
Optimizing in a Multi-Cloud World

Insights from Cloud Operations Professionals in 2024

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Introduction

The cloud ecosystem is constantly evolving, with countless services and resources working together seamlessly to power the online world. Navigating this complexity is compelling cloud practitioners to implement a wide range of strategies and innovative solutions, including automation, containerization, cloud management platforms, cost optimization, DevOps practices, security best practices, and more. As such, they are continually exploring — and advocating to their management — new technologies, best practices, and strategies that simplify and streamline the management of cloud ecosystems and mitigate the challenges posed by their inherent complexity.

Are cloud practitioners effectively harnessing the cloud’s full potential or struggling to ensure that their infrastructure is continuously available and reliable? Are their teams optimizing DevOps resources or overwhelmed by manual processes and a lack of standards? What is the current state of today’s dynamic public clouds, according to those who carry out day-to-day operational responsibilities? The primary goal of this study is to capture relevant data on the current state of automation and the optimization of public cloud infrastructures from the perspective of cloud operations practitioners.

The following report, sponsored by Spot by NetApp and conducted by Dimensional Research, is based on an online survey of more than 300 individuals. Each had responsibility for cloud operations as a “practitioner” at a company with more than 100 employees. This study intentionally focused on the front line staff that do the work day-to-day, and specifically excluded management roles. This research also includes feedback from a series of in-depth interviews conducted with cloud operations stakeholders.

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Key Findings

- **The 2024 cloud operations environment**
 - 74% are multi-cloud
 - 81% have adopted Kubernetes
 - 75% have already adopted DevOps for optimizing cloud infrastructure
 - 93% face challenges with cloud infrastructure optimization
- **Continuous optimization is a work in progress**
 - Only 33% optimize cloud infrastructure resources continuously
 - 53% optimize cloud infrastructure resources quarterly or less often
- **Automation and cloud operations**
 - Only 18% characterize their environment as “highly automated”
 - 63% use manual methods to manage workload variation
 - The complexity of cloud environments tops the list of challenges to implementing and maintaining automation
- **Tool selection has become democratized**
 - Practitioners, including IT operations (64%), DevOps (47%), and platform teams (35%), have responsibility for selecting automation tools
 - Only 45% report that technology leadership has responsibility for selecting cloud infrastructure automation tools
- **Automation delivers benefits that increase with maturity**
 - 96% report benefits from their automation and optimization investments
 - Top benefits of investments include improved reliability and uptime (64%), cost savings (58%), and faster deployment time (56%)
 - 75% of “highly automated” environments report cost savings compared to only 47% of those with “minimal” investment in automation
 - 67% who have invested in commercial tools report cost savings compared to only 51% of those who don’t use commercial tools
- **Cloud operations practitioners are embracing innovation**
 - 57% report AI or machine learning is contributing to cloud infrastructure optimization
 - Overprovisioning is the top challenge in optimizing Kubernetes for cost efficiency (46%)

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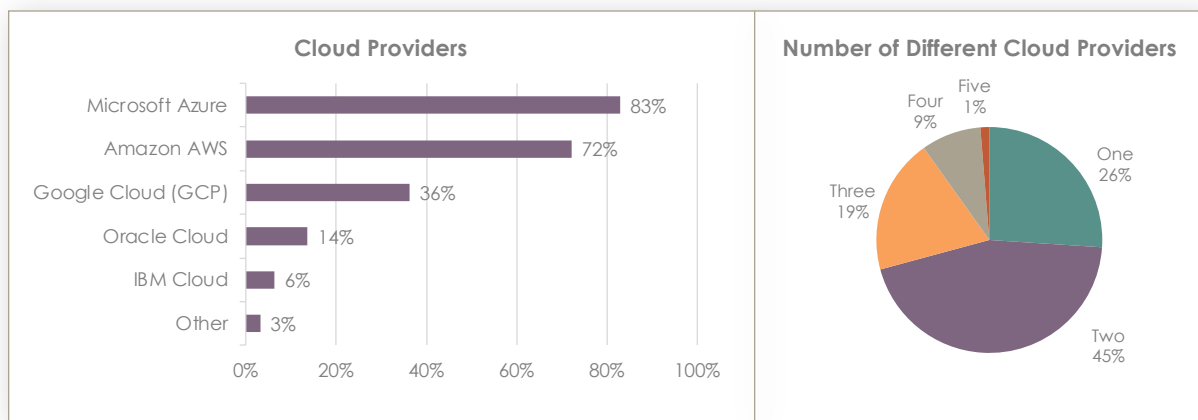


Detailed Findings: The 2024 cloud operations environment

Complexity is the norm: multi-cloud and Kubernetes

To understand the cloud landscape, it's essential to dig deeply into the rapidly evolving environment and explore several key aspects of its current state, including the leading cloud providers, the number of different providers used within each company's cloud infrastructure, and the adoption of Kubernetes for container orchestration in cloud environments.

When we asked cloud operations practitioners to describe their cloud environments, 74% shared that they run clouds from multiple vendors (multi-cloud). Of those, 29% reported using three or more different cloud providers. As expected, the "big three" cloud providers continue to dominate, with Microsoft Azure (83%), Amazon Web Services (72%), and Google Cloud Platform (36%) topping the list.



Less than half (45%) of survey participants who used multiple cloud providers indicate that multi-cloud deployment is a strategy for ensuring the availability and reliability of their cloud infrastructure, indicating that multi-cloud is more typically (55%) motivated by tactical reasons, such as acquisitions, historical decisions, or application requirements.



"I wouldn't say having multiple cloud platforms is a bad thing, but it depends. It's not obviously good either. There are use cases for both. But multi-cloud can get complicated."

- Cloud Operations Engineer, Large Legal



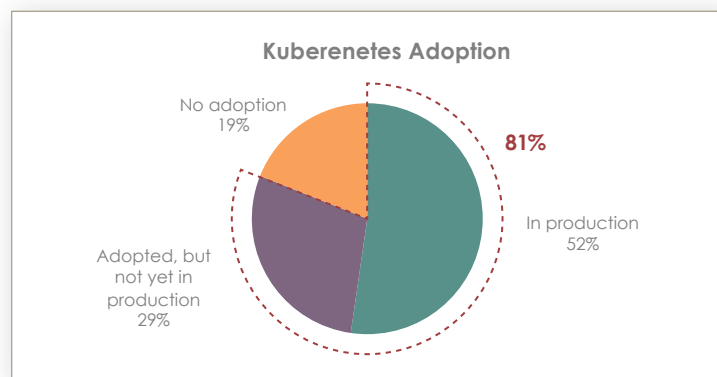
As we dug into the motivations for multi-cloud environments during interviews with cloud operations practitioners, it was interesting that we didn't find strong advocates for multi-cloud architectures. Multi-cloud was perceived as having both good and bad impacts. In the list of positive factors, having options was stressed frequently. If one cloud provider begins to have quality issues, changes pricing models, or does not keep up with innovation, it is good to have the skills and relationship with an alternate. However, there are also challenges. A lack of standardization across clouds adds to complexity and increases the need for understanding differences, which can often be subtle.



"More clouds means more to learn. Some of it is one-to-one, but usually it's just more complicated, even with things like IaC, that is supposed to save doubling the work across clouds. It still requires you to have a different plan for each cloud."

- DevOps, Mid-size Media

Using containerization technologies, like Kubernetes, is one way for enterprises to simplify application deployment and management in multifaceted cloud environments. Containers package applications and their dependencies into isolated units, making them portable and enabling consistent deployment across different cloud environments. It's no surprise that 81% of cloud operations practitioners report they have Kubernetes in their environment, with more than half (52%) saying they are in production.



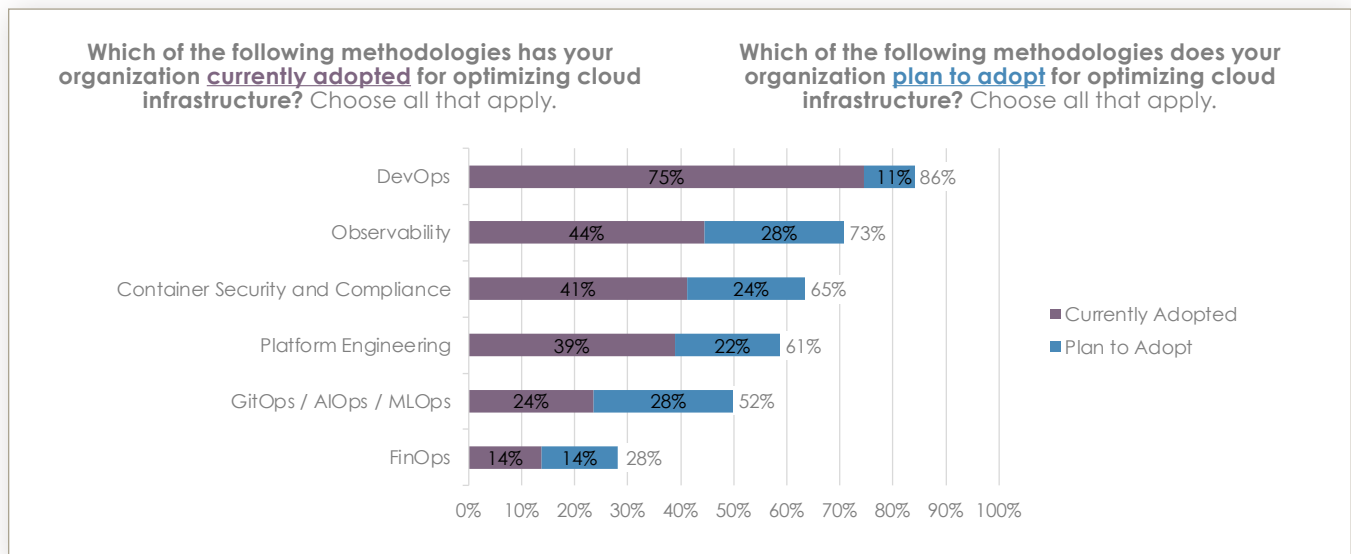
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DevOps is the most widely adopted methodology for optimization

Optimizing cloud infrastructures involves a dynamic combination of strategic planning, efficient resource management, and continuous monitoring and refinement. When we asked cloud operations practitioners about the optimization methodologies adopted by their organizations, 93% cited at least one approach already existed, while 83% planned to adopt additional methods. Specifically, the most widely adopted methodology for cloud optimization is DevOps (75%), followed by observability (44%), container security and compliance (41%), and platform engineering (39%). On the list of cloud optimization methodologies tested, FinOps came at the bottom of the list for current adoption (14%) while only DevOps had less planned future growth. This finding indicates an educational opportunity to include cloud practitioners in FinOps approaches.

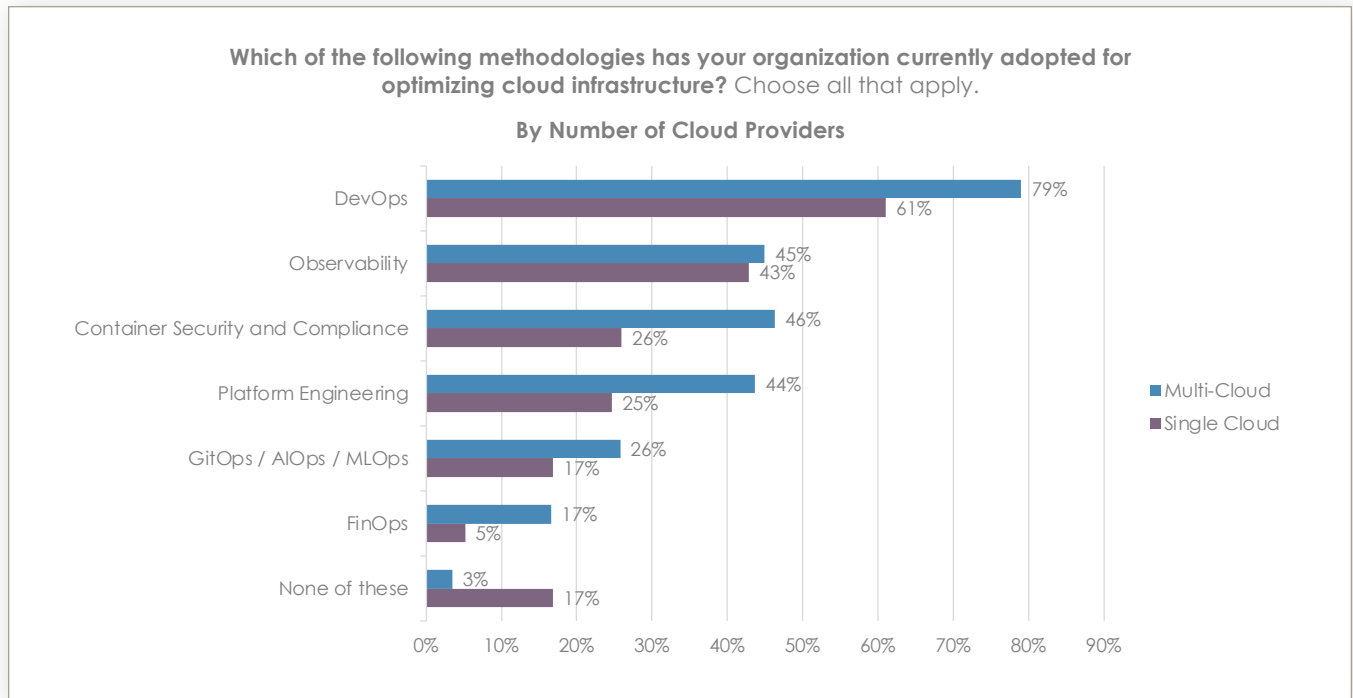


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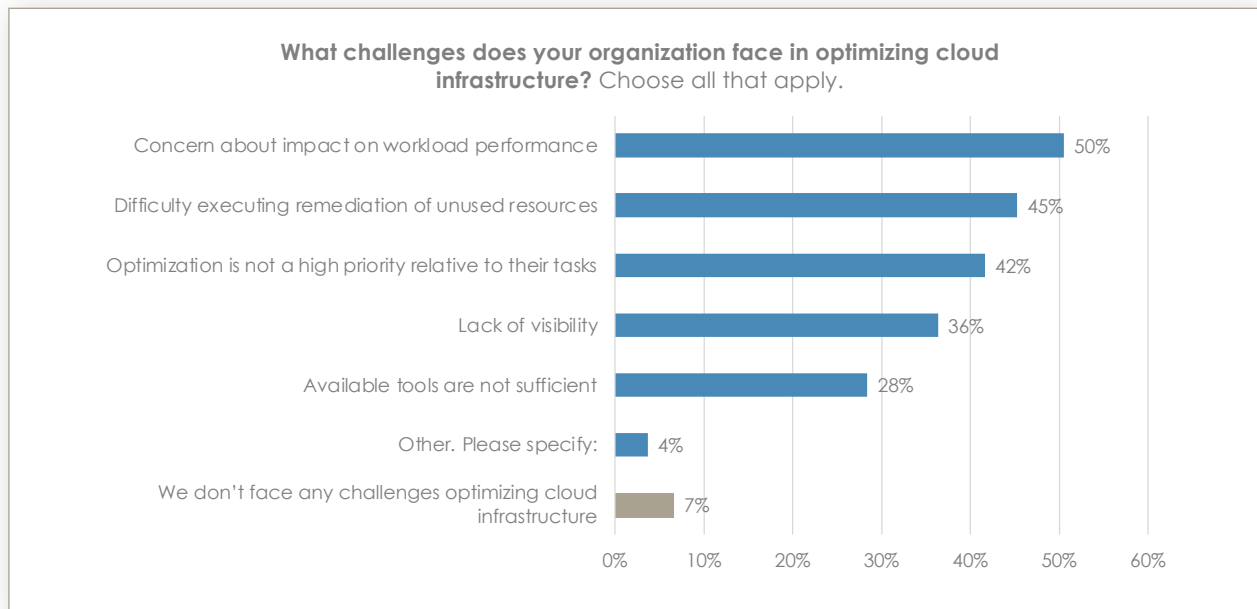
Managing workloads across multiple cloud environments often introduces interoperability, data integration, and workload portability issues. To help navigate this complexity, we see that companies with multi-cloud infrastructures are more likely to adopt various types of optimization methodologies at a higher rate than those with single-cloud infrastructures.





Most organizations report challenges optimizing cloud infrastructures

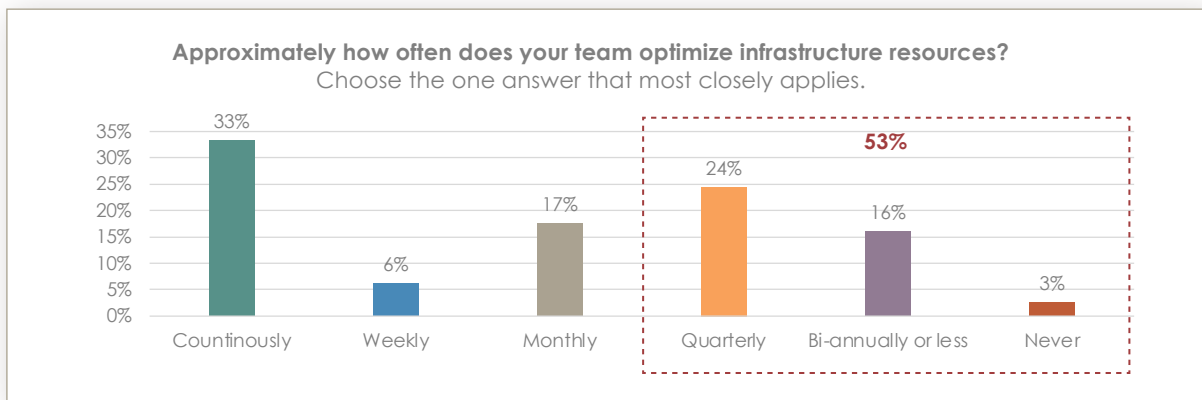
Cloud technology can be transformative, but operating in cloud environments is often messy. Cloud practitioners agree, with 93% reporting that they face challenges in optimizing cloud infrastructures. The top issue identified is performance (50%), which, for practitioners, is mission-critical to their jobs as they are on the frontlines, ensuring the smooth operation of cloud-based systems, applications, and services.





Detailed Findings: Continuous optimization is a work in progress An opportunity exists to do better by increasing optimization frequency

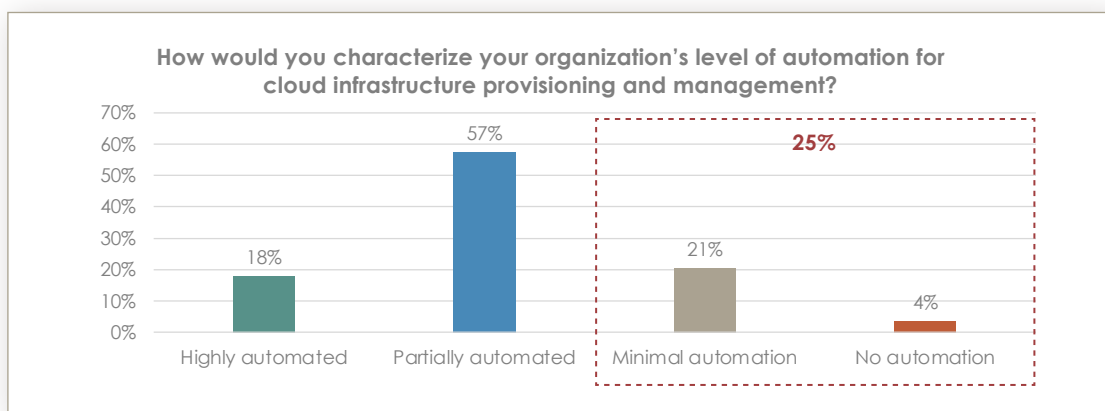
Cloud optimization is the ongoing process of fine-tuning and improving cloud performance, cost-effectiveness, and resource utilization. This process involves adjusting various parameters and configurations to ensure that cloud resources are utilized efficiently and effectively to meet the changing demands of applications and workloads. When asked how often their teams optimize cloud infrastructure resources, only one-third (33%) do it continuously, and a worrisome 53% do it quarterly or less. This finding demonstrates an opportunity for those companies to improve by increasing optimization frequency.



Detailed Findings: Automation and cloud operations

Automation is still a work in progress

Using tools and scripts to automate cloud tasks and processes can streamline operations and reduce manual intervention. With more automated processes, organizations can typically manage more cloud resources with fewer people, allowing them to strategically deploy talent to more strategic initiatives. However, according to cloud practitioners, there is still significant work to be done. Only 18% of organizations characterize their environment as “highly automated,” while 25% have “minimal” or “no automation.”





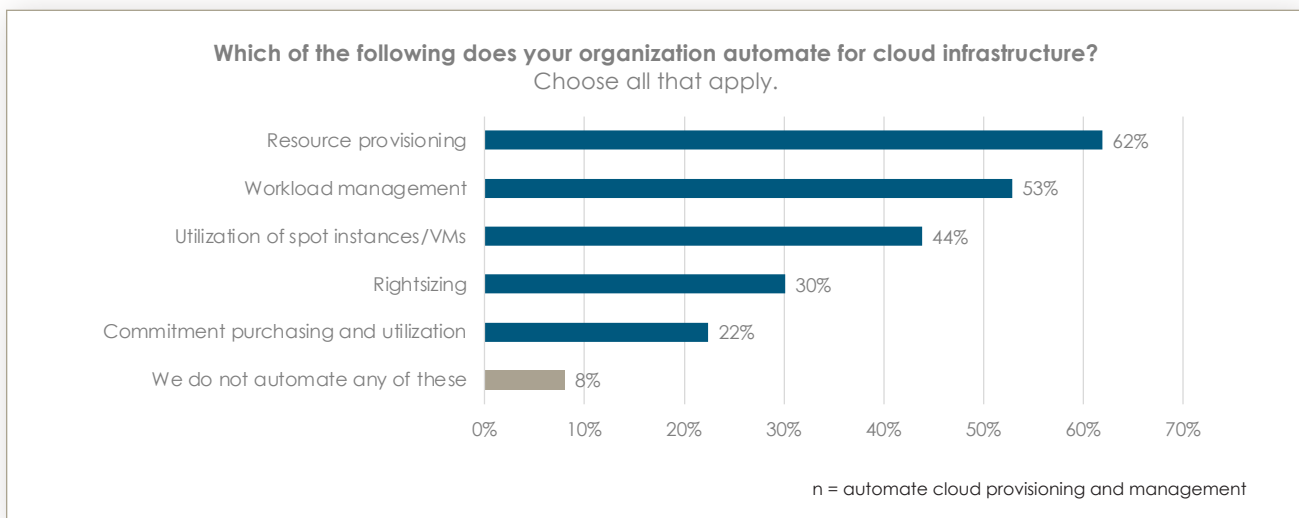
One bright spot in this data is that when examining this response by role, DevOps and Platform Engineering practitioners are much more likely to report that they are highly automated (34%), a sign that investments in those roles is paying off.



"I look for opportunities to automate everywhere. It's my instinct to automate anything I've already done once before."

- Platform Engineer, Mid-sized Financial Services

Within the cloud infrastructure, there are various opportunities to automate operational tasks. The most frequently reported areas by practitioners are resource provisioning (62%), workload management (53%), utilization of spot instances/VMs (44%), rightsizing (30%), and commitment purchasing and utilization (22%). Interestingly, financial optimization, such as commitment purchase and utilization, is often done manually and ranks the lowest on the list (22%) which signifies it is the automation area with the most opportunity for many organizations to reduce and govern cloud spending while driving application efficiency.

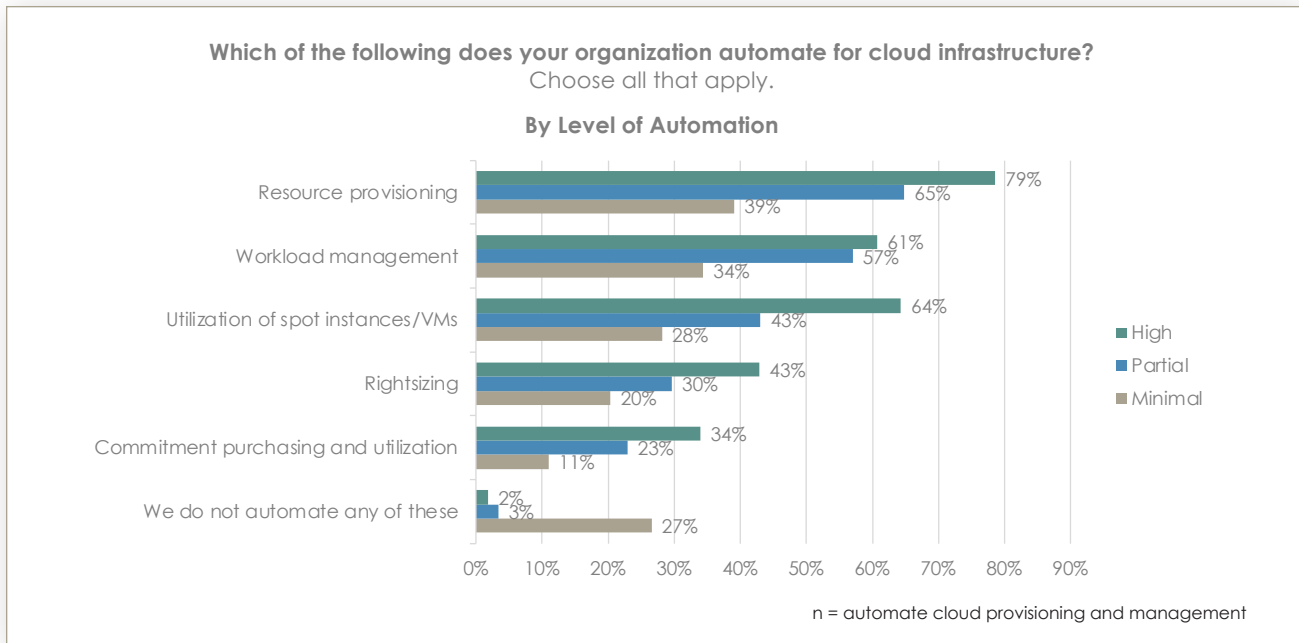


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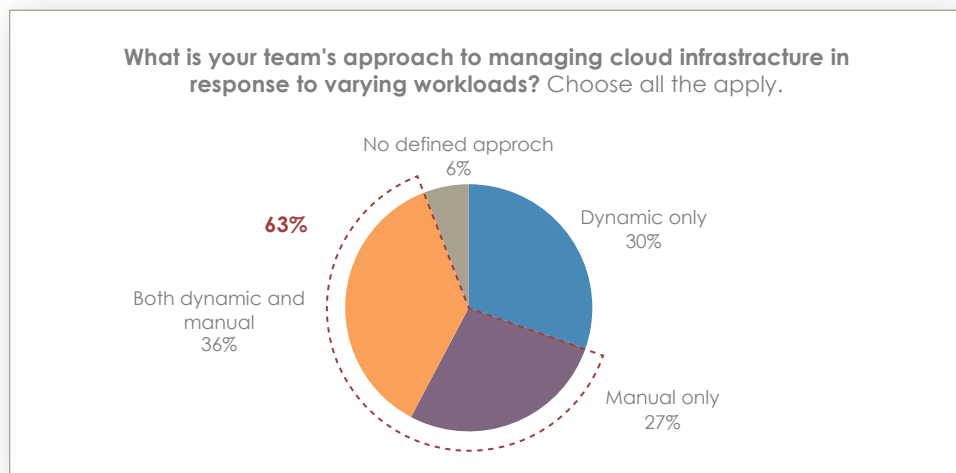


As expected, teams with “high” levels of automation are more likely to automate more tasks than those with “partial” or “minimal” levels of automation. However, even those with “minimal” automation automate a range of tasks. “Minimal automation” doesn’t imply that they have nothing in place, but rather that they still have work to do.



Teams still use manual methods to manage varying workloads

One of the benefits of cloud environments is that they can be expanded and contracted as workloads require different levels of processing. We asked cloud practitioners about their team’s approach to managing workloads that vary. The majority (63%) admitted they have still not fully automated their approach to managing varying workloads and continue to use manual methods. Less than a third (30%) relied solely on dynamic approaches.



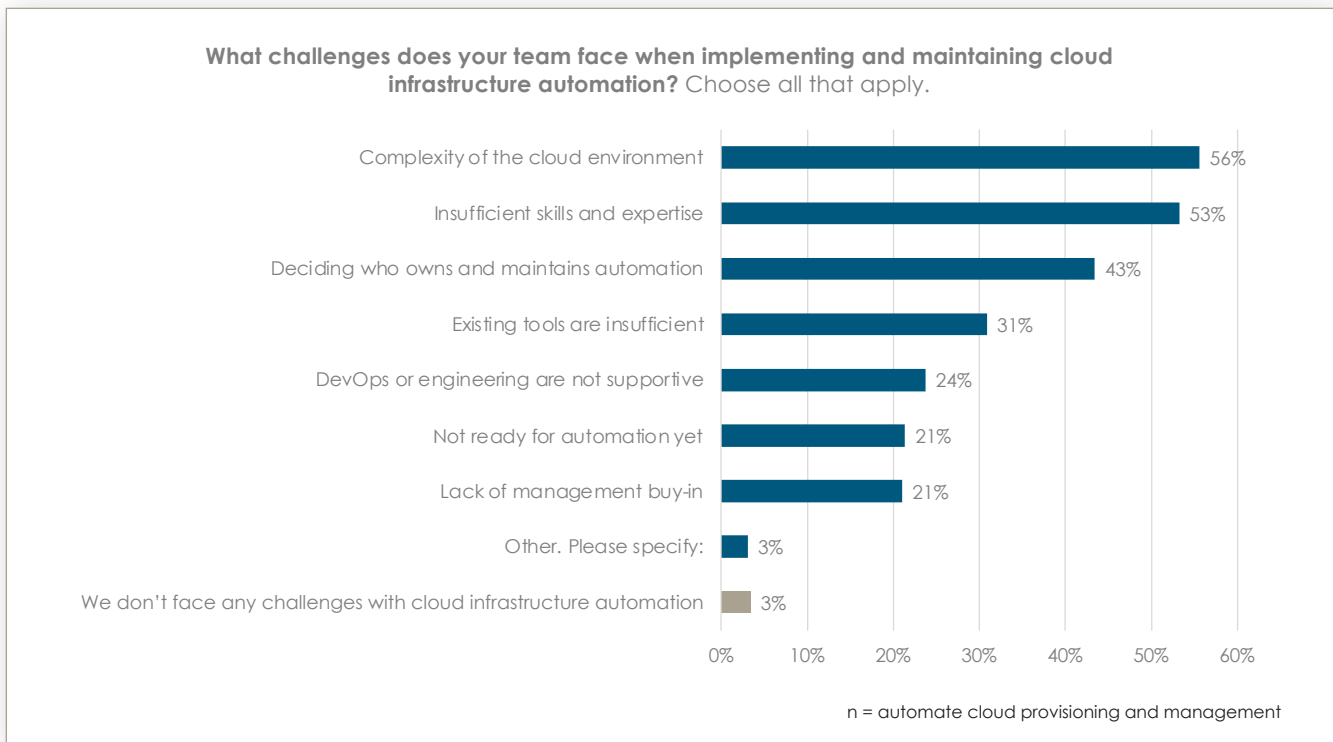
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Cloud complexity and insufficient skills top the list of automation challenges

Because cloud operation teams often deploy across clouds as well as hybrid environments. Systems can be complicated and IT environments can overflow with problematic twists and turns when trying to implement effective automation strategies. According to cloud practitioners, the overall complexity of the cloud environment (56%) and insufficient skills and expertise (53%) are their primary challenges. Other issues mentioned with automation are deciding who owns and maintains automation (43%), that existing tools are insufficient (31%), lack of support from DevOps or engineering (24%), and more. A few participants also wrote about “other” automation challenges, including cost, ownership, dynamic traffic patterns, application scaleup time, legacy technical debt, customization that makes consistent deployment difficult, poor quality cloud vendor APIs, and security.



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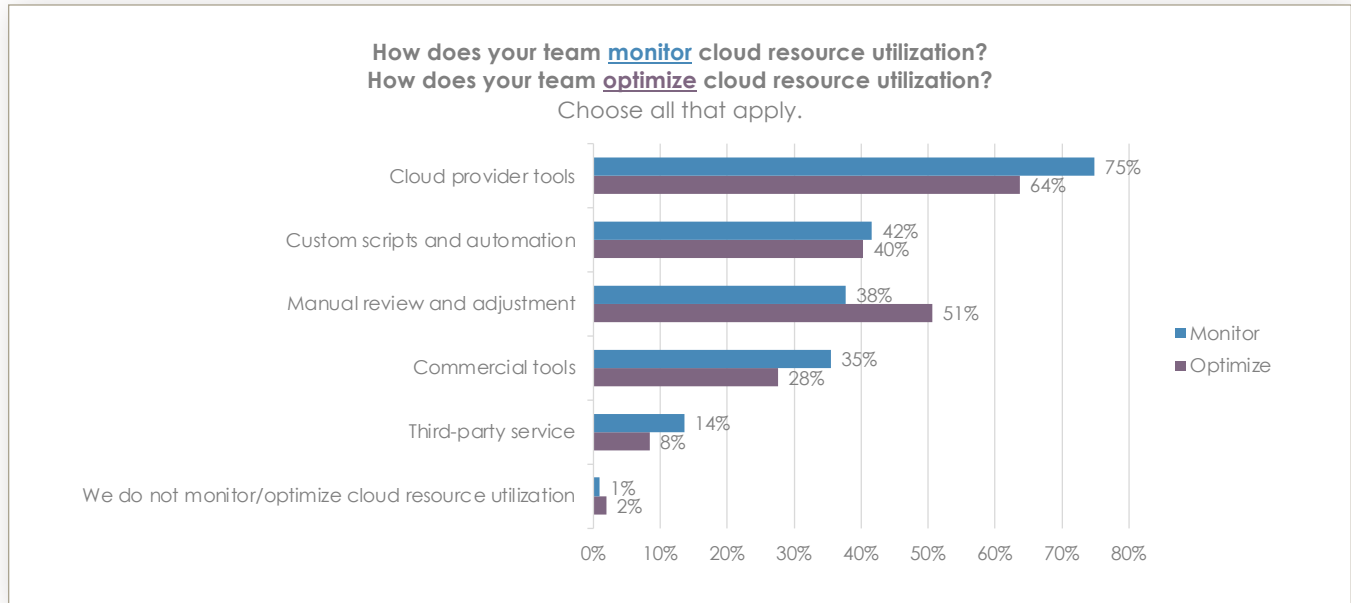
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Detailed Findings: Tool selection has become democratized Cloud provider tools are used most frequently for monitoring and optimization

Cloud provider tools are specific applications, platforms, services, and utilities created by cloud service providers to facilitate various aspects of their cloud offerings. When we asked cloud practitioners which types of tools their teams use most frequently, cloud provider tools topped the list for both monitoring (75%) and optimization (64%). Custom scripts and automation are used at a similar level for both monitoring (42%) and optimization (40%), while manual methods are far more likely for optimization (51%) than for monitoring (38%).

Investments in 3rd-party commercial tools are in the minority for both monitoring (35%) and optimization (28%) of cloud resource utilization, although as we will see later in this report, those investments appear to be paying off.



Practitioners have a stake in selecting their automation toolset

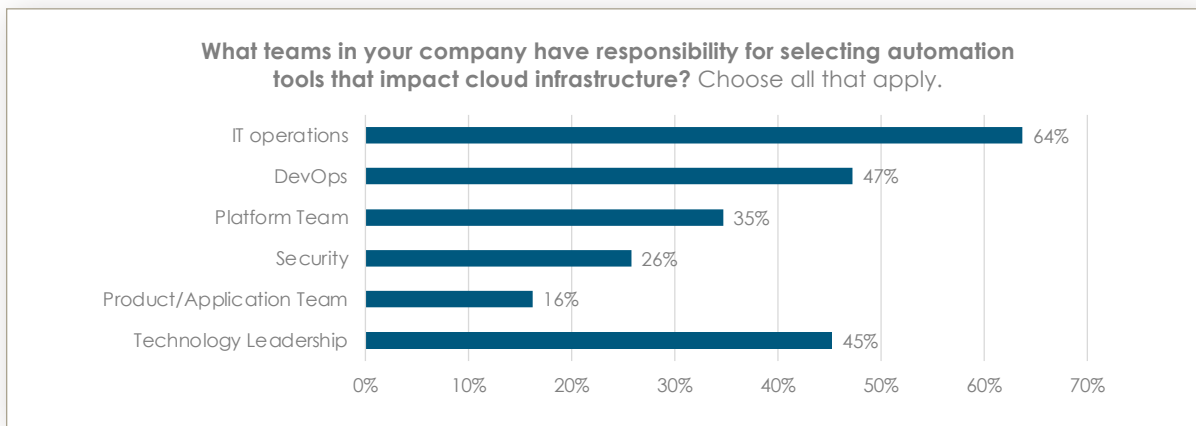
There appears to be an interesting shift in toolsets, with frontline staff no longer being forced to use a tool selected in the executive suite. With the increasing accessibility and empowerment of practitioners in choosing the tools and services that best suit their needs within the cloud computing ecosystem, there is more democracy in tool selection.

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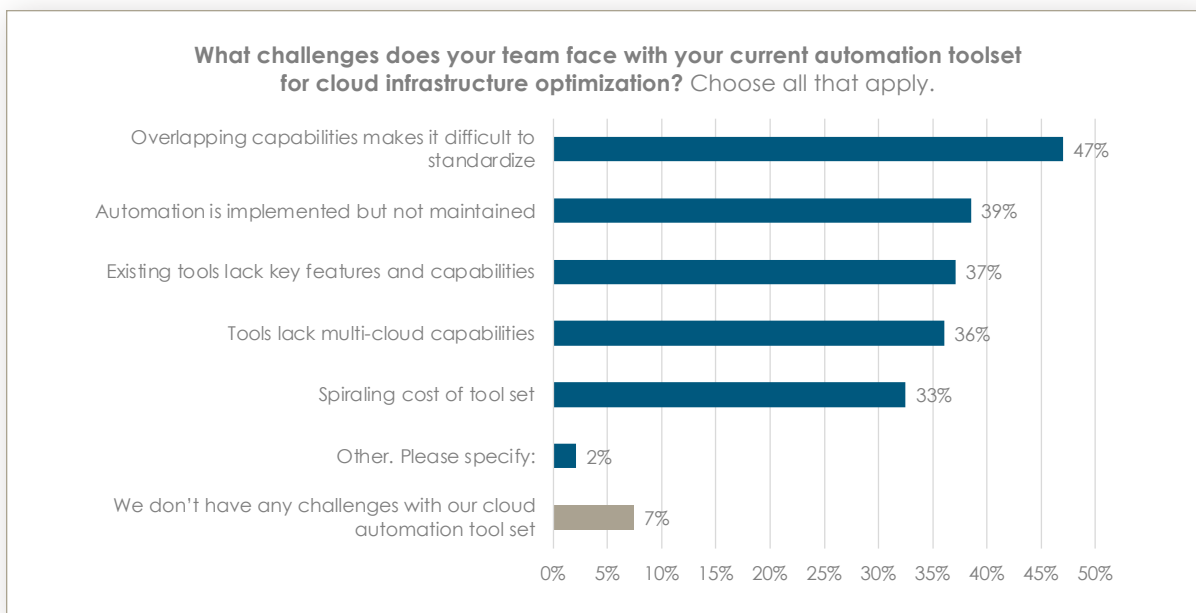
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According to cloud practitioners, automation tool selection is distributed across the organization, with only 45% of practitioners reporting that their leadership has responsibility for selecting cloud infrastructure automation tools. The practitioners themselves are the ones selecting their tools, including IT operations (64%), DevOps (47%), platform teams (35%), security (26%), and product/application teams (16%). It should be noted that it is not a free-for-all with tool selection. The majority (75%) report that technology leadership does approve budgets for purchases.



The automation toolset landscape continues to evolve as providers innovate and introduce new services to meet users' changing needs, which can lead to tool overload. When asked about the challenges their teams face with their current automation toolset for cloud infrastructure optimization, the top issue reported is overlapping capabilities that make it difficult to standardize (47%).



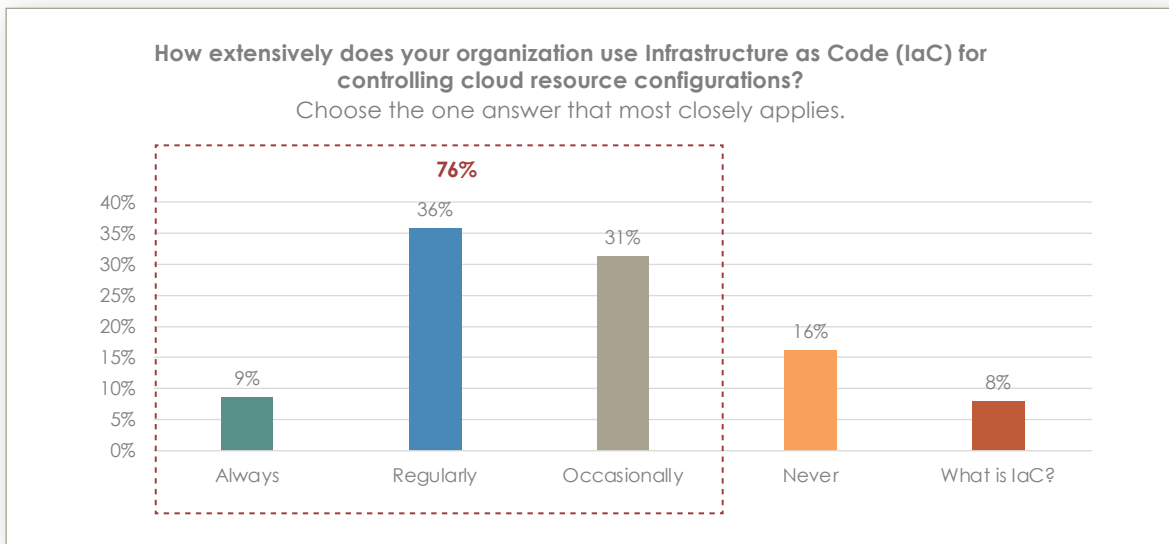
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Infrastructure as Code is gaining traction

Infrastructure as Code (IaC) provides numerous benefits for managing cloud resource configurations, including improved consistency, automation, scalability, and cost optimization. It ultimately enhances an organization's agility and efficiency in the cloud. The data clearly indicates that IaC adoption is progressing steadily across enterprises with 76% of cloud practitioners sharing that they use it. Nearly half (45%) report that they use IaC "always" or "regularly" a number that jumps to over two-thirds (69%) among DevOps and Platform Engineering roles.



Unsurprisingly, the use of IaC correlates to far higher levels of automation in most tasks, including resource provision, workload management, utilization of spot instances/VMs, rightsizing, and commitment purchasing. For example, among those that use IaC regularly, 73% automate resource provisioning compared to only 41% of those who do not use IaC.

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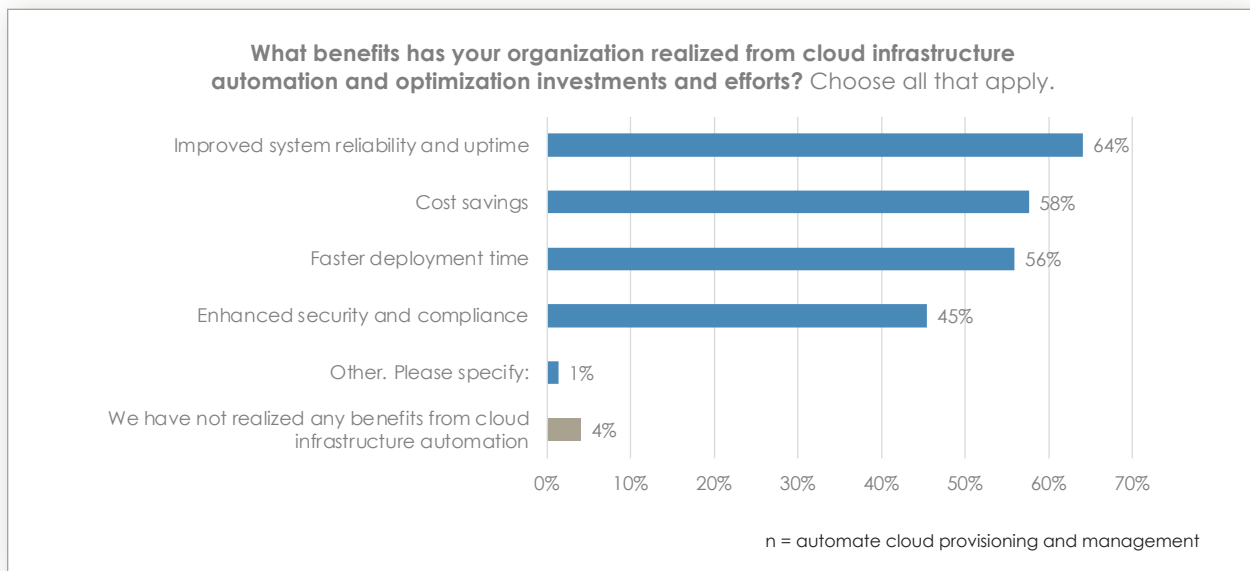
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Detailed Findings: Automation delivers benefits that increase with maturity

Nearly all companies benefit from automation and optimization investments

Cloud infrastructure automation and optimization are considered mainstream and ubiquitous across modern organizations, but are companies reaping tangible business benefits for their efforts? The answer is a resounding “yes.” Almost all (96%) cloud practitioners report positive outcomes from these investments. The primary benefit reported is improved system reliability and uptime (64%), followed by cost savings (58%), faster deployment time (56%), and enhanced security and compliance (45%). Several participants also took the time to write “other” responses, which included better integration, flexibility, predictability, and scaling for seasonal demand.

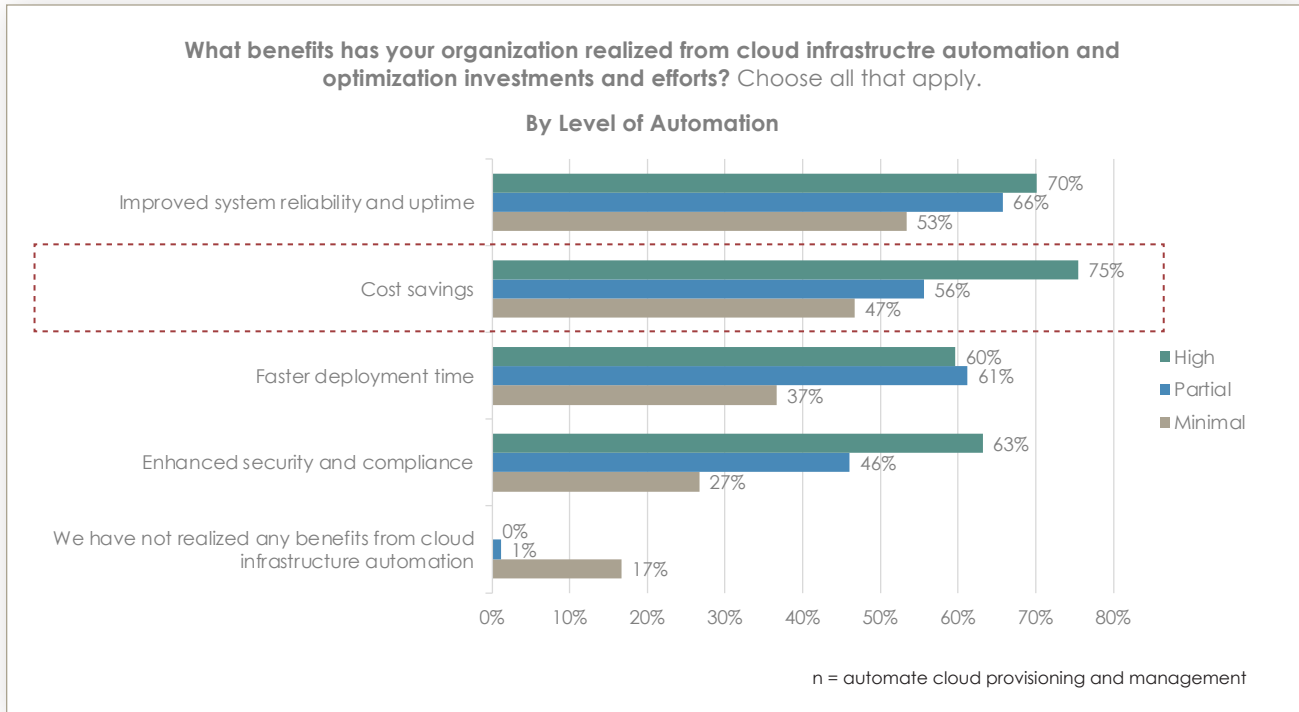


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When we further examined their responses based on the level of automation achieved, certain benefits were more common. Specifically, 75% of “highly” automated environments report cost savings compared to 56% with “partial” automation and only 47% with “minimal” investments. The good news is that even those with minimal investments are seeing results.



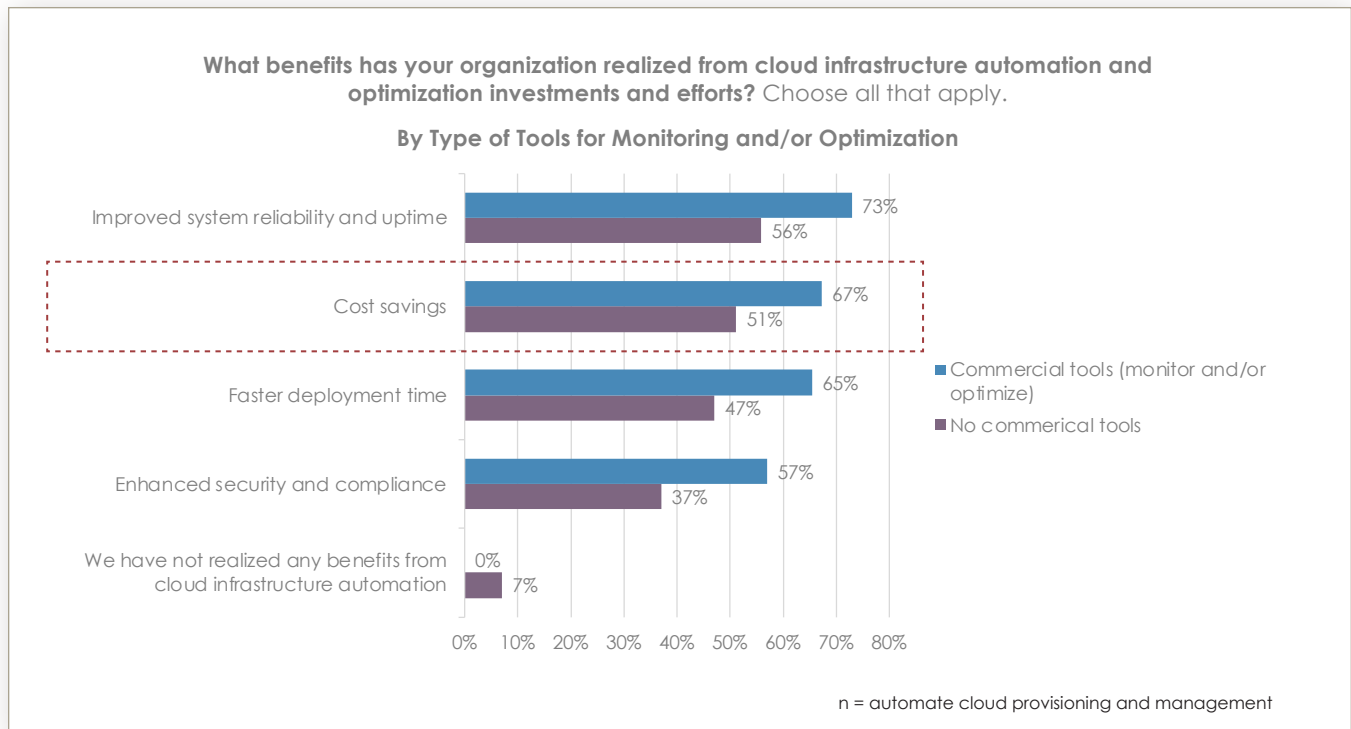
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Companies investing in commercial tools are more likely to report various types of benefits

Companies that have already invested in [commercial tools](#) are likelier to report all types of benefits from cloud infrastructure automation compared to those who rely only on cloud provider tools, custom scripts, or manual approaches. For example, 67% of those who have invested in commercial tools report cost savings, compared to only 51% who don't.



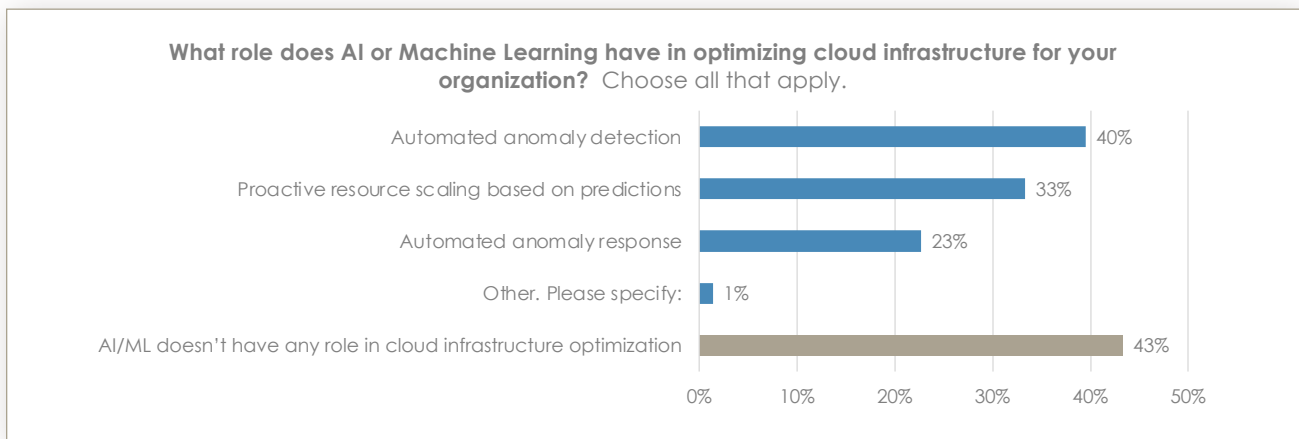
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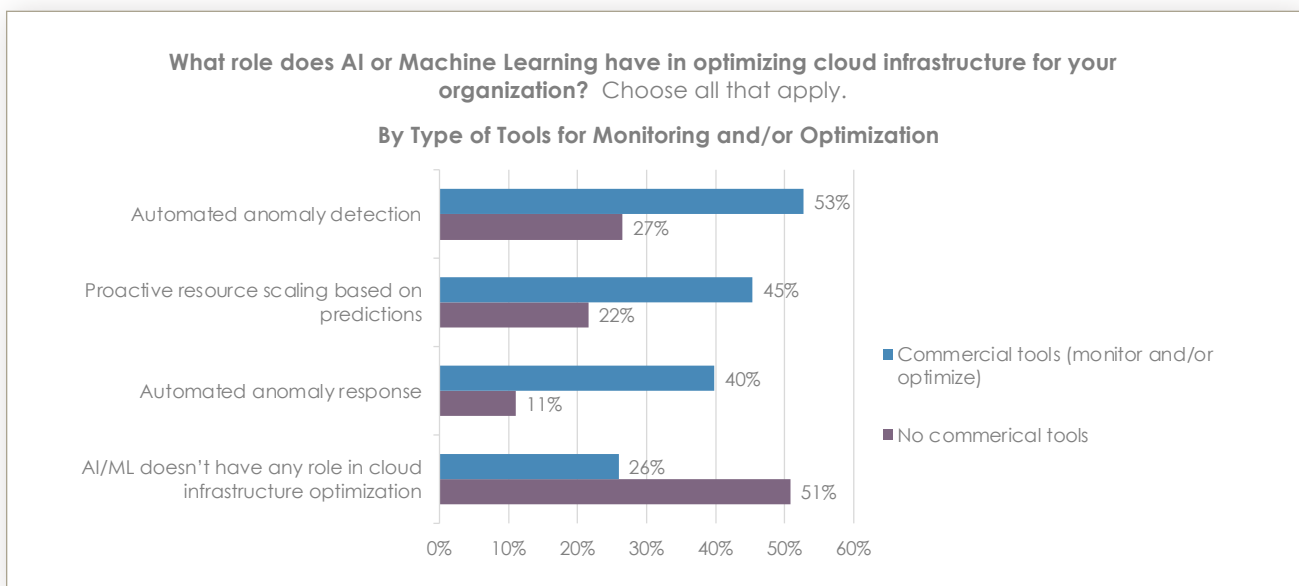


Detailed Finding: Cloud Ops practitioners are embracing innovation AI and ML are gaining momentum in optimizing cloud infrastructures

AI and machine learning are well suited for processing large volumes of data and handling complex and unstructured data, such as activity logs. The good news is that these technologies are already contributing to cloud infrastructure optimization, with well over half (57%) of companies reporting their use. However, it's still a work in progress, with more work to be done, as 43% of enterprises do not see a role for AI and machine learning in their cloud infrastructure optimization efforts.



Companies already invested in commercial tools are also far more likely to report a role for AI and machine learning. For instance, 45% of companies with commercial tools rely on AI or machine learning for proactive resource scaling, compared to only 22% that have not invested in 3rd party solutions.





Teams struggle to optimize Kubernetes for cost efficiency



"It's hard to ignore how much market share Kubernetes has in my field. Every job description is looking for people with experience."

- Platform Engineer, Large Healthcare

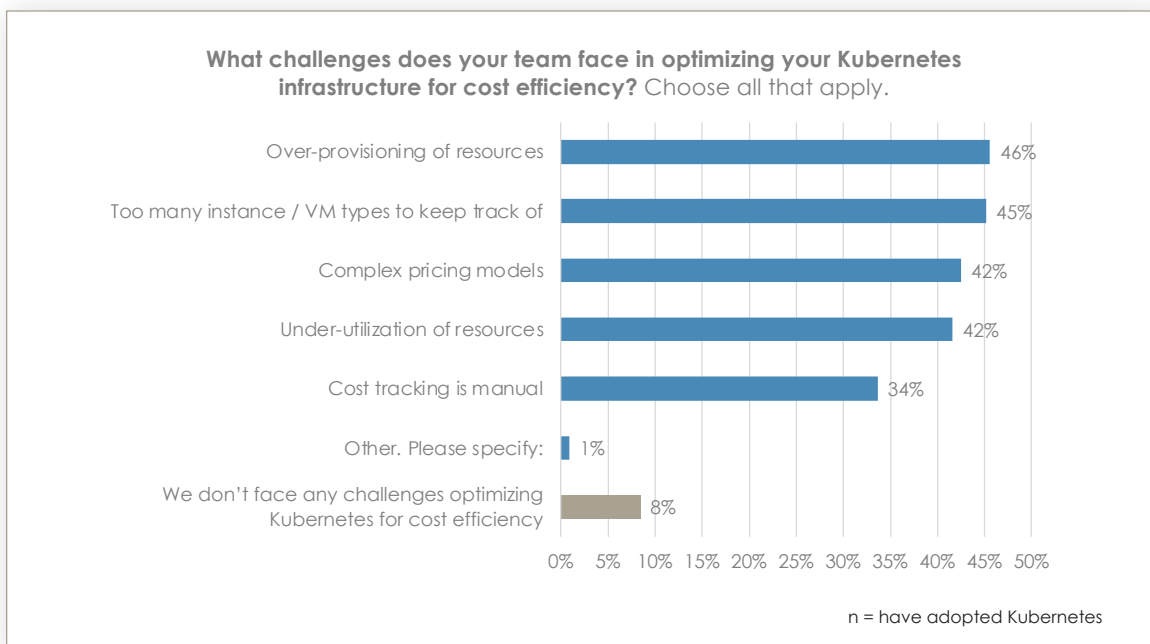
Kubernetes is a powerful container orchestration platform that simplifies containerized application deployment, scaling, and management. Its growing popularity stems from its ability to offer container orchestration, which enables organizations to automate application deployment, scaling, and management across clusters of hosts.



"Cost management isn't something that is specifically called out by management, but it is something we automatically do. It's an expected attribute."

- DevOps, Very Large Consulting

As cloud teams gain more experience with Kubernetes it's important to find out how they feel about the effort they put into that work and what obstacles they face in optimizing Kubernetes infrastructures, particularly when it comes to cost management. This research reveals that organizations face various challenges in optimizing costs of Kubernetes infrastructure, with overprovisioning (46%) topping the list. Other key challenges are too many instances/VMs to manage (45%), complex pricing models (42%), underutilized resources (42%), manual cost tracking (34%), and more. A few participants also cited "other" challenges: dynamic traffic causing metrics to skew, which leads to resource count determination difficulties, and the lack of proper Kubernetes experience.

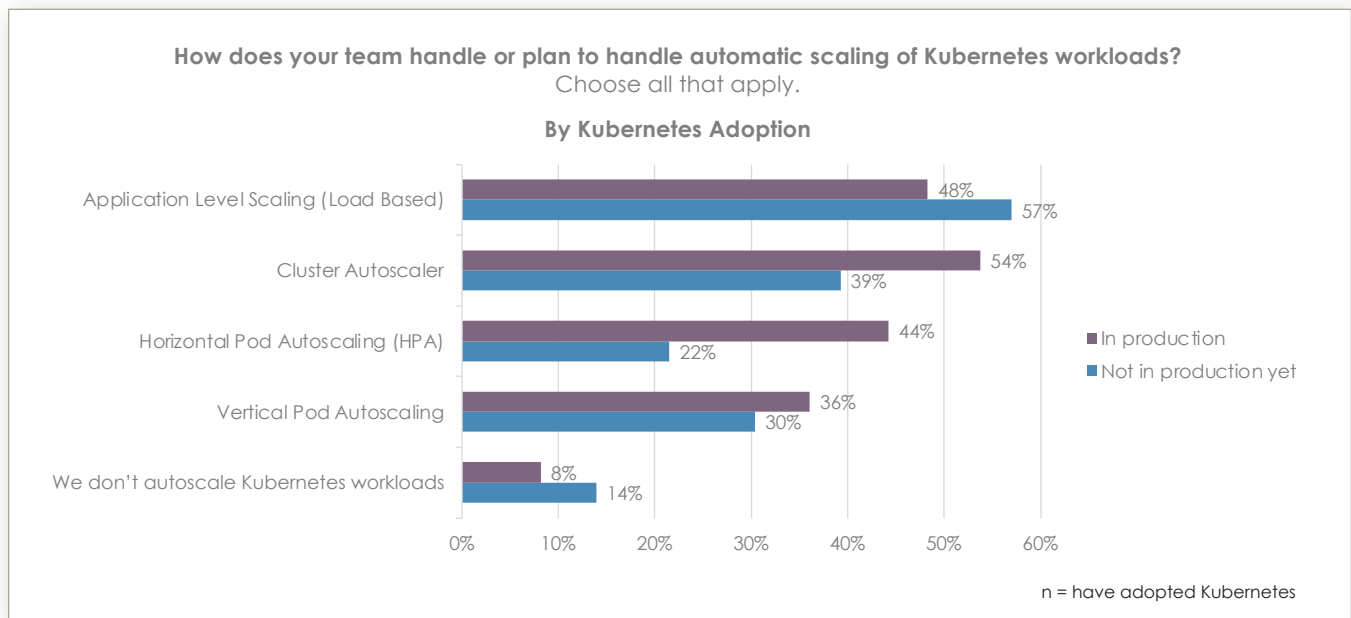




As noted above, companies experience a wide range of challenges in optimizing their Kubernetes infrastructures. Yet specific issues shift depending on whether they are in pre-production or production environments. For example, managing the underutilization of resources in production (46%) is more problematic compared to pre-production (33%) environments. Conversely, only 39% of cloud practitioners in production report that optimizing complex pricing models is challenging, a number which leaps to 49% for those Kubernetes infrastructures in pre-production.

There is no commonality in the approach used for scaling Kubernetes workloads

Scaling Kubernetes workloads involves ensuring that an organization's clusters can handle changing demand by adjusting the resources allocated to applications and the number of replicas running. Even though most organizations embrace strategies and innovative technologies for automatic scaling, the data indicates that there is no single, consistent approach used for scaling.



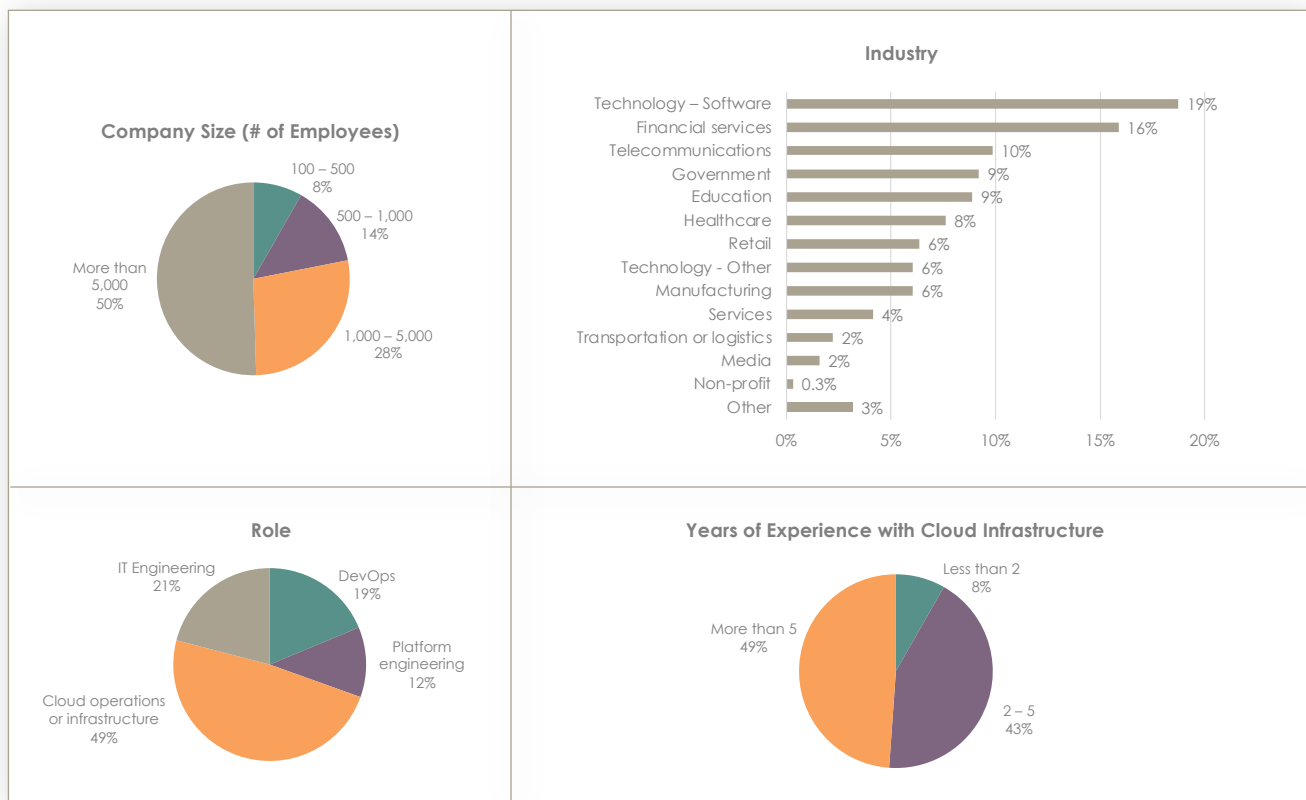
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Survey Methodology and Participant Demographics

In early 2024, an online survey was sent to independent sources of technology professionals responsible for the operations of public IaaS environments. A total of 315 qualified individuals completed the survey. All participants were responsible for cloud operations as “practitioners” (not “decision makers”) at a company with more than 100 employees. Due to rounding, certain graph options may not add up to exactly 100%. In addition, ten cloud operations stakeholders were interviewed in depth during a 45-minute online call. Their quotes have been edited for grammar and clarity.





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