The resilient digital supply chain

How intelligent workflows balance efficiency and sustainability

IBM | celonis

How IBM can help

IBM Consulting is a new partner for the new rules of modern business. We embrace an open way of working by bringing a diverse set of voices and technologies together. We collaborate closely, ideate freely, and swiftly apply breakthrough innovations that drive exponential impact to change how business gets done. We believe open ecosystems, open technologies, open innovation, and open cultures are the key to opening opportunities and are the way forward for modern business and for our world. We want to work together, create together, and rethink what's possible together. For more information, please visit: ibm.com/consulting.

IBM's extensive portfolio of AI software can help organizations take a 360-degree approach to operationalize sustainability efforts across their business—such as extending the life of physical assets, creating more efficient and resilient supply chains, understanding the impact of climate on business operations, or analyzing and reporting on ESG data and initiatives. These solutions are underpinned by environmental insights, operational data, and AI—transforming data into insights that drive smarter, more sustainable decisions every day. To learn more about these solutions including IBM Environmental Intelligence Suite, IBM Maximo Application Suite, IBM Supply Chain Intelligence Suite, and Envizi, visit ibm.com/sustainability.

How Celonis can help

Celonis helps companies reveal and fix inefficiencies they can't see, enabling them to perform at levels they never thought possible. Powered by its market-leading process mining technology, the Celonis Execution Management System (EMS) x-rays a company's entire business operation to show, in real time, how the business really works. The EMS then acts as a brain, orchestrating across systems, processes, and people to fix inefficiencies and eliminate these silent killers of performance. Celonis enables customers to deliver phenomenal business performance in very short periods of time by unlocking billions in corporate inefficiencies, providing better employee and customer experiences, and reducing carbon emissions. Go to celonis.com to find out more.

Letter from the executives

Supply chain disruption has forced leaders to rethink how they operate. During the pandemic, companies and customers have witnessed the chaos caused by demand volatility. In response, organizations are searching for ways to rebuild resilient supply chains—based on data and informed by intelligence—that deliver efficiency with sustainability.

Intelligent workflows are the solution. The backbone of enterprise value chains, intelligent workflows are foundational to digital transformation. As these workflows extend through ecosystems, the power of technology multiplies to unlock sustainable differentiation.

But workflows require work. Inaccessible data sitting in silos and hidden inefficiencies get in the way of success, and this is where process mining comes in. By analyzing data from transactional systems to visualize and identify trends, process mining accelerates discovery, validation, and optimization of workflows. It opens the door to scale and growth. This is what IBM and Celonis help clients do.

IBM and Celonis are proud to celebrate their 1-year partnership. Together, we are helping enterprises reinvent workflows—focused on purpose—and delivering value to organizations, ecosystems—and hopefully, to you.

Jonathan Wright
Managing Partner
Finance and Supply Chain Transformation
IBM Consulting

Janina Nakladal
Global Director
of Sustainability
Celonis

Key takeaways

CSCOs who are looking ahead can distinguish themselves from peers who are only focused on the present.

Leaders are seizing opportunities

Supply chain leaders are reinventing processes by leveraging the newest data-infused technologies. And they are doing it fast. 69% are planning to accelerate cloud adoption to enhance real-time data access.

Executives are optimizing processes

72% of supply chain executives expect most of their processes and workflows to be automated in the next 3 to 5 years.

Organizations are embracing sustainability

66% of supply chain leaders say sustainability is a core business value, and they are embedding it into redesigned workflows to shape more circular economies.

Obstacles trigger opportunities

Supply chain disruptions continue to dominate headlines. Navigating through the uncertainty has become a top business priority for Boards and C-suites alike.

But as supply chain leaders deal with successive challenges, they are discovering unexpected opportunities to innovate. They tell us they are building more agile, flexible, and resilient supply chains for the future by accelerating investments in data-infused transformation. In particular, Chief Supply Chain Officers (CSCOs) recognize that introducing intelligence to workflows is key.

These intelligent workflows promise to reduce costs while boosting efficiency and resilience. They feed circular economies, helping executives answer calls for sustainability as they embrace and embed Environmental, Social, and Governance (ESG) imperatives across end-to-end supply chains.

CSCOs who seize the moment and advance higher-value, forward-looking strategic initiatives can distinguish themselves from peers who struggle just to manage the present. And as detailed in the CSCO playbook for 2022, envisioning the supply chains of tomorrow is essential to succeeding today.

As IBM Consulting and Celonis mark a year of working together to help clients optimize processes and advance intelligent workflows, the IBM Institute for Business Value (IBV), in collaboration with Celonis and Oxford Economics, surveyed 500 Chief Supply Chain Officers to gauge what drives maximum success in next-generation supply chains (see “Study approach and methodology” on page 28). In this report, we share the results.

Test of a lifetime

Empty shelves and shipping delays have exposed the complexity—and the fragility—of supply chains while highlighting how important they are to communities and the economy at large. Inflationary pressures and geopolitical uncertainty have further intensified the situation. As a consequence, supply chain leaders find themselves cast as both heroes and villains, with renewed authority and expanded responsibility. At the same time, with climate change continuing to chart its inexorable path forward, CSCOs face fresh demands for sustainability, adaptability, and value creation—revealing new risks and possibilities for growth.

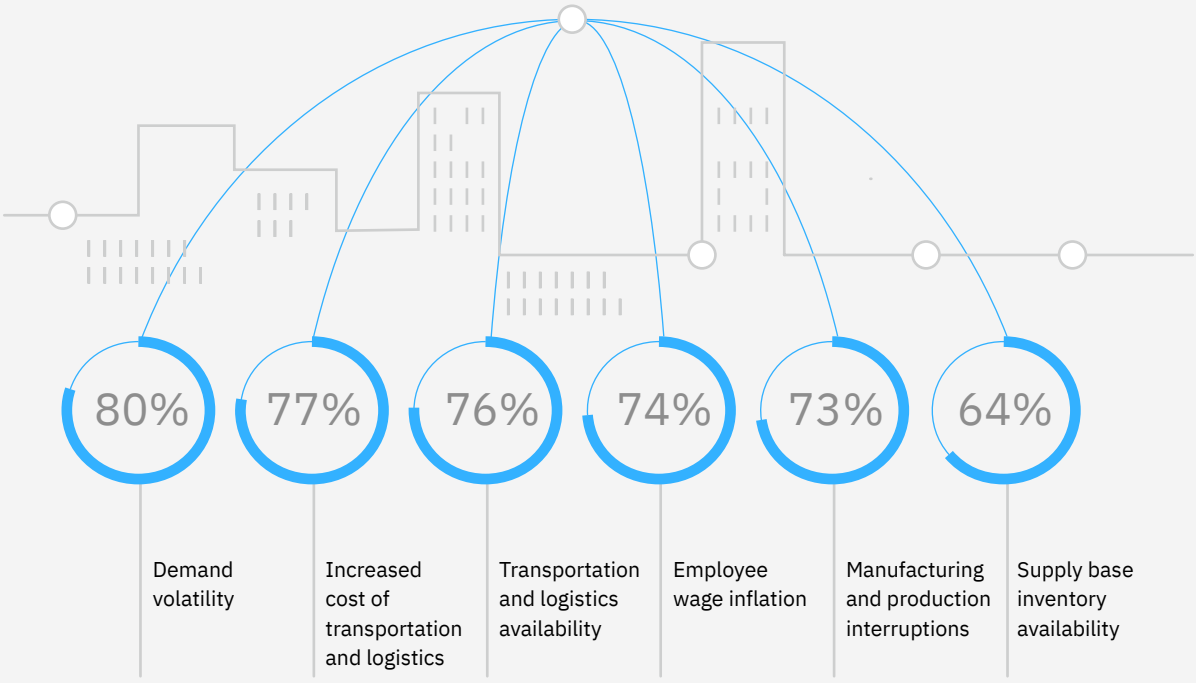
Dynamic, uncertain conditions have burdened supply chains over the last 2 years (see Figure 1). Our new data confirms these challenges have resulted in dramatic performance and financial impacts. 65% of CSCOs report significant negative effects on demand forecasting. Another 65% report greater volatility in order cycle times. And 49% tell us that perfect order rates are worsening.

71% of CSCOs say lower inventory for raw materials and finished goods has created stock-outs and lost sales. And 60% have reverted to expediting products to meet customer needs, further accelerating logistics challenges and driving up transportation costs.

FIGURE 1

Supply chain disruptions

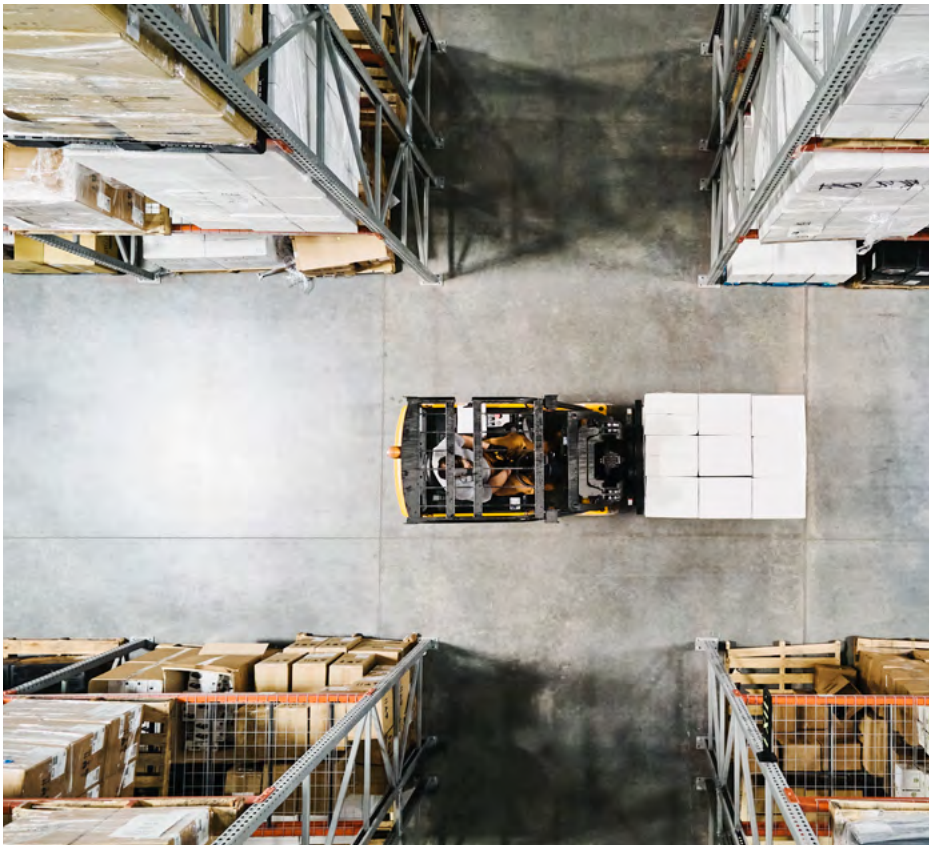
Multiple factors have challenged supply chain leaders over the last 2 years



In response, supply chain leaders have initially focused on short-term answers. 52% of CSCOs report they have sought alternate types of transportation and logistics capabilities. 49% have reassigned more personnel to planning while balancing worker well-being and mental health. 41% have worked with alternate suppliers. A further 41% are overhauling outreach with new policies to communicate with customers, manage disruptions with ecosystem partners, and establish around-the-clock contact with suppliers and service providers.

However, some organizations are trying to get ahead of the curve with a two-pronged, data-led approach to running their supply chains. The first prong follows a predictive model, exploiting efficiencies by using advanced analytics, data modeling, and automation to drive reliability and a frictionless experience. The second prong is more proactive, addressing high variability and unexpected disruption while embracing exponential technologies including AI, edge computing, data process mining, and even quantum.

They are doing this across their entire supply chain, including tier 2, 3, and 4 suppliers, with CSCOs telling us that these bimodal capabilities help them provide continuity in dynamic markets while preparing for an unknown future at the same time.



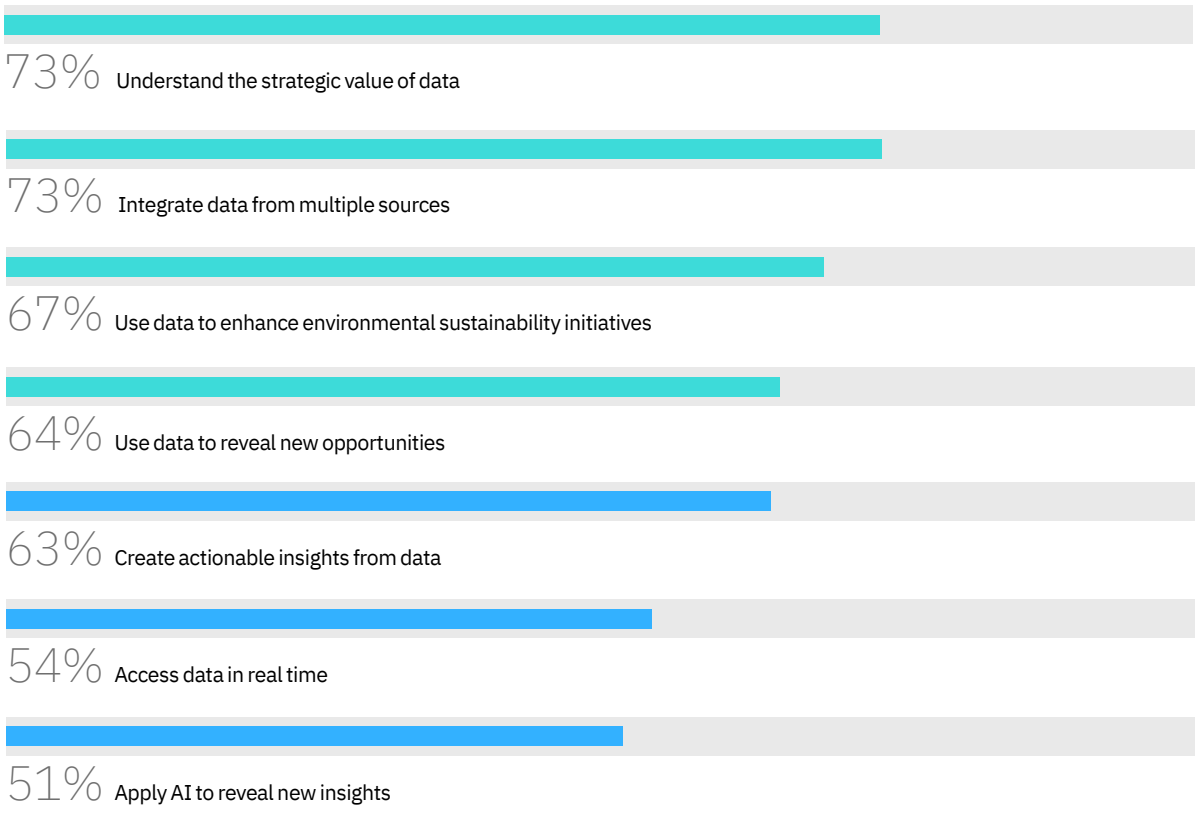
Digital wins inspire transformation blueprint

Looking ahead, CSCOs are pursuing aggressive strategies to build smarter, more agile supply chains designed to deliver radically improved performance and resilience. They realize that the data-led solutions successfully fueling their short-term responses are crucial to a complete digital transformation. Leaders are adopting a data-first mindset with 73% recognizing the strategic value in data and 64% using data to identify new opportunities (see Figure 2).

FIGURE 2

Data-first mindset

Supply chain leaders champion transformation with data



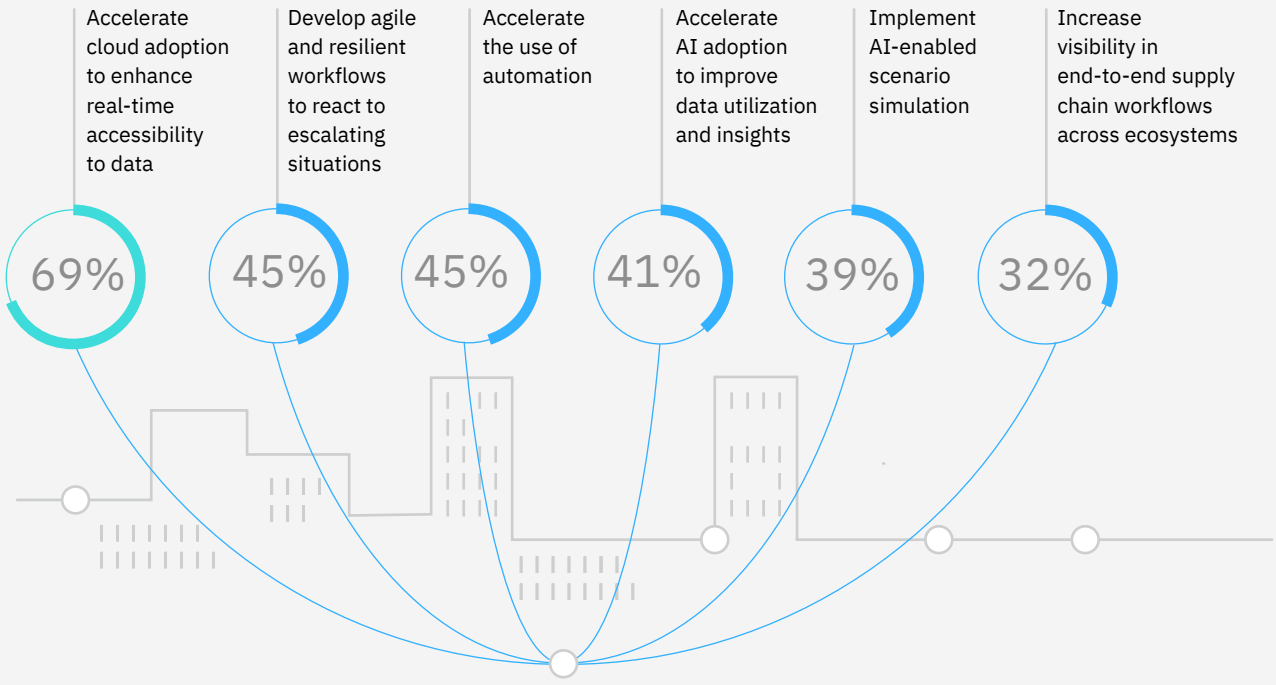
To achieve more dynamic, responsive, insight-driven supply chains, CSCOs are focused on building resilient workflows powered by automation and intelligence. They also recognize the critical role cloud plays. 74% of CSCOs tell us that hybrid cloud integration is crucial to accelerating and enabling the digital transformation of supply chains. And 69% also cite the need to accelerate cloud adoption to enhance real-time accessibility to data—the data that feeds the long-term strategies for modernizing supply chain operations (see Figure 3).

74% of CSCOs say that hybrid cloud integration is crucial to accelerating and enabling the digital transformation of supply chains.

FIGURE 3

Optimizing operations

Disruption kindles data-led, long-term strategies for modernizing supply chains



Q: What longer-term supply chain strategies is your organization undertaking as a result of disruptions?

A digital twin is the virtual representation of a physical object or system across its lifecycle, using real-time data and other sources to enable learning and reasoning, while dynamically recalibrating for improved decision-making.

With the right data in hand, organizations can tackle the hard work of reinventing processes and designing their automated, intelligent workflows. An essential first step is uncovering and fixing hidden process inefficiencies—silent performance blockers that tend to develop over time due to the growing complexities in how people, processes, and technology work together.

Consider, for example:

- Order management, where 1 in 5 orders might be canceled due to stock-outs
- Information Technology Service Management (ITSM), where tickets might be reassigned as many as 10 times
- Accounts Payable, where a specialist might unintentionally pay an invoice twice—or even more.

To identify these inefficiencies, organizations can use process mining, which integrates workflows and process data in real time across multiple data models, rendering an "X-ray" of processes. With this information, supply chain teams can remove bottlenecks, deploy automation, and reengineer processes in Accounts Payable, Accounts Receivable, Inventory Management, Order Management, and Procurement. (See case study "Global oil and gas company optimizes processes to transform asset management.")

The modern toolkit of CSCOs also includes data-led emerging technologies such as machine learning, simulations, and execution management—all in support of designing automated, AI-enabled, intelligent workflows that support continuity of operations, build resilience, and amplify value (see Figure 4). More than 51% of CSCOs also plan to implement digital twins over the next 3 years, which can help identify new areas of workflow improvement.

Case study

Global oil and gas company optimizes processes to transform asset management

The production and distribution of oil and gas is extremely complex. Asset management optimization is key to operational efficiency and value impact.

Challenge
As this company scaled production to accommodate increased demand, it needed to optimize operations and resulting margins.

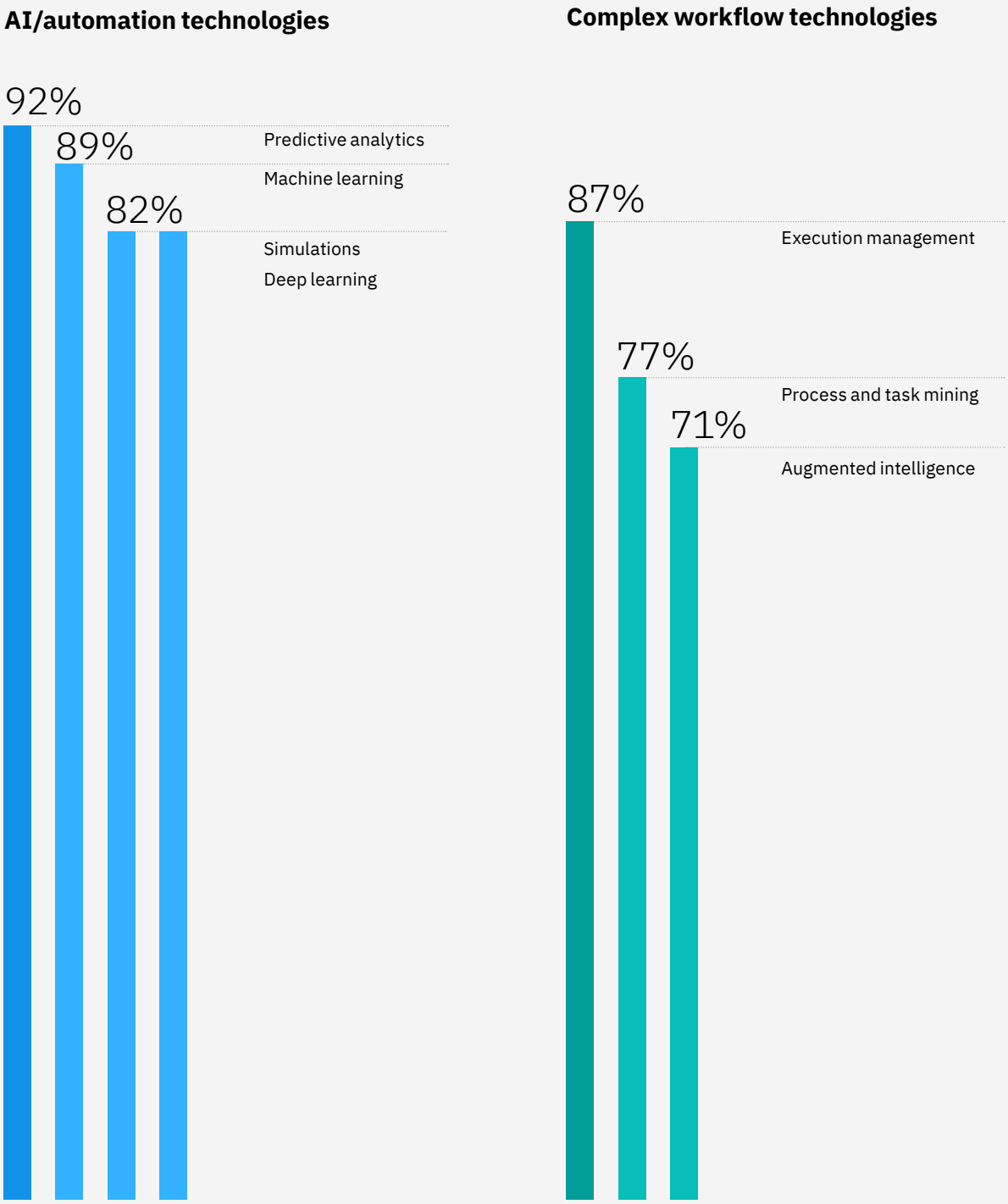
Solution
Applying AI-enabled process analytics on 9 process areas across 5 systems, Mining Squads designed and re-configured their enterprise asset management processes. These steps allowed them to transform and modernize their asset and investment management portfolio and capabilities, while harmonizing processes globally.

Outcomes
This optimization led to process visibility and standardization, delivered efficiency through automation, and established real-time observability through KPI dashboards for continuous monitoring and measurement.

FIGURE 4

From emerging to essential

New technologies power intelligent workflows



Q: On a 1-5 scale (5 = to a very large extent), to what extent is your organization implementing the following technologies? Percent responding 3, 4 or 5.

Supply chain leaders are optimistic about the future. 72% expect most of their processes and workflows to be automated within the next 3 to 5 years. They also project 27% of their workflows will be AI enabled during that same time frame, increasing to 33% by 2030. More specifically, through 2025, 83% of CSCOs plan to introduce AI-enabled real-time inventory management; another 83% expect to introduce self-monitoring, self-correcting assets; and 81% are looking to AI-enabled processes and workflows for real-time demand sensing.

87% of CSCOs plan to use execution management in modernizing supply chain operations.

Streamlining processes with partners

Supply chain leaders also highlight benefits from applying intelligent workflows to processes involving partners and ecosystems. CSCOs say they plan to integrate 26% of their intelligent workflows with ecosystem partners by the end of 2025, growing to 32% by 2030. Cloud-based process mining facilitates this ecosystem process integration by introducing visibility and transparency into workflows that extend into supply chain partners. (See case study "Global chemical company improves process transparency for purchase-to-pay workflows.")

CSCOs plan to integrate 32% of their intelligent workflows with ecosystem partners by 2030.

Case study

Global chemical company improves process transparency for purchase-to-pay workflows

A global chemical company, with an outreach of suppliers in 21 countries, needed to optimize its purchase-to-pay (P2P) workflows with visibility, automation, and compliance.

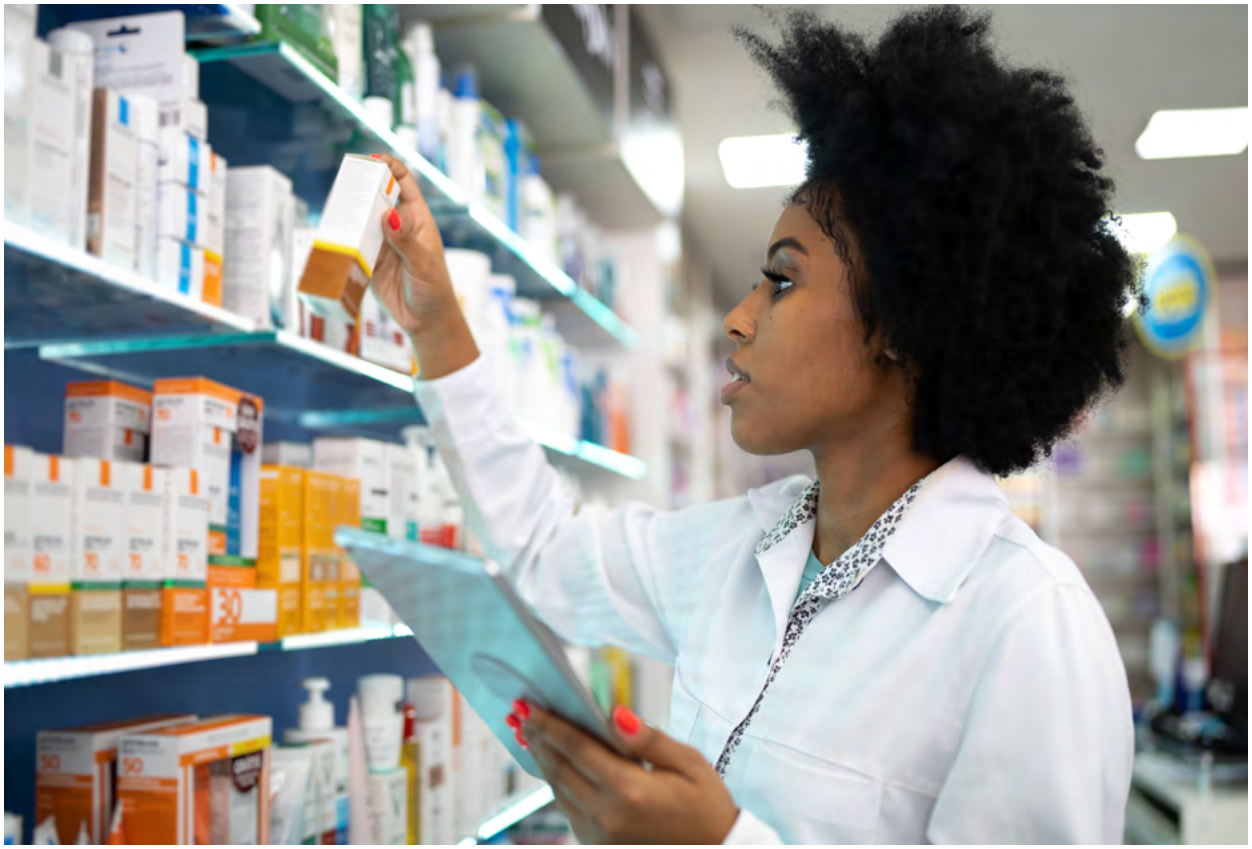
Challenge
Invoices required high manual intervention, which negatively impacted the P2P process performance.

Solution
The solution team applied analytics to simulations of the end-to-end P2P workflow. Dashboards exposed new insights into 6 process areas and use cases for process flow analysis and reporting automation.

Outcomes
Monitoring and transparent management of the integrated workflow resulted in early payments to suppliers. This improved the company's working capital, resulting in $50 million in cash flow, and positioned them to receive additional discounts that rendered $300,000 in income increase.

"We continue to build and strengthen a consortium across the pharmaceutical industry. 15 major global pharmaceutical companies are working toward a blockchain utility network that can be linked to each company's system, while appropriately safeguarding the confidentiality and security of each company's data. On top of that, we are building applications that allow for a trusted and compliant connectivity with the entire healthcare value chain, connectivity with regulators for product release, and connectivity to distributors all the way down to clinics and healthcare providers. This blockchain-based ecosystem will provide information at the point of dispensing—validating the quality and the provenance of the product through all aspects of transportation and distribution to the clinic and to the patient."

Associate Vice President
Pharmaceutical company



The power of the people

Great supply chains require great people with great skills and talent. Around half of the world's population contributes in some way to the supply chain, and as many as 40% of the jobs in the United States are supply chain related.[1] With so much of the workforce contributing to supply chain success, identifying the right people and setting them up for success is essential.

Pandemic-driven advances in workplace technologies have delivered new options for when, where, and how people work. So now is an ideal time to re-examine and optimize the workforce processes that can lead to a more resilient and data-enabled supply chain. Automating mundane tasks can improve efficiency and frees talent to focus on more impactful work.

But automation can be uncomfortable and even intimidating for the workforce. To optimize the people-technology partnership across supply chain activities, leading CSCOs are prioritizing reskilling of talent to perform higher-value tasks, such as analytics and workflow monitoring, along with optimizing these tasks and flows with ecosystem partnerships. 65% of CSCOs say they anticipate that skills will be accessed from anytime, anywhere talent over the next 3 years. The goal, when people and technology are working together effectively, is to unlock new potential across a digital supply chain.

"Digital acceleration is the new mantra. Continuous balancing. We need to maintain a laser focus on data-based decision-making. Improving the digital view of the supply chain—digital twins of everything. Improving algorithms. Improving the organization fluidity as well."

Corporate Senior Vice President and Chief Supply Chain Officer
Chemical and Consumer Goods company

Making supply chains the differentiator

Automated, intelligent workflows can help CSCOs not only meet customer demands but distinguish their organizations from the competition. Customers expect full transparency from the first to the last mile of the supply chain. When embedded with predictive intelligence, intelligent workflows make this visibility possible. They can power dynamic customer response, preventative product and service maintenance, and real-time inventory and delivery status. AI-enabled automation facilitates data-supported decisions so organizations can rapidly identify, prioritize, and recommend Next Best Actions for response, action, and reaction.

This increased knowledge also offers greater insight into risks, supporting the resilience of the supply chain, which is a key area of concern for supply chain leaders. In anticipation of realizing these many benefits, most CSCOs expect visibility and transparency to be a key differentiator in the next 3 years with 53% saying their digital supply chain transformation initiatives will be the most significant area of competitive advantage during this time.

Connecting supply chains with sustainability

66% of CSCOs report that sustainability is a core element of overall business value.

Across the C-suite, sustainability has become a top priority. In a recent IBV survey, 32% of C-suite executives cited increasing sustainable operations as one of their most important business priorities. And fully half of all organizations expect to move toward carbon neutrality by 2024.[2]

CSCOs share the sustainability imperative. 66% report it's a core element of overall business value. But, even though recent IBV research has shown sustainability can positively affect revenue growth,[3] 51% of CSCOs in our survey are willing to–perhaps unnecessarily—sacrifice profit to improve sustainability outcomes. By how much? On average, 5%, which equates to an estimated $22 billion among US Fortune 500 companies in 1 year.[4]

CSCOs identify specific sustainability goals. 71% tell us their organization plans to aggressively move to carbon neutral. And 29% say their efforts will include carbon take-back programs.

They have also already begun to tie sustainability to specific processes. Another recent IBV sustainability study found 78% of CSCOs are incorporating environmentally sustainable business practices into demand and supply chain planning functional activities. And 72% have sustainability initiatives incorporated into procurement and sourcing functional activities.[5]

But pressure to deliver on sustainability goals continues to hit CSCOs from all sides—including their Boards, customers, investors, and regulators. Partnerships across the C-suite can help them link social and environmental issues with technology-driven business solutions. For example, in our 2021 CIO study, 42% of CIOs said technology can have a significant impact on sustainability initiatives over the next 3 years.[6]

Meanwhile, to meet stakeholder demands, CSCOs are responding with multiple initiatives, including improving energy efficiency and using more organic and recyclable materials (see Figure 5).

FIGURE 5

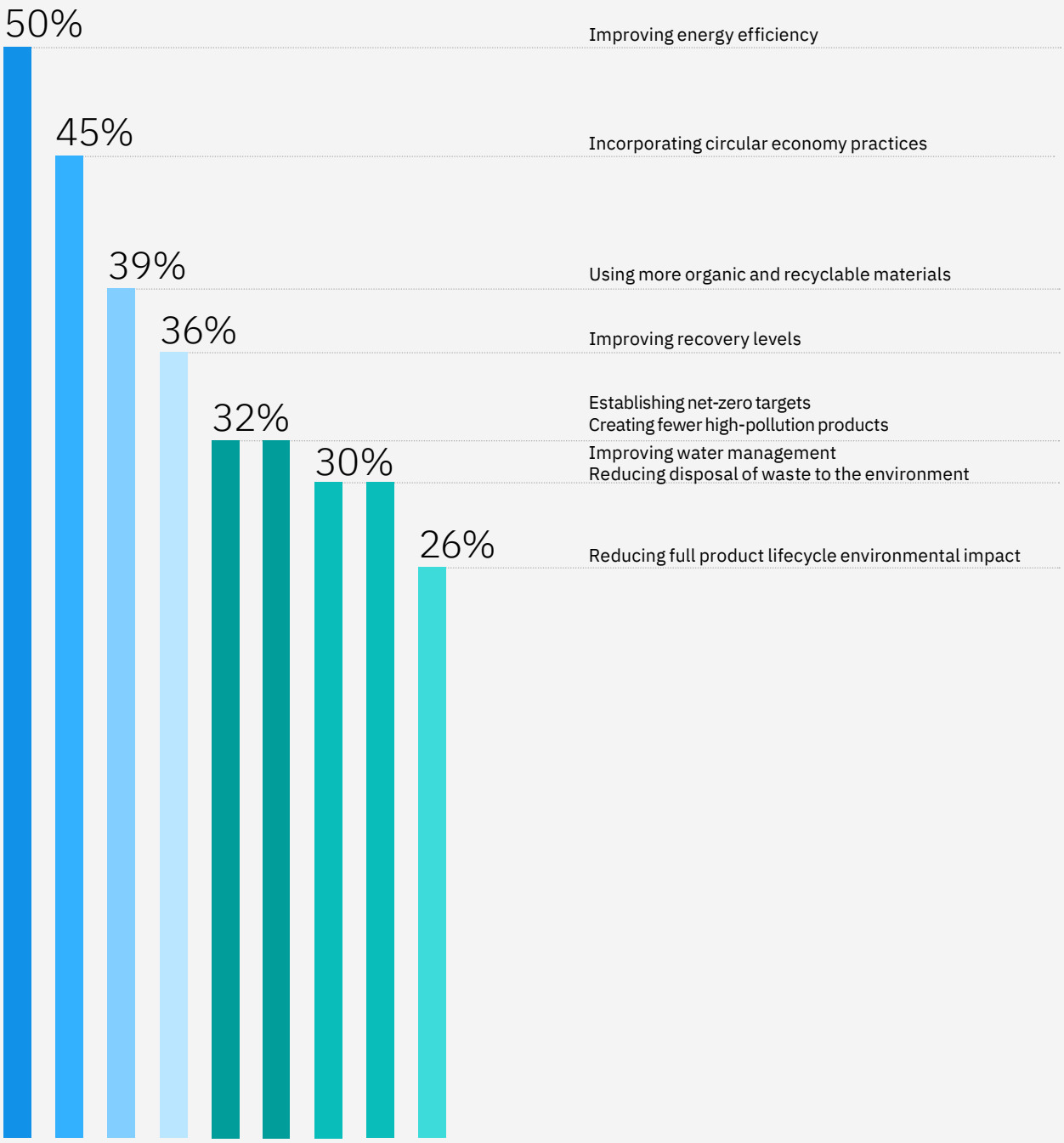
Demands from all directions

CSCOs are responding to intensifying pressure for sustainability progress

Stakeholders demanding sustainability improvements

70%	66%	66%	65%
Boards of directors	Customers	Investors	Regulators

Specific actions CSCOs are taking



Circular economy

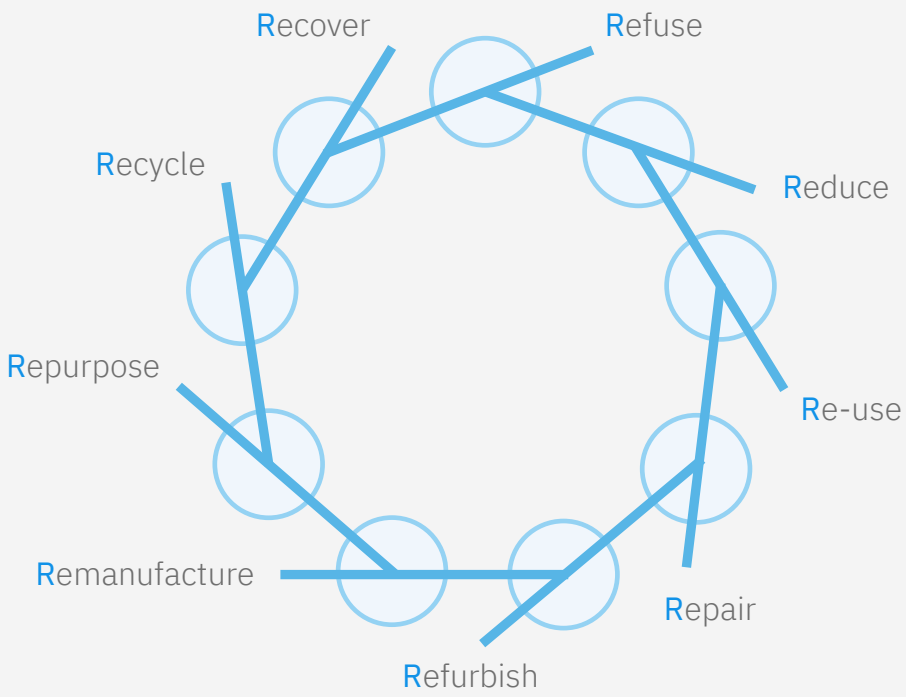
The circular economy can help CSCOs mitigate near-term cost concerns and emphasize long-term value to customers. To move toward circularity, organizations can infuse data from multiple sources—internal, public, scientific, marketplace—into business process redesign and decision-making. They can evaluate and redesign workflows with environmental impact in mind.

(See case study "European automotive company tackles distribution and transportation processes to reduce carbon footprint.") And they can use virtualization to help shrink environmental footprints and support the 9Rs of circularity, a concept that lives at the top of CSCOs' current sustainability agendas (see Figure 6).[7]

FIGURE 6

The 9Rs of circularity

Supply chains are moving to a circular business model to support sustainability



Source: van Buren, Nicole, Marjolein Demmers, Rob Van der Heijden, and Frank Witlox. "Towards a circular economy: The role of Dutch logistics industries and governments." Sustainability.

CSCOs identify several specific actions they plan to take over the next 3 years in pursuit of their circular economy goals. 47% are initiating full lifecycle design of their materials and products with the intent to expand re-use of materials and components to reduce waste in the product lifecycle. 44% also plan to improve energy-efficiency of their products and services. 35% plan to develop new products and services based on renewable energy componentry, and 30% expect to engineer new zero-waste products and services. Packaging goals include reducing first-use (virgin) plastic usage (32%) and increasing the use of recyclable or biodegradable materials and packaging (30%).

Case study

European automotive company tackles distribution and transportation processes to reduce carbon footprint

Every touch and movement of a product (parts or automobile) increases the potential for carbon amplification.

Challenge
This global automotive company sought process improvements across their extensive network of distribution and transportation providers and associated complex processes.

Solution
The team performed a root-cause analysis of material transfers, returns, and production line process inefficiencies. Then they applied ABC analysis to identify workload, share of beneficial stored materials, and distance traveled across their warehouse and transportation network.

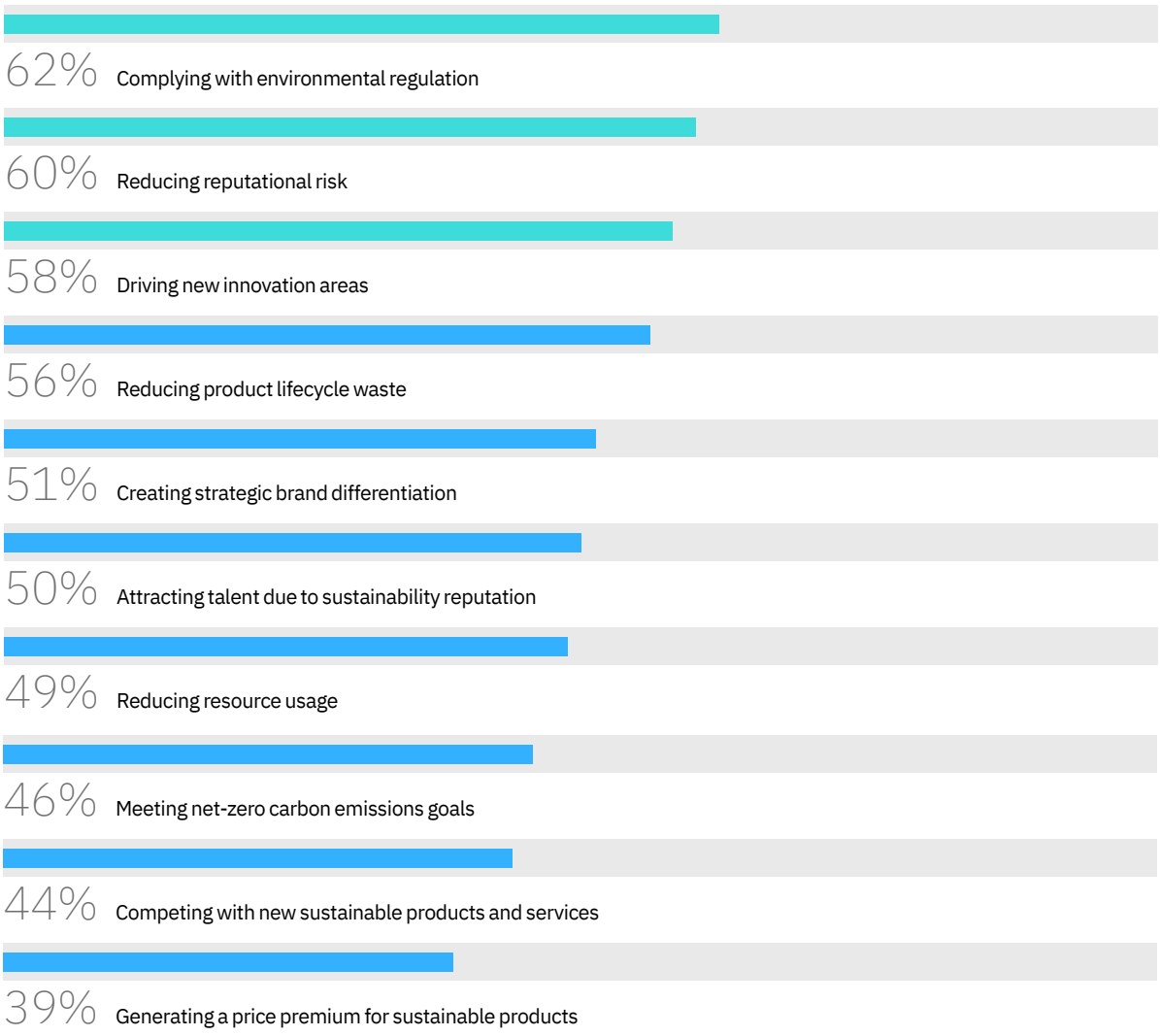
Outcomes
These simulations, with their associated transparent dashboards and metrics, helped the company reduce available distribution routes by 601 km per year, cut more than 13 hours of administrative workload for urgent materials orders, optimize production line supply, establish demand-based delivery, and reduce returns-associated logistics across all locations, accelerating carbon-reducing operations.

Circular economy activities can yield significant advantages, such as improving the security of the raw materials supply, stimulating innovation, boosting economic growth, and creating jobs. Accordingly, CSCOs cite a long list of more specific benefits obtained from their initiatives (see Figure 7). Additionally, 55% of CSCOs tell us that in the next 3 years they expect to incorporate real-time monitoring and reporting on environmental and social sustainability.

FIGURE 7

Sustainability success

CSCOs report benefits from their sustainability initiatives



Meeting supply chain ESG goals

Sustainability should not stop at addressing environmental or climate impacts, and too few supply chain leaders have operationalized a full set of ESG initiatives and measurements. A sustainable supply chain encompasses environmental, social, and economic management (see Figure 8).

Recent years have taught us that existential threats are real; that industries can come together across the global economy to address a problem; and that the well-being of employees and customers is as important to organizations as the condition of the planet.

Accordingly, ESG efforts must address environmental challenges including greenhouse gas reduction/carbon neutrality, water management, air pollution, ocean health, biodiversity, and energy management. But they should also encompass employee wellness, diverse and equitable workplaces, and ethical supplier relationships. From a business perspective, organizations can differentiate themselves by turning environmental and social challenges into marketplace opportunities that benefit both society and the individual enterprise. Such integrated enterprise sustainability practices can build lasting brand value and a competitive edge.

FIGURE 8

Building a sustainable supply chain

Integrated technologies help support ESG objectives

The virtual community: Customers, employees, ecosystem partners

Environment: Open innovation can help solve some of the planet's most daunting challenges

Social: The extended virtual community supports agility, diversity, and inclusion

Governance: Many environmental and social challenges cut across industry sectors requiring new forms of governance

Virtualization and new ways of working

Environment: Remote working can support decarbonization by reducing office space and commuting

Social: AI-powered workflows leverage continuous learning and new skill enhancements

Governance: Agile and virtual operating models can uncover new opportunities for stakeholder engagement

New business platforms and ecosystems

Environment: Platform visibility and transparency enhance ecosystem collaboration

Social: New insights to working conditions and sourcing behaviors support cooperation on resolutions

Governance: Platforms provide opportunities to promote ethical standards

Hybrid cloud and exponential technologies

Environment: Analytics for operational predictability can reduce waste and reinforce the circular economy agenda

Social: Digital twins model the physical to simulate sustainable practices in infrastructure and impact decisions

Governance: Stakeholder entrepreneurship can provide a holistic lens of people, planet, purpose, and profit impact

Human-technology partnerships

Environment: Circularity requires partnerships and technology-enabled platforms

Social: New team models and technology create purpose-driven relationships from the home to the community

Governance: Ethics and governance issues arise as technology weaves into our lives

Intelligent workflows and transparency

Environment: Intelligent workflows can monitor and provide insights into energy, water, and waste management

Social: Customers and employees make purchase and work choices based on trust in the organization's values

Governance: Increased visibility and transparency can transform the way economies operate and govern

Source: IBM Institute for Business Value analysis.

"We must humanize the sustainability emergency. This is a call to action—the relationship surrounding equity for all. We are experiencing 'carbon tunnel vision.' So many executives are only talking about net-zero transitions. There are other critical risks that are larger, including: biodiversity loss, water scarcity, air pollution, ocean health, and overconsumption. Sustainability is the next systemic impact on the entire system—and supply chains are front and center to build a better planet for us all."

Chief Sustainability Officer
Consumer Products company

Perspective

Celonis: Toward sustainable business execution across the value chain

Process inefficiencies don't just cost businesses productivity, they have catastrophic consequences for the environment as well. For example, 61 million containers—almost 25% of all shipping containers—are shipped empty every single year, costing tens of billions of dollars and emitting approximately 122 million tons of carbon dioxide.[8] So, eliminating inefficiencies not only drives business process improvements, but it supports sustainability initiatives as well.

The Celonis Execution Management System (EMS) reveals and fixes hidden inefficiencies at speed. By connecting the data across systems, apps, and desktops, it gives a 360-degree view of business execution, revealing the hidden inefficiencies across systems and processes.

The EMS acts as a brain, coordinating across all the moving parts of an organization's people, processes, and technologies. It empowers teams to operate at their highest level of efficiency and effectiveness, reaching a new level of performance. In effect, the EMS does not directly replace any existing systems or technologies but acts as an intelligent orchestrator for execution, uniquely providing what's required to optimize process execution and achieve desired business outcomes.

In terms of sustainability, the EMS breaks down silos and embeds sustainability in every process. Business processes are one of the most horizontal and ubiquitous concepts in the world. By embedding a data-based sustainability view in every single process, Celonis empowers global sustainable transformation and operationalizes sustainability strategies toward action. Here are the 3 components that power how it works:

- *Real-time data*: Integrates data across transactional and analytical systems in real-time at scale, including ESG data (for example, carbon emissions).
- *Process intelligence*: Applies technologies like process mining and machine learning to visualize what's really happening in processes to surface the digital truth, revealing inefficiencies and root causes of negative ESG impact.
- *Targeted action*: Finally, and within the same platform, based on those recommendations, the EMS can trigger actions to fix the inefficiencies and orchestrate systems. Some of these actions may simply be to alert some of the process stakeholders that an undesired event is taking place, to write back and change a value in the underlying systems, or trigger a manual or automated logic to do so.

Celonis can develop specific sustainability EMS assets and partner with sustainability leaders to help organizations eliminate process inefficiencies, so they can ultimately reduce carbon emissions, increase transparency, and meet sustainability goals.

Action guide

How CSCOs can deliver on expectations

We anticipate that great supply chains will be recognized for their resilience and agility as they adapt and overcome whatever forces and shock they face. Future leaders will use data-fueled automation to power proactive operations and improved risk management in both uncertain and stable times. Their intelligent workflows can help them deliver on sustainability by reducing the carbon footprint wherever possible, preserving the planet and its natural resources, and building resilient communities. And their employees, freed from rote tasks, can embrace more challenging roles focused on exceptional customer experiences.

The massive explosion of data sources and micro-insights born from extreme digitalization makes it possible to solve complex problems across the end-to-end supply chain with data feeding the AI that fuels intelligent, automated workflows. And it's important to remember that the value of that data depends on the transparency, trust, and security of its sources. CSCOs must consider a robust data management system in a hybrid cloud model, combined with process mining and execution management, as they build AI-enabled platforms with shared visibility across their ecosystems.

CSCOs can take the steps outlined here to develop and operate data-informed, optimized, sustainable supply chains.

01

Explore new business models that amplify resiliency

Experiment beyond traditional modeling methodologies:

- Rely on testing of hypotheses, simulation, and other scientific method tools that are core to discovery.
- Encourage collaboration and sharing of new ideas within the organization, with partner networks, and through extended ecosystems.
- Reimagine where, how, and what your organization can achieve with a data-led strategy.

Focus on both predictive and proactive approaches to better anticipate the likely scenarios and prepare for unpredictable ones:

- Deploy AI and machine learning to allow better pattern recognition, workflow optimization, and solution gathering.
- Combine predictive and prescriptive analysis for better decision-making.
- Engage with quantum computing tools and methods to experience expanded predictive capabilities.

Implement technology-infused workflows to enable real-time insights, automated decision-making, and reduced risk profiles:

- Rely on an open, secure, hybrid cloud model to smooth and speed extended intelligent workflows.
- Leverage process mining and execution management to reveal and fix inefficiencies, enabling automated solutions and central workflow management.
- Enhance cybersecurity capabilities as you engage ecosystem partners to both protect and encourage collaboration, co-creation, and data sharing.

02

Invest consistently in the near- and long-term potential of automation

Develop robust AI and automation capabilities to speed insights and decision-making across ecosystem intelligent workflows:

- Configure workflows by assembling data in varied computing environments, supporting AI and extreme automation.
- Connect devices and assets with intelligence to provide data for process mining so you can understand the current state, learn from it, and act accordingly.
- Prioritize technologies with the highest compounding value to drive business results while considering whether you have the right technologies in place to deliver and scale.

Extend end-to-end connectivity among contributing supply chain players:

- Build out and optimize intelligent workflows infused with data and enabled by exponential technologies to capitalize on the business potential of digital acceleration.
- Invest in programs that drive internal and external sharing, partnering, and openness.
- Leverage co-creation, co-execution, and cooperation to accelerate idea development and value capture.

Integrate segmentation principles into supply chain modeling parameters and build the rules into algorithms:

- Explore digital dashboard approaches, cloud management platforms, and cloud-based process mining solutions.
- Modernize your data management infrastructure with a data fabric that connects data from across a hybrid multicloud IT environment, making it consumable by digital products and available in the right location for the right application at the right time.
- Leverage open architectures that multiply the benefits of data sharing.

03

Make sustainability one of your most important business priorities

Operationalize a full set of ESG initiatives and mine data from across your supply chain processes to capture sustainability metrics and performance:

- Engage with ecosystem partners from within and outside your industry to accelerate improvements to workflows and the development of more sustainable products and services.
- Establish sustainability ESG benchmarks, measurement/monitoring tools, and reporting dashboards.
- Commit to open innovation in pursuit of more sustainable outcomes and practices.

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.

About
the authors

Sheri Hinish

Sustainability Services Lead, Enterprise Sustainability Offering Workflow Leader, IBM
Sheri.Hinish@ibm.com
linkedin.com/in/supplychainqueen

Sheri's goal is simply to make a meaningful impact for the clients, colleagues, partners, and communities she serves. She helps customers design and build supply chains of the future that empower the human experience, strategically champion stewardship, and create change that is impactful, equitable, responsible, and profitable. Sheri is recognized as the 2021 Top Supply Chain Leader by Supply Chain Digital; a 2022, 2021, 2020, and 2019 Supply & Demand Chain Executive Pro to Know; the People's Choice 2020 Global Woman in Supply Chain Leader; a Corporate Vision Excellence award recipient for the 2020 Most Influential Leader in Supply Chain & Technology; and a trusted partner for insights in supply chain, retail, manufacturing, sustainability, and the sustainability development goals (SDGs).

Lars Reinkemeyer

Vice President, Customer Transformation
Celonis
l.reinkemeyer@celonis.com
de.linkedin.com/in/lars-reinkemeyer-b35745

Lars helps customers drive their digital transformation initiatives forward with the Celonis Execution Management System and core process mining technology. Before joining Celonis, Lars held multiple senior executive roles at Siemens where he expanded the company's own Celonis implementation. He is the author of *Process Mining in Action: Principles, Use Cases and Outlook*.

Karen Butner

Karen Butner
Global Research Lead
IBM Institute for Business Value
kbutner@us.ibm.com
linkedin.com/in/karenvbutner

As the IBM Institute for Business Value Global Research Leader for Virtual Enterprise, Sustainable Supply Chains, and Intelligent Workflow Automation, Karen is responsible for market insights, industry trends, and thought leadership development and deployment. She is frequently invited to speak at international conferences and is widely quoted in leading business and industry publications. Her passion is to bring insights to clients in the development of their strategies and improvement agendas along their digital transformation journey.

Janina Nakladal

Global Director of Sustainability
Celonis
j.nakladal@celonis.com
linkedin.com/in/janina-nakladal

After building up the Celonis Academic Alliance team to democratize process mining education and partner with global educational institutions, Janina took over the global sustainability program. In her role, she steers sustainable product and use case development as well as co-innovation projects with customers and partners to operationalize sustainability in every business process along the supply chain using the Celonis Execution Management System. This covers work in sustainable procurement, decarbonization, waste reduction, or overall ESG performance. She also oversees ESG reporting, drives the Celonis net-zero journey, supports diversity and employee engagement initiatives, and organizes the Celonis Aspire program for an integrated and holistic ESG strategy.

Anthony Marshall

Senior Research Director
IBM Institute for Business Value
anthony2@us.ibm.com
linkedin.com/in/anthonyejmarshall

As the Senior Research Director of thought leadership at the IBM Institute for Business Value, Anthony leads the company's top-rated thought leadership and analysis program. He heads a global team of 60 technology and industry experts, statisticians, economists, and analysts. Anthony also is personally active in conducting original thought leadership in areas including innovation, digital transformation, artificial intelligence, and cloud strategy.

About Research Insights

Research Insights are fact-based strategic insights for business executives on critical public and private sector issues. They are based on findings from analysis of our own primary research studies. For more information, contact the IBM Institute for Business Value at iibv@us.ibm.com.

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.

Study approach and methodology

In the first quarter of 2022, the IBM Institute for Business Value, in collaboration with Celonis and Oxford Economics, surveyed 500 Chief Supply Chain Officers across industries to gain an in-depth understanding of how recent disruptions in global supply chains are affecting their short-term tactics, longer-term strategies, and performance. We also researched the technologies they are deploying as part of their digital supply chain transformation to prepare for more resilient and agile global operations and to meet sustainability demands.

10 industries are represented: banking, consumer products, healthcare, electronics, telecommunications, insurance, industrial products, manufacturing, automotive, and life sciences, each comprising 5%-15% of our total sample. The size of organizations surveyed, in terms of revenue, ranges from $500 million to $500 billion.

Our approach to this study has also drawn on data from multiple recent surveys covering different aspects of technology use and its relationship to business priorities and performance.

Data findings are based on classification analysis, maximum difference scaling (MaxDiff) analysis—a form of choice modeling—as well as financial analyses based on average revenue growth for the last 2 fiscal years. All data is self-reported.

Related reports

The magic of extended intelligent workflows

"The Virtual Enterprise: The magic of extended intelligent workflows." IBM Institute for Business Value. September 2021. https://ibm.co/virtual-enterprise-intelligent-workflows

The urgency of sustainability and impact

"The Virtual Enterprise: The Urgency of Sustainability and Impact." IBM Institute for Business Value. November 2021. https://ibm.co/virtual-enterprise-sustainability

The 2021 CIO Study

"The 2021 CIO study: The CIO revolution." IBM Institute for Business Value. November 2021. https://ibm.co/c-suite-study-cio

Notes and sources

1 "The Hot Supply Chain Management Job Market: How to Take Advantage." Supply Chain Careers. https://supplychaincareers.com/supply-chain-management-job-market/#

2 "The Virtual Enterprise: The Urgency of Sustainability and Impact." IBM Institute for Business Value. November 2021. https://ibm.co/virtual-enterprise-sustainability

3 Balta, Wayne, Manish Chawla, Jacob Karl Dencik, and Spencer Lin. "Sustainability as a transformation catalyst: Trailblazers turn aspiration into action." IBM Institute for Business Value. January 2022. Previously unpublished data. https://ibm.co/sustainability-transformation

4 Based on IBV analysis.

5 Balta, Wayne, Manish Chawla, Jacob Karl Dencik, and Spencer Lin. "Sustainability as a transformation catalyst: Trailblazers turn aspiration into action." IBM Institute for Business Value. January 2022. Previously unpublished data. https://ibm.co/sustainability-transformation

6 "The 2021 CIO Study. The CIO Revolution: Breaking barriers, creating value." IBM Institute for Business Value. November 2021. https://ibm.co/c-suite-study-cio

7 van Buren, Nicole, Marjolein Demmers, Rob Van der Heijden, and Frank Witlox. "Towards a circular economy: The role of Dutch logistics industries and governments." Sustainability. 2016. https://www.mdpi.com/2071-1050/8/7/647/htm

8 "The Empty Space Economy." Forbes Insights in association with DS Smith. https://www.euractiv.com/wp-content/uploads/sites/2/2018/11/DSSmith_REPORT-FINAL-PRINT_EN_V03.pdf

© Copyright IBM Corporation 2022

IBM Corporation
New Orchard Road
Armonk, NY 10504

Produced in the United States of America | April 2022

IBM, the IBM logo, and ibm.com are trademarks of International Business Machines Corp., registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the web at “Copyright and trademark information” at: ibm.com/legal/copytrade.shtml.

This document is current as of the initial date of publication and may be changed by IBM at any time. Not all offerings are available in every country in which IBM operates.

THE INFORMATION IN THIS DOCUMENT IS PROVIDED “AS IS” WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, INCLUDING WITHOUT ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND ANY WARRANTY OR CONDITION OF NON-INFRINGEMENT. IBM products are warranted according to the terms and conditions of the agreements under which they are provided.

This report is intended for general guidance only. It is not intended to be a substitute for detailed research or the exercise of professional judgment. IBM shall not be responsible for any loss whatsoever sustained by any organization or person who relies on this publication.

The data used in this report may be derived from third-party sources and IBM does not independently verify, validate or audit such data. The results from the use of such data are provided on an “as is” basis and IBM makes no representations or warranties, express or implied.

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.

QJZQEZ6P-USEN-02

IBM