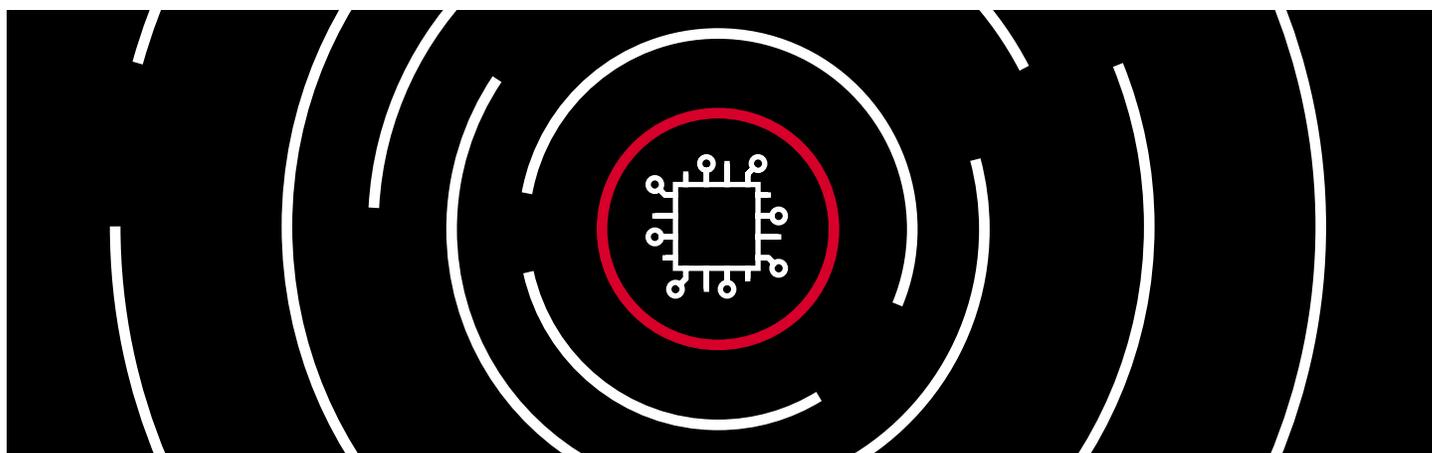


The Big Picture: 2022 Information Technology Industry Outlook

A look ahead to the key strategic trends and opportunities expected to drive the IT industry narrative through 2022 and beyond



Trend 1: The time for immersive work will arrive

Trend 2: Infrastructure will be all of the above

Trend 3: Risk management will need a universal perspective

Trend 4: AI will continue to change the way decisions are made

Trend 5: True leaders emerge as CX tech investments boost equity

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Introduction

The year ahead holds significant promise for IT, especially considering the recent upheaval that swept across the field. Enterprises scrambled to address the changes caused by the COVID-19 pandemic, and vendors and service providers pivoted to fill the needs that these shifts created. This report looks at five key areas in IT that will have significant impacts today and in the near future. They are bound together by the need to more closely connect technology to the people who interact with it, shifting technology from an end to a means. Technology must serve new models of work, meld dispersed elements of infrastructure, and inform and enhance customer experience while securing the systems and information that drive it.

The Take

As organizations transition from the urgent, crisis-driven work of the recent past, they will be well served to reconsider how they have used the technology assets at their disposal. They must become more data-driven and build skills across their business lines to put that data to work to serve their customers, employees and partners. Employees are demanding greater flexibility in how they work, and technology has become a decision point in what companies they choose to work for. Customers want visibility into how and where their data is used and how it is protected. To support all of this, enterprises will have to become skilled at managing and securing a hybrid collection of resources and services if they are to remain competitive in their markets and be an attractive place to work. Technology mastery will pay off for them in those markets and as responsible stewards of their place in society and the planet.

The time for immersive work will arrive

Eric Hanselman, Principal Research Analyst, 451 Research

Chris Marsh, Research Director, Workforce Productivity & Collaboration, 451 Research

The fallout of the pandemic has created a watershed moment for businesses. Seventy-five percent say they will increasingly rely on remote work, which in part explains why 30% of employees say they feel less engaged at work now compared with before the pandemic. It is no surprise, then, that more than 50% of organizations say employee productivity and business agility are more important to their organizational decision-making now compared with before 2020, according to 451 Research's Voice of the Enterprise: Digital Pulse, Business Reinvention & Transformation 2021 and *VotE: Workforce Productivity & Collaboration, Employee Lifecycle & HR 2021* surveys.

The truth is that work has been broken for a good while. The past five years have seen more organizations growing their focus on and investment in improving their workforce's productivity and engagement experience. The pandemic has accelerated and mainstreamed this, and a consensus is emerging around some key ideas. More strategic thought needs to be put into how to create an environment that drives workforce productivity and engagement; it cannot just be the sum of a series of technology choices, HR policies and tradition.

Operational agility, team building and alignment, and individual engagement emerge as key business goals that cannot be achieved if they are only seen as the outcomes of technology choices designed to address functional challenges. A new kind of operational culture is needed where more trust is placed in employees to design and orchestrate their own work, with the appropriate guardrails to keep teams aligned with governance, compliance and strategic objectives.

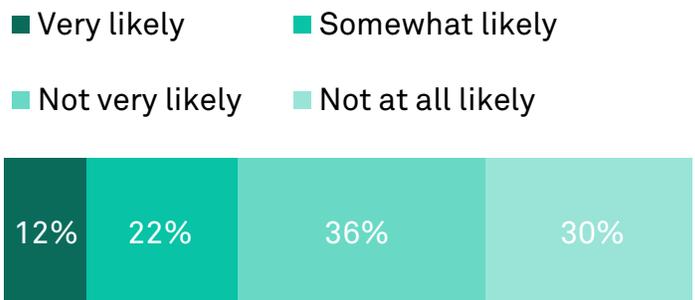
Technology decision-makers are looking to their organizational leadership to step up and help frame this new positioning. The implications of not getting this right are clear: Employees are already switching jobs at high numbers as part of the "great resignation." The desire for a more fulfilling daily work experience – not just for compensation and benefits – is featuring more strongly in decisions about where people choose to work.

This turning point has implications for organizations. First, it is reorienting workplace technology investments. Seventy-one percent of technology decision-makers say the pandemic has impacted their longer-term workforce technology strategies, while 27% say "very significantly" so. For many organizations, part of this approach is to be less reliant on point solutions and have a more strategic focus on the core estate of applications. Integrating the core estate can generate more workflow value and a better overall experience for employees.

Second, organizations will need to elevate their employee experience. The "work execution culture" is becoming a central pillar of employee experience strategies crucial for a range of business goals, such as talent retention and acquisition, operational innovation and customer engagement. To that last point, a strong customer experience is built on a strong employee experience.

The transition to a long-term hybrid model will prove to be more disruptive than was the immediate shift to remote work in the early days of the pandemic, bringing with it a new set of corporate, cultural, technology and operational challenges. In the short term, business process and workflow innovation are among the key priorities. Seventy-six percent of technology decision-makers believe that their departmental processes and workflows need to change for decision-makers to effectively adjust to the new environment created by the coronavirus pandemic, according to 451 Research's *VotE: Workforce Productivity & Collaboration, Technology Ecosystems 2020* survey.

Figure 1: Accepting New Job Based on Better Availability of Devices, Applications



Q. How likely would you be to accept a new job if the only way it differed from your current job was better availability of devices, applications, and other productivity tools?
Base: All respondents (n=1,033)
Source: 451 Research's Voice of the Enterprise: Workforce Productivity & Collaboration: Employee Engagement 2020

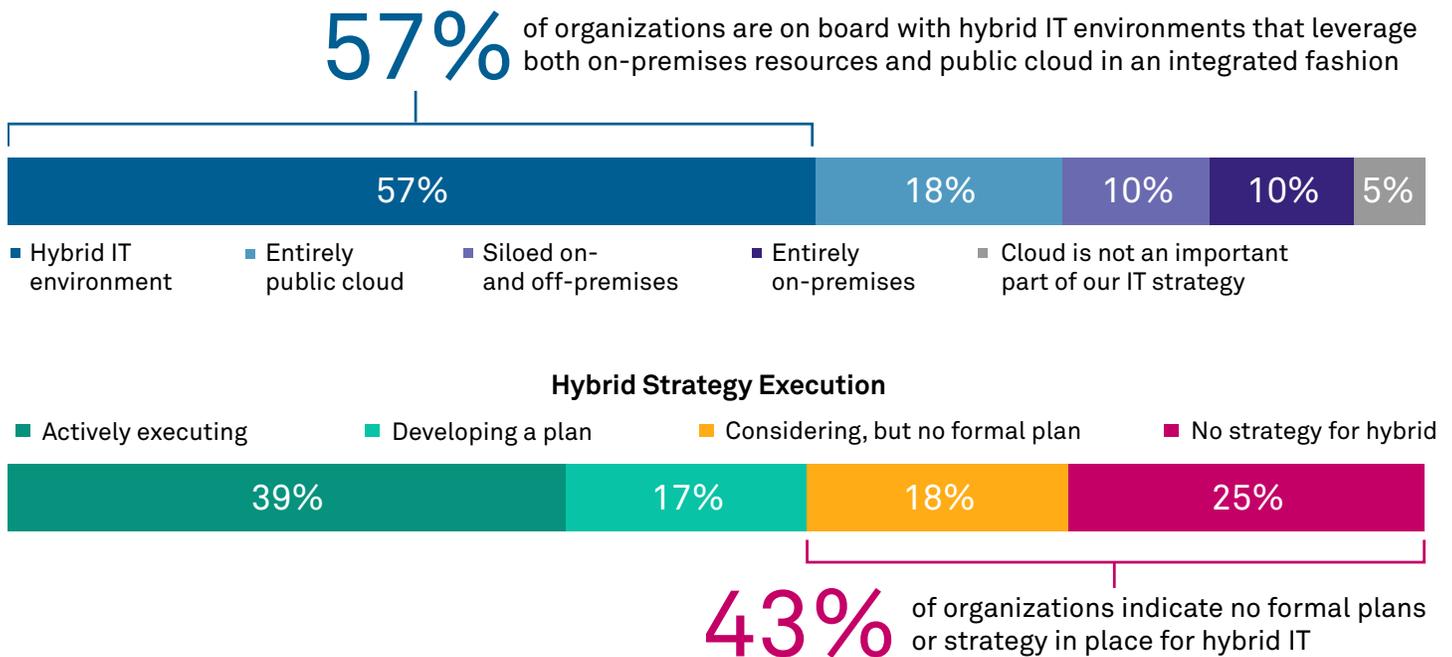
Infrastructure will be all of the above

Dr. Owen Rogers, Research Director, Cloud & Managed Services Transformation, 451 Research

Eric Hanselman, Principal Research Analyst, 451 Research

The real-world validation of the resilience of the cloud operating model for IT will have repercussions long after the dust has settled on the COVID-19 pandemic. Hyperscalers and other cloud providers kept up a steady pace of service innovation and portfolio growth during stay-at-home mandates. In fact, cloud services in large part were enablers of this transition along with broadband access providers, with virtual desktop infrastructure, videoconferencing applications and streaming services ably weathering an unprecedented surge in traffic. Cloud’s ability to flex usage in response to changes in volume served a dual role: accommodating surging demand for at-home services while conserving costs and enabling/accelerating digital transformation for industries, such as travel and hospitality, for which business activity plummeted. In fact, 54% of enterprises are increasing their proportion of workloads on cloud, according to VotE: Digital Pulse, Vendor Evaluations 2020. Of all the uncertainty over the past year, the resilience of the technology used to get through these challenging times has rarely, if ever, been in question.

Figure 2: IT Environment Strategic Vision



Q. Which of the following best describes your organization's existing or planned IT operating environment? (n=434)

Q. Which of the following best describes the state of your organization's strategy regarding hybrid IT? (n=457)

Base: All respondents

Source: 451 Research's Voice of the Enterprise: Cloud, Hosting and Managed Services, Organizational Dynamics 2020

The Big Picture

Cloud is ultimately an operating model; consumption is on-demand and flexible, and infrastructure is managed independently of the applications on top. These characteristics made cloud powerful during such unpredictable times. A decade ago, this model only really applied to public clouds, but now, cloud is spreading to on-premises and expanding myriad edge locations. Established tech vendors and hyperscalers are expanding offerings in both spheres. Enterprises like the flexible cloud model, but they do not want to be constrained by location. They want to locate workloads for their own convenience, cost and scalability, making hybrid the de facto model for enterprises, with 57% stating they are following a hybrid approach; see Figure 2.

Being able to choose the right location for each workload allows great flexibility, which is only really unleashed when enterprises can manage them together as one. Cloud management platforms provide tools to move workloads between clouds. Telcos and colocation providers are enabling fast connectivity between disparate environments. And cloud providers themselves are launching services that allow cross-cloud interoperability. Service providers and systems integrators are looking to manage these environments as managed services.

Cloud-native frameworks present a tremendous opportunity for organizations to fundamentally transform their businesses by providing the means by which applications can scale across public, private and edge locations to best take advantage of capability. The replatforming to cloud native is well underway across all industries, but like replatforming to the internet and web in the 2000s, it will take a few years. Cloud native enables faster software releases and delivers incremental value more quickly, reducing technical debt and

Seeing the successes proven by the cloud during difficult times, in 2022, enterprises will emphasize making IT flexible, scalable and optimized for each specific workload.

improving collaboration. However, the benefits of cloud-native computing, especially reducing operational overhead and better agility, are not without challenges. Among them is how to best integrate all the moving parts associated with cloud-native applications, especially considering skills shortages, which vendors and service providers are looking to address.

For many, hybrid cloud is still an aspiration: 43% of enterprises have no formal hybrid plan in place. But an ecosystem of companies exists to help make this dream a reality, and enterprises must put this to work. Seeing the successes proven by the cloud during difficult times, in 2022, enterprises will emphasize making IT flexible, scalable and optimized for each specific workload. They will have to do that with well-managed hybrid and multicloud architectures to remain competitive. And it is clear that cloud infrastructure and cloud-native application development/operations are no longer special bespoke variations – they are mainstream IT.

Risk management will need a universal perspective

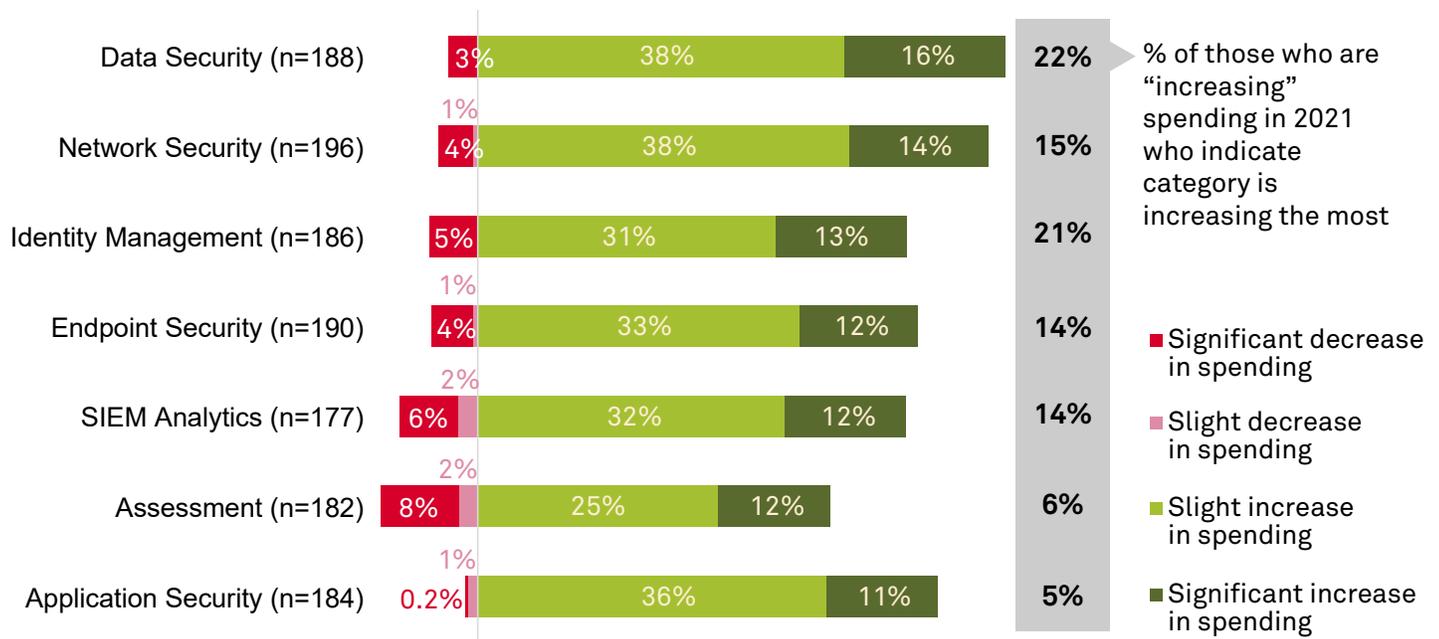
Scott Crawford, Research Director, Information Security, 451 Research

Eric Hanselman, Principal Research Analyst, 451 Research

If cybersecurity is a field defined by incidents as much as by innovation, the impact of 2021 may be felt for a long time to come. The year was heralded by one of the most extensive attack campaigns against the IT supply chain ever witnessed: the compromise of SolarWinds and many others relying on its technology in the public and private sectors. Major strategic vendors such as Microsoft have also been targeted, while physical supply chains and logistics fell prey to the widespread scourge of ransomware in major incidents including the compromise of Colonial Pipeline in the U.S. and Brazil-based food industry supplier JBS. More recently, a lawsuit was brought against an Alabama hospital alleging a death related to ransomware. The highest levels of government around the world have been compelled to respond, with the White House issuing executive orders on cybersecurity in the U.S. and the subject factoring into summit talks among world leaders.

These incidents highlight the drivers of trends shaping today's security technology and services markets. Among these, better visibility into adversary activity has been at or near the top of the list. Threat detection, along with user behavior and phishing – among the most exploited aspects of attacker targeting – are among the top five most cited information security pain points among respondents to 451 Research's VotE: Information Security, Vendor Evaluations 2021 survey. Reflecting this concern has been the rise of industry trends such as extended threat detection and response, or XDR.

Figure 3: Expected Spending Changes for Vendor-Based Security Tools in 2021



Q. For each of the following vendor-based security tools, how will your organization's spending change in 2021 – if at all – compared to 2020?

Base: All respondents

Source: 451 Research's Voice of the Enterprise: Information Security, Budgets and Outlook 2021

The Big Picture

The synergies of endpoint and network detection and response and related fields enhancing security operations effectiveness have helped to forge the larger trend of XDR. XDR is having a disruptive impact on the markets serving security operations teams and not just in technology products. It has become a center of gravity in managed security services as well, introducing a field of competitors in managed detection and response that helps clients make the most of these emerging techniques with specialized expertise.

These technologies reflect even larger trends shaping the industry. Visibility not only in adversaries and their tactics but also into the attacker's view of its targets – what may be collectively thought of as “outside-in” visibility into the threat landscape – is the unifying theme in more than \$5 billion in M&A activity in the past year alone. Meanwhile, adversary exploits of identity and access privileges evident in attacks such as ransomware are a key factor in driving continued interest in so-called zero trust initiatives shaping the identity and access management and data security markets (see Figure 3).

Technologies formerly deployed only within the brick-and-mortar enterprise are now appearing virtually anywhere because of approaches such as the secure access service edge. As organizations continue to adapt to a new work-from-anywhere reality, we expect heightened sensitivity to attacker activity and improved defense against continued and highly damaging attacks such as ransomware to define key movements in the security market.

Visibility not only in adversaries and their tactics but also into the attacker's view of its targets – what may be collectively thought of as “outside-in” visibility into the threat landscape – is the unifying theme in more than \$5 billion in M&A activity in the past year alone.

AI will continue to change the way decisions are made

Nick Patience, Research Director, Data, AI & Analytics, 451 Research

Eric Hanselman, Principal Research Analyst, 451 Research

Artificial intelligence has changed the way decisions are made from being a combination of human judgment and rules-based process to being a combination of those two elements along with predictions made by models trained by large volumes of disparate data. For decades, we have had predictive analytics based on historical, and almost always structured, data. Predictive analytics were usually done using on-premises tools, results took a long time to produce and integrating predictions into other applications was difficult. We are moving to an era where we can make predictions based on structured, unstructured and semistructured data. Now we have predictions driven by models that are adapting and learning all the time and can be retrained.

This has implications for:

- **The way software is developed and deployed.** Introducing machine learning models into applications requires them to be monitored and retrained; this is known as MLOps.
- **The way humans make predictions.** More decisions can be automated by arguably more sophisticated models using broader and deeper datasets.
- **Speed of decision-making.** Cloud and faster infrastructure have enabled everything to happen much faster and in more places. The market for cloud-based data science and analytics tools is set to grow three times faster than on-premises, according to 451 Research's Market Monitor for Data Science & Analytics tools.
- **What skills are needed**, both in the software development phases and in general usage.

China's new Data Security Law and Personal Information Protection Law came into effect in the second half of 2021, and we expect more to come. The European Commission announced a proposed AI act in April featuring tiers of AI risks; the act will work its way through member countries' parliaments in coming years. The U.K. announced its National

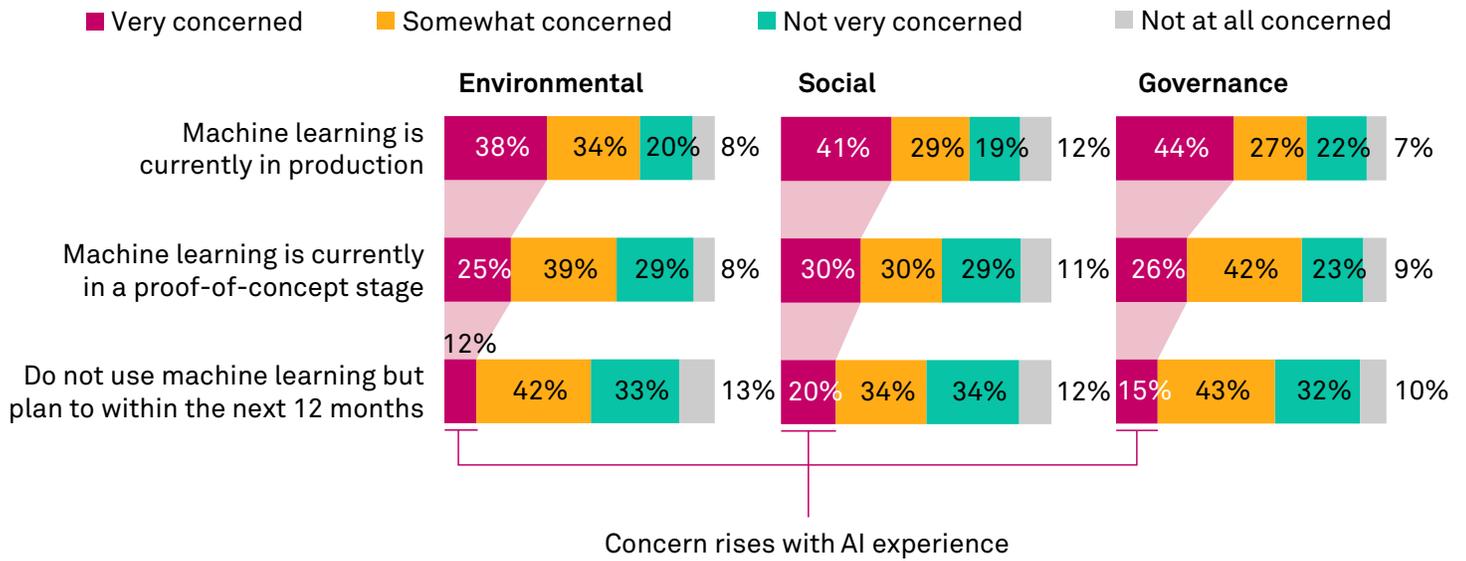
2022 will see several issues rise up the list of concerns about AI: the continuing march toward more automated decision-making, sustainability, and an increasingly complex AI regulatory environment.

AI Strategy in September, which looks to update regulations for the AI era. The U.S. published updated guidance for regulating AI in December 2020 but has no general regulatory framework for AI yet. These and other countries' efforts will not be resolved in 2022 and will become more complex as a global patchwork of regulatory standards emerges that organizations will have to comply with eventually.

Some elements of AI – notably large language models using models called transformers, trained on massive datasets to produce prose, poetry, code, music and other outputs – can cost tens of millions of dollars to train due to the vast compute resources, and thus energy, required. And each time they need to be retrained, more resources are required. Some 72% of organizations with machine learning in production say they are either “very” or “somewhat concerned” about the environmental impact of AI, according to VotE: AI & Machine Learning, Infrastructure 2021 (see Figure 4). On the flip side, the U.K.'s National Grid halved errors in electricity forecasting using a transformer model, which should lead to lower carbon emissions and costs as demand prediction is a crucial factor in running the grid on a net-zero generation basis in coming years.

The Big Picture

Figure 4: ESG Concern at Different Stages of Machine Learning Adoption



Q. Finally, how concerned are you about each of the following? – Machine learning being used for immoral or unethical purposes (n=688); The environmental impact of executing/building/training/deploying ML models (n=682); Government regulation of AI/ML initiative (n=685)
 Base: All respondents
 Source: 451 Research's Voice of the Enterprise: AI & Machine Learning, Infrastructure 2021

2022 will see several issues rise up the list of concerns about AI: the continuing march toward more automated decision-making, sustainability, and an increasingly complex AI regulatory environment – even before any such proposal becomes law. We also expect more focus on data literacy in organizations and more focus on AI bias and explainability.

True leaders emerge as CX tech investments boost equity

Sheryl Kingstone, Research Director, Customer Experience & Commerce, 451 Research

Eric Hanselman, Principal Research Analyst, 451 Research

While 2020 changed the face of customer experience, or CX, by forever accelerating the shift to digital, what has not changed is 451 Research's analysis that experiences are the battleground for competitive differentiation. We are witnessing a dramatic shift in the balance of power between many organizations and their customers across virtually all industries. Competing on price and products is no longer enough because customers value experiences. Organizations can digitally transform their businesses by leveraging the latest applications, analytics and infrastructure to provide customers with a differentiated experience that is not a luxury but is a necessity for survival.

The power of a digital transformation strategy lies in executive leadership determining its vision and objectives. Formal digital transformation strategies have accelerated over the past decade. According to a 2020 survey conducted by 451 Research, 54% of businesses have formal strategies in place, up from 43% in 2019 and 29% in 2016. The results also show that 24% of businesses consider themselves early adopters of technology. Technology today can ensure that businesses meet changing customer expectations, but many businesses have a long way to go to ensure that vision meets reality.

As we head toward a post-pandemic reality, businesses must address the shifting behaviors and preferences of empowered consumers not just online but across the entire customer journey. Once-aspirational views of innovative digital experiences are now requirements for future immersive experiences in both business-to-customer and business-to-

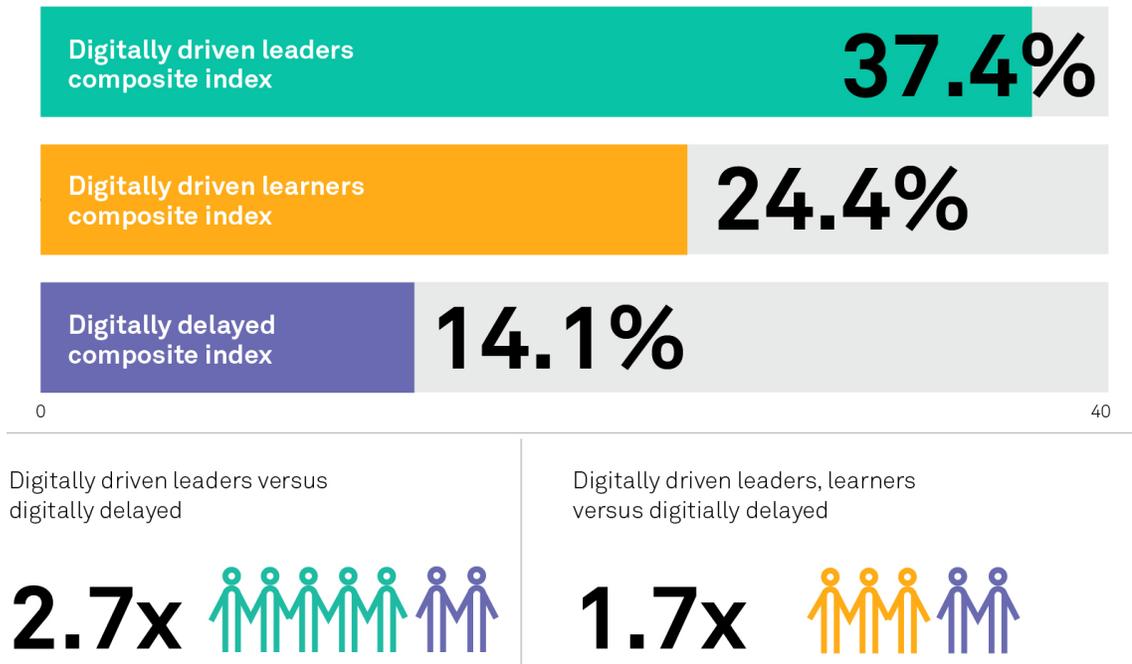
We are witnessing a dramatic shift in the balance of power between any organizations and their customers across virtually all industries.

business markets. B2B organizations are not immune to rising customer expectations for less friction and improved digital experiences, with 80% of businesses stating that they are likely to stop buying from a vendor because of poor CX. This is driving digital transformation acceleration, including the need for more modern applications for front-line employees and customer self-service.

Companies that are using digitization as a way of focusing on and adapting to their customers' needs have a clear advantage from the standpoint of investor appetite. Indeed, CX leaders have a higher composite index equity return than their digitally delayed counterparts. Our data shows how the use of CX focus and technology investments affects companies' equity performance and creditworthiness across sectors (see Figure 5).

The Big Picture

Figure 5: Comparing the Averages



Sources: S&P Global Ratings and S&P Global Market Intelligence, June 2021

Digital transformation is real, and it is happening. Every business is becoming a digital business through the delivery of one or more of the following:

- Innovative products, services or business models.
- Continuous improvement in business operations.
- Personalized experiences for customers, employees and partners.

As businesses look to navigate shifting market dynamics, tracking the changing behaviors and preferences of digitally empowered consumers will help inform businesses' CX strategy over the next two to three years. Ultimately, a CX strategy is key to making or breaking a business, bearing significant influence over revenue. This requires a well-planned approach to business and IT innovation and investing in new tactics to remain relevant in the eyes of customers.

As businesses increase their spending to improve digital experiences, investments in intelligent personalization, customer engagement, and customer data and intelligence emerge as the most prominent areas of focus for CX technology. Convenience, context and control act as the common baseline that guides thinking around expectations for engagement through both digital and physical interactions, partly because of the COVID-19 pandemic. Organizations must measure and align future CX investments with the latest expectations around convenience, context and control for both the customers and the employees who support them on their journey.

Businesses are shifting priorities to implement technologies that facilitate experiences that drive stickier relationships and competitive differentiation, key to the digital-first future. Execution is at a critical stage, and digital maturity matters as businesses focus investments on cloud infrastructures, AI and machine learning, and data-driven insight to deliver new immersive, frictionless and contextual experiences.

Further reading

[Voice of the Enterprise: Information Security, Vendor Evaluations 2020](#)

[Voice of the Enterprise: Information Security, Budgets & Outlook 2021](#)

[Voice of the Enterprise: AI & Machine Learning, Infrastructure 2021](#)

[Voice of the Enterprise: Digital Pulse, Business Reinvention & Transformation 2021](#)

[Voice of the Enterprise: Workforce Productivity & Collaboration, Employee Lifecycle & HR 2021](#)

[Voice of the Enterprise: Workforce Productivity & Collaboration: Employee Engagement 2020](#)

[Voice of the Enterprise: Workforce Productivity & Collaboration, Technology Ecosystems 2020](#)

[Data, AI & Analytics Market Monitor: Data Science & Analytics, September 2021](#)

[Data science and analytics in the cloud set to grow three times faster than on-premises, September 2021](#)

[Customer Experience Focus Can Improve Equity And Credit Performance, September 2021](#)

['Outside in' visibility: Security's new hot approach complements 'inside out' trends, August 2021](#)

[The Rise of Extended Detection and Response, June 2021](#)

Methodology

Reports such as this one represent a holistic perspective on key emerging markets in enterprise IT. They combine quantitative and qualitative insights driven by our data products and informed by intensive market research. These markets evolve quickly, though, so 451 Research offers additional services that provide critical marketplace updates. These updated reports and perspectives are presented on a daily basis via the company's core intelligence service, 451 Research Market Insight. Forward-looking M&A analysis and perspectives on strategic acquisitions and the liquidity environment for technology companies are also updated regularly via Market Insight, which is backed by the industry-leading 451 Research M&A KnowledgeBase.

Emerging technologies and markets are covered in 451 Research channels including Applied Infrastructure & DevOps; Cloud & Managed Services Transformation; Cloud Native; Customer Experience & Commerce; Data, AI & Analytics; Datacenter Services & Infrastructure; Information Security; Internet of Things; and Workforce Productivity & Collaboration.

Beyond that, 451 Research has a robust set of quantitative insights covered in products such as Voice of the Enterprise, Voice of the Connected User Landscape, Voice of the Service Provider, Cloud Price Index, Market Monitor, the M&A KnowledgeBase and the Datacenter KnowledgeBase.

All of these 451 Research services, which are accessible via the web, provide critical and timely analysis specifically focused on the business of enterprise IT innovation.

For more information about 451 Research, please go to: www.451research.com.

This report cites data from the following 451 Research surveys:

- **Voice of the Enterprise: AI & Machine Learning, Infrastructure 2021** – This web-based survey was fielded from May 5 to May 27, 2021, among approximately 700 IT end-user decision-makers worldwide.
- **Voice of the Enterprise: Digital Pulse, Business Reinvention & Transformation 2021** – This web-based survey was fielded from May 6 and June 21, 2021, among approximately 445 IT and line-of-business decision-makers worldwide.
- **Voice of the Enterprise: Information Security, Vendor Evaluations 2020** – This web-based survey was fielded between Aug. 6 and Nov. 30, 2020, among approximately 420 IT decision-makers and technology practitioners primarily based in North America.
- **Voice of the Enterprise: Information Security, Budgets & Outlook 2021** – This web-based survey was fielded between Oct. 29, 2020, and Jan. 21, 2021, among approximately 500 IT decision-makers and technology practitioners primarily based in North America.
- **Voice of the Enterprise: Workforce Productivity & Collaboration, Employee Lifecycle & HR 2021** – This web-based survey was fielded in March 2021 among approximately 250 IT end-user decision-makers worldwide.
- **Voice of the Enterprise: Workforce Productivity & Collaboration, Employee Engagement 2020** – This web-based survey was fielded in October and November 2020 among approximately 1,000 IT and line-of-business decision-makers, managerial and nonmanagerial employees.
- **Voice of the Enterprise: Workforce Productivity & Collaboration, Technology Ecosystems 2020** – This web-based survey was fielded from Sept. 30 through Oct. 9, 2020, among approximately 500 IT end-user decision-makers worldwide.

Key contacts

451 Research analyzes the technologies, services and companies that disrupt and evolve information technology. For more information on how to access 451 Research's unique, data-driven insight, please contact 451sales451@spglobal.com.

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