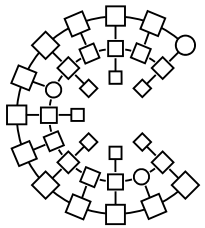
Imagine— Operations that think

Chief Operations Officer

Global C-suite Study
19th edition

IBM Institute for
Business Value



The IBM Institute for Business Value, in cooperation with Oxford Economics, interviewed 2,116 Chief Operations Officers. In 238 face-to-face and 1,878 phone interviews, both quantitative and qualitative responses were collected. The analytical basis for this COO report uses 2,000 valid responses from the total data sample collected.

More than 12,800 CxOs, representing six C-suite roles, 20 industries and 112 countries, contributed to our latest research. We used the IBM Watson Natural Language Classifier to analyze their contextual responses and ascertain overarching themes. We also used various statistical methods, including cluster analysis and discriminant analysis, to scrutinize the millions of data points we collected.

How today’s COOs create connected experiences with “thinking” operations

For years, Chief Operations Officers (COOs) have been *thinking* about how agility, automation, technological prowess and the right mix of partners could help them innovate their global operations. Now, they are applying artificial intelligence (AI)/cognitive technology to establish *thinking processes*—processes that communicate real-time insights to employees and partners across expanding ecosystems. COOs are redesigning their business models and operational execution to create:

– Cooperation and knowledge sharing

– Adaptive and self-learning systems

– Compelling customer experiences

A cadre of forward-thinking COOs are leading the way in virtually every aspect of such process innovation—from vision and value creation to execution and impact.

A broader context

Perspective from the Global C-suite Study

Two decades after the Internet became a platform for transformation, we're still wondering how it all might turn out. The signals aren't always clear. Today, winner-take-all organizations are on the rise, but collaborative ecosystems are flourishing as well. Even in industries where competitive concentration is increasing, innovation hasn't—as would be expected—flatlined. Which way to the future?

The organizations that are prospering aren't lying in wait to time the next inflection point—the moment when a new technology, business model or means of production really takes off. Remaking the enterprise, they recognize, isn't a matter of timing but of continuity. What's required, now more than ever, is the fortitude for perpetual reinvention. It's a matter of seeking and championing change even when the status quo happens to be working quite well.

Drawing from the responses to a survey of executives across the C-suite, IBM client engagements and our work with academics, the 19th edition of the IBM Global C-suite Study, "Incumbents Strike Back," covers four topics that describe the changing business landscape.[1]

Dancing with disruption: Incumbents hit their stride

Is disruption dead? Certainly, there's less of it than most C-suite executives anticipated. Just under three in ten say they're experiencing significant disruption; hardly the deluge expected. What happened? As industries consolidated, startups deprived of venture capital funding stalled at the gate—or were snapped up by incumbents. Confounding the situation, C-suite executives report that it's not the fearsome digital giants they're concerned about most, but the once lumbering, now innovative, industry incumbents that have gained the capacity to strike first and strike back.

Disruption hasn't gone underground; instead it's emerging as a capability incumbents are ready to embrace. They orchestrate advantage by continuously reallocating resources to invest in promising new areas. They have learned to move fast, experiment and iterate. They're reinventing themselves before they are forced by competitors to reconsider their options.

Trust in the journey: The path to personalization

Personalization is a huge opportunity to grow revenues and loyalty, but absent true customer insight, too many organizations are in danger not just of falling short of their targets, but disappointing their customers. Leading organizations are modeling a new path to insight; they are design thinkers. They use data to interrogate their environments, create context and reveal what's deeply human about their customers. To achieve the elegant and irresistible design of the customer experience, they don't start with solutions; instead, they seek to ask the next best question.

They excel at two activities—customer co-creation and detailed journey mapping. These activities generate insights in abundance, feed on-target personalization and have equally important second-order effects: they propagate trust. Trust between peers in co-creation communities is transferred to the enterprise and extended outside the community by a cadre of influencers. Likewise, journey maps cement trust by instilling a culture of accountability to customers inside the organization. Leading organizations dedicated to discovering their customers' unmet needs don't just ask for loyalty on the basis of personalization. They earn and provide reasons to trust.

Orchestrating the future: The pull of platforms

Who wouldn't want to be an Amazon or Alibaba? An intrepid few in every industry are venturing onto business platforms, creating dazzling network effects by orchestrating direct interactions between consumers and producers, and pulling others fast in the same direction. Organizations will need to consider whether they reinvent themselves to own or participate in a business model platform, or to do both. Regardless, the "rules" for success are shifting.

Platforms break down conventions. Prime among those conventions is the value derived from proprietary advantage. Platform operators create value from reciprocity—they cultivate win-win propositions for the network of organizations on their platforms. Above all else, platform owners are ready to reallocate resources from defending markets to innovating in new ones. Attracted by the potential for outsized returns, 28 percent of the C-suite executives surveyed report their enterprises are reallocating some portion of capital to build out platforms. Past and future reallocation could approach an estimated USD 1.2 trillion in the next few years.

Innovation in motion: Agility for the enterprise

Asked to rank the capabilities most instrumental to their success, CEOs cited two characteristics above all others: a new willingness to experiment and the support of empowered employees. Leading organizations are rethinking the employee construct at its most elemental level: they're cultivating autonomy and learning on the fly by implementing a more fluid work structure made up of cross-functional teams. For many, the initial inspiration to do so is to get closer—and become more responsive—to their customers.

Leaders in these organizations look to employees to actively challenge and reshape their own views on the course the company should take next. They make it clear that they value smart experimentation and rapid response to market changes. Their employees aren't lined up neatly behind them; they're encouraged to explore.

As part of the Global C-suite Study, we interviewed over 2,100 COOs to better understand how the COO function is evolving. In this report, we outline how COOs are innovating in response to the challenging and changing landscape outlined in the Global C-suite Study.

Connected experiences

"We did something very innovative that is quite disruptive in our industry. We transformed our operations to be fully digital across all of our channels."

Chief Operations Officer, Telecommunications, Ireland

The sudden shock of disruption? That's in the past. Instead of feeling caught off balance by the ground shifting beneath them, organizations have embraced a mindset of continuous reinvention. Industry incumbents, once mired in legacy thinking, have learned from the march of the digital giants. The result? They're innovating in new ways.

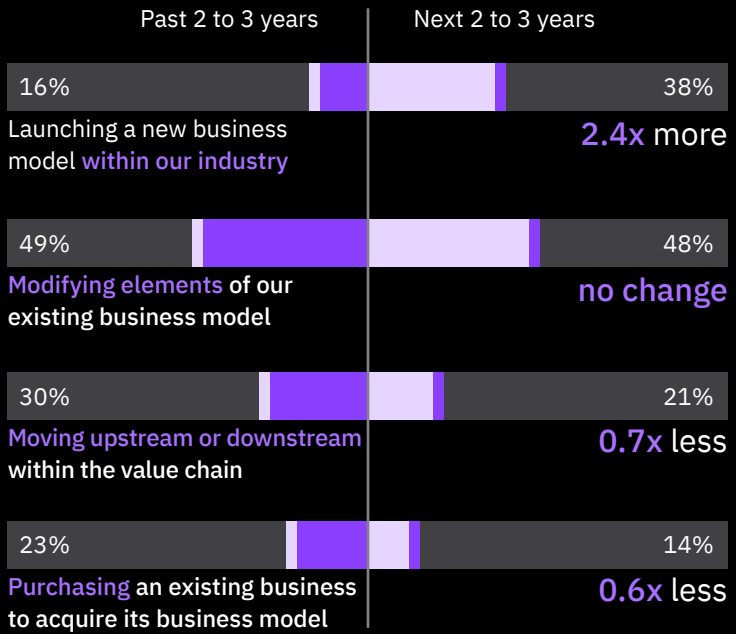
Members of the C-suite have broadened their focus from just products to the totality of the customer experience. They're expanding partner networks, creating value from collaboration across ecosystems and reallocating resources to create new business models. In fact, launching a new business model has become a top prerequisite—2.4 times more so than in the past few years (see Figure 1).

Figure 1

Breakaway

More organizations expect to launch new business models

Past and future planned enterprise business model changes



Q. How has/does your enterprise plan to change its business model in the past 2 to 3 years and within the next 2 to 3 years?

Another IBM report has found that digital customer experiences are more critical than ever to the success of a company, because businesses are interacting with their customers in many different ways. By using data from self-learning software and automated processes, companies can create “connected experiences” that build meaningful customer relationships across a variety of channels.[2]

In the recent past, organizations have pursued change primarily by launching existing products and services in new markets. Now they’re seeking a balance between new and existing markets. They have also learned that growth can come from redirecting investments and resources to reinvent the customer experience.

For operations executives, the mandate to improve the customer experience may not seem new. But exactly how they achieve those improvements and how their operations change as a consequence will be new. For leading organizations, different sources of data and innovative technologies are playing an outsize role in their operation makeovers. Organizations are returning to their industry roots as they aggressively launch new business models.

Water Mission, a nonprofit organization that specializes in environmental engineering solutions, is a great example of these new business models. The organization's mission is to help communities in developing nations, including many in sub-Saharan Africa, obtain access to clean, safe water. But Water Mission has learned to do more. It is empowering those communities to manage and maintain their own water supplies, as well as the supporting infrastructure. Water Mission uses remote monitoring technology with their pumps, wells and equipment in order to generate real-time data about conditions and usage, which the organization analyzes to perform predictive maintenance and maintain safe water supplies.

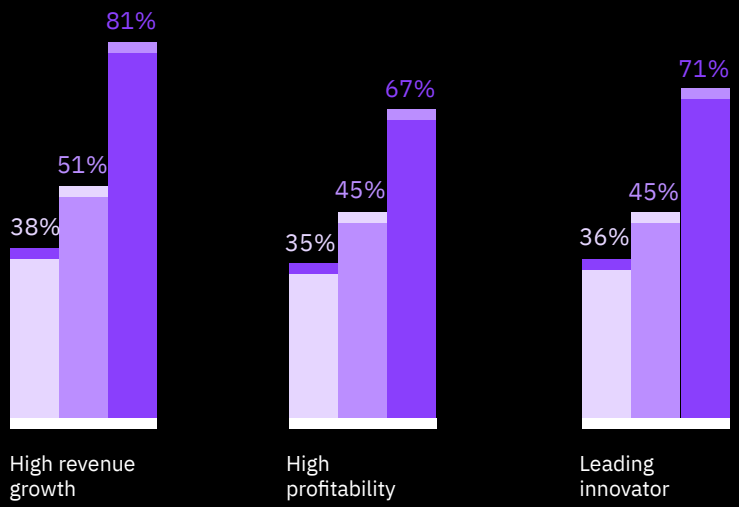
To better understand the forces at play today, we applied cluster analysis to identify distinct segments of organizations among more than 12,500 participants in the Global C-suite Study. Three archetypes emerged, which we've named the Reinventors, the Practitioners and the Aspirationals. The organizations clustered in these archetypes are at different stages of Digital Reinvention™ and are eyeing opportunities from their respective vantage points.

The Reinventors, 32 percent of all COOs surveyed, are the standouts. They report that they outperform their peers in both revenue growth and profitability or operating efficiency as well as in innovation (see Figure 2). They optimize their business

Figure 2

Good to go

Reinventors' success suggests a bright future



Q. How does the revenue growth, profitability and market perception of your enterprise's innovation capability compare to that of your peers over the past 3 years?

processes to support changing strategic objectives. Reinventors express confidence in their abilities to reshape their operations. They have well-defined strategies to manage disruption.

Practitioners—36 percent of COOs—haven't yet developed the capabilities to match their ambitions. And they *are* ambitious. Both Practitioners and Reinventors are building one of the most radical business model options—the business model platform.

The Aspirationals, as their name implies, have some ways to go in their digital reinvention and their ability to seize opportunities. They make up 32 percent of the COOs surveyed.

In this report, we focus primarily on the Reinventors and the ways they are innovating their operational processes.

"In order to meet demands of next-generation consumers, we have completely embraced digital transformation."

Chief Operations Officer,
Insurance, China

Uncover to discover

"Our growing network of partners, followed by adoption of advanced AI technologies, provides an exceptional experience to our customers, which is positive for our brand value in the market."

COO, Financial Services, United States

Reinventors are design thinkers, adept at exploring and investigating before settling on possible answers. In essence, they compete through discovery—most typically to uncover unmet customer needs. Design thinkers reimagine how business processes could support new customer experiences that fulfill those needs. Most COOs solve for optimization and alignment challenges across supply chains and ecosystems. Design thinkers reconfigure connections among participants in those supply chains and ecosystems to create value.

As design thinkers, Reinventor COOs seek to understand their customers' needs and wants to design personalized experiences (see sidebar on page 11, "Reinventors are design thinkers"). They stand in their customers' shoes by embracing customer co-creation with detailed customer journey maps—and consequently create irresistible experiences. Seven in ten Reinventor COOs report they're very effective at collaborating with their customers to create products or services. Indeed, co-creation isn't a one-time occurrence or something that only happens during product and service design (see Figure 3).

"We moved to data interpretation and prediction across the full value chain, focusing on the customer experience."

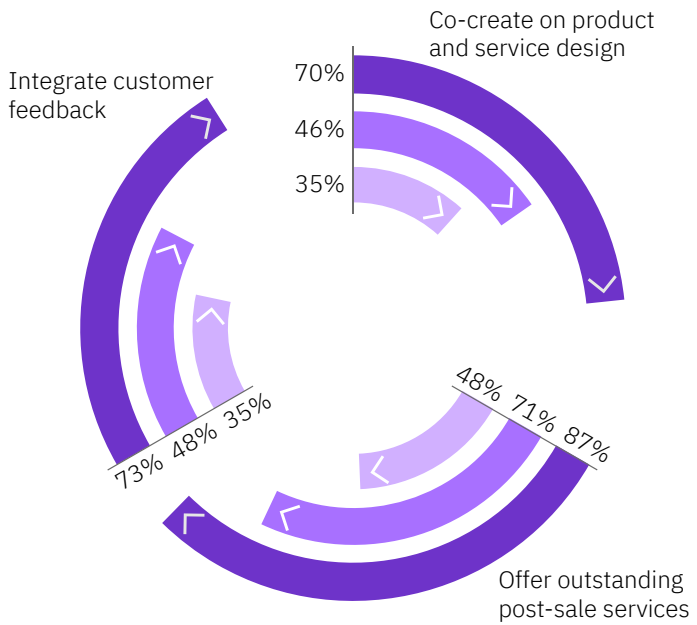
Chief Operations Officer, Life Sciences, Switzerland

Figure 3

COO Reinventors
Practitioners
Aspirationals

Learning loop

Reinventors seek to understand relevant aspects of their customers' lives and needs



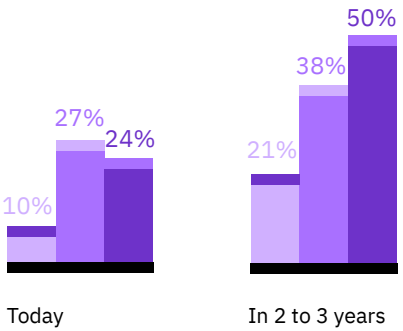
Q. To what extent does your enterprise collaborate with and integrate customer feedback in product and service design? How effective is your enterprise at creating compelling customer experiences through post-sale services?

With all eyes focused on the customer, Reinventor COOs look to AI/cognitive technologies for insights and impact (see Figure 4). For COOs, this means they leverage AI/cognitive technologies not just to better understand customers (gaining insights) but also to redesign important aspects of their operations (creating impact). This can affect innumerable activities, from customer interactions such as delivery to production that yields the right price point.

Figure 4

Get smart

Reinventors turn to AI/cognitive technology to improve the customer experience



Q. Indicate the impact of AI/cognitive technologies on your customer experience to date and in the next 2-3 years. (Significant impact is 4/5 on 5-point scale.)

Reinventors are design thinkers and excel at customer co-creation. They frequently:

- Create close connections to customers to garner direct feedback
- Analyze data and conduct detailed journey mapping to develop customer empathy
- Turn to their partners to better understand the customer experience
- Use AI technologies and cognitive solutions to reveal patterns that might otherwise go undetected.

U.S.-based Baldor Electric Company, for example, designs and manufactures industrial electric motors, drives and mechanical power transmission products. Baldor knows that manufacturing downtime is costly—and the rapid manufacturing and delivery of its custom motors is key to customer service. The company applied an AI-based analytics accelerator to publish real-time order information along its production line. Integrating and analyzing sales, finance, production and device data, Baldor is able to optimize its processes from manufacturing to delivery.

COO support for better customer experiences extends well beyond product and service design and even standard process optimization. It also includes speed and responsiveness across their operations. Six in ten Reinventor COOs are already accessing real-time information to optimize their processes and networks for quick actions and outcomes (see Figure 5).

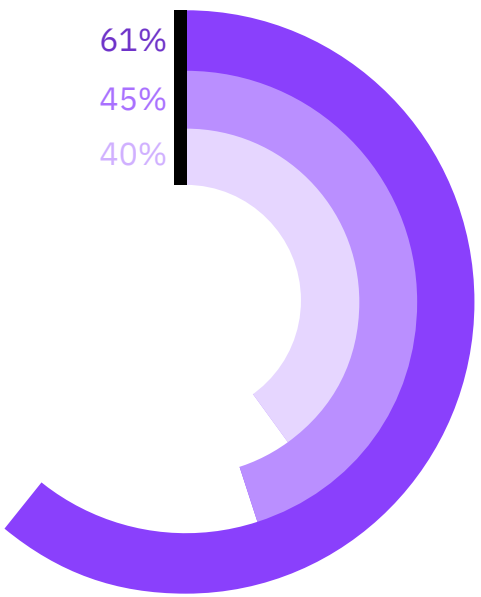
Figure 5

Quick fix

Reinventors rewire operations to move fast

COO Reinventors
Practitioners
Aspirationals

Use real-time information to optimize processes/networks



Q. To what extent does your business strategy apply real-time information to optimize processes/networks?

As systems thinkers, COOs are skilled at making sense of their operational environments. Reinventor COOs excel at orchestrating innovative Internet of Things (IoT) connections. As sensors stream data from manufacturing equipment, shipping containers, networked buildings and more, real breakthroughs and entirely new ways of working (man and machine) become possible. Among the Reinventors, 71 percent have a clear vision and plan for the interconnectivity of the IoT. Just 54 percent of Practitioners and 45 percent of Aspirationals do.

A European-based organization, one of the world's leading industrial suppliers, is accelerating its digital transformation using cognitive computing and the IoT. Among other activities, it is building virtual models that represent highly complex industrial systems. This can enable different approaches to product design, manufacturing and after-sales service. The organization's cognitive platforms can use data from millions of sensors. This helps employees understand equipment performance in real time, monitor machines on- and off-site, and offer preventative maintenance and optimization services to their customers.

As the IoT opens up opportunities for insight, new business model platforms such as Amazon and Alibaba promise to fundamentally change the customer experience. In both cases, design and systems thinking grow in importance.

Business model platforms, in which multiple organizations and customer segments directly interact, are attractive in part because of the considerable payoff. Organizations that own and operate a platform typically receive high valuations for their businesses, and dominate their industries or category segments. Already, 26 percent of COOs report that their organizations are implementing a business model platform. Forty-four percent are investing in or considering one.

For operations executives, business model platforms pose new challenges as well as opportunities. To create a seamless customer experience, for example, organizations on a platform need to stay in sync with each other. Platform owners are encouraged to collect and circulate data freely so that member organizations can collaborate to create mutual value. On business platforms, connecting and creating insights for breakthrough innovation and continuous learning becomes an everyday endeavor.

Processes that “think”

“The combination of AI and the IoT will improve real-time decision making and create new and innovative experiences.”

COO, Energy and Utilities, Indonesia

As more organizations collaborate across an ecosystem or business platform, the challenge of optimizing operations is exacerbated by the need for these organizations to seamlessly align their processes. This complex orchestration ups the ante. Businesses need to see around corners and through blind spots, gathering in-the-moment insights for rapid learning and new value.

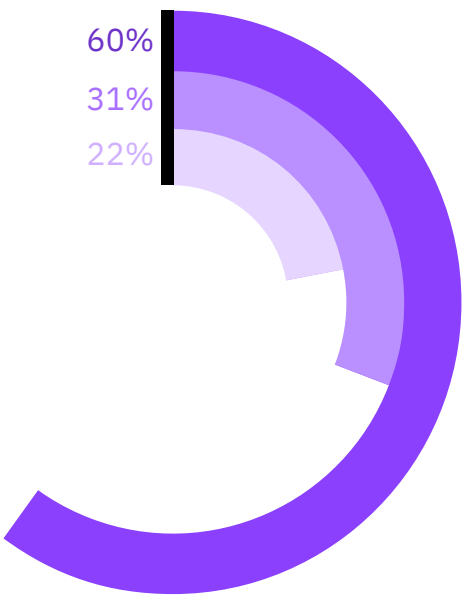
Reinventor COOs recognize the importance of AI/cognitive computing to automate and orchestrate new services and integrated processes. In fact, 58 percent report that their implementations of predictive analytics have delivered a higher level of ROI than other technologies. And 46 percent report the same results with AI/cognitive technologies. Moreover, when we asked COOs specific questions about AI/IoT, 60 percent of Reinventor COOs report that the integration of AI with IoT technologies in their organizations can make a substantial contribution to their digital reinvention over the next several years (see Figure 6).

Figure 6

COO Reinventors
Practitioners
Aspirationals

Entwined

Reinventors know that the combination of AI/ cognitive and the IoT can contribute significantly to digital transformation



Q. To what extent will AI/cognitive computing and IoT technologies contribute to the digital transformation of your enterprise in the next 2 to 3 years? (Significant impact is 4/5 on 5-point scale.)

In addition to the IoT, emerging technologies such as blockchain are creating fresh data streams for analysis by savvy COOs. Logistics, for example, has long remained dependent on a flood of paper that is seldom digitized or electronically shared due to authenticity concerns. One small error on paper can — and too frequently does — result in delays that spoil a shipment or hold up payments. Across the supply chain, blockchains, which establish trust in the authenticity of data, are creating resources for visibility, forecasting and optimization.

Blockchain's ability to manage transactions — without requiring a central point of control — may be the new foundational paradigm shift in business model reinvention. It can increase trust, accountability and transparency across extended business networks for operational and financial transactions. In our research, COOs report that blockchain will support their enterprise strategy by providing security, transparency and automation. Many are piloting blockchain capabilities in various market sectors and specific business functions. They are identifying new and potential opportunities to transact securely and efficiently with their expanding ecosystem of partners, suppliers, manufacturers, lenders and more. And when ready to commercially scale, almost 80 percent revealed that they are focused on the core of their network — their customers.

Many organizations begin their AI journeys by applying intelligence and advanced automation capabilities to improve their understanding of customer needs—and create more compelling customer experiences. Nearly half of Reinventor COOs apply AI more broadly (see Figure 7). They use AI to enhance decision making overall, drive new business models and revenue streams, and enable a new classification of IoT-driven products and services based upon reasoning and learning.

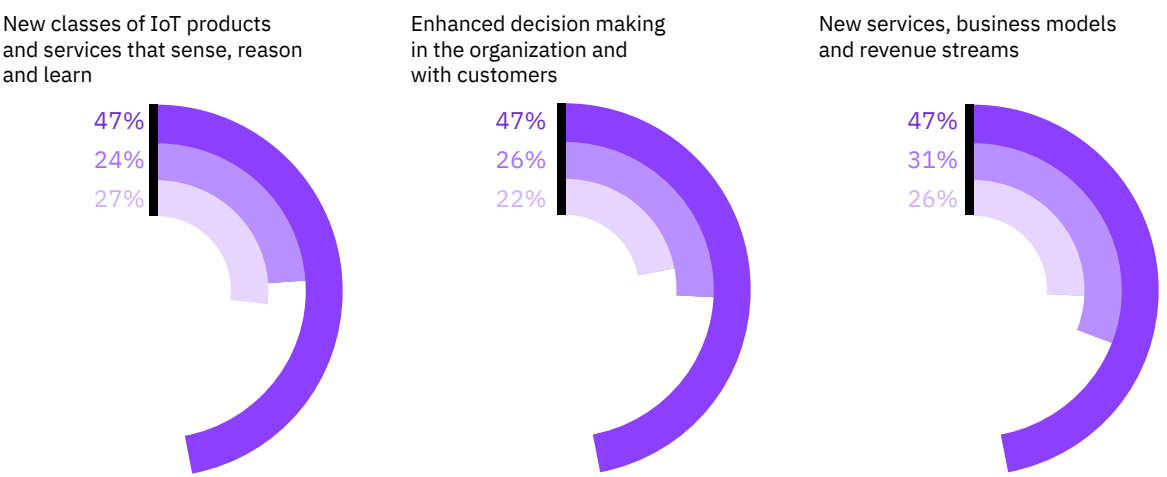
For example, an agricultural startup in California helps growers reduce water consumption and energy usage while increasing its farm production yields. The company implemented a cloud-based, decision-optimization solution that employs IoT and cognitive language processing technologies. Sensors placed in the soil provide data on current conditions. This data is supplemented by unstructured and semi-structured information extracted from agriculture documents and reports, as well as live weather data feeds. As a result, the startup, using a chatbot to conduct personalized question-and-answer dialogue, can provide farmers with tailored farm conditions and predictive recommendations.

Figure 7

Exponential effect

Reinventors use AI for broad transformation

COO Reinventors
Practitioners
Aspirationals



Q. To what extent do you agree that combining AI/cognitive computing and IoT technologies in the scenarios listed above relate to your business?

Predictive analytics has allowed organizations to forecast and operate more flexibly in real time. With AI/cognitive systems connected to the IoT and cloud, they can now automate and autonomize for the unexpected. COOs anticipate creating cognitive processes across their operations. However, they see the greatest benefit in three core areas: risk management (56 percent), demand management and forecasting (43 percent), and inventory and network optimization (39 percent), as we explore in the use cases below.

Risk management: Cognitive + cloud + machine learning

A large energy company in Russia wanted to reduce uncertainty in the exploration and development of oil and gas fields. These activities are not only risky but also enormously expensive and capital intensive. Understanding risks posed by an extended network of suppliers that provide the infrastructure, monitoring systems and services is critical. The company determined that about 80 percent of the data related to assessing this risk was already on the Internet, but it was unstructured. It used an AI risk assessment solution to plumb this mountain of data. The company incorporated advanced machine learning algorithms to assess risk and flag problematic suppliers, including those who might be unable to fulfill their on-time and quality commitments. It then provided analysts with recommended actions.

Demand management/forecasting: Cognitive + cloud

A perfume and cosmetics company in Brazil has increased demand forecast accuracy by 20 percent and enhanced operational agility by enabling real-time “thinking” insights into customer demand. Accurate demand forecasting is vital to planning production and marketing campaigns months in advance. But predicting the demand for a new product that has not yet been released and has no sales history is even more difficult. The company built predictive models that analyze extensive marketing, sales, production and macroeconomic data. Aligning demand from end-customers and franchisees with greater precision, the solution reduces stock-out situations, which results in higher sales and lower costs.

Inventory and network optimization: Cognitive + cloud

A UK-based retailer of electronics and automation components relied heavily on forecasting and planning to meet future product demand. These plans needed to be communicated immediately to suppliers to ensure proper inventory levels. But communications were often slow and disjointed. The retailer solved this challenge by implementing an advanced analytical communications and data-sharing cloud-based platform. Today, they manage supply chain connections in real time and optimize inventory—while consequently improving the customer experience.

Motivate to innovate

"We have optimized our internal processes and systems to offer real-time support to our employees. We can now track our customer queries in real time and resolve them quickly. This leads to a better customer experience."

Chief Operations Officer, Energy and Utilities, United States

Reinventor COOs clearly understand where their industries are headed and can inspire their teams to get there (see Figure 8). They have the tools and techniques, experiences and organizational culture to navigate shifting tides. Seventy-three percent of the Reinventor COOs report that their organizations have been very successful at managing change in the past and can respond to emerging business trends in the same way.

COO Reinventors lead from a position of trust. They actively solicit ideas from their employees and empower their teams to take action. They cultivate autonomy and continuous learning by creating cross-functional teams empowered to respond proactively—with minimal management oversight—to customer needs and new opportunities. Seventy-three percent report having a fluid work structure based on teams that span functions.

Figure 8

COO Reinventors
Practitioners
Aspirationals

Shared vision

Reinventor COOs understand where their industries are headed

Q. To what extent do you agree that your leadership has a strong understanding of where your industry is heading? (To a large extent is 4 or 5 on a 5-point scale.)

Q. To what extent do you agree that your leadership solicits employee input to develop new ideas, promote transparency and empower employees?

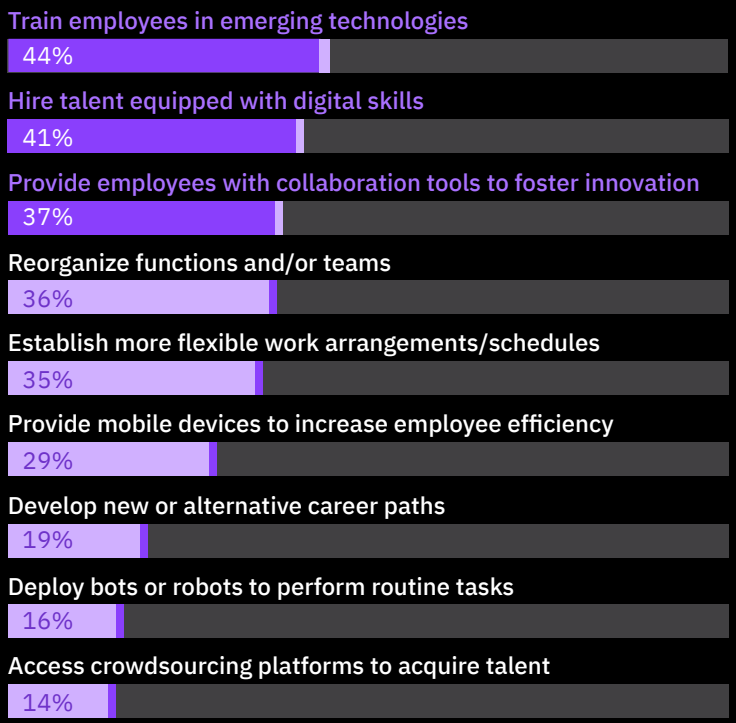
A ship management company in Norway needed to collect considerable data on transport conditions to better investigate incidents. Employees on land and at sea needed to work together efficiently for the safe passage of both vessels and cargo. Employees at sea work in demanding and often inhospitable environments, with safety a top priority. The company developed a collaboration platform with advanced analytics, empowering its employees around the world to share and react to real-time data, ideally before an incident occurs.

As organizations liberate their employees to share in decision making, they still need to upgrade their workforce skills and approaches to talent acquisition. Many COOs are actively training employees in new digital and emerging technologies, while others focus on recruiting the needed talent (see Figure 9). In general, Reinventor COOs focused slightly more than their peers on training versus hiring to acquire skills.

Figure 9

Up to date

Changes in the 2 to 3 years to embrace digital environments



Q. As a result of the changing digital environment, which of the actions listed above is your enterprise most likely to implement within the next 2 to 3 years?

Organizations are pursuing many creative ways to address the digital skills gap in both the short and long term, including new university, technical and vocational programs—as well as apprenticeships and certifications.

Many organizations are considering a "new collar" approach—filling technical jobs with workers who do not have a traditional college degree but *do* have the technical training, skills and aptitudes for many of today's hard-to-fill jobs. One example is Pathways in Technology Early College High Schools (P-TECH) that offer a seamless pathway from high school to college completion and career readiness within six years.[3]

PNC Bank and IBM partnered to expand new collar technical career training opportunities. The program, Corporate America Supports You, is designed to build in-demand technology skills to prepare veterans for new collar careers in the United States.[4] These include skilled positions such as data and cybersecurity analysts.

"We started to hire people with digital skills who can accept any kind of challenge and respond/ support positively."

Chief Operations Officer
IT and Professional Services, UK

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In a recent IBM Institute for Business Value study, "The human-machine interchange," 70 percent of operational executives reported that digitization and intelligent machines lead to higher value work.[5] Sixty-one percent said that intelligent machines will create meaningful impact on changing job descriptions and activities in the next three years.[6]

COOs agree. When asked how AI/cognitive computing will help their enterprises compete in the next several years, 43 percent reported that they expect it to significantly enhance workforce capabilities and productivity. Because AI/cognitive systems don't just provide answers but also the reasoning and evidence behind the answers, they have the potential to elevate employee expertise and the actual value of their work. Paradoxically, it seems, AI/cognitive has the potential to liberate employees from being mere cogs in the machine.

How to create thinking operations: Act now

Uncover to discover

Design thinkers collaborate with their customers, business partners and service providers across the lifecycle of their product/service portfolios.

- Uncover ways to apply intelligence to operational functions and activities to power real-time insights that are suitable for action.
- Broaden your ecosystem of partners and customers. Leverage your ecosystem to achieve competitive differentiation by sharing assets, skills, data and information. Communicate regularly.
- Use design thinking to collaborate with customers and build capabilities across the entire product/service lifecycle. Analyze customer data and conduct detailed journey mapping to explore the customer experience.

How do you plan to collect, connect and consume real-time signals and information for operational agility and flexibility?

Train processes to think

The infusion of AI into the IoT enables a new class of products and services with the ability to reason.

- Use predictive analytics and AI to optimize operational processes. Infuse intelligence into decision making from product/service conception through design and development. Implement using global standards and fine-tune to market specifications.

- Enable a new class of IoT-driven products and processes that can reason and learn with the support of AI. Use AI technologies and cognitive solutions to reveal patterns that people might otherwise not see or predict.
- Instill customer loyalty while creating agile operations with learning processes. Use data interpretation and prediction across the entire value chain, remaining customer-focused.

To what extent will you individualize the customer experience with optimized processes and networks?

Motivate to innovate

Reinventor COOs empower their teams to think, act and share.

- Train employees to embrace emerging technologies and work with intelligent processes. Consider a “new collar” approach that addresses the digital skills gap with technical and vocational programs.
- Create high-value work environments. Empower your teams to decide on the best course of action. Equip them with automated human-to-device and device-to-human understanding. Encourage and reward collaboration and skills sharing.
- Actively solicit input from employees to develop ideas and innovate products, services and processes. Rapidly prototype approaches to enable testing and refinement before full adoption and scaling.

How will you enhance the digital competency of your operations to bring higher value work to your employees?

“AI/cognitive computing will help us to reinvent our business by providing effective knowledge about the needs of our customers with intelligent processes to execute on those needs.”

Chief Operations Officer
Telecommunications, Brazil

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Related IBM IBV C-suite Program executive reports

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Opher, Albert, Mark Peterson, Hila Mehr. “Disruptive Competencies for a Cognitive IoT World.” IBM. March 2017. https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=GBJ03079USEN

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