

# Kubernetes Turns 10

The Technology's Impact on Careers,  
Organizations, and Cloud Native Computing

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**Foreword by**  
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# Kubernetes

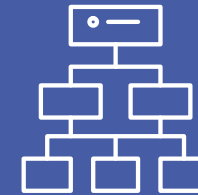
## 10 YEARS

# Kubernetes Turns 10

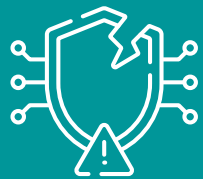
Kubernetes transformed the respondents' careers by providing **growth, change, and opportunity.**



**Scalability** (54%), **automation** (48%), **availability** (44%), and **microservices** (38%) are the biggest impacts of using Kubernetes.

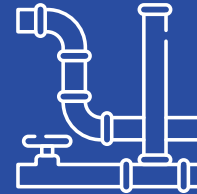


92% of organizations believe that Kubernetes **improved their deployment processes.**



**Automation** has the biggest impact on the deployment process, both positively and negatively.

90% of organizations believe that Kubernetes **improved their software development processes.**



71% believe that software development processes improve because Kubernetes boosts the **deployment speed**, while the learning curve is the main negative effect.



On a scale from 1 to 10, participants perceive **the value of Kubernetes as 8.82**, and this perception is consistent across respondent demographics.

77% of the organizations consider Kubernetes **very or extremely important to their business**, and 76% **plan to increase adoption.**



87% think Kubernetes is evolving to **meet the needs of the technology industry.**



The top challenges for Kubernetes are the **learning curve** (59%), **security** (44%), and **talent shortage** (36%).

**Community forums and KubeCon** are among the most recommended communication channels for interacting with the Kubernetes community.



69% of the Kubernetes contributors believe the project development **has improved over time.**



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## Foreword

It's been 10 years! When Brendan, Craig, and I started the project, we never imagined the impact it would have and the community that would form around it. This survey is both a testament to the journey so far and a call to action for keeping focus on what matters to advance the project into the future. I want to take this time to thank all of the people (too many to mention here) who made this magical thing happen. This project is a testament to what can happen when we work together and support each other.

Kubernetes is big and complicated. This applies across the project itself, the community, and the ways that people use it. Like the proverbial elephant, folks see differently and focus on various aspects of the project. There is the core technology and systems, but there are also innumerable supporting projects around adapting Kubernetes to so many situations and processes. There is the community of users and the community of contributors. There are those who run and administer clusters or cluster-as-a-service in various forms, and then there are those who manage applications on top of those clusters. Everyone comes to Kubernetes from a different direction.

Because individual populations see Kubernetes so differently, it is hard for any one person to understand the strengths and weaknesses of the project: where we are doing well and where we could do better. Oftentimes, depending on the perspective, what one person considers a strength, another person might consider a weakness. This survey provides critical information to help us understand how the project is doing from different angles. Thank you to the CNCF and the authors for doing the hard work of pulling this together. Kubernetes is, in a very real sense, the community. Only by listening to that community (both users and contributors) can the project stay vibrant and relevant for the next 10 years!

**Joe Beda**



## Introduction

Kubernetes, an open source platform that has revolutionized the deployment and management of applications, originated as an internal project at Google and was inspired by their extensive experience running production workloads at scale. Officially open sourced in 2014, Kubernetes sought to address the complexities of managing containerized applications across a cluster of machines, offering automation in deployment, scaling, and operations of application containers across clusters of hosts. This innovative platform quickly gained traction due to its efficiency and flexibility, spearheading the movement toward microservices architectures and playing a pivotal role in the contemporary cloud native landscape.

After 10 years, Kubernetes has more than 540,000 commits made by approximately 15,000 contributors, representing over 63 million lines of code, with an estimated effort of 22,000 person-years. This impressive growth highlights its widespread adoption and critical role in modern software infrastructure. As the backbone of container orchestration, Kubernetes has fostered a massive ecosystem, including support from major cloud providers, such as AWS, Microsoft Azure, and Google Cloud, which have integrated the technology into their services. This integration has not only simplified the deployment of applications across various

environments but also promoted portability and scalability. The community around Kubernetes continues to expand, contributing to its ongoing evolution and the continuous improvement of its capabilities, ensuring it remains at the forefront of technology innovation.

As Kubernetes continues to shape the software industry's future, it was time to understand its impact and evolution. We conducted a global survey in August 2024 to gather stories and perspectives from practitioners. The survey received 715 valid responses. The overwhelming participation and the effort put into writing such a large number of stories is evidence of the vibrancy and engagement of the Kubernetes community. In this report, we present some key findings and stories. We encourage readers to explore the complete dataset, which is available on the Data.World repository.

For more information about the survey methodology and demographics, please refer to the "About the survey" section at the end of this report.

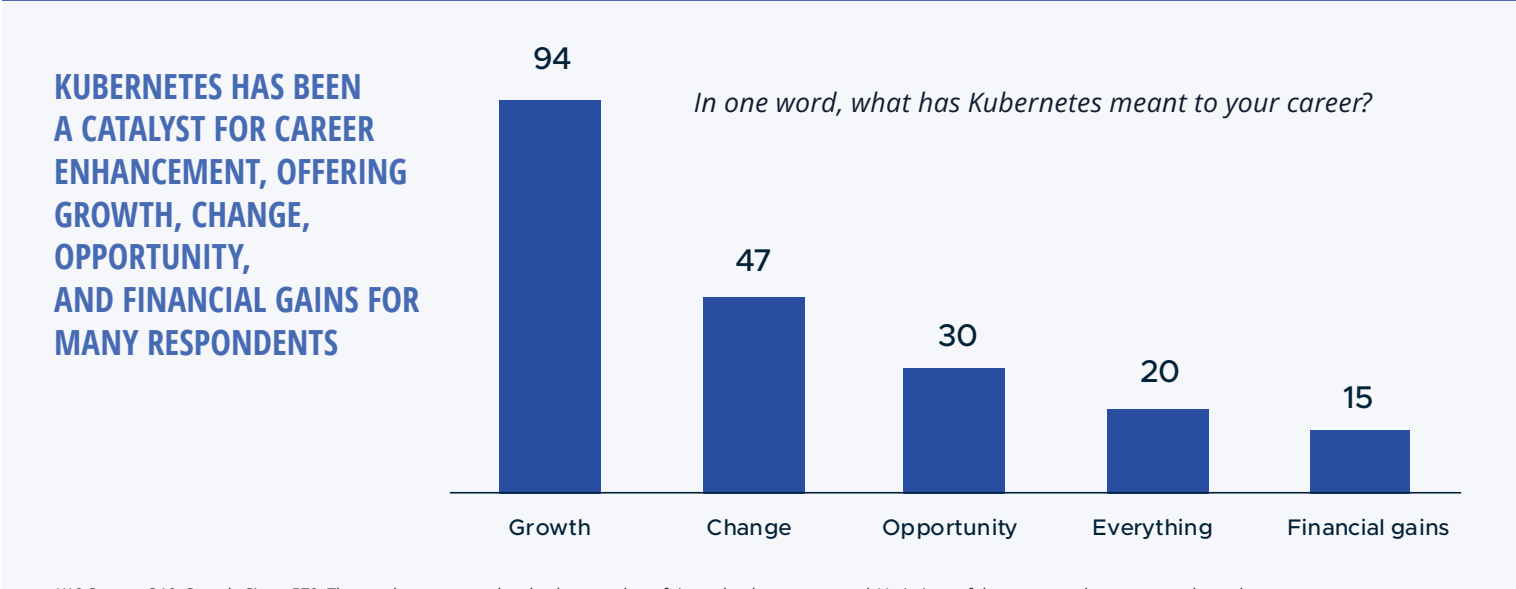
# Learning Kubernetes transforms careers across the technology industry

When surveyed about the significance of Kubernetes in their professional lives, respondents frequently mentioned growth, change, opportunity, and financial gains, as depicted in Figure 1. These responses reflect Kubernetes' transformative and far-reaching effects on careers in the tech industry. The term "everything" also emerged as a recurring response, evidencing Kubernetes' comprehensive impact on professional lives. The stories that Kubernetes users shared corroborate this finding, highlighting the profound personal and professional transformations that involvement with this technology enables. Story 1 illustrates a journey of commitment and perseverance. Despite facing financial hurdles and geopolitical instability, the individual's

determination to enhance their skills through Kubernetes certification shows a deep investment in personal growth. This dedication not only filled a crucial knowledge gap but also boosted their confidence, ultimately broadening their professional capabilities. Story 2 offers an inspiring account of an engineer's transformative journey from a Senior Network Engineer without a job to a successful position as a DevOps Engineer working with Kubernetes. This kind of transformation and growth opportunity was recurrent among our respondents, with many reporting substantial salary increases, as Story 3 illustrates.



**FIGURE 1**



K10 Survey, Q10, Sample Size = 579. The graph represents the absolute number of times the theme appeared. Variations of the same word were grouped together



*When I realized that my knowledge in Kubernetes and similar cloud technologies was lacking, I decided to take matters into my own hands. I dedicated significant time to learning Kubernetes, diving deep into hands-on practice and studying the intricacies of the platform. Despite the high cost of certification exams in my country, which was exacerbated by inflation and political instability, I was determined to fill this gap in my skillset. I paid for the exam out of my own savings, understanding that this was an investment in my professional growth. The satisfaction and confidence I gained after successfully passing the Kubernetes certification were immense. Not only did this achievement fill a crucial gap in my knowledge, but it also empowered me to apply my skills effectively in my professional endeavors. Today, I feel well equipped to leverage Kubernetes in any cloud environment, making it a pivotal part of my career development.*

#### RESPONDENT STORY 1.

*I used to be a Senior Network Engineer, and due to life circumstances, I was three years without a job. But during these forced sabbatical years, I attended different meetups and conferences on Docker and Kubernetes. I realized that it would be a must for me to learn about both technologies in order to continue my professional career. I decided to learn both technologies from different sources, starting my journey to these new technologies. One day, I decided to apply for a DevOps position, confident that my network background and Kubernetes would give me an advantage over other candidates. That was the result: I got a job as a DevOps Engineer and have been working with Kubernetes since then!*

#### RESPONDENT STORY 2.

*I am a certified Kubernetes Application Developer. I got a 200% hike in my salary after completing CKAD certification within two years.*

#### RESPONDENT STORY 3.

## Kubernetes impacts scalability, automation, availability, and microservices architectures

Figure 2 depicts Kubernetes' significant impacts according to our respondents. **Scalability** (54%) is the foremost advantage of using Kubernetes. Many applications benefit from dynamically managing resource allocation based on demand. Kubernetes facilitates this by allowing organizations to adjust infrastructure and efficiently handle varying workloads, preparing them to scale if their services gain in popularity. Respondents also regarded **deployment automation and improved DevOps practices** (48%)

as one of Kubernetes' biggest impacts. Kubernetes streamlines the deployment process, supporting continuous integration and continuous deployment (CI/CD) pipelines that enhance operational efficiency. Kubernetes not only automates application deployment but also integrates seamlessly with various DevOps tools, fostering automation and reducing manual errors.

Kubernetes also significantly contributes to the availability and resiliency of applications (44%). By managing clusters of hosts running containers, Kubernetes ensures that if a container or host fails, it can automatically redistribute and schedule those containers on healthy hosts. This intrinsic redundancy and fault tolerance improves the overall uptime and reliability of services, which is essential for maintaining high-performance levels across business operations. Kubernetes also facilitates **microservice architecture implementation** (38%), enabling easier updates and maintenance, improved fault isolation, and better scalability by allowing the deployment of services independently of one another. Other impacts mentioned include resource efficiency, reduced vendor lock-in, and improved developer productivity, evidencing

Kubernetes' influence on various aspects of modern software development and infrastructure management.

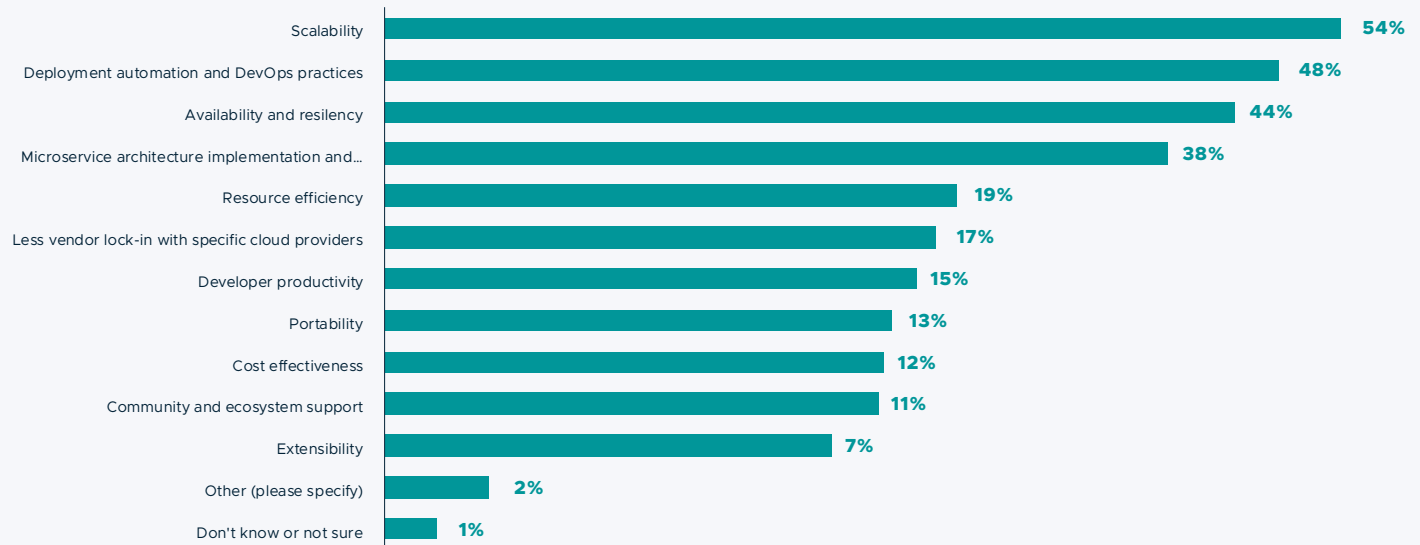
The respondent stories also highlight Kubernetes' transformative impact on organizations. Story 4 illustrates how Kubernetes radically improves the infrastructure of rapidly growing organizations. The company's adoption of Kubernetes at a pivotal time enabled it to scale its operations to manage tens of thousands of pods, which was critical for handling vast amounts of data in the AI industry. Story 5 illustrates the role of Kubernetes in migrating from a monolithic application to a microservices architecture. The transition required the adoption of a DevOps culture, emphasizing Kubernetes' role in fostering environments that prioritize



FIGURE 2

## PERCEIVED BIGGEST IMPACTS OF USING KUBERNETES

*In your opinion, what are the biggest impacts of using Kubernetes? (select up to three)*



K10 Survey, Q19, Sample Size = 674, Total Mentions = 1,892





continuous improvement across quality, security, and process automation. Story 6 reflects on the critical role of Kubernetes in a startup environment faced with scalability challenges. By enabling efficient infrastructure management through automation and improved deployment processes, Kubernetes significantly reduced the system's complexity after a steep learning curve. These stories collectively highlight Kubernetes' profound influence on organizational capabilities, echoing the key impacts of scalability, deployment automation, improved DevOps practices, resilience, and support for microservices architecture identified in Figure 2.

*In 2018, while working at my current organization, we reached a pivotal point where we recognized the need for greater flexibility and scalability in our infrastructure. The rapid growth we were experiencing made it clear that we could no longer rely solely on AWS ECS or similar services for orchestration. We needed to be agnostic and adaptable to different environments to sustain our growth and innovation. This realization led us to embrace Kubernetes. The journey from then to now has been transformative. We successfully scaled our operations to manage over 50,000 pods, enabling us to handle billions of conversations in the AI space. Kubernetes empowered us to deploy some of the largest chatbot and generative AI solutions in the industry, all with remarkable ease and efficiency. Of course, the road wasn't entirely smooth. Upgrades posed significant challenges, especially as our deployment grew more complex. However, through continuous learning and iteration, we have made considerable improvements in managing upgrades, making the process more streamlined and less disruptive over time. Kubernetes has not only impacted my professional journey by enhancing my understanding of scalable, flexible infrastructure but also played a critical role in our organization's ability to innovate and lead in the AI domain.*

#### **RESPONDENT STORY 4.**

*Recently, I worked on a migration project involving a monolithic application hosted on a virtual machine, serving around 20 cloud users. They brought me in to address the scalability challenges, and naturally, I chose Kubernetes as the orchestration solution. However, before diving into Kubernetes, it was crucial for the entire company to adopt a DevOps culture. The most significant impact of Kubernetes wasn't just on scaling but in fostering a new mindset focused on quality, security, and process automation.*

#### **RESPONDENT STORY 5.**

*Kubernetes significantly impacted my professional life when I was part of a growing startup facing scalability challenges. Our transition to Kubernetes allowed us to efficiently manage our infrastructure by automating deployments and scaling our applications effortlessly. Although the learning curve was steep, the shift to containerization and microservices architecture ultimately improved our system's reliability and performance. Overall, Kubernetes played a crucial role in our ability to scale and succeed.*

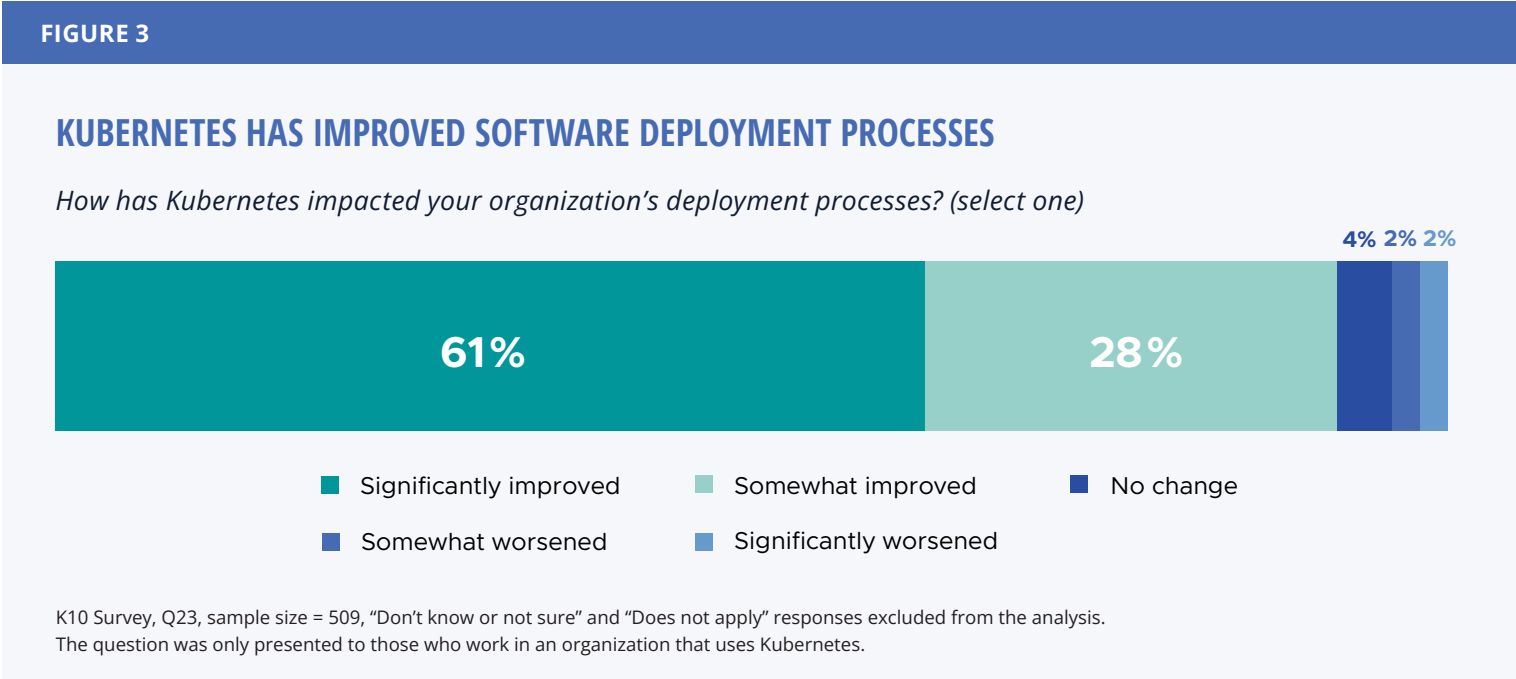
#### **RESPONDENT STORY 6.**

# Kubernetes substantially improves software deployment processes

As illustrated in Figure 3, an overwhelming 89% of respondents acknowledge that Kubernetes has enhanced deployment processes within their organizations. The primary factor driving this improvement, cited by 72% of these respondents, is **deployment automation**, as depicted in Figure 4. Automated deployments reduce human error, ensure consistent environments, and enable rapid scaling, which is crucial for organizations dealing with dynamic workloads and complex infrastructure needs, as Story 7 illustrates.

Interestingly, 65% of those who believe that Kubernetes has negatively impacted their deployment processes also cite deployment automation as the primary reason. Kubernetes has a steep learning curve and can lead to complexity and misconfigurations,

which may worsen the deployment processes. For smaller projects or teams, the time and resources required to manage a Kubernetes environment effectively can outweigh the benefits, leading to a more cumbersome deployment process, as Story 8 illustrates. Kubernetes is not a one-size-fits-all solution, and it is sometimes applied unnecessarily in situations where simpler solutions could suffice. Moreover, introducing Kubernetes might clash with existing organizational workflows or cultural practices. If the shift to Kubernetes-based automation is not managed with careful consideration of existing processes and team dynamics, it can disrupt established procedures, leading to resistance or errors in deployment. As a project contributor stated, *“Unfortunately, currently, people are pushing Kubernetes to use cases where it’s not the best fit, and that overengineering gives it a bad reputation.”*

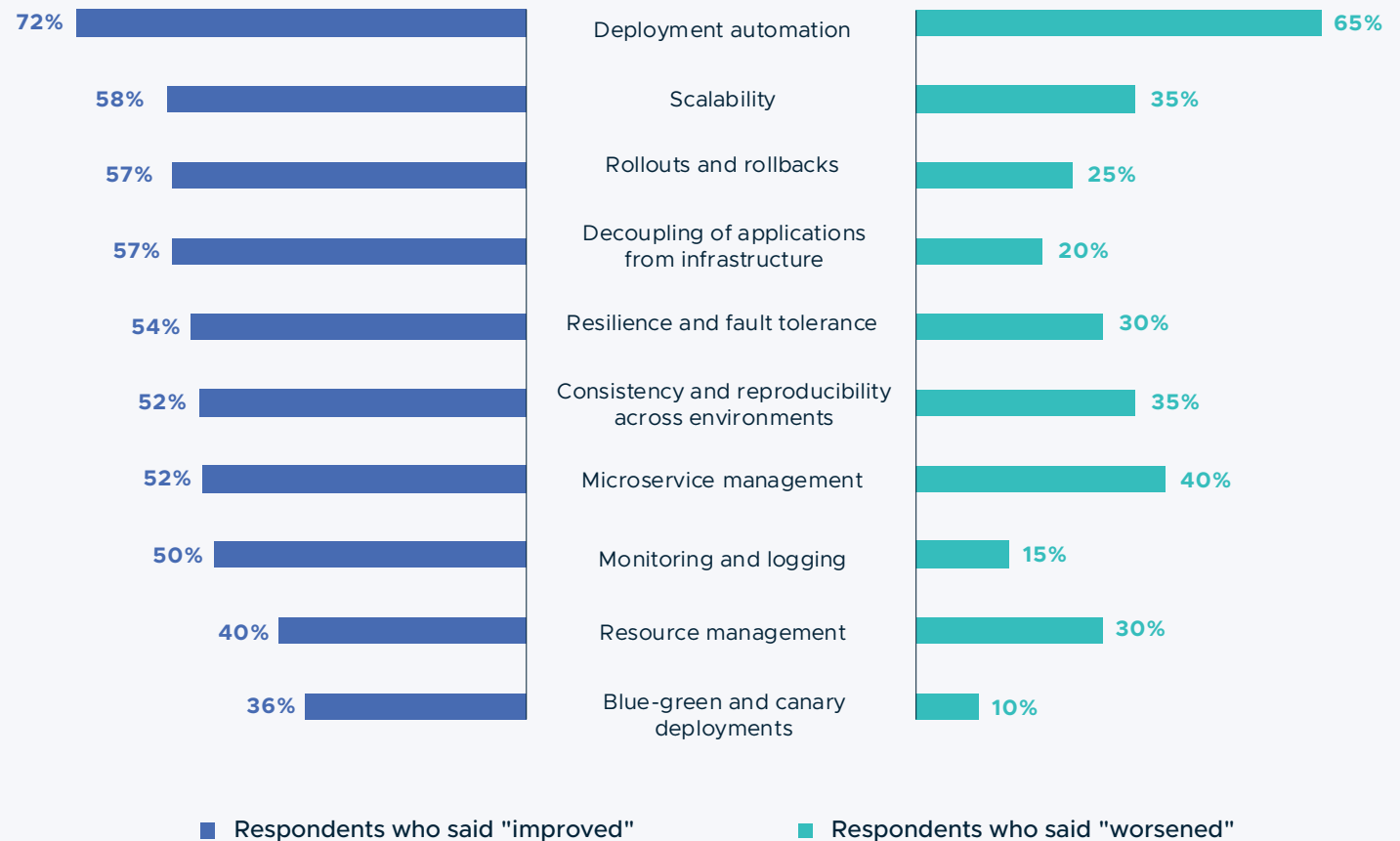




**FIGURE 4**

## REASON FOR IMPROVING OR WORSENING SOFTWARE DEPLOYMENT PROCESSES

*What factors primarily influenced your response to the previous question regarding how Kubernetes impacted software deployment in your organization? (select all the apply)*



K10 Survey, Q24 x Q23, Sample Size = 486, Valid Cases = 486, Total Mentions = 2,522, "Does not apply", "Don't know ore not sure", and "No change" responses from Q23 excluded from the analysis, Q24 only shown for respondents who said "improved" or "Worsened" in Q23.



The survey data also reveals several other factors influencing how respondents perceive Kubernetes' impact on software deployment within their organizations. Fifty-eight percent of respondents highlighted **scalability**, emphasizing Kubernetes' ability to efficiently manage varying workload sizes. **Rollouts and rollbacks** and the **decoupling of applications from infrastructure** both received 57% acknowledgment, highlighting Kubernetes' impact on deployment processes and its capability to isolate applications from underlying hardware constraints, thereby enhancing portability and operational flexibility. **Resilience and fault tolerance** were also notable, with 54% of participants appreciating Kubernetes' robustness against failures, ensuring continuous operation and service availability. **Consistency and reproducibility across environments, effective microservice management, and improved monitoring and logging** each garnered support from over half of the respondents, pointing to Kubernetes' positive impacts in diverse deployment scenarios.

*Implementing Kubernetes has been transformative for our organization. Before Kubernetes, managing our containerized applications was a complex and time-consuming process. By adopting Kubernetes, we were able to automate deployment, scaling, and management of our applications. This not only improved our efficiency but also significantly reduced downtime and enhanced the reliability of our services. One notable impact was during a major product launch. Kubernetes allowed us to seamlessly handle the increased traffic by automatically scaling our applications, ensuring a smooth user experience.*

#### **RESPONDENT STORY 7.**

*Kubernetes is an example of what happens when software developers ruin a great idea by throwing it into all sorts of unnecessary situations.*

#### **RESPONDENT STORY 8.**

# Kubernetes substantially improves software development processes

As illustrated in Figure 5, 90% of respondents acknowledged that Kubernetes has improved the development processes within their organizations. As observed in Figure 6, deployment speed emerges as the most significant improvement, which 71% of respondents cited, reflecting Kubernetes' ability to accelerate the rollout of applications, enhancing agility and responsiveness to market changes. As Stories 9 to 11 illustrate, the integration of Kubernetes with CI/CD pipelines streamlines the entire deployment process, reducing time to market for new features and allowing teams to focus more on business logic, innovation, and customer-facing functionality rather than managing deployments, which significantly enhances both the development process and the quality of the software produced.

Another notable Kubernetes impact is application performance, reliability, and other non-functional requirements, as 59% of respondents acknowledged. Story 12 illustrates how an

organization streamlined deployments, improved reliability, and reduced downtime, leading to more efficient development cycles and a significant boost in productivity.

Standardized development practices are also highly relevant, which 54% of the respondents noted, suggesting that Kubernetes helps establish a more structured development environment that can lead to more consistent outputs across projects and teams. Story 13 illustrates this point, evidencing the enhanced mobility and productivity among developers. Developers can switch teams and immediately contribute without the steep learning curves associated with different environments. This flexibility is largely due to the consistent and standardized environment that Kubernetes offers across the board. Story 14 reflects how the best practices adopted in Kubernetes influence how developers design their applications, breaking down complex systems into manageable, scalable components.



FIGURE 5

## KUBERNETES HAS IMPROVED SOFTWARE DEVELOPMENT PROCESSES

*How has Kubernetes impacted software development in your organization?*



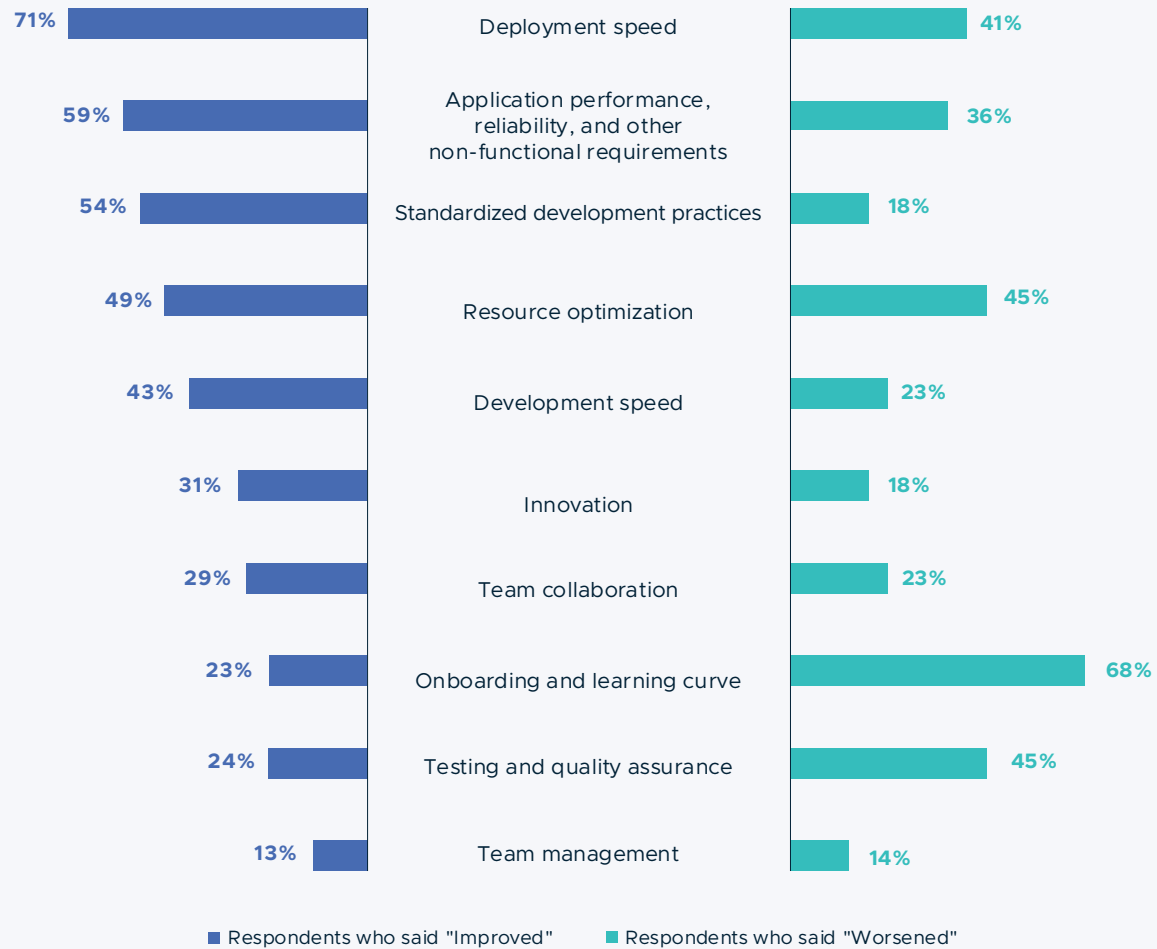
K10 Survey, Q21, Sample Size = 496, "Does not apply" and "Don't know or not sure" responses excluded from the analysis, Q21 presented only to those who work in an organization that uses Kubernetes.



FIGURE 6

## REASON FOR IMPROVING OR WORSENING SOFTWARE DEVELOPMENT PROCESSES

What factors primarily influenced your response to the previous question regarding how Kubernetes impacted software development in your organization? (select all the apply)



Sample Size = 462, Q22 x Q21, Valid Cases = 462, Total Mentions = 1,823, "Does not apply", "Don't know or not sure", and "No change" responses from Q21 excluded from the analysis, Q22 only shown for respondents who said "improved" or "Worsened" in Q21.



*Kubernetes' integration with CI/CD pipelines enabled us to automate the deployment process, drastically reducing the time to market for new features. In one instance, the automated deployment pipeline reduced deployment times from hours to minutes, allowing the development team to focus on innovation rather than managing deployments. This shift not only improved efficiency but also minimized human error, leading to more reliable and consistent releases.*

**RESPONDENT STORY 9.**

*Kubernetes revolutionized how we deploy and manage distributed systems. In the old days, we would have used a CORBA or DDS bus to have services communicate with each other. We always ended up with a tightly coupled mess of services that were not highly available, not resilient, and difficult to measure. Kubernetes allows us to develop resilient, decoupled, distributed systems that are easy to measure (i.e., logging, tracing, and metrics) and allows the developers to focus on the business logic for their applications, i.e., developers don't worry about the infrastructure.*

**RESPONDENT STORY 10.**

*Kubernetes allows us to operate at scale, focusing on business logic and customer-facing functionality. The ecosystem is highly customizable, usually offering a robust and mature solution for any need we encounter. Once the learning curve has been conquered, the patterns and practices we've learned and adopted facilitate quick implementation of new services and functionality.*

**RESPONDENT STORY 11.**

*Kubernetes allowed the company I was with to streamline deployments, improve reliability, and reduce downtime. Kubernetes empowered us to automate infrastructure management, leading to more efficient development cycles and a significant boost in productivity.*

**RESPONDENT STORY 12.**

*All the services we've moved to Kubernetes have an incompatible frequency of releases compared with the old-fashioned services that run on VMs. Also, developers who work on the Kubernetes services can easily move from one team to another and become productive almost instantly in the new team. So, the speed of development has increased a lot.*

**RESPONDENT STORY 13.**

*When I first encountered Kubernetes, my primary focus was on the immediate benefits it offered: ease of deployment, streamlined management, and enhanced monitoring of applications. However, as I delved deeper into Kubernetes and Docker, I realized that the impact went far beyond operational convenience. Understanding the architecture of Kubernetes opened my eyes to the intricacies of system design. It wasn't just about deploying applications anymore; it was about thinking strategically about how to break down complex systems into manageable, scalable components. This shift in perspective has profoundly influenced my approach to software development. For instance, when tasked with designing a new feature or system, I know instinctively how to modularize it and make it resilient, much like Kubernetes itself. The lessons I learned from Kubernetes have enabled me to design systems that are not only robust but also scalable and maintainable. This mindset has been invaluable in both my professional growth and the success of the projects I've worked on.*

**RESPONDENT STORY 14.**

## All respondent profiles value Kubernetes highly

Respondents consider Kubernetes an invaluable tool. On a scale from 1 to 10, respondents rated the technology with an average value perception of 8.8. As highlighted in Story 15, this value comes from Kubernetes' capacity to significantly enhance deployment and development processes and save time after overcoming the initial learning curve.

This high rating remains relatively consistent across various respondent segments, indicating that the perceived value of Kubernetes is high across all different groups, as Figure 7 illustrates. Interestingly, respondents from Latin America, India, and Africa reported slightly greater value perception than their counterparts in the United States, Canada, and Europe. This regional variation suggests that Kubernetes may be particularly beneficial in markets that are rapidly modernizing their IT infrastructure or are more sensitive to the cost efficiencies and scalability that Kubernetes offers. As Story 16 illustrates, Kubernetes opens doors for many smaller players to benefit and contribute.

Considering roles, leadership often perceives even more value in Kubernetes than respondents in technical positions. This difference in perception may come down to leadership's broader oversight of organizational impacts, where the strategic advantages of Kubernetes—such as cost savings, scalability, and operational efficiency—are more pronounced. Leaders are likely to appreciate how Kubernetes facilitates a more resilient IT infrastructure, aligning with business objectives that contribute to overall growth and competitive advantage. This perspective highlights the integral role of Kubernetes in driving business transformation and evidences its importance not just at the technical level but across the entire organization.

*My team migrated the app to Kubernetes, which resulted in significant improvement of the administrative tasks—scaling, logging/monitoring, rolling updates, etc. While our team previously had to secure about 25% of the time every sprint to those tasks, we now have lowered that amount to 5%, with more automation upcoming. We have saved a lot of time and simplified a lot of tasks. Once we have passed the initial knowledge threshold for using Kubernetes, it has proved to be an invaluable tool.*

### RESPONDENT STORY 15.

*Kubernetes has presented ironic but powerful opportunities to improve individual socioeconomic mobility and for more progressive company cultures to take hold. Being open source, cloud native, and community governed is a unique combination because it opens doors for many smaller players to benefit and contribute. Because the core projects have large company backing, the smaller companies that have emerged around specific tangential specialties can more comfortably focus on their niche with and build a company around practices that the large companies can't or won't prioritize, such as inclusion, remote-first work, shorter or more flexible work weeks, and global hiring.*

### RESPONDENT STORY 16.





FIGURE 7

## HOW MUCH VALUE KUBERNETES HAS FOR THE RESPONDENTS

On a scale of 1 to 10, how valuable do you think Kubernetes is?



K10 Survey, Q9, Sample Size = 709. Sample size may vary by segmentation. The number represent the average.



## Kubernetes is essential for businesses, and the majority plan to increase adoption

As businesses continue to embrace digital transformation, Kubernetes has become an indispensable tool for supporting application deployment and orchestration across diverse environments. An expressive 77% of respondents consider Kubernetes to be “Extremely important” or “Very important” to their business operations, as depicted in Figure 8. This high valuation evidences how Kubernetes is important to the modern economy by powering containerized applications. One respondent stated: “Kubernetes allowed the company I work for to support thousands of new customers by allowing us to scale our apps easily” (Story 17).

Kubernetes’ importance is also evident in the fact that 76% of the organizations are looking to increase their adoption of Kubernetes, indicating a strong, ongoing commitment to Kubernetes, as one respondent’s statement illustrates: “We currently have a company-wide initiative that’s converting every app we have to running it on Kubernetes” (Story 18). Interestingly, less than 1% of the organizations are planning to decrease adoption. These results suggest that Kubernetes has become a de facto standard for container orchestration. As one respondent stated, “Kubernetes is the new norm for customer solutions” (Story 19). Another respondent stated: “The rate of adoption of Kubernetes and Kubernetes-backed cloud services has been astounding” (Story 20).

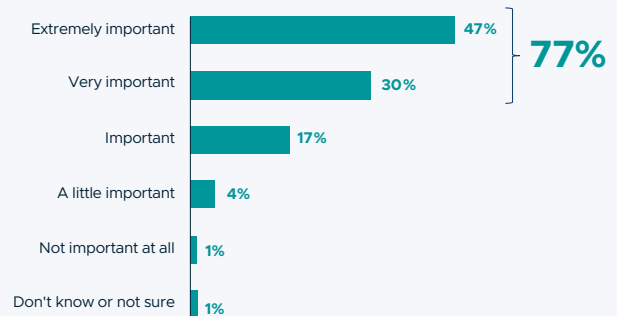
These results illustrate the importance and growth of Kubernetes within organizations and how they are increasingly relying on Kubernetes to support their business. Similarly to what we described in the previous section, these results were consistent even when we segmented the analyses by expertise, region, role, organization size, organization type, number of nodes, and relationship with Kubernetes.



FIGURE 8

### CURRENT IMPORTANCE OF KUBERNETES TO ORGANIZATIONS

How important is Kubernetes to your organization's business?

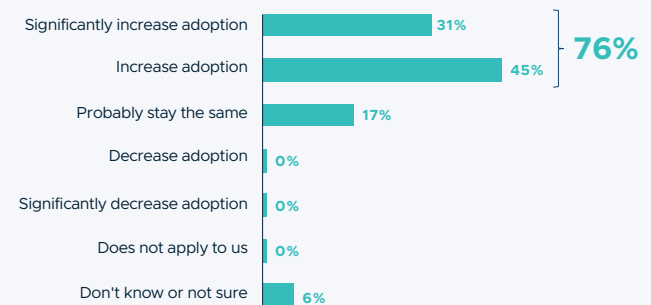


K10 Survey, Q17, Sample Size = 631

FIGURE 9

### ORGANIZATIONS' FUTURE PLANS FOR KUBERNETES

What are your organization's future plans for Kubernetes?



K10 Survey, Q18, Sample Size = 631

*Kubernetes allowed the company I work for to support thousands of new customers by allowing us to scale our apps easily. We migrated all our workloads from Heroku to EKS in 2021.*

**RESPONDENT STORY 17.**

*We currently have a company-wide initiative that's converting every app we have to running it on Kubernetes. So, any Kubernetes knowledge is widely appreciated. I have my KCNA certification, and I'm gaining a lot of hands-on experience with Kubernetes and Argo. It has for sure changed my professional career and the change in my pocket.*

**RESPONDENT STORY 18.**

*Kubernetes is the new norm for customer solutions.*

**RESPONDENT STORY 19.**

*The rate of adoption of Kubernetes and Kubernetes-backed cloud services has been astounding.*

**RESPONDENT STORY 20.**



## Kubernetes is getting better over time

As Kubernetes turns 10, it is important to reflect on its evolution. Respondents perceive improvements in all Kubernetes characteristics we asked about, as observed in Figure 10. Respondents especially perceive improvements in key technical characteristics, such as **security, observability and monitoring, API and CRDs, and reliability**, with more than 80% of users indicating that these characteristics have improved. Features such as **performance, multicluster and hybrid cloud support, documentation, stateful application support, and cloud agnosticism** have also shown noticeable progress, with more than 70% of respondents reporting improvements. Overall, this indicates that Kubernetes is

becoming more stable and versatile, addressing critical enterprise needs such as multi-cloud compatibility and secure infrastructure. One respondent makes this clear: *“Kubernetes has continuously improved in areas such as multicluster support, observability, and security, making it more robust and adaptable to different environments”* (Story 21).

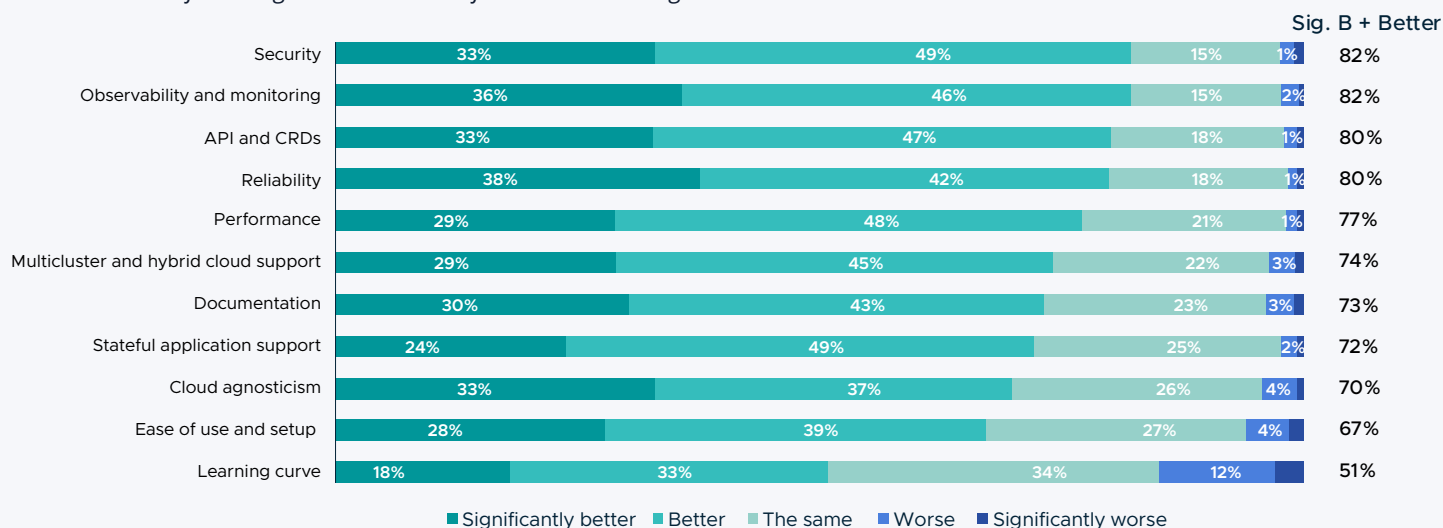
However, the figure also shows areas where progress has been slower or more challenging. **ease of use and setup** still has room for improvement, with 32% of respondents indicating that it remains unchanged or has worsened. Additionally, **the learning**



FIGURE 10

### EVOLUTION OF KUBERNETES CHARACTERISTICS

How have the following characteristics of Kubernetes changed over time?



K10 Survey, Q25, Sample Size = 637, DKNS excluded (5% to 22%), i.e., the number of valid answers varies per item



**curve** remains a significant challenge, as 49% see it as either unchanged or worse. This suggests that while Kubernetes is making strides in its technical capabilities, there is a continued need for enhancements in user accessibility and education to make it easier for organizations to adopt and integrate Kubernetes more efficiently. Nevertheless, as a respondent observed, *“the ecosystem has improved and gained so much. It can be hard at times to keep up and absorb all the required knowledge”* (Story 22). Another respondent states that *“the learning curve is worse, but that’s obvious, as Kubernetes supports more and more features.”* Indeed, as Kubernetes has evolved tremendously and supports very complex workflows and advanced concepts, it is quite expected to have a steep learning curve. Nevertheless, the fact that most respondents perceive the learning curve as getting better over time is encouraging.

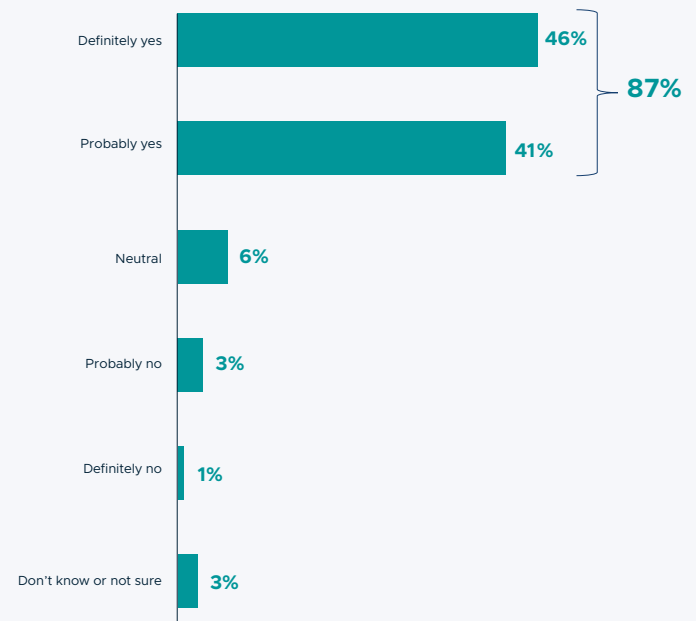
We also asked whether Kubernetes is evolving to meet the future needs of the technology industry. As observed in Figure 11, the vast majority (87%) of respondents believe that Kubernetes is indeed evolving in this direction, with 46% stating *“Definitely yes”* and 41% saying *“Probably yes.”* This shows that the overwhelming consensus within the industry is that Kubernetes is positioned to address future technological demands, highlighting its importance and potential in supporting future innovation. One respondent illustrates this: *“Kubernetes is rapidly developing, and it is covering the entire tech stack very soon”* (Story 24). Another respondent highlighted the role of Kubernetes in supporting the AI-powered future: *“Resilient multicluster with multi-master support will be a real need in the future for AI-enabled microservices and to host AI systems themselves”* (Story 25). As AI models often require significant computational resources, Kubernetes helps by automating the deployment, scaling, and management of containerized applications across distributed systems. This allows AI workloads to run in parallel, helping to process large datasets and train complex machine learning models. Additionally, Kubernetes has a new dynamic resource allocation capability, which is designed to manage resources beyond core compute, memory, and storage resources that Kubernetes natively manages. This enables the

management of nonstandard resources, such as GPUs, and ensures high availability so that AI applications can perform optimally in both development and production environments. Kubernetes also integrates well with popular AI tools and frameworks, such as TensorFlow and PyTorch, making it a powerful platform for advancing AI innovation.

FIGURE 11

### HOW KUBERNETES IS EVOLVING TO MEET THE FUTURE NEEDS OF THE TECHNOLOGY INDUSTRY

*Do you think Kubernetes is evolving to meet the future needs of the technology industry?*



K10 Survey, Q27, Sample Size = 646

*Kubernetes has continuously improved in areas such as multicluster support, observability, and security, making it more robust and adaptable to different environments.*

**RESPONDENT STORY 21.**

*I selected “worse” for the learning curve. This is by no means a negative point. It’s just that the whole product and the ecosystem has improved and gained so much. It can be hard at times to keep up and absorb all the required knowledge.*

**RESPONDENT STORY 22.**

*Learning curve is worse, but that’s obvious, as Kubernetes supports more and more features... It’s like some new engineers that don’t know how a computer internally works... (they should still learn it).*

**RESPONDENT STORY 23.**

*Kubernetes is rapidly developing, and it is covering the entire tech stack very soon.*

**RESPONDENT STORY 24.**

*Resilient multicluster with multi-master support will be a real need in the future for AI-enabled microservices and to host AI systems themselves.*

**RESPONDENT STORY 25.**



## Learning curve, security, and talent shortage are the top challenges

Respondents also indicated the challenges they expect Kubernetes to face in the next five years, as observed in Figure 12. The most prominent challenge is the **complexity for new users**, which 59% of respondents cited, highlighting the steep learning curve associated with Kubernetes. As mentioned in the previous section, Kubernetes is difficult to learn primarily due to its inherent complexity and the multitude of concepts involved. It requires a deep understanding of containerization, orchestration, and cloud native architecture, all of which can be overwhelming for newcomers. The platform introduces unique terminology, such

as pods, services, and namespaces, which are essential to grasp for effective usage. Moreover, Kubernetes is highly flexible and customizable, but this also means that users must learn how to configure, manage, and troubleshoot a wide array of components and integrations. Additionally, as Kubernetes often runs in dynamic, distributed environments, learners must also familiarize themselves with networking, storage, security, and scaling concepts, further complicating the learning curve. The evolving ecosystem, with continuous updates and new features, also adds to the challenge of keeping up to date. Nevertheless, as observed



in the previous sections, respondents perceive that the learning curve is getting better over time. One respondent observed: *“I still see beginners struggling and feel there is a barrier to entry. However, as soon as a person gets a little hold, things get much easier”* (Story 26).

**Security concerns** rank second at 44%, reflecting ongoing worries about protecting workloads and data in containerized environments. Kubernetes introduces unique security challenges, such as managing access control for different components, securing communication between microservices, and ensuring container isolation. Key areas of focus include role-based access control, which helps manage permissions for users and applications, and network policies, which regulate traffic between pods. Additionally, securing the Kubernetes API server is essential, as it controls cluster interactions. Tools such as Secrets help in managing sensitive data, but proper encryption and handling practices are necessary to prevent exposure. Security also involves securing the underlying infrastructure, ensuring that containers are free from vulnerabilities, and regularly updating Kubernetes to patch potential security flaws. As observed in Story 27, security is still a challenge for Kubernetes, but there are improvements. This is consistent with the findings presented in the previous section, which show that security is one of the characteristics in which most participants perceive improvements over time. Nevertheless, the need for security leads to job opportunities. As described in Story 28, specializing in securing Kubernetes pays off, since the market is adopting Kubernetes but still doesn't know how to protect it.

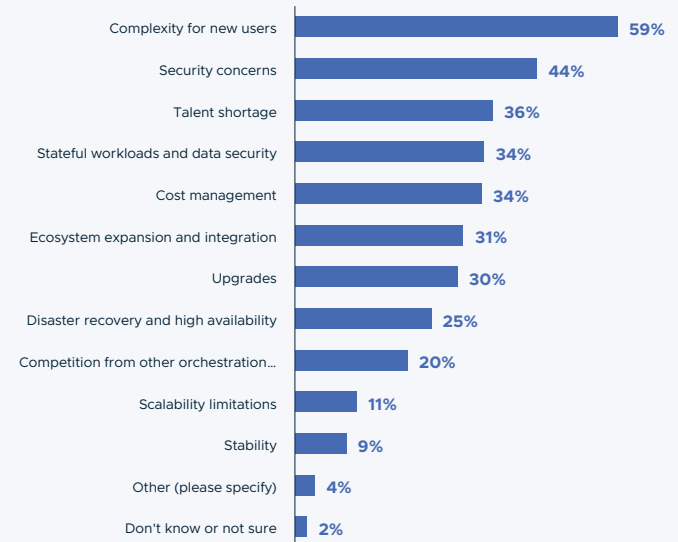
In fact, investing in learning Kubernetes can open many professional opportunities, as described earlier in this report. Another major challenge the respondents reported is a **talent shortage** (36%), evidencing the need for more skilled Kubernetes professionals. Some job platforms currently list over 140,000 Kubernetes-related positions. This number is likely to grow, with projections suggesting the Kubernetes market could quintuple within the next decade, according to some reports. The Linux

Foundation's 2024 State of Tech Talent Report confirms the need for more cloud, container, and virtualization resources. When we asked development leaders and technical hiring managers which approach organizations would use to address their needs, the cloud/container/virtualization ranked first, and it would be addressed through the following combination of actions: hire new technical staff (21%), upskill or cross-skill existing technical staff (52%) and hire consultants (21%).

FIGURE 12

## BIGGEST CHALLENGES FACING KUBERNETES IN THE NEXT FIVE YEARS

*What are the biggest challenges facing Kubernetes in the next five years? (select all that apply)*



K10 Survey, Q28, Sample Size = 646, Total Mentions = 2,186



To support developers onboarding into this technology, the Cloud Native Computing Foundation (CNCF) and the Linux Foundation offer a variety of learning opportunities for Kubernetes to help individuals learn the technology, including online courses, certification programs, conferences, and workshops. For some, as illustrated in Story 29, Kubernetes learning is a lifelong commitment. Individuals, including this one, who have successfully passed every CNCF Kubernetes certification—CKA, CKAD, CKS, KCNA, and KCSA—receive the title of “Kubestronaut” together with a series of benefits. Stories 30 and 31 reflect significant professional evolution and satisfaction for achieving the Kubestronaut status, illustrating how proficiency of Kubernetes can propel one’s career forward.

*I still see beginners struggling and feel there is a barrier to entry. However, as soon as a person gets a little hold, things get much easier.*

**RESPONDENT STORY 26.**

*For the Kubernetes community, security is still a second priority, but there are improvements.*

**RESPONDENT STORY 27.**

*I bet my security engineering career on Kubernetes and Linux containers. The bet paid off, and thanks to it, I quickly became a very experienced professional on the market, where people were still trying to adopt Kubernetes and didn’t know how to protect it.*

**RESPONDENT STORY 28.**

*I think Kubernetes is an ocean and we can deep dive as much as we want: There is no fixed depth, it is endlessly deep. I want to be in touch with Kubernetes forever, and I believe that Kubernetes is not just a technology because I am a Kubestronaut, and I lived my life like a heaven when I was*

*preparing for CKAD, CKA, and CKS. Those labs and those problems I enjoyed a lot. I have a deep hunger to learn more and more about Kubernetes.*

**RESPONDENT STORY 29.**

*I’m constantly learning new aspects of Kubernetes, and my dedication culminated in successfully completing all five certification exams. Becoming a Kubestronaut was a significant achievement that brought me great satisfaction.*

**RESPONDENT STORY 30.**

*My journey from a savvy architect to a Kubestronaut significantly advanced my career. I will continue to mentor and inspire others, promoting the adoption and understanding of Kubernetes.*

**RESPONDENT STORY 31.**



## Kubernetes has an active and helpful community

Besides the learning opportunities described in the previous section, Kubernetes has a vibrant, collaborative open source community that can provide support for those interested in the technology. As depicted in Figure 13, **KubeCon** is among the main channels for interacting with the community, highlighting its importance as a key event for community engagement. **Stack Overflow** and **Kubernetes Slack** channels also rank highly, evidencing the importance of these platforms for knowledge exchange. Other notable channels include **community forums**, **Kubernetes GitHub**, and **LinkedIn groups**, each catering to different styles of interaction.

Figure 14 shows the net promoter score (NPS) of various Kubernetes community interaction channels, indicating how likely

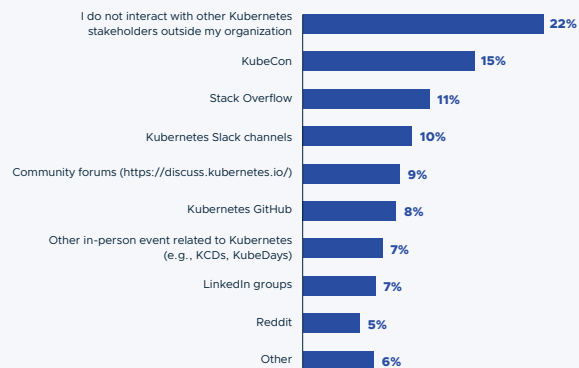
users are to recommend these channels to others. Community forums (65) are the most highly recommended, reflecting their usefulness for learning and collaboration. KubeCon (56) and other in-person Kubernetes events (42) also score well, showing the value of events in fostering networking and education. Other channels—GitHub (40), LinkedIn groups (38), Kubernetes Slack channels (37), Stack Overflow (23), and Reddit (12)—also have strong positive scores, with more respondents strongly recommending the channels than weakly recommending them. This distribution highlights the availability of varied platforms for facilitating Kubernetes-related interaction and learning. Stories 32 to 36 highlight the role of community engagement in overcoming the steep learning curve associated with Kubernetes. As another respondent stated: “Community, community, community!”



FIGURE 13

### MAIN KUBERNETES COMMUNITY INTERACTION CHANNELS

Which of the following is your main channel for interacting with other Kubernetes stakeholders? (select one)

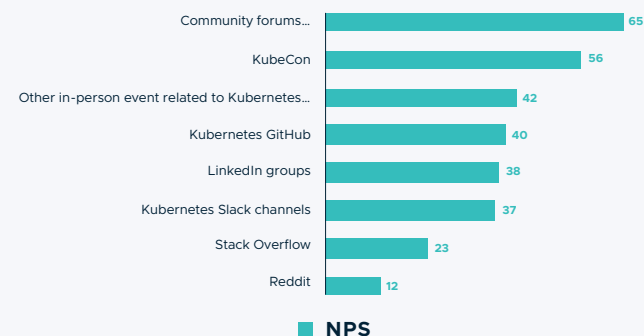


K10 Survey, Q29, Sample Size = 646

FIGURE 14

### NET PROMOTER SCORES (NPS) FOR KUBERNETES COMMUNICATION CHANNELS

On a scale of 1 to 10, how likely are you to recommend the channel you selected to others?



K10 Survey, Q30, Sample Size = 483. The number of valid answers varies per item. NPS = Promoters - Detractors. Promoter = 9 or 10. Detractors = 1 to 6.

*I'm an old-school Sysadmin for about 30 years and made my move to Kubernetes two years ago, when I was at a project to install Gitlab on a Kubernetes cluster. This made me curious about Kubernetes, and that curiosity never left. I'm currently learning, and my objective is to become a KubeStronaut in one year. It will be difficult, since I'm also a proud dad and husband, but I'm sure I will succeed due to the help of the Kubernetes community and the CNCF.*

**RESPONDENT STORY 32.**

*New project was exciting to work upon, but had its challenges around implementation in the Kubernetes world. This gave me good exposure to community forums where I used to look for answers when I got stuck with a problem.*

**RESPONDENT STORY 33.**

*While Docker motivated me to learn about containers, Kubernetes showed me how welcoming the community was, and it impacted my career for the better by working for a company that creates Kubernetes distros and helps both the community and the enterprise on their journey. Since the switch, my journey has simply been amazing, and it has allowed me to meet the “heroes and legends” who make the Kubernetes community one of the most inclusive in the world.*

**RESPONDENT STORY 35.**

*Through the Kubernetes community, I was able to level up my cloud native skills and knowledge of key areas maturing within the Kubernetes project. The various SIGs also helped in establishing a product strategy for a container-native storage startup and learning from other projects about integrations for a container security startup.*

**RESPONDENT STORY 36.**



## Each community channel has its own strengths

Figure 15 details the factors that the Kubernetes community members considered when recommending their primary interaction channels. It breaks down the considerations based on multiple criteria, such as technical support quality, variety of discussion topics, accessibility of information, and community inclusiveness. For instance, respondents regard **KubeCon** highly for its variety of discussion topics (81% mentions) and technical support quality (69% mentions), showing that it's a popular platform for deep, varied discussions. **Kubernetes Slack** stands out for its technical support quality (75% mentions) and variety of discussion topics (66% mentions), making it a key resource

for problem solving. Respondents also appreciate **community forums** and **Stack Overflow** for accessibility of information and moderation quality, reflecting their role as knowledge-sharing platforms. The data highlights how different platforms cater to specific needs within the Kubernetes community, from support and information to inclusiveness and interaction quality. Story 37 emphasizes how deeply the Kubernetes ecosystem connects professionals, making it not just a technology but a network of shared identity and passion. Story 38 highlights Kubernetes as a global community and cites KubeCon as a source of opportunities for interaction, learning, and inspiration.

*Kubernetes has opened the door to several significant job opportunities that I wouldn't have been offered otherwise. It has connected me with a community more than any other technology has. I have also engaged with random strangers due to t-shirts I have worn with Kubernetes logos proudly displayed.*

**RESPONDENT STORY 37.**

*Kubernetes represents a global community. That a single technology can bring people together from all over the world and create opportunities for interaction and learning through KubeCon is very inspiring.*

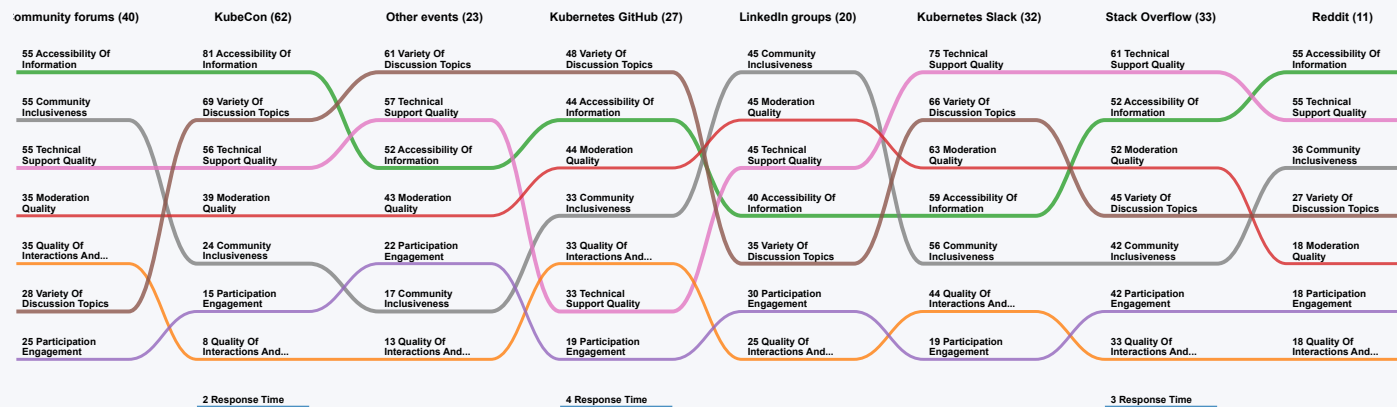
**RESPONDENT STORY 38.**



**FIGURE 15**

## MAIN STRENGTHS OF KUBERNETES COMMUNITY CHANNELS

*What did you consider in your answer to the previous question? (select all that apply)*



K10 Survey, Q31, Sample Size = 256, Valid Cases = 256, Total Mentions = 883. The number at the top of the column represents the number of respondents. The numbers in the lines are the percentages. Promoters answered 9 or 10 to Q30. Showing only the promoters' responses.

## Project development is also getting better over time

Project contributors report that the **overall community progress** has improved significantly, with 70% of respondents indicating that the community has gotten better or significantly better, as observed in Figure 16. **Documentation on how to contribute** stands out, with 82% reporting improvements, which is very important for onboarding new contributors and enhancing the community's accessibility. Aligned with this finding, contributors believe that **onboarding new contributors** and the **contributor experience** have seen positive changes for 63% and 65% of respondents, respectively. **The level of active contribution, governance and leadership, and diversity and inclusion improvements** were noted by 62%, 55%, and 55% respectively, showcasing the health of the community and the potential for further receiving contributions.

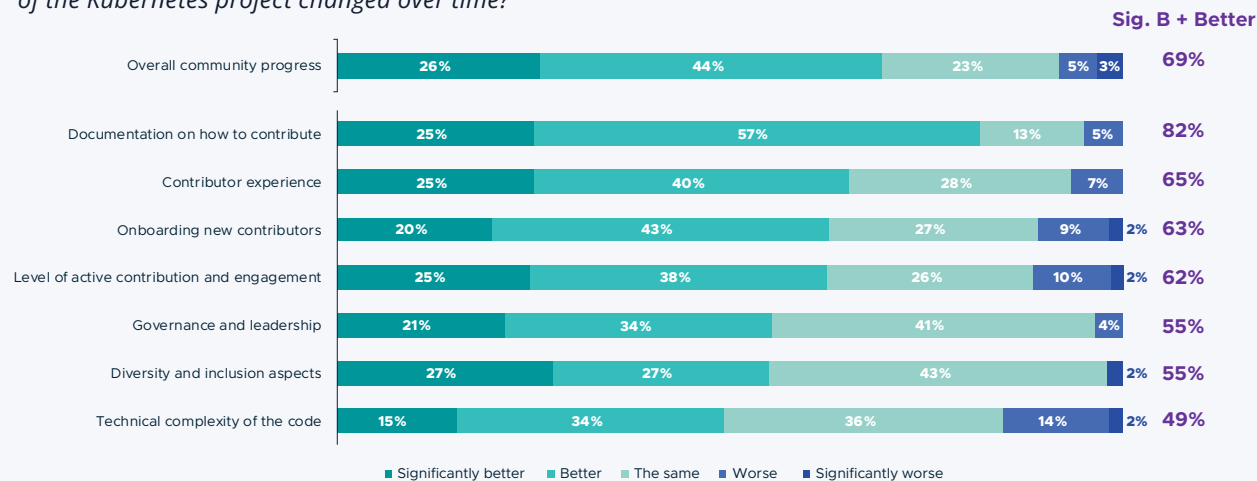
**Technical complexity of the code** presents the highest proportion of negative feedback, with 16% stating that it has worsened and 36% indicating that it has stayed the same. This suggests that as Kubernetes has matured, its codebase has become more complex, which might be posing challenges for new contributors. Technical complexity of the code is another unintended consequence of the platform's growing sophistication and wide range of features. As Kubernetes evolves to meet the demands of larger and more diverse use cases, the need to support advanced features, scalability, and security inevitably adds layers of complexity to its architecture. Nevertheless, the perception that documentation, contributor experience, onboarding of new contributors, and level of active contributions and engagement are improving over time is an encouraging signal to new contributors who want to participate in this inclusive project and help shape the future of the technology.



FIGURE 16

### CONTRIBUTORS' PERCEPTIONS OF HOW THE PROJECT CHARACTERISTICS ARE EVOLVING OVER TIME

*You indicated that you contribute to Kubernetes. How have the following characteristics of the Kubernetes project changed over time?*



K10 Survey, Q32, Sample Size = 71, DKNS excluded (10% to 25%), i.e., the number of valid answers varies per item. Question answered only by contributors.

## Conclusion

Over the past decade, Kubernetes has become a foundational element in the IT infrastructure of countless organizations globally. The survey findings evidence Kubernetes' transformative influence on both organizations and individual professionals, facilitating scalability, automation, and improved deployment and development processes. The enthusiastic adoption and plans for increased utilization of Kubernetes across a variety of industries indicates a bright future for the technology. The survey showed that Kubernetes is evolving to meet the industry's needs and has improved in many aspects over time.

Kubernetes' robust contributor community supports its growth. The community not only drives continuous improvement and innovation but also provides a supportive ecosystem for newcomers. Looking ahead, while challenges such as the steep learning curve, security concerns, and talent shortages persist, the community's

commitment to evolving Kubernetes to meet future technological demands is clear.

The stories that the survey respondents shared paint a vivid picture of Kubernetes' impact on individual careers and organizational success. From developers who found new career opportunities to companies that were able to scale their operations significantly, these narratives underscore the practical benefits of the adoption of Kubernetes. Many respondents described their journey from struggling with the initial complexity to becoming proficient enough to lead major projects or achieve certifications such as Kubestronaut, highlighting both the challenges and the rewards of joining Kubernetes.



## Methodology

### About the survey

This study is based on a web survey that Linux Foundation Research and the CNCF conducted during August 2024. The survey's goal was to understand the impact that Kubernetes has had on organizations. We were also especially interested in stories about how Kubernetes has made a difference and the data to support these stories. Then, we wanted to understand how the project and its community have evolved over the years from individuals' perspectives.

From a research perspective, it was important to eliminate any perception of sample bias and ensure high data quality. We handled the elimination of sample bias by sourcing our usable sample from Linux Foundation subscribers, members, partner communities, and social media. We addressed data quality through extensive prescreening, survey screening questions, and data quality checks to ensure that respondents had sufficient professional experience to answer questions accurately on behalf of the organization they worked for.

We collected survey data from industry-specific companies; IT vendors and service providers; nonprofit foundations; and



academic and government organizations. Respondents spanned many vertical industries and companies of all sizes. The data we collected spanned all four primary geographic regions, although 92% originated from a combination of North America, Europe, and Asia-Pacific and just 8% from the rest of the world.

The 2024 Kubernetes Turns 10 Survey comprised 33 questions that addressed screening, respondent demographics, perceptions of Kubernetes, the impact of Kubernetes on organizations, and how the Kubernetes project is evolving. The dataset driving the analysis in this report and survey frequencies can be found on Data.World. For information about access to the 2024 Kubernetes Turns 10 Survey, its dataset, and survey frequencies, see the Data.World access information below. Table 1 outlines the high-level design of the Kubernetes Turns 10 Survey.

**Table 1: Survey design**

Question categories	Pages	Questions	Who answers the questions
Introduction	P1		
Demographics	P2 - P4	Q1 - Q6	All respondents (N=715)
Perceptions of Kubernetes	P5	Q7 - Q12	All respondents (N=715)
Impacts on organizations	P6-9	Q12 - Q24	Organizations using Kubernetes (except Q19) (N=631)
Evolution	P10	Q25 - Q29	All respondents (N=646)
Community at large	P11	Q30 - Q31	Those who identified a stakeholder interaction channel (N=491)
Project evolution	P12	Q32 - Q33	Kubernetes contributors only (N=71)
Optional closing questions	P13-15	Q34 - Q35	All respondents (N=646)

The target audience included respondents who met the following criteria:

- Must have a basic or advanced level of Kubernetes expertise
- Must have more than one year of experience using Kubernetes

Survey development by Linux Foundation Research occurred in July 2024, and the survey took place in August 2024. A total of 715 respondents began the survey, and 646 completed the survey. Respondents included students (N = 5) and IT professionals (N = 710). The margin of error for this sample size of 646 is +/- 3.8% at a 90% confidence level and +/- 3.2% at a 95% confidence level.

We stratified the data collection by company size, geographic region, and organization type. We segmented the data primarily by geographic region, company size, and type of organization.

Although we required respondents to answer nearly all questions in the survey, we made a provision for when a respondent was unable to answer a question. We accomplished this by adding a “Don’t know or not sure” (DKNS) response to the list of responses for every question. However, this creates a variety of analytical challenges.

One approach was to treat a DKNS response just like any other response so that the percentage of respondents that answered DKNS was available to us. The advantage of this approach is that it shows the exact distribution of data collected. The challenge with this approach is that it can distort the distribution of valid responses, i.e., responses where respondents could answer the question.

Some of the analyses in this report exclude DKNS responses. This is because we can classify the missing data as either missing at random or missing completely at random. Excluding DKNS data from a question does not change the distribution of data (counts) for the other responses, but it does change the size of the denominator used to calculate the percentage of responses across the remaining responses. This has the effect of proportionally increasing the percentage values of the remaining responses. Where we have elected to exclude DKNS data, the footnote for the figure includes the phrase “DKNS responses excluded from the analysis.”

The percentage values in this report may not total to exactly 100% due to rounding.

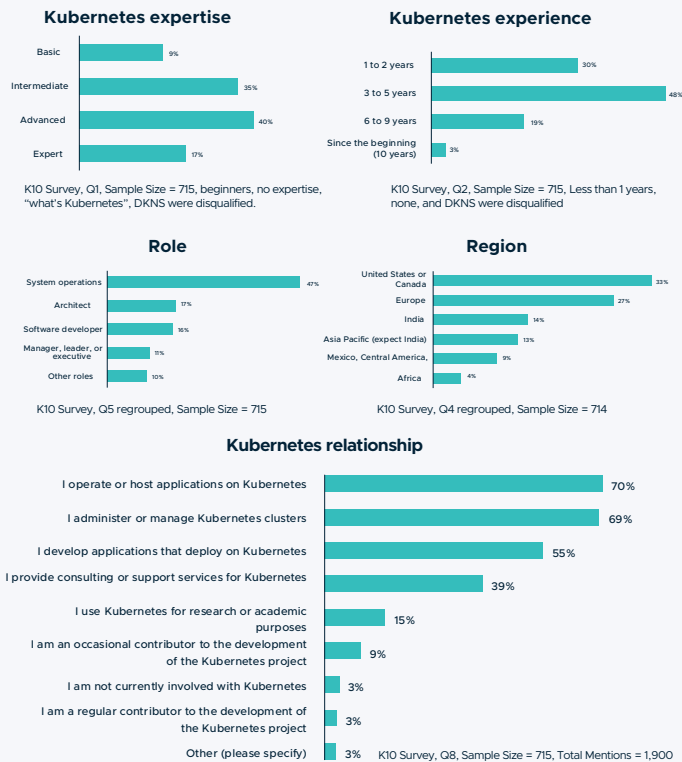
## Data.World access

LF Research makes each of its empirical project datasets available on Data.World. Included in this dataset are the survey instrument, raw survey data, screening and filtering criteria, and frequency charts for each question in the survey. LF Research datasets, including this project, can be found at [data.world/thelinuxfoundation](https://data.world/thelinuxfoundation). Access to Linux Foundation datasets is free, but it does require you to create a Data.World account.



FIGURE 17

## RESPONDENT DEMOGRAPHICS

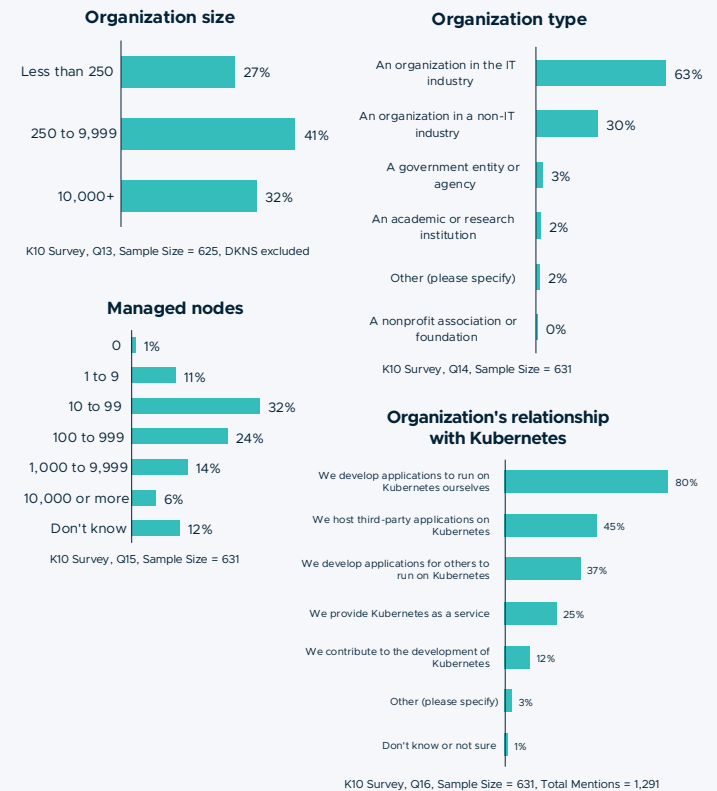


## Respondent demographics

These demographics provide you with a profile of the 2024 Kubernetes Turns 10 Survey respondents. Figure 17 presents the respondent demographics, and Figure 18 presents the organization demographics. We have regrouped some demographics to facilitate more insightful analysis. For the original source data and study frequencies, please see the Data.World dataset and access, as described above.

FIGURE 18

## ORGANIZATION DEMOGRAPHICS



## About the authors

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## Acknowledgements

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Cloud native computing leverages an open-source software stack to deploy applications as microservices, where each component is packaged into its own container and orchestrated dynamically to optimize resource utilization. [The Cloud Native Computing Foundation](#) (CNCF) hosts key projects within the cloud native ecosystem, including Kubernetes, Envoy, Prometheus, and many others. CNCF serves as a neutral hub for collaboration, bringing together leading developers, end users, and vendors—from the world’s largest public cloud providers and enterprise software companies to innovative startups. As part of The Linux Foundation, a nonprofit organization, CNCF fosters the growth and adoption of cloud-native technologies across industries. For more information, visit [www.cncf.io](http://www.cncf.io).

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