IBM **Institute for Business Value**

C-suite Series: The 2021 CIO Study

The CIO Revolution

Breaking barriers, creating value

IBM

The IBM Institute for Business Value (IBV) surveyed 5,000 C-suite technology leaders, including both Chief Information Officers (CIOs) and Chief Technology Officers (CTOs). A select group of executives were contacted for in-depth qualitative interviews, revealing insights about their on-the-ground experiences leading technology organizations throughout a period of exceptional disruption.

With respondents spanning 29 industries and 45 locations worldwide, this study is our most exhaustive examination of this critical cohort in more than 19 years of IBV research. For more details, see "Research methodology" on page 41.

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Introduction

*From digital to
virtual, overnight*

"The idea that the business leads technology strategy is now obsolete. Business strategy is developed in partnership with our technology strategy—as we share a common goal of putting clients first and making it easier to do business with us digitally."

Laura Money, CIO, Sun Life Financial

The pressure on technology leaders has never been more intense. Technology was already at the center of modern society, but in 2020, the pandemic thrust digital capabilities into the forefront. COVID-19 accelerated the adoption of new tools and practices in ways previously unanticipated but now accepted as the norm.

For many individuals, organizations, and communities, technology was more than a solution. It was the lifeline by which they sustained themselves.

Rapid adaptation has continued to accelerate during 2021. A "Virtual Enterprise" model is emerging, fueled by a new "post-digital" approach to business opportunity.[1] This model is based on the speed and scale of cloud technologies—notably the flexibility and interoperability of hybrid cloud, and the rapid results generated by combining artificial intelligence (AI) and automation. Together, these technologies create synergies and unlock new value streams that are orders of magnitude greater than what each can enable individually.[2]

As organizations pursue radical agility,[3] technology executives and the organizations they lead have taken center stage. "The idea that the business leads technology strategy is now obsolete," observes Laura Money, CIO at Sun Life Financial. "Business strategy is developed in partnership with our technology strategy—as we share a common goal of putting clients first and making it easier to do business with us digitally."

Steve McCrystal, Chief Enterprise and Technology Officer at Unilever, expresses similar sentiments: "If a CIO talks about the business as if it's something external to them, I think there's a big problem. You are the business and the idea that you're not is problem number one."

This 2021 IBM CIO Study explores how—even in the midst of uncertainty—CIOs are driving transformation and business value at an astonishing pace. Back in 2011, only 1 in 5 CIOs ranked themselves as a critical enabler of business/organization vision.[4] Now, they're collaborating with colleagues to meet fast-changing demands and driving value throughout their enterprises and beyond. At a high level, this report reveals:

Chapter 1
Unprecedented change, unprecedented opportunity
How technology leaders have emerged as strategy leaders by driving technology-fueled change, even as CIO and CTO roles evolve and sometimes overlap

Chapter 2
Collaboration at the crossroads
The relationship between technology leadership and business outcomes, specifically how collaboration is essential to driving value from an expanding and diversifying technology portfolio

Chapter 3
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3 discrete CIO mandates, defined by the roles they play in their organizations and what drives success for each one

Action guide
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Chapter 1

Unprecedented change, unprecedented opportunity

While the events of the past 2 years defy easy explanation, the undercurrents of change have long been in the making. Online business platforms and virtual operating models are the future of work. Technology leaders are at this critical crossroads, learning from firsthand experience.

Technology adoption has been accelerating and becoming an inextricable part of every organization and business function. Correspondingly, the *technology function* has grown dramatically in scope and complexity. The role of technology leaders has expanded not just in breadth, but increasingly in strategic influence.

When we recently asked 3,000 CEOs to identify the C-suite executives most critical to their organizational success, CIOs and CTOs jointly ranked in the top three. Among CEOs at top-performing organizations, technology leaders were second only to CFOs.[5]

This prominence brings challenges. Today's technology portfolio is a dynamic mix of centralized, decentralized, and federated services. CIOs at large enterprises now manage hundreds, if not thousands, of applications spanning dozens of functions, often at global scale. And while CIOs continue to deliver the core IT services that power the day-to-day operations of the business, they are also expected to drive innovation that paves the way to a successful future (see Figure 1). Many technology leaders not only embrace this increasingly diverse set of responsibilities, but they also do so under longstanding talent and budget constraints.

The pandemic continues to underscore that the CIO role is more crucial than ever. Whatever the future holds, the ability to adapt to the unknown and transform risks into opportunities will be indispensable.

Technology leaders are champions for a new identity in which the technology function is core to every interaction and every business process. Platforms and ecosystems are transforming virtually all businesses into technology businesses, providing access to adjacent markets and integration across the value chain.

Emerging technologies—from advanced analytics to hybrid cloud-enabled microservices to AI-fueled automation—are driving both supply and demand. Built upon a common data, integration, and orchestration layer, the combination of these technologies can yield exponential gains.[6]

Several CIOs likened their role to that of a "Chief Operating Officer of technology," aligning to business goals and business outcomes. "IT is involved in every functional unit," explains John Gibbs, CIO at International Airlines Group (parent company to British Airways). "The role of the CIO is becoming less of a tech leader and more of a business leader. It's how you apply the technology that makes a difference."
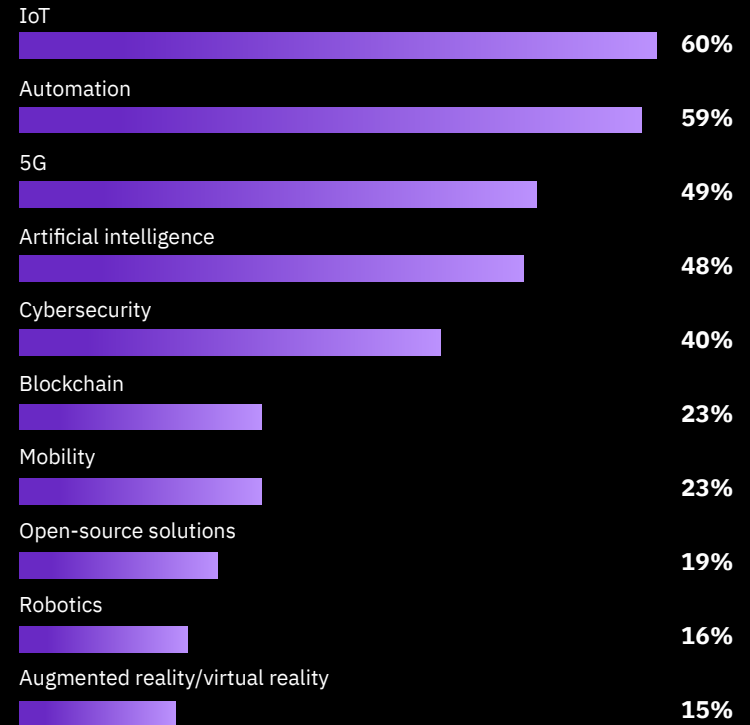
Because IT teams work across the organization, CIOs have a unique opportunity to share best practices across functions. "The CIO role is becoming more horizontal," says Steve McCrystal at Unilever. "We try to eliminate siloes and align to business outcomes."

As Rong Xian, General Manager of the Technology & Information Department at China Tourism Group, puts it, "Connecting the dots across business functions to balance and rearrange technology resources and capabilities drives a more agile, more effective business and operation."

Figure 1

Investing beyond the cloud

IoT, automation, 5G, and AI rank highest as planned technology investments, in addition to cloud

IoT
60%

Automation
59%

5G
49%

Artificial intelligence
48%

Cybersecurity
40%

Blockchain
23%

Mobility
23%

Open-source solutions
19%

Robotics
16%

Augmented reality/virtual reality
15%

Q. In which of the above technologies do you expect to invest the most over the next 3 years?

Leading the charge for change

During a period of widespread anxiety and workplace disruption, technology leaders have been central to addressing their organizations' most pressing needs. Citing examples from tackling supply chain issues to helping ensure business continuity to enabling remote work, 77% of the CIOs in our study report that their teams played a vital role in their organizations' response to the pandemic (see Figure 2).

Furthermore, according to IBV research, the pandemic has prompted 55% of organizations to permanently course-correct their strategies.[7] This includes accelerating the pace of digital transformation, adjusting the approach to change management, and shifting to more cloud-based business activities. Curiously, only 23% of CIOs in our study expect pandemic-related shifts to remote workplaces to become permanent.

Given these workplace changes from the pandemic, organizations that innovate and iterate deftly can gain decisive advantage. "We need to constantly reinvent ourselves to stay relevant," says Avinash Raghavendra, EVP and Head of IT of India's Axis Bank. "It is important to be successful, but failure is a part of the learning process. So, in case of failure, it is imperative to fail fast and learn quickly."

Figure 2

How the pandemic primed change

CIO teams became an indispensable part of the COVID-19 response

Unexpected pandemic-related staff absences created significant issues

83%

My team played a vital role in driving my organization's response to the pandemic

77%

Acute availability and/or capacity issues affected our business continuity

71%

Supply chain issues disrupted our business operations

70%

The pandemic has negatively impacted my organization

67%

A significant percentage of our workforce transitioned to remote work because of the pandemic

63%

Our remote workplace changes from the pandemic will become permanent

23%

Q. How has your organization changed as a result of the pandemic?

"Connecting the dots across business functions to balance and rearrange technology resources and capabilities drives a more agile, more effective business and operation."

Rong Xian, General Manager, Technology & Information Department, China Tourism Group
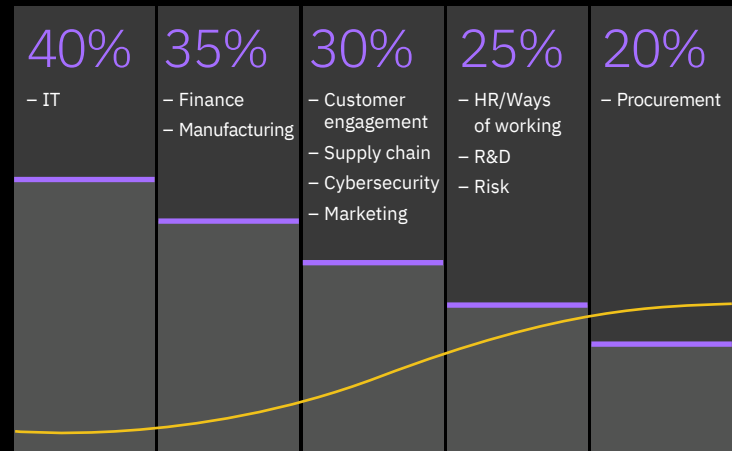
Case in point: CIOs report that 20% to 40% of organizational business processes have been automated—from supply chain to manufacturing, finance to procurement, and marketing to R&D. This automation helps drive intelligent workflows, which in turn create a "golden thread" of value, enhancing connections both within the enterprise and across its ecosystem (see Figure 3).

Figure 3

Destination automation

Automation represents an untapped source of value in the enterprise technology portfolio

The extent of automation within the enterprise

40%	35%	30%	25%	20%
– IT	– Finance – Manufacturing	– Customer engagement – Supply chain – Cybersecurity – Marketing	– HR/Ways of working – R&D – Risk	– Procurement

Automation helps drive intelligent workflows, which in turn create a "golden thread" of value.

Q. What percentage of your business processes have been automated?

And the technology evolution continues to accelerate (see case study "Airtel" on page 9). Respondents say that cloud, in all its implementations, represents an increasing portion of current IT workloads. This reflects the swift and growing embrace—and effectiveness—of cloud-native platforms, in particular, their proficiency for connecting and activating data to enhance engagement and collaboration. Perhaps most tellingly,
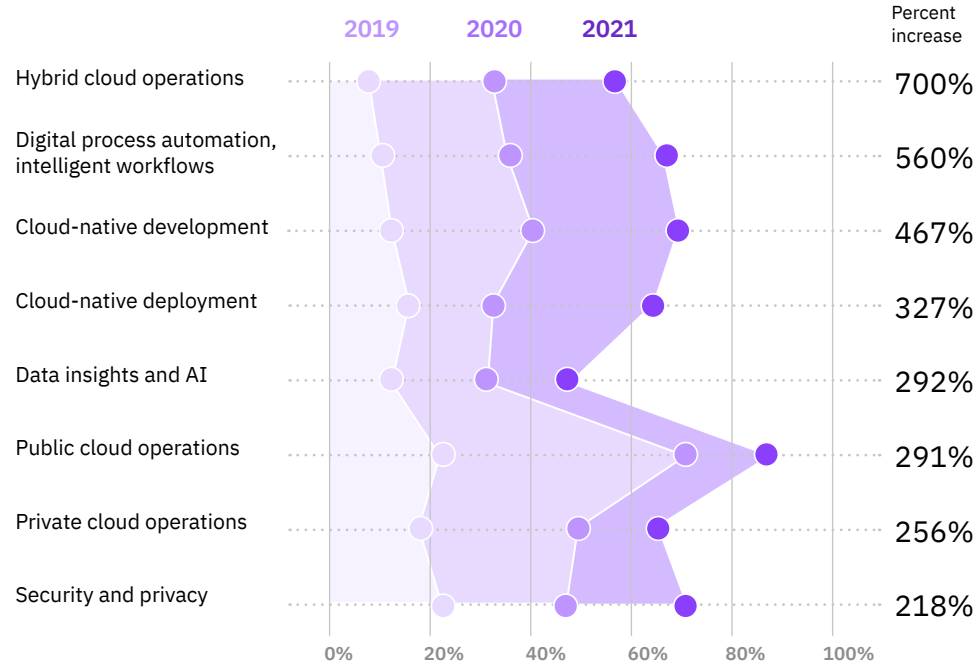
when asked to reflect on their organizations' transformations, a dramatically increased number of CIOs report higher levels of maturity in their hybrid cloud operations (a 700% increase in CIOs reporting advanced capabilities since 2019), AI-enabled workflows (a 560% increase since 2019), cloud-native development (a 467% increase since 2019), and other key technologies (see Figure 4).

Figure 4

Technology tidal wave

The pandemic catalyzed a dramatic increase in the number of organizations adopting key technologies

Q. Assess your organization's transformation journey in these areas (% reporting advanced capabilities at maturity stages 4 and 5).

	2019	2020	2021	Percent increase
Hybrid cloud operations				700%
Digital process automation, intelligent workflows				560%
Cloud-native development				467%
Cloud-native deployment				327%
Data insights and AI				292%
Public cloud operations				291%
Private cloud operations				256%
Security and privacy				218%

0% 20% 40% 60% 80% 100%

Case study

Airtel
Hybrid cloud, AI, and new telco services[8]

Airtel—one of India's largest integrated telcos—faces rapidly growing data consumption at a compound annual growth rate (CAGR) of over 70% by 2022. The company is turning to a modern hybrid cloud architecture to deliver more responsive networks that tap into automation and AI. This can help address growing customer needs and deploy new services at the right location and network tier.

Airtel's open hybrid cloud platform is expected to help enable new revenue streams with the onboarding of third-party services, including gaming, remote media production, and enterprise services. Airtel aims to improve the time-to-market of services

and reduce operating and capital expenses. The network cloud also could position ecosystem partners, including B2B and B2C application developers, to create value-added services, including new edge offerings.

Additionally, the network cloud is embedded with AI, designed to facilitate automation in onboarding and improve monitoring and predictive capabilities for different services from network equipment providers.

The rapid advancement in hybrid cloud maturity over the previous 2 years suggests leaders are changing how they think of cloud, shifting from capacity on demand to more sophisticated use cases based on integrating and orchestrating cloud services from multiple providers—a trend that is likely to accelerate as cloud technologies continue to mature.

Given the magnitude of these changes, it's clear organizations will not fully return to pre-pandemic ways of operating.[9] For those that integrate core technologies most effectively, there can be massive benefits. For example, IBV research has revealed that organizations strategically integrating cloud with open organizations, operational enablers, exponential technologies, and advanced data capabilities can potentially realize a 13-fold increase in revenue.[10] Such gains underscore the transformative power of a holistic hybrid cloud strategy.[11]

"It's working across the organization, but also working at different levels of the organization. One moment I can be interfacing with a line-level operator and the next moment I'm speaking with the CEO."

John Gibbs, CIO, International Airlines Group

CIOs as interconnectors

CIOs today manage a complex portfolio, spanning a diverse set of responsibilities and constituents. These include offering technology services to a wide spectrum of users, making data insights readily available, transforming work environments through productivity platforms, and extending workflows across business functions (see case study "Sixense" on page 12). Reflecting their increasingly strategic role, 52% of the CIOs in our study report engaging with their CEOs more than they do with any other C-suite leader (see Figure 5). This positions CIOs at a critical intersection in their organizations, with a direct connection to the most senior levels of leadership and a vantage view across business functions.

"I think Technology has the privilege of being able to see the company as a whole," says Luzia Sarno, CIO and CDO of Fleury Group. "I can't think of another area that has this holistic view and can see all the connections and opportunities inside and outside the company."

John Gibbs of International Airlines Group describes the CIO role as "diagonal," explaining, "It's working across the organization but also working at different levels of the organization. One moment I can be interfacing with a line-level operator and the next moment I'm speaking with the CEO."

Abhijit Shah of Nippon India Mutual Fund (who has a CTO title but also handles CIO responsibilities) adds, "The CIO is like a bridge, a connector across the business and technology ... Their value comes from knowing both the organization's business objectives and the technology landscape."

Sitting at this intersection presents challenges. The priority to "serve the moment," as former CIO of the London Metropolitan Police Angus McCallum describes his task, can become a monumental challenge. Amid multiple priorities from multiple constituencies, CIOs need to stay ahead of the curve, or else their role devolves into ongoing crisis management and firefighting. "CIOs are a connector across business functions," says CIO Robert Hobbelman of the Virginia Department of Behavioral Health and Developmental Services in the US. "The CIO role has evolved. We are not always providing the solution, but we are connecting the dots and creating value."

Successful CIOs focus on finding a way to accelerate change. And they do this while redefining their role from short-term crisis manager or specialized operations guru to more of a leader and advisor driving a synthesis of business and technology objectives.

"My ultimate goal for our organization," says Laura Money of Sun Life Financial, "is we'll get some great insight in the morning, by lunchtime we'll have a design, by the afternoon we'll have a working prototype, and by evening it will move into production. If you can do that in 24 hours instead of 2 weeks, that's a decisive, competitive, and client-focused advantage."

Figure 5

The collaborative suite spot

CIOs report engaging with their CEOs more than with any other C-suite leader
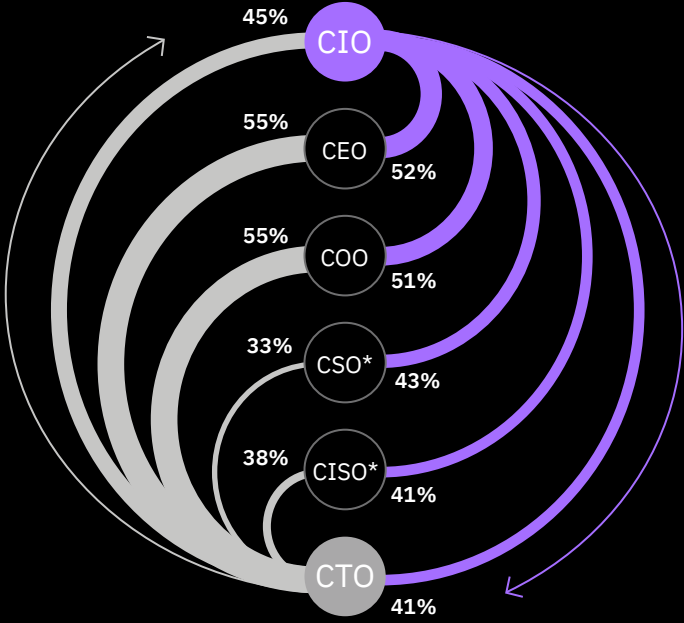
Q. In your organization, which C-suite roles do you interact with most?
*Chief Strategy Officer (CSO). Chief Information Security Officer (CISO)

Case study

Sixense

Mapping out the future with transformative technology[12]

As buildings move from design to construction to operations, valuable information gets lost at every stage. Sixense saw an opportunity to transform the building industry by creating Beyond: a digital platform that combines building information modeling (BIM), 3D mapping, and Internet of Things (IoT) technologies to provide new insights across project lifecycles.

Part of VINCI Group, the world's largest construction company, Sixense has global expertise in technical, digital, and scientific solutions for the construction, civil engineering, and infrastructure management markets.

For the Beyond platform, Sixense established the foundations of a new cloud architecture. Instead of requiring companies to rip-and-replace their existing systems, the platform acts as an integration layer, using APIs to flow data from legacy source systems into a new central cloud repository. Once the data is available, the platform can then empower users to interact with that data in entirely new ways. One example: combining mapping and 3D modeling data to create a virtual replica of each project site and enable stakeholders to gain a 360-degree view of progress.

The CIO-CTO alliance: Delivering value, together

The good news for CIOs facing these challenges: they are not alone. With the increasing prominence of the CTO role, CIOs have crucial allies within the technology function. And while organizations may have unique combinations of technology needs, at a high level, the technology function has a common set of responsibilities that are typically distributed between CIOs and CTOs (see Figure 6).
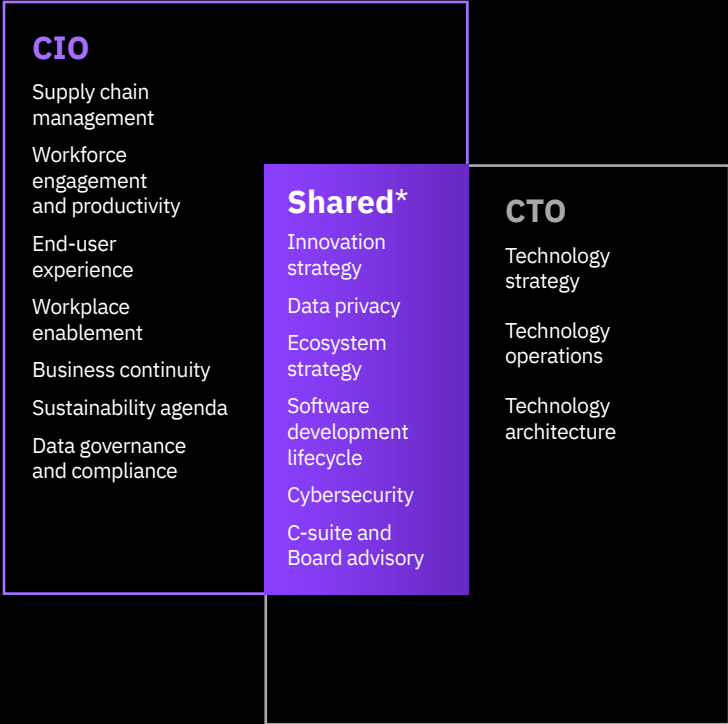
As noted, CIOs tend to own a broad set of responsibilities that bridge from the C-suite to the business units. More than 70% of technology leaders surveyed report that CIOs own back-office applications, including supply chain, workforce engagement, end-user experience, and workplace enablement. They also often own areas including business continuity, sustainability, and data governance and compliance.

In contrast, a significant majority of CTOs focus on technology strategy, operations, and architecture. Whereas CIO responsibilities varied greatly by industry and organization, responses from both CIOs and CTOs reveal that CTOs are typically vested with primary responsibility for the above 3 areas, regardless of industry or organization.

Figure 6

Finding common ground

How responsibilities are allocated across the technology function

CIO

Supply chain management

Workforce engagement and productivity

End-user experience

Workplace enablement

Business continuity

Sustainability agenda

Data governance and compliance

Shared*

Innovation strategy

Data privacy

Ecosystem strategy

Software development lifecycle

Cybersecurity

C-suite and Board advisory

CTO

Technology strategy

Technology operations

Technology architecture

Q. In your organization, who owns each of the above responsibilities?
Select one: 1) exclusive CTO ownership, 2) primarily CTO ownership,
3) primarily CIO ownership, 4) exclusive CIO ownership.
**Degree to which responsibilities are shared can vary by industry and organization.*

Steve McCrystal of Unilever emphasizes this big picture. "We get so good at creating these islands because we're trying to create accountability in the right way. But we lose sight of what the CTO and the CIO are actually there to do, which is to use technology to drive business value. That's something they have to work on together."

One might generally characterize CIOs as operating across the organization, often in a "diagonal" sense of interfacing at different levels of the organization. Their success depends on their proficiency in doing so. On the other hand, there is a general consensus that CTOs focus on a more defined set of responsibilities—anchored by technology strategy, operations, and architecture. Yet it is this focus that enables CTOs to address the most strategic opportunities and the most pressing challenges influencing their organizations' use of technology.

It would be a mistake, however, to assume any given organization is structured precisely this way. In fact, our analysis finds that allocation of responsibilities varies greatly based on industry, organizational structure, and reporting relationships. And while the responsibilities of CTOs tend to be more consistent across organizations than those of CIOs, both roles show meaningful variability. We delve into those further in Chapter 3 by way of exploring 3 distinct CIO mandates. Next, however, let's explore how these technology leaders are aligning to business objectives and delivering value for their organizations.

Chapter 1.

Three essential questions

How do you leverage technology to differentiate your organization?

What unique perspective do you bring to C-suite strategy discussions?

How could different parts of your organization be connected to drive even greater value?

Chapter 2

Collaboration at the crossroads

Technology adoption in and of itself doesn't deliver optimal value.[13] But when deployed strategically, effectively, and often in tandem, technologies such as hybrid cloud, AI, and automation can enable modern enterprises to transform massive change into substantial benefits. How to best lead the technology function and drive success? The executives we spoke with consistently returned to a specific theme—collaboration. For example:

"Strong integration capabilities are paramount for sustaining in the ever-evolving digital landscape," says CTO Abhijit Shah of Nippon India Mutual Fund. "The ones who can fuse their services with partners seamlessly can get the business value at a much faster pace."

"We try to foster a community of technology leaders," says Melanie Kolp, Senior Vice President and Chief Technology Officer at Nationwide Insurance. "We want to emphasize the sharing of best practices."

"What are our common interests and common values?" says Rong Xian of China Tourism Group. "We should believe in others and do good for others."

Curiously, despite this stated emphasis on teamwork, our research reveals that CIOs and CTOs are often working independently, and sometimes at cross-purposes. Only 45% of CTOs indicate frequent interaction with their CIO counterparts. And it works both ways: just 41% of CIOs highlight frequent interaction with CTO peers.

So, why aren't CIOs and CTOs sitting together at lunch? Bart Murphy, Chief Technology and Information Officer for global nonprofit OCLC, offers some insight. "The CTO role was born out of the idea that the CIOs can't innovate," he says. "I'm not in favor of separating the 'build' function from the 'run' function. These things inform each other."

Arun Aggarwal, SVP, Business Technology for Finland-based energy company Fortum, recognizes the need to align both intent and incentives, explaining: "In collaborating with other tech leaders, there needs to be absolute clarity of purpose. That means a clarity of mission and no duplication across functions. You have to be aligned on financial and operational incentives."

Considering an even broader perspective, Yorimasa Tanaka, Executive Officer (Responsible for Digital Function), Yamato Transport Co., Ltd., defines a common purpose that just may unite technology leaders after all. "The IT division plays an essential role in promoting digital transformation because of its ability to see the whole company comprehensively, from a systematic perspective," he notes. "It is not a requirement for CIOs to have an IT background. It doesn't matter if they have programming skills. The most important thing is to be able to promote the transformation of business according to the digitally changing business environment."

"The IT division plays an essential role in promoting digital transformation because of its ability to see the whole company comprehensively, from a systematic perspective. It is not a requirement for CIOs to have an IT background. It doesn't matter if they have programming skills. The most important thing is to be able to promote the transformation of business according to the digitally changing business environment."

Yorimasa Tanaka, Executive Officer (Responsible for Digital Function), Yamato Transport Co., Ltd.

Driving business value through technology maturity, effectiveness, and ROI

The measure of high performance is when technology investments consistently enhance operational capabilities and drive business outcomes. As Lawrence Fong Yat-cheung, Director of Digital & Information Technology for Cathay Pacific Airways, puts it, "The CIO should be able to get a holistic business and technology view across the organization—in terms of capabilities, maturity, efficiency, limitations, and constraints."

To dive deeper into the ways technology leaders are delivering business value, we assessed the organizations in our study on 3 measures of their technology function:

Technology maturity—the stage of their cloud, AI, automation, and security journeys

Technology effectiveness—their agility, data management, governance, and resilience

Technology ROI—the return on their technology investments, normalized by industry.

Our analysis indicates that organizations reporting higher technology maturity, effectiveness, and ROI achieved better business performance. In particular, we discovered financial gains accelerated during the pandemic—organizations with higher technology measures built a substantial advantage over their peers (see Figure 7).

Figure 7

High performers pull away

Organizations with stronger tech measures report a financial performance premium relative to peers with lower tech measures

Tech maturity
Assessed by the stage of their cloud, AI, automation, and security journeys

Tech effectiveness
Assessed by their agility, data management, governance, and resilience

Tech ROI
Assessed by the return on their technology investments, normalized by industry
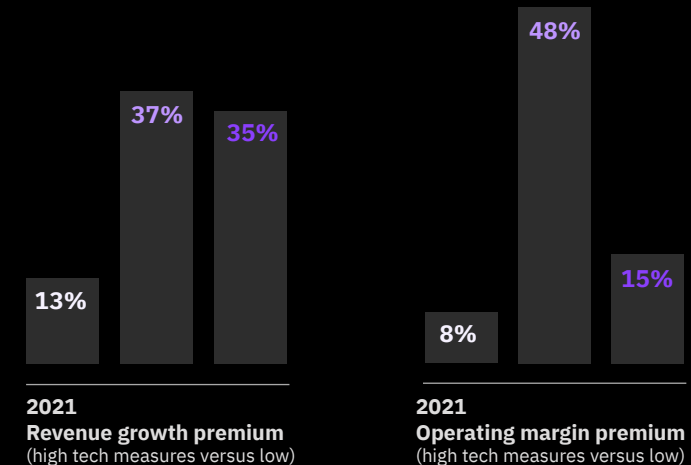

13% 37% 35%

2021
Revenue growth premium
(high tech measures versus low)

8% 48% 15%

2021
Operating margin premium
(high tech measures versus low)

Figure 8

Collaboration counts

Organizations see dramatic operating margin improvement from strong CIO–CTO collaboration

Operating margin improvement with strong CIO-CTO collaboration

+20%
For organizations with higher than average return on their technology investments

+36%
For organizations with greater agility and effectiveness in their data management, governance, and resilience

+26%
For organizations with greater maturity in cloud, AI, automation, and security
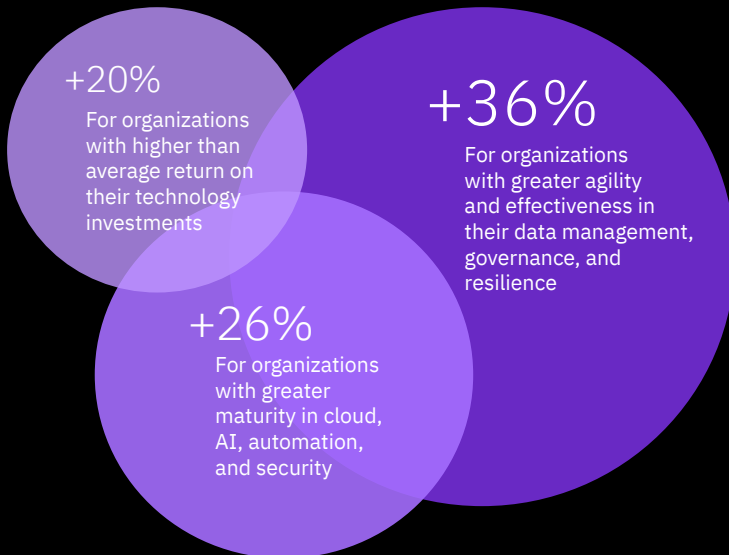
We also found that organizations enjoyed additional financial gains based on the strength of collaboration between CIOs and CTOs. Organizations in which the CIO and CTO both work together and define each other as strategically critical had operating margins 32% higher than those organizations where technology leaders are not as closely aligned.

Our analysis revealed:
– Organizations with high tech measures and strong CIO-CTO collaboration showed substantial operating margin improvements versus those with high tech measures alone (see Figure 8).

In terms of revenue growth, we discovered the effects of collaboration are somewhat more muted:
– Organizations with high tech maturity and effectiveness and strong collaboration between CIOs and CTOs saw revenue growth gains of 6% and 2%, respectively.
– When comparing surveyed organizations with high technology measures and strong CIO-CTO collaboration to those with low technology measures and low collaboration, we found revenue growth improvements across the board averaging 27%.

Finally, our analysis suggests that technology and collaboration reinforce each other in ways that magnify the impact of each.
– Organizations with strong collaboration and high technology measures reported operating margin improvements averaging 39% over organizations with low levels of collaboration and low technology measures.

Thus, the combination of an advanced technology function plus strong CIO-CTO collaboration had a net compounding effect on financial performance, as measured by revenue growth and operating margin.

Synergy for success: A tapestry of 6 value drivers

Success is based on an organization's ability to drive business value and capabilities throughout the enterprise in a strategic, structured, efficient manner. As business and technology operations converge, technology leaders need to think differently to align their business, operations, and technology strategies.[14]

"It's easy to design a dashboard based on 'piece parts' that show all green measures," observes Unilever's Steve McCrystal. "It's hard to break down siloes to enable a specific stakeholder outcome. The CIO has the ability to see across the organization, to create a tapestry out of that patchwork."

To best conceptualize this broad approach, consider driving value across 6 value drivers (see Figure 9).

Figure 9

Core convergence

Integration and collaboration enhance the power of 6 value drivers
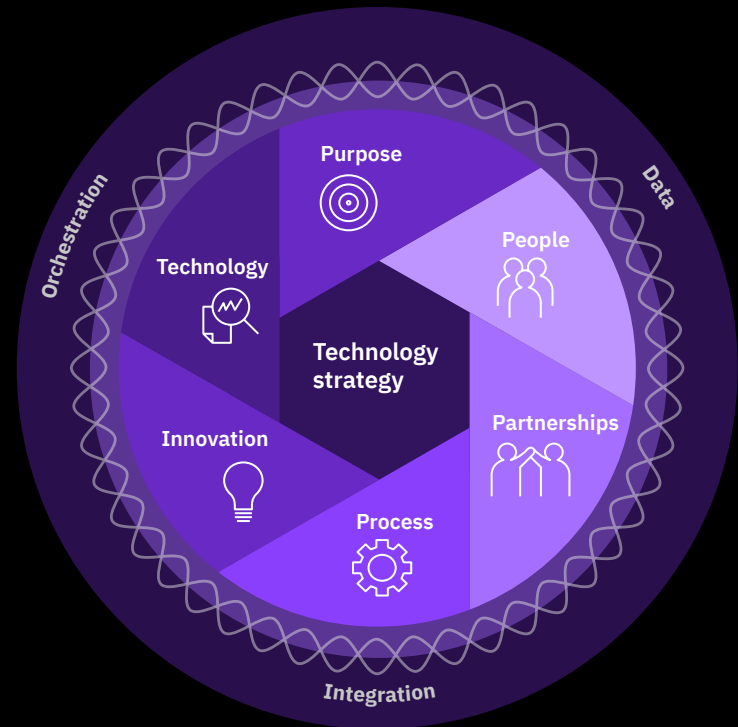
What is so special about these 6 value drivers? Taken individually, they can only do so much. But in combination, they can create new value propositions that dramatically extend the reach and impact of technology.[15]

Our analysis suggests such value stems from the ability to bring assets, resources, insights, and opportunities together—dynamically and in response to real-time variables. The efficiency and effectiveness of these capabilities can make a huge difference in business outcomes. These capabilities are less centralized and more distributed. Realizing the associated benefits depends less on optimizing resources, and more on enhancing connections and accelerating insights.

Given the growing complexity and interdependence of technology strategy and operations, these responsibilities are increasingly shared. For CIOs, that may mean leveraging technology as a core business capability, and serving the day-to-day technology needs of diverse constituents and stakeholders. For CTOs, this may mean taking a leadership role in developing a more comprehensive, holistic approach to technology strategy, architecture, and operations.

Given this context, we deeply explore 3 value drivers—technology, people, and process—in which CIOs are leading strategic efforts. We then briefly touch on 3 additional value drivers—purpose, partnerships, and innovation—where CIOs may either lead or play a supporting role.

"We need to constantly reinvent ourselves to stay relevant. It is important to be successful, but failure is a part of the learning process. So, in case of failure, it is imperative to fail fast and learn quickly."

Avinash Raghavendra, EVP & Head of IT, Axis Bank

Value driver 1: Technology

CIOs are leading the transition to hybrid cloud technologies. Consider this: cloud, when implemented in conjunction with organizational and operational enablers, and enhanced exponential technologies and data capabilities, has the potential to unlock significant revenue growth upwards of 13x.[16]
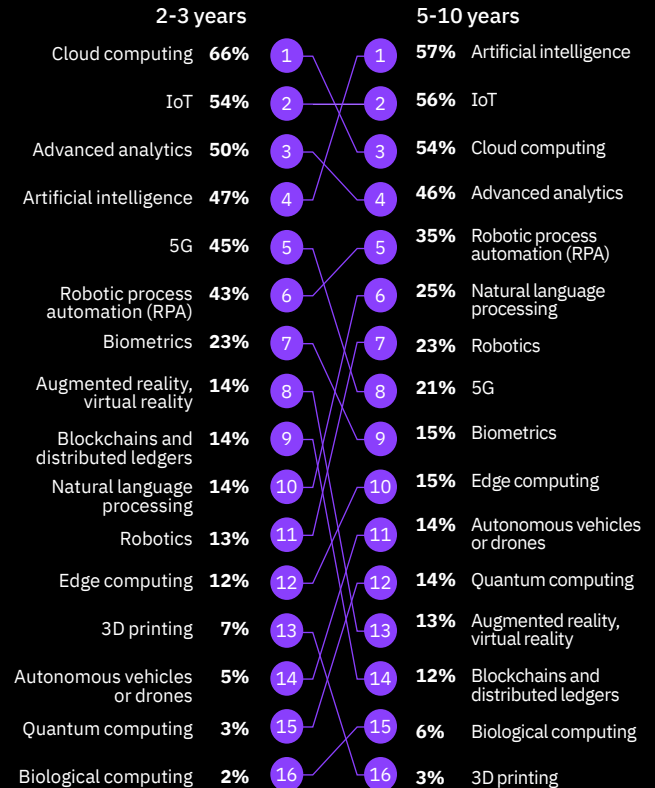
As cloud-based technologies mature, the cloud estate will continue to evolve. CTOs, who are primarily responsible for their organization's technology road maps, consistently identified cloud among the emerging technologies most important to delivering results. Within a broad set of technologies, more CTOs indicated cloud is important to delivering results over the next 2-3 years, and it remains in the top three technologies for contributing to business results 5-10 years from now—reinforcing cloud's role as a fundamental enabler for other emerging technologies (see Figure 10).

As an example, the data, integration, and orchestration layer inherent in hybrid cloud designs are key to delivering value across functional areas (see case study "BNP Paribas" on page 22).

Figure 10

Building on cloud

Tech leaders expect cloud and other cloud-enabled technologies to impact their business results

2-3 years				5-10 years
Cloud computing	66%	1 — 1	57%	Artificial intelligence
IoT	54%	2 — 2	56%	IoT
Advanced analytics	50%	3 — 3	54%	Cloud computing
Artificial intelligence	47%	4 — 4	46%	Advanced analytics
5G	45%	5 — 5	35%	Robotic process automation (RPA)
Robotic process automation (RPA)	43%	6 — 6	25%	Natural language processing
Biometrics	23%	7 — 7	23%	Robotics
Augmented reality, virtual reality	14%	8 — 8	21%	5G
Blockchains and distributed ledgers	14%	9 — 9	15%	Biometrics
Natural language processing	14%	10 — 10	15%	Edge computing
Robotics	13%	11 — 11	14%	Autonomous vehicles or drones
Edge computing	12%	12 — 12	14%	Quantum computing
3D printing	7%	13 — 13	13%	Augmented reality, virtual reality
Autonomous vehicles or drones	5%	14 — 14	12%	Blockchains and distributed ledgers
Quantum computing	3%	15 — 15	6%	Biological computing
Biological computing	2%	16 — 16	3%	3D printing

Respondents consist of 2,500 Chief Technology Officers. Q. Which of the above emerging technologies will most help deliver the results you need over the following periods: next 2–3 years (short term), next 5–10 years (long term)?

Case study

BNP Paribas

Transforming the development environment[17]

Among the world's largest banks, BNP Paribas embarked on a major modernization project, overhauling software development for its core IBM Z® mainframe systems. The bank, which offers both retail and investment banking services, discovered that its developers faced challenges relating to capacity constraints and outdated tools.

To improve quality and efficiency—and facilitate more rapid product development—BNP Paribas deployed an integrated development environment backed by open-source tools. Driving both cost and quality improvements, the modern environment enables more efficient development and testing, which also helps attract new developers. It also boosts developer engagement and code quality by offering greater autonomy and tool standardization.

By building a strong foundation with agile, modern development practices and services, BNP Paribas adds business value by seamlessly using the business-critical data and transactions on its modern mainframe systems within its hybrid cloud strategy.

"The modernization project improves our understanding of and control over services running on our enterprise systems," says Abdelhakim Loumassine, Head of the Mainframe Division at BNP Paribas. "The more we can expose applications and business logic running on IBM Z, the more value we can add to the business and to our clients."

A number of executives indicated that their ability to provision cloud capacity, applications, and services on demand has become integral to how they do business. "The transition to digital has been sudden and accelerated by the pandemic," says Avinash Raghavendra of Axis Bank. Recent IBV research has documented ways executives were able to transition to digital platforms and thereby help maintain competitive advantage.[18]

Many CIOs emphasized the importance of data and automation in breaking down siloes and creating new value streams. According to Zhi Hong Zhao, Vice President and Chief Risk Officer for China Bohai Bank, "How to integrate data into strategy, operations, and culture—and develop a new way to realize value based on data—is a topic worthy of deep thinking by the CIO."

Ulf Brömster, Head of Supplier and Commercial Governance at Group IT Ericsson, advocates an entrepreneurial perspective: "As the CIO controls how the business can integrate and use data, the CIO is helping on the path of experimenting and discovering new business opportunities."

Often, what's missing is a data fabric that enables insights on demand and facilitates smarter automation. This approach makes more data available and actionable—providing not just advanced analytics but insights that drive moment-to-moment calibration and optimization.

"As the CIO controls how the business can integrate and use data, the CIO is helping on the path of experimenting and discovering new business opportunities."

Ulf Brömster, Head of Supplier and Commercial Governance, Group IT Ericsson
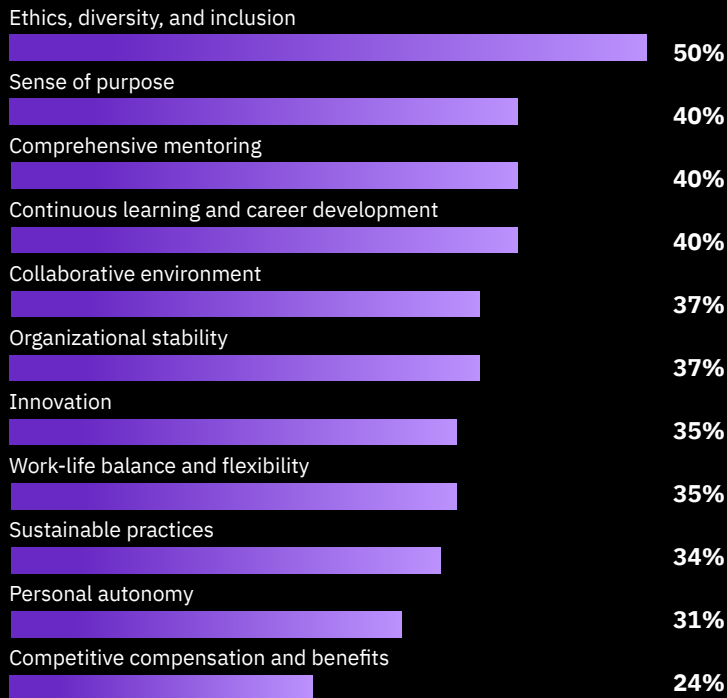
Adds Steve McCrystal from Unilever: "Everything we're trying to do and every choice we make as a business is to be as data-informed as possible. We want to surface data at every decision point—the right data at the right time to the right person, when it matters most."

Many CIOs are re-orienting IT operations around the ability to capture, analyze, and enrich proprietary data insights. 74% of CIOs report they are proficient in integrating data from sources inside and outside the organization, while 87% indicate they occupy a leadership role in their organization's data strategy. CIOs are recognizing that data value is not one-dimensional, but rather is about serving a specific need to a specific user at a specific moment in time.[19]

Figure 11

The engaged workplace

CIOs are looking to ethics, diversity, and inclusion as critical to employee engagement

Ethics, diversity, and inclusion
50%

Sense of purpose
40%

Comprehensive mentoring
40%

Continuous learning and career development
40%

Collaborative environment
37%

Organizational stability
37%

Innovation
35%

Work-life balance and flexibility
35%

Sustainable practices
34%

Personal autonomy
31%

Competitive compensation and benefits
24%

Q: What are the most important organizational attributes for engaging employees?

Value driver 2: People

A recurring theme in our conversations with executives was the unique perspective of CIOs to see across functional areas.

CIOs interface with virtually every part of the organization. And as a result, they are uniquely positioned to understand new value propositions and also existing operational constraints. This is the real benefit of working across the organization.

Given CIOs' proximity to cloud partners, they are well-situated to advocate for new cloud services and understand how to better leverage relationships across the IT estate. Looking ahead, Jonathan Li, CIO of WNC Group, observes, "As the leader of transformation, the CIO's soft skills will be more important."

That's because many CIOs must contend with difficult trade-offs on a daily basis. Laura Money of Sun Life Financial shares an example: "In one meeting, we're talking about locking things down. In the next meeting, we are talking about removing constraints—yet both have our focus on our clients as the driving force. The mindset between these two is so fundamentally different—figuring out how to balance those two goals is a real test of leadership. But I'm confident that we can do it, given our common passion for delivering in new ways for our clients."

As hybrid workplaces evolve, CIOs expect to play an important role in establishing a productive, supportive, and enriching work environment (see Figure 11). CIOs have become major proponents of progressive end-user experiences—a trend that has culminated over the past 18 months with an array of cloud-based productivity tools and the transition to more flexible work environments.

A more fundamental change is underway. How people approach their work is evolving rapidly—shifting to an emphasis on collaboration, community, co-creation, and co-innovation. "Today, we are experiencing new ways of working, which imply very interesting challenges, both technological and cultural," observes Fernando Treviño Elizondo, CIO at Banorte. CIOs understand that diversity and inclusivity have a critical role to play in how we design and deliver technology services.

Half of CIOs cite ethics, diversity, and inclusion goals as the most important organizational attributes for employee engagement. A sense of purpose ranks second. Both of these are increasingly critical focus areas for CIOs.

The hybrid work environment, of course, will be profoundly different than more traditional workplaces where location and presence are paramount (see Figure 12). However, while 83% of CIOs say they've implemented remote work strategies and 70% say their leadership team is empowered to work remotely, critical gaps are evident.

A bracing example: only 23% of CIOs expect the transition to remote work will persist for significant parts of their workforce. Meanwhile, concurrent IBV research finds 39% of surveyed employees expressing a preference to work exclusively from home or remotely. Another 27% prefer a hybrid model. The challenge for CIOs goes beyond operational, as more than half (56%) of employees that have already or plan to voluntarily change employers in 2021 cite the need for more flexibility in their schedule or work location as a main reason for making the move.[20]

Figure 12

Remote and thriving

A majority of CIOs have made substantial changes to support hybrid environments, but much work remains

Use software-defined solutions to expand capacity on demand
86%

Define and implement a comprehensive strategy for remote work
83%

Conduct operation drills to practice response to adverse situations
78%

Employ agile methods across all levels of the business
76%

Implement common productivity and collaboration tools to improve quality of remote work
70%

Empower leadership team to work and lead remotely
70%

Adopt a zero-trust security model
58%

Run business in a purely virtual environment
34%

Q: To what extent do you agree with the above about your enterprise?

34% of CIOs say they can run their business in a purely virtual environment, but of course this is far from uniform across industries. While 60% of IT services CIOs and 50% of financial markets CIOs are confident in their ability to operate virtually, only 12% of petroleum CIOs, 18% of industrial products CIOs, and 19% of life sciences and pharmaceutical CIOs share this confidence.[21]

Finally, the expectations we place on technology are changing as well. When considering the areas where technology will have the greatest impact over the next 3 years, leaders put sustainability at the top of their list (see "Perspective: Sustainable opportunities" on page 27).

Executives told us that part of what makes the CIO role so interesting is the combination of people and technology, of soft skills and hard skills.

Indeed, talent is key to the success of transformation initiatives. CIOs are contending with an abundance of demand that is vying for a finite supply of resources. According to Avinash Raghavendra at Axis Bank, "Organizations are not competing with their industry peers but across industries for talent."

And the same is true across the IT organization—putting a premium on hard-to-find skills in areas such as AI, advanced analytics, and cybersecurity. In response, CIOs are finding new ways of expanding talent pools—for example, through shared services across the ecosystem or relying on partners for specialized talent. But making the most of talent is an ongoing challenge.

"The academic world cannot train the professionals at the speed we need, and in the pandemic it gets worse—more certifications and badges are being valued by the workforce and companies," observes Walkiria Marchetti, CIO of Banco Bradesco. She adds, "To face this competitive world, other skills are being required, such as anthropology, statistics, economics, and other knowledge."

Laura Money from Sun Life emphasizes the need to re-orient around talent: "You need to be an innovator more than a controller, a thought partner more than a service provider, and a talent magnet. More than simply being a good manager, you need to engage people in ways that are innovative yet personally matter to them."

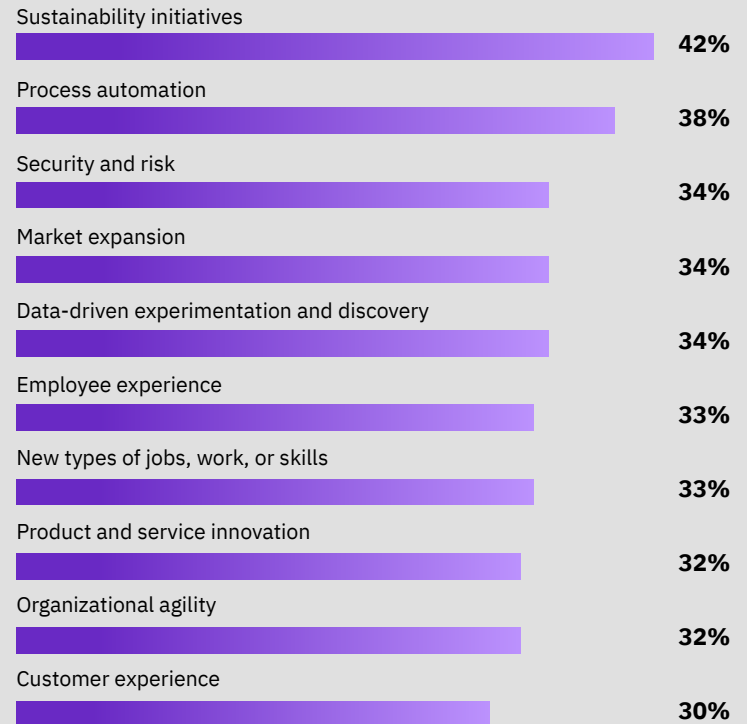**Perspective**

Sustainable opportunities

Sustainability is a rapidly growing C-suite priority, with new ecosystem-based business models helping to resolve some of the biggest challenges of our time.[22] In fact, in recent IBV research, 9 in 10 companies say they'll be working on various sustainability initiatives across the enterprise by the end of 2021. 7 in 10 executives expect their sustainability development goals to improve operational effectiveness, agility, and drive business results.[23] And many CIOs expect technology to significantly impact sustainability initiatives (see figure).

What's more, sustainability issues are increasingly important to consumers. When compared to 2 years ago, 22% more consumers say environmental responsibility is very or extremely important when deciding on a brand. A full 84% of consumers now indicate environmental sustainability is at least moderately important.[24]

For technology leaders, the switch to sustainability raises new questions about sourcing and supply chain integrity. Steve McCrystal at Unilever describes the change this way: "We want to lead the world in enabling people to make more sustainable choices. I need to understand the footprint of different products so I can optimize for a better outcome right from the start, and then use the knowledge we gain to make a better product in the future."

Sustainability in the spotlight

CIOs expect technology to have a significant impact on sustainability over the next 3 years
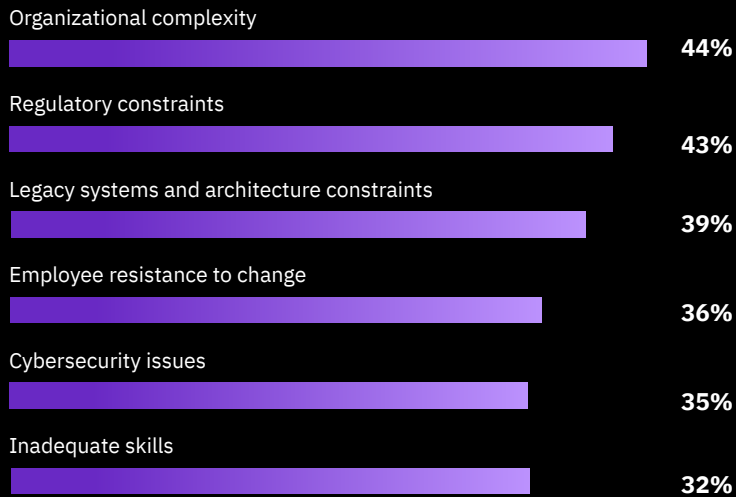
Sustainability initiatives
42%

Process automation
38%

Security and risk
34%

Market expansion
34%

Data-driven experimentation and discovery
34%

Employee experience
33%

New types of jobs, work, or skills
33%

Product and service innovation
32%

Organizational agility
32%

Customer experience
30%

Q. Where do you see technology having the greatest impact at your organization over the next 3 years?

Figure 13

Challenges of a changing world

Organizational complexity and regulatory constraints lead the concerns

Organizational complexity

44%

Regulatory constraints

43%

Legacy systems and architecture constraints

39%

Employee resistance to change

36%

Cybersecurity issues

35%

Inadequate skills

32%

Q. What are the biggest current challenges to your organization's digital transformation?

Value driver 3: Process

CIOs have front-row seats to digital transformation, serving both people-centric requirements for emerging skills and adaptive solutions, as well as technology-centric requirements for scale and speed. In light of this, CIOs can play an instrumental role in enabling extended workflows based on emerging "threads of value."[25]

Indeed, the most impactful opportunities for value realization come from connecting different layers. Unilever's Steve McCrystal states, "We don't talk about the integration layer and the orchestration layer anywhere near as much as we should. That's how you break down the siloes and that's how you create flow. That's our opportunity to bring something new to the story."

Complicating this is a reality that many CIOs contend with: a combination of legacy infrastructure for critical applications and a diversification of workloads for new applications (see Figure 13). Though legacy solutions may require disproportionate amounts of support, many CIOs are leery of trading paid-in-full solutions for recurring line items that may never go away. As Angus McCallum, formerly of London Metropolitan Police, describes it, "I'm reluctant to trade technical debt for supplier debt."

"Many CIOs are dealing with issues around technology debt, integration, and abstraction," says Bart Murphy of OCLC. "But when you break off innovation, you end up with cool kids and non-cool kids, and that's not the culture you want."

Amid these challenges, automation holds great promise for reducing the overhead associated with routine business processes. Among CIOs and CTOs in our study, 77% say their organizations are effective in terms of automating business processes. CIOs report that the greatest use of automation is in IT, finance, and manufacturing—at 40%, 35%, and 35% of workloads, respectively. And overall, 37% of CIOs cite process automation as the top opportunity for positive impact within their organizations.

"We don't talk about the integration layer and the orchestration layer anywhere near as much as we should. That's how you break down the siloes and that's how you create flow. That's our opportunity to bring something new to the story."

Steve McCrystal, Chief Enterprise and Technology Officer, Unilever

Additional value drivers: Purpose, partnerships, and innovation

In this report, we've focused on the value drivers most relevant to CIOs. It is important to recognize, however, that CIOs are actively delivering value across all 6 drivers. "I believe that today the CIO is part of the group that defines and determines the transformation of companies," says Fernando Treviño Elizondo at Banorte, "working hand in hand with business partners."

Walkiria Marchetti of Banco Bradesco speaks of CIOs and purpose: "This generation is driven by purpose. It's an agenda that companies have to take care of, including the way they apply technology. Discussions around artificial intelligence, ethical issues, what to do with your data—the CIO cannot be out of these conversations. You must be aware of the context of the society beyond the matter of your company only."

For CIOs interested in a deeper dive, we elaborate further on the 3 additional value drivers—purpose, partnerships, and innovation—in our companion Chief Technology Officer Study.[26]

"This generation is driven by purpose. It's an agenda that companies have to take care of, including the way they apply technology. Discussions around artificial intelligence, ethical issues, what to do with your data—the CIO cannot be out of these conversations. You must be aware of the context of the society beyond the matter of your company only."

Walkiria Marchetti, CIO, Banco Bradesco

Chapter 2.

Three essential questions

How are you shaping your technology function to optimize value throughout the organization?

How are you engaging executives outside the technology function to help advocate and advance your organization's technology strategy?

How are you eliminating constraints to empower employees and increase productivity?

Chapter 3

Finding your path:
The 3 CIO mandates

As the technology portfolio expands and diversifies, so too do the responsibilities of technology leaders. How the CIO or CTO role is defined often reflects factors that have little to do with the individual leader and more to do with organizational structure and the needs of the organization.

To determine how and where CIOs may make the greatest contribution—and have the greatest impact—it's essential to understand how the CIO role has been defined within their organizations.

Yet the CIO role varies dramatically among industries and among organizations—including the responsibilities, scale, and maturity of the technology function, the level of C-suite authority, and the strategic credibility. From our conversations with leaders, it's clear that there is no single right way to tackle the challenges and opportunities facing CIOs. Nippon India's Abhijit Shah sums it up, "There's not a discrete definition of what the CIO does."

"Even though I am CIO, my role is quite closer to being on the management side, than on the technical side."

Yuji Mikasa, Director and Senior Managing Executive Officer, Nippon Life Insurance Company

That very lack of clarity creates opportunity: many CIOs are taking advantage of the situation to actively redefine what their role means. Rong Xian of China Tourism Group states, "The CIO role is no longer just delivering technology for IT projects, but delivering business and customer outcomes through joint collaboration." Yuji Mikasa, Director and Senior Managing

Executive Officer, Nippon Life Insurance Company agrees: "Even though I am CIO, my role is quite closer to being on the management side, than on the technical side."

To help CIOs better contextualize their experiences compared to those of their peers, we have identified 3 distinct CIO mandates (see Figure 14):

Mandate 1. The Cross-functional Facilitator

Mandate 2. The Critical Operator

Mandate 3. The Visionary Builder

Figure 14

The 3 CIO mandates

Archetypes for success

*Percentages of CIOs in our respondent sample, based on IBV data analysis.

Mandate 1 — 49%*

The Cross-functional Facilitator

Top 5 responsibilities

- **73%** Data governance and compliance
- **73%** Supply chain management
- **72%** End-user experience
- **71%** Data privacy
- **68%** Business continuity

Top 3 time investments

- **42%** Innovation strategy
- **39%** Data privacy
- **36%** Cybersecurity

Mandate 2 — 28%*

The Critical Operator

Top 5 responsibilities

- **99%** Business continuity
- **99%** Workplace enablement
- **99%** Workforce engagement and productivity
- **98%** Supply chain management
- **98%** End-user experience

Top 3 time investments

- **71%** Business continuity
- **58%** Ecosystem strategy
- **42%** Sustainability agenda

Mandate 3 — 23%*

The Visionary Builder

Top 5 responsibilities

- **96%** C-suite and Board advisory
- **85%** Technology strategy
- **76%** Technology operations
- **75%** Data privacy
- **75%** Technology architecture

Top 3 time investments

- **67%** Technology strategy
- **58%** Technology architecture
- **56%** Data privacy

To identify each of these, we focused on clusters of responsibilities and associated success criteria, rather than individual characteristics or leadership styles. These mandates reflect typical ways in which organizations define the CIO's role today. Within these common sets of responsibilities, a given CIO may approach the role differently based on a range of variables.

Reflecting the evolution of the CIO role, organizations have modified what they're looking for from technology leaders. The CIO title, along with CTO, has become more fluid as the role of the technology function grows. Several CIOs even describe their role as a combination of what may be considered both CIO and CTO responsibilities.

Taking this evolution of executive titles a step further, Melanie Kolp at Nationwide Insurance shares that her organization has made a conscious decision to emphasize the term "technology" in all leadership titles. This reflects the organization's transformation into a technology-driven firm. She adds, "We wanted to de-emphasize the traditional back-office aspects of the CIO role and instead emphasize more of a front-office engagement role. Technology is taking the lead."

In recognizing their own scope of responsibilities and embracing the strategic role of technology throughout their organizations, CIOs can collaborate and coordinate more effectively with other business and technology leaders. Collectively, they can optimize the distribution of responsibilities to avoid overlap and close gaps.

As we've shown, the value of strong CIO-CTO collaboration can be a significant improvement in organizational performance. How any given CIO might go about that varies based on the needs of the organization.

"There's not a discrete definition of what the CIO does."

Abhijit Shah, CTO, Nippon India

CIO Mandate #1. The Cross-functional Facilitator

These CIOs represent about half of our global survey sample. They operate as innovators across functions, with the most diverse set of responsibilities and broadest range of success factors.

While their responsibilities are broadly defined, Cross-functional Facilitators rate their organizations' technology maturity as significantly higher when compared to those of the other CIO mandates. Perhaps because of their broad scope, they have achieved the highest level of collaboration with CTOs in their organizations. With an extensive range of constituencies, these CIOs may realize they can benefit from the vision and expertise of a peer focused on many of the same objectives.

When asked to name their most common responsibilities, Cross-functional Facilitators' responses are relatively diffuse. Neither technology strategy or technology architecture is at the top of their list.

Rather, the responsibilities they cite most often are data governance and compliance and supply chain management (both 73%), end-user experience (72%), and data privacy (71%). In sharp contrast, more than 90% of the Critical Operators and Visionary Builders agree on their top responsibility.

For this mandate group, time investments don't directly align with responsibilities. They report spending the most time on innovation strategy (42%), data privacy (39%), cybersecurity (36%), and data governance and compliance (35%).

When asked to identify their criteria for success, Cross-functional Facilitators most often identify operational uptime (46%) and the launch of tech-enabled platforms (43%). Just behind this are criteria related to financial impact: attributed revenue from products and services (42%), budget performance (40%), and impact on business outcomes (40%).

The broad scope of responsibilities for these CIOs means they may struggle for resources, contend with conflicting priorities and difficult trade-offs, and may not always be fully recognized for the breadth and reach of their accomplishment. Yet many CIOs tell us that this expanse of responsibility and the inherent challenges of serving many constituencies are significant aspects of why the role is appealing to them.

CIO Mandate #2. The Critical Operator

These CIOs represent just over a quarter of our global survey sample. They have a clear and consistent core set of responsibilities. Among the 3 mandates, Critical Operators rate their organizations' technology maturity the lowest and report the lowest return on their technology investments. But according to a technology effectiveness index we developed for this research, this particular mandate group leaves its peers in the dust. They report an average index score of 81%, compared to Visionary Builders (41%) and Cross-functional Facilitators (36%).

A top responsibility of Critical Operators, cited by 99% of respondents, is business continuity. Workplace enablement (99%) and workforce engagement and productivity (99%) are followed by end-user experience (98%), supply chain management (98%), and sustainability agendas (97%). In contrast to the relative diffusion of Cross-functional Facilitators, their near-unanimous priorities distinguish Critical Operators. It's a deep-dive approach, compared to Cross-functional Facilitators' embrace of wide-ranging responsibilities serving a broad set of stakeholders.

Given their focus, it's no surprise that Critical Operators invest the most time in areas that track their responsibilities more closely. The 4 most common areas noted are business continuity (71%), ecosystem strategy (58%), sustainability agenda (42%), and workplace enablement (35%).

For Critical Operators, a deeper commitment to fewer responsibilities can mean coalescing around a common sense of mission. Indeed, in keeping with their priorities, this group has the highest consistency of self-identification: 41% describe themselves as "transformational business leaders." In the other mandates, no more than a third of respondents agree on any single description of their roles.

Critical Operators are closely aligned to maintaining core functionality. In terms of success criteria, half of respondents point to product-quality measures, and 43% point to operational uptime. Curiously, the success metrics cited by Critical Operators are much more dispersed than their top responsibilities and appear somewhat disconnected from the CIOs' activity. That may be because new priorities are being pushed onto these CIOs, or because these CIOs are proactively embracing what, from their perspective, are key tasks.

While their scope of responsibility is far tighter than Cross-functional Facilitators, Critical Operators still report a fairly high level of collaboration with CTOs. As discussed earlier, this can be a powerful catalyst for unlocking business value through improved revenue growth and operating margins.

CIO Mandate #3. The Visionary Builder

This group of CIOs, representing just under a quarter of our survey respondents, has a focused set of responsibilities very different from the other 2 mandates. The top responsibility, cited by 96% of them, is advising the C-suite and the Board. In effect, Visionary Builders combine traditional CIO duties with CTO-type duties. They have relatively low levels of collaboration (perhaps because they can function as both CIO and CTO) and operate more independently from business counterparts. However, they reported significantly better returns on their technology investments than the other groups.

These CIOs have a great deal of vested authority over technology strategy and operations, and exercise comprehensive authority over the technology function. They have a broad sphere of influence over technology strategy and decision making at the senior leadership level.

Beyond the C-suite advisory role, their top responsibilities are CTO-like. Technology strategy is cited by 85% of respondents in this group, followed by technology operations (76%), data privacy (75%), technology architecture (75%), and innovation strategy (72%). While not as aligned within their mandate group as the Critical Operators, these Visionary Builders focus in quite different ways.

This is reflected in how they spend their time: on technology strategy (noted by 67% of this group), on technology architecture (58%), on data privacy (56%), and on technology operations (52%).

Operational uptime, which is noted as a key success criteria by the other cohorts, does not crack the top ranks for Visionary Builders. Instead, their number one success criteria is the subjective assessment of their impact by senior leaders (75%), followed by the launch of tech-enabled platforms (68%). Their clarity regarding success criteria is notable—the top-cited criteria of the other mandates garner no more than 50%. This strength of sentiment underscores the importance Visionary Builders place on delivering—and being recognized—for results.

"We wanted to de-emphasize the traditional back-office aspects of the CIO role and instead emphasize more of a front-office engagement role. Technology is taking the lead."

Melanie Kolp, Senior Vice President and Chief Technology Officer, Nationwide Insurance

Chapter 3.

Three essential questions

How are you actively defining your mandate to build on your strengths and grow your effectiveness?

How can you leverage your personal characteristics and leadership style to advance the impact of your organization?

What skills and capabilities of your close collaborators are most needed to complement your areas of need?

Action guide

Planning for the road ahead

For many organizations, last year's response to the pandemic highlighted the heroic efforts of CIOs and their teams. That organizations could shift to digital platforms and virtual operating models over mere weeks and months represents a remarkable accomplishment.

Today, the technology function is even more vital to ongoing business success and business relevance. We find ourselves in an escalating cycle: as technology becomes distributed throughout the enterprise, the organization's identity centers more on technology. The Virtual Enterprise of tomorrow needs a mature and collaborative technology function to thrive.[27]

Whatever form the future takes, CIOs and CTOs will play a vital role in how technology shapes it. Braver and bolder, but also more vulnerable and uncertain, more artificially intelligent yet also more humanistic, this world will unavoidably reflect not only our aspirations, needs, and talents but also our biases, oversights, and neglect.

The stakes are intense, but so are the opportunities for collaboration, increased effectiveness, and technology investments that advance technology maturity. It's a moment for embracing this new reality with energy and openness. The steps we take now determine the future.

Recommendations for all CIOs

Seize your seat at the table—Expand technology's leadership influence

– *Define your purpose and mission*. Actively align with other technology leaders to help ensure clarity of purpose and mission and avoid duplication of functions.
– *Champion technology's role*. Build on complementary strengths across your IT organization and amplify the technology function's role in driving business strategy.
– *Track results that matter.* Implement performance measures for technology investments to track impacts on operational capabilities and business outcomes.

Address complexity head on—Take advantage of your unique capabilities to boost value

– *Create a tapestry*. Combat technical complexity with a strategic enterprisewide approach focused on integration, orchestration, and flow.
– *Be an interconnector*. Leverage the CIO's "diagonal" positioning within the organization—horizontally across functions and vertically supporting all levels of authority. Use this visibility to break down silos that are limiting effectiveness and efficiency.
– *Unleash talent*. Eliminate data, process, or decision roadblocks that limit employee ability to deliver value to customers and constituents anytime, anywhere.

Become a force-multiplier—Deliver innovative technology, intelligent processes, and inspired people

– *Use technology to weave a "golden thread" of value.* Continuously enhance agility, innovation, and adaptation by deploying leading technologies such as AI, hybrid cloud, and intelligent workflows.
– *Deliver the data*. Get the right information to the right decision makers faster using advanced analytics and automation, with a focus on insights that enable rapid calibration and optimization.
– *Embrace your influence*. Inspire employees and business partners by being an innovator more than a controller and a talent magnet and exciter more than simply a good manager.

Mandate-specific recommendations

CIO Mandate #1. The Cross-functional Facilitator

– *Become a designated delegator.* Recognize that the breadth of your mandate involves difficult trade-offs that can pull you in different directions. Identify the IT services of greatest value to diverse constituencies and designate leaders to drive results in those areas.

– *Set priorities by focusing on core value*. Focus on developing talent in critical areas and build a bench of multiskill and high-skill talent to support cross-functional efforts in data, integration, and orchestration.

– *Share the load*. Embrace your ability to connect different parts of the business. Expand the impact of technology by pairing the breadth of your mandate with the depth and expertise of other leaders, especially your CTO counterparts.

CIO Mandate #2. The Critical Operator

– *Build out the hybrid work environment*. Take the lead in supporting a more flexible workforce and new work models. Use emerging technologies to re-orient IT services related to engagement, collaboration, productivity, and business value.

– *Transform your sense of mission into a larger purpose*. Your focus around a core set of responsibilities can be the seeds of cultural transformation. Use your influence to foster a community of like-minded leaders based on connecting the technology estate with broader strategic goals.

– *Surround yourself with allies*. Reinforce your sharp focus on a few key responsibilities by entrusting other responsibilities to trusted delegates and/or your CTO(s).

CIO Mandate #3. The Visionary Builder

– *Communicate with purpose.* Foster a culture that prevents short-term decisions from impeding longer-term goals.

– *Engage the ecosystem*. Advance your role to drive technology transformation beyond the boundaries of the organization and across partner ecosystems.

– *Take advantage of your reach*. Strengthen the influence of your strategic vision by identifying and actively collaborating with those who lead implementation and operations.

Research and analysis methodology

In Q2 and Q3 2021, the IBM Institute for Business Value (IBV), in cooperation with Oxford Economics, interviewed 2,500 Chief Information Officers (CIOs) and 2,500 Chief Technology Officers (CTOs) from 45 locations and 29 industries. These interviews were conducted virtually.

The IBV supplemented data collection with in-depth conversations with select CIOs from 11 industries and 11 locations. These quantitative and qualitative interviews focused on the evolving role of the CIO, the emergence of other technology leaders such as CTOs, the shift to operating models centered on collaboration and partnership, as well as CIO leading practices and success factors. Interviews were conducted from May to September 2021.

We designed data collection by country, industry, and organizational size. To better understand pre-pandemic and post-pandemic impacts, we captured operational and financial data for the period 2018–2021. In terms of data analysis, we sought to understand the impacts of collaboration on the technology leadership function as a whole, inclusive of both CIOs and CTOs. The strength of CIO–CTO collaboration was based on the frequency of interaction and the extent to which they view their counterparts as critical to organizational success over the next 3 years.

To dive deeper into the ways technology leaders are delivering business value, we also assessed respondents on 3 measures of technology performance:

Technology maturity—the stage of their cloud, AI, automation, and security journeys

Technology effectiveness—their agility, data management, governance, and resilience

Technology ROI—the return on their technology investments, normalized by industry

The IBV converted these measures into standardized scores to facilitate comparison across categories and understand the extent to which factors influenced each other. In addition, we conducted a regression analysis to determine how the 6 value drivers—purpose, people, partnerships, process, innovation, technology—influence the 3 technology measures. This was supplemented by a financial analysis of enterprise-wide revenue growth and operating margin. The analysis was structured around various performance scenarios and models were adjusted to enhance goodness of fit.

We also used segmentation logic to define 3 core CIO identities, which we characterized as distinct CIO leadership mandates based on responses to specific items from the survey instrument.

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