Kong

2021 Digital Innovation Benchmark

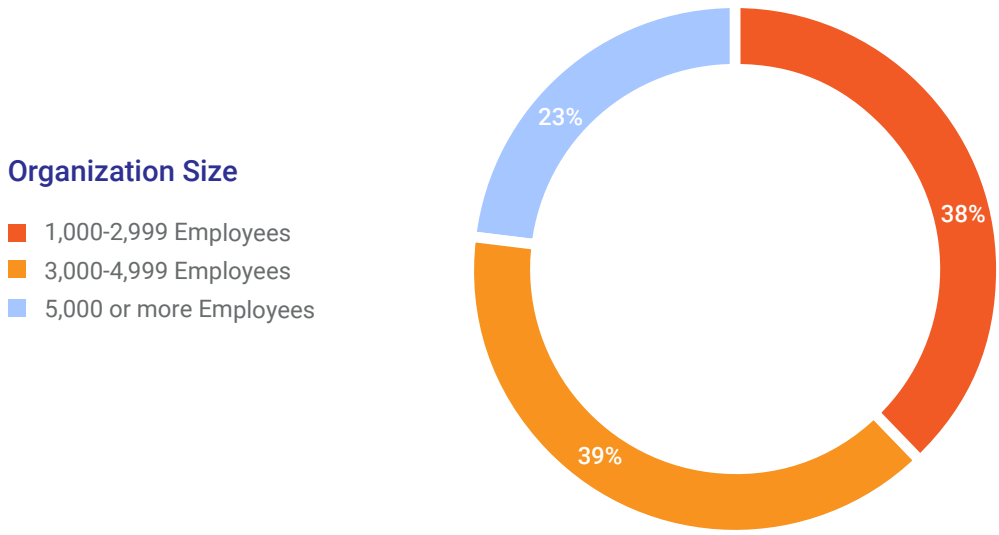
INTRODUCTION

What do technology leaders need to know to remain competitive in an innovation-driven business landscape?

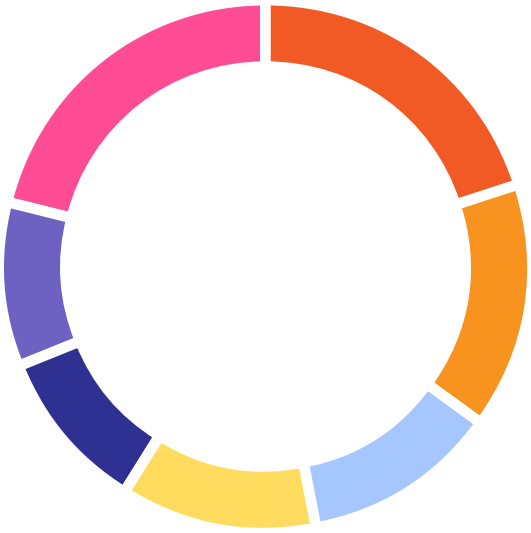
In our annual Digital Innovation Benchmark report, we explore how today's leading organizations are using modern software architectures and other emerging technologies to enable business innovation. The 2021 edition of our report investigates such questions as:

- What is the current state of IT initiatives and challenges?
- How does the IT landscape within organizations impact their overall ability to innovate?
- What IT strategies are organizations using to increase their agility?
- What challenges do organizations face in executing their key IT objectives?
- How are organizations addressing these challenges?

Kong engaged Vanson Bourne to field a survey of 400 senior technology decision makers in the U.S. and Europe, including CIOs, CTOs, VPs of IT, IT directors/architects and software engineers/developers from organizations across a range of industries.

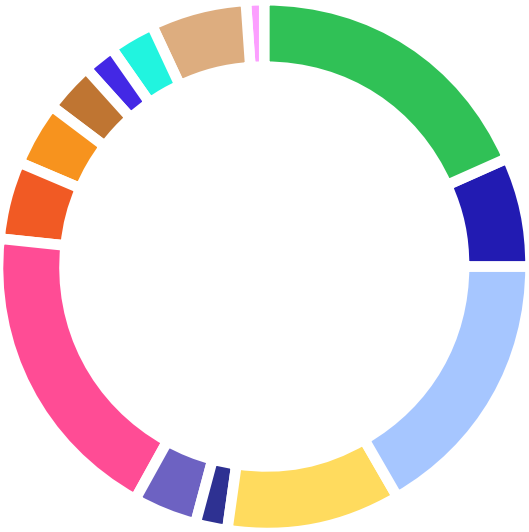


Organization Sector



- IT, technology and telecoms **20%**
- Business and professional services **15%**
- Financial services **12%**
- Retail, distribution and transport **12%**
- Manufacturing and production **10%**
- Construction and property **10%**
- Other commercial sector **21%**

Job Role



- Chief Information Officer (CIO) **19%**
- Chief Information Security Officer (CISO) **7%**
- Chief Technology Officer (CTO) **17%**
- VP/Head of IT **11%**
- VP/Head of Architecture **2%**
- VP/Head of IT Security **4%**
- IT Director **19%**
- IT Security Director **5%**
- IT Architect **4%**
- IT Infrastructure Architect **3%**
- IT Solution Architect **2%**
- DevOps **3%**
- Software Engineer/Developer **6%**
- Software Architect **1%**

The survey was fielded in December 2020-January 2021, with respondents coming from a range of industries, including business and professional services; financial services; IT, technology and telecoms; manufacturing and production; and retail, distribution and transport. Vanson Bourne rigorously screened interview candidates to ensure suitability and data quality.

TABLE OF CONTENTS

Innovate Fast or Fail Even Faster 5

Speed of Innovation Cannot Undermine Quality 11

Open Source Powers Digital Innovation 15

Microservices Enable Innovation 17

Complexity and Challenges of Microservices at Scale 22

What Technology Leaders Need to Know 26

Innovate Fast or Fail Even Faster

Do or Die: The High Stakes of Digital Innovation

Innovation is the bedrock of our technology-fueled economy, but even in an era when long-standing industries continue to be disrupted by startups with new technologies, innovation continues to accelerate.

The need for rapid innovation influences everything from new product design with agile development cycles to just-in-time supply chains to M&A activities. “Disruption” has become a cliché for a reason: because it has replaced “creative destruction” as the ideological foundation of technology-driven, free-market economies.

62%

of technology leaders fear they are at risk of being displaced by competitors who innovate more quickly

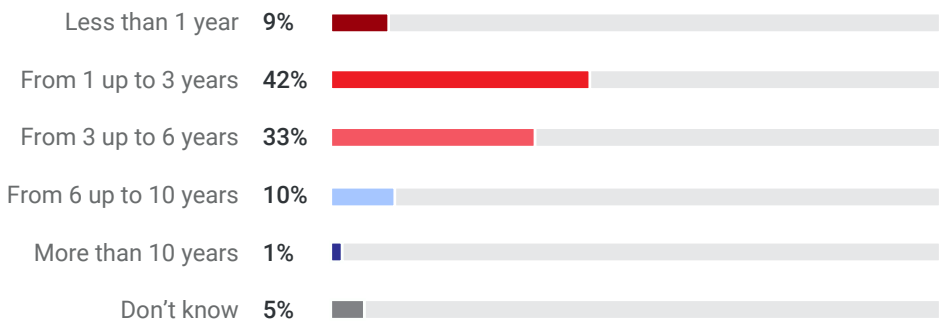
Today, the speed at which an organization innovates is a critical factor in determining the overall viability of the business. In our previous 2020 Digital Innovation Benchmark report, 57% of technology leaders across industries reported being concerned that they were at risk of being left behind by competitors if their own organizations innovated too slowly. In our 2021 Digital Innovation Benchmark report, that number jumped to 62%.

51%

of organizations believe they can only survive up to three years before going out of business or being absorbed by a competitor if they are unable to keep up with digital innovation.

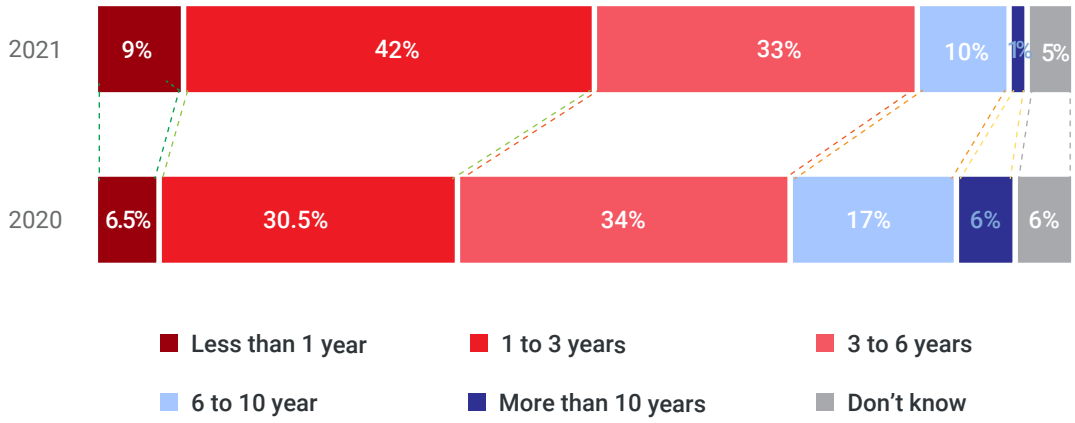
In fact, technology leaders believe that slow innovation could serve as a near-term death knell for their organizations. A full 84% of respondents believe that their businesses will fail in under six years if they are slow to innovate. Again, that numbers represent an increase from 2020, when 71% of respondents believed their organizations would fail within six years if they didn't keep pace with digital innovation in their industries.

Survival Time if Unable to Keep Up With Digital Innovation



The urgency to innovate has significantly increased over the last year. While in 2020 a stunning 37% reported they believed organizations would be out of business in fewer than three years if they failed to keep pace with innovation, this number jumped even higher in 2021 to a whopping 51%.

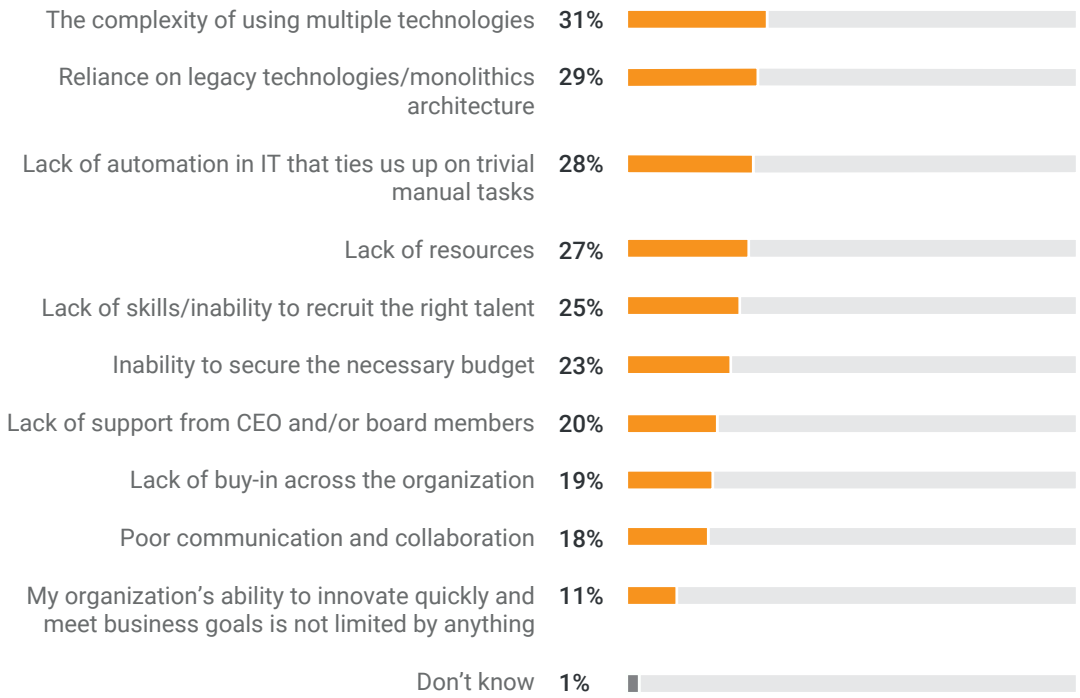
Survival Time: 2020 vs. 2021



In 2020, a measly 6% of respondents believed that their organizations could survive 10 years or longer without rapid innovation. This year, with a larger and more geographically diverse respondent pool, that number has fallen all the way down to 1%.

Technology leaders that we spoke to cite a number of factors that hinder their ability to innovate quickly in order to meet business goals.

Limiting Factors for Innovating Quickly and Meeting Business Goals



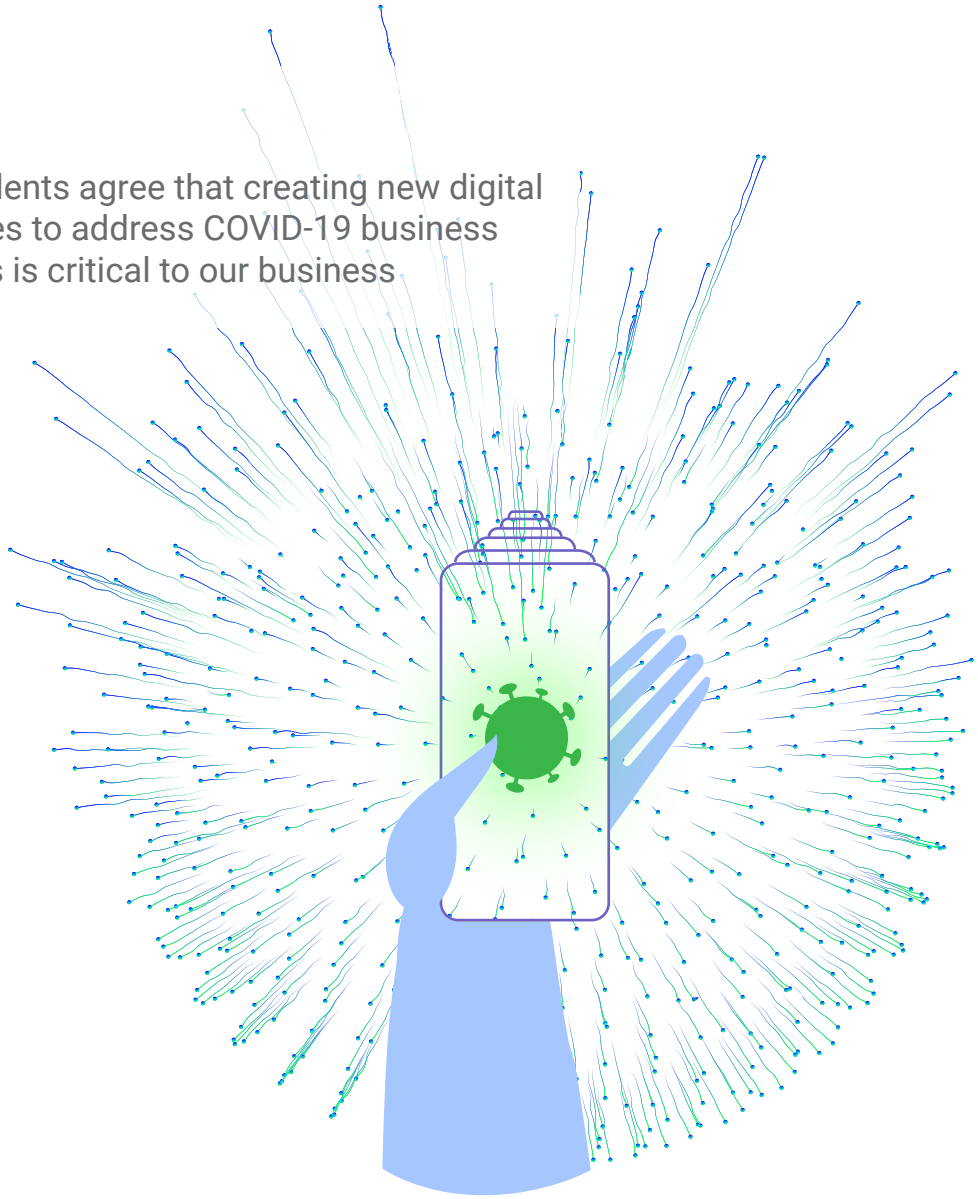
COVID-19 Pandemic Accelerates Existing Trends

One major difference between this year's report and last year's is the impact of the COVID-19 pandemic, so we asked technology leaders how COVID-19 is impacting their digital innovation efforts.

The pandemic has impacted the economy unevenly, harming industries like hospitality while buoying such sectors as teleconferencing. However, technology leaders across the economy and in both the U.S. and Europe overwhelmingly agree (89%) that creating new digital experiences to address COVID-19 business challenges is a business-critical endeavor.

89%

of respondents agree that creating new digital experiences to address COVID-19 business challenges is critical to our business

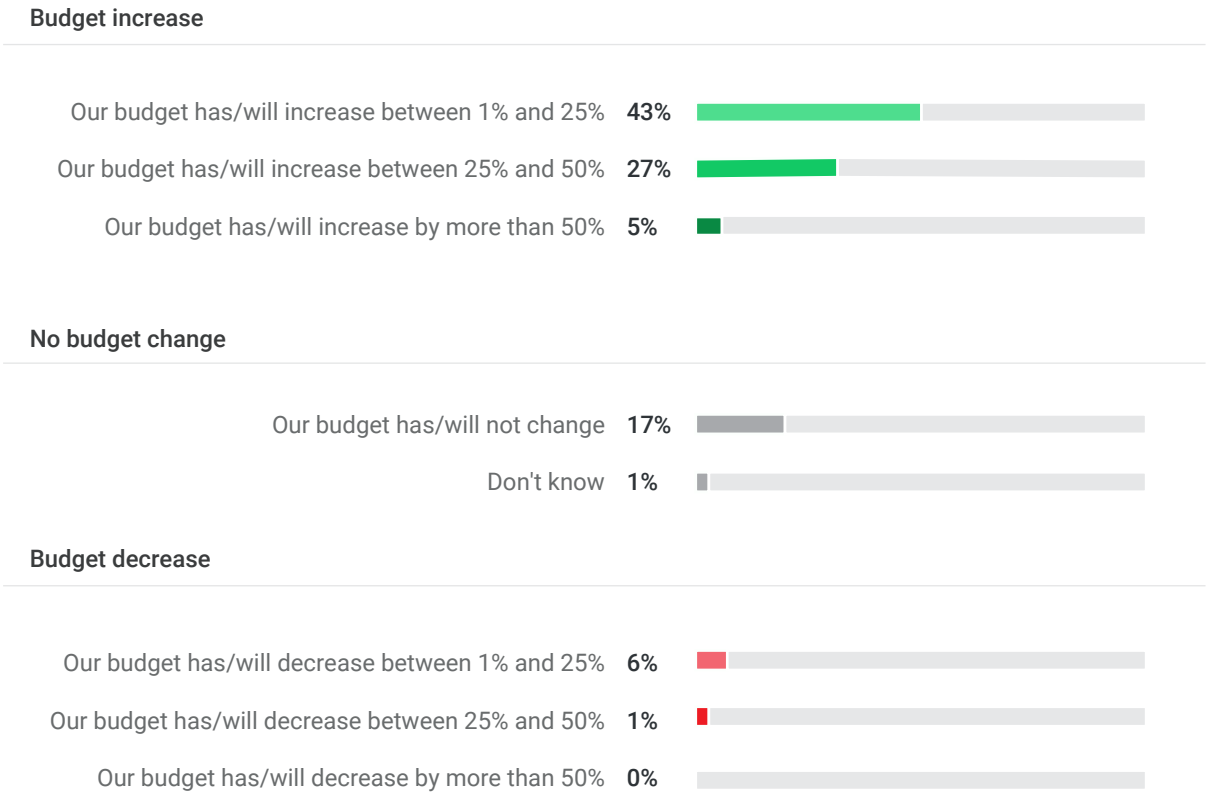


As COVID-19 pushes a range of physical activities online, our survey respondents unsurprisingly report that COVID-19 is accelerating, not hindering, digital transformation initiatives. Just under two-thirds of technology leaders we surveyed (64%) report that COVID-19 has had no impact on multi-year digital transformation projects, has triggered a slight increase in investments into these projects (24%) or has sparked a significant increase in their investments (11%).

In fact, COVID-19 has forced organizations to invest more into IT and developer resources. Three-quarters (75%) of survey participants expect to see an increase in their IT/developer budgets in the next 12 months, with 27% of respondents expecting an increase of 25-50% in their budgets and 5% of participants expecting to see more than an increase of 50%.

Slightly more U.S. technology leaders expect their organizations to invest more in the next year than their European counterparts, 79% in the U.S. vs. 72% in Europe.

COVID-19 Impact on Digital Transformation Projects



In both the U.S. and Europe, COVID-19 is having an effect on technology leaders' computing and networking architectural choices.

In the U.S., 51% of organizations have increased their focus on security versus 40% in Europe. This could be because European technology leaders have already invested more into Internet security since their digital privacy laws (such as the GDPR) are more well-established than similar laws in the U.S. (California's CCPA, New York Privacy Act and others.

More than 2 in 5 U.S. technology leaders (41%) say that COVID-19 has accelerated their transition to the cloud. In Europe, more technology leaders (44%) say that the pandemic has accelerated their transition to the cloud. The reason for the greater number of migrations in Europe is likely a mirror image of the security data point above, with more U.S.-based organizations already transitioned to the cloud than in Europe.

Nearly 40% of technology leaders in both the U.S. (37%) and Europe (38%) say that the pandemic has accelerated their adoption of microservices and cloud native architectures.

A sizable number of technology leaders also said that:

	Overall (%)	U.S (%)	Europe (%)
COVID-19 has increased their focus on reliability and availability	**43**	43	43
It has increased their focus on performance and scalability	**41**	42	40
It has delayed projects that introduce new architectural choices	**28**	33	22

On the negative side of the scales, the pandemic has prompted 9% of organizations in the U.S. and 5% in Europe to significantly delay or even cancel digital transformation initiatives because of the pandemic. Roughly a quarter of all respondents (24%) say that the pandemic has slightly delayed digital transformation efforts, slowing them by fewer than six months.

More businesses in the U.S. faced long delays or cancellations than in Europe, 9% vs. 5%, and U.S.-based businesses were also more likely to see short delays of six months or less than in Europe, 29% vs. 19%.

Speed of Innovation Cannot Undermine Quality

Moving Fast Is Again a Top Priority, but Quality Matters More

To assess how quickly technology leaders are pursuing various innovation efforts, we annually ask them to rank their top three priorities. In our 2020 report, leaders ranked improving operational efficiency (47%), reducing costs (41%) and improving application security (40%) as their top priorities.

In 2021, technology leaders shifted priorities. “Improve operational efficiency” is still the most cited priority, with 39% of all respondents citing it as a top-three priority. Reducing costs, which was the second most commonly listed priority last year, has fallen to fourth place (33%) behind “improve application performance/reliability” (37%) and “improve application security” (35%).

The top three priorities varied slightly between our U.S. and European respondents. U.S. technology leaders ranked “improve application security” as their number-one priority, with roughly 2 in 5 (38%) listing it as one of their top-three priorities. Their second and third top priorities for the coming year are “improve operational efficiency” (37%) and “improve application performance/reliability” (36%), respectively.

European respondents ranked “improve operational efficiency” as their top priority (41%), followed by “improve application performance/reliability” (39%). The third-most cited priority results in a tie between “reduce cost” (33%) and “accelerate innovation” (also 33%).

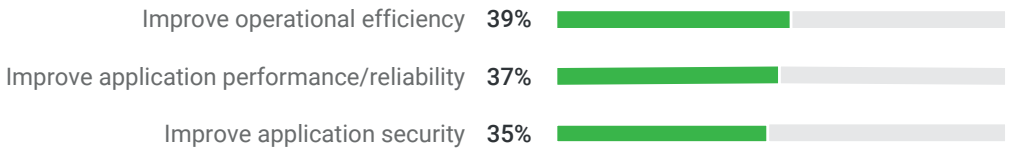
U.S. leaders cited “accelerate innovation” less often than their European counterparts (22% vs. 33%), but we believe this is due to U.S. businesses, in general, adopting new technologies more quickly than European businesses.

However, this data point shifts somewhat when we ask a different question about the speed of innovation. As we noted above, when we asked leaders how concerned they are that their organizations could be at risk of being left behind by competitors who can innovate faster and, thus, be better positioned to respond to changing business landscapes, nearly a quarter of all respondents (23%) admitted being “extremely concerned.” More than 3 in 5 (62%) were either “extremely concerned” or “somewhat concerned” that rivals would outflank them with speedier innovations.

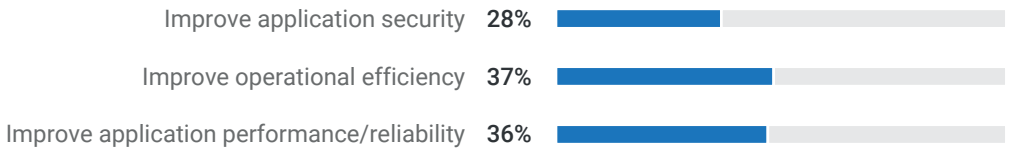
And despite not listing “accelerate innovation” as often as a top-three priority, more U.S. than European technology leaders are worried about being left behind by competitors who can innovate more quickly. A far largers proportion of U.S. leaders (68%) are either “extremely concerned” or “somewhat concerned” than European leaders (57%).

Top Business Priorities

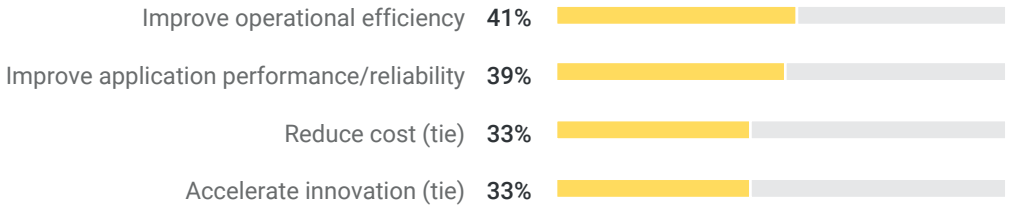
Overall



U.S.

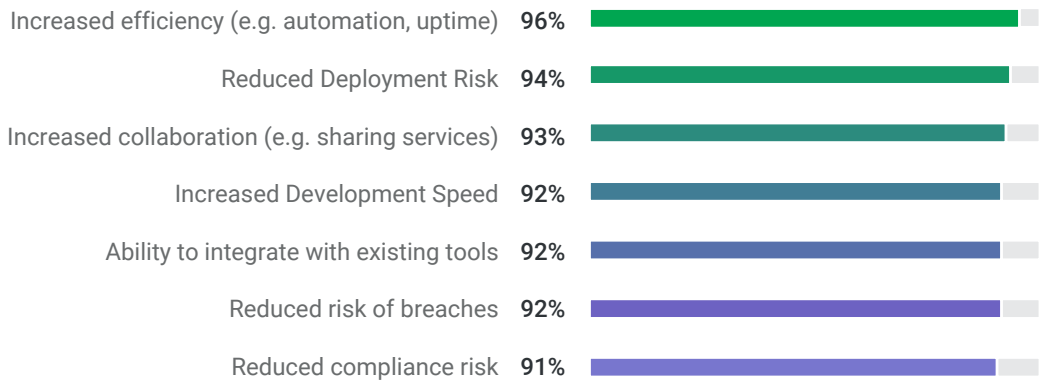


Europe



When adopting new technologies, more than 9 in 10 respondents ranked the following seven key factors as their desired outcomes when adopting new technologies (note: survey participants were asked about all seven of these factors, ranking them all as important but almost equally so):

Top Benefits of Adopting New Technologies (Beyond Cost)



The only sizeable differences between respondents in the U.S. and Europe is with the "ability to integrate with existing tools." U.S. respondents were more worried about reducing their risks of breaches, with nearly all U.S. respondents (96%) saying this is "very" or "somewhat important" versus 89% of respondents in Europe who felt the same.

U.S. respondents were also 5% more likely to list the "ability to integrate with existing tools" as "very" or "somewhat important" than respondents from Europe, 95% vs. 90%, respectively.

Funding Innovation and Speed in 2021

A sizable majority of survey respondents in both the U.S. (81%) and Europe (78%) are increasing their IT/developer budgets in the coming year, with 28% of companies in the U.S. expecting their budgets to grow by 26% or more. Europe lags behind the U.S. here, with only 16% of European companies expecting their budgets to increase by 26% or more.

Meanwhile, only 4% of respondents in the U.S. and 5% in Europe expect any kind of budget drop for their IT/developer teams.

However, slightly more European technology leaders than U.S. ones report that COVID-19 has already sparked an increase in IT/developer spending. Fifty-six percent of European technology leaders say that the pandemic sparked an increase in their IT/developer budgets over the past 12 months versus 54% in the U.S.

Those numbers should draw even closer later in 2021, as U.S. businesses intend to spend more in the next 12 months. Seventy-nine percent of U.S. decision makers report that their IT/developer budgets will increase in 2021 in response to COVID-19 versus 72% in Europe who report the same.

Failed Tech Initiatives Could Cost You Your Job

The technology leaders we surveyed clearly understand how larger digital innovation trends could impact them personally. Many respondents worry about their own jobs, believing that COVID-19 has eliminated the margin for error for digital transformation initiatives. Nearly 7 in 10 (67% overall; 72% in the U.S. vs. 62% in Europe) believe that in the wake of the COVID-19 pandemic, failed efforts to transition to modern architectures – such as building hybrid clouds, deploying microservices or adopting other new technologies, such as AI or IoT – could impact them personally.

These leaders worry that bad digital transformation outcomes for their organizations could result in the respondent suffering personally, losing out on a bonus, missing a promotion or even being fired.

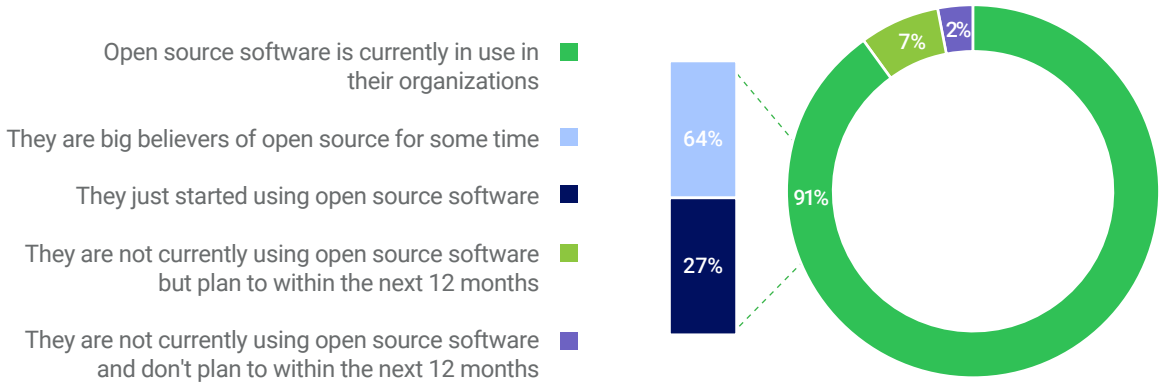
Open Source Powers Digital Innovation

Developers Favor Open Source

Consistent with last year's findings, we learned that technology leaders in 2021 consider developers as the gatekeepers of new technologies, especially in an API-driven world. Developers drive innovation by test-driving new technologies, acting as early adopters for the ones that prove useful and creating path dependencies that lock in open source as a preferred architecture. Once adopted, key open source technologies, especially infrastructure, force an organization's hand towards other open source resources as they scale.

Open source software continues to be a key enabling technology for digital innovation. Across all regions, 91% of organizations currently use open source and another 7% intend to adopt open source within the year.

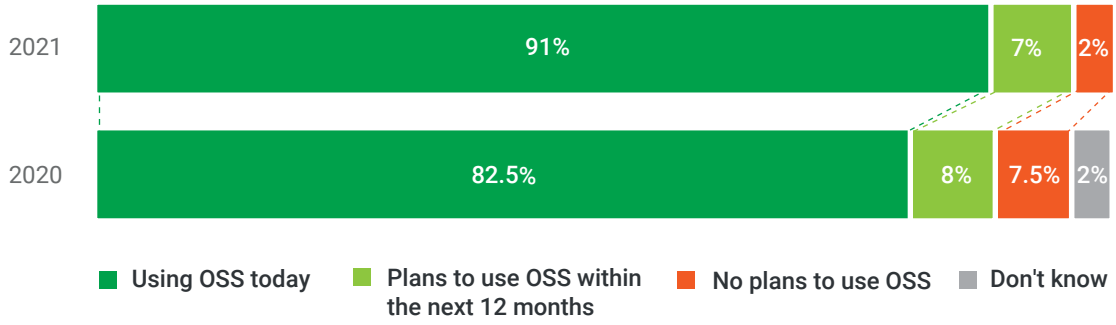
Use of Open Source Software



The U.S. is ahead of Europe in the adoption of open source software. Technology leaders in the U.S. overwhelmingly report that their organizations rely on open source software and have been for some time (73%), while in Europe a bit over a majority (56%) says the same. Another 22% in the U.S. say that they recently adopted open source, meaning 94% of U.S. organizations are currently using open source. Of those not using open source in the U.S., 4% intend to adopt it within the year.

This number is up from last year's report, when 91% of U.S respondents reported using or very soon planning to use open source.

Use of Open Source Software: 2020 vs. 2021



In Europe, 56% of organizations report that they use open source software and have been for some time, while another 33% say they just started using open source. Another 9% of respondents say they will adopt open source in the next year, which would draw Europe roughly into parity with the U.S. in open source adoption by early 2022 (99% vs. 98%).

Open Source Key to the Transition to Microservices

The most commonly adopted open source technologies are databases, which are currently used by 57% of all respondents. The next most commonly used open source technologies are infrastructure automation (47%); API design, testing and documentation (46%); API gateways (38%); and containers (38%).

Across the boards, adoption rates are higher in the U.S. than Europe, with two notable exceptions: containers and CI/CD tools. Europe is on par with the U.S. when it comes to CI/CD tools (30% for each). With containers, Europe is in the lead. Forty percent of European respondents say they are currently using them, while only 35% in the U.S. say they are using containers.

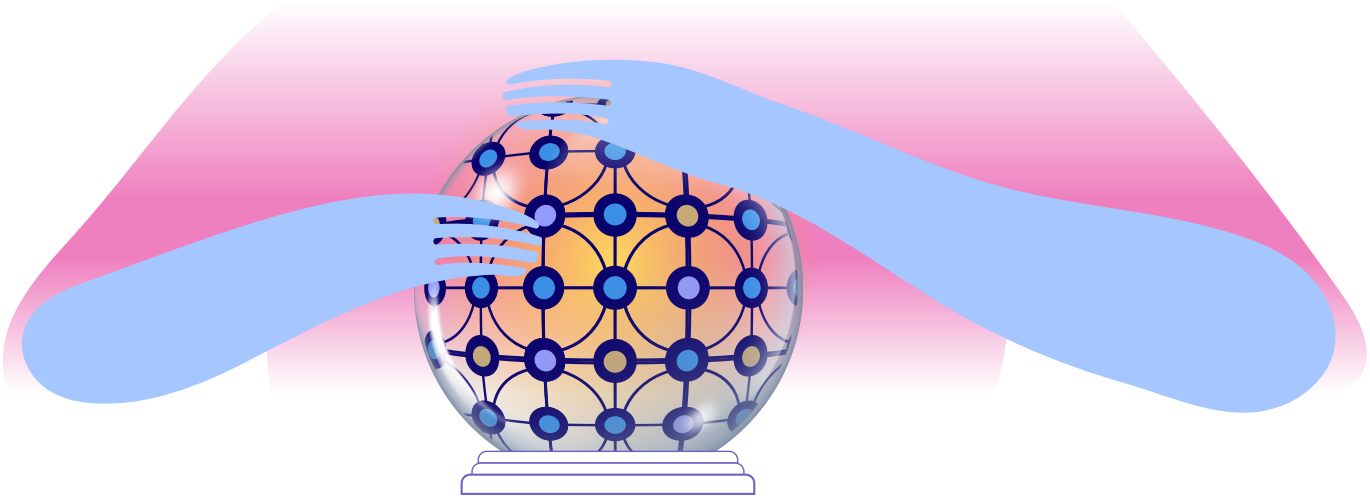
Most Popular Open Source Technologies	Overall (%)	U.S (%)	Europe (%)
Databases (e.g. MongoDB)	**57**	61	53
Infrastructure automation (e.g. Terraform)	**47**	53	42
API design, testing and documentation (e.g. Insomnia)	**46**	49	42
API gateways (e.g. Kong)	**38**	40	37
Containers (e.g. Docker)	**38**	35	40
Logging (e.g. Prometheus)	**35**	37	33
Tracing (e.g. OpenTracing)	**35**	35	34
CI/CD tools (e.g. Jenkins)	**30**	30	30
Serverless (e.g. OpenFaas)	**29**	34	25
Container orchestration (e.g. Kubernetes)	**29**	31	27
Service mesh (e.g. Kuma)	**20**	26	15

Interestingly, containers and API gateways are both at a 38% adoption rate, which indicates the close link between those two technologies. Service meshes are an important technology when using containers with microservices at scale, but since service meshes are still a newer technology the adoption rate of 20% is still lagging behind. Serverless has reached a significant adoption rate of 29% as an alternative to the use of containers.

One thing to note about open source software adoption patterns is that, aside from NoSQL databases, all of the other open source projects listed above are needed to develop, deploy and manage microservices. In other words, technology leaders clearly believe that microservices are the future of modern, distributed infrastructures.

Microservices Enable Innovation

While many technology leaders struggle to ensure that digital transformation efforts match business goals, there seems to be a consensus that applications built with modern architectures using microservices, containers and Kubernetes are the linchpins to successful digital transformation initiatives

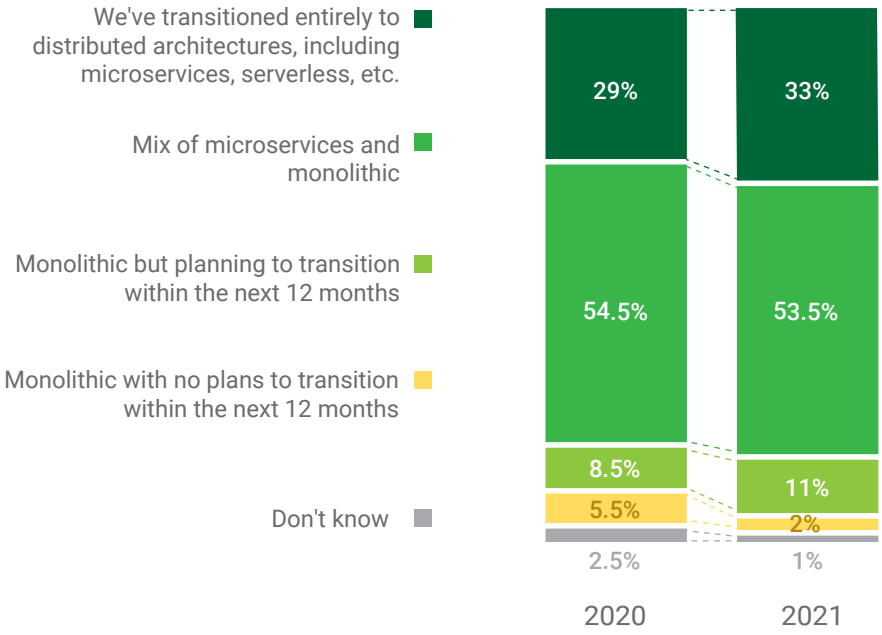


87%

of survey participants agree that microservices-based applications are the future, and companies that are not able to support distributed applications will hinder their ability to compete

Eighty-seven percent of respondents say their organizations have either already fully transitioned to entirely distributed architectures (microservices, serverless, etc.) or are currently using a mix of monolithic architectures and microservices. This is up from 84% a year ago. Another 11% of 2021 participants report that they are planning to transition to distributed architectures within the next 12 months. Clearly, the adoption of microservices is accelerating.

Types of Software Architectures Deployed

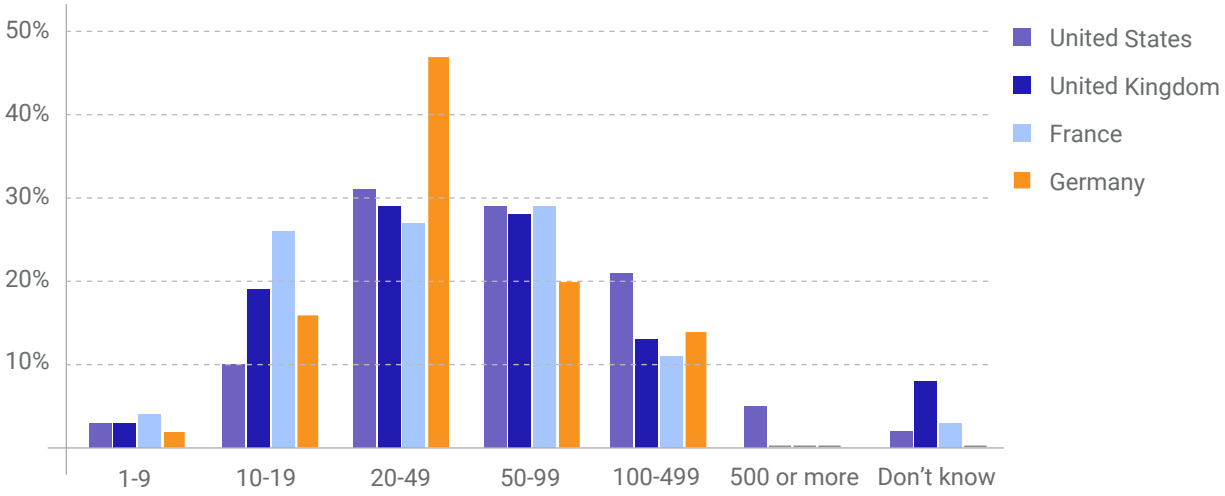


Only 2% of those surveyed have no plans for microservices. This is strong evidence that microservices have quickly become the de-facto approach for modern application architectures that enable digital innovation.

Of those already using microservices, the average number in production is 102 across all regions. The average is significantly higher in the U.S. than in Europe, 129 versus 74.

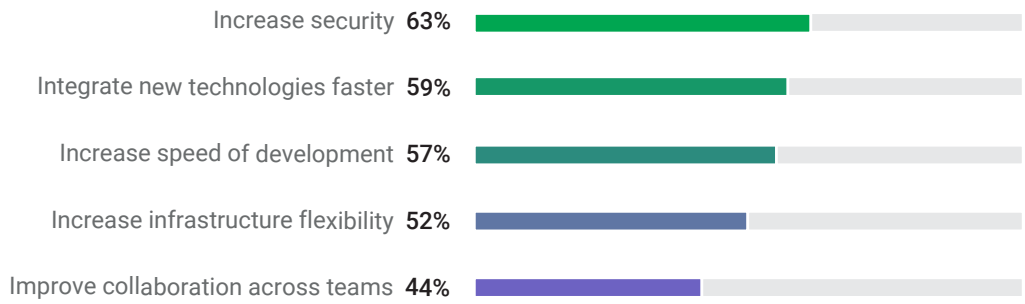
Nearly half (47%) overall say they are using 50 or more. Organizations in the U.S. are using more microservices than their European counterparts. More than half of U.S. respondents (55%) report using 50 or more microservices versus only 39% in Europe. Similarly, 26% of technology leaders in the U.S. say that they are using 100 or more microservices, while only 12% of European technology leaders report using that many.

Number of Microservices Deployed in Production



As with so many computing- and networking-related innovations, reduced cost is a major driver in the adoption of microservices. When you remove cost from the equation, however, the top three drivers across all geographies are to increase security (63%), integrate new technologies faster (59%) and increase the speed of development (57%).

Drivers for Transitioning to Microservices (Beyond Cost)



The top three drivers to microservices adoption are the same as last year. However, a larger percentage of technology leaders this year cited them, again showing the accelerated mainstreaming of microservices.

In our 2020 report, the top three drivers were improvements to security (56%), increased development speed (55%) and increased speed of integrating new technologies (53%), which was tied with improved infrastructure flexibility (53%).

While the top three drivers were the same across geographies, a slightly different picture emerges if you drill down to the country level, especially with regards to security. In the U.S., 67% of technology leaders cited increased security as a top driver to microservices. In France, that number falls to 64%. In the U.K., it dips to 57%, and in Germany, only 55% mention increased security as a top driver. We interpret this to mean that Europe is significantly ahead of the U.S. when it comes to prioritizing security, with the U.K. straddling the divide between the two poles.

Kubernetes Emerges as Standard Operating Environment for Containers

For this year's report, we asked technology leaders whether or not their organizations are using Kubernetes. Overwhelmingly, they are. In fact, only a tiny fraction are not using Kubernetes and have no plans to deploy them in the next 12 months.

Only 5% overall are not using and have no plans to use Kubernetes, although slightly more respondents from Europe (8%) say this than their U.S. colleagues (3%). The U.S. also leads in Kubernetes in production, 39% (U.S.) vs. 24% percent (Europe). In contrast, Europe is ahead of the U.S. when it comes to Kubernetes currently in deployment, with 40% in Europe versus 37% in the U.S. reporting this.

With 86% of all respondents saying that they currently have Kubernetes in production, deployment or plan to deploy it in the next 12 months, Kubernetes has clearly emerged as the standard operating environment for modern distributed architectures. The sky-high adoption rate of this container orchestration tool also highlights the need for APIM or services meshes to integrate with the ingress of Kubernetes so that not only containers, but also microservices and APIs can be managed natively through Kubernetes CRDs.

Kubernetes Challenges Include Complexity and Security

While Kubernetes has become the de facto standard for container orchestration, challenges persist. Security is the number-one challenge IT decision makers cite in the U.S. (49%), ahead of complexity (43%) and performance (40%). In Europe, complexity (46%) leapfrogs security (44%), which is followed by performance (37%).

Other commonly mentioned challenges include monitoring, availability and compliance.

Biggest Challenges With Using Kubernetes	Overall (%)	U.S (%)	Europe (%)
Security	**49**	53	44
Complexity	**43**	41	46
Performance	**40**	42	37
Monitoring	**37**	43	30
Availability	**34**	34	35
Compliance	**32**	29	35
Networking (e.g. configuring load balancers)	**30**	29	31
Cost	**29**	25	33

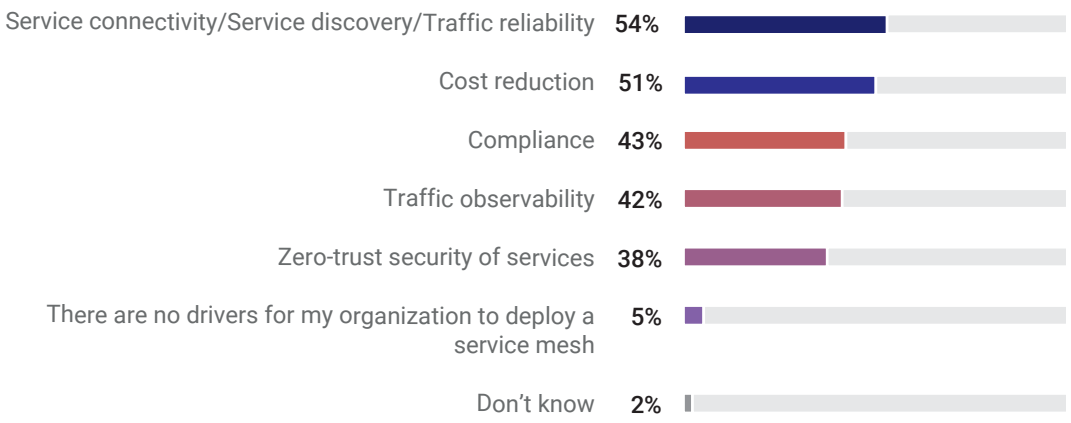
Complexity and Challenges of Microservices at Scale

Service Meshes Clear a Path to Microservices

Service meshes have caught on with early adopters because they enable the transition to microservices. Service meshes complement API gateways to provide reliable, secure and observable connectivity between services in distributed, cloud native environments.

While service meshes are still an emerging technology with a small installed base, those using them point to service discovery and connectivity and traffic reliability (54%), cost reduction (51%), and compliance (43%) as major drivers. A sizable percentage of respondents also cited zero-trust security of services (38%) as an important reason to deploy service meshes.

Drivers for Deploying a Service Mesh



Because it is an emerging technology, the technology leaders we surveyed understand that they will likely need to overcome several obstacles before they can start reaping the benefits of a service mesh.

Biggest Challenges Deploying Service Mesh	Overall (%)	U.S (%)	Europe (%)
Complexity deploying, managing & scaling up	**43**	43	43
Ensuring performance at scale	**42**	40	45
Meeting security and compliance policies	**41**	43	40
Bridging monolithic services running in virtual machines with microservices running in containers	**36**	35	37
Managing multi-tenant environments	**34**	40	27
Managing multiple clusters	**32**	35	29
Handling day 2 operations at scale	**28**	29	28

Taken together, the challenges above spotlight how complexity slows the adoption of service meshes. Bridging monolithic applications running in virtual machines with microservices running in containers and across clouds is an inherently complex task. If service mesh providers are not able to abstract that complexity away from the mesh layer, adoption will remain low. Other complexity-related challenges that organizations must overcome are issues such as multi-tenancy and multi-cluster communications, security and management.

Mixed Deployment Environments Add Complexity

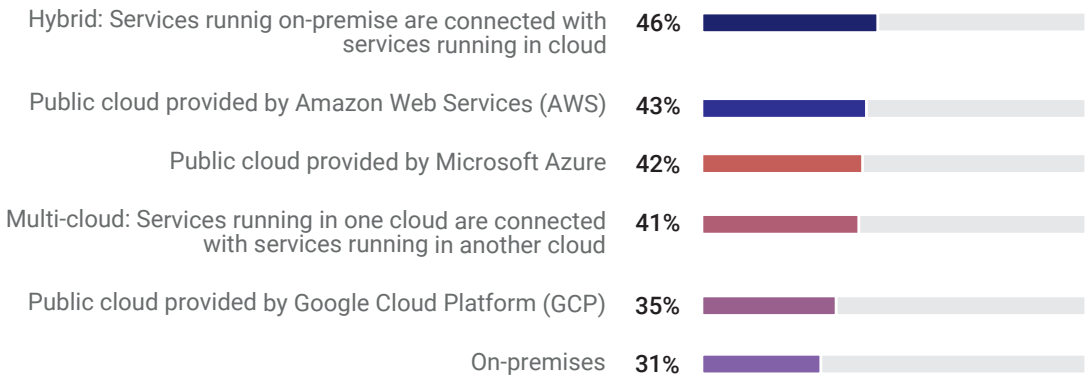
The variety of deployment environments that modern, distributed applications live in add to the overall complexity of modern architectures. Technology leaders we spoke to use a range of environments, from hybrid on-premises services that connect to public clouds to multi-cloud environments that connect to one another (i.e., AWS to Azure).

Overall, hybrid deployments are the most cited deployment environment, mentioned by 46% of all respondents. Hybrid environments were once seen as a transitional technology, so when we asked about hybrid environments, we narrowed our definition by asking specifically about on-premises services that communicate directly with public-cloud services. Even so, nearly half of all respondents report using hybrid clouds. With their persistence, along with worries over availability, security and scalability, it's clear that hybrid environments have staying power and won't disappear anytime soon.

Notably, applications are now widely deployed in multi-cloud environments where services running in one cloud are connected with services running in another cloud. Overall, 41% of respondents are using multi-cloud environments, with U.S. organizations outpacing European ones 44% to 38%.

The technology leaders we surveyed narrowly preferred Amazon Web Services (43%) as their public-cloud environment over Microsoft Azure (42%). Google Cloud Platform was a third at 35%.

Environments Where Services/Applications are Deployed

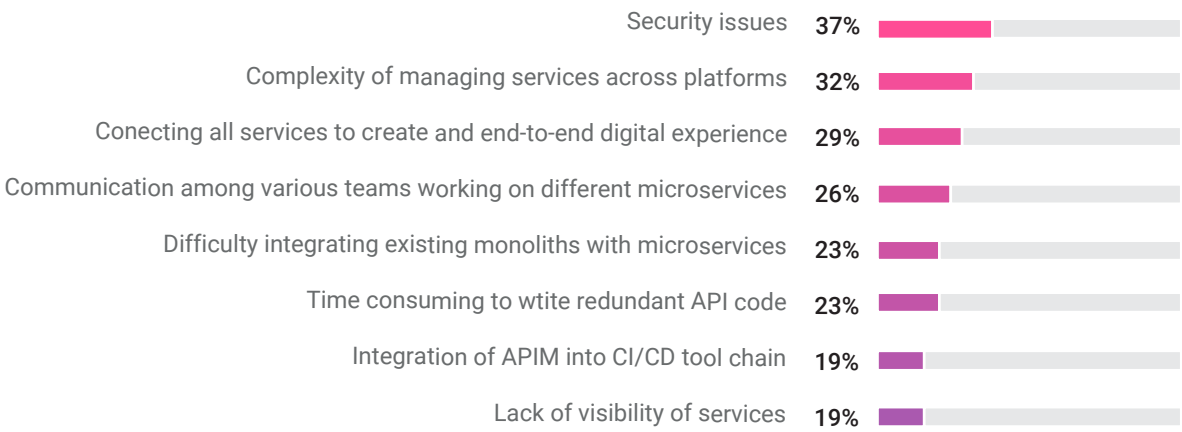


Security, Complexity and End-to-End Connectivity Bedevil Microservices Deployments

We asked technology leaders about the main challenges they expect to face or have already faced when deploying microservices. Security issues (37%), the complexity of managing services across platforms (32%) and connecting all services to create an end-to-end digital experience (29%) were their top-three concerns.

Other challenges cited by 20% or more of respondents involved communication among various developer teams, integrating monolithic services with microservices and the time-consuming need to write redundant API code.

Challenges of Deploying Microservices-Based Applications



What Technology Leaders Need To Know

In conclusion, technology leaders across geographies and in organizations of all sizes and types are relatively consistent in their understanding of the pressures to innovate, the obstacles to innovations and the top strategies to address those obstacles. Here are four key takeaways from our discussions with these technology leaders.

Innovation drives success; without it business leaders expect to fail fast

As customers increasingly demand new digital experiences, the threat of competitive disruption looms larger than ever, with 62% of technology leaders expressing fear that they are at risk of competitive displacement if competitors innovate more quickly than they do. In fact, 51% of organizations believe they will fail or be absorbed by competitors in fewer than three years if they are unable to keep pace with digital innovation.

COVID-19 has heightened personal stakes

In the wake of the coronavirus pandemic, technology leaders face sky-high pressures to succeed. 67% say that a failed effort with initiatives to transition to modern architectures (cloud, containers, microservices, etc.) is likely to result in bad outcomes that could include the respondent missing out on a bonus, losing a promotion or even being fired.

Microservices are the future

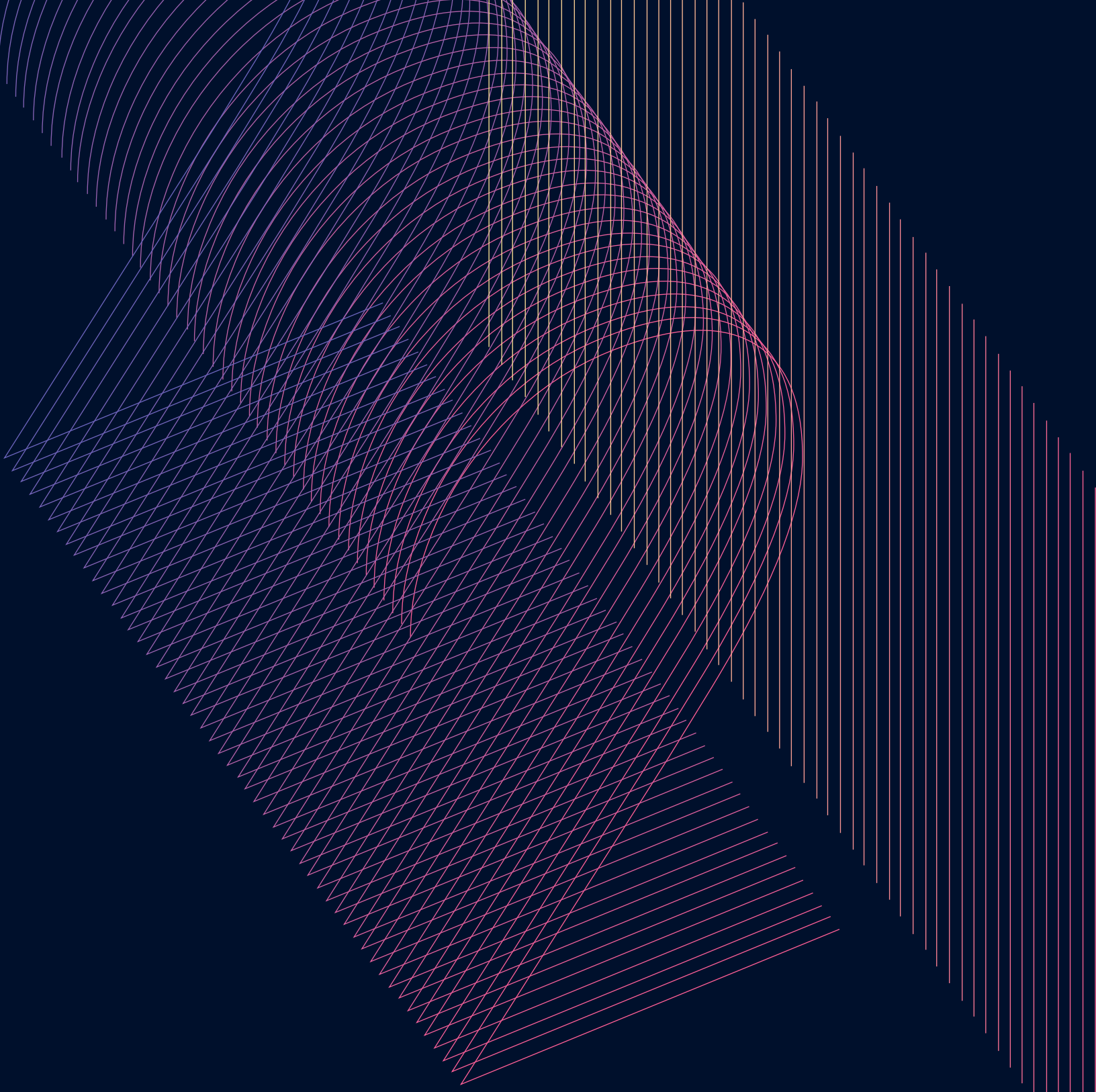
The vast majority of survey participants (87%) agree that microservices are the future, and companies that are not able to support distributed applications will hinder their ability to compete, increasing the risk of competitive displacement.

Service meshes help organizations manage complexity

While service meshes are an emerging technology, those who use them point to service discovery/connectivity/traffic reliability (54%), cost reduction (51%) and compliance (43%) as major drivers. Thirty-eight percent also cite zero-trust security of services as an important reason to deploy service meshes.

ABOUT KONG

Kong creates software and managed services that connect APIs and microservices natively across and within clouds, Kubernetes, data centers and more using intelligent automation. Built on an open source core, Kong's service connectivity platform enables digital innovation by allowing organizations to reliably and securely manage the full lifecycle of APIs and services for modern architectures, including microservices, serverless and service mesh. By providing developer teams with unprecedented architectural freedom, Kong accelerates innovation cycles, increases productivity, and seamlessly bridges legacy and modern systems and applications.



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