2020

Flexera™

STATE OF THE CLOUD REPORT

Cloud spend is rising as organizations adopt multi-cloud strategies and put more workloads and data in the cloud

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FLEXERA™ 2020 STATE OF THE CLOUD REPORT

Cloud spend is rising as organizations adopt multi-cloud strategies and put more workloads and data in the cloud

Executive summary

In a rapidly evolving public, private and hybrid cloud market, insight into emerging cloud trends can guide an organization's digital business decision processes, vendor and technology selection and investment strategies. This ninth annual *Flexera 2020 State of the Cloud Report* (previously known as the *RightScale State of the Cloud Report*) delves into the details of what respondents had to say to reveal what's happening with all things cloud—from spend allocation to cost management to strategies. Leveraging this data can help IT professionals plan the next steps of their cloud journey.

The report explores the thinking of 750 global cloud decision-makers and users about the public, private and multi-cloud market. It shares their current and future cloud strategies, often showing year-over-year (YoY) changes to help identify trends. And it offers perspective on how some trends have changed over the years. The survey began in the first quarter of 2020 during the early days of the COVID-19 outbreak spreading outside of China. To gauge the initial impact of the pandemic on cloud plans, Flexera added a question to the survey after it started—capturing the reactions of the last 25 percent of the people who responded.

Terminology used throughout the report:

Enterprises are public- or private-sector organizations with 1,000 or more employees

SMBs are small-to-midsized businesses with fewer than 1,000 employees

Organizations refers to the combination of enterprises and SMBs participating in the survey

The highlights

The *Flexera 2020 State of the Cloud Report* survey captured insights into how organizations are progressing in their journey to cloud. This information includes their mix of public and private clouds, the volume of workloads and data in the cloud, top challenges and initiatives, cost management concerns, and the cloud providers, technologies and tools they're using. The following are some of the responses we found the most interesting:

Enterprises embrace multi-cloud

- 93 percent of enterprises have a multi-cloud strategy; 87 percent have a hybrid cloud strategy

- Many organizations silo applications within a given public or private cloud, with 41 percent integrating data between clouds

- Only 33 percent of all participating organizations use multi-cloud management tools

- Respondents use an average of 2.2 public and 2.2 private clouds

Public cloud adoption continues to accelerate

- 20 percent of enterprises spend more than $12 million per year on public clouds

- More than 50 percent of enterprise workloads and data are expected to be in a public cloud within 12 months

- 59 percent of respondents who answered a question about COVID-19 expect cloud use to exceed plans due to the pandemic

- The top challenge in cloud migration is understanding application dependencies

Understanding cloud initiatives and metrics

- 73 percent of organizations plan to optimize existing use of cloud (cost savings), making it the top initiative for the fourth year in a row

- 61 percent of organizations plan to focus on cloud migration

- 77 percent of organizations use cost efficiency and savings to measure cloud progress

Organizations taking a centralized approach to cloud

- 73 percent of enterprises have a central cloud team or cloud center of excellence (CoE)

- 57 percent of cloud teams are responsible for governing infrastructure-as-a-service (IaaS)/platform-as-a-service (PaaS) usage and costs

- 51 percent of enterprises reported using cloud managed service providers (MSPs) to manage public cloud use

Top challenges are security, spend, governance and expertise

- 83 percent of enterprises indicate that security is a challenge, followed by 82 percent for managing cloud spend and 79 percent for governance

- For cloud beginners, lack of resources/expertise is the top challenge; for advanced cloud users, managing cloud spend is the top challenge

- 56 percent of organizations reported that understanding cost implications of software licenses is a challenge of software in the cloud

Organizations struggle to handle growing cloud spend

- Organizations are over budget for cloud spend by an average of 23 percent and expect cloud spend to increase by 47 percent next year.

- Respondents estimate organizations waste 30 percent of cloud spend

- Organizations aren't taking advantage of all cloud provider discounting options, but are beginning to leverage automated policies to shut down workloads after hours (51 percent) and rightsize instances (49 percent)

Containers are now mainstream

- 65 percent of organizations are using Docker for containers, and 58 percent use Kubernetes

- AWS, Azure and Google container-as-a-service offerings are experiencing notable growth

- Lack of resources/expertise is cited by 41 percent of respondents as a top container challenge

Adoption of cloud configuration tools is shifting

- Ansible (43 percent) and Terraform (42 percent) are now the configuration tools most widely adopted by respondents

- More enterprise respondents use Ansible while more SMBs used Terraform

Public cloud adoption is evolving

- The top three public cloud providers remain AWS, Azure and Google

- Azure is narrowing the gap with AWS in both the percentage of enterprises using it and the number of virtual machines (VMs) enterprises are running in it

- 40 percent of enterprise AWS users spend at least $1.2 million annually versus 36 percent for Azure

- Google experienced the fastest growth in adoption since last year's survey

Use of public cloud PaaS services is rising

- At 63 percent, relational DBaaS has the highest adoption among enterprises

- IoT services experienced the fastest growth among enterprises at 21 percent followed by container-as-a-service and machine learning/ artificial intelligence (ML/AI), both of which came in at 17 percent

Private cloud adoption is mixed

- VMware vSphere continues to lead in private cloud adoption, with Azure Stack and AWS Outpost showing the most vigorous growth

Methodology

A total of 750 technical professionals from around the globe and across a broad cross-section of organizations participated in the *Flexera 2020 State of the Cloud Report* survey. The participants provided insights into their adoption of cloud infrastructure. The independent panel is rigorously maintained and comprises vetted respondents with detailed profiles.
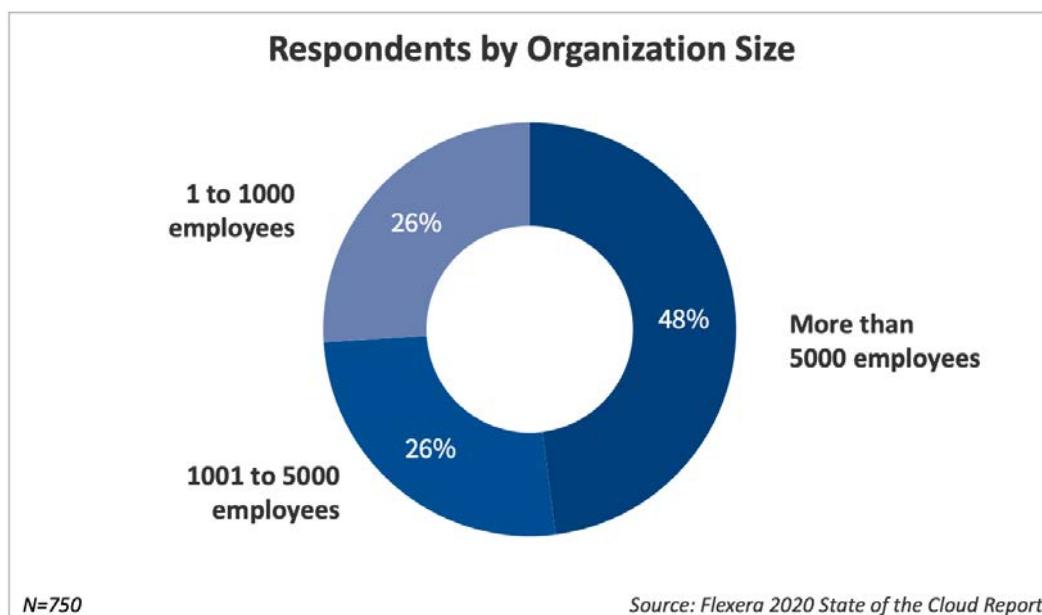
Most respondents are cloud decision-makers and users from organizations ranging from 100 employees to more than 10,000 employees. Their answers provide a comprehensive perspective on the state of the cloud today.

Respondent demographics

Organizations of all sizes are using the cloud to help manage IT workloads. However, this survey skews toward larger organizations. As **Figure 1** shows, nearly three-quarters of participating organizations are enterprises that employ at least 1,000 people. These larger enterprises face challenges due to greater complexity, whereas SMBs often struggle with budget and headcount constraints.

Terminology used throughout the report:

- All respondents = 750
- Enterprise respondents (at least 1,000 employees) = 554
- SMB respondents (less than 1,000 employees) = 196
- In early March, Flexera added a question to assess the impact of COVID-19 on cloud plans and progress; there were 187 responses.

Figure 1. Respondents by organization size

Businesses in almost all industries leverage cloud computing. As **Figure 2** indicates, the report covers a broad range of industries. The *Other* category includes those industries that represent less than three percent of respondents.

Respondents by Industry

- Other: 17%
- Software: 22%
- Tech Services: 22%
- Financial Services: 13%
- Healthcare: 11%
- Retail and eCommerce: 5%
- Industrial Products: 4%
- Telecom: 3%
- Education/Government: 3%

N=750

Source: Flexera 2020 State of the Cloud Report
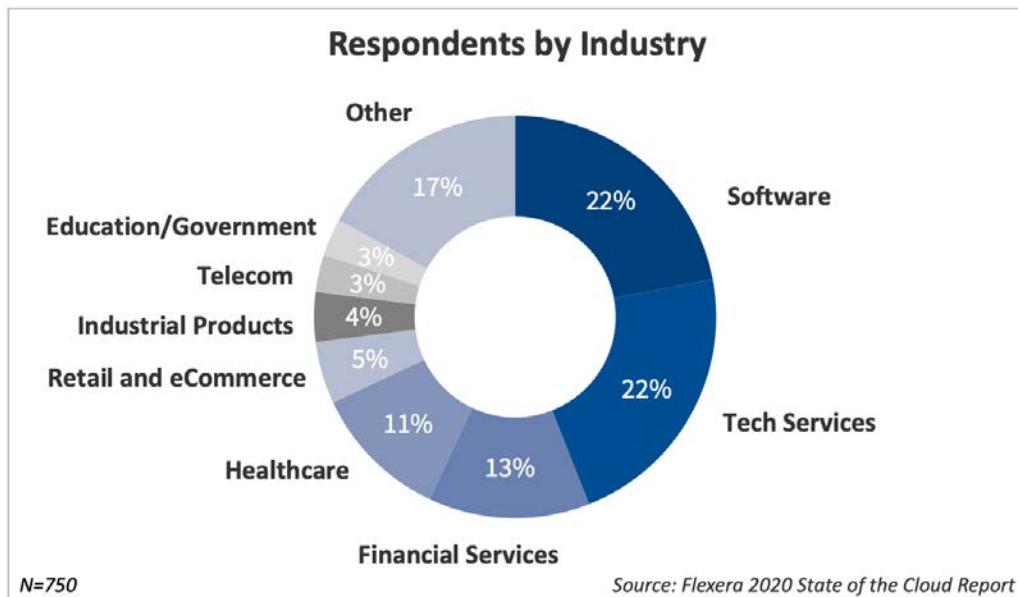
Figure 2. Respondents by industry

Figure 3 shows the locations of participating organizations around the world:

- The Americas include respondents from the United States, Canada, Mexico and Brazil
- Europe includes respondents from a broad set of countries
- The Asia-Pacific region comprises respondents from Australia, India, Japan, Singapore and South Korea

Respondents by Region

Rest of world 2%
Asia-Pacific 14%
Europe 20%
Americas 64%

N=750   Source: Flexera 2020 State of the Cloud Report
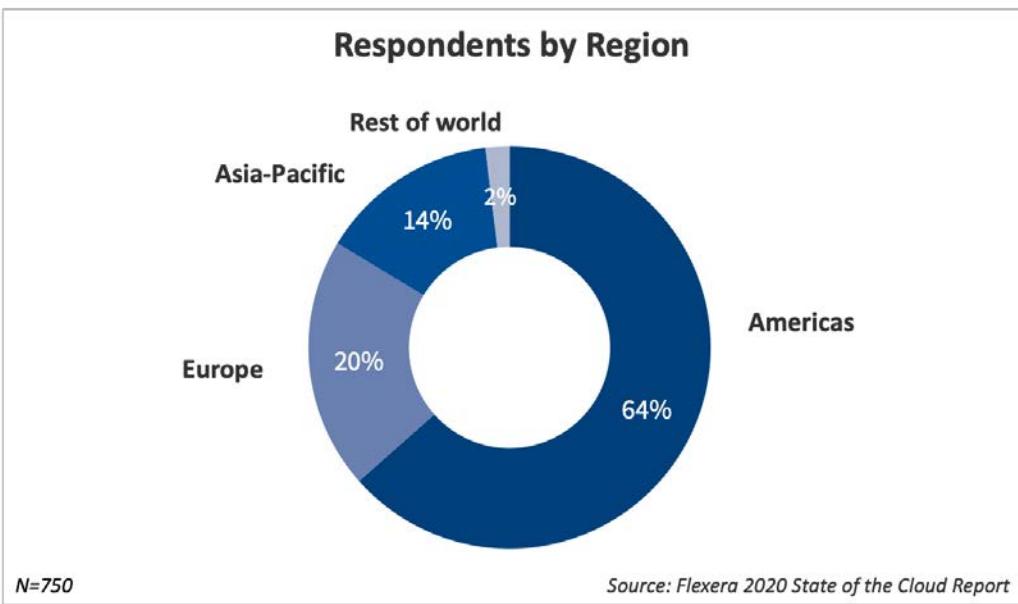
Figure 3. Respondents by geography

Figure 4 indicates the breakdown of respondents by level within the organization and by business role. Cloud architects are the largest group of respondents, representing 27 percent.

Respondents by Level

Other 6%
IT/Dev 3%
Exec 13%
Architect 43%
Dir/Mgr 35%

N=750   Source: Flexera 2020 State of the Cloud Report

Respondents by Role

Business 7%
Dev 11%
IT/Op 55%
Cloud Architect 27%

Source: Flexera 2020 State of the Cloud Report
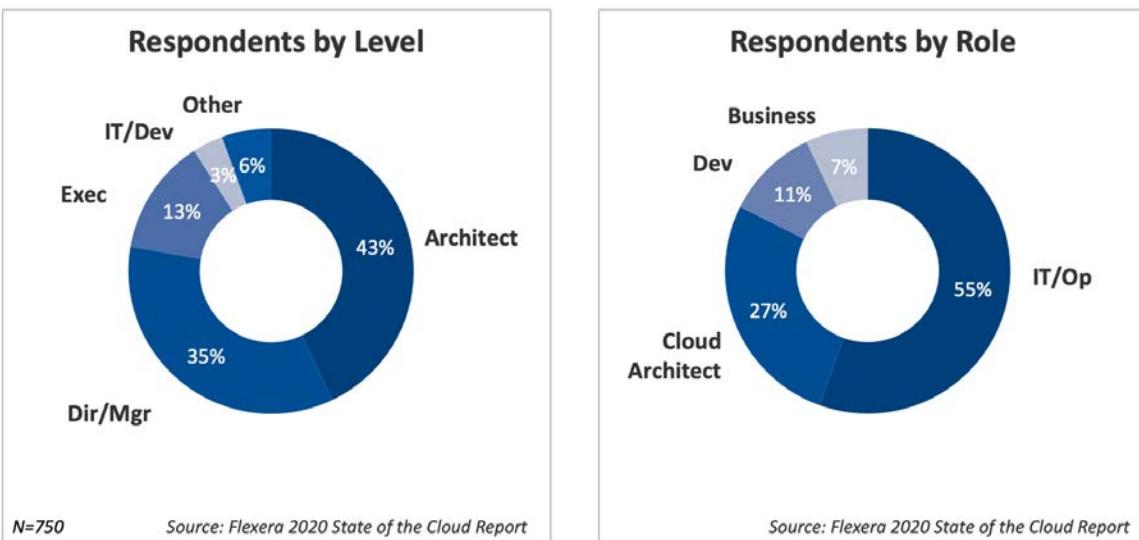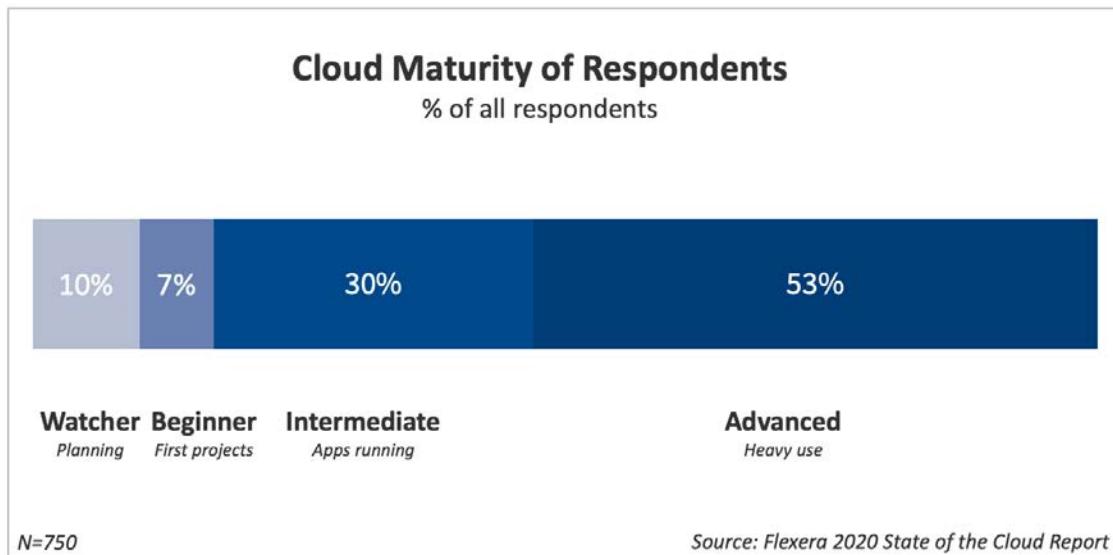
Figure 4. Respondents by level and by role
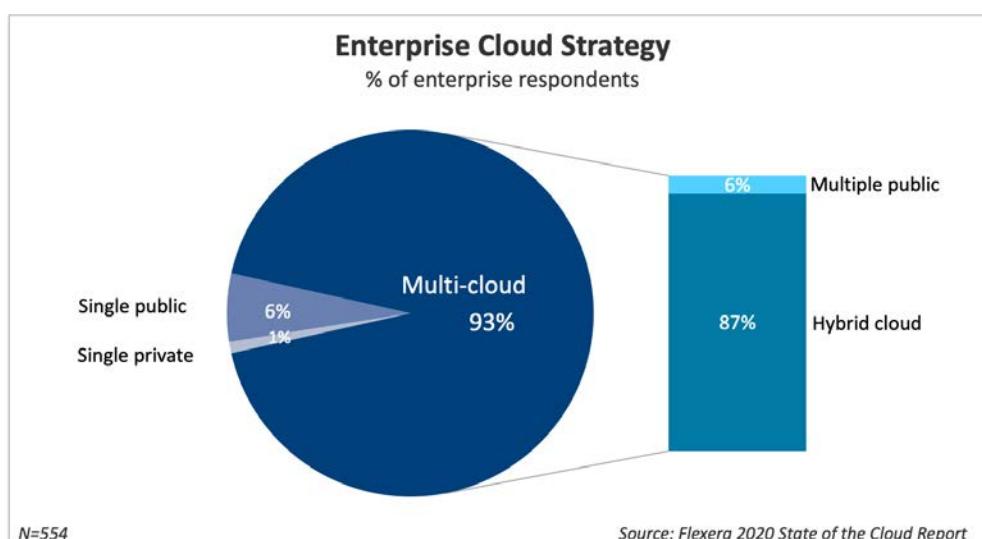
Cloud has now become mainstream. As **Figure 5** shows, more than half of respondents use cloud heavily and have reached the advanced cloud maturity level. Thirty percent of organizations are at the intermediate maturity level, and seven percent are beginners. Only 10 percent, called cloud watchers, are at the planning stage and developing a cloud strategy. For the first time in the history of this report, none of the organizations reported that they lacked cloud plans.

Figure 5. Cloud maturity levels for all organizations

Enterprises embrace multi-cloud

Enterprises have almost entirely embraced multi-cloud. As **Figure 6** indicates, 93 percent of respondents reported having a multi-cloud strategy. Eighty-seven percent are taking a hybrid approach, combining the use of both public and private clouds.

Figure 6. Nearly all enterprises have a multi-cloud strategy

Enterprises combine multiple public and private clouds

This year's survey delved into the various cloud combinations used by enterprises with a hybrid strategy, as **Figure 7** shows. Of those enterprises, 86 percent said they're incorporating multiple public clouds while 60 percent report using more than one private cloud. The most common combination is a mix of various public and private clouds, with 53 percent taking this approach.
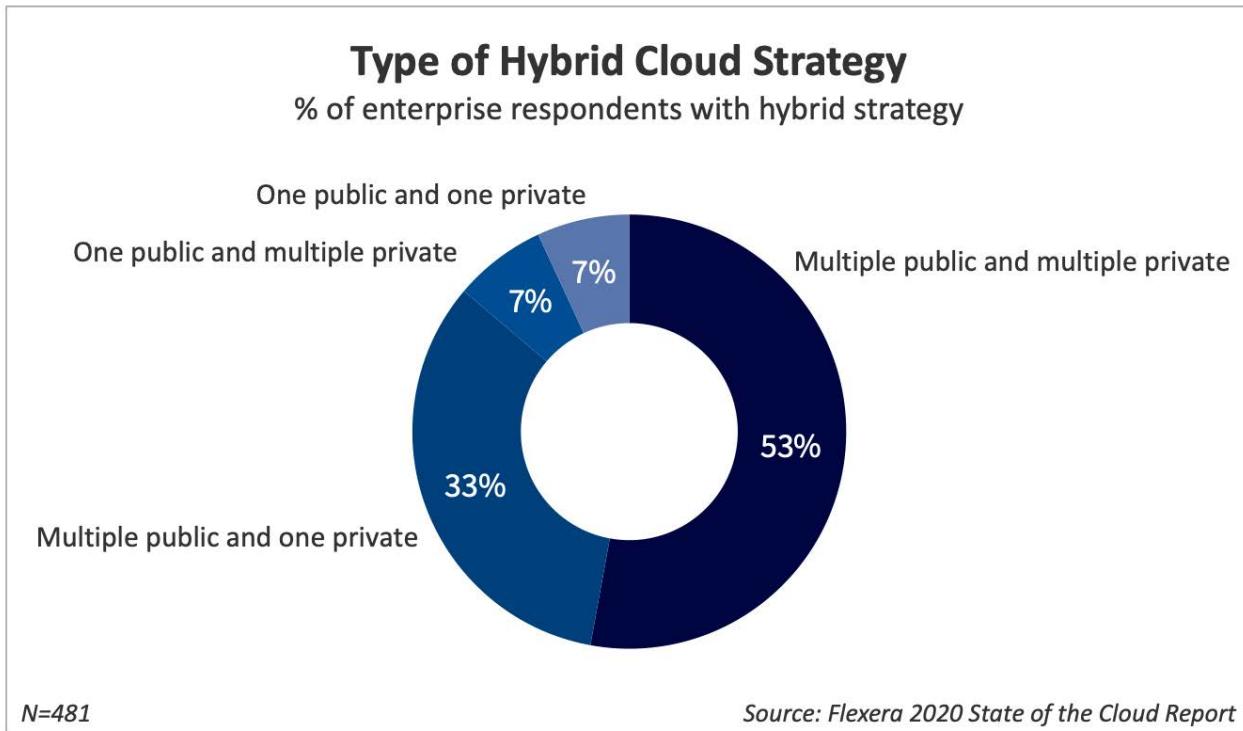
Figure 7. Enterprise hybrid cloud strategies

Applications often are siloed on different clouds

While organizations are using multiple clouds, this doesn't necessarily mean individual applications are spanning clouds. As **Figure 8** shows, *siloed apps on different clouds* is the most common multi-cloud implementation, with 55 percent of respondents saying they use it. *Data integration* is the most common type of architecture that spans clouds. However, more than one-third of respondents are using more advanced architectures, such as *workload mobility between clouds* and *individual apps that span public and private clouds*.

Multi-Cloud Architectures Used
% of all respondents

Architecture	%
Apps siloed on different clouds	55%
Data integration between clouds	41%
Workload mobility between clouds	36%
DR/Failover between clouds	35%
Individual apps span public and private cloud	34%
Workload bursting (cloud-bursting)	26%
Intelligent workload placement	24%
Cloud brokering	18%

N=750   Source: Flexera 2020 State of the Cloud Report

Figure 8. Use of multi-cloud architectures by all organizations

Most organizations aren't using multi-cloud management tools
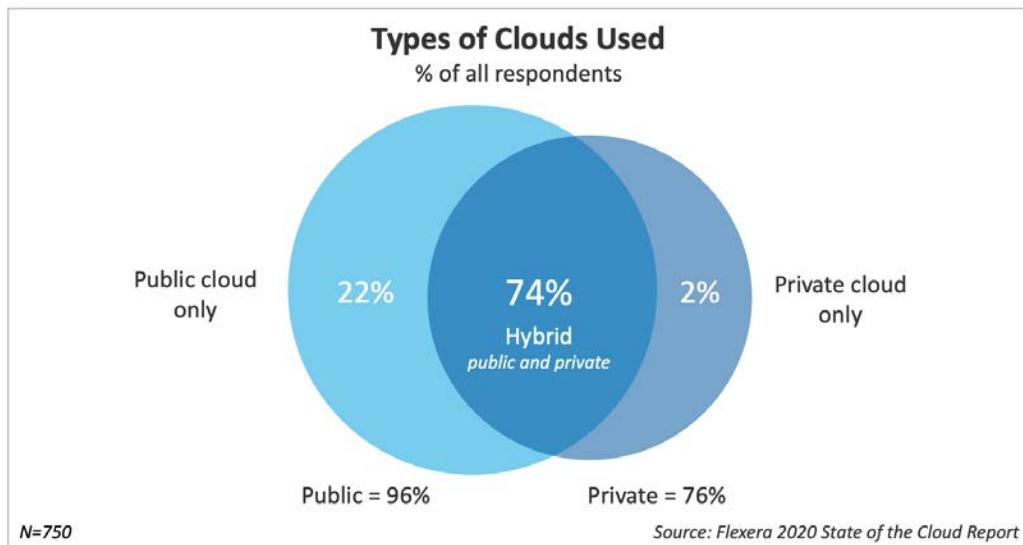
Multi-cloud architectures are more complex and, therefore, more challenging to manage. Multi-cloud tooling is essential to managing cloud resources cost-effectively and ensuring strong governance and security. Unfortunately, only one-third of organizations are taking advantage of multi-cloud management tools, as **Figure 9** indicates.

Use of Multi-Cloud Management Tools
% of all respondents

Tool	Use	Don't use
Multi-cloud cost management tools	33%	67%
Multi-cloud security tools	33%	67%
Multi-cloud management tools	32%	68%
Multi-cloud governance tools	29%	71%

N=750

Source: Flexera 2020 State of the Cloud Report

Figure 9. Use of multi-cloud management tools for all organizations

Almost all organizations are using at least one cloud
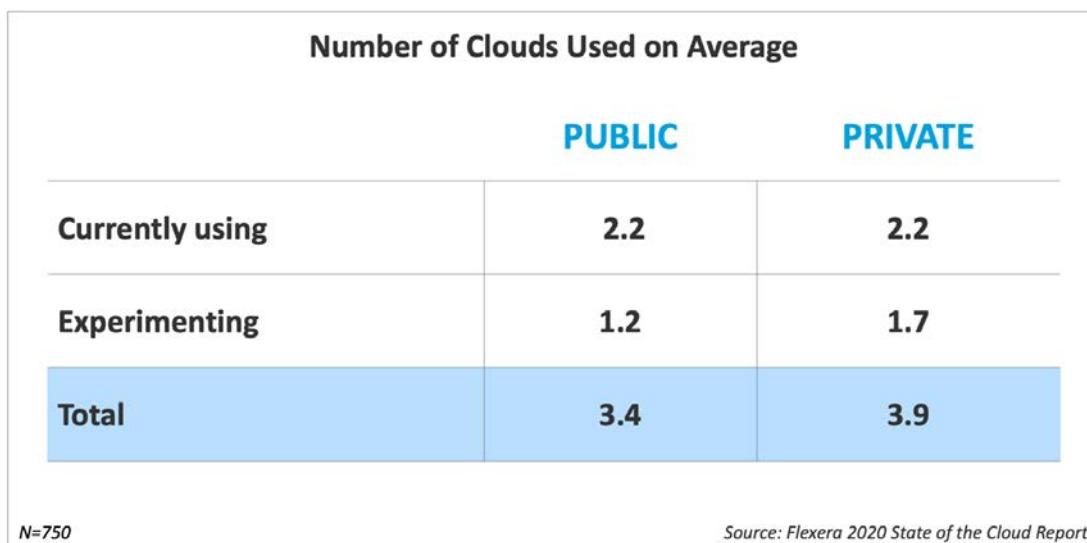
As **Figure 10** indicates, 98 percent of respondents are using at least one public or private cloud. Ninety-six percent of respondents utilize at least one public cloud, while 76 percent have at least one private cloud. Seventy-four percent of respondents are using hybrid cloud.

Figure 10. Breakdown of cloud types used for all organizations

Organizations currently use multiple clouds

As **Figure 11** shows, organizations currently are using an average of 2.2 public and 2.2 private clouds. They're also experimenting with an additional 1.2 public clouds and 1.7 private clouds.

Number of Clouds Used on Average

	PUBLIC	PRIVATE
Currently using	2.2	2.2
Experimenting	1.2	1.7
Total	3.4	3.9

N=750   Source: Flexera 2020 State of the Cloud Report

Figure 11. Average number of public and private clouds used for all organizations

Public cloud adoption continues to accelerate

The increasing use of public cloud is driving up cloud spend for organizations of all sizes. Public cloud spend is now a significant line item in IT budgets, especially among larger organizations.

As **Figure 12** indicates, 16 percent of respondents reported annual spend of at least $12 million ($1 million per month) on public cloud while 63 percent spend $1.2 million or more per year ($100,000 per month).

Annual Public Cloud Spend
% of all respondents

More than $12M — 16%
$2.4M to $12M — 31%
$1.2M to $2.4M — 16%
$600K to $1.2M — 13%
Up to $600K — 24%

N=750

Source: Flexera 2020 State of the Cloud Report
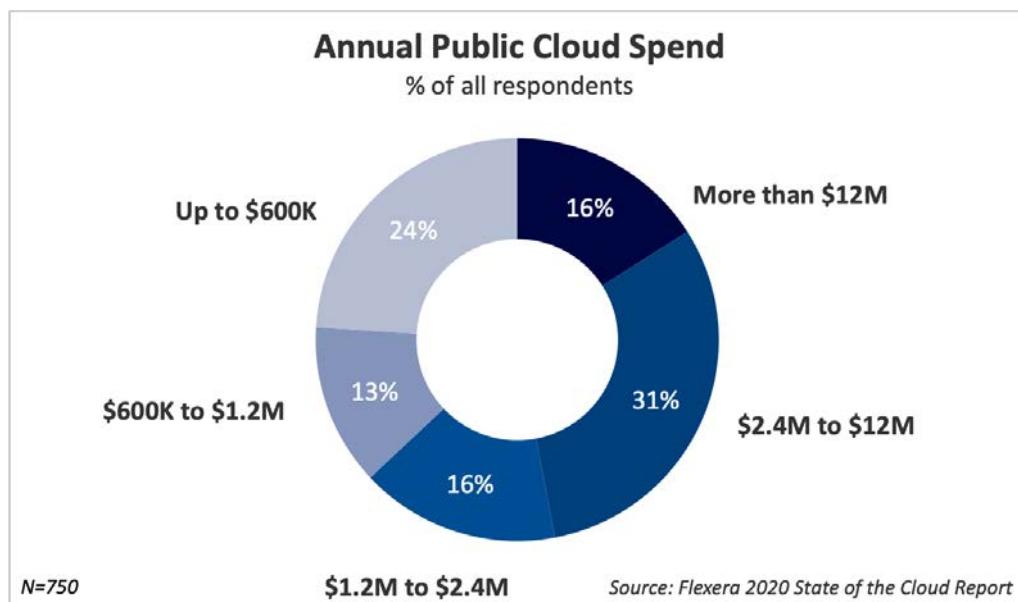
Figure 12. Public cloud spend for all organizations

Enterprise cloud spend is growing

As **Figure 13** shows, 20 percent of enterprises said their annual spend exceeded $12 million, and 74 percent reported that cloud spend exceeds $1.2 million per year. These figures represent a large increase over last year in which 13 percent of enterprises reported an annual spend of more than $12 million, and 50 percent reported yearly spend of more than $1.2 million.

Annual Public Cloud Spend by Enterprises
% of enterprise respondents

- Up to $600K — 13%
- More than $12M — 20%
- $2.4M to $12M — 36%
- $1.2M to $2.4M — 18%
- $600K to $1.2M — 13%

N=554

Source: Flexera 2020 State of the Cloud Report
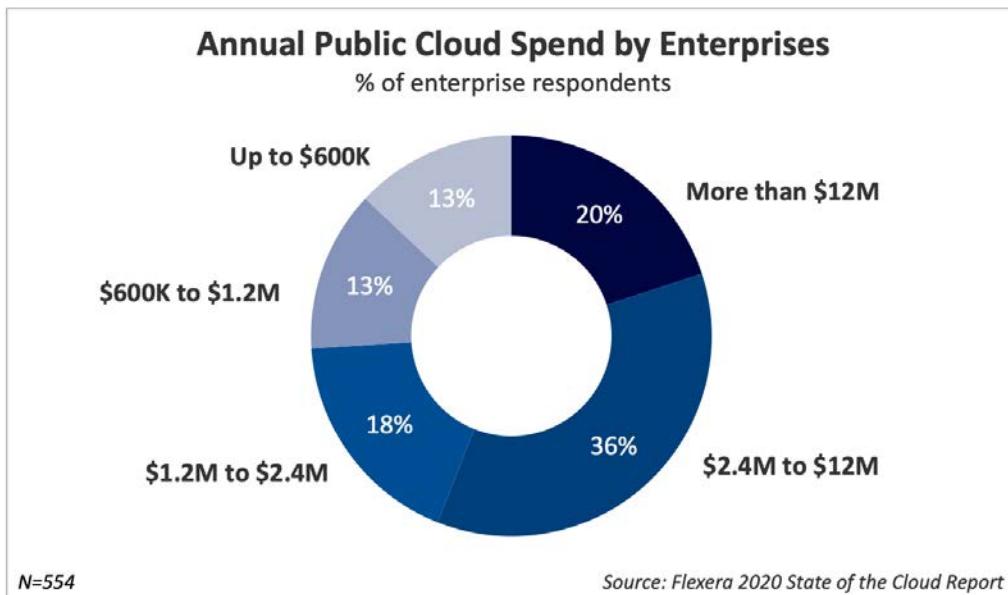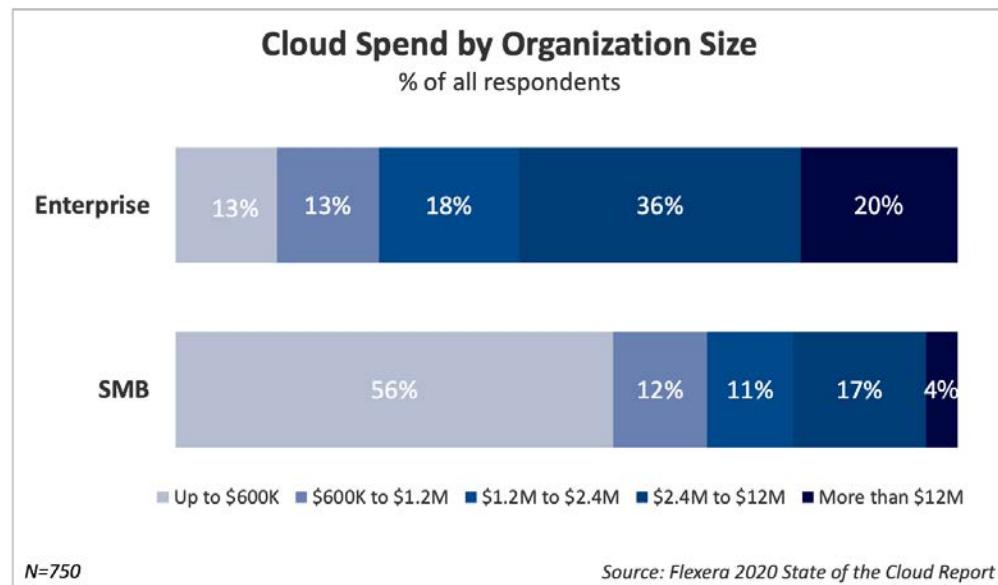
Figure 13. Annual public cloud spend for enterprises

SMB spend is less than enterprise spend
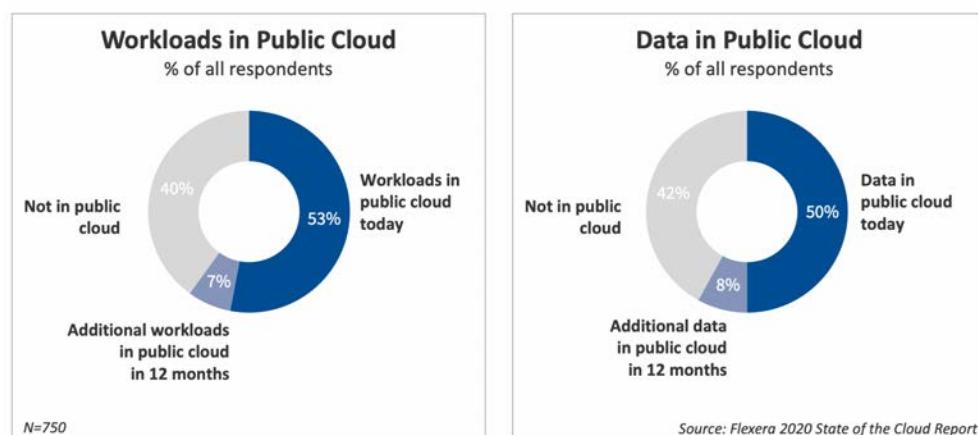
SMBs generally have substantially lower cloud bills because they run fewer workloads in the cloud than enterprises. As **Figure 14** indicates, 56 percent of SMBs are spending less than $600,000 annually compared with only 12 percent of enterprises. However, nearly one-third of SMBs spend more than $1.2 million—up from 20 percent reported last year.

Figure 14. Comparison of enterprise and SMB cloud spend

Half of workloads and data are in a public cloud
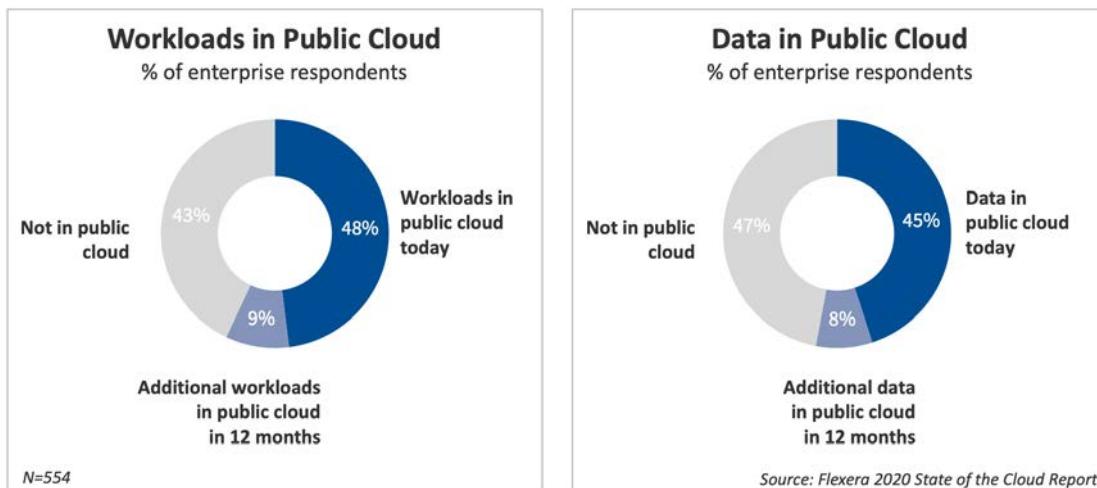
Figure 15 shows that respondents are running 53 percent of their workloads in a public cloud, and they expect to increase that number to 60 percent in the next 12 months. Fifty percent of organizations' data is in a public cloud today, and respondents expect to add eight percent over the next 12 months.

Figure 15. Workloads and data in a public cloud for all organizations

Nearly half of enterprise workloads and data are in a public cloud

As **Figure 16** indicates, enterprises are running 48 percent of workloads and storing 45 percent of data in a public cloud. Enterprise respondents plan to increase workloads and data in public cloud over the next 12 months by nine percent and eight percent, respectively.
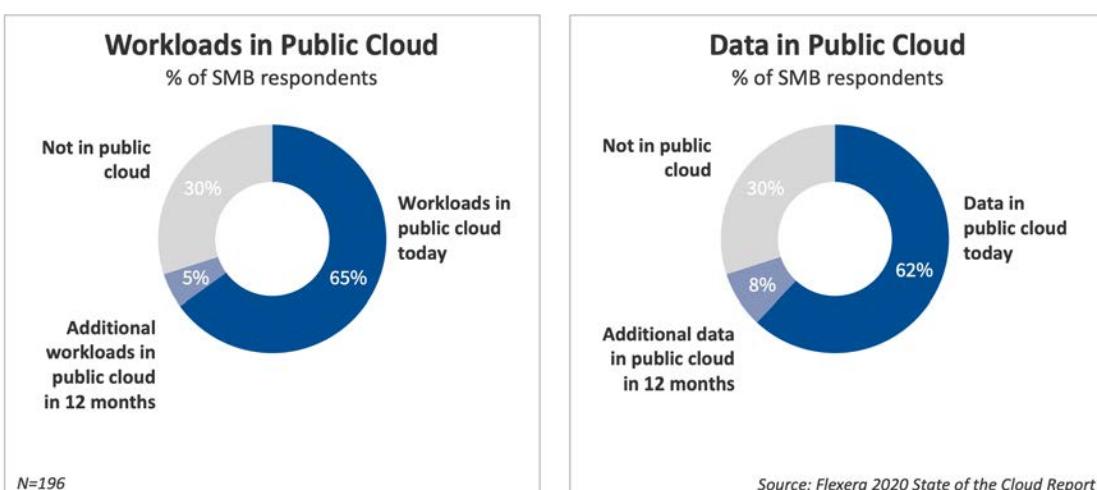
Figure 16. Enterprise workloads and data in a public cloud

SMBs are adopting public cloud faster than enterprises

SMBs are moving more quickly than enterprises in their adoption of public cloud.
As **Figure 17** indicates, 70 percent of SMB workloads and data will reside in a public cloud within the next 12 months.
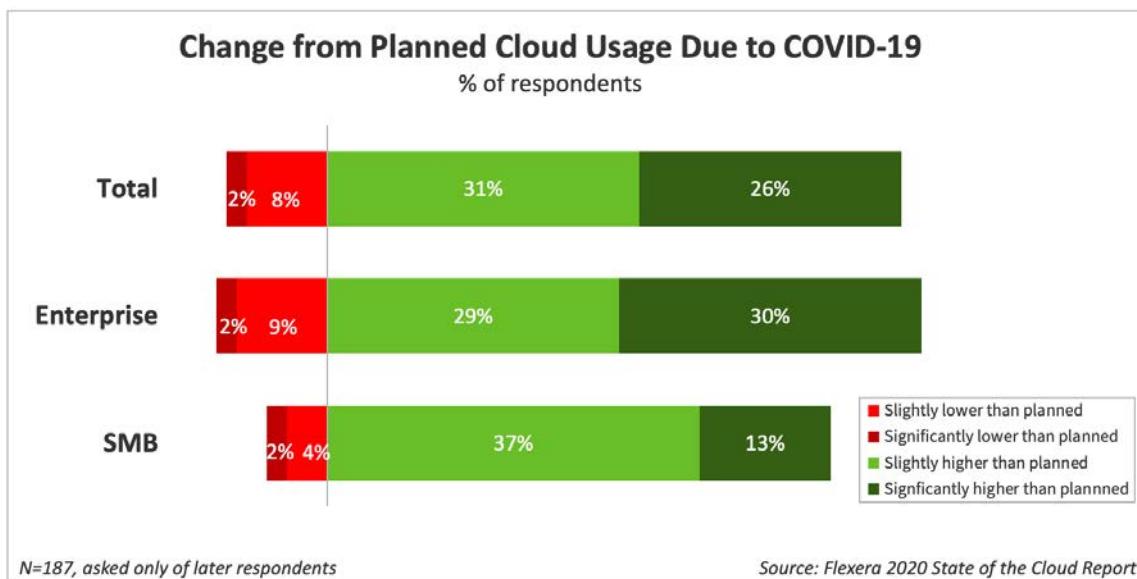
Figure 17. SMB workloads and data in a public cloud

Most believe COVID-19 will increase their cloud usage

The emergence of COVID-19 prompted Flexera to add a question to the survey that gauges how the pandemic might affect cloud plans. Virtually all countries have implemented stay-at-home policies for consumers, work-from-home policies for employees and shutdowns of nonessential businesses. Some industries are experiencing massive economic impacts as a result of the pandemic. Cloud demand will undoubtedly shift as a result of these events.

A subset of 187 survey respondents indicated how they expect COVID-19 to affect their cloud plans. As **Figure 18** indicates, more than half said cloud usage will be higher than initially planned. Some of the increase is a result of the extra capacity needed for current cloud-based applications to meet increased demand as online usage grows. Other organizations may accelerate migration from data centers to cloud in response to reduced headcount, difficulties in accessing data center facilities and delays in hardware supply chains.

As the pandemic runs its course, some organizations may also find that public cloud providers offer a more reliable option for business continuity.

Figure 18. COVID-19 impact on planned cloud usage for all organizations

Organizations are open to moving sensitive data to the cloud

In the past, some organizations hesitated to put certain types of data in public clouds. This year's survey found many respondents are reconsidering. As **Figure 19** shows, more than half of respondents said they'll consider moving at least some of their sensitive consumer data or corporate financial data to the cloud, which reflects increasing confidence in the security practices of the cloud providers.

Data in the Cloud
% of respondents

TYPE OF DATA THAT WILL MOVE TO CLOUD	Corporate financial data	Consumer data (PII/PHI)	Order/Sales data	IoT/Edge data	Non-sensitive data for analysis	Other non-sensitive data
All stays on-premises	21%	19%	12%	6%	5%	5%
Mostly stays on-premises	25%	18%	16%	13%	10%	11%
Mix of on-prem and in-cloud/SaaS	24%	30%	27%	20%	22%	22%
Mostly will move to cloud/SaaS	11%	13%	17%	20%	23%	21%
All will move to cloud/SaaS	15%	17%	23%	24%	37%	35%

N=750
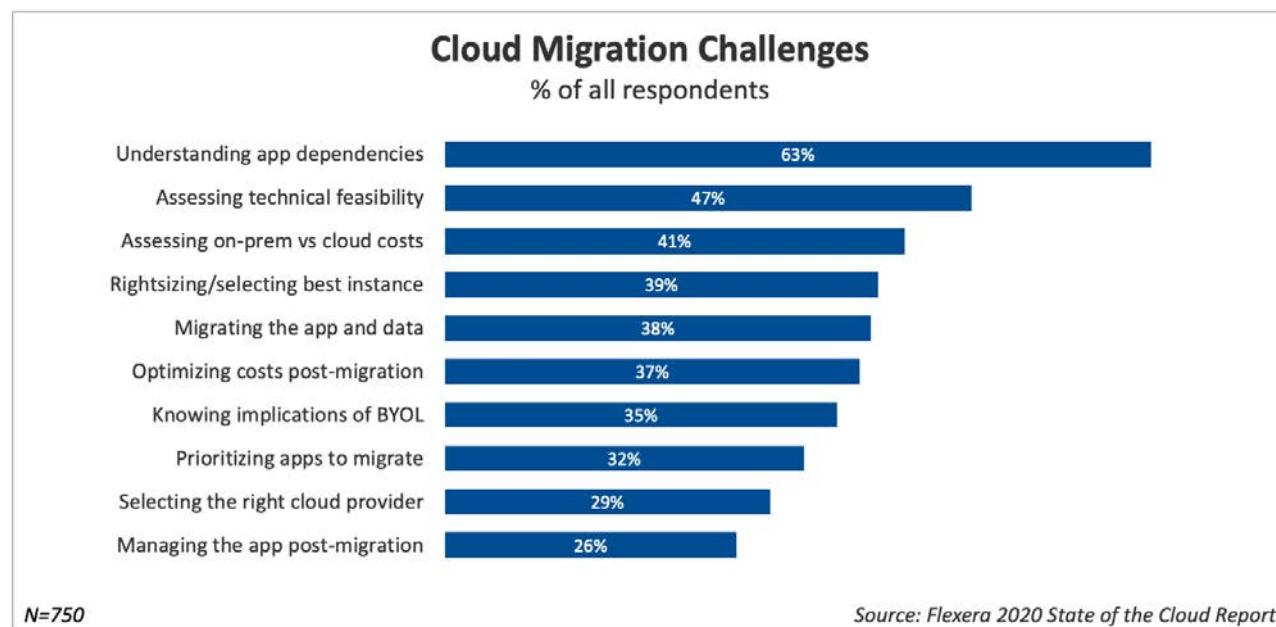
Source: Flexera 2020 State of the Cloud Report

Figure 19. Type of data that will move to public clouds for all organizations

Dependency mapping is top cloud migration challenge

Mapping all the relationships across apps, hardware and networking devices for each IT-delivered service is notoriously difficult to do, especially in a rapidly evolving environment. It's therefore no surprise that 63 percent of respondents reported *understanding app dependencies* as the top cloud migration challenge, as **Figure 20** indicates.
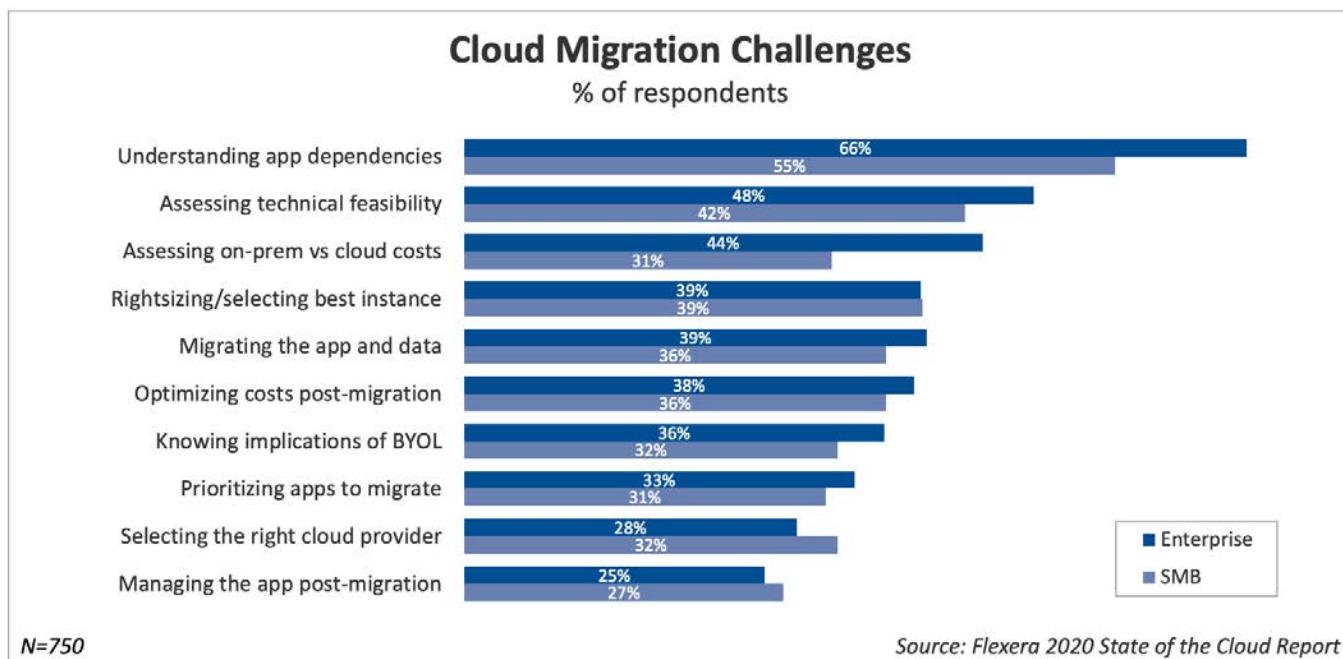
Other critical challenges include *assessing the technical feasibility* (of migrating on-premises apps), *assessing on-prem versus cloud costs* and *rightsizing/selecting the best instance*. Organizations need to address these challenges so they can make informed decisions as to which apps to migrate and optimize the cost of running on-premises apps that were in the cloud.

Cloud Migration Challenges
% of all respondents

Challenge	%
Understanding app dependencies	63%
Assessing technical feasibility	47%
Assessing on-prem vs cloud costs	41%
Rightsizing/selecting best instance	39%
Migrating the app and data	38%
Optimizing costs post-migration	37%
Knowing implications of BYOL	35%
Prioritizing apps to migrate	32%
Selecting the right cloud provider	29%
Managing the app post-migration	26%

N=750

Source: Flexera 2020 State of the Cloud Report

Figure 20. Cloud migration challenges for all organizations

Migration challenges are greater for enterprises

As **Figure 21** indicates, both enterprises and SMBs rank *understanding app dependencies* and *assessing technical feasibility* as their top challenges. However, these obstacles are tougher for larger organizations, which have more on-premises applications and more complex environments. Enterprises also face significantly larger challenges than SMBs in assessing the cost implications of cloud migrations.

Figure 21. Comparison of cloud challenges for enterprises and SMBs

Understanding cloud initiatives and metrics

Optimizing spend is top cloud initiative for the fourth year running

For the fourth year in a row, *optimizing the existing use of cloud (cost savings)* is the top initiative for the year ahead, followed by *migrating more workloads to cloud* and *expanding use of containers*. **Figure 22** shows the rankings for this year.

Optimizing usage is a cost-control measure. Migrating workloads can save money and drive agility. As organizations move more workloads to the cloud, they can retire the technical debt associated with maintaining and operating traditional data centers. Container usage can also help control costs because they allow more efficient use of infrastructure. Consequently, they offer a more cost-effective way to deploy workloads in the cloud.

Top Cloud Initiatives for 2020
% of all respondents

Initiative	%
Optimize existing use of cloud (cost savings)	73%
Migrating more workloads to cloud	61%
Expand use of containers	51%
Progressing on a cloud-first strategy	48%
Automated policies for governance	46%
Better financial reporting on cloud costs	46%
Move on-prem software to SaaS	43%
Implement CI/CD in the cloud	39%
Expand public clouds we use	35%
Manage software licenses in the cloud	33%
Enable IT to broker cloud services	21%
Expand use of cloud MSPs	14%
Expand use of cloud marketplaces	10%

N=750   Source: Flexera 2020 State of the Cloud Report

Figure 22. Ranking of 2020 cloud initiatives for all organizations

Figure 23 compares the top cloud initiatives for 2019 and 2020. All initiatives showed growth over last year, but the most substantial growth was in moving on-premises software to SaaS.

Top Cloud Initiatives YoY
% of respondents

Initiative	2020	2019
Optimize existing use of cloud (cost savings)	73%	64%
Move more workloads to cloud	61%	58%
Expand use of containers	51%	39%
Implement a cloud-first strategy	48%	39%
Automated policies for governance	46%	35%
Better financial reporting on cloud costs	46%	35%
Move on-prem software to SaaS	43%	29%
Implement CI/CD in the cloud	39%	33%
Expand public clouds we use	35%	33%
Manage software licenses in the cloud	33%	24%
Enable IT to broker cloud services	21%	20%

N=750   Source: Flexera 2020 State of the Cloud Report

Figure 23. YoY ranking of top cloud initiatives for all organizations

Figure 24 divides the respondents by cloud maturity—beginner, intermediate and advanced. Beginners rank *migrating workloads to cloud* as their top initiative, followed by *optimizing existing use of cloud (cost savings)*. However, the cost savings initiative becomes more critical as cloud users mature, with 70 percent of intermediate-level organizations and 77 percent of advanced organizations ranking it as their number one priority.

Cloud Initiatives by Maturity

BEGINNER	INTERMEDIATE	ADVANCED
1. Migrating more workloads to cloud (65%)	1. Optimizing existing use of cloud (70%)	1. Optimizing existing use of cloud (77%)
2. Optimizing existing use of cloud (54%)	2. Migrating more workloads to cloud (65%)	2. Migrating more workloads to cloud (60%)
3. Cloud-first strategy (52%)	3. Expanding use of containers (49%)	3. Better financial reporting on cloud (51%)
4. Expanding use of containers (48%)	4. Cloud-first strategy (48%)	4. Cloud-first strategy (51%)
5. Better financial reporting on cloud (46%)	5. Automated policies for governance (44%)	5. Automated policies for governance (51%)

N=750   Source: Flexera 2020 State of the Cloud Report

Figure 24. Top cloud initiatives by cloud maturity for all organizations

Organizations measure cloud progress by savings, agility and value

Figure 25 lists the ranking of metrics organizations are using to measure cloud progress. The top three are *cost savings/efficiency, delivery speed of product/services* and *value delivered to business units*. To achieve cost benefits, organizations must optimize as they migrate by rightsizing and using automation to monitor and optimize spend continually.

Metrics Used to Measure Cloud Progress
% of all respondents

Metric	%
Cost efficiency/savings	77%
Delivery speed of products/services	69%
Value delivered to business units	57%
Increased speed of innovation	56%
Number of workloads migrated	45%
Cost avoidance	45%
Increase in competitive advantage	44%
Decreased data center footprint	37%
Customer adoption of cloud offerings	36%
Retirement/decrease of technical debt	35%

N=750   Source: Flexera 2020 State of the Cloud Report

Figure 25. Top metrics for assessing progress against cloud goals for all organizations

Figure 26 provides more insight into how organizations rank the top metrics. Here the respondents rated the metrics first, second and third in terms of importance to their respective organizations. It's no surprise that cost savings is a key metric. Delivery speed of products/services is a metric that indicates organizations are gaining agility due to cloud use.

Ranking of Top Metrics for Cloud Success

RANK 1	RANK 2	RANK 3
1. Number of workloads migrated (23%)	1. Cost efficiency/savings (24%)	1. Cost efficiency/savings (15%)
2. Delivery speed of new products/services (22%)	2. Delivery speed of new products/services (17%)	2. Delivery speed of new products/services (12%)
3. Cost efficiency/savings (19%)	3. Customer adoption of cloud-based products and services (10%)	3. Cost avoidance (11%)
4. Value delivered to business units (10%)	4. Value delivered to business units (10%)	4. Increase in competitive advantage (11%)
5. Increased speed of innovation (7%)	5. Cost avoidance (9%)	5. Increased speed of innovation (11%)

N=750   Source: Flexera 2020 State of the Cloud Report

Figure 26. Ranking of top metrics for cloud success for all organizations

Organizations are taking a centralized approach for cloud

As organizations adopt cloud-first strategies, many are creating a central cloud team or a cloud center of excellence (CoE) tasked with providing centralized controls, tools and best practices. The purpose of these teams is to accelerate cloud adoption by centralizing expertise while reducing costs and risk. As **Figure 27** shows, nearly 70 percent of organizations have a central cloud team or cloud CoE.

Central Cloud Team
% of all respondents

- No plans 14%
- Planning one 17%
- Have cloud CoE 38%
- Have central cloud team 31%

N=750

Source: Flexera 2020 State of the Cloud Report
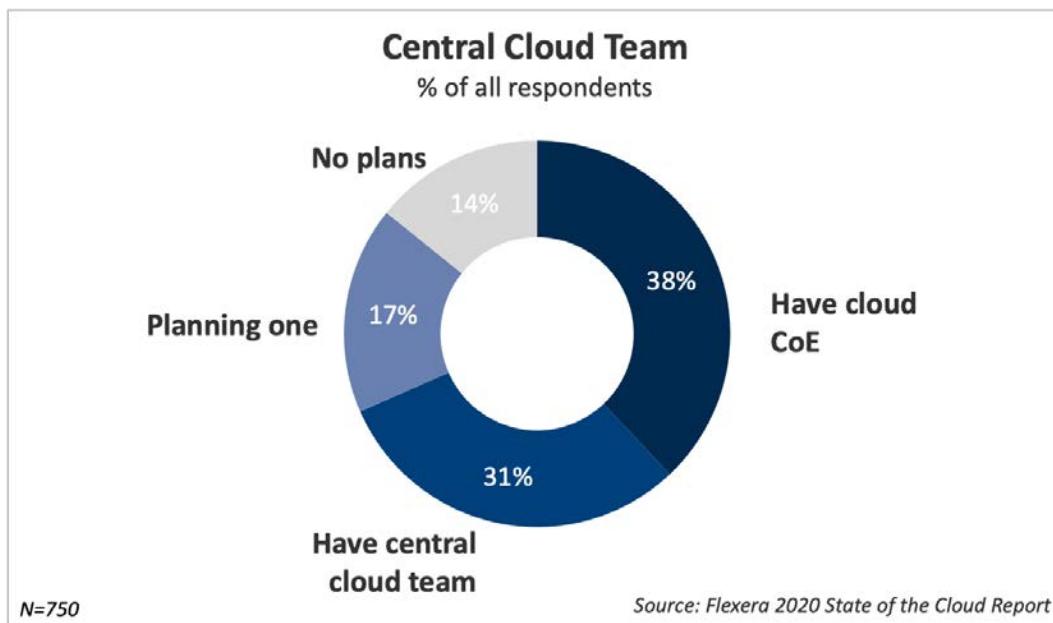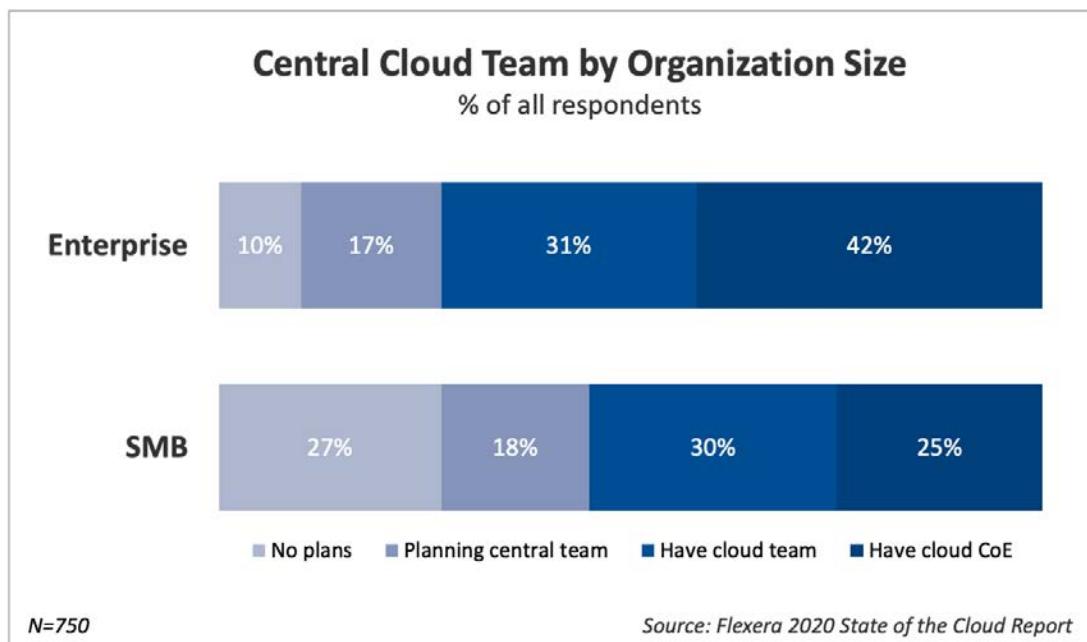
Figure 27. Adoption of central cloud team/CoE for all organizations

Enterprises lean heavily on central teams

Enterprises have a greater need for centralization than SMBs. Spend, governance and security within larger organizations are much more complex, and teams overseeing those areas must coordinate across multiple business units and functional areas. As **Figure 28** indicates, 73 percent of enterprises already have a central cloud team or cloud CoE compared with 55 percent of SMBs. Only 10 percent of enterprises and 27 percent of SMBs have no plans for a central cloud team.

Figure 28. Central cloud team/CoE by organization size

Enterprise central teams optimize cloud costs and govern use

Figure 29 shows the role enterprise central IT teams play in providing guardrails for cloud use. These cloud teams shoulder most of the responsibility for cloud cost optimization, migration planning and governance. They also serve in an advisory capacity to help stakeholders make informed decisions and ensure the apps selected comply with the enterprise governance framework and security policies.

Role of Central IT in Cloud Use
% of enterprise respondents

Manage/optimize costs of cloud services	65%
Decide/advise on apps appropriate for cloud	63%
Plan for cloud migrations	62%
Set policies for cloud use	61%
Select public cloud providers	53%
Act as a cloud broker	50%
Automate policies to govern cloud use	49%
Select private clouds	48%
Provide/manage a private cloud	38%
Manage all cloud deployments	36%

N=554

Source: Flexera 2020 State of the Cloud Report

Figure 29. Central IT responsibilities in enterprises

SAM and vendor management can lend expertise

As **Figure 30** indicates, the cloud team and infrastructure and operations team are actively involved in enterprise cloud cost management. Their top responsibilities include *governing IaaS and PaaS usage and costs, forecasting cloud costs, governing SaaS usage and costs* and *optimizing spend*.

These are responsibilities that software asset and vendor management teams have traditionally handled for on-premises software. Consequently, SAM and vendor management professionals have extensive experience in optimizing license consumption. This expertise ensures compliance with contract terms, negotiating and managing favorable contracts, reclaiming unused licenses, optimizing renewals, and automating license management for on-premises and enterprise SaaS agreements. Organizations could benefit significantly from increased involvement by these teams in cloud cost management.

Cloud Cost Management Responsibilities for Teams

CLOUD COST MANAGEMENT RESPONSIBILITIES	CLOUD TEAM	INFRASTRUCTURE AND OPS	BUSINESS UNITS	FINANCE	APPLICATION TEAMS	SAM & VENDOR MGMT
Govern IaaS/PaaS usage/costs	57%	46%	18%	17%	14%	7%
Forecast cloud costs post migration	46%	44%	27%	18%	17%	6%
Govern SaaS usage/costs	40%	49%	23%	16%	16%	8%
Optimize cloud spend	40%	49%	19%	11%	20%	7%
Report/analyze cloud costs	40%	43%	24%	25%	14%	11%
Define cost management policies	39%	38%	22%	21%	16%	8%
Govern software licenses in IaaS/PaaS	37%	45%	24%	13%	16%	9%
Own cloud budgets	33%	39%	33%	21%	15%	4%
Chargeback cloud costs	33%	35%	21%	35%	9%	5%
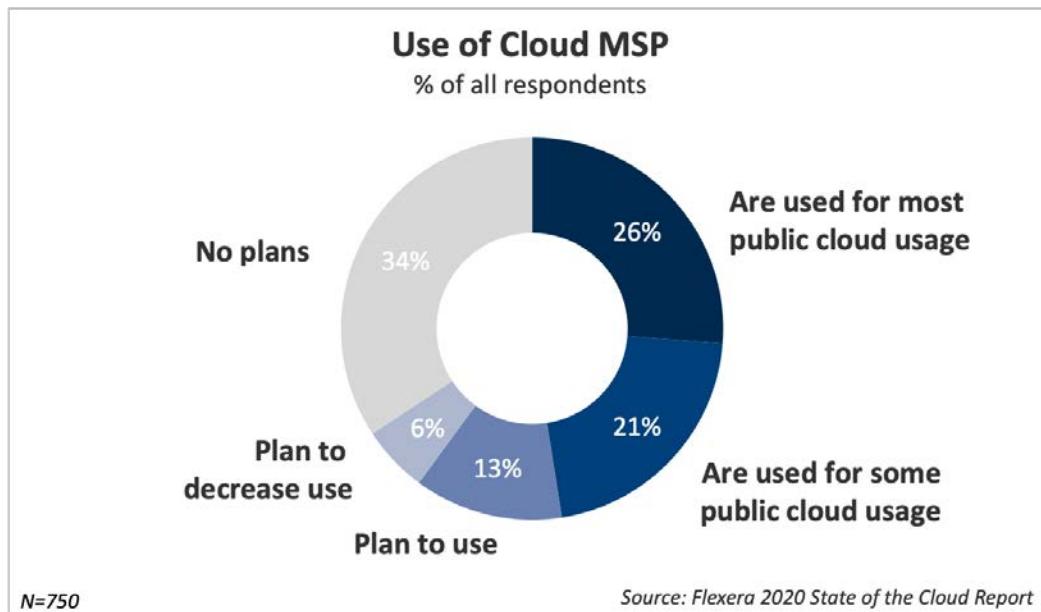
N=750

Source: Flexera 2020 State of the Cloud Report

Figure 30. Cloud cost management responsibilities by IT team for all organizations
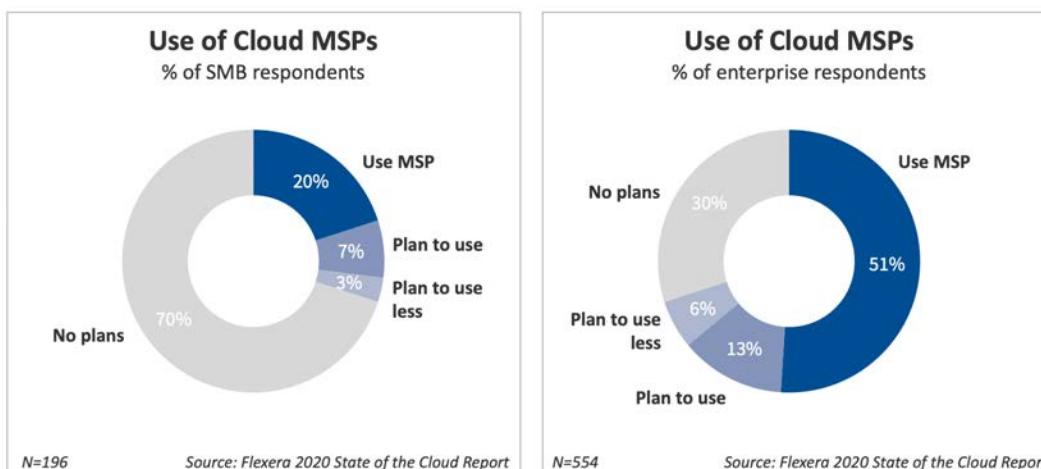
MSPs help with cloud work

In the 2020 survey, Flexera asked for the first time about the use of MSPs for managing public clouds. As **Figure 31** shows, nearly half of respondents are outsourcing at least some cloud work, with 26 percent engaging MSPs for most of their public cloud use.

Figure 31. Leveraging MSPs to manage public cloud resources for all organizations
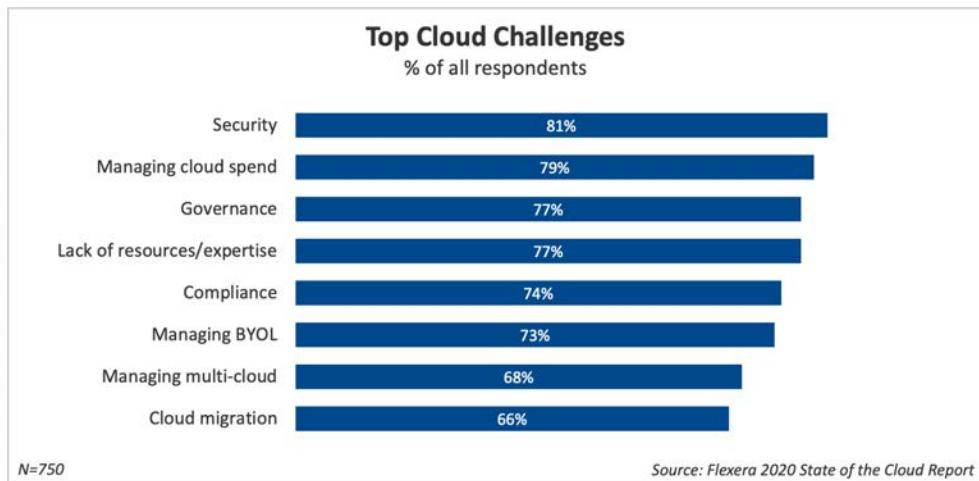
Figure 32 indicates that enterprises are far more likely to use MSPs than are SMBs. One possible reason for this disparity is that enterprises traditionally have more experience in outsourcing, such as in running their data centers or service desks.

Figure 32. MSP usage by enterprises versus SMBs

Top challenges are security, spend, governance and expertise
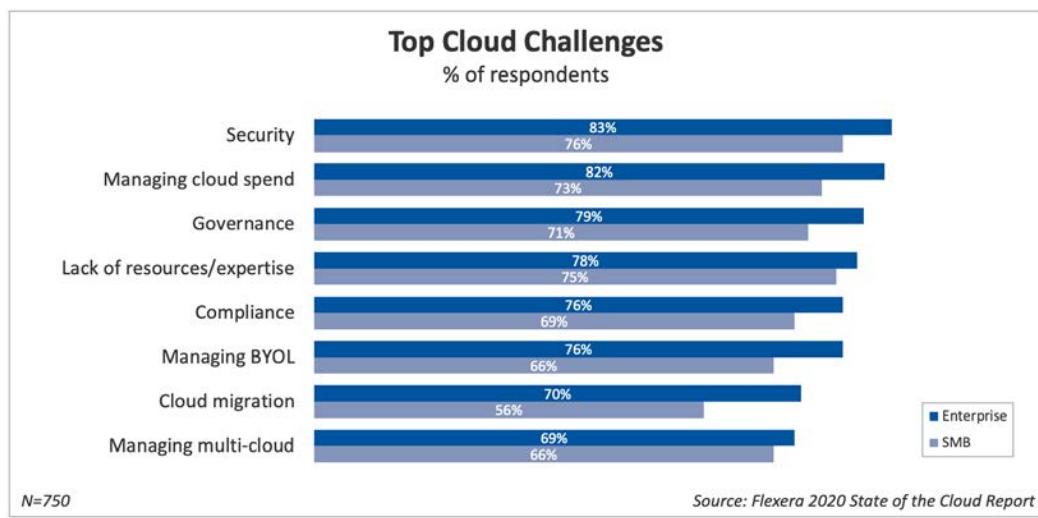
The top cloud challenges in 2020 are all quite close in how often respondents cite them. As **Figure 33** shows, the top four are *security, managing cloud spend, governance* and *lack of resources/expertise*.

Top Cloud Challenges
% of all respondents

Challenge	%
Security	81%
Managing cloud spend	79%
Governance	77%
Lack of resources/expertise	77%
Compliance	74%
Managing BYOL	73%
Managing multi-cloud	68%
Cloud migration	66%

N=750 — Source: Flexera 2020 State of the Cloud Report

Figure 33. Top cloud challenges for all organizations

Enterprises see governance as larger challenge

Enterprises and SMBs diverged in their ranking of the top four challenges. **Figure 34** indicates enterprises followed the overall trend with *security* at the top. But SMBs ranked *lack of resources/expertise* as their second challenge, followed by *managing spend* and *governance*.

Top Cloud Challenges
% of respondents

Challenge	Enterprise	SMB
Security	83%	76%
Managing cloud spend	82%	73%
Governance	79%	71%
Lack of resources/expertise	78%	75%
Compliance	76%	69%
Managing BYOL	76%	66%
Cloud migration	70%	56%
Managing multi-cloud	69%	66%

N=750 — Source: Flexera 2020 State of the Cloud Report

Figure 34. Comparison of top challenges for enterprises versus SMBs

Enterprise challenges decline, except for security

Enterprises are gaining experience with cloud, which has led to slight decreases in perceived cloud challenges. However, due to the growing number of workloads in the cloud and the development of hybrid and multi-cloud strategies, enterprises still face severe challenges around *security, managing cloud spend* and *governance*. **Figure 35** shows the top enterprise cloud challenges for 2020 compared with 2019.
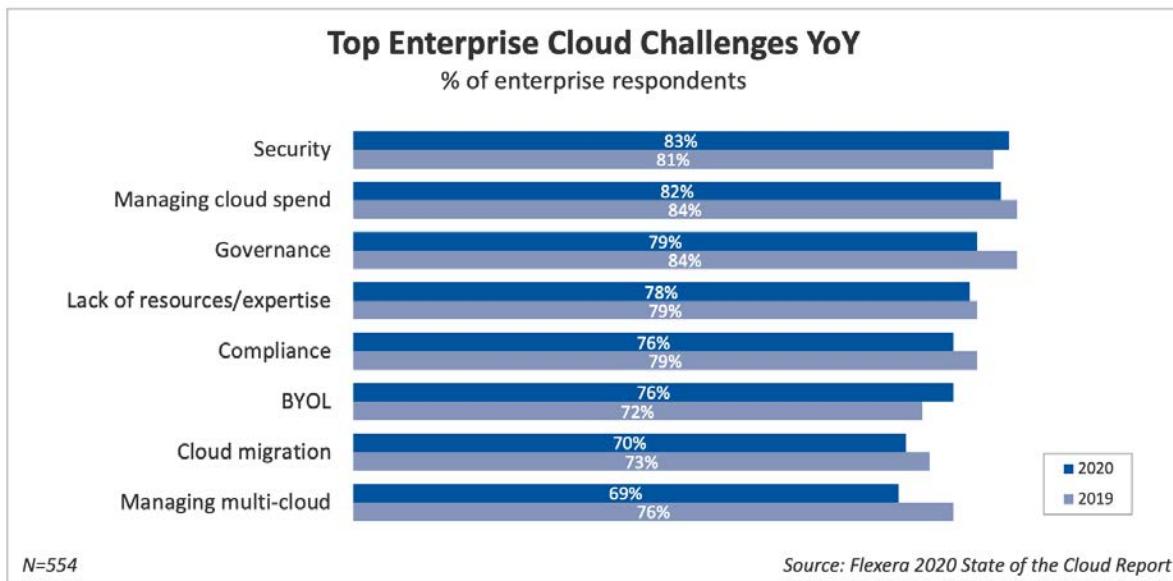
Figure 35. YoY comparison of top cloud challenges for enterprises

Maturity doesn't mitigate all cloud challenges

Some types of challenges, such as *cloud migration* and *managing multi-cloud environments*, become more manageable as the organization matures and gains experience. But others remain significant, even in organizations at the advanced cloud maturity level. As **Figure 36** indicates, *security, cost management, governance* and *compliance* are among these.

One possible reason for this phenomenon is that the factors driving these challenges present moving targets. Hackers continue to increase their sophistication, requiring constant attention to cloud security. Also, new legislation and regulations continue to appear, particularly in industries such as financial services and healthcare, as legislators attempt to catch up with technology.
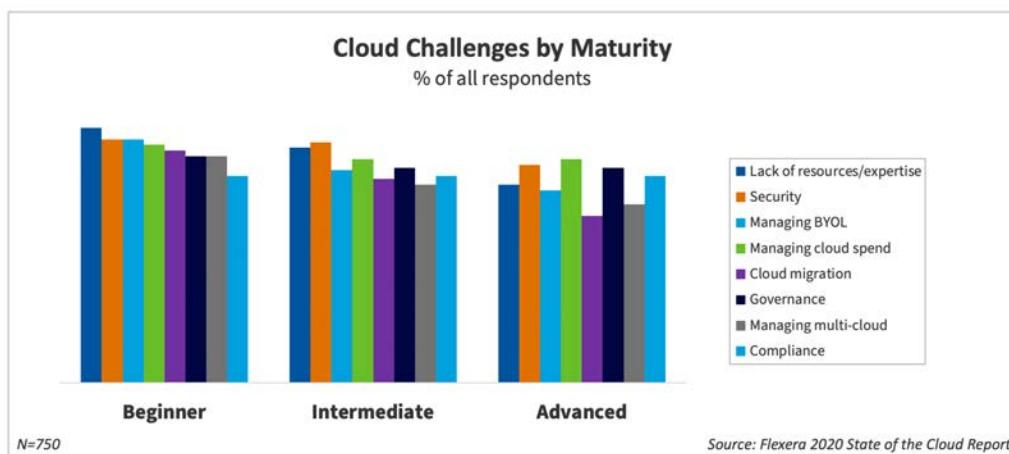
Figure 36. Cloud maturity doesn't lessen the severity of every challenge for all organizations

As **Figure 37** indicates, *lack of resources/expertise* is the top challenge for beginners but diminishes for intermediate and advanced cloud users. Conversely, *managing cloud spend* becomes the top challenge for advanced users. *Security*, however, remains in the top three regardless of maturity.
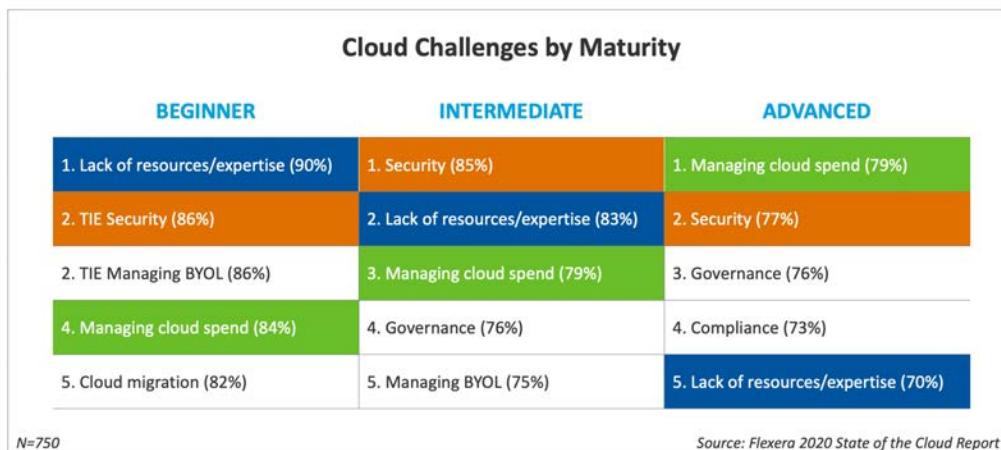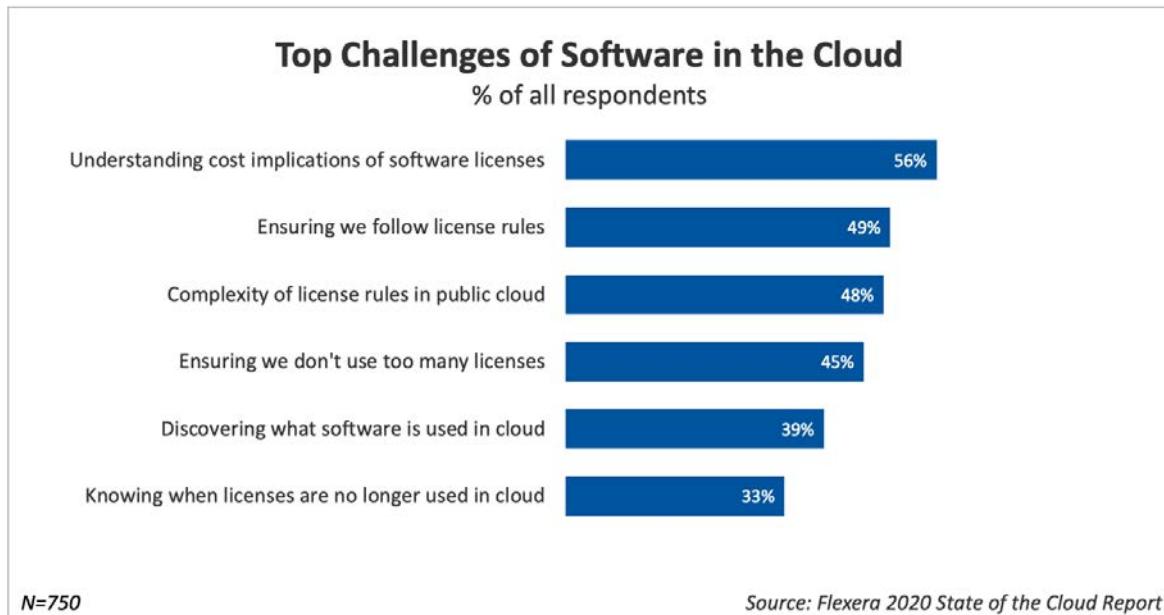
Figure 37. The ranking of cloud challenges by maturity level for all organizations

Managing software costs is challenging in the cloud

As **Figure 38** shows, the top software-related challenge in the cloud is *understanding the cost implications of software licenses*, followed by challenges related to license compliance.

As stated earlier, the software asset management and vendor management teams have considerable expertise in these areas, and organizations would be well advised to leverage their skills to address software challenges in the cloud.

Top Challenges of Software in the Cloud
% of all respondents

Challenge	%
Understanding cost implications of software licenses	56%
Ensuring we follow license rules	49%
Complexity of license rules in public cloud	48%
Ensuring we don't use too many licenses	45%
Discovering what software is used in cloud	39%
Knowing when licenses are no longer used in cloud	33%

N=750   Source: Flexera 2020 State of the Cloud Report

Figure 38. Top software challenges for all organizations

Organizations struggle to handle growing cloud spend

Organizations are continuing to increase their cloud spend rapidly. In doing so, they struggle to accurately forecast their fast-growing cloud costs. As **Figure 39** indicates, respondents reported their public cloud spend was over budget by an average of 23 percent. Moreover, respondents expect their cloud spend to further increase by 47 percent in the next 12 months. This trend means it's more critical than ever to get a handle on forecasting and cost optimization.

Organizational Spend on Public Cloud
Average % across all respondents

	Current spend	Growth in next 12 months
Next 12 months		47%

	Original budget	Amount over budget
Current cloud spend		23%

N=750

Source: Flexera 2020 State of the Cloud Report
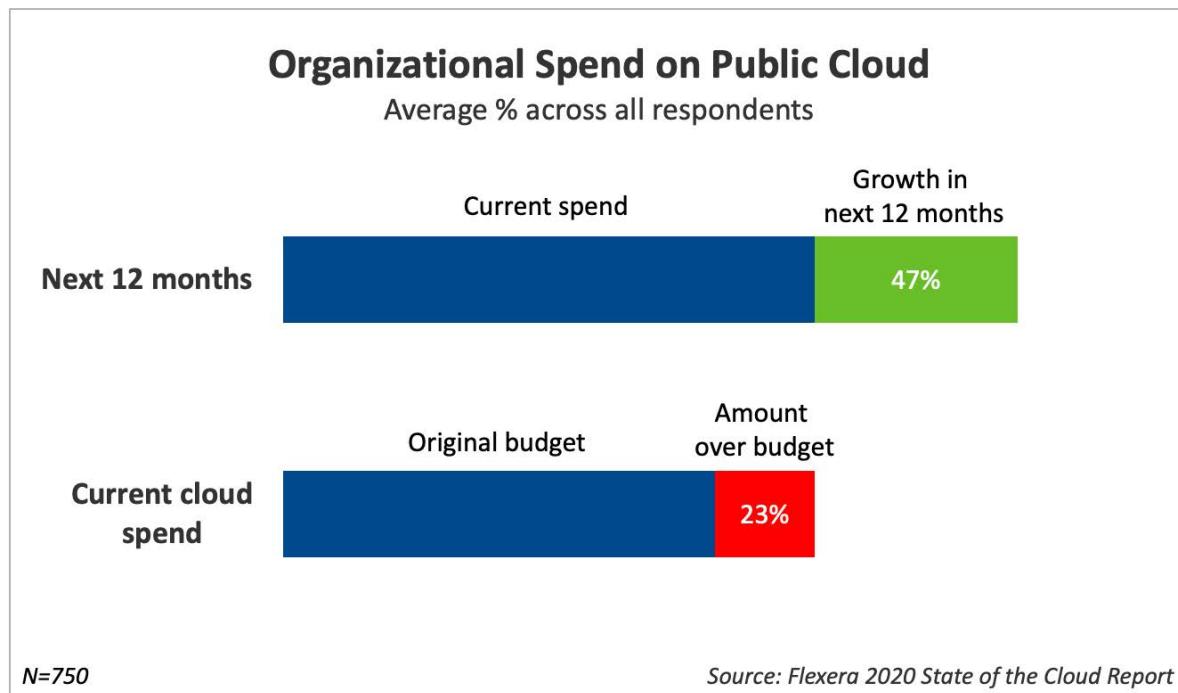
Figure 39. Overspending on public cloud for all organizations

Organizations waste significant cloud spend

Wasted cloud spend is a major issue and becomes more critical as cloud costs continue to rise. As **Figure 40** shows, respondents self-estimate that their organizations waste 30 percent of cloud spend. However, spend is likely less efficient as many organizations tend to underestimate the amount of waste. In working with customers to identify waste, Flexera has found that, on average, actual waste is 35 percent or even higher.

Percentage of Cloud Spend Wasted
% waste of all respondents

Self-estimated wasted spend

30%

70%

Efficient spend

N=750

Source: 2020 Flexera State of the Cloud Report
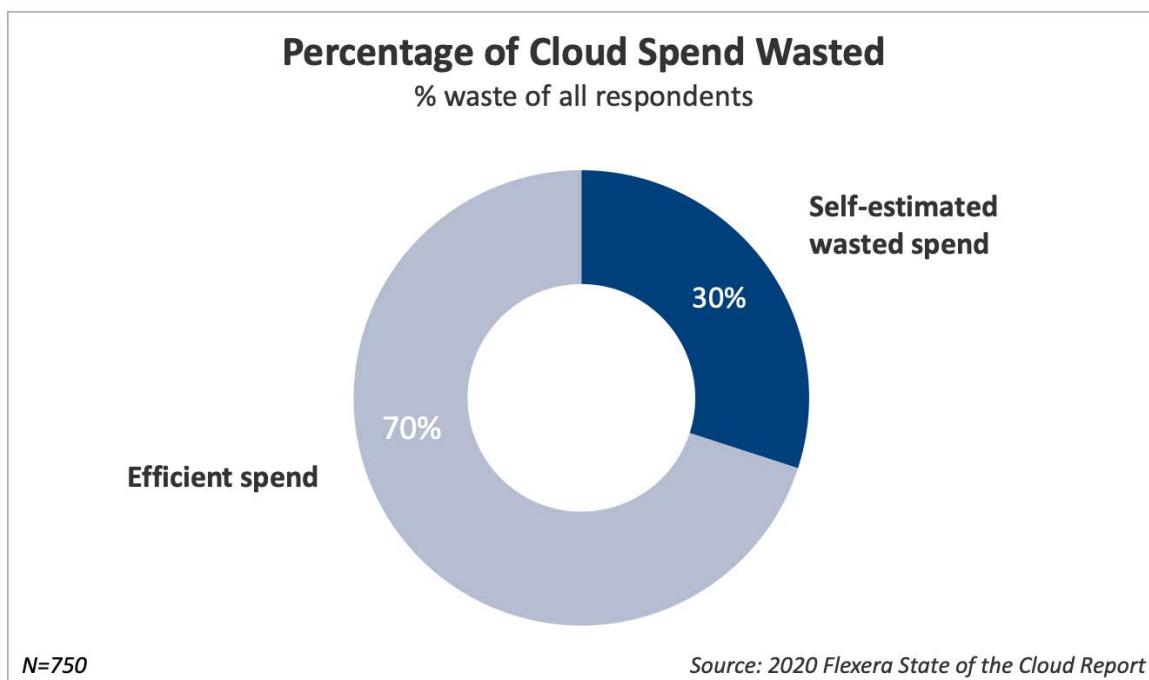
Figure 40. Respondent self-estimates of wasted cloud spend for all organizations

Cloud provider discounts offer savings opportunities

Cloud provider pricing structures are complex and tricky to decipher. However, taking a close look at provider discounts could uncover opportunities to reduce costs. **Figure 41** indicates that organizations aren't taking advantage of all the available discounts. Just over half (53 percent) of AWS users leverage *reserved instances*, and only 43 percent of Azure users do so. But organizations seem to be moving quickly to adopt the AWS Savings Plan, a new offering in 2020 that simplifies discounting.

Discount Types Used by Cloud Provider

AWS	AZURE	GOOGLE
AWS Reserved Instances **53%**	Enterprise Agreement **51%**	Committed use discounts **43%**
AWS Spot Instances **38%**	Azure Reserved Instances **43%**	Ad hoc negotiated discounts **18%**
AWS EDP (Enterprise Discount) **37%**	Azure Hybrid Benefit **30%**	
AWS Savings Plan **30%**	Azure Low Priority VMs **24%**	
Ad hoc negotiated discounts **20%**		
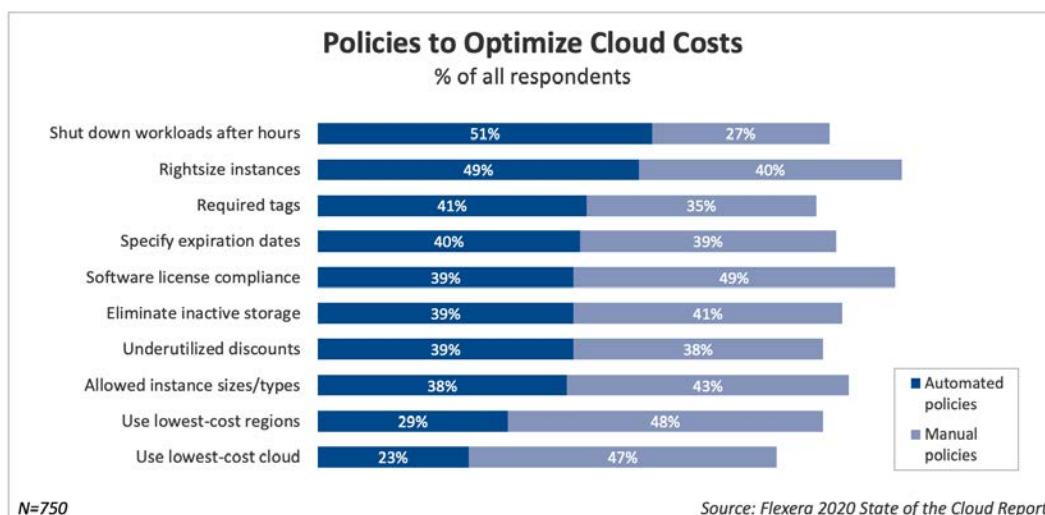
N=750

Source: Flexera 2020 State of the Cloud Report

Figure 41. Discount types organizations are leveraging

Organizations use automation to optimize costs

Figure 42 indicates that policies are being leveraged by organizations to optimize costs. Automated cloud cost optimization policies can save time while ensuring organizations monitor their environments consistently to eliminate waste.

Policies to Optimize Cloud Costs
% of all respondents

Policy	Automated policies	Manual policies
Shut down workloads after hours	51%	27%
Rightsize instances	49%	40%
Required tags	41%	35%
Specify expiration dates	40%	39%
Software license compliance	39%	49%
Eliminate inactive storage	39%	41%
Underutilized discounts	39%	38%
Allowed instance sizes/types	38%	43%
Use lowest-cost regions	29%	48%
Use lowest-cost cloud	23%	47%

N=750

Source: Flexera 2020 State of the Cloud Report

Figure 42. Cloud cost optimization policies for all organizations

Larger organizations are increasingly replacing cumbersome and inadequate manual processes with automated ones. As **Figure 43** shows, the YoY increase in enterprises using policy automation is significant. For example, *shut down workloads after hours* rose from 41 to 51 percent, and *rightsizing instances* increased from 35 to 49 percent. As enterprises make progress, they can expect their efforts to pay off in better-optimized cloud costs.

Automated Policies YoY
% of enterprise respondents

Policy	2020	2019
Shut down workloads after hours	51%	41%
Rightsize instances	49%	35%
Required tags	41%	35%
Specify expiration dates	40%	33%
Eliminate inactive storage	39%	26%
Software license compliance	39%	27%
Underutilized discounts	39%	25%
Allowed instance sizes/types	38%	24%
Use lowest-cost regions	29%	18%
Use lowest-cost cloud	23%	17%

N=554

Source: Flexera 2020 State of the Cloud Report

Figure 43. Enterprises are increasing their use of automation

Containers are now mainstream
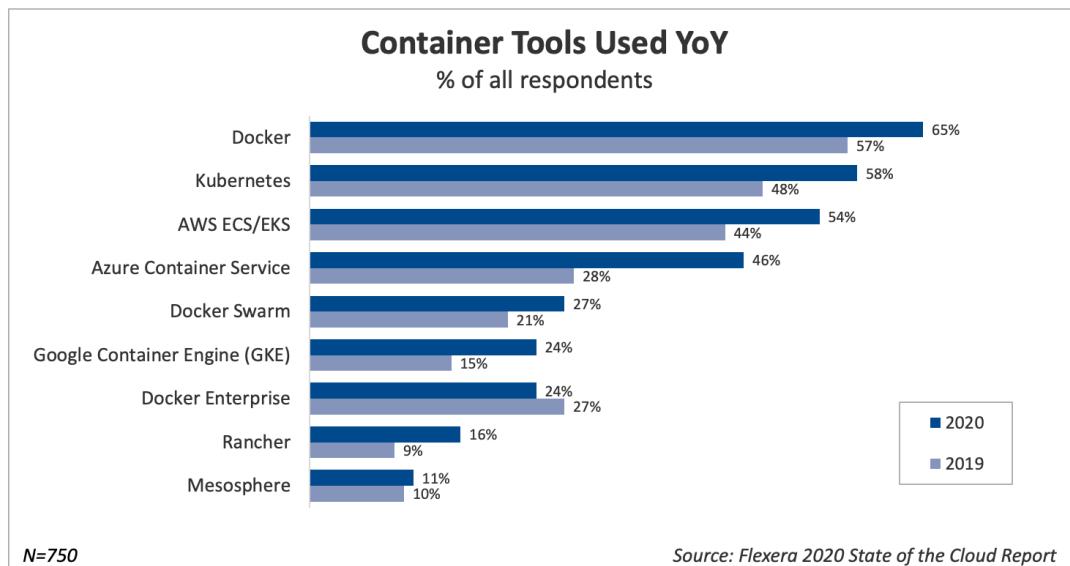
The use of Docker and Kubernetes continues to be considerable. As **Figure 44** indicates, 65 percent of organizations use Docker, and 14 percent plan to use it. Fifty-eight percent are using Kubernetes, a container orchestration tool that leverages Docker, and another 22 percent plan to use it.

Many organizations are also choosing container-as-a-service offerings from public cloud providers. The AWS container service (ECS/EKS) experienced substantial adoption, with 54 percent using it and another 24 percent planning to use it. Azure Container Service adoption reached 46 percent, and Google Container Engine (GKE) reached 24 percent.

Container Tools Used
% of all respondents

Tool	Currently use	Plan to use
Docker	65%	14%
Kubernetes	58%	22%
AWS ECS/EKS	54%	24%
Azure Container Service	46%	26%
Docker Swarm	27%	21%
Google Container Engine (GKE)	24%	27%
Docker Enterprise	24%	22%
Rancher	16%	17%
Mesosphere	11%	18%

N=750

Source: Flexera 2020 State of the Cloud Report
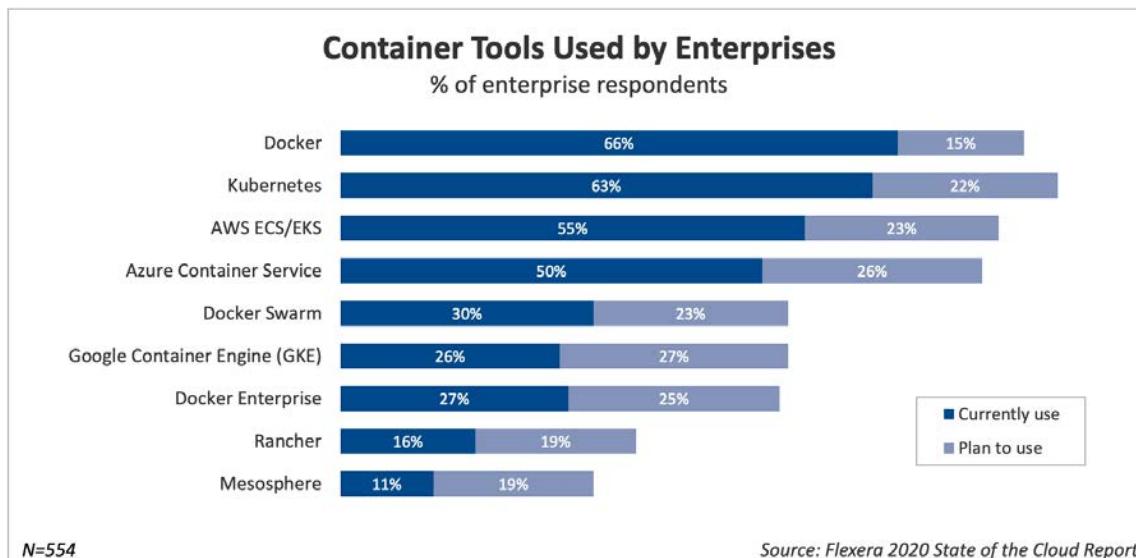
Figure 44. Current and planned container use for all organizations

As **Figure 45** shows, there's continued growth across container-as-a-service offerings from Docker, Kubernetes and cloud providers. Both Azure Container Service and Google Container Engine exhibit particularly strong growth. Azure Container Service grew from 28 percent in 2019 to 46 percent in 2020, while Google Container Engine increased from 15 percent to 24 percent.

Container Tools Used YoY
% of all respondents

Tool	2020	2019
Docker	65%	57%
Kubernetes	58%	48%
AWS ECS/EKS	54%	44%
Azure Container Service	46%	28%
Docker Swarm	27%	21%
Google Container Engine (GKE)	24%	15%
Docker Enterprise	24%	27%
Rancher	16%	9%
Mesosphere	11%	10%

N=750

Source: Flexera 2020 State of the Cloud Report
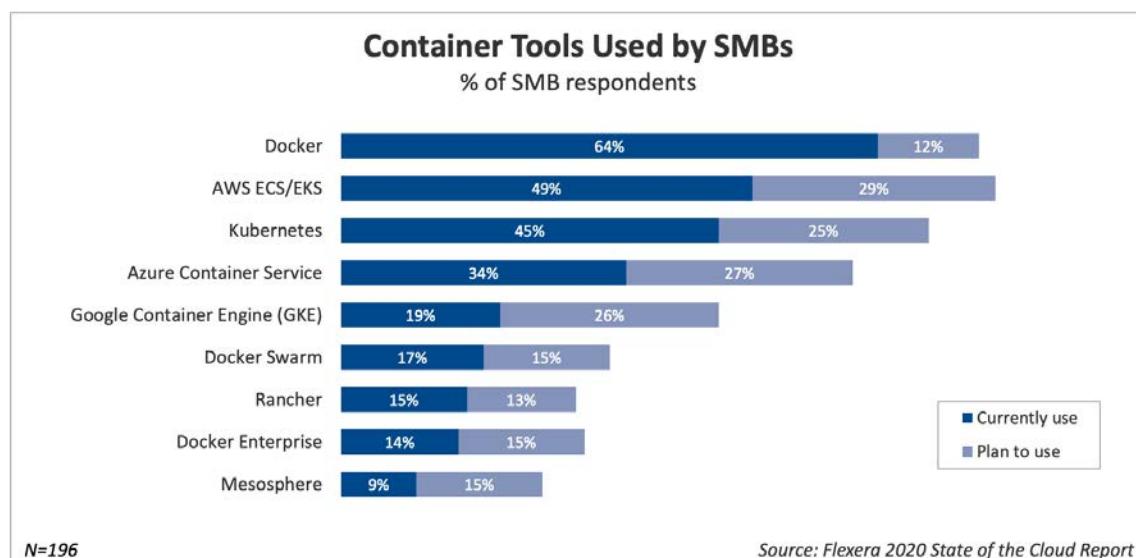
Figure 45. YoY increase in container use for all organizations

As **Figure 46** and **Figure 47** illustrate, Docker is used about the same between enterprises (66 percent) and SMBs (64 percent). In contrast, enterprises use Kubernetes more frequently (63 percent) than SMBs (45 percent).
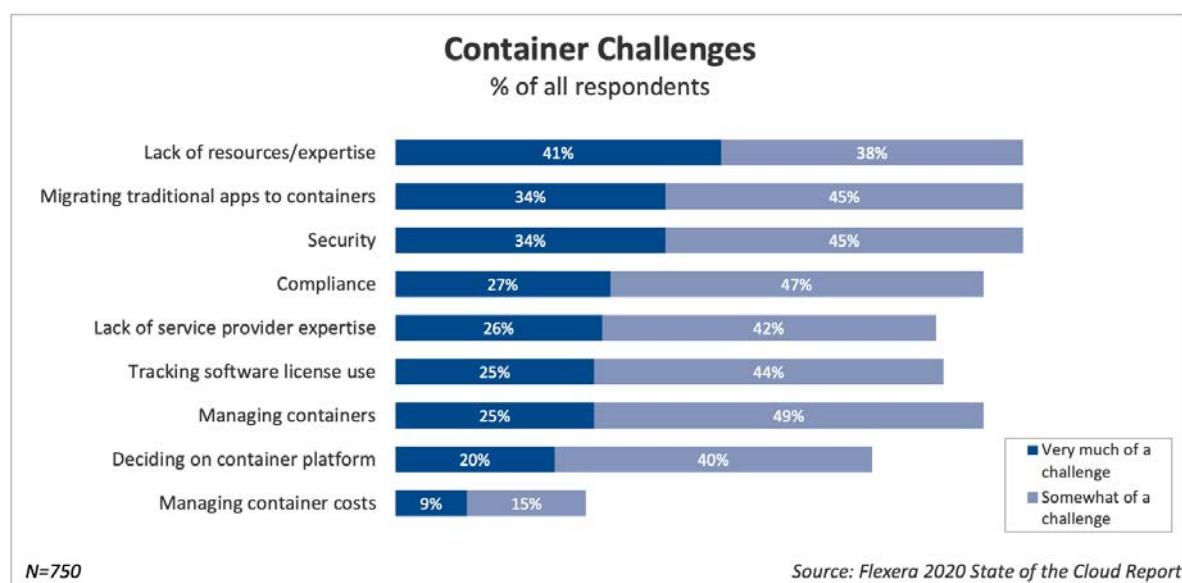
*Figure 46. Enterprise use of container tools*

Figure 47. SMB use of container tools

Lack of expertise is the top challenge for container use

Because of the relative newness of container technology, organizations face many challenges in their use. As **Figure 48** indicates, the top container challenges are the *lack of resources/expertise, migrating traditional apps to containers* and *security*. The resource challenges can be attributed to the relatively recent adoption of container technology. Migrating traditional applications to containers is problematic because containers are optimized for microservices, while traditional apps aren't.
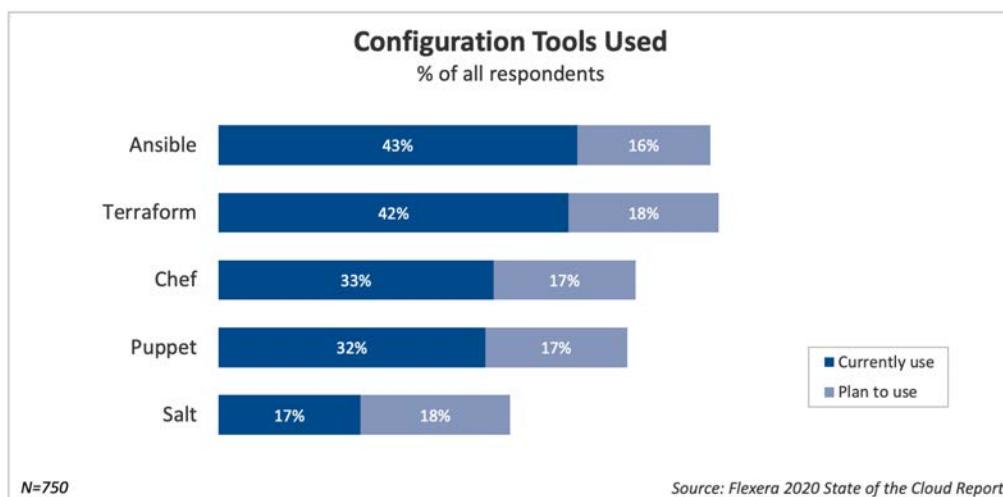
Figure 48. Top container-related challenges for all organizations

Adoption of cloud configuration tools is shifting
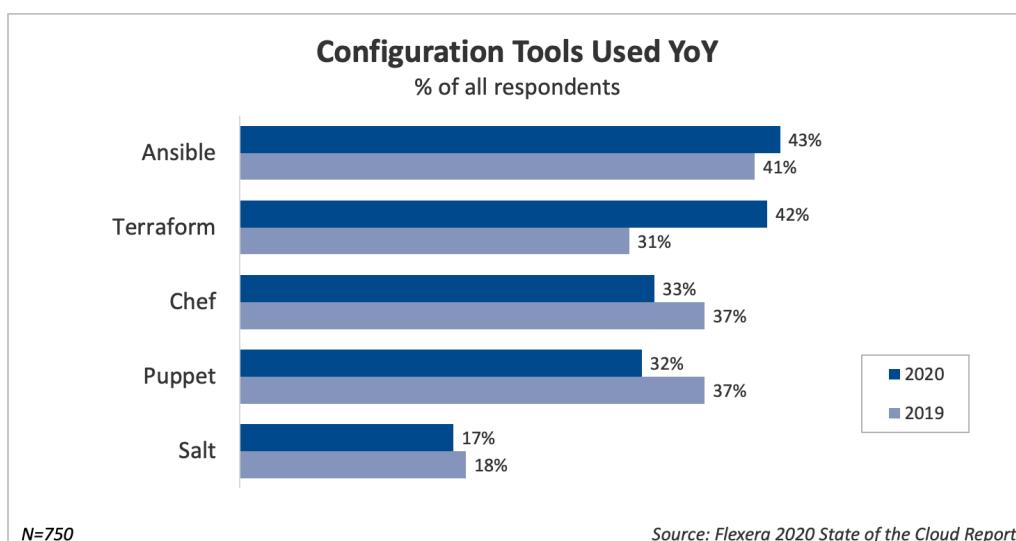
Cloud use often goes hand in hand with adopting DevOps processes. Organizations will frequently choose to implement configuration management tools that allow them to standardize and automate deployment and configuration of servers and applications. As **Figure 49** shows, Ansible leads among all respondents with 43 percent. Terraform is close behind with 42 percent. Chef and Puppet are in a virtual tie at 33 percent and 32 percent, respectively. (Note: Many organizations use more than one tool, so the individual percentages add up to more than 100 percent.)

Figure 49. Current and planned configuration tools for all organizations

Figure 50 indicates the YoY changes in tool adoption. Terraform has increased in popularity and showed strong growth in the past year, rising from 31 percent in 2019 to 42 percent in 2020. It has caught up with Ansible, which grew only slightly over the past year.

Figure 50. YoY configuration tool usage for all organizations

Figure 51 shows the configuration tools used by enterprises, and **Figure 52** indicates the tools used by SMBs. Overall, the use of configuration tools is higher among enterprises. Ansible leads for enterprises, with Terraform second at 43 percent and Chef and Puppet tying for third at 35 percent.
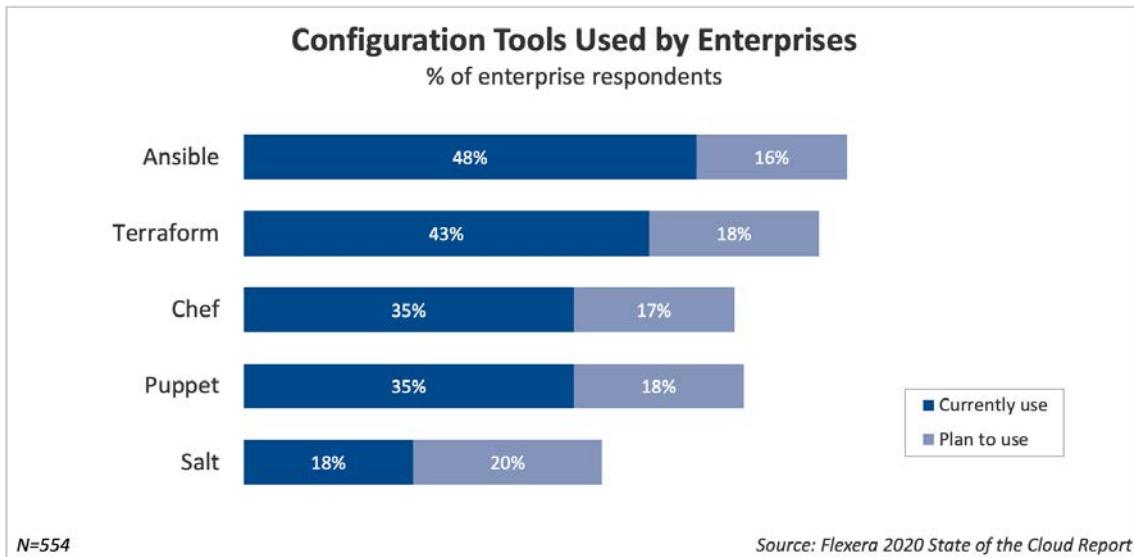
Figure 51. Enterprise container tool usage
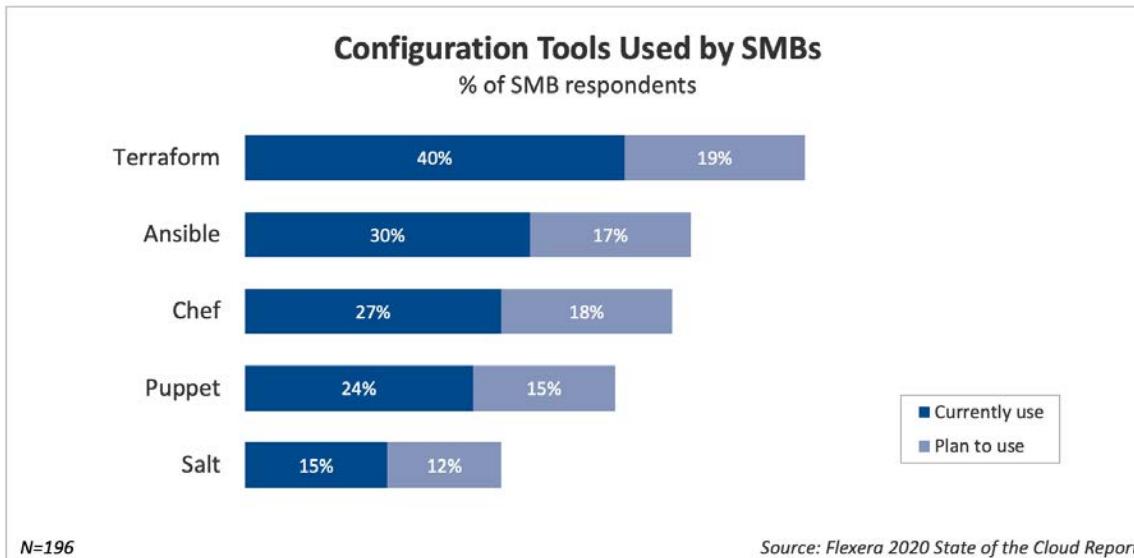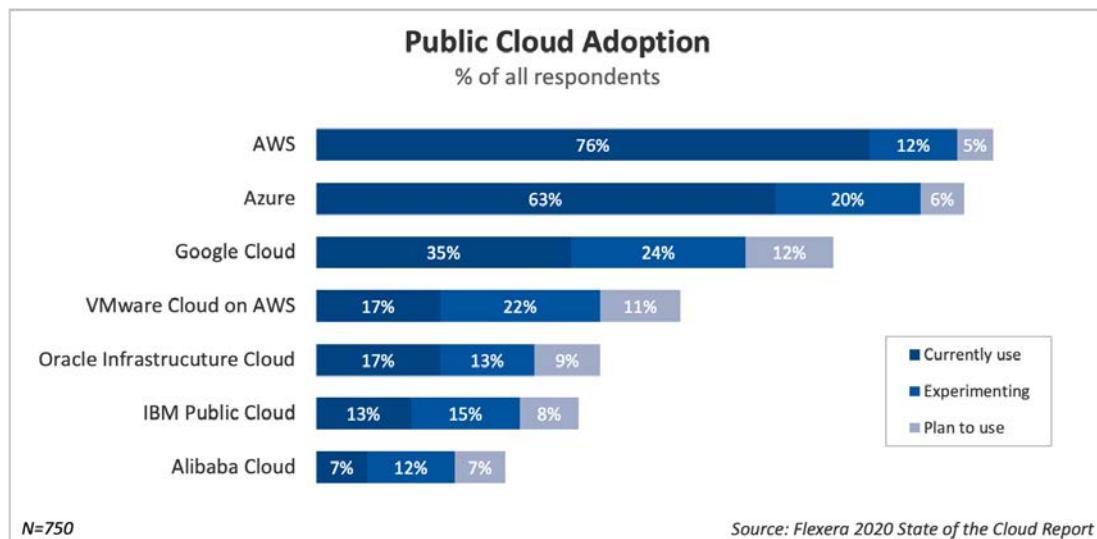
Figure 52. SMB container tool usage

Public cloud adoption is evolving

The survey delved into the private and public clouds that organizations are using. For each public cloud provider, respondents specified whether they're running applications in that cloud, experimenting with it, planning to use it or had no plans to use it. Most respondents are using more than one cloud, so individual percentages sometimes total up to more than 100 percent.

It's important to note that adoption—meaning an organization is using a cloud provider—is only one factor influencing revenue growth for the provider. The survey also explores other factors, including the number of VMs running and PaaS cloud services used. This year respondents were also asked about their level of cloud spend per cloud provider.

In 2020, as in previous years, AWS, Microsoft Azure and Google Cloud are the top three public cloud providers. **Figure 53** shows how the major providers stack up for adoption across all respondents in 2020. **Figure 54** compares the rankings for 2019 and 2020.

Figure 53. Public cloud provider adoption rates for current use/experimenting/planned for all organizations

Public Cloud Adoption YoY
% of all respondents

- AWS: 76% (2020), 61% (2019)
- Azure: 63% (2020), 52% (2019)
- Google Cloud: 35% (2020), 19% (2019)
- VMware Cloud on AWS: 17% (2020), 12% (2019)
- Oracle Infrastructure Cloud: 17% (2020), 11% (2019)
- IBM Public Cloud: 13% (2020), 12% (2019)
- Alibaba Cloud: 7% (2020), 3% (2019)

■ 2020   ■ 2019

N=750

Source: Flexera 2020 State of the Cloud Report
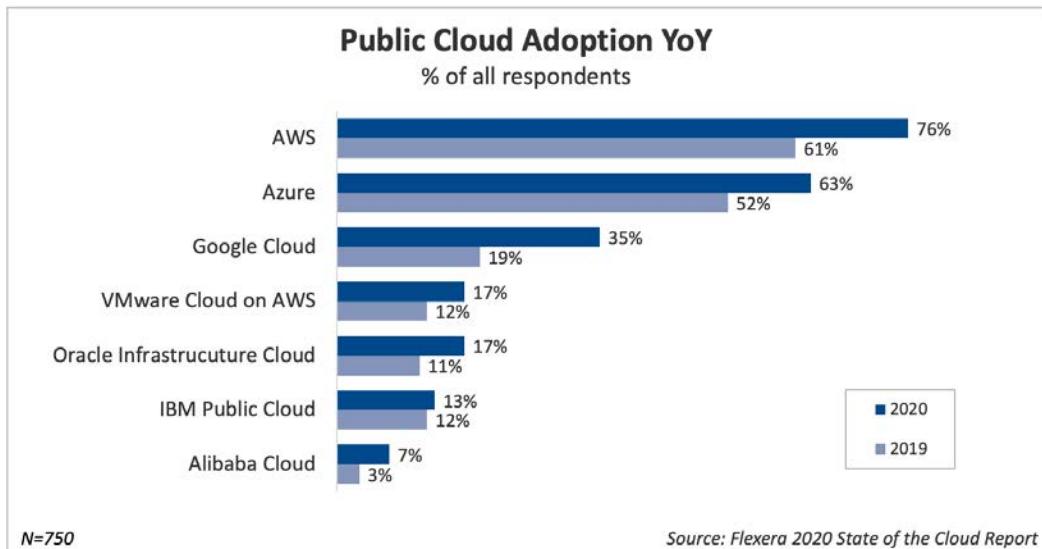
Figure 54. YoY public cloud provider adoption rates for all organizations

Major public cloud provider use shifting among enterprises

Among enterprises, Azure has nearly closed the gap with AWS in the breadth of adoption, as **Figure 55** indicates. Oracle has moved into the number four spot, followed by VMware Cloud on AWS. Google exhibited the most robust growth among the top three. More than one-quarter of respondents are experimenting with Google Cloud and VMware Cloud on AWS, which could drive more adoption in future years.

Public Cloud Adoption for Enterprises
% of enterprise respondents

- AWS: 76% (Currently use), 12% (Experimenting), 5% (Plan to use)
- Azure: 69% (Currently use), 18% (Experimenting), 5% (Plan to use)
- Google Cloud: 34% (Currently use), 26% (Experimenting), 12% (Plan to use)
- Oracle Infrastructure Cloud: 20% (Currently use), 14% (Experimenting), 11% (Plan to use)
- VMware Cloud on AWS: 19% (Currently use), 25% (Experimenting), 10% (Plan to use)
- IBM Public Cloud: 15% (Currently use), 15% (Experimenting), 9% (Plan to use)
- Alibaba Cloud: 7% (Currently use), 13% (Experimenting), 8% (Plan to use)

■ Currently use   ■ Experimenting   ■ Plan to use

N=554

Source: Flexera 2020 State of the Cloud Report

Figure 55. Enterprise public cloud adoption rates for current use/experimenting/planned

Figure 56 shows that AWS and Azure adoption rates rose somewhat among enterprises over the previous year. Azure closed the gap slightly, reaching 91 percent of AWS adoption among enterprises as compared to 90 percent in 2019.

Google adoption rates rose by 70 percent—a sizable increase from 2019.
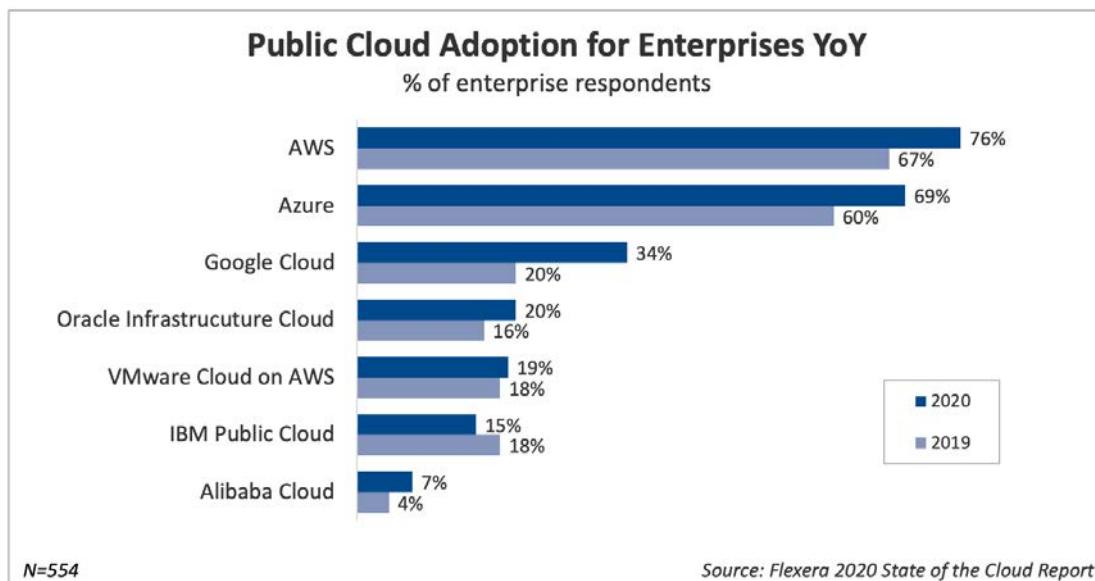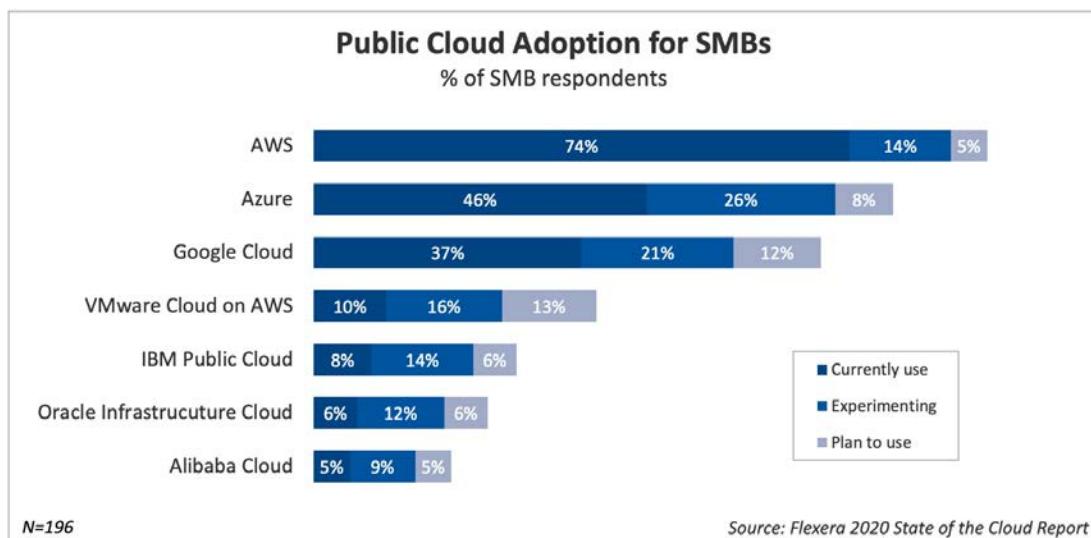
Figure 56. YoY enterprise adoption rates

FLEXEra **52**

Choice of public cloud provider changing for SMBs
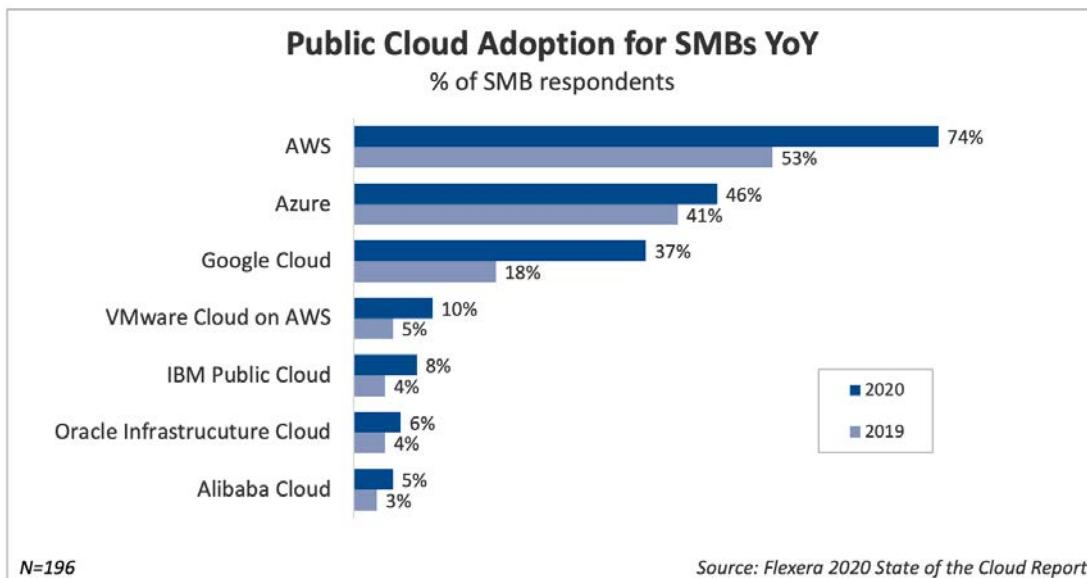
Among SMBs, AWS continues to show a clear lead. As **Figure 57** indicates, vendors that have traditionally appealed to enterprises (VMware, IBM and Oracle) have 10 percent or less penetration in this market in terms of current use. Alibaba Cloud is used widely in China, but much less so globally. More than one-quarter of SMBs are experimenting with Azure and more than one-fifth are trying Google.

Figure 57. SMB public cloud adoption rates for current use/experimenting/planned

In 2019, SMB respondents with future projects—indicated by the combination of the clouds they're experimenting with and planning to use—demonstrated the most interest in Google Cloud, followed closely by AWS. In 2020, they favor Azure slightly, with 34 percent saying they're experimenting with or plan to use Azure. Google follows close behind at 33 percent.

SMB adoption rates for both AWS and Google are increasing much faster than the rates for Azure, as **Figure 58** indicates. Adoption of VMware Cloud on AWS, IBM Public Cloud, Oracle Infrastructure Cloud and Alibaba Cloud rose year over year. However, only a small percentage of SMBs still chose each one.

Public Cloud Adoption for SMBs YoY
% of SMB respondents

Provider	2020	2019
AWS	74%	53%
Azure	46%	41%
Google Cloud	37%	18%
VMware Cloud on AWS	10%	5%
IBM Public Cloud	8%	4%
Oracle Infrastrucuture Cloud	6%	4%
Alibaba Cloud	5%	3%

N=196

Source: Flexera 2020 State of the Cloud Report

Figure 58. YoY SMB adoption rates

Maturity affects public cloud provider choice

Cloud maturity correlates to the length of time an organization has been using the cloud. That correlation is due to the time it takes to build cloud expertise and create processes and best practices across the organization. **Figure 59** indicates public cloud provider adoption based on the organization's cloud maturity level.

As the first large-scale cloud provider, AWS is used more frequently by organizations that have been using the cloud over a longer period—those at the advanced cloud maturity level. Across all respondents, 83 percent of advanced organizations use AWS compared with 66 percent using Azure. The gap between AWS and Azure is less for those with intermediate cloud maturity. These organizations often adopted cloud later than those with advanced maturity when the Azure offering had become more developed.

This year, Azure enjoys higher adoption for cloud beginners for the first time—holding a sizable lead over AWS and Google Cloud.

Google remains in third place at all three maturity levels. But its popularity is significantly higher, at 41 percent, within advanced maturity organizations.
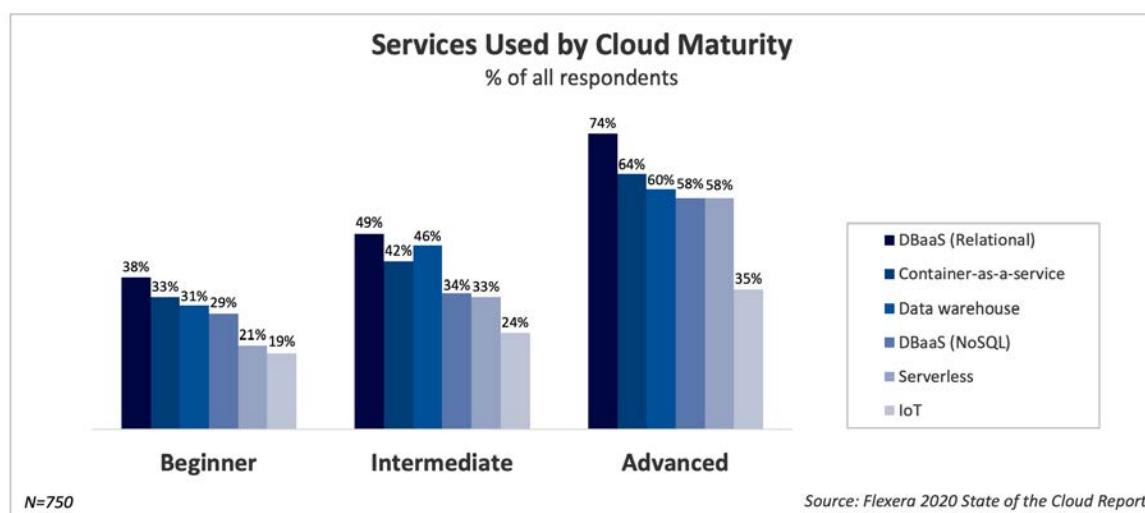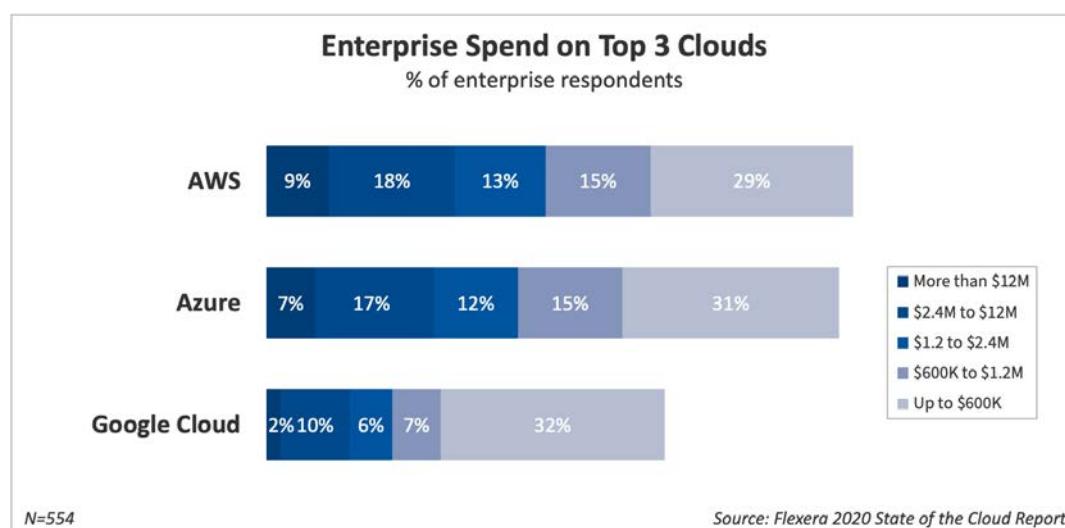
Figure 59. Public cloud provider adoption based on cloud maturity level for all organizations

Enterprises are growing their public cloud footprint

Cloud-first policies and cloud migration are top of mind for senior IT leaders, particularly in enterprise environments. As a result, enterprises are rapidly increasing public cloud spend and workload volumes.

Cloud spend is a good indicator of how much an enterprise is using a public cloud provider. As **Figure 60** indicates, 40 percent of enterprises spend $1.2 million or more annually on AWS. By comparison, 36 percent spend $1.2 million or more annually on Azure, showing Azure's footprint is approaching that of AWS. Only 18 percent of enterprises reported spending $1.2 million or more annually on Google, which is less than half of AWS or Azure.

Figure 60. Enterprise spend for top three cloud providers

The number of VMs deployed is also a measure of the extent of enterprise use of each cloud provider. **Figure 61** shows that, based on this metric, Azure is approaching AWS in the percentage of enterprises with at least 100 VMs. Fewer respondents said they're running 100 or more VMs in Google. Meanwhile, Google has experienced large growth in this metric since 2019.

More than 100 VMs in a Cloud for Enterprises YoY
% of enterprise respondents

|	2020	2019
AWS	51%	47%
Azure	44%	38%
Google Cloud	21%	13%
VMware on AWS	15%	Not asked in 2019
Oracle Infrastructure Cloud	15%	Not asked in 2019
IBM Public Cloud	14%	11%
Alibaba Cloud	10%	Not asked in 2019

N=554   Source: Flexera 2020 State of the Cloud Report
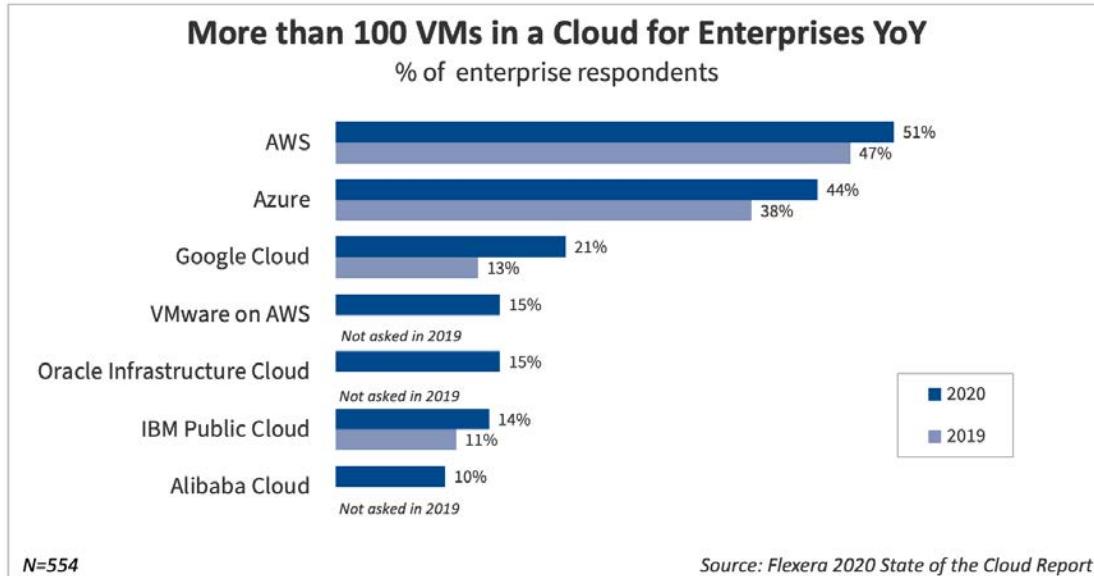
Figure 61. Enterprises with 100 or more VMs in a cloud

The number of VMs or instances currently running in each cloud provides additional insight into the size of organizations' footprint within each cloud. For example, **Figure 62** indicates that Azure is now close to AWS among the larger footprint sizes. Fourteen percent of respondents run more than 1,000 VMs in AWS compared to 12 percent in Azure.

Number of VMs by Cloud for Enterprises
% of enterprise respondents

	More than 1000	501 to 1000	101 to 500	51 to 100	1 to 50
AWS	14%	12%	25%	15%	22%
Azure	12%	11%	21%	13%	26%
Google Cloud	4%	7%	10%	13%	26%
Oracle Infrastructure Cloud	4%	5%	7%	7%	14%
VMware Cloud on AWS	5%	4%	6%	9%	18%
IBM Public Cloud	2%	6%	6%	4%	11%
Alibaba Cloud	2%	4%	4%	4%	6%

N=554   Source: Flexera 2020 State of the Cloud Report
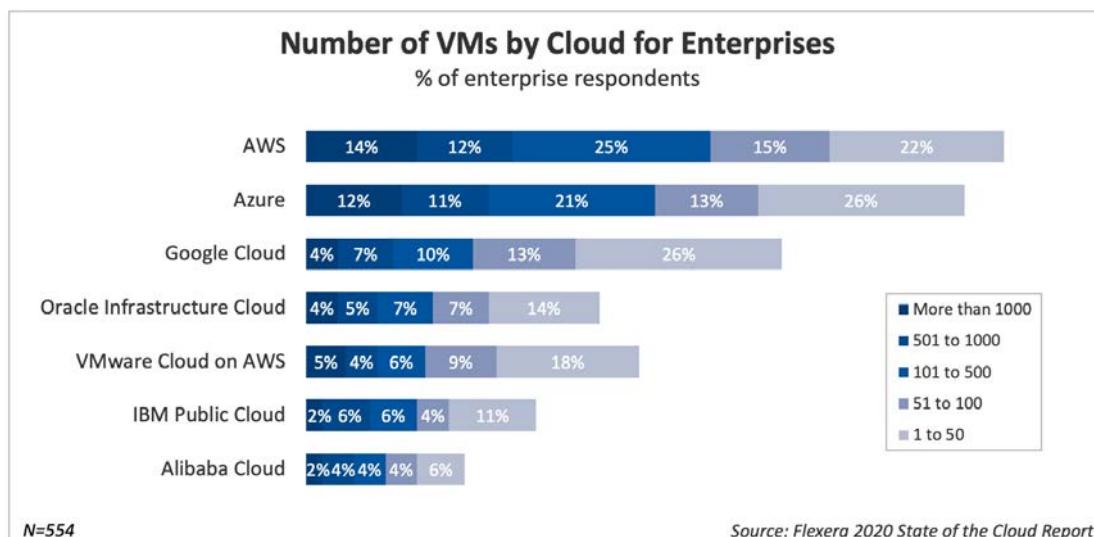
Figure 62. Number of VMs enterprises use by cloud provider

Use of public cloud PaaS services is rising

The number of public cloud users leveraging services beyond basic compute, storage and network services continues to grow.

Lock-in concerns not a large factor for PaaS use

For the first time, respondents were asked this year about the factors that drive or impede the use of PaaS services from cloud providers. In the early days of PaaS, many organizations hesitated to use PaaS offerings due to concerns about vendor lock-in. Today, only 30 percent of respondents limit PaaS usage for this reason.

Figure 63 provides insight into the reasons survey respondents are using PaaS and the policies they've established for governing PaaS usage. *Accelerating development* (59 percent), *reducing costs* (58 percent) and *gaining new capabilities* (55 percent) are the top three reasons.

Nearly half of the organizations require approval for people to spin up new PaaS services. Using PaaS services can have cost implications—vendors often price them at a premium due to lower competitive pressures. Therefore, a sound cloud cost management policy must consider the expanding use of PaaS services to avoid PaaS sprawl and ensure the return on investment justifies PaaS use.

Factors Governing PaaS Use
% of all respondents

Factor	%
Use PaaS to accelerate dev	59%
Use PaaS to reduce costs	58%
Use PaaS for new capabilities	55%
PaaS services must be approved	49%
App/Dev teams can choose	49%
Limit PaaS to avoid cloud lock-in	30%
Use PaaS services whenever possible	28%
No policies for use of PaaS	6%

N=750

Source: Flexera 2020 State of the Cloud Report
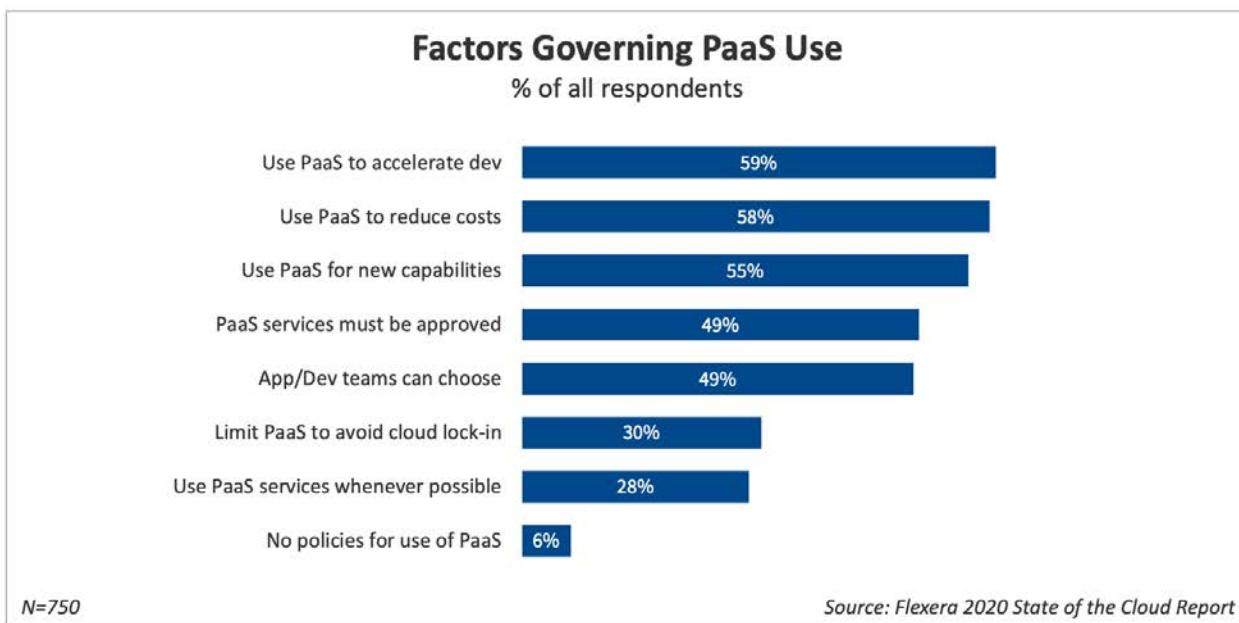
Figure 63. Why organizations use PaaS

Most heavily used PaaS services have shifted

Organizations are increasingly leveraging the many PaaS services from cloud providers. **Figure 64** ranks the services organizations are currently using, experimenting with or plan to use. The top three are *relational database as a service (DBaaS), container-as-a-service* and *data warehouse*. The most noticeable change is that *container-as-a-service* jumped from sixth place in 2019 to second place this year. Organizations are driving this shift due to their growing interest in leveraging containers to speed deployment, scale operations and increase the efficiency of workloads running in the cloud.


Public Cloud Services Used
% of all respondents

Service	Currently use	Experimenting	Plan to use
DBaaS (Relational)	62%	17%	10%
Container-as-a-service	53%	24%	11%
Data warehouse	53%	22%	12%
DBaaS (NoSQL)	47%	22%	17%
Push notifications	46%	18%	17%
Serverless	46%	25%	12%
Caching	45%	21%	18%
Search	44%	19%	21%
Batch processing	42%	20%	21%
Queueing	42%	20%	19%
Mobile services	41%	21%	18%
Machine learning/AI	38%	31%	11%
Hadoop	35%	22%	28%
Stream processing	33%	25%	24%
IoT	32%	23%	26%
Edge services	28%	26%	23%
DRaaS	23%	22%	27%

N=750

Source: Flexera 2020 State of the Cloud Report

Figure 64. Public cloud services organizations are using, experimenting with or plan to use

A look at the respondents experimenting with or planning to use a PaaS service sheds light on their strategies. In 2019, *machine learning* garnered the top score (48 percent) for future interest, but only 26 percent of respondents were using it at that time. In 2020, *Hadoop* has captured the top spot with 50 percent showing interest, demonstrating the growing curiosity in big data projects. Forty-nine percent are experimenting with or plan to use *edge services, IoT, stream processing* and *disaster recovery as a service*.

Enterprises use more PaaS services

Enterprises use more PaaS services overall than SMBs. **Figure 65** lists the rankings for enterprise respondents. These respondents place database services (relational, NoSQL and data warehouse) as well as *container-as-a-service* and *serverless* in the top five. While the current use of machine learning/AI is lower on the list, it has the highest number of respondents experimenting or planning to use the service.
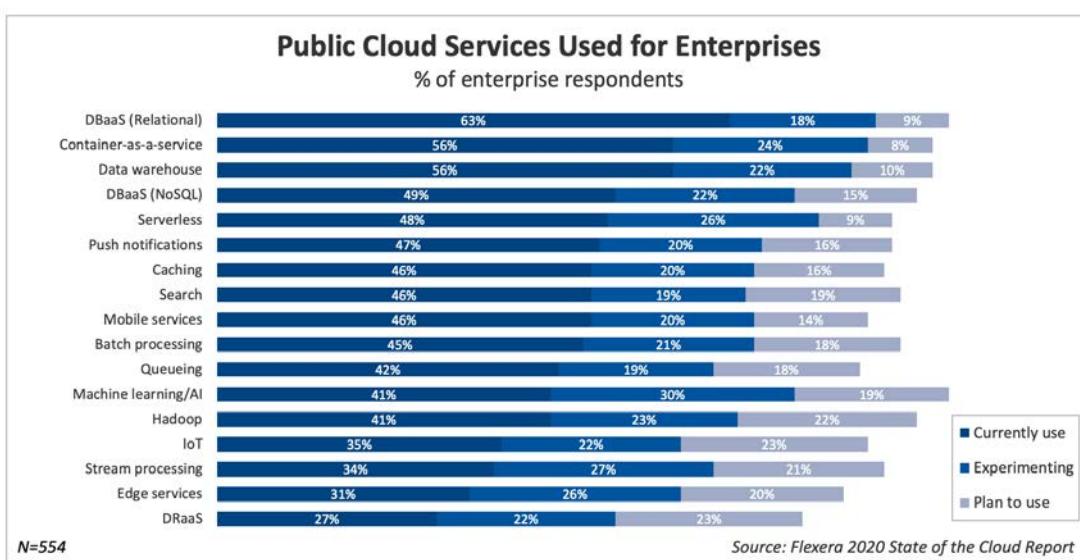

Figure 65. Public cloud services enterprises are using or plan to use

Growth rates for the various cloud services provide visibility into how enterprise usage is changing over time. **Figure 66** lists the five fastest-growing cloud services for 2019 and 2020. All five were the fastest growing for both years.
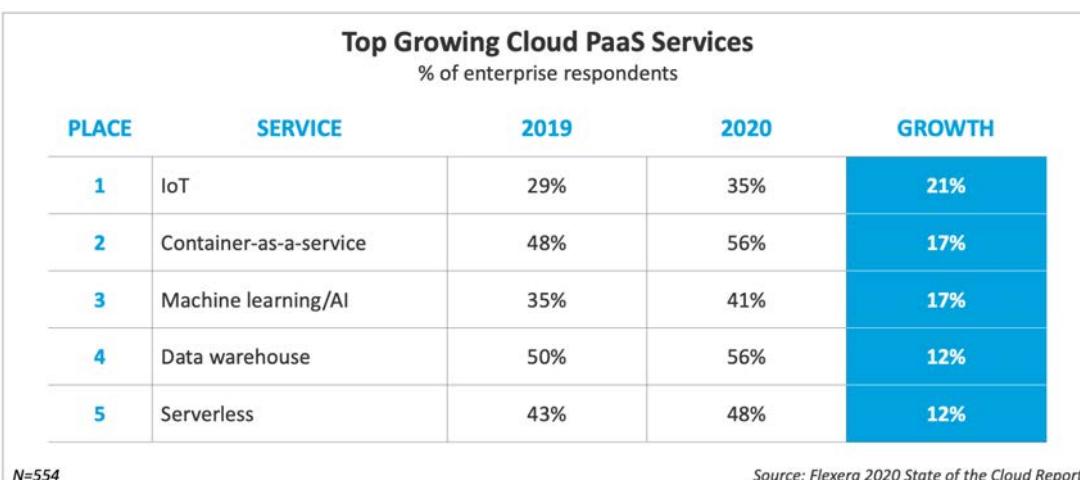
Figure 66. Fastest-growing services in the enterprise segment

SMBs have the same top PaaS services as enterprises

SMBs are also taking advantage of PaaS service offerings from their cloud providers. **Figure 67** shows the SMB rankings for services they're currently using, experimenting with or plan to use. SMBs cite the same top three services as enterprises, although in a different order.
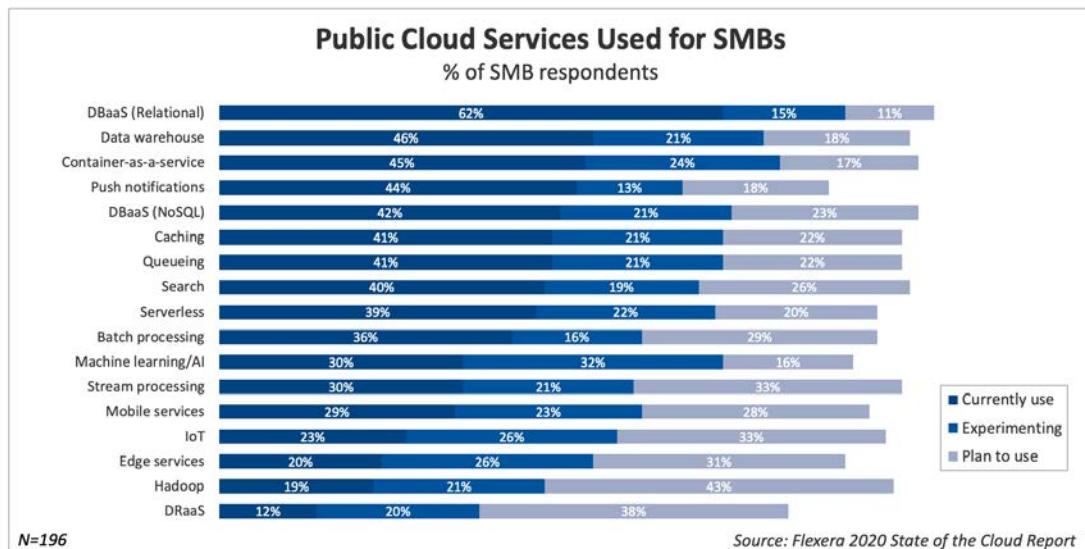
*Figure 67. Public cloud services SMBs are using*

PaaS services use increases with maturity

Organizations increase their use of PaaS services as they mature, as **Figure 68** indicates. For example, advanced organizations use *DBaaS, container-as-a-service* and *data warehouse* at about twice the rate of cloud beginners.
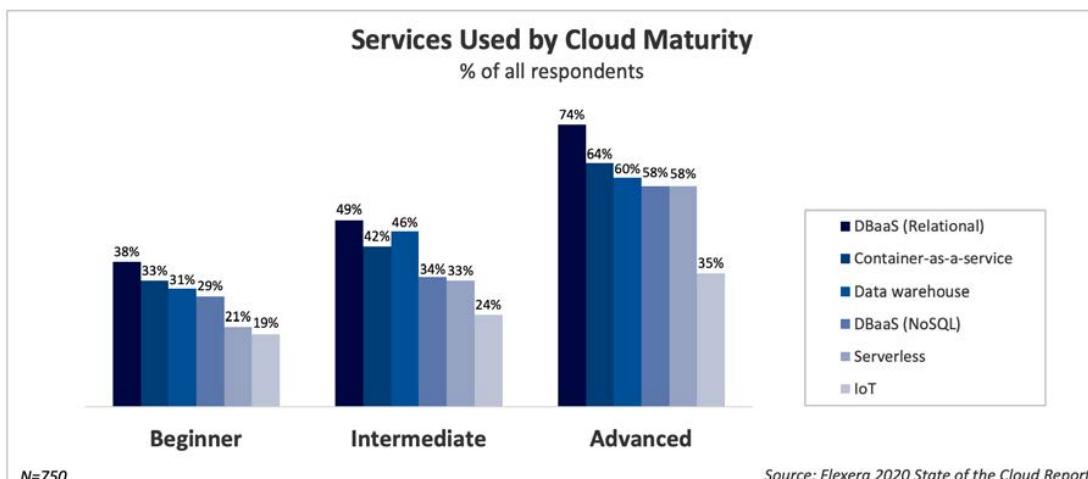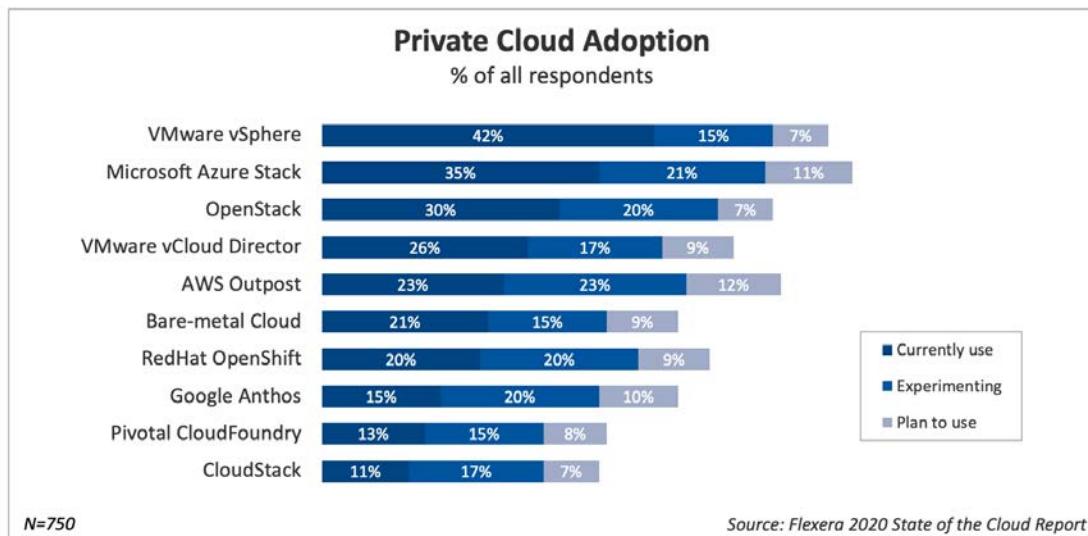

Figure 68. Services used based on cloud maturity for all organizations

Private cloud adoption is mixed

Most organizations are taking a multi-cloud, hybrid approach in which private cloud plays an important role. As mentioned earlier in this report, about 76 percent of survey respondents are running at least one private cloud (see **Figure 10**).

As in previous years, respondents reported on the technologies their organizations are using to run private clouds. This year, Flexera expanded the list of technologies, adding container platforms such as RedHat OpenShift and Pivotal CloudFoundry to the options. **Figure 69** lists the technologies organizations are currently using, experimenting with or planning to use.

Private Cloud Adoption
% of all respondents

Technology	Currently use	Experimenting	Plan to use
VMware vSphere	42%	15%	7%
Microsoft Azure Stack	35%	21%	11%
OpenStack	30%	20%	7%
VMware vCloud Director	26%	17%	9%
AWS Outpost	23%	23%	12%
Bare-metal Cloud	21%	15%	9%
RedHat OpenShift	20%	20%	9%
Google Anthos	15%	20%	10%
Pivotal CloudFoundry	13%	15%	8%
CloudStack	11%	17%	7%

N=750   Source: Flexera 2020 State of the Cloud Report

Figure 69. Private cloud technologies organizations are using, experimenting with or plan to use

Figure 70 compares private cloud technology rankings from 2019 and 2020. Fewer respondents indicated they use vSphere as a private cloud. With public cloud usage increasing, respondents may be less likely to describe their on-premises vSphere environments as a *private cloud*.

Since 2019, there has been striking growth in respondents reporting they use Microsoft Azure Stack and AWS Outpost. Specific industries, including hosting, are driving the increased adoption of AWS Outpost.
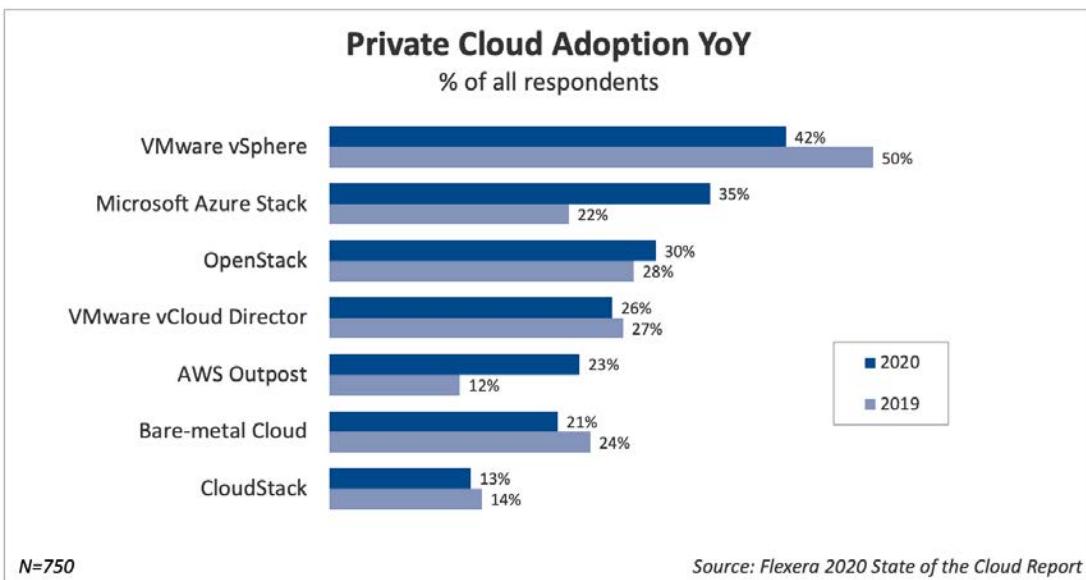

Figure 70. YoY changes in private cloud technology adoption for all organizations

SMBs use private clouds less than enterprises

Figure 71 shows the ranking of the private cloud technologies enterprise respondents are currently using, experimenting with or plan to use. **Figure 72** indicates the YoY comparison. vSphere leads again, but with 46 percent adoption compared with 61 percent in 2019. The private cloud options from public cloud providers—Azure Stack and AWS Outpost—lead among respondents who are experimenting with and planning to use these technologies. AWS Outpost is at 37 percent, and Azure Stack is at 33 percent. VMware vCloud Director, which took the second slot in 2019, dropped to fourth place in 2020.
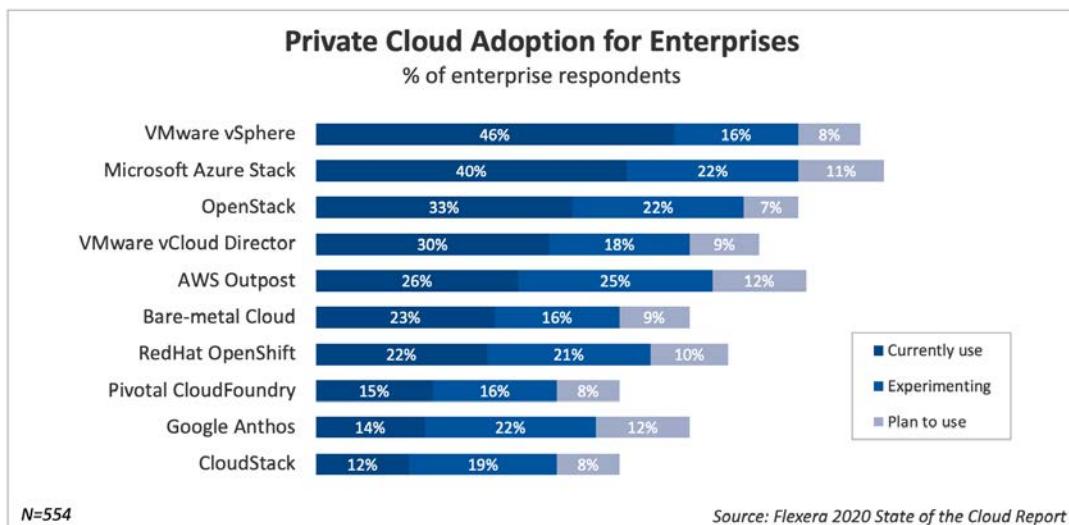

Figure 71. Providers enterprises are currently using, experimenting or planning to use private cloud
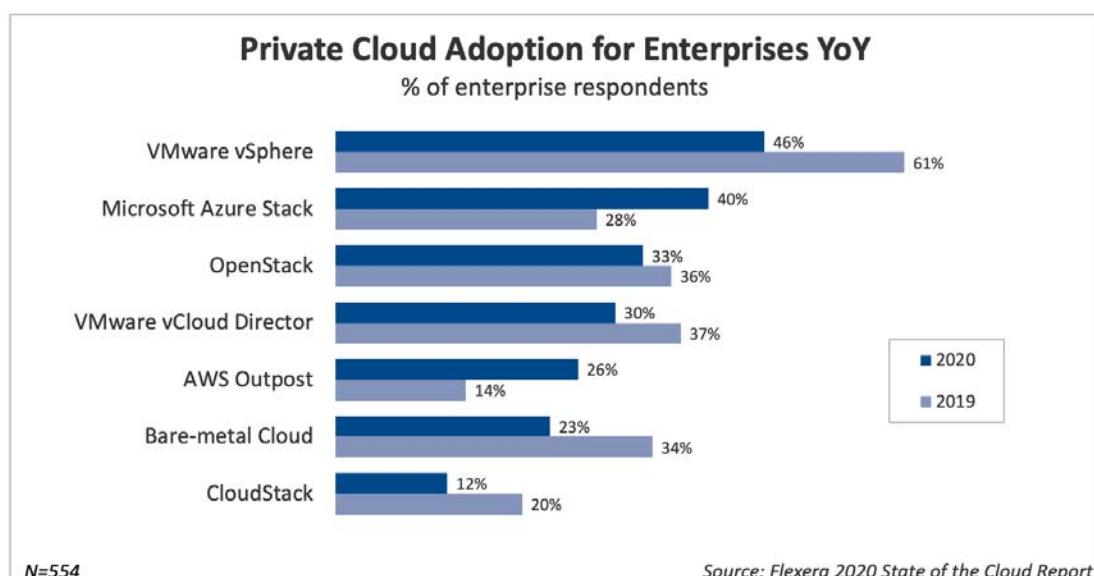

Figure 72. YoY comparison for enterprises

Private cloud adoption by SMBs is lower overall than for enterprises. **Figure 73** shows SMB rankings for the technologies they're currently using, experimenting with or plan to use. With 30 percent of SMB respondents, VMware vSphere is also their top choice. Microsoft Azure Stack edged out OpenStack for second place, being cited by 23 percent of SMB respondents compared with 22 percent for OpenStack.

In terms of future potential, AWS Outpost leads with 32 percent of SMB respondents experimenting with or planning to use it. Microsoft Azure Stack is next at 27 percent, followed by OpenStack at 23 percent.


Private Cloud Adoption for SMBs
% of SMB respondents

Provider	Currently use	Experimenting	Plan to use
VMware vSphere	30%	13%	5%
Microsoft Azure Stack	23%	18%	9%
OpenStack	22%	16%	7%
VMware vCloud Director	16%	15%	8%
AWS Outpost	16%	20%	12%
Google Anthos	15%	12%	7%
Bare-metal Cloud	14%	12%	6%
RedHat OpenShift	13%	17%	6%
CloudStack	8%	13%	5%
Pivotal CloudFoundry	6%	11%	6%

N=196   Source: Flexera 2020 State of the Cloud Report

Figure 73. Providers SMBs are currently using, experimenting or planning to use private cloud

Figure 74 compares SMB responses from 2019 to 2020. VMware vSphere is losing ground while Microsoft Azure Stack and AWS Outpost are gaining in popularity.


Private Cloud Adoption for SMBs YoY
% of SMB respondents

Provider	2020	2019
VMware vSphere	30%	35%
Microsoft Azure Stack	23%	14%
OpenStack	22%	17%
VMware vCloud Director	16%	15%
AWS Outpost	16%	9%
Bare-metal Cloud	14%	11%
CloudStack	8%	8%

N=196   Source: Flexera 2020 State of the Cloud Report
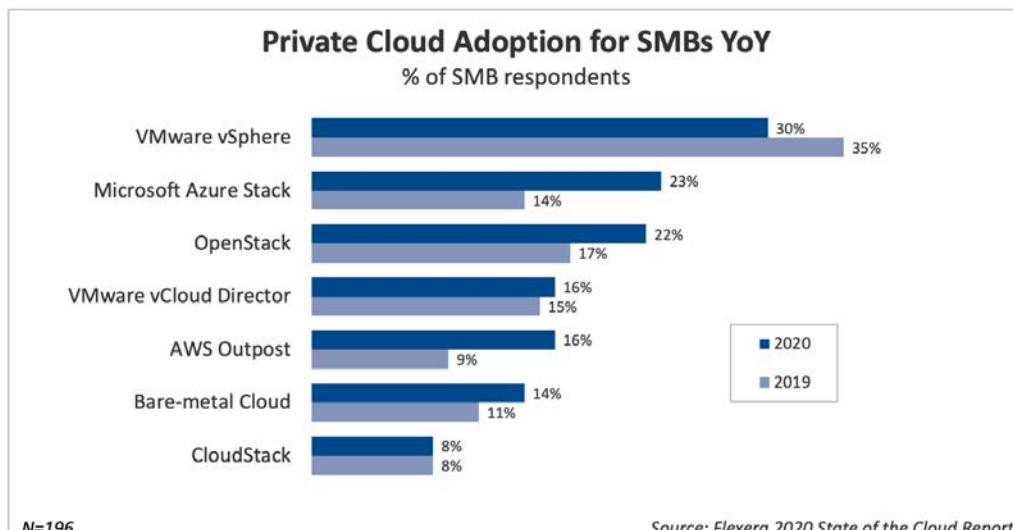
Figure 74. SMB private cloud adoption year over year

Summary

The 2020 State of the Cloud survey reveals that multi-cloud continues to be the dominant strategy, adopted by nearly all surveyed enterprises. The most common multi-cloud approach among enterprises is a mix of multiple public and multiple private clouds. The survey also shows that organizations are becoming increasingly comfortable with putting even sensitive data in the cloud.

Due to its complexity and dynamic nature, the multi-cloud environment brings many challenges, such as assessing the suitability of on-premises apps for migrating to the cloud.

The use of public clouds continues to grow dramatically in all organizations. The growth has driven a significant increase in public cloud spend, and the COVID-19 outbreak may drive that spend even higher. As a result of continually increasing cloud spend, *optimizing the existing use of cloud (cost savings)* continues to be the top cloud initiative for all organizations for the fourth year in a row. Organizations are leveraging automated policies to continually scan and optimize their cloud costs.

The quest to reduce cost and the increasing adoption of DevOps are driving up the use of containers. Docker and Kubernetes use continues to grow, and many users are also adopting container-as-a-service offerings from AWS, Azure and Google.

The growing move to the cloud continues to affect organizational structure. Organizations are increasingly establishing central cloud teams and centers of excellence to best leverage in-house expertise, especially in managing and optimizing cloud costs.

Organizations are moving to the cloud because of its scalability, economy and reach, and are using a variety of metrics to measure the resulting business value of cloud. Cloud advantages have proven to be especially valuable as organizations have had to adapt nearly overnight to the work-at-home explosion intensified by COVID-19.

About Flexera

Flexera helps business leaders succeed at what once seemed impossible: getting full visibility into, and control of, their company's technology "black hole." From on-premises to the cloud, Flexera helps organizations unravel IT complexity and maximize business value from their technology investments. For more than 30 years, our 1300+ team members worldwide have been passionate about helping our more than 50,000 customers optimize IT to achieve their business outcomes.
To learn more, visit **flexera.com**

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