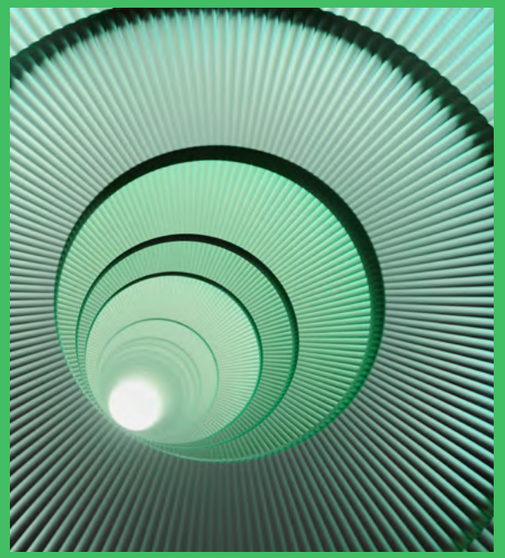
Global C-suite Series
26th Edition
The CSCO Study

Own your transformation

Data-led innovation for the modern supply chain

IBM Institute for Business Value

IBM



The IBM Institute for Business Value, in cooperation with Oxford Economics, interviewed 1,500 CSCOs and COOs from 35+ countries and 24 industries as part of the 26th edition of the IBM C-suite Series. All respondents identified themselves as the most senior executive responsible for supply chain operations. Therefore, to simplify, we refer to the full population as CSCOs. These conversations focused on executives' perspectives on leadership and business; their changing roles and responsibilities; and sustainability, including how they are addressing challenges, what they see as opportunities, and their visions for the future.

Periodically, the IBV convenes a coalition called Think Circles. In these small group discussions, C-suite executives and changemakers engage in action sharing and collaboration as they discuss and work toward solving the biggest challenges of today's turbulent environment. These cross-functional and cross-industry executives tackle current global concerns and future supply chain strategies, and their perspectives and influence are global. This report includes excerpts from these conversations.

Contents

1,500
CSCOs and COOs surveyed

35+
countries

24
industries

26th
edition

“There’s no way any company considered successful today has a bad supply chain. Internally, boards and CEOs have realized the importance of supply chain leaders. And those leaders are now part of creating strategy and have a seat at the table.”

Halide Alagöz
Executive Vice President, Chief Supply Chain and Sustainability Officer, Ralph Lauren, US

Introduction

Another day, another crisis.

A persistent pandemic and global geopolitical conflict continue to dominate headlines. Sustainability concerns are escalating, and extreme weather conditions are more frequent. And with inflation expected to reach historic highs, this generation of business leaders is facing yet another extraordinary situation. Navigating uncertainties—and managing supply chain challenges accordingly—has out of necessity become a top business priority for boards and C-suites alike.

Over the next two to three years, Chief Supply Chain Officers (CSCOs) say that issues related to supply chain disruptions, technology infrastructure, sustainability, and market shifts are their greatest challenges. Yet when addressed with an open mindset, challenges create opportunities within the enterprise—and visibility. A heightened emphasis on supply chain functionalities and roles is giving CSCOs the expertise, latitude, and organizational authority to innovate into a data-led future.

"It's managing the present and also shaping the future. I would tell a new Chief Supply Chain Officer to make sure your foundation is solid and that you're managing the day to day. And then ask, where's technology going? Where's the supply chain profession going? It's more of a strategic approach and looking ahead."

Mike Corbo
CSCO, Colgate Palmolive, US

As Mike Corbo, CSCO of US-based Colgate Palmolive, noted, "Manage the present; shape the future. We live in both camps. Digital transformation will ignite and will help. I think that future states will have to be fluid and dynamic."

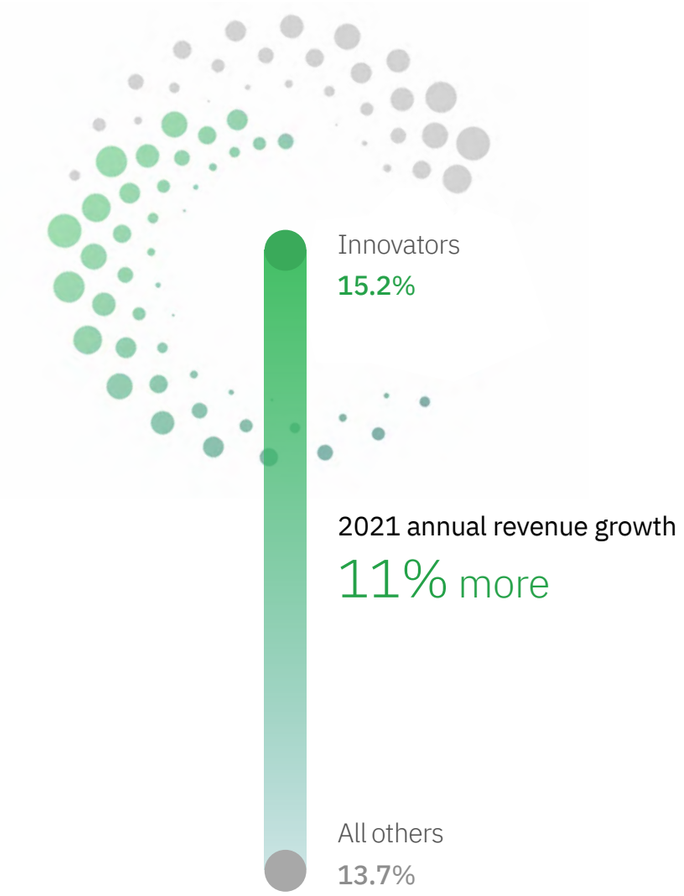
To better understand how these essential supply chain organizations are grappling with persistent challenges, the IBM Institute for Business Value (IBV) surveyed 1,500 CSCOs and COOs in 35+ countries and across 24 industries. Because all respondents confirmed their responsibility for supply chain operations, to simplify, we refer to the full population as CSCOs. (For more information, see "Research and analysis methodology" on page 51.)

We'll share what CSCOs overall are doing to admirably cope. And we'll also highlight a group that stands apart, one that's using data-led innovation to prepare for a precarious future. And, for 2021, this group achieved 11% more annual revenue growth than their peers (see Figure 1).

Figure 1

The Innovator advantage

The rewards of creativity and thinking ahead.



Q. What was your organization's annual revenue/budget growth in 2021?

Chapter 1

Drama, disruption, and daring to look ahead

The supply chain dramas of the past three years still reverberate today—with no sign of easing. In the past year alone, IBV research has revealed a 36% increase in the percentage of CEOs citing supply chain disruptions as one of their greatest challenges.[1]

These challenges don't play favorites. They flow steadily across the supply chain ecosystem, with CSCOs reporting substantial issues related to demand volatility (46%); logistics availability, including ships, trucks, and drivers (46%); supply base inventory availability (45%); technology adequacy (42%); and availability of skilled labor (41%). And not only is labor scarce, it's also more expensive: 38% of CSCOs cite wage inflation as causing significant supply chain disruptions in the past two years.

CSCOs also expect challenges to persist, reporting dramatic increases in the economic and sustainability factors they think will impact their enterprises (see Figure 2). That these factors were much lower even three years ago evokes the dizzying rate at which current events, sustainability concerns, and tech issues have ambushed—and sometimes shattered—supply chains.[2]

"There have always been periods of intensity when external factors affect supply chains. Those periods are usually more around single disruptions like severe weather. But there has been a consistent flow of serious events for the last three years with Covid, extreme weather, logistics challenges, war, etc. In many respects, all of our supply chain teams have been delivering heroic efforts to keep products moving."

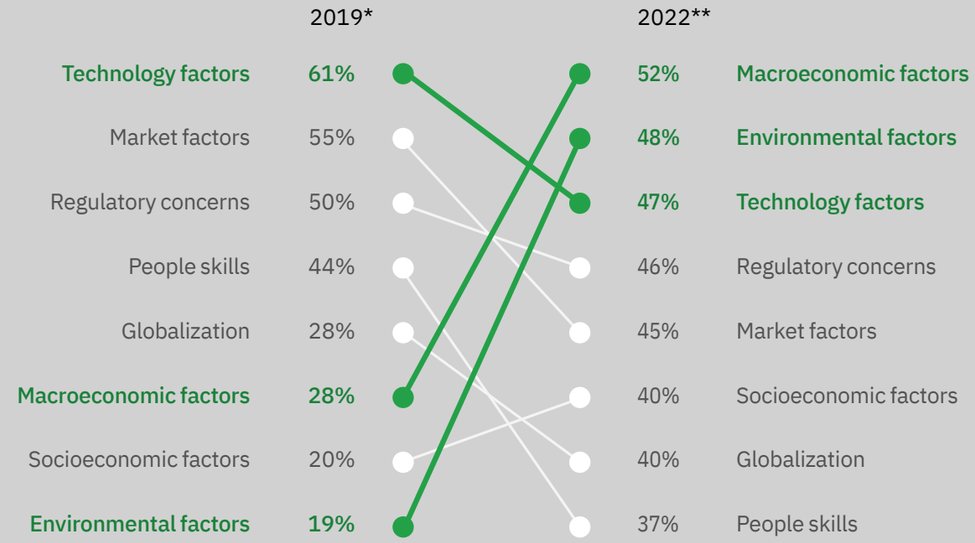
Greg Jozwiak
CSCO, Dow, Inc., US

But bad news (sometimes) begets good news. In many cases, we're seeing CSCOs rebalance and regroup in near-acrobatic ways that transform challenges into innovation. They're amping up the technological resources to generate data and insights that create a foothold from which they can move forward. And concurrently, we're seeing supply chains garnering increased exposure—even in mainstream media.[3] The news may not always be positive, true, but CSCOs are using this attention as a catalyst for action with CEOs, C-suite peers, and across their organizations and ecosystems.

Figure 2

Changing world, changing impacts

Macroeconomic and environmental factors have dramatically increased in importance since 2019.



**2019 IBV C-suite COO Study. "The intelligent operations advantage." **2022 IBV C-suite CSCO Study. "Own your transformation."*
***Q.** What are the most important external forces that will impact your enterprise over the next 2–3 years?*

CSCOs on a tightrope

"This is just a day in the life: disruptions across the world," says one CSCO. "We must know this is our world and plan and operate within it."[4]

Time, attention, and resources are finite entities—and what we're seeing are moment-by-moment trade-offs and compromises as CSCOs rebalance and reimagine their operations.

Almost half (47%) of CSCOs have introduced new automation technologies—an approach that can add predictability, flexibility, and intelligence to operations—especially automating decision-making. Production is streamlined, with robots performing the same tasks repeatedly and efficiently, and AI can monitor quality and track performance.[5]

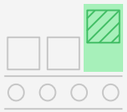
48% report increased design and collaboration with partners (see Figure 3), which enables segmentation. Parsing the supply chain by segment can promote tighter collaboration with suppliers and service providers that have differentiated skills and capabilities.[6]

Figure 3

Creativity in a crunch

Almost half of supply chain organizations have reacted to disruptions by adopting new technologies, including automation.

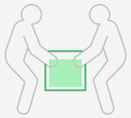
48%
Rebalanced workforce



48%
Collaborated with partners to manage disruptions

47%
Adopted new technologies, including automation

42%
Rebalanced inventory to customers



41%
Reassigned personnel to alternative functions

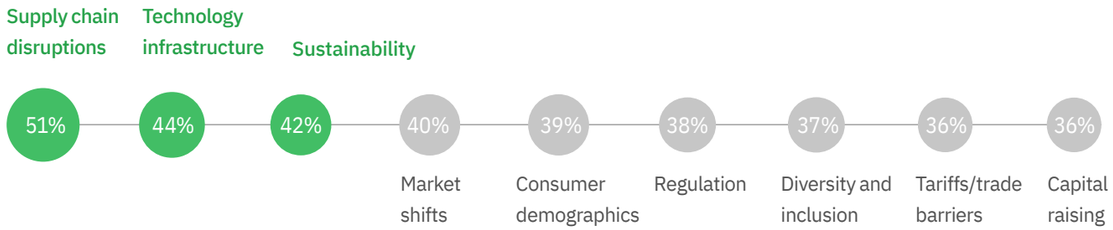
Q. In which of the above ways has your supply chain organization responded to disruptions?

But even as supply chains waver under incessant disruption, "business as usual" trials and tribulations provide a constant background thrum. In other words—crises aside—navigating market shifts, consumer demographics, regulatory issues, and other concerns are still omnipresent on a CSCO's list of worries (see Figure 4). Add technology growing pains and sustainability imperatives to the mix, and CSCOs are walking a tightrope. They are constantly balancing those "business as usual" challenges with supply chain disruptions and complex transformational objectives—and they don't see this changing over the next several years.

Figure 4

Anticipating a tightrope of challenges

Sustainability is among the top priorities for CSCOs over the next 2 to 3 years.



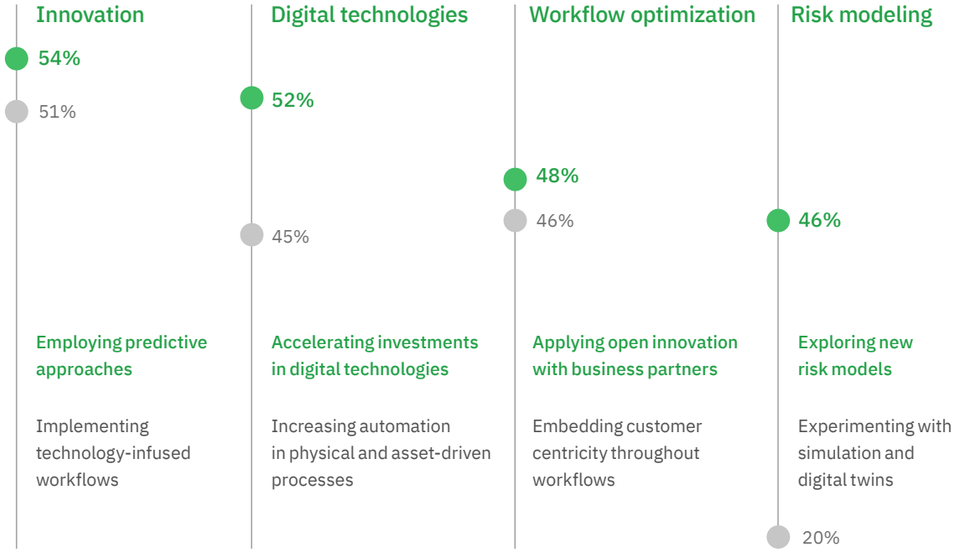
Q. What do you expect will be the greatest challenges for your organization over the next 2-3 years?

CSCOs may be swaying, but their steps across this tightrope are far from tentative. Starting right now and moving forward, more than half (52%) are accelerating investments in digital technologies, including increasing automation and digitization of physical and asset-driven processes. 48% are applying open innovation with business partners. 46% are exploring new risk models (see Figure 5). And 54% are taking a cutting-edge approach to data-driven innovation, including employing predictive approaches and implementing tech-infused workflows.

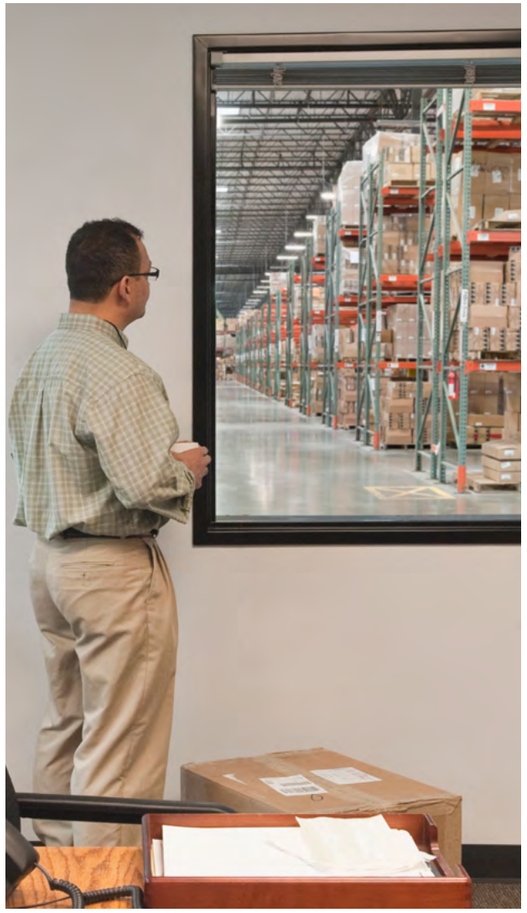
Figure 5

How CSCOs mitigate risk

Innovation and digital technologies are two leading approaches for managing risks.



Q. What actions are your organization undertaking in supply chain operations to manage risks?



In addition to ongoing disruptions and the "normal" day-to-day challenges that have always vexed CSCOs, let's add another consideration, one that stretches the tightrope well past the horizon:

Effective supply chain management means a wholehearted commitment to anticipation. In other words, what can possibly (or probably) happen next?

"The CSCOs of the future will be technologists. Mathematics, optimization, and computer science will be more relevant to their education. Also important is a good understanding of cloud deployment and the different solutions you can leverage from an infrastructure point of view. The transition will be significant."

Alessio Garofalo
CIO/CTO, Oxagon, NEOM, Saudi Arabia

Won’t get fooled again

To anticipate. It means the act of looking *forward*, to visualize a future event or state.[7] Despite all the current-day strife—or perhaps because of it—looking forward is more important to CSCOs than ever.

We don’t need a crystal ball to anticipate CSCO priorities over the next two to three years: we simply asked them. And we found substantial focus on areas that depend on data-led insights, intelligent automation, and innovation to succeed.

52% of CSCOs emphasize the delivery of better customer experiences. 49% want to improve efficiency or profitability. 47% want to generate more predictive forecasts—in other words, more anticipation. And delivering more innovative business models is critical to 45% of CSCOs (see Figure 6). An emerging perspective among forward-thinking CEOs is that open innovation with business partners drives sustainability initiatives and transformation.[8] In fact, we see an even stronger alignment between these CEOs and outperforming CSCOs, with 53% of the latter saying their sustainability strategy specifically dovetails with digital transformation.

Figure 6

What matters most

Enhanced customer experiences, improved profitability, and more predictive forecasts are high on CSCOs’ priority lists.

52%

Deliver better customer experiences

49%

Improve efficiency or profitability

47%

Generate more accurate forecasts

45%

Increase sustainability

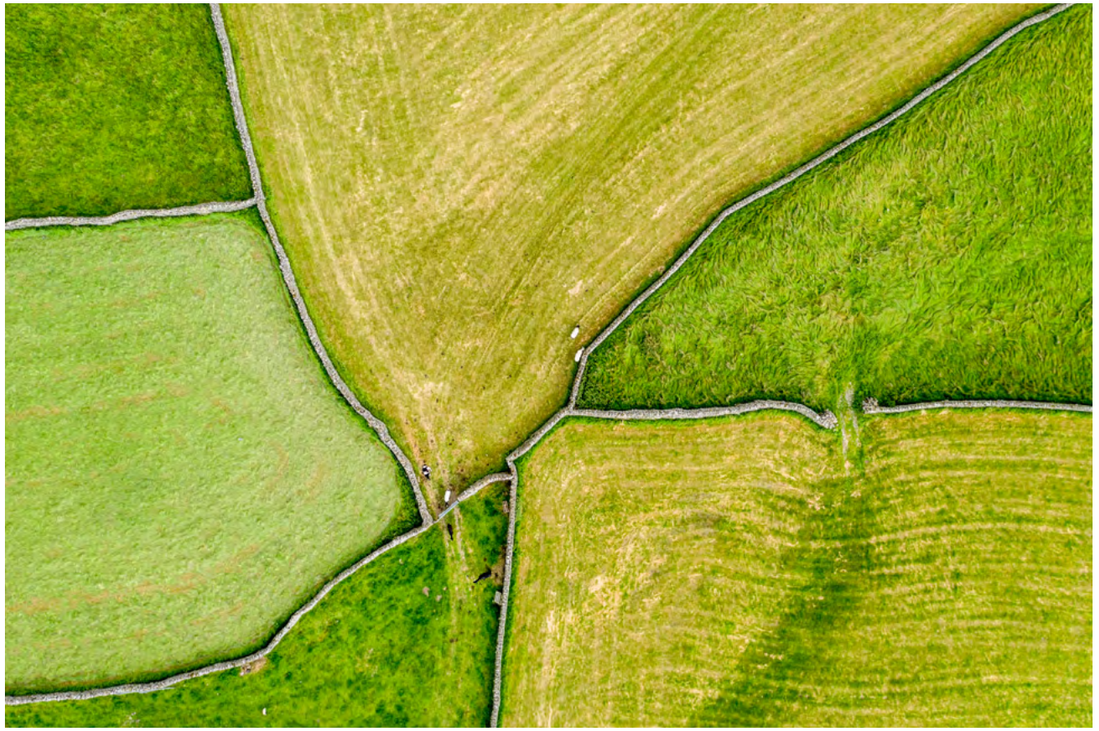
45%

Deliver more innovation in business models

Q. Which of the above represent your organization’s highest priorities over the next 2–3 years?

“Digitize when it’s going to create value. Invest in data and systems where you know you have an issue, and where you strongly believe that digitalization with data analytics, artificial intelligence, and advanced technology is going to help resolve that issue.”

Sami Naffakh
Chief Supply Officer, Reckitt Benckiser, UK

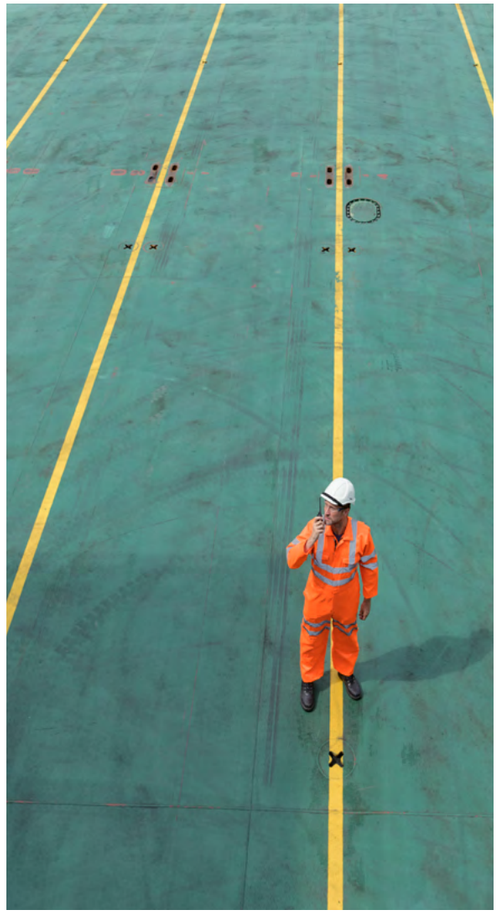


CSCOs told us that *intelligent automation is transformational*. As noted earlier, almost half (47%) of them are introducing new automation technologies to enhance what they already have in play. In fact, the most innovative CSCOs are getting ahead of the game and expect continued development of data-driven digital capabilities and intelligent automation.

In effect, there's an emerging determination among many CSCOs. Their new mantra:

"Don't take anything for granted."

Sami Naffakh
Chief Supply Officer, Reckitt Benckiser, UK



Extended role, extensive insights, and common DNA

There's a popular line of thinking captured in a *Fortune* headline: "From obscurity to superhero: Chief supply chain officer is now the toughest job in the C-suite."[9] Some CSCOs might say their role is the same as ever, but they're doing it under crisis conditions and increased scrutiny.

And yet: a famous puzzler in quantum mechanics is that the mere act of being observed changes the outcome of an experiment.[10] So perhaps it's not such a leap to say that the recent exposure, for better or worse—and the resulting higher profile of CSCOs—has truly evolved the role. Supply chains *do* drive the enterprise. And when CSCOs effectively navigate daunting challenges to deliver toward customer expectations, they are indeed superheroes.

For decades, the CSCO has served as the senior executive overseeing the end-to-end supply chain operation, including sourcing, procuring, planning, manufacturing, and distributing the enterprise's products and services. Some had strategic influence as well, but we're seeing an evolution.

Today, nearly every CSCO role not only encompasses the operational element but also increasingly emphasizes that *strategic* or future-focused side of supply chain. In fact, many organizations have started looking at their supply chain as what it should be—a value chain. Consequently, we're seeing CSCOs with responsibility for supply chain operations transformation, sustainable operations, business model innovation, sales and operations planning, and even financial performance (see Figure 7).

Figure 7

A role-evolution

The top 5 areas that supply chain operations executives are responsible for in 2022 and beyond.

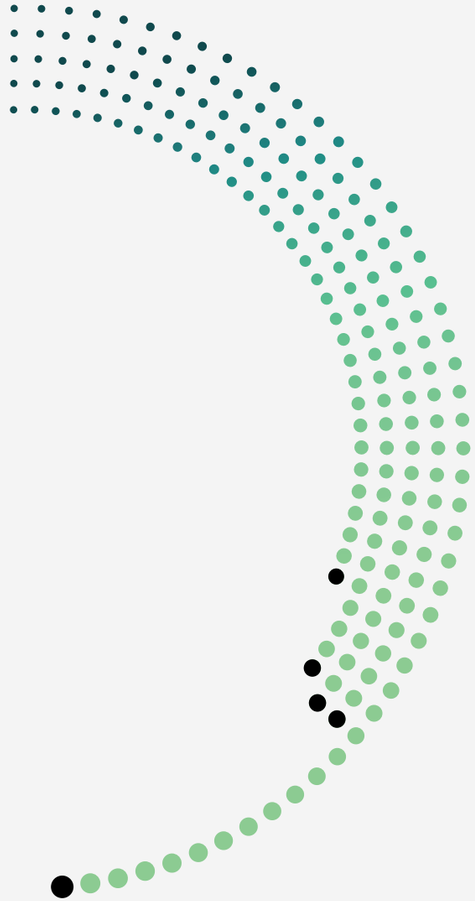
48%
Supply chain operations transformation

38%
Sustainable operations

38%
Business model innovation

37%
Sales and operations planning

33%
Financial performance



Q. What functional areas of supply chain operations are you responsible for?

"I believe CEOs and boards got us into this situation by looking at the supply chain as a way to cut costs. We did that very well for 20 years. But then we had a major tremor—and now they understand. Supply chain can't just be a cost center. It's got to be an enabler of growth."

Mike Corbo
CSCO, Colgate Palmolive, US

As the CSCO role evolves and expands, our research reveals common trends in perspectives and focus. In our next chapter, we'll do a deeper dive into initiatives that keep supply chains strong. And we'll introduce a forward-thinking group of CSCOs that leads the way with future-focused, data-led innovation—and outperforming business results.

Chapter 2

The path forward: Data is destiny

"You've got to get the supply chain where it needs to be to cope with crises going forward. That's where I come back to digital transformation. For me, it's about accessing the available data and also seeking the unavailable data that will help you predict how the supply chain will operate going forward."

Think Circle CSCO executive

Today's CSCOs have little room for failure, and they're adapting to that narrow ledge by emphasizing automation, AI and intelligent workflows, ecosystems, and sustainability initiatives. CSCOs have created a foundational approach that can reap benefits, whether a supply chain is focused on efficiency and resiliency today, or data-led insights and innovations that illuminate the future.

Automation on the A list

Some CSCOs report using an array of AI/automation technologies (see Figure 8). And no wonder. They are potent tools that can deliver more timely insights across ecosystems and intelligent workflows. In effect, they support data-based decisions, helping supply chain organizations quickly identify, prioritize, and recommend next best actions.[11]

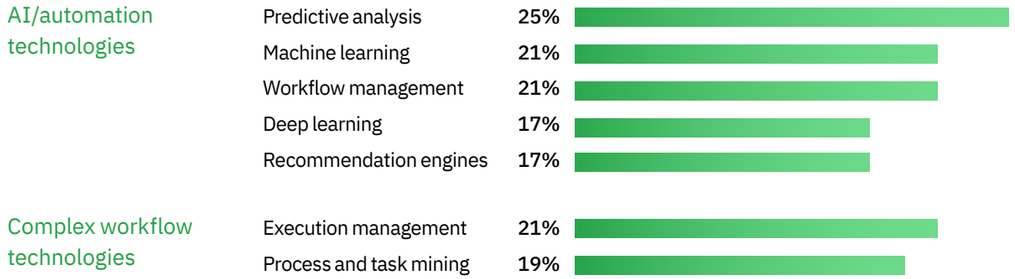
The dependency? Data. And data that's consumable by machines on the shop floor, intelligent workflows, IoT, and beyond needs to be flexible, accessible, and secure. To perform at its peak, automation requires incessant data from across the organization—and even the broader ecosystem.

Automation can also augment employee skills. By helping reduce wasteful cognitive re-processing of similar analysis, decisions, and actions, it can free employees to focus on more strategic, analytical, value-added responsibilities. Forward-looking enterprises use automation and AI to augment their core strengths, supplement their weaknesses, and empower their people to focus on what's important. Intelligent automation can enable your organization to be virtually "always on," optimizing the delivery of goods and services to create continuity in dynamic markets.[12] It can bring out the best of people and technology, creating greater value across the supply chain.

Figure 8

Today's dynamic duos

New technologies are powering intelligent workflows across supply chain organizations.



Q. To what extent is your organization implementing the above technologies today?
Percent responding large/very large. Source: IBV CSCO Pulse Survey. 2022.

ASTRI

Intelligent workflows for smarter manufacturing [13]

Hong Kong Applied Science and Technology Research Institute Company Limited (ASTRI) was founded to promote Hong Kong's competitiveness in technology-based industries through applied research. As part of its mission, ASTRI is tasked with helping manufacturers shorten time to market, reduce development costs, and enhance quality.

ASTRI has implemented a science-based, agile approach to designing smarter manufacturing equipment, leveraging intelligent workflows across assets throughout the extended production process. Using requirements-driven analysis and a model-based design, the organization creates a digital "twin" of an equipment piece. This allows engineers to perform a wide range of simulations and tests, at nominal incremental cost, and identify potential design defects much sooner in the cycle. This model-based method also enables earlier validation of customer requirements.

ASTRI estimates that the twin approach has reduced integration time by 40% and cut the total cost of development by 30%. In addition, the use of robotic automation, IoT sensor integration, and digital twin modeling for predictive maintenance supports 24x7 factory uptime.

AI and intelligent workflows: Seeing everything all at once

With black swan disruptions landing in every direction, CSCOs will need deep organizational awareness to keep their balance. AI and intelligent workflows can deliver 360-degree insights and impact analysis that provide interconnectivity and help with predictability. These workflows can help the workforce—digital and human—dynamically adjust to the unforeseen with both self-learning and self-calibration. And automation—ranging from chatbots to robots—is an essential component.

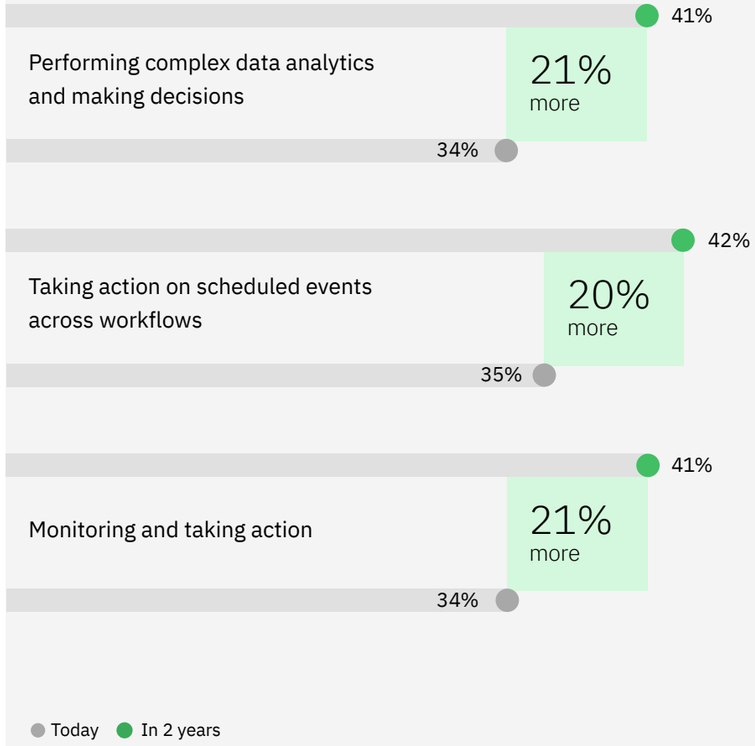
Related IBV research shows that 70% of CSCOs agree: customers expect full transparency from the first kilometer to last mile of the supply chain.[14] However, for this transparency and visibility to create value—not vulnerability—requires trusted, secure data. Most CSCOs expect these enhanced levels of transparency and visibility to be a key differentiator in the next three years, with 53% anticipating their digital supply chain transformation initiatives becoming the most significant competitive advantage during this time.[15] When organizations partner intelligent workflows with predictive intelligence, this visibility becomes possible.

Not surprisingly, CSCOs expect the use of intelligent machines powered by AI and machine learning to overall jump by 20% over the next two years. Specifically, they see increases in using intelligent workflows for monitoring and taking action; executing on scheduled events across workflows; and performing complex data analytics and making decisions (see Figure 9).

Figure 9

Trending up

CSCOs expect the use of intelligent machines powered by AI and machine learning to rise significantly over the next 2 years.



Q: What percentage of the above activities are performed by intelligent machines today and in 2 years?

In fact, how CSCOs prioritize technologies speaks to their near- and mid-term devotion to intelligent workflows, with more than half (54%) emphasizing AI and machine learning, and almost half (49%) focusing on hybrid cloud and IoT over the next three years (see Figure 10). And CSCOs are not stopping with implementing intelligent workflows internal to their organization. In related IBV research, CSCOs say they plan to integrate 32% of their intelligent workflows with ecosystem partners by 2030.[16]

Figure 10

Great expectations going forward

CSCOs look to exponential technologies to deliver results over the next 3 years.

54%
AI

49%
Hybrid cloud

49%
IoT

43%
Process and task mining

41%
Predictive advanced analytics

33%
Augmented, virtual, and extended reality, including the metaverse

32%
Visualization

Q. Which technologies will most help deliver results your supply chain organization needs over the next 3 years?

"Anything that could give us more horizontal data visibility into n-tier suppliers with connectivity all the way through logistics delivery is immense. Then, if you can add AI and smart insights, not only are you building better planning, but you are building insights for risk management."

Sophie Bechu
COO, Philips, Netherlands

Pandora

Innovating customer experience with intelligent workflows[17]

Pandora found international success in designing, manufacturing, and marketing hand-finished jewelry made from high-quality materials at affordable prices. It was sold in more than 100 countries through more than 6,700 points of sale, including approximately 2,700 concept stores. In the wake of the pandemic, Pandora was forced to close down most of its stores. This created a shift to online retail and acceleration of its digital transformation.

The company quickly leveraged a comprehensive order management platform as the backbone to omnichannel fulfillment with a commerce-on-cloud solution powering its ecommerce workflows. Greater automation across its channels streamlined workflows for more efficient delivery while also boosting the jeweler's sustainability credentials.

At the same time, an intelligent workflow provided in-store staff and virtual customer service representatives superior end-to-end visibility to better meet consumer needs. The digital transformation has brought digital and store technology closer together and closer to the customer. Virtual queuing for stores and virtual product trials emulate the in-store experience via augmented reality technology. Pandora is meeting its digital mission of creating personal experiences that are individualized, localized, and connected across channels and markets.

Supply chains *are* ecosystems

It's simple, really: by its very definition, a chain is a series of entities linked, connected, or associated together.[18] Extending that concept, a modern supply chain connects the organizations, activities, people, information, and resources that intersect to move a product or service from producers to suppliers to customers and now, with a focus on circularity, back again. These ecosystems are complex, interconnected, and they're global.[19] They are everything *but* chains. They're ecosystems of partners.

Our data indicates that the strongest supply chains function explicitly as ecosystems. For example, CSCOs named seven domains in which new technologies can enable greater transparency and visibility—*and all seven relate to ecosystems.* Areas include trusted, secure digital connections; end-to-end workflows across partner networks; project collaboration; and more (see Figure 11).

46% of CSCOs expect to emphasize open innovation models with customers and ecosystem partners that can promote collaboration over the next three years. And four in ten say their value streams will be transformed by cross-industry platforms.

"In this environment, we are continuously asked to reinvent how we manage our business, including external partners and suppliers," observes Dr. Dirk Holbach, CSCO of Germany-based Henkel. "The whole ecosystem network has to be synchronized. Each company, each business, each supply chain has to look at new business model opportunities in the context of how and where they operate."

Figure 11

Crystal clear

More than half of CSCOs report looking to ecosystems for greater transparency and visibility.

***Q.** In which areas will new technologies enable greater transparency and visibility?*

Furthermore, supply chain organizations are shifting to ecosystem-friendly work models. For example, nearly 80% of innovative CSCOs are redesigning the way that they work—and ecosystems play heavily. As the importance of physical work location diminishes, the opportunities to access skills and capabilities from anywhere escalate. But these new logistics require robust and defined workflows, and the ecosystems to accommodate them. 51% of CSCOs report that agility will extend into fluid work teams situated with their ecosystem partners. And half also expect skills to be accessed from anytime/anywhere talent pools within three years.

And ecosystems, of course, are mere skeletons of systems unless they are powered by data. When it comes to that data, cross-industry, multi-enterprise platforms require shared visibility, interoperability, and verified chain of custody for data aggregation. This level of transparency and accountability makes ecosystem-wide metrics essential for understanding and tackling sustainability.[20]

"I think generally that society is moving past the aspirational nature of sustainability to the reality of today's social perspective. We're looking at three types of value: shareholder, environmental, and social. CSCOs will need to trade financial value for environmental and social value. And you can't articulate value without measurement data."

Think Circle CSCO executive

The heat is on: Sustainability takes center stage

CSCOs rank sustainability as their third biggest challenge in the next few years, trailing only supply chain disruptions and technology infrastructure. From a broader perspective, CEOs are even more concerned, ranking sustainability as their number one challenge.[21] It's clearly something that's keeping executives up at night across the C-suite—and motivating them in the morning.

CSCOs are feeling the heat from many sources. They tell us they experience the most direct pressure for sustainability transparency from investors (56%), board members (50%), and customers (50%). Other IBV research reveals nearly 80% of consumers indicate sustainability is important to them.[22]

The result of this increased scrutiny on sustainability? When it comes to setting goals for their digital transformation initiatives over the next three years, 52% of CSCOs place sustainability at or near the top of their priority list (see Figure 12), and 50% of CSCOs tell us that their sustainability investments will accelerate business growth.

Workflow digitization also contributes to helping organizations meet their sustainability goals. As teams evaluate and build workflows, they can incorporate ways to reduce their environmental impact and move toward comprehensive circularity programs. In these programs, end-of-life products aren't disposed, they flow back into the supply chain.[23] Increasingly, as sustainability and stakeholder capitalism—including diversity, equity, and inclusion initiatives, as well as responsible sourcing—become C-suite imperatives, circularity-oriented business models, powered by intelligent workflows, have an important role to play.

CSCOs are also responding to sustainability pressures with other initiatives, including improving energy efficiency, water management, and using more organic and recyclable materials. Nearly 50% report these sustainability initiatives will substantially change their supply chain models over the next two to three years. Many CSCOs are looking at a portfolio of strategies that often include environmental, social, and government (ESG) initiatives with the potential to drive lower emissions, ethical sourcing practices, and much more.

Figure 12

Digital drivers

Sustainability initiatives lead the way toward digital transformation.

***Q.** To what extent do you agree with the above statements as they relate to your supply chain operation's digital transformation over the next 3 years? (Percentages reflect "agree" and "strongly agree" responses.)*

Farmer Connect

Fostering supply chain transparency—and sustainability[24]

Coffee drinkers consume more than half a trillion cups per year, and two-thirds aged 19-24 say they prefer to buy coffee that is sustainably grown and responsibly sourced.[25] But despite progress by international certifying bodies, there is still a lack of awareness around the need for coffee farmers to earn a sufficient living. The industry's large global supply chain makes tracing coffee difficult, with participants tracking only their small segments of the journey and using their own systems to log data.

Consumers hoping to close the gap between their neighborhood barista and the farmer who grew their coffee now have a solution. Farmer Connect® has created "Thank My Farmer," a consumer-facing application that connects consumers to farmers and everyone in between for a more transparent and sustainable food supply chain.

Information is presented on an interactive map, allowing each product to tell a story in a simple and scalable way. The "Thank My Farmer" app also presents sustainability projects in coffee communities and an opportunity for consumers to support them. The solution is underpinned by blockchain technology that brings all the parties in the coffee and cocoa supply chain together. Farmers, cooperatives, traders, and retailers can interact more efficiently, and consumers can gain new insights about the origins of the products they consume.

Chapter 3

The Innovators: Taking supply chains from “now” to “next”

Universal problems can prompt a universal response, and that’s the case with CSCOs. Across the spectrum, CSCOs have adopted a steady-as-they-go emphasis on automation, AI and intelligent workflows, ecosystems, and sustainability.

But with a steely eye to the future, a group we call the Innovators—comprising 20% of CSCOs—stands out in their obsession with investing in transformational technology. They’re *ratcheting up* these strategies, adopting a data-driven approach that emphasizes four tech-enabled areas:

- The scaling of a hybrid cloud infrastructure
- AI-enabled workflows
- Transparent, customer-focused sustainability
- Deeper focus on cybersecurity.

The Innovators that have embraced these four priorities achieved 11% more annual revenue growth than their peers in 2021. And they also report being substantially more proficient than their peers at leveraging AI for demand management and forecasting; focusing on cybersecurity; and using agility to navigate market shifts (see Figure 13). This adds up to a compelling competitive advantage for data-driven organizations focused on innovation for the future.

"I would say for me, it's a lot about mindset. It's the ability to live and operate the system under uncertainty and the ability to anticipate. I think of it as being agile and having that resilient mindset. Nowadays, we have to phase this in for everyone who is in the supply chain role."

Dr. Dirk Holbach
CSCO, Henkel, Germany

Figure 13

Metrics that matter

Innovators achieved 11% more annual revenue growth than their peers in 2021, and reported outperforming their peers in planning, cybersecurity, and agility over the past 3 years.

Q1. *How effective is your organization in leveraging data and AI/advanced analytics to assist with business decision-making in demand management/forecasting?*

Q2. *How did your organization compare to your competitors/other similar organizations over the past 3 years in cybersecurity and ability to navigate market shifts?*

Q3. *What was your organization's annual revenue/budget growth in 2021?*

Innovators are mastering the art of hybrid cloud

With hybrid cloud, Innovator CSCOs are extending the value and reach of their legacy applications and data in a flexible infrastructure *that also accommodates the exponential technology needed to drive innovation*. Supply chain organizations choose where to run their workloads—both new and pre-existing—and can further link them to value-added services across the partner ecosystem. And the flexibility of a hybrid cloud platform helps provide access to all-important data and insights.

A hybrid cloud approach is a canvas for creative thinking and innovative design. As such, it's especially suitable for a future-driven supply chain organization. Mastering hybrid cloud can create four distinct value propositions:

- Build applications once, deploy them anywhere.
- Manage applications once, host them anywhere.
- Develop skills once, deploy them anywhere.
- Innovate anywhere, with anyone's technology.[26]

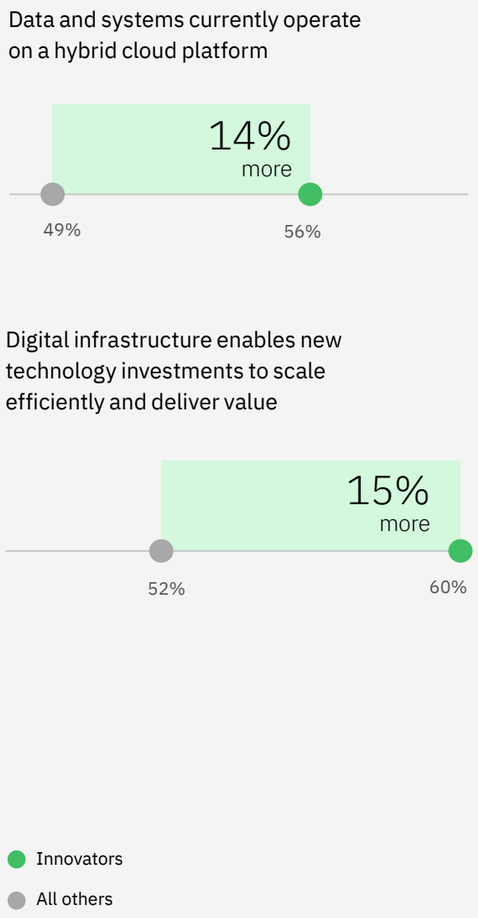
Innovators are edging out other CSCOs in their use of hybrid cloud platforms, 56% to 49%. They also lead the field with digital infrastructure that enables new technology investments to scale efficiently and deliver value (see Figure 14)—testimony to their forward-thinking mindset.

> "Being able to connect the data and make sense of it is important. But the other important part is understanding the localizations of the data. There is a governance that comes into this. You have to clarify because even if the data fabric is good, you still need to understand the layering and utilization of the data within the organization."
>
> **Alessio Garofalo**
> CIO/CTO, Oxagon, NEOM, Saudi Arabia

Figure 14

Hello, hybrid

Innovative CSCOs are operating on hybrid cloud platforms as they scale to deliver value.



Q. To what extent do you agree with the above statements? (Percentages reflect "agree" and "strongly agree" responses.)

Innovators amplify AI-enabled workflows

Today's scenario and modeling analysis often combines AI, analytics, and data visualization, while also leveraging cognitive computing capabilities. The end game? Simulating decision impact, anticipating operational challenges, modeling preemptive new strategies, and—critically—*evaluating options when there's no available historical data.*[27] In fact, 53% of CSCOs expect new technologies to enable greater transparency and visibility for predictive operations with visualization and simulation. Innovators are leading the way.

Risks, which are all too familiar to CSCOs these days, include economic or political stability and that handy catch-all term, "unforeseen events." A bit easier to manage are factors such as a lack of integration and monitoring across your supply chain, and data quality.[28] Modeling, simulations, and predictions using AI and cognitive insights will be an ongoing essential component of successful supply chain operations.

Not surprisingly, *risk management* is a "lean-in" initiative, with one study reporting that 79% of large organizations are pursuing resilience and risk management. The study also predicts that by 2025, supply chain risk management will be a key driver of success for more than half of organizations.[29]

Innovators track well ahead of their peers when it comes to AI-enabled workflows for risk management and to handle other predictions. And they expect continued development of these workflows and other capabilities over the next three years. Right now, Innovator CSCOs report developing digitized workflows and leveraging AI automation a full *95% more* than their peers (see Figure 15).

Innovators also stand out by leveraging data with AI and advanced analytics in demand management. With demand volatility and associated supplier, operations, and logistics disruption at all-time highs, CSCOs are applying AI and machine learning to the critical and strategic continuous planning elements of demand management and forecasting. A full 90% of Innovators use AI and advanced analytics in demand management and predictive forecasting, 18% more than their peers (76%).

Figure 15

Pulling away from the pack

Innovators use digitization and AI automation to integrate workflows across their organization and with ecosystem partners.

Q. Describe the state of your organization's digitization efforts today?

Innovators and sustainability: The competition and customer intersection

While all CSCOs acknowledged the importance of sustainability, when it comes to broader opportunities for impact, Innovators edge out their peers in three key areas (see Figure 16).

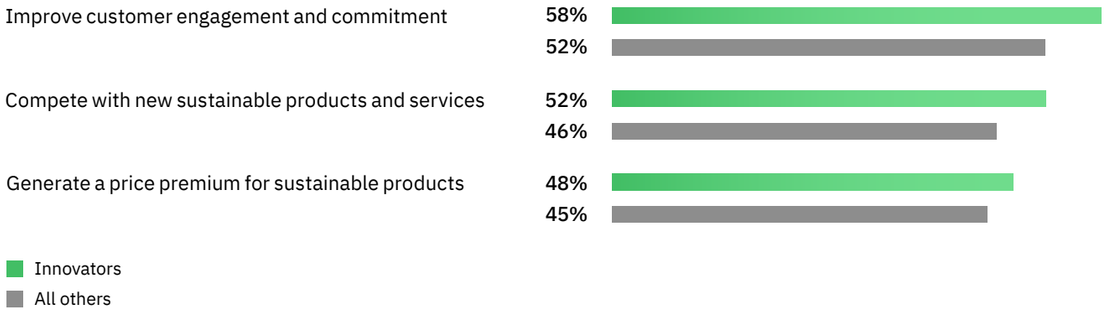
- 58% of Innovators see opportunities to bond with customers over sustainability imperatives, using that shared mission to improve customer engagement and fulfillment.
- 52% of Innovators state that creating strategic brand differentiation through new products is a primary business objective of their sustainability initiatives.
- 48% of Innovators believe they can generate price premiums that could provide support to a robust sustainability strategy. They may be right: IBV consumer research showed that for those who rank sustainability as very/extremely important, more than 70% would pay a premium of 35%, on average, for brands that are sustainable and environmentally responsible.[30]

To drive significant value, sustainability investments need to be an integrated part of organizational transformation. Digitalization and modernization can make sustainability visible, operational, and actionable. According to more than half of Innovators, sustainability initiatives can also complement their data-driven transformation efforts: 53% of Innovators agree or strongly agree that their sustainability strategy is explicitly aligned with digital transformation.

Figure 16

Sustainable strategies

A focus on customers, products, and services.



Q. What are the most important business objectives of your sustainability initiatives?

The new cybersecurity targets: Manufacturing and supply chains

According to IBM research, ransomware players sought to fracture the backbone of global supply chains with attacks on manufacturing, the most attacked industry in 2021. The big bet for cybercriminals: that downstream supply chains would pressure manufacturing organizations into paying ransoms, all to avoid supply chain disruptions. According to the study, 47% of attacks on manufacturing were due to vulnerabilities these organizations could not—or failed to—patch.[31] It's a red flag indicating that organizations need to increase emphasis on vulnerability management.

On another sober note, the cost of a data breach has reached an all-time high, averaging $4.35 million in 2022.[32] Increasingly, CSCOs must take an active approach to cybersecurity, avoiding crime-related delays, data breaches, and financial losses, which only exacerbate the other disruptions they face. Fortunately, cybersecurity and cloud-based digital capabilities complement each other in the support of sustainable performance, end-user trust, and reduced exposure to disruption.

"We are building a consortium of 15 participants across the pharmaceutical industry—a blockchain network, linked to each company's system, while safeguarding the confidentiality and security of each company's data."

Brian Thornley
Associate Vice President, Supply Excellence, MSD Pharmaceuticals, Germany

Conclusion

At the heart of innovation is experimentation—whether in science, technology—or supply chains. With access to exponential technologies such as AI, IoT, automation, and quantum computing, supply chains can more quickly enable integrated, data-driven processes and test their impact. This spirit of experimentation taps into a powerful combination: new technologies and rapidly exploding volumes of data being unleashed by sensors, information sharing, and other connectivity efforts. A very human element plays here as well: the wide-ranging styles and modes of problem-solving and thinking that come from a cognitively diverse workforce.

The result is data-led innovation that can improve sustainability outcomes, increase visibility in supply chain workflows ecosystem-wide, and accelerate hybrid cloud adoption for real-time decisions and actions (see Figure 17). In short, data-led innovation can help CSCOs navigate that ever-present tightrope of managing the present while preparing for the future.

Broad supply chain ecosystems have some of the biggest potential for ideation and breakthroughs. They're where the sheer scale of data, inputs, and participants drives acceleration of not just the idea origination process, but more importantly, the execution and scaling of solutions. For this reason, we expect virtual models, ecosystems, and digitization to increasingly drive the solutions to the biggest supply chain and sustainability challenges.

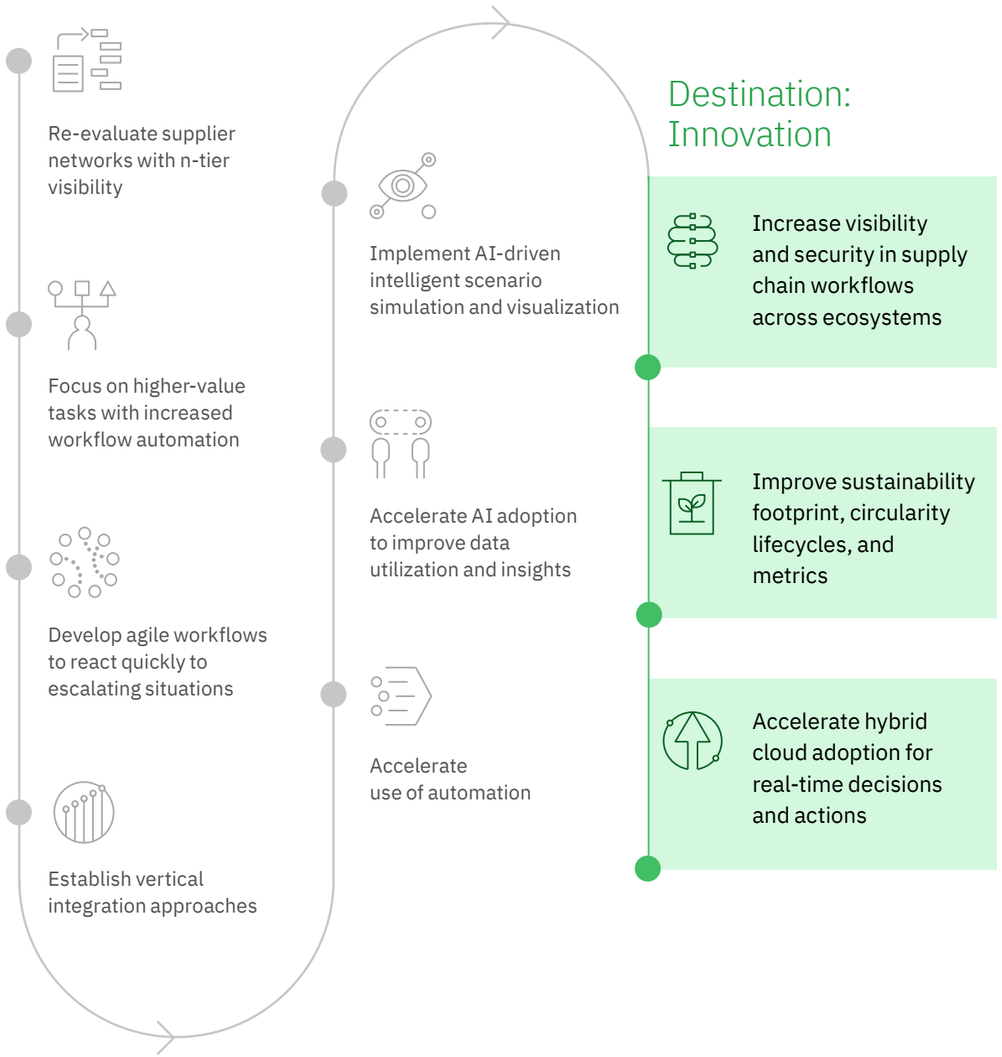
As noted earlier, we looked at the 2021 annual revenue growth across CSCOs and found that Innovators—those CSCOs who report digitizing workflows and leveraging AI automation 95% more than their peers—achieved 11% more annual revenue growth than their peers.

In short, if you want to increase performance and value, data-led innovation is your journey. It's time to hypothesize, test, learn—and act.

Figure 17

The path to data-led innovation

Strategies to value and competitive differentiation.



"There is a long-term scientific and systemic approach as to how we do things and iterate them based on our learnings. There's a lot of short-term, ad hoc firefighting going on based on unexpected challenges thrown your way. All the big players realize the importance of data and integrated planning for real-time decision-making for both dealing with these short-term challenges and also to continue building long-term, agile strategies."

Halide Alagöz
Executive Vice President, Chief Supply Chain & Sustainability Officer, Ralph Lauren, US

Action guide

CSCOs have learned to expect the unexpected. They routinely manage daily “business as usual” challenges, hyper-caffeinated crises, and data-driven innovation while strategically planning—all at once.

By the very nature of this juggling act, the CSCO role is changing. And CSCOs are indeed superheroes—when they get it right. Here are some concrete steps, as well as strategic discussion points, that can get your supply chain organization moving not only in the right direction, but ahead of your competition.

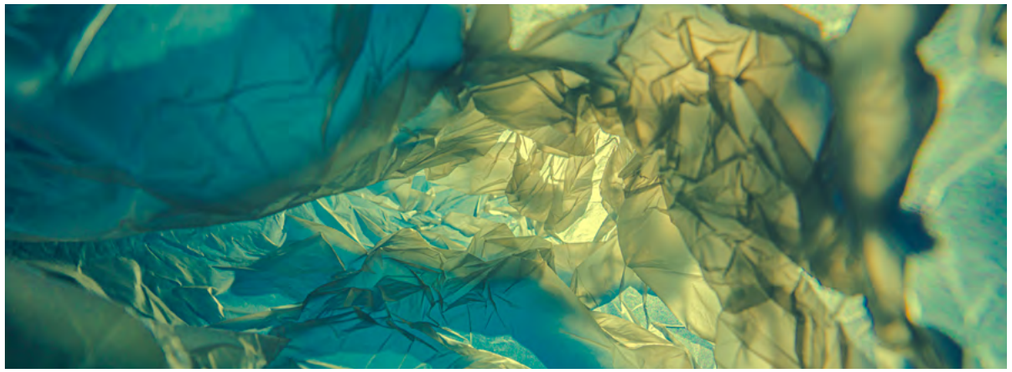
It’s all about capitalizing on this era’s unique opportunities, as well as learning from innovative CSCO organizations that are outperforming. And if, from where you sit, you’re already an Innovator organization, we have suggestions that can help you amplify your success.

"If I started my career again, I would create a digital twin of everything. The importance of the data those digital twins generate is learning. Learning how you operate with those insights allows the ability to tackle the next issue faster. I think that comes from knowledge in that data."

Sophie Bechu
COO, Philips, Netherlands

"At Northrop Grumman, we created an organization called the Quick Reaction Force. They're agile developers and supply chain experts who get ideas from their customers and put them through an ops model to ensure they can be deployed in 90 days. They then dive in, and the developers work with the supply chain experts. We're getting rapid turn deployments out of this."

Travis Hedges
Director of Global Supply Chain Digital Transformation, Northrop Grumman, US



Our Action Guide takes a two-step approach. Below, we provide an "at a glance" high-level perspective—nine main steps your organization can take to drive innovation and move toward a digital supply chain.

Automation

- Accelerate automation in extended workflows
- Amp up AI to make workflows smarter
- Cultivate collaborative ecosystems

Sustainability

- Link environmental and social initiatives with business solutions
- Optimize workflows with AI to manage carbon, waste, energy, and water consumption
- Compete with new sustainable products and services

Modernization

- Architect modern infrastructures
- Scale hybrid cloud platforms
- Increase awareness of cybersecurity vulnerabilities and solutions

Ready to move forward?

Read through the following pages, where we share detailed, comprehensive actions that you can use to formulate a personalized action roadmap toward data-led innovation.

Accelerate automation

If everyone's doing it, then do it better

- Accelerate *automation*, especially within workflows.
  - Streamline production, with robotics performing the same tasks repeatedly and efficiently.
  - Focus employees on higher-value analytical decisions and actions.
  - Use AI and machine learning to guide the quality and track performance of workflow reactions and decisions, as well as to monitor physical assets with predictability.
  - Rely on open, more secure hybrid cloud environments to smooth and speed intelligent workflows.
- Make your *workflows* smarter through amping up AI.
  - Accelerate AI adoption to improve data utilization and insights.
  - Get creative with AI intelligent scenario simulation and visualization.
- Cultivate *ecosystems* that become fertile ground for collaboration and innovation.
  - Increase visibility and security in every touchpoint of supply chain workflows across ecosystems.
  - Re-evaluate supplier networks with n-tier visibility and trusted data sharing.
  - Use segmentation techniques to examine your ecosystems in minute detail for collaborative opportunities.
  - Join ecosystems of discovery to tap into new ideas.
  - Prepare guidelines and roadmaps for engagement, information verification, and trust.

Increase focus on sustainability

Adopt both a micro and macro perspective

- Approach sustainability as a serial innovator, linking environmental and social issues with business solutions.
  - Integrate environmental sustainability and social impact into your enterprise strategy—recalibrate value with a holistic lens of people, planet, purpose, and profit impact.
  - Experiment with open innovation and scientific discovery to explore new solutions and possibilities.
  - Emphasize sustainability in operational metrics, leadership assessments, and investment criteria.
- Partner with CIOs to apply digital technologies to the challenges and opportunities of sustainability.
  - Assess how data, digital technologies, and automation can improve your organization's and enterprise's workflows while achieving more sustainable outcomes.
  - Optimize production, processes, and supply chains through automation and AI to manage carbon, waste, energy, and water consumption.
  - Implement and advocate for conscientious computing, including accountable practices around infrastructure, such as minimizing environmental footprints and fostering the ethical use of data.

Modernize continuously

Take inspiration from the Innovators

- Architect modern infrastructure.
  - Leverage open architectures that multiply the benefits of data sharing.
  - Accelerate hybrid cloud adoption for real-time decisions and actions.
  - Begin experimenting with quantum computing tools and methods to lay the groundwork for expanded capabilities.
  - Respond to increased threats to manufacturing and supply chains with amped-up, state-of-the-art cybersecurity initiatives.
- Aim for AI-enabled workflows on steroids.
  - Develop agile workflows to react quickly to escalating situations.
  - Deploy AI and machine learning to allow better pattern recognition, workflow optimization, and solution gathering.
  - Build and replenish clean, clear, reliable information sets, drawn both deeply and broadly.
  - Combine predictive and prescriptive analysis for better decision-making.
  - Look for micro-insights revealed through extreme digitalization.
- Up your sustainability game.
  - Transcend routine sustainability strategies and find ways to collaborate with customers in the quest.
  - Through price premiums and other business strategies, make it a point to do good and perform better by achieving accelerated competitive advantage.
- Make the future your friend.
  - Support well-researched solutions, even when challenging the "status quo" of an organization.
  - Invest in ongoing open-ended—but value-based—discovery initiatives
  - Reimagine where, how, and what your organization can achieve in light of new science- and data-led exponential possibilities.
  - Execute on new ideas to scale inventions and innovations.
  - Redefine workforce roles for the discovery-led practices of tomorrow.

Innovators must constantly re-invent

- Modernize continuously.[33]
  - Avoid the impulse to look at transformation as an event. Instead, accept ongoing improvement as a never-ending goal and process.
  - Explore digital dashboard approaches; cloud orchestrator/management platforms; and cloud-based ERP, software-as-a-service (SaaS), and independent software vendor (ISV) solutions.
  - Implement feedback loops that promote learning, best practices, and improved processes.
- Drive cultural change.[34]
  - Foster an open culture that encourages constant experimentation, builds new skills and ways of working, and understands that new ideas can come from anywhere.
  - Clarify strategy and establish clear criteria for prioritizing the most valuable ideas.
  - Develop and institute performance metrics that value and reward innovation, collaboration, and value creation.

Research and analysis methodology

In cooperation with Oxford Economics, the IBM Institute for Business Value surveyed 1,500 CSCOs and COOs from 35+ countries and 24 industries as part of the 26th edition of the IBM C-suite Series. All respondents identified themselves as the most senior executive responsible for supply chain operations. Therefore, to simplify, we refer to the full population as CSCOs.

The IBV implemented an in-depth analysis on how the 1,500 respondents characterize their investments in supply chain automation. What are their focused priorities and anticipated outcomes? Representing 20% of the respondents, one data-driven, transformative group of CSCOs emerged: the Innovators.

As well, the IBV has been convening a coalition called Think Circles. In these small group discussions, C-suite executives and changemakers engage in action sharing and collaboration as they discuss and work toward solving the biggest challenges of today's turbulent environment. These cross-functional and cross-industry executives tackle current global concerns and future supply chain strategies, and their perspectives and influence are global. Included in this report are excerpts from these conversations.

The IBM Institute for Business Value, in cooperation with Oxford Economics, interviewed 1,500 CSCOs and COOs from 35+ countries and 24 industries as part of the 26th edition of the IBM C-suite Series.

IBM Institute for Business Value

For two decades, the IBM Institute for Business Value has served as the thought leadership think tank for IBM. What inspires us is producing research-backed, technology-informed strategic insights that help leaders make smarter business decisions.

From our unique position at the intersection of business, technology, and society, we survey, interview, and engage with thousands of executives, consumers, and experts each year, synthesizing their perspectives into credible, inspiring, and actionable insights.

To stay connected and informed, sign up to receive IBV's email newsletter at ibm.com/ibv. You can also follow @IBMIBV on Twitter or find us on LinkedIn at https://ibm.co/ibv-linkedin.

The right partner for a changing world

At IBM, we collaborate with our clients, bringing together business insight, advanced research, and technology to give them a distinct advantage in today's rapidly changing environment.

Notes and sources

1 “Own your impact: Practical pathways to transformational sustainability.” Global C-suite Series. 25th Edition. The CEO Study. https://ibm.co/c-suite-study-ceo

2 Lee, Jim and Jonathan Wright. “COVID-19 and shattered supply chains: Reducing vulnerabilities through smarter supply chains.” IBM Institute for Business Value. March 2020. https://ibm.co/covid-19-supply-chains

3 Mull, Amanda. “Americans Have No Idea What the Supply Chain Really Is.” *The Atlantic*. September 21, 2021. https://www.theatlantic.com/technology/archive/2021/09/pandemic-supply-chain-nightmare-slow-shipping/620147/; Sorkin, Amy Davidson. “The Supply-Chain Mystery.” ***New Yorker.*** September 26, 2021. https://www.newyorker.com/magazine/2021/10/04/the-supply-chain-mystery

4 “Rethinking, rebalancing, and reinventing supply chains: Insights from IBM Think Circles.” IBM Institute for Business Value. May 2022. https://www.ibm.com/thought-leadership/institute-business-value/en-us/role/coo-operations-and-supply-chain

5 Newton, Emily. “6 Ways Technology Makes the Supply Chain More Efficient.” The Network Effect. February 25, 2022. https://supplychainbeyond.com/6-ways-technology-makes-the-supply-chain-more-efficient/

6 “Rethinking, rebalancing, and reinventing supply chains: Insights from IBM Think Circles.” IBM Institute for Business Value. May 2022. https://www.ibm.com/thought-leadership/institute-business-value/en-us/role/coo-operations-and-supply-chain

7 “Anticipation.” Merriam-webster.com. Accessed June 28, 2022. https://www.merriam-webster.com/dictionary/anticipation

8 “Own your impact: Practical pathways to transformational sustainability.” Global C-suite Series. 25th Edition. The CEO Study. https://ibm.co/c-suite-study-ceo

9 Wahba, Phil. “From obscurity to superhero: Chief supply chain officer is now the toughest job in the C-suite.” Fortune.com. November 10, 2021. https://fortune.com/2021/11/10/chief-supply-chain-officer-c-suite-jobs/

10 Siegel, Ethan. “Observing The Universe Really Does Change The Outcome, And This Experiment Shows How.” Forbes.com. May 26, 2020. https://www.forbes.com/sites/startswithabang/2020/05/26/observing-the-universe-really-does-change-the-outcome-and-this-experiment-shows-how/?sh=219f0ced67af

11 Hinish, Sheri, Lars Reinkemeyer, et al. “The resilient digital supply chain: How intelligent workflows balance efficiency and sustainability.” IBM Institute for Business Value and Celonis. April 2022. https://ibm.co/digital-supply-chain

12 Butner, Karen, Tom Ivory, Marco Albertoni, and Katie Sotheran. “Automation and the future of work: Creating intelligent workflows across the enterprise.” IBM Institute for Business Value. July 2020. https://ibm.co/automation-workflows

13 “Hong Kong Applied Science and Technology Research Institute Company Limited: Ushering in Industry 4.0 with an agile approach to systems engineering.” IBM case study. Accessed July 29, 2021. https://www.ibm.com/case-studies/hong-kong-astri-engineering-rhapsody

14 Hinish, Sheri, Lars Reinkemeyer, et al. “The resilient digital supply chain: How intelligent workflows balance efficiency and sustainability.” IBM Institute for Business Value and Celonis. April 2022. https://ibm.co/digital-supply-chain

15 Ibid.

16 Ibid.

17 Farre, Tom. “Jewelry customers gain a personalized digital experience: Optimizing e-commerce fulfillment with cloud-based order management.” IBM case study. Accessed July 29, 2022. https://www.ibm.com/case-studies/pandora-jewellery/

18 “Chain.” Merriam-webster.com. Accessed June 28, 2022. https://www.merriam-webster.com/dictionary/chain

19 “Understanding Supply Chain Ecosystems.” Alison: Empower Yourself. Accessed July 7, 2022. https://alison.com/course/understanding-supply-chain-ecosystems-revised-2018

20 Hinish, Sheri. “Realizing equity for all with sustainable supply chains.” IBM Smarter Business Review. October 20, 2021. https://www.ibm.com/blogs/services/2021/10/20/realizing-equity-for-all-with-sustainable-supply-chains/

21 “Own your impact: Practical pathways to transformational sustainability.” Global C-suite Series. 25th Edition. The CEO Study. https://ibm.co/c-suite-study-ceo

22 Haller, Karl, Jim Lee, and Jane Cheung. “Meet the 2020 consumers driving change: Why brands must deliver on omnipresence, agility, and sustainability.” IBM Institute for Business Value with the National Retail Federation. June 2020. https://ibm.co/consumer-2020

23 Soufani, Khaled and Christoph Loch. “Circular Supply Chains Are More Sustainable. Why Are They So Rare?” *Harvard Business Review*. June 15, 2021. https://hbr.org/2021/06/circular-supply-chains-are-more-sustainable-why-are-they-so-rare

24 “Farmer Connect Uses IBM Blockchain to Bridge the Gap Between Consumers and Smallholder Coffee Farmers.” IBM Newsroom. January 6, 2020. https://newsroom.ibm.com/2020-01-06-Farmer-Connect-Uses-IBM-Blockchain-to-Bridge-the-Gap-Between-Consumers-and-Smallholder-Coffee-Farmers

25 Goldschein, Eric. “11 incredible facts about the global coffee industry.” *Business Insider*. November 14, 2011. https://www.businessinsider.com/facts-about-the-coffee-industry-2011-11; “Millennial coffee drinkers want farmers appropriately rewarded.” *Financial Times*. September 24, 2017. https://www.ft.com/content/a3f69e50-51c8-11e7-a1f2-db19572361bb

26 Granger, John et al. “Mastering hybrid cloud.” IBM Institute for Business Value. May 2022. https://ibm.co/mastering-hybrid-cloud

27 Brown, Marisa. “Adopt Planning Capabilities That Enable Scenario Modeling and Analysis.” Supply & Demand Chain Executive. June 27, 2022. https://www.sdcexec.com/software-technology/article/22289170/apqc-adopt-planning-capabilities-that-enable-scenario-modeling-and-analysis

28 Levins, Cory. “Four Risks Most Supply Chains Face, and Six Ways to Manage Them.” Supply Chain Brain. July 5, 2021. https://www.supplychainbrain.com/blogs/1-think-tank/post/33355-four-risks-most-supply-chains-face-and-six-ways-to-manage-them

29 Turner, Jordan. “How Supply Chain Leaders Can Prepare for the Next Big Disruption.” Gartner. June 8, 2022. https://www.gartner.com/en/articles/how-supply-chain-leaders-can-prepare-for-the-next-big-disruption

30 Haller, Karl, Jim Lee, and Jane Cheung. “Meet the 2020 consumers driving change: Why brands must deliver on omnipresence, agility, and sustainability.” IBM Institute for Business Value with the National Retail Federation. June 2020. https://ibm.co/consumer-2020

31 “IBM Report: Manufacturing Felt Brunt of Cyberattacks in 2021 as Supply Chain Woes Grew.” IBM Newsroom. February 23, 2022. https://newsroom.ibm.com/2022-02-23-IBM-Report-Manufacturing-Felt-Brunt-of-Cyberattacks-in-2021-as-Supply-Chain-Woes-Grew

32 “Cost of a Data Breach Report 2022.” IBM Security. July 2022. https://www.ibm.com/security/data-breach

33 Foster, Mark and John Granger. “The Virtual Enterprise Blueprint: Six building blocks for openness, innovation, and sustained growth.” January 2022. https://ibm.co/virtual-enterprise

34 Ibid.

IBM Corporation
New Orchard Road
Armonk, NY 10504

Produced in the United States of America | September 2022

This document is printed on chlorine-free recycled post consumer paper by a certified printer with Forest Stewardship Council (FSC) Chain of Custody certification using bio-based inks. The energy used to manufacture this paper and print was generated through renewable green energy. Please recycle.

1BYY6VEM-USEN-01