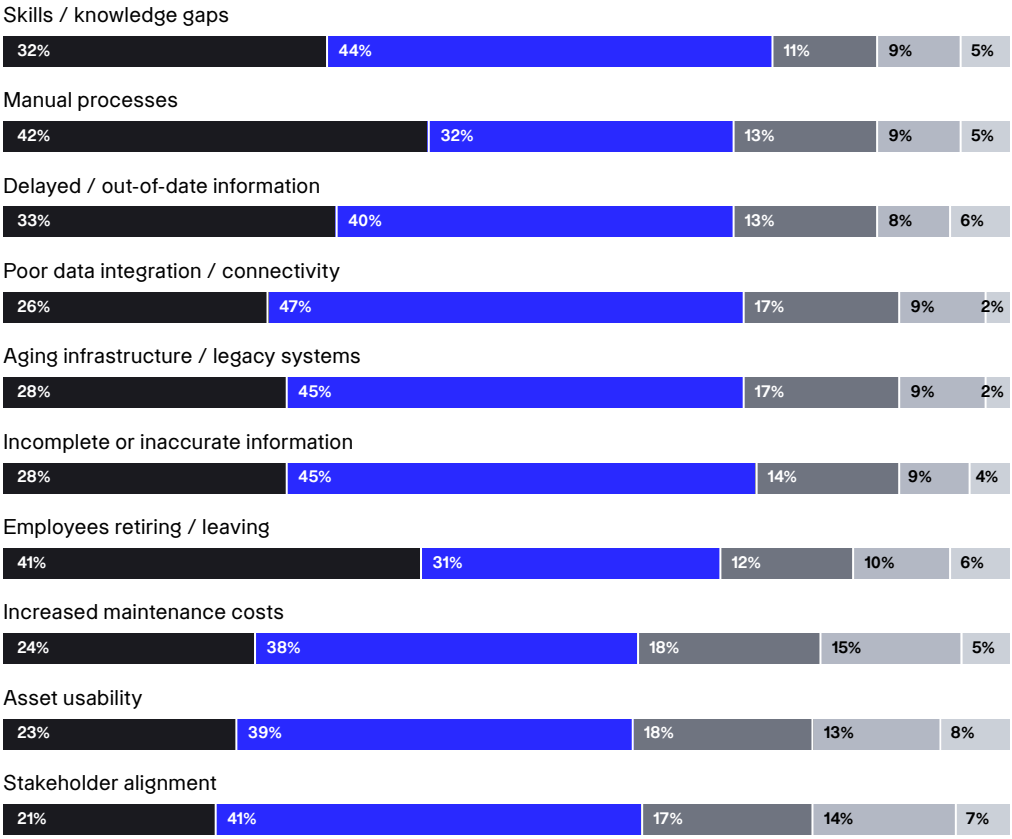


Note: totals may not amount to 100% due to rounding

Q2: Which of the following are contributory factors to the challenges and to what extent?

All respondents (400)

- Severe Impact
- Strong Impact
- Moderate Imapct
- Slight Imapct
- Not at all



The factors behind the challenges

The availability of experienced industry talent is significantly behind the challenges identified above. 76% of leaders worldwide cite skills and knowledge gaps as having a severe or strong contribution to the discussed challenges. Employees retiring or leaving organizations have this level of impact for 72% of those surveyed.

Data quality and availability are also major contributing factors to the challenges. Severe or strong impacts were reported for delayed or out-of-date information (74% of all those questioned), poor data integration/ connectivity (73%) and incomplete or inaccurate information (73%).

Outdated methodologies and systems are playing into this data problem. 74% of executives cite manual processes as having a strong or severe impact on the challenges. Whereas 73% confirm the same level of impact from aging infrastructure and legacy systems.

Other factors that have a strong or severe impact to disruptive challenges include increased maintenance costs (62%), asset unreliability (62%) and a lack of stakeholder alignment (62%).

The data integration factor

Bilal Alani is group head of IT and data, CIO for R&D at multinational food business Danone. Alani explains why the organization, which has hundreds of factories, experiences data integration challenges and projects that run over budget in its manufacturing operations. "The landscape in manufacturing is very segmented for many reasons – partly because of acquisitions of factories.

"Another reason is the unique specificities of different factories and their production lines around the world. For that reason, factories can define the strategy they want to implement for digitalization. But that means standardization of a system across the factories can become very difficult.

Regarding the impact of different legacy systems across the factory landscape, Alani adds: "Across different factories, legacy systems can have different processes and different data models. From a global view, this means there are gaps in the reconciliation of data for dashboarding to make decisions. We can bridge that gap, there are many ways to do it, but it is not always a consistent process."

Another executive, the group head of digital engineering at a global chemicals manufacturing organization, says that, prior to a recent digital transformation, "decoupled" data was holding up operations. "A lot was related to 'we have an asset, where can I find the information?' You had lots of applications where you could find information about an asset, but no clarity on what was up to date, there was barely connectional interface between tools. A document-centric orientation, with redundant information in different sources, prevented efficiency and reliability for project execution. Additionally, working in organizational silos - operations being one silo, engineering, with their disciplines, was lots of silos, - hindered data flow and handover of information.

For Dan Everest, fleet information systems manager in the engineering department at Greater Anglia – a major train operating company in the United Kingdom – questions about digital tools and data interoperability are particularly relevant. They will be one of many UK companies to be renationalized in the coming years.

"Many train operating companies, including ours, are expected to be brought under a single guiding structure. At present, we're unsure how that's going to look – for example, will everyone adopt the same asset management system? Will everyone adopt the same operational system? How will we operate that with the technology we've got currently? It will be a big challenge."

"Legacy systems can have different processes and different data models. From a global view this means there are gaps in the reconciliation of data for dashboarding to make decisions."

Bilal Alani
Group head of IT and data and CIO for R&D, Danone

Data visualization: the most adopted

Digital tools are increasing to counteract challenges

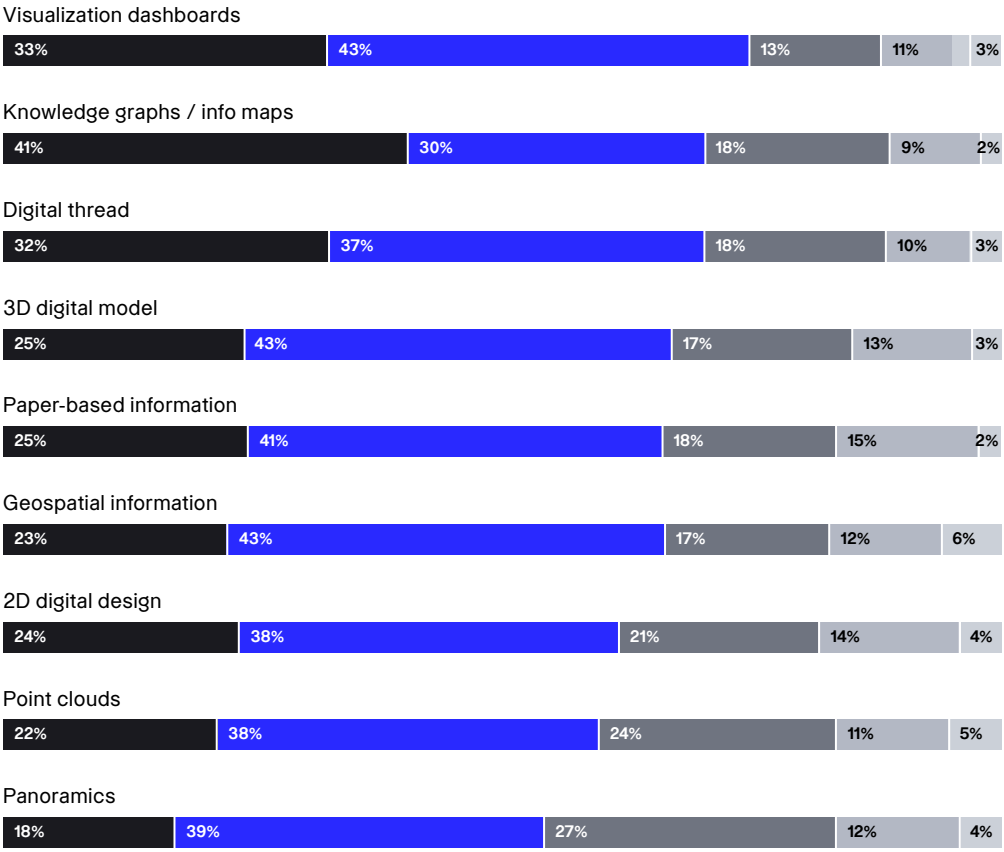
70%

have increased the number of digital tools in the past year

Q3: Which of the following methods and platforms are you currently able to leverage for visibilty of your assets and processes, and to what extent are you using them?

All respondents (400)

- Continuous use
- Frequent use
- Moderate use
- Limited use
- Not available



The research shows that organizations are responding to challenges by increasing technology investment. For example, 70% of leaders surveyed agree with the statement: 'My business has increased the number of digital tools and data sources over the past 12 months.'

Tools designed to enhance visibility into assets and processes are being adopted. Visualization dashboards are being used the most frequently or continuously by 76% of organizations. The data indicates that, globally, digital twins are becoming widely used. This trend is predicted to grow according to Hexagon's digital twin industry report. 80% of leaders say AI has made them more interested in digital twin technology. Meanwhile, knowledge graphs and info maps are frequently or continuously used by 71% of respondents.

Digital thread technology is being used to a high degree by 69% of businesses. Yet, varying approaches to data connectivity are being taken. This leads to varying results. For example, 66% of industrial businesses still rely on the continuous or frequent use of paper-based information. Other point solutions used to this degree include 3D digital models (68%), geospatial information (66%), 2D digital design (62%), point clouds (60%) and panoramics (57%).

Reliance on manual processes and point solutions suggests there is headroom for many organizations to enhance data connectivity and visibility.

Digital tools

Dan Everest says that Greater Anglia uses an enterprise asset management (EAM) platform for its fleet management system. This is a key data visualization component of the digital backbone. "It's our single source of truth for everything from work orders and maintenance schedules, to inspections and so on. And now we're working to do more with large-scale data analysis, using LLMs [large language models]. It brings together our data sources and turns it into intelligence, which is really exciting."

The IT director of an energy infrastructure company, based across North America and Latin America, says the business used to use paper-based processes but saw a competitive edge in moving away from them. "Anyone still using paper is starting to look at moving away from it as a competitive advantage as well. If something gets missed because it was done on paper, it's not trackable, it leads to greater expenses in running your operation and it could be a safety issue, which can cause severe reputational harm."

Stanley Dorasamy, managing director at the Dorasamy Decarbonization Energy Consultancy, has experience as a technical director in the energy industry. He says one organization he worked for addressed the challenge of losing skilled people to retirement by providing younger engineers with data visualization tools. "The new generation of young engineers are taking digitalization to new heights through apps," he says. "Now, for example, the startup engineer, on their mobile phone, can get insights into exactly what's happening in the power plant in real-time."

"The new generation of young engineers are taking digitalization to new heights through apps."

Stanley Dorasamy
Managing director, Dormasany Decarbonization Energy Consultancy

The investment/ value gap

Data access, connectivity and continuity needed for digital thread technology

58%

say their teams spend too much time consolidating data point

The use of data visualization tools is widespread and expanding across industries. Yet the question remains - **why are these digital investments not always alleviating challenges?**

56% of the leaders surveyed agree with the statement 'transformation efforts in our organization haven't yet returned the expected value.'

62% agree with the statement 'the lack of available data on asset performance is affecting the financial performance of the business.' While 57% agree that 'the tools and platforms used to visualize data lack connectivity to each other.'

The increased adoption of digital tools is creating more work for teams and is negatively affecting responses to business challenges. Our study shows that adding more tools also affects stakeholder alignment in some organizations. 64% of those who have grown digital toolsets in the past year acknowledge this challenge. This compares to 56% of those who have not. For example, 63% of those with more tools than a year ago agree that their team spends too much time manually creating reports and consolidating data points. They spend an average of 18.72 hours a week, equating to 117 working days a year.

Of those who have increased the number of digital tools in the past year, 75% report that missed project milestones have had a detrimental impact on their organization. This compares to 57% of those who have not increased the number of tools. 67% of those who have increased tools cite projects running over budget as a challenge. Only 55% of those who haven't added more tools say the same.

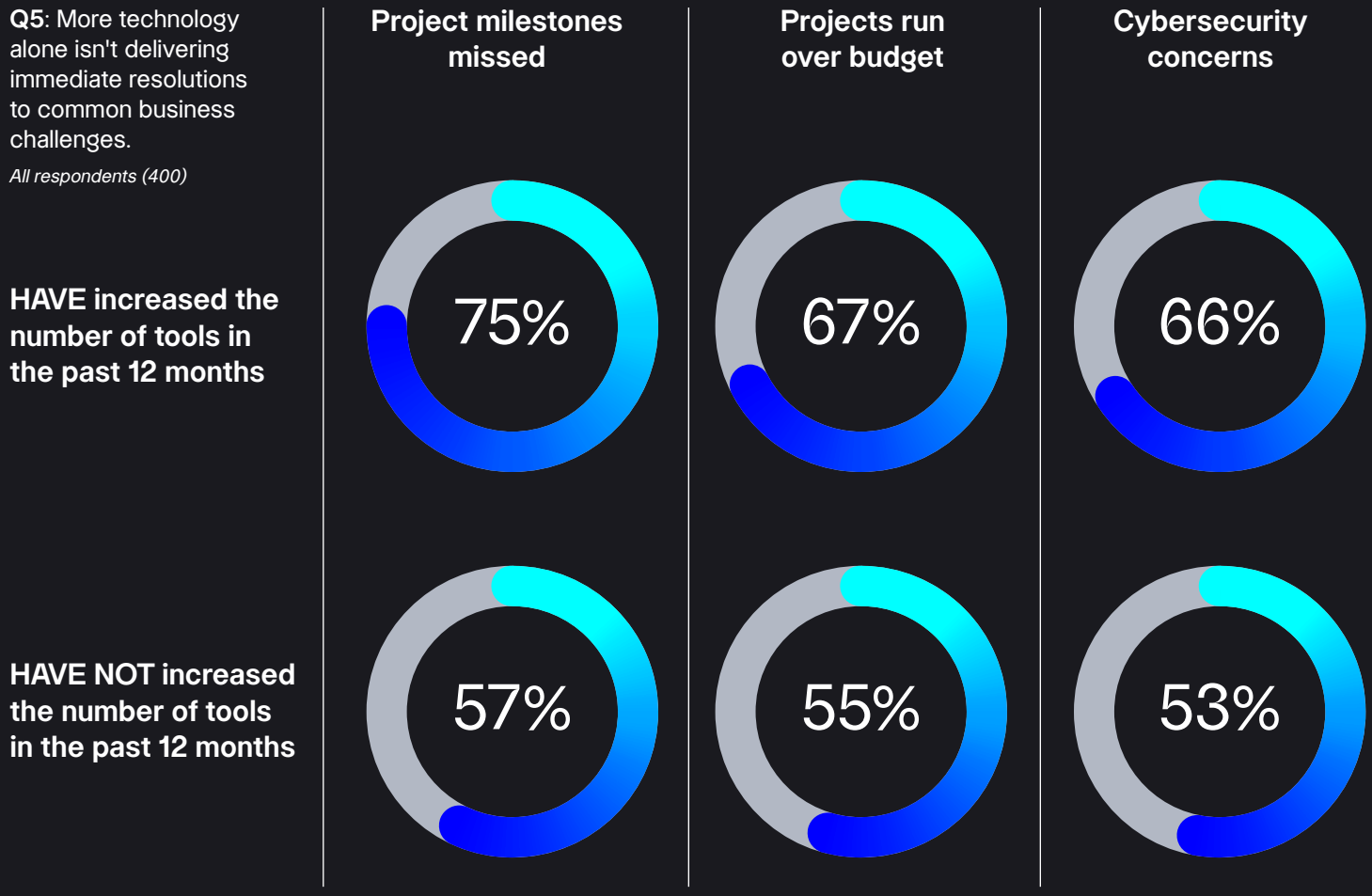
Best practice strategies are required to ensure that tools deliver the expected value and solve the challenges they were brought in to address.

63%

of those with more tools than a year ago agree that their team spends too much time manually creating reports and consolidating data points. They spend an average of 18.72 hours a week, equating to 117 working days a year.

Q5: More technology alone isn't delivering immediate resolutions to common business challenges.

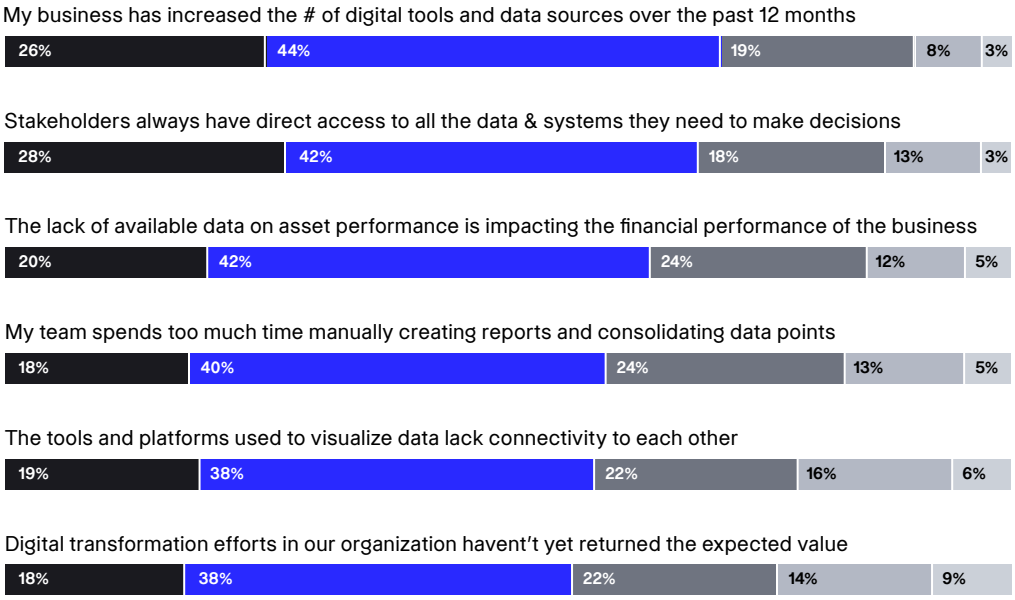
All respondents (400)



Q4: To what extent do you agree or disagree with the following statements?

All respondents (400)

- Severe impact
- Strong impact
- Moderate impact
- Slight impact
- Not at all



Cybersecurity implications

Cybersecurity is also impacted for those with increased digital tools. 66% of companies with more tools than a year ago see cybersecurity concerns as a challenge, compared with 53% of those who haven't added more tools.

Having multiple vendors and tools brings its own complexity to cybersecurity. Syed Belal, global director, OT cybersecurity at Octave, commented: "When talking about cybersecurity challenges, the number one thing we hear the most is companies trying to gain asset visibility. They want to know what's running in their environments, which sounds relatively easy. However, it tends to be a really complex problem for several reasons: there are a lot of different vendors, various types of technologies and often no common protocols. So, gaining visibility into those systems is the number one recurring theme we hear."

Executive viewpoints

Too many tools?

Bilal Alani, from Danone, says it's important to have a strategy to mitigate risk across digital tools. "Cybersecurity is very complex as each factory has a lot of digital components and tools, but we control this through compliance – defining standards in cybersecurity that each factory must comply with.

"The business also takes a pragmatic approach to how new technology tools are greenlit by the organization, allowing flexibility but within certain parameters: "For example, if a factory wants to change their MES [manufacturing execution system] because the moment is right and the value is right, then they can do it on demand, but only by using the approved core system – rather than another vendor or solution.

"For other aspects, such as demand planning, this is a top-down decision, a control tower – this is not something for which the factory can decide which [system or tool] they want to use.

> "Cybersecurity is very complex as each factory has a lot of digital components and tools, but we control this through compliance..."
>
> **Bilal Alani**
> Group head of IT and data and CIO for R&D, Danone

The digital thread

End-to-end visibility for organizations that follow best practices

69%

use some type of digital thread technology continuously or frequently

The need for data visibility

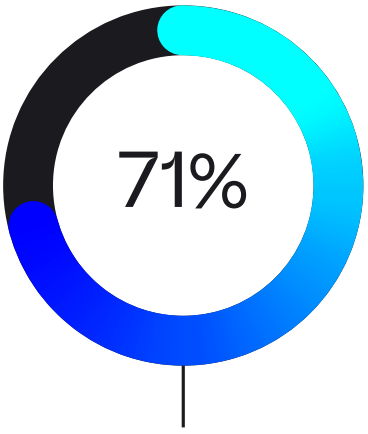
Digital thread technology connects data across all operations, assets and digital tools. In theory, this solution can solve all the issues discussed in this report. But here too, organizations have been facing challenges with adoption.

Digital thread technology and data access

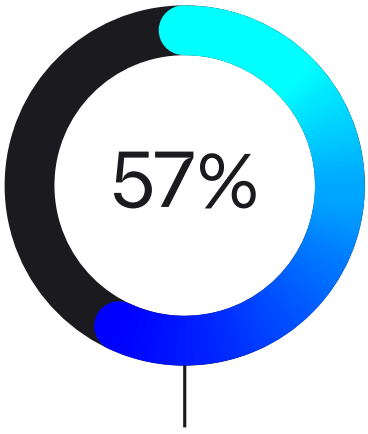
69% of executives confirm frequent use of digital thread technology at their organizations. 71% of those say their stakeholders have direct access to the data and systems they need. This compares to 57% for those who use it less frequently.

But what about those who say stakeholders still don't have direct access to the data and systems needed? For those organizations, why is the digital thread still not delivering on its promise? Where is the 'single pane of glass' where all operational and asset data?

To achieve benefits, a digital thread maturity curve must be navigated. Jump ahead to the next chapter to learn more.



of those who use digital threads frequently or continuously say that their stakeholders have direct access to the data and systems they need, compared with...



who use it less frequently.

Grasping the digital thread

Bilal Alani at Danone says that mature organizations should have a digital thread to sharpen visibility into their manufacturing operations. Although he understands the challenges other organizations may be facing. The digital backbone [the technology on which the digital thread relies], he says, can sometimes be "the foundation that the business doesn't always understand."

He adds: "The expectation from the business C-Level is to have real-time data when it's needed, but sometimes there isn't the realization that this needs the investment and people to maintain and govern it, to get to the data clean and harmonized and gain the new digital capabilities."

Dan Everest says Greater Anglia is now laying the foundation to connect data across operations. "We are building a central data repository for everything to feed into – from EAM engineering data, to revenue and customer experience, all in one place. It will enable joined-up intelligence – for example, not just on delays, or missed revenue, or customer sentiment, but a real full picture of ourselves. Any time of day or night, to be able to get the up-to-date data is what we're aiming for and exactly where we're heading."

Other organizations have found that building a central data repository is foundational for a digital thread. The head of engineering at a global engineering organization says: "We developed the idea that we needed to have a central repository for our data in the project. We had been working with databases for 20-30 years, but there was not really a central repository where data from all disciplines would be collected, checked against each other and provided as a base for further work.

"This is really one of the biggest strategic digital projects we've ever had, because it required a change in our execution process – we no longer rely on paper handovers but instead maintain a digital representation of our plant."

"Any time of day or night, to be able to get the up-to-date data is exactly what we're aiming for and exactly where we're heading."

Dan Everest
Fleet information systems manager, Greater Anglia

Expert insights

Advanced digital thread maturity

Digital thread technologies and methodologies

"As a priority, legacy systems need to be addressed."

Lawrence Benson
VP, portfolio strategy, Octave

So, how can organizations amplify digital thread maturity and the data visibility needed for key business challenges?

Lawrence Benson, Vice president of portfolio strategy at Octave, has worked with organizations across industrial sectors to unleash maturity in this area. He offers these five pieces of advice:

Lawrence Benson
VP, portfolio strategy, Octave

1 Address legacy systems and manage change

"Closing digital maturity gaps isn't just about having data—it's about having the right people and connected systems to make that data reliable and accessible. That means best practices, skilled staff, solid integration tools and quality processes that ensure teams can actually trust and use the information." Part of what's holding organizations back from increasing their digital thread maturity is that this really is a large endeavor – so where do you start? As a priority, legacy systems need to be addressed because older software systems and processes don't provide the infrastructure for mature digital thread capabilities."

"And this needs to go hand in hand with change management. The IT team can be doing a fantastic job at maintaining existing infrastructure, but may not know the best route to creating the modern and robust digital backbone required for a digital thread. There will potentially be a lack of expertise in the business and those gaps need to be quickly identified."

2 Consider scalability

"What you need to avoid is investing in tools that will get you a little bit further, but then realizing a couple of years later that they are now not able to achieve what the business needs. Think long-term and focus on the ideal end state you'd like to achieve, then select solutions capable of scaling with you as your digital thread maturity grows.

"With that wider vision in place, identify the shorter-term easy wins along the journey and build momentum and excitement in the organization. When people see progress, it garners more enthusiasm for the next phase."

3 Use solutions that meet you where you are

"Wherever you are on your digital thread maturity journey, moving to the next phase requires partners and solutions that can meet you where you are and extend on that progress – rather than discounting the investments that have already been made. They should be able to assess how your available data can be connected to other systems, in a way that isn't just point-to-point – bringing things together in an intelligent way."

4 Take a platform approach

"A key way to build on what you have today and bring it all together is through the adoption of a platform-based architecture. This means that, instead of passing data from point solution to point solution, you have a connected 'single pane of glass' for data across all sources – so you can instantly access contextualized data from anywhere, analyze and share it. You want all your data to remain close to its sources, where it is authored, changed, kept accurate and up-to-date, and so on. But then you have your overarching platform that democratizes that data – making it instantly accessible to stakeholders from anywhere in the business."

5 When you reach robust maturity, exploit AI

"The most successful organizations have data they know they can rely on. It's from a trusted source, in a trusted location, it's comprehensive and up to date, and their digital thread makes it always available, from anywhere. Their next stage of maturity is exploiting AI. When the foundation is right, it's not a daunting task to layer on AI tools that enable the exponential acceleration of data analysis – identifying anomalies and root causes, and enabling fast decisions that improve all around operational efficiency."

IDC's three stages of digital thread maturity

In the 2025 IDC analyst brief, 'Unlocking industrial transformation with a unified digital thread from engineering to operations,[1]' IDC, in conjunction with Octave, observes that there are three stages of digital thread maturity, based on the solutions selected and methodology followed:

Low maturity:

"Labor-intensive, ad hoc integrations of data and manual data transfers of external data are conducted. Often, this external data fails to be utilized, especially in the case of engineering and construction data. The electronic product code process creates value-rich documentation and data that provides a baseline ontology of an entire operational setting. However, at the handoff, this data set is often recreated nearly entirely from scratch by the owner operator."

Moderate maturity:

"Some isolated data integration capabilities are executed with the help of IT staff by utilizing horizontal tools and practices. This works for some data and use cases, but often neglects the operations subject matter expertise necessary to contextualize data fully. Many organizations report years-long efforts to pipe operational data from many sources to an IT data lake only to find that combining the data in meaningful ways is severely limited because it lacks context and is not available in a timely manner."

Robust maturity:

"Organizations develop a digital thread through a platform-based architecture that maintains data context within original applications while ensuring data access and continuity through engineering to operations and beyond. These organizations understand that data context is best preserved closest to the source and is ever changing."

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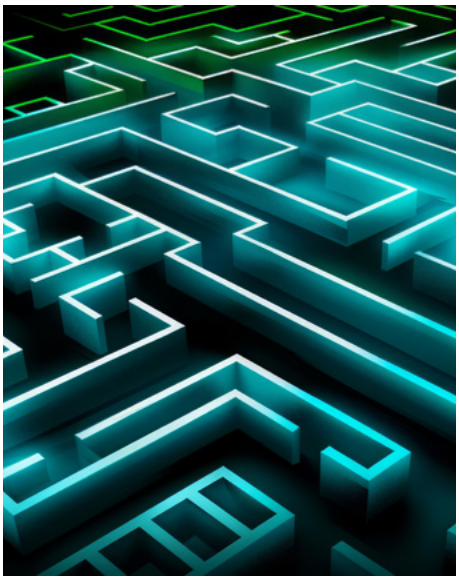
[1] Unlocking Industrial Transformation with a Unified Digital Thread from Engineering to Operations, 2025 IDC Analyst Brief, sponsored by Octave, document no. US52853924, January 2025

Survey methodology

How we put our global survey together



This report uses data from the Octave study into the impact of digital tools and data in industrial business environments. Four hundred decision-makers were surveyed, including C-level executives, about key business challenges and digital tools in their organizations.

We surveyed respondents from APAC (Australia, Hong Kong, Japan, Singapore and South Korea), Europe (France, Germany, Italy, Spain and the U.K.), Latin America (Brazil, Chile and Mexico), the Middle East (Israel, Qatar, Saudi Arabia and the UAE) and North America (Canada and the U.S.).

We focused on three key sectors: manufacturing (food and beverage, and pharma), oil and gas / chemicals and power. All organizations surveyed have annual revenues of more than US$1 billion.

Fieldwork was conducted over the phone and online between December 2024 and January 2025. To qualify, respondents had to meet certain criteria – to either be a top-level decision maker or report to a top-level decision-maker.

Questions focused on both the digital tools they are using and the business value they are seeing.

About Octave

Octave is a leader in enterprise software, turning data into decisive action and intelligence into your edge. Our software solves for and simplifies complexity, from the design and build to operations and protection of people, property, and assets– for any scope, at any scale. For decades, we've partnered with customers to sharpen performance, elevate efficiency, and amplify results. From factory floors to entire cities, our solutions are tuned to scale up what's possible from day one onward.