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AHEAD OF THE CURVE® SERIES

PUBLIC CLOUD XI: COST SAVINGS CYCLE MAKES WAY FOR BURGEONING GEN AI

SEPTEMBER 25, 2023

Our 11th annual survey of 680 US respondents suggests a vast majority of Cloud customers will finish cost optimizations by YE '23, setting up for additional workload transition.

Generative AI workflows are ramping, with nearly 75% of respondents either highly considering allocating IT budget or having already allocated budget.

Customers continue extending Cloud contracts, (48% extended within last year), with Enterprise & Mid-Market most likely to be renegotiating. 63% have contracts of two or more years.

The multi-cloud trend continues, as 84% of respondents use multiple providers, vs 68% and 63% in '22/'21; Enterprise (90% of cohort) and Mid-Market (86%) lead multi-cloud trend.

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DATA SCIENCE INITIATIVE

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EQUITY RESEARCH

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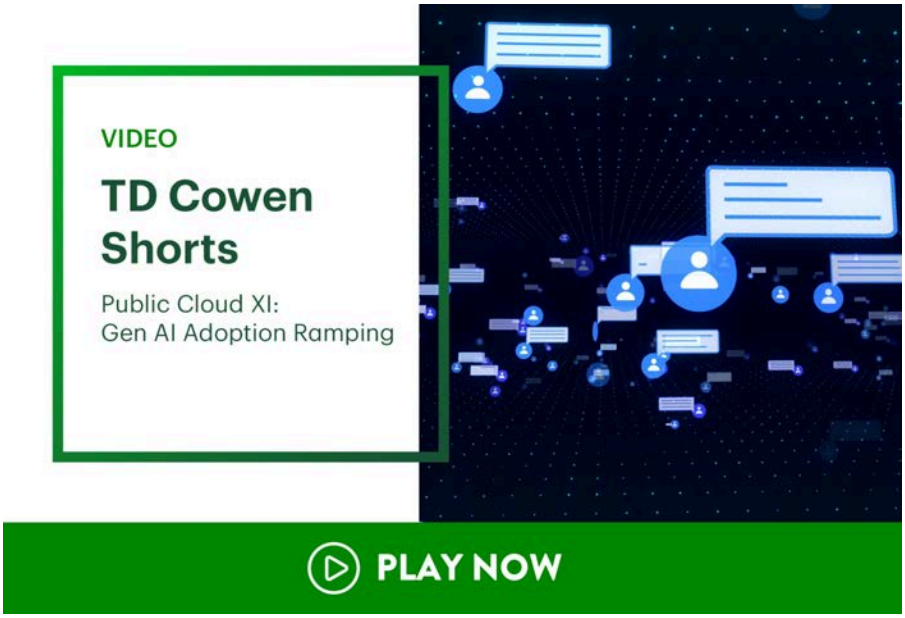
INDUSTRY UPDATE

PUBLIC CLOUD XI: GEN AI ADOPTION RAMPING - AHEAD OF THE CURVE SERIES + VIDEO

THE TD COWEN INSIGHT

Based on our 11th annual Public Cloud market report, comprising a survey of 680 US respondents, we're encouraged that Cloud customers are moving past cost optimizations (that will largely be done by YE23), while ramping their Gen AI budgets. Other insights include workload migration, multi-cloud, & lengthening contracts. Survey was positive for AWS, Azure, & GCP as well as other leading platforms.



What Is Proprietary: Our 11th annual Cloud Survey provides an updated view on (i) Public Cloud spending trends, including pace of growth, where we are on the cost optimization curve for hyper-scalers, and potential impact of macro environment; (ii) Gen AI current and future budget allocation and use cases; (iii) Public Cloud contract length; (iv) Shift to multi-cloud vendors; and (v) workload migrations, among other areas. We surveyed 680 respondents comprising ~$9.5BN in IT spend; the sample was split evenly among SMB, Mid-size, and Enterprise customers.

Our Thesis: We view the major Public Cloud platforms as mostly through cost optimizations that started in mid '22; per our survey, the vast majority of Cloud customers (or 76% of total who implemented cost optimizations) will likely finish their efforts by the end of '23, while >50% finished by the end of 3Q23. Key levers of Public Cloud spend growth going forward include (i) 85% of Cloud customers are committed to moving a significant amount or fair amount of workloads to the Cloud in '23 as a part of their recent cost optimizations; top 3 workloads include AI inference and training, front office, and back office applications; (ii) Gen AI adoption should be incremental to Cloud spend as ~75% of respondents are allocating spend or intend to allocate spend over the next year; and (iii) Macro conditions

appear benign to Cloud spend. Additionally, the shift to longer contracts and multi-cloud vendors continues.

Financial and Industry Model Implications: Global Public Cloud market revenue of $488BN in '22 is expected to rise to $1.16TN in '27, a ~19% CAGR per Gartner, while Infrastructure as a Service (IaaS) is the fastest growing segment at a 23% CAGR '22-'27.

On average, survey respondents expect their spend with Public Cloud providers to grow ~30% in '23, down from 35% in '22 (at the median), giving us greater confidence in our forecasts for the Big 3 hyperscalers (AMZN, MSFT, GOOG) and painting a more constructive picture than current investor sentiment. The data directionally shows the revenue deceleration we are seeing from the large Public Cloud platforms and led in part by heightened cost optimizations, which we expect will largely be over post '23. The respondents' expectation for spend growth deceleration aligns with our estimates of major Public Cloud vendors; for instance, we forecast AWS revenue growth of ~15% y/y in 4Q23 vs +20% y/y in 4Q22, and for Google Cloud (which includes Workspace), we forecast revenue growth of ~26% y/y in 4Q23 vs. +32% y/y in 4Q22.

We view this trend as consistent with recent mgmt. comments regarding optimizations. The data is encouraging in light of our current 2H23 and '24 topline forecasts; for instance, we expect that AWS revenue growth bottomed in 2Q23 at +12% y/y and will slightly accelerate in 2H23, as we forecast revenue growth of +13% y/y in 3Q23 and +15% y/y in 4Q23, accelerating further to +16% y/y in FY24 as AWS and other platforms distance themselves from heightened cost optimizations. For Google Cloud (which includes Workspace), we forecast y/y revenue growth in the mid 20's % range in 2H23 and '24, a slight deceleration from +28% y/y in 2Q23.

Overall, we are encouraged by upcoming growth levers, including more workloads moving to the cloud and investments in Gen AI.

What to Watch:

(1) Cost Optimizations Ramped over the Last 12 Months, But There is a Light at the End of the Tunnel: Roughly 41% of Cloud customers suggested more cost optimizations than normal, driven by (i) Reduced Storage usage (42% of respondents); (ii) Lower rates driven by renegotiated contracts (40%); (iii) Reduced Compute usage (34%); and (iv) Moving some workloads back to on-prem (33%), among other areas.

Roughly 86% of Public Cloud customers optimized spend either in the middle of '22 (19% of respondents), towards the end of '22 (27%) or at the start of '23 (37%), with the bulk of optimizations starting toward the end of '22 or in the beginning of '23. In terms of when cost optimizations will end, 12% indicated that they are already finished with optimizations, while >60% expect to end their cost optimizations within the next 3 months or within the next 3-6 months, which implies (i) 43% of Cloud customers expect to be through cost optimizations by the end of 3Q23; and (ii) the vast majority (76%) of Cloud customers implementing cost optimizations will likely have finished their efforts by the end of '23.

(2) Gen AI Workflows Ramping: Nearly 75% of respondents are either highly considering allocating IT budget to Gen AI (41% of respondents) or have already allocated budget to Gen AI (33% of respondents). Another 19% of respondents are considering allocating budget to Gen AI, while only 7% do not expect to allocate budget to Gen AI.

(3) Gen AI Adoption Across Key Business Functions: Current usage areas of Gen AI across business functions are already seeing solid adoption, with roughly 50% of survey respondents either currently using or expecting to use Gen AI in the next year for (i) Software Development, (ii) Marketing, (iii) Product Dev / Mgmt and (iv) Customer Service. Looking ahead, roughly 75% of respondents expect to use Gen AI for one of these four functions within the next 3 years.

(4) Customers Are Extending Public Cloud Contract Length: 48% of respondents indicated they have extended their public cloud contract length within the last year, with Enterprise and Mid-Market businesses most likely to be renegotiating. This translates to the most common contract length of 2 years (33% of respondents), followed by 1 year (23%) and 3 year (20%). Overall, 63% of respondents have contracts of 2 years or longer.

(5) Shift to Multi-Cloud Continues: For the third consecutive year, businesses have indicated that they are increasingly using multiple cloud providers. This year, 84% of respondents indicated that they utilize more than one cloud provider, up significantly from 68% who said the same last year. 39% of respondents now use 3 Cloud providers, up from 13% in '20. Enterprise businesses were most likely to be using multiple providers (90% of the cohort), followed by Mid-Market (86%) and then SMB firms (74%).

(6) Migration of Back Office Apps to Cloud Jumped in Priority: Our survey highlighted that Back-Office Apps (ERP, SCM, HCM, Financials) were the #3 most likely workload to transition to cloud over the next 2 years (out of 14 different workload categories), a meaningful increase from #8 last year and #11 2 years ago. More specifically, 42% of respondents believe Back Office Apps will transition within 2 years, up from 38% last year.

Stock Conclusions: The data in this report makes us incrementally more comfortable with our revenue and earnings forecast for: ACN, AMD, AMZN, CFLT, CRWD, CTSH, DDOG, DXC, EQIX, GOOG, INFY, LSCC, MPWR, MRVL, MSFT, NET, NTAP, NVDA, ORCL, PANW, PSTG, S, SAP, SNOW, STX, WDAY, WDC, ZS.

Primary Company Implications: AMZN, GOOG, MSFT, ORCL

Amazon (Blackledge): We forecast AWS revenues to grow 16.2% annually from 2023 to 2028, rising from ~$91.2BN in '23 to ~$193.5BN in '28. Per our survey, the vast majority of respondents have either allocated budget to Generative AI (33% of respondents) or are "highly considering" allocating budget to Gen AI within the next year (41% of respondents). This trend could bode well for AMZN's AWS, in our view, given the company's vertically integrated strategy of providing services across three key layers (hardware infrastructure, AWS Bedrock, and top layer applications).

Of note, AWS reported 12.2% y/y revenue growth in 2Q23, partially reflecting recent customer focus on value and cost optimizations; in the near-term, we expect growth to re-accelerate in 2H23 and into 2024, helped by the move of additional workloads to the Cloud. Our survey data shows that the bulk of Cloud cost optimizations will be finished by the end of '23; digging deeper into the data, it shows that SMB and Mid market Cloud customers began optimizations earlier than Enterprise, and expect to complete them earlier, which bodes well for AWS, given its customer mix.

This year's Cloud survey also suggests (i) 34% of respondents who expect to add a Public Cloud vendor suggested they would add AWS and 18% who expect to replace a Public Cloud vendor would replace it with AWS; in both cases, AWS ranked #2 behind Azure; and (ii) AWS custom silicon is seeing healthy adoption, as 33% of respondents report using Graviton, up from 9% of respondents who utilized Graviton in our 2022 survey. Of note, another 25% of respondents in our '22 survey stated they were actively looking to adopt Graviton at the time, underscoring how quickly these custom chips are gaining traction.

Additionally, our forecast calls for AWS Operating Income (GAAP) to rise from $22.1BN to $53.0BN, a 19.2% CAGR '23E-'28E. Overall, we see Operating Income (GAAP) margins rising from 24.2% in '23E to 27.4% in '28E.

Alphabet (Blackledge): Google Cloud Platform had another solid showing in our annual survey, although a gap remains between GCP and market leaders AWS and Azure. GCP awareness was strongest among SMB respondents, expanding to 64% awareness in the cohort vs. 62% last year. Meanwhile, overall awareness of 56% fell from 61% last year. GCP usage rose among existing Enterprise and Mid-Market customers; Enterprise usage of 36% grew vs. 34% last year, while Mid-Market usage of 45% grew from 39% in '22. Finally, SMB usage of 41% was flat vs. the prior year, compared to 53% and 51% SMB usage for AWS and Azure customers, respectively.

26% of current GCP users expect to replace their provider in the next two years (vs. 26% and 31% among AWS & Azure users, respectively), while a higher 35% of GCP users will add another cloud provider, compared to 31% among all survey respondents. Finally, when we asked respondents which provider they would add or replace, 30% of respondents stated they plan to add GCP, while 10% said they expect to replace an existing provider with GCP.

We expect that GOOG will benefit from ramping Gen AI implementation among Cloud users. Per our survey, 74% of respondents are either highly considering or have already

allocated a portion of their IT budget to Gen AI related offerings. As such, Cloud users should increasingly adopt GOOG's Gen AI solutions that include Duet AI, offering AI tools like coding assistant, chatbot support, and content creation; and Vertex, a cloud-based platform that allows developers the ability to create their own user applications on top of ~100 foundation models.

Our survey data shows that the majority of Cloud cost optimizations will be finished by the end of '23; digging deeper into the data, SMB and Mid market Cloud customers began optimizations earlier than Enterprise customers, and they expect to complete them earlier. This trend bodes well for Google Cloud in our view (and is also positive for AWS), given its customer mix.

GOOG's Cloud business reported $15.5BN of revenue in 1H23, up 28.0% y/y. Cloud also had ~$60.6BN in contract backlog in 2Q23 vs. $51.2BN as of the year ago period. We expect GOOG will generate Cloud revenue of $33.3BN in '23, +26.9% y/y and growing to $74.8 BN by '27, a 23.3% 5-year CAGR. GOOG's Cloud biz reported an Operating Income (GAAP) profit for the first time in 1Q23, with 2Q23 profit rising to $395MM vs. ($590MM) in 2Q22. Looking forward, we expect Cloud segment Op Inc will rise from $1.7BN in '23 to $13.8BN in '27.

Microsoft (Wood): Azure continues to rank very well throughout the survey, capturing the #1 spot in public cloud usage for the sixth consecutive year. 57% of respondents currently use Azure, ahead of AWS at 49%. Azure remained dominant in Enterprise, with the #1 usage rate of 60%, well ahead of IBM Cloud at #2 with 43%. Azure ranked #2 in Mid-Market (56% vs. AWS at 60%), and #2 in SMB (51% vs. AWS at 53%). Azure was the #1 choice for adding a new cloud provider (42% of respondents vs. AWS at 34%), while it was also #1 for those looking to replace their current provider (21% vs. AWS at 18%). The survey suggests that more Tier 1 apps (i.e. ERP) are migrating to the cloud, which bodes well for both Azure consumption and margins as these apps are more compute-intensive.

Considering MSFT retains its strong #1 position among respondents, and considering our survey implies that growth in overall cloud spend is expected to be ~30% in 2023, we see a favorable growth outlook for MSFT Azure heading into 2H of CY23 whereby growth should start to show more signs of stabilization. Following 37% cc growth in CY22, we model Azure revs to grow 26% cc in CY23 to $64b (including 31%, 27%, 26%, 25% growth in C1Q-C4Q), and 25% cc in CY24 to $80b. Our survey takeaways, especially on nearing the end of optimization cycles, give us greater confidence in our CY23 estimates, and a slight upside bias to our CY24 estimates, particularly if new AI spending begins to ramp.

Oracle (Wood): Oracle had the largest Y/Y increase in public cloud usage out of all surveyed companies, from 11% in last year's survey to 22% this year, reinforcing our view of market share gains and a strengthening competitive position. Mid-Market drove the increase with a 14pp increase to 26%, followed by a 9pp increase to 25% in SMB and an 8pp increase to 17% in Enterprise. Moreover, we think the rise in multi-cloud strategies and the strong interest in migrating high-performance AI workloads to the cloud are favorable trends for ORCL. We view OCI as a share gainer in the cloud space driven by its highly scalable RDMA high-bandwidth, low-latency infrastructure delivery, which mgmt highlights enables 2x+ performance at 1/2 the price vs. competitors. We currently model OCI revenue to grow 64% cc in CY23 to $5.7b, and 47% cc in CY24 to $8.3b.

Our survey also highlighted that Back-Office Applications (ERP, SCM, HCM, Financials) were the #3 most likely workload to transition to cloud over the next two years (out of 14 different workload categories), a meaningful increase from #8 last year. We think this shows rising priority for Back Office transformation, which should support durable medium-term growth trends. For its Strategic Back Office business, we model revenue to grow 21% cc in CY23 to $6.7b and 21% cc in CY24 to $8.1b.

Implications for Enterprise Software (Wood):

IaaS: Azure remained dominant in vendor usage at 57% of respondents using it (+6pp Y/Y), followed by AWS at 49% (+5pp), IBM at 43% (+1pp), GCP at 41% (+3pp), SAP at 24% (+2pp), and ORCL at 22% (+11pp). ORCL saw the largest Y/Y increase in usage of the group.The median expectation among respondents for Cloud spending is for 30% Y/Y growth in 2023,

a modest deceleration following 35% in our 2022 survey. Growth expectations were highest for mid-market companies.

39% of respondents are now using 3 public cloud vendors, up from 23% in 2022 and 15% in 2021. Only 16% are using one public cloud, down from 33% and 37% over the last two years. We were encouraged by data points suggesting that cost optimizations are largely expected to be complete within 6 months. In addition to the 12% of respondents that already completed their cost optimizations, 63% of respondents indicated they expect to finish cost optimizations within the next 6 months, with 31% expecting to finish in the next 3 months. We think this bodes well not only for the IaaS vendors, but also for Data Cloud and Observability vendors with consumption-based models such as SNOW, CFLT, DDOG & others.

We were also encouraged by the high propensity to spend on AI and the implications for both the IaaS and Data Cloud vendors. ~75% of respondents are current users or plan to use generative AI within the next 3 years. 33% of respondents have already allocated budget to generative AI, and another 41% are highly considering allocating budget within the next year. We note that 32% of respondents have been or plan to leverage a commercially packaged LLM (such as GPT-4 or Amazon Titan) while 28% prefer open-source LLMs (like Meta's Llama or TII's Falcon). Only 12% plan on utilizing a self-built LLM. Overall, the fact that so many respondents have already carved out or plan to soon carve out budgets for AI is an encouraging sign for vendors (IaaS, PaaS or SaaS) that are rolling out new AI products and positioning for new growth levers.

SaaS/PaaS: 48% of respondents are planning to migrate AI Inference & Training workloads to the cloud over the next 2 years. Migrating Front-Office Apps was the 2nd most popular workload to move to SaaS with 43% of respondents, though this was down from 46% last year, reflecting pressure we've seen in recent quarters around the broader CRM market. Back-Office Apps ranked #3 in priority (out of 14 different workloads), a strong move up vs. its #8 ranking last year, with 42% of respondents planning to migrate to SaaS vs. 38% last year. We think this directional improvement bodes well for ERP/HCM companies like WDAY, ORCL & SAP and reinforces our view of durable spending trends in these markets.

41% of respondents indicated they expect Database Apps to transition from on-prem to the cloud within 2 years, little changed vs. 40% last year. 40% of respondents indicated they expect Analytical Apps (i.e., BI, Data Warehousing) to migrate to cloud within 2 years, down from 43% last year. We think the directional down-tick here reflects consumption headwinds we've seen in recent quarters from Data Clouds, including a greater focus on optimization of existing workloads, but we come away encouraged by the survey data suggesting we're nearing the end of the optimization cycle. Moreover, File Systems were seen as the highest priority workload to move away from on-prem to cloud, a positive for Cloud Storage and Data Cloud vendors.

Implications for IT Services (Bergin): More Nuanced Cloud-Related Spend Supports IT Services Vendors with Cost-Focused Value Proposition

Demand for cloud services and the development of increasingly complex cloud environments continues, underpinning spend tailwinds for IT Services over time. Cloud infrastructure migration appears to be maturing and our survey reflects a stabilization in the on-premise workload mix (29% of respondents, down -1 pt y/y). In our survey, cost optimization emerged as a prevalent theme that materialized in late 2022/early 2023. Only 12% of respondents completed their cost optimization efforts as of July 2023 which helps to explain the ongoing visibility challenges in IT Services. Gen AI survey data reflects palpable interest in the new technology, though the shape of the initial adoption curve in certain areas supports our skepticism on consensus views. We believe the evolving AI wave will serve as a net benefit to IT Services providers in the medium-term (2-3 years) given enterprise clients are not equipped with the core competencies to ideate and implement on their own. The most commonly cited IT Services vendors were IBM (51%) and ACN (25%). Over the next 12 months, participants anticipate the highest level of spend increase with Wipro (6.9%), Capgemini (6.8%), and TCS (6.5%). Meanwhile, ACN (5.6%) was inline with the group average. Survey trends also impact DXC, INFY, EPAM, GLOB, DAVA, TWKS, & GDYN.

Implications For Third-Party Data Center Operators (Elias): Colocation Remains A Consistent Component Of Enterprise Infrastructure

Based on survey responses, the share of workloads living in a colocation environment has increased to 15% in 2023 from 11% in 2019, although the share remained flat Y/Y. This increased share of workloads is supportive of the continued enterprise outsourcing trend as well as the adoption of hybrid multi-cloud. Furthermore, when enterprise respondents were asked to describe their mix of infrastructure five years from now, respondents noted that they expect 15% of their workloads to live in a colocation environment. To the extent this proves to be correct, we would view it as positive considering the absolute number of workloads continues to grow, which suggests that the enterprise colocation market should grow in-line with that of broader workloads, driving continued dollar revenue growth for third-party operators such as Digital Realty (DLR, Market Perform, Elias) and Equinix (EQIX, Outperform, Elias). When asked what the top criteria were in selecting a colocation provider, SMB, Mid-Market, and Enterprise respondents were unanimous that "Price" was the primary selection criteria, followed by "Availability/Uptime" and "Physical Security". In our view, this aligns with commentary from both data center operators such as Equinix as well as other enterprises as they began "tightening their belts" on cost in late 2022 and into 2023 as the economic environment slowed.

Implications for Processors, Accelerators, and Analog Semis (Ramsay): We view the datacenter market as perhaps the most important of the key growth verticals within our semiconductor investing framework (Automotive, Edge/IoT. Industrials, Gaming being the others) Incremental to our view from this survey data is the belief in the continued growth of the traditional server market in light of GenAI. Survey results appear to support our view that traditional cloud computing spend will return to an equilibrium of steady growth over time, with more than half of respondents expecting the traditional server market to grow and >80% expecting either growth or stability

Implications for Cloud and Enterprise Storage (Sankar):

With our survey indicating public cloud spending growth remaining in line with prior years, we see that as positive for our HDD coverage (STX and WDC) as 90% of public cloud remains stored on hard disk drives. Additionally, Enterprise on-prem workload distribution seem to have stabilized as 5-year outlook now points to flat on-prem mix (at ~25%) versus last year's survey pointing to 600bps decline over next 5 years. We view this stabilization as positive for PSTG and NTAP who sell their storage systems to enterprise customers.

Implications for Cybersecurity & Information Security (Eyal):

Demand for cybersecurity and information security in cloud environments continues to rise, driven by a variety of factors including, a cybersecurity landscape that is increasingly dangerous, rising levels of regulation, digital transformation, and remote computing trends. While effective point solutions are critical, cybersecurity leaders must strive to deliver comprehensive solutions, preferably platform portfolios, that protect data, networks, and devices. Cybersecurity leaders must be able to effectively detect threats ahead of attacks, neutralize attacks when launched, control damage caused by penetrations, and recover when damage is sustained.

Leaders must be able to deliver solutions whatever the customers approach to computing infrastructure—Cloud, hybrid cloud, multi-cloud, on-premise or a combination of approaches. Cybersecurity vendors can accelerate adoption by supporting partners and other 3rd parties with a robust ecosystem facilitating solution implementation and management. Security providers must be agile enough to quickly adapt to emerging networking paradigms.

Within our cybersecurity universe, leaders are delivering effective solutions by leveraging next-generation technologies. These vendors typically increase the number of solution modules offered as they build comprehensive portfolios. This combination of leading edge technologies and platformization opens up greenfield opportunities and displaces incumbents from legacy markets. In our coverage, these leaders include CHKP, CRWD, CYBR, FTNT, NET, OKTA, PANW, S, TENB, VRNS, and ZS.

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Survey Description

Our annual Cloud Survey provides an updated view into several topics including cloud spending trends, workload migration dynamics, and vendor positioning based on a survey of IT purchase decision makers. We also added new questions around several topics including Generative AI and broader AI implementation, cost optimization and macroeconomic impacts on cloud spend, and pricing & discounting patterns. Survey respondents are limited to US users of outsourced IT infrastructure services. The sample is weighted roughly evenly across customer segments, which we realize does not fully align with end-market spend. We worked with Altman Solon, a TMT-focused strategy consulting firm, to conduct the survey. We relied on a survey sample set of 680 respondents; the sample was split among Small, Medium, and Enterprise customers.

This is our 11th report on the Public Cloud market, following our Ahead of the Curve® Series reports titled Public Cloud X: Survey Implies Further Acceleration Ahead (5/26/22), Public Cloud IX: Cloud Migration Continues Apace (5/26/21), Public Cloud VIII: COVID-19 Accelerating Migration (5/28/20), Public Cloud VII: Growth Remains Strong (5/28/2019), Growth Appears Robust in 2018 (5/23/2018), AWS and Azure Still Leading the Pack (5/25/2017), The Infrastructure Workload Evolution (5/24/2016), Public Cloud Deep Dive 3.0 (7/7/2015), AWS Public Cloud Survey; A Deep Dive into AWS And The Competitive Landscape (6/19/2014), and Pricing Analysis of Leading Public Cloud Providers (11/14/2013). Our prior work has examined competitive dynamics, the use of AWS and other Public Cloud providers, specific AWS product consumption, spend and use cases, overall IT and cloud spending, how customers are using Public Cloud by workload, and has also examined the impact of the COVID-19 pandemic.

Figure 1 US Survey Description

Survey Description

Background	This survey is the 9th iteration of a survey we ran from 2015 to 2022 **This survey covers:** • Trends in cloud computing • Public cloud and on-prem migration • Public cloud sales coverage • AI Adoption and usage
Target Audience	• **IT and cloud services buyers / decision-makers**
Screening Criteria	• More than **10 employees** • **$10k+** annual IT budget • Involved in **IT purchasing decisions** • **Full Time** employment status • Familiar with **at least 1 CSP**
Sample Size	• Targeting **for around 750** distributed across business sizes

Respondent Detail

Release Date (Full Launch)	7/19/23
Completion Date	7/31/23
# of Completes (SL)	57
# of Completes (FL)	785
# Qualified	680 *(13.4% DQ'd)*
Median Completion Time	15.3 minutes

Firmographics
- Roughly similar distribution across firm sizes
- ~34% SMB, ~30% Mid-Size, 36% Enterprise[1]
- 100% of respondents are responsible for IT purchasing decisions around Cloud Services, Network, Colocation, Managed Hosting, & IT Hardware, IT service management roles, or Developers, data engineers and product architects

New Questions for 2023 Survey
- Macroeconomic impact on cloud spending
- Cost optimization and duration
- Pricing and discounting patterns
- AI awareness, usage, and providers
- Introduction of custom silicon processors

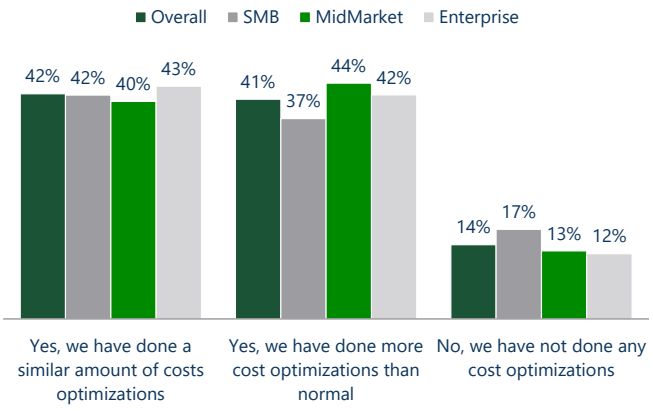
Source: TD Cowen

EXECUTIVE SUMMARY

Cloud Spend Growth Decelerating: Overall, companies expect Cloud spend growth of 30% y/y, at the median, down from 35% y/y in '22, led by SMB and Mid-Market companies. The expectation for spend growth deceleration aligns with major Public Cloud, for instance, we forecast AWS revenue growth of ~15% y/y in 4Q23 vs +20% y/y in 4Q22 and for Google Cloud (which includes Workspace), we forecast revenue growth of ~26% y/y in 4Q23 vs. +32% y/y in 4Q22.

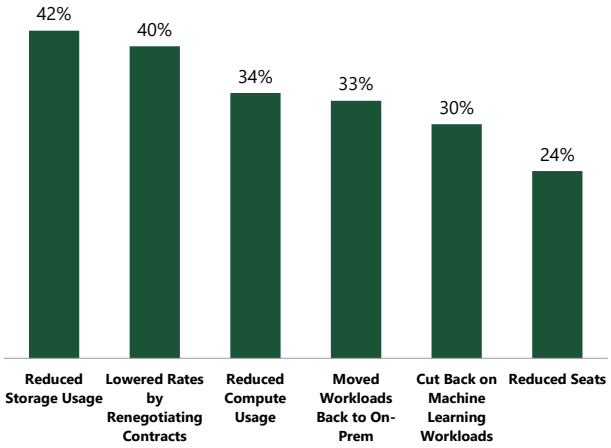
Cost Optimizations Ramped over the Last 12 Months: Roughly 41% of Cloud customers suggested more cost optimizations than normal, driven by (i) reduced Storage usage (42% of respondents), (ii) Lowered rates by renegotiating contracts (40%), (iii) Reduced Compute usage (34%), and (iv) Moved workloads back to on-prem (33%), among other areas. In terms of how companies arrived at cost optimizations, they either (i) Used tools on managing spend from the Cloud provider (31% of respondents), (ii) Identified cost saving opportunities by more proactively analyzing their usage (27%), (iii) Used 3rd party tools like Cloudcheckr, etc (14%) or (iv) Did one-off reactive optimization of spending due to cost-related issues arising in the last year.

Figure 2 Has your company taken any steps to reduce spend or done any cost optimizations?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680. Excludes respondents who answered "I don't know."

Figure 3 What steps have you taken to optimize your cloud spend?



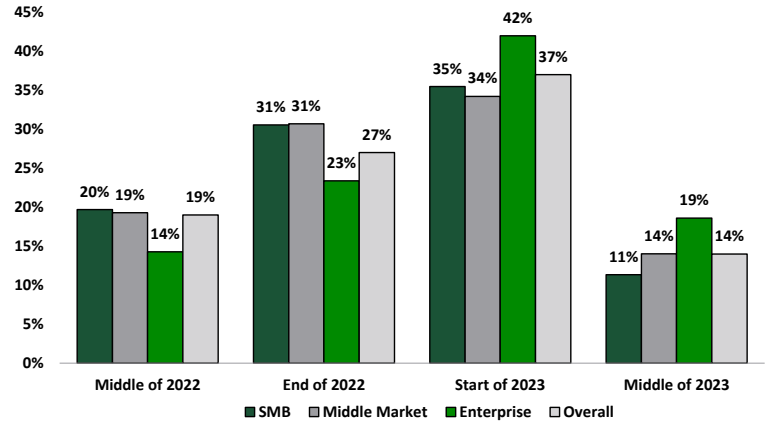
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680. Excludes respondents who answered "Other."

The Light at the End of the Tunnel as Cloud Platforms Get Through Customer Cost Optimizations: Roughly 86% of Public Cloud customers optimized spend either in the middle of '22 (19% of respondents), towards the end of '22 (27%) or at the start of '23 (37%), with the bulk of optimizations starting toward the end of '22 or in the beginning of '23. Namely, Enterprise businesses were more likely than their smaller counterparts to have started optimizations more recently with 42% among the cohort suggesting they began optimizations in the start of '23, vs. 37% overall, and 19% in the middle of '23, vs. 14% overall. In terms of when cost optimizations will end, 12% indicated that they are finished with the optimizations, while over 60% expect to end their cost optimizations within the next 3 months or within the next 3-6 months, which implies (i)

43% of Cloud customers expect to be through cost optimizations by the end of 3Q23 and (ii) the vast majority (76%) of Cloud customers implementing cost optimizations will likely have finished their efforts by the end of '23.

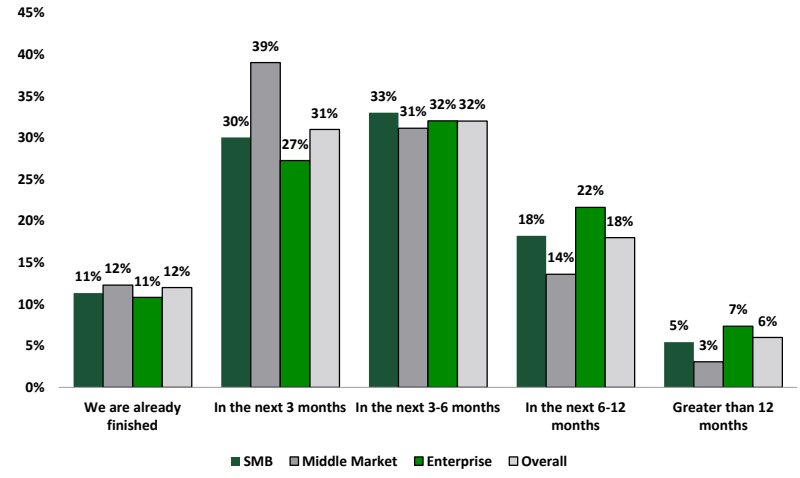
We view this as consistent with recent mgmt. comments regarding optimizations. The data is encouraging in light of our current 2H23 and '24 topline forecasts; for instance, we expect that AWS revenue growth troughed in 2Q23 at +12% y/y and will slightly accelerate in 2H23, as we forecast revenue growth of +13% y/y in 3Q23 and +15% y/y in 4Q23, accelerating further to +16% y/y in FY24 as AWS and other platforms distance themselves from heightened cost optimizations. For Google Cloud (which includes Workspace), we forecast y/y revenue growth up in the mid 20% range in 2H23 and '24, a slight deceleration from +28% y/y in 2Q23.

Figure 4 Cost Optimization Start Time



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=563.

Figure 5 Expected Cost Optimization End Time



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=563.

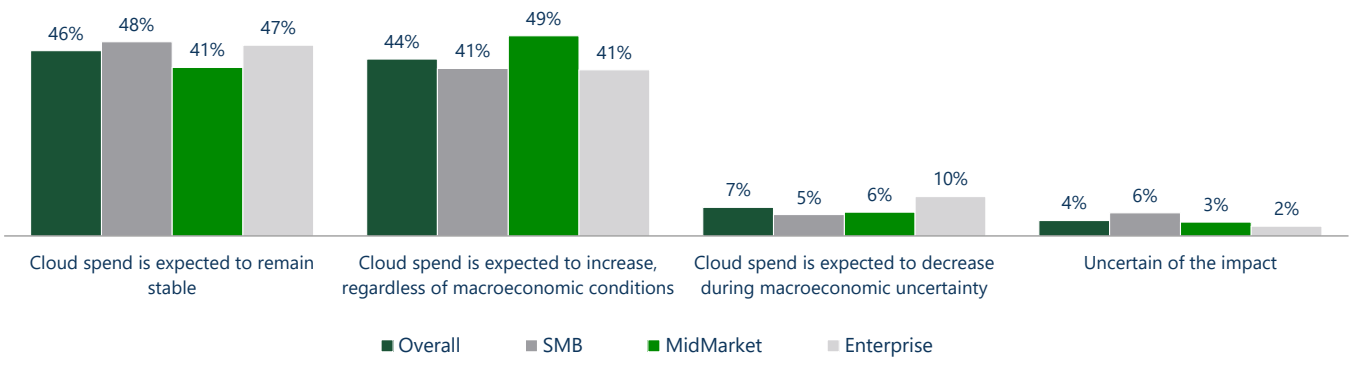
Parallel Tracks - While Cloud Customers Were Doing Cost Optimizations of Existing Workloads, They Were Also Committing to Move More Workloads to the Cloud: Per our survey, ~85% of respondents have committed to moving more workloads to the cloud in 2023; namely, 41% expect to move significantly more workloads to the cloud while 44% expect to migrate a fair amount of workloads. Lastly, ~14% of respondents have not committed to moving workloads to the cloud in 2023.

Figure 6 Has your company entered into any new agreements with existing public cloud vendors for new workload migrations?

Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Macro Conditions Appear Benign to Near-Term Cloud Spend: Roughly 88% of respondents expect either (i) No change to near-term Cloud spend (51% of respondents), led by SMBs and Mid-Market customers, or (ii) To increase near-term Cloud spend (38%), led by Enterprises and Mid-Market customers. Roughly 12% of respondents expect near-term Cloud spend to decrease in light of the current macro conditions.

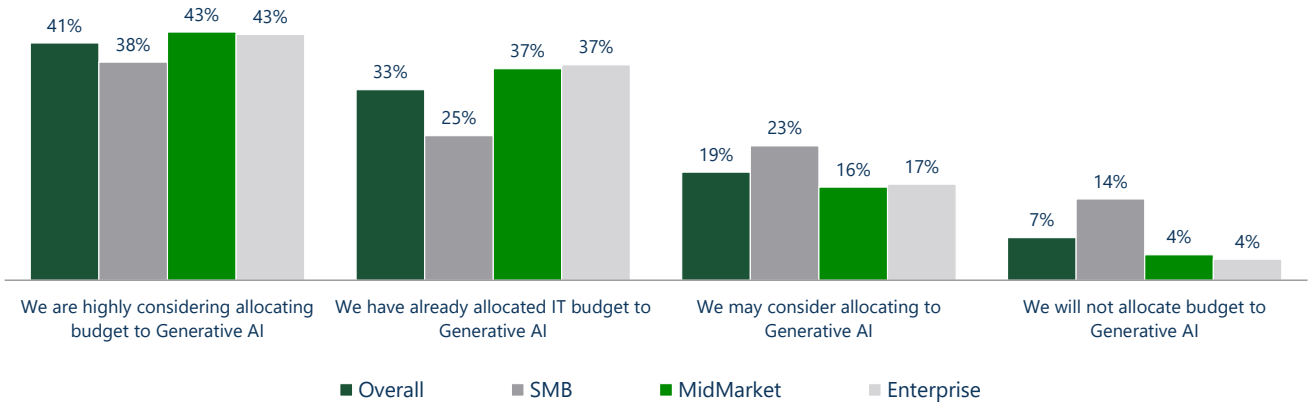
Figure 7 Expected Macroeconomic Impact on Cloud Spend



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Gen AI Spend Likely Incremental to Cloud Platforms: Nearly 75% of respondents are either highly considering allocating IT budget to Gen AI (41% of respondents) or have already allocated budget to Gen AI (33% of respondents). There is another 19% that are considering allocating budget to Gen AI, while only 7% do not expect to allocate budget to Gen AI.

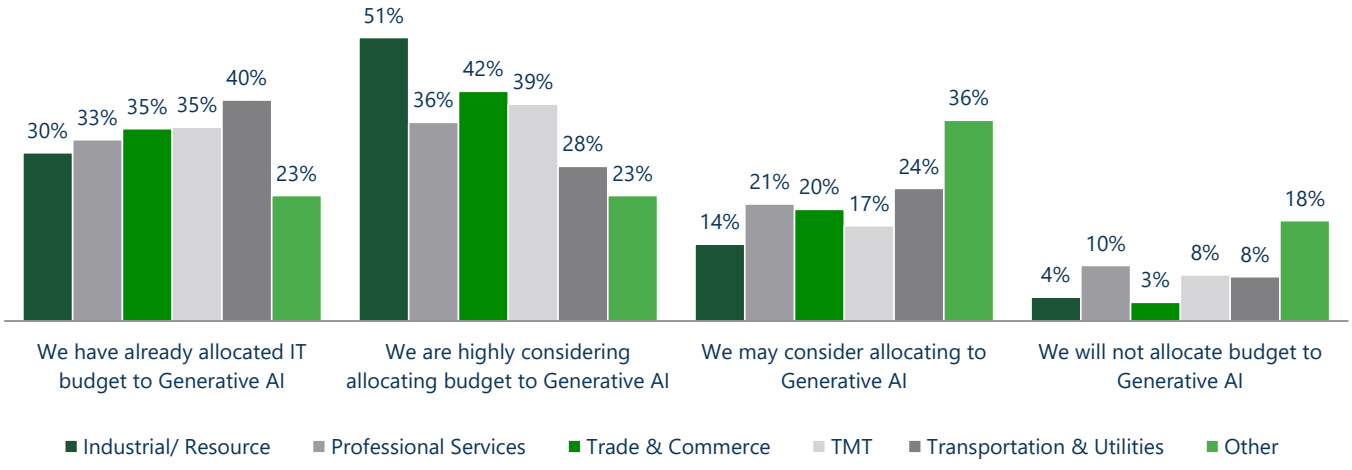
Figure 8 Is your organization allocating budget to generative AI spending this year or next?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Gen AI Budget Allocation Across Sectors: Upon breaking out respondents by sector, we find that those within the Industrial/Resource (77%) and TMT (74%) sectors are most likely to have already allocated or be highly considering budget allocation to Gen AI. While Professional Services and Trade & Commerce sector respondents were less likely to be allocating budget to Gen AI, a still significant 69% and 68% in either sector have either already allocated or are highly considering allocating budgets to Gen AI.

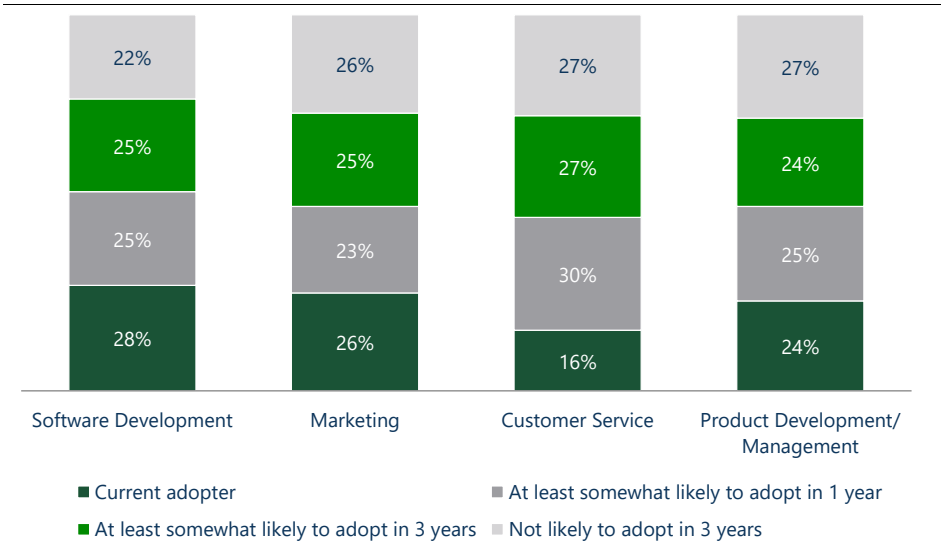
Figure 9 Gen AI Budget Allocation by Sector



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Gen AI Adoption Across Key Business Functions: The current key areas of Gen AI across business functions are already seeing solid adoption, with roughly 50% of respondents, either currently using or expecting to use Gen AI in the next year for (i) Software Development, (ii) Marketing, (iii) Prod Dev / Mgmt and (iv) Customer Services. Expanding more broadly, roughly 75% of respondents expect to use Gen AI for the four functions within the next 3 years.

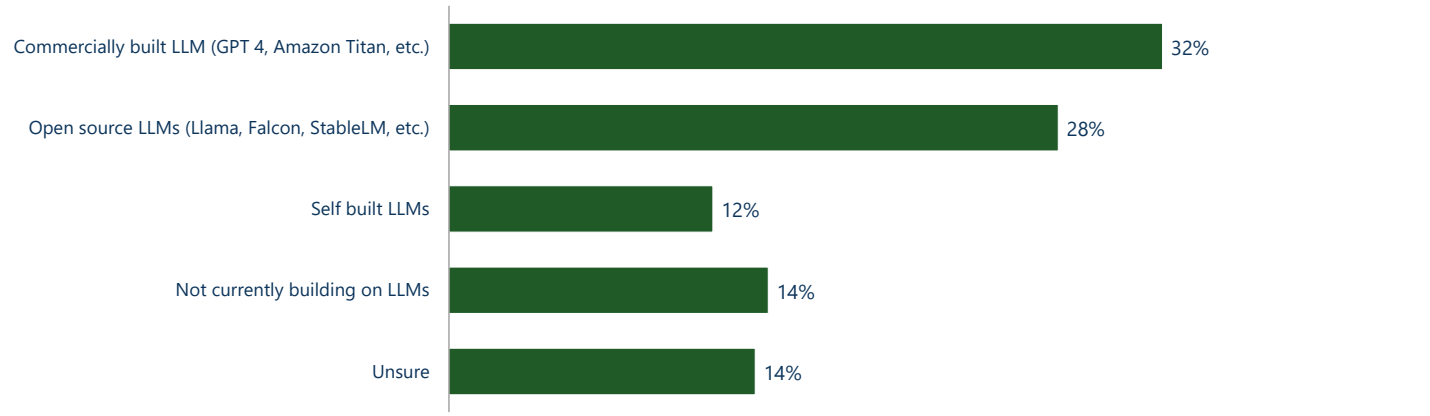
Figure 10 What is your adoption status of Generative AI in each area?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Companies are Primarily Using Commercial LLM's: Per our survey, businesses are more likely to be utilizing commercial Large Language Models (LLMs) than open source alternatives. 32% of respondents said that they either built on or plan to build on commercial LLM's, which include GPT4, Amazon's Titan, and Google's Bard, among others. Meanwhile, 28% of respondents are using open-source models such as META's LLaMA and Falcon.

Figure 11 Which type of LLM have you been building on or do you plan to build on?

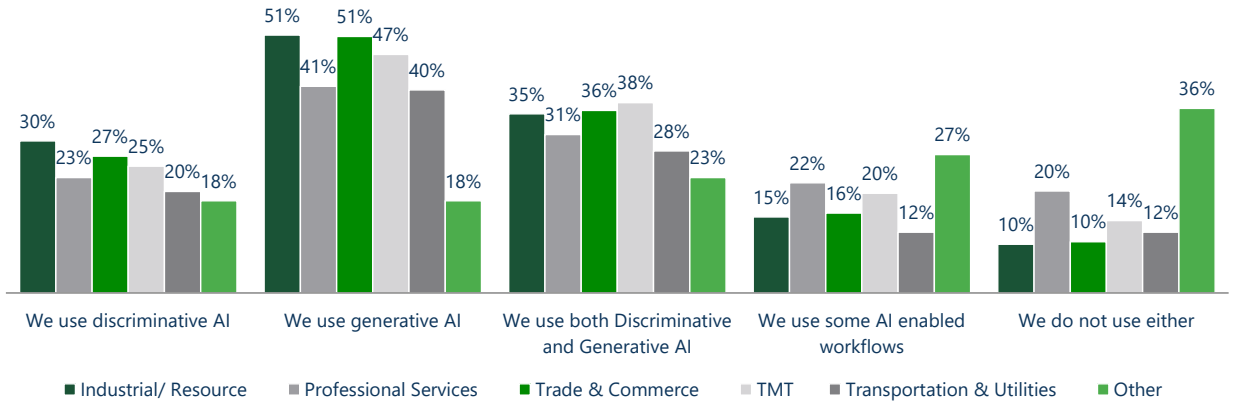


Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=679.

AI Usage is Broad-based: Respondents were highly likely to be implementing discriminative AI or Gen AI resources across sectors. Just 10% of those in Industrial/Resource and Trade & Commerce sectors were not using a form of either AI, while 12% in Transportation & Utilities and 14% in TMT said the same. Of note, the Professional Services sector was most likely not to be implementing AI tools, as 20% said that they don't use either form of AI.

Note: By definition, 'Generative AI' models how data is distributed and can generate new data of the same type, while 'discriminative AI' differentiates between existing data to classify inputs into categories.

Figure 12 AI Usage by Sector



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Public Cloud Contracts Lengthening Further: 48% of respondents indicated that they have extended their public cloud contract length within the last year, with Enterprise and Mid-Market businesses most likely to be renegotiating. This translates to the most common contract length of two years (33% of respondents), followed by one year (23%) and three years (20%).

Figure 13 Cloud Contract Length

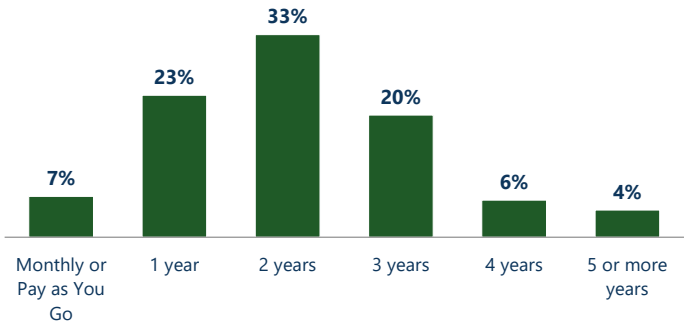
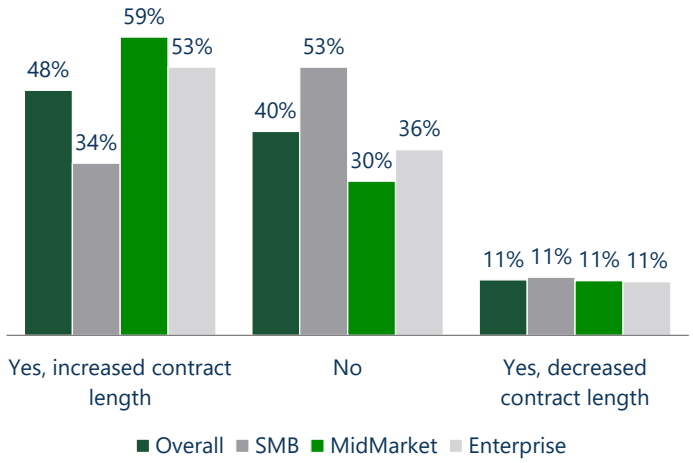


Figure 14 Have you renegotiated contract length in the last year?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Shift to Multi Cloud Continues: For the third consecutive year, businesses have indicated that they are increasingly using multiple cloud providers. This year, 84% of respondents indicated that they utilize more than one cloud provider, up significantly from 68% who said the same last year. 39% of respondents now use 3 Cloud providers, up from 13% in '20. Enterprise businesses were most likely to be using multiple providers (90% of the cohort), followed by Mid-Market (86%) and then SMB firms (74%).

Figure 15 How many cloud providers do you use? - BY YEAR

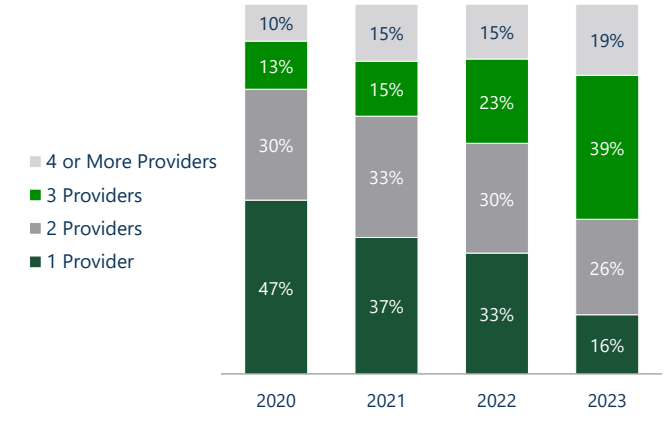
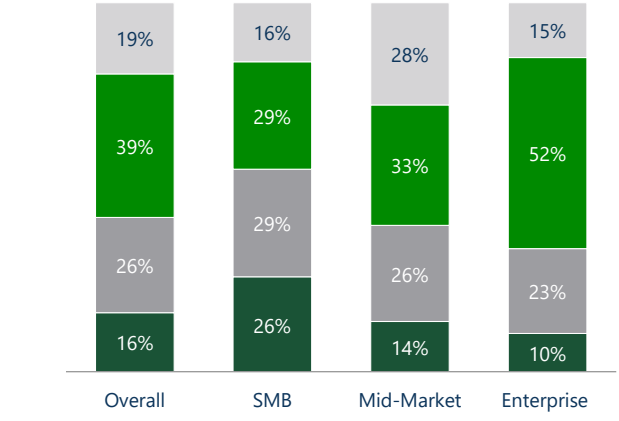


Figure 16 How many cloud providers do you use? - BY COMPANY SIZE

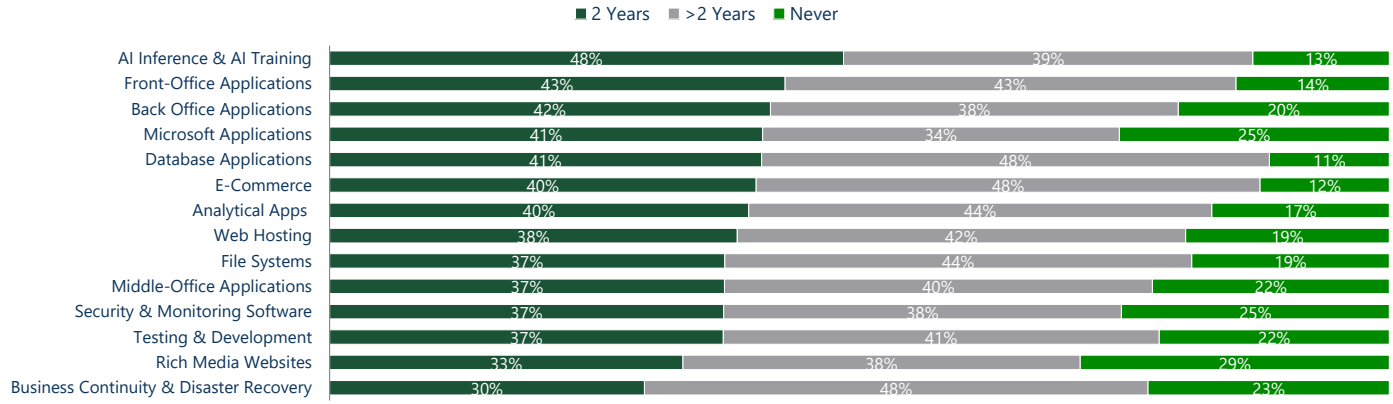


Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=581.

Workload Migration Patterns: Of those workloads not yet migrated to the cloud, respondents indicated that AI inference & training, front-office Applications, & back-office applications are most likely to be migrated within the next two years. Meanwhile,

rich media websites, Microsoft apps, and security and monitoring software are the top three most likely categories to never be migrated.

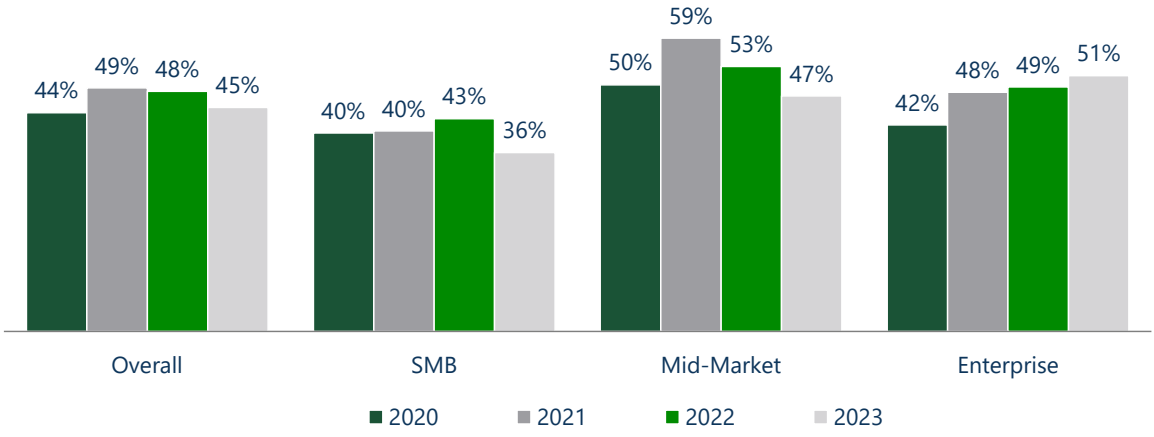
Figure 17 When do you expect to migrate the following non-cloud based workloads?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

45% migrated some workloads away from Public Cloud, led by Enterprises (51% of respondents indicated moving some workloads away from the Public Cloud), followed by Mid-Market (47% of respondents down from 53% in '22), SMB (36% of respondents, down from 43% in '22). Key reasons for workload migrations include (i) regulatory, compliance and privacy requirements (41% of respondents), (ii) workloads grew and insourcing made more sense (38%), (iii) Technical incompatibilities (37%), (iv) Public Cloud was more expensive than anticipated (28%, down from 31% in '22), among other factors.

Figure 18 Have you migrated any workloads away from public cloud in the last 2 years?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

PaaS + IaaS Expected to Grow at a 22% CAGR '22-'27

Global Public Cloud market revenue of $488BNin '22 is expected to rise to $1.16TN in '27, a ~19% CAGR per Gartner, while Infrastructure as a Service (IaaS) is the fastest growing segment at a 23% CAGR '22-'27.

Worldwide Public Cloud Service Revenue Forecast ($, MM)

	2022	2023E	2024E	2025E	2026E	2027E	CAGR '22-'27
Cloud Application Infrastructure Services (PaaS)	$122,140	$151,769	$184,042	$221,779	$266,076	$317,321	21.0%
Cloud System Infrastructure Services (IaaS)	122,710	150,326	189,796	236,593	291,066	348,809	23.2%
Total (PaaS + IaaS)	**$244,850**	**$302,095**	**$373,838**	**$458,372**	**$557,142**	**$666,130**	**22.2%**
Other (SaaS, BPaaS, DaaS)	$243,388	$284,272	$328,386	$377,147	$432,255	$494,502	15.2%
Total Market	**$488,238**	**$586,367**	**$702,224**	**$835,519**	**$989,397**	**$1,160,632**	**18.9%**
Y/Y% Growth							
Cloud Application Infrastructure Services (PaaS)		24.3%	21.3%	20.5%	20.0%	19.3%	
Cloud System Infrastructure Services (IaaS)		22.5%	26.3%	24.7%	23.0%	19.8%	
Total (PaaS + IaaS)		**23.4%**	**23.7%**	**22.6%**	**21.5%**	**19.6%**	
Other (SaaS, BPaaS, DaaS)		16.8%	15.5%	14.8%	14.6%	14.4%	
Total Market		**20.1%**	**19.8%**	**19.0%**	**18.4%**	**17.3%**	
SaaS	$178,264	$212,845	$250,425	$292,716	$341,019	$396,000	
BPaaS	$62,681	$68,450	$74,593	$80,760	$87,273	$94,235	
DaaS	$2,443	$2,977	$3,367	$3,672	$3,963	$4,268	
Total	**$243,388**	**$284,272**	**$328,386**	**$377,147**	**$432,255**	**$494,502**	

Table created by TD Cowen based on Gartner research. Source: Gartner, Inc. Forecast: Public Cloud Services, Worldwide, 2021-2027, 2Q23 Update. By Colleen Graham, Shailendra Upadhyay, Amarendra, Robin Schumacher, Nicholas Carter, and Arunasree Cheparthi. July 10, 2023

Company / Sector Highlights

Implications for Internet (Blackledge)

Amazon (AMZN): Survey Results Reflect Ongoing Momentum at AWS

Rising Awareness of AWS: Our 2023 survey is positive for AWS, particularly around awareness, as AWS led all providers in cloud vendor familiarity; in addition, AWS awareness rose compared to '22 across SMB, Mid-Market, and Enterprise respondents. When asked which 3rd party cloud service providers they are familiar with, AWS rose to 72% among SMB respondents (compared to 67% in our '22 survey). Among Mid-Market respondents, AWS rose to 77% (vs 72% in '22), and among Enterprise respondents, AWS rose to 71% (vs 66% in '22). Among all three respondent groups, AWS awareness was higher when compared to competitors (in the case of Enterprise, Azure tied AWS with 71% awareness).

AWS Usage Rises Among SMBs and Mid-Market Firms: AWS also saw usage gains among SMBs and Mid-Market firms when compared to our 2022 survey. Among Small and Medium Sized Businesses, 53% of respondents reported using AWS as a Cloud vendor (up from 44% in our 2022 survey), while 60% of Mid-Market respondents stated they use AWS (vs 49% in 2022). By contrast, AWS usage among Enterprise respondents declined slightly to 37% in our '23 survey (vs 40% of respondents in '22). Of note, AWS led all Cloud providers in usage among both SMB and Mid-Market respondents, ahead of Azure, GCP, IBM, Oracle, and SAP. Among Enterprise respondents, Azure had the highest usage, followed by IBM and AWS.

Cloud Spending Should Remain Robust: Despite macro uncertainty, we see multiple signs that overall Cloud spending is likely to remain robust, benefiting AWS in our view. For example, ~90% of overall respondents in our '23 survey expect Cloud spend to either remain stable or increase over the next 5 years, regardless of broader macroeconomic conditions. In addition, survey respondents expect public Cloud spend growth of 30% in '23 (median), down from 35% in '22 (median); we believe this suggests that Cloud spending growth is likely to remain healthy, albeit despite some deceleration.

We note that the survey includes only existing customer spend (excludes net new) and is limited to US customers. AWS growth stabilized in 2Q23 at +12.2% y/y; we forecast growth re-accelerating into 2H23E, and we estimate +16.4% y/y growth in '24E and a 16.2% growth CAGR '23E-'28E.

Generative AI is Early Innings But Should Drive Incremental AWS Spend Over Time: Of note, 33% of overall respondents in this year's survey have already allocated budget to Generative AI, while another 41% of respondents are "highly considering" allocating budget to Gen AI within the next year. This trend could bode well for AMZN's AWS, in our view, given the company's vertically integrated strategy of providing services across three key layers including i) Base layer, by offering access to AWS's Inferentia and Trainium hardware chips to train and inference LLM's; ii) Middle layer, through AWS's Bedrock service that provides access to leading LLM models; and iii) Top layer, through applications like their coding companion, Code Whisperer. Net-net, we think the implied incremental IT budget for Gen AI (reflected in our survey) is positive for AWS because of their ability to monetize across infrastructure, Bedrock and the app layer.

This year's Cloud survey also suggests i) 34% of respondents who expect to add a Public Cloud vendor suggested they would add AWS and 18% who expect to replace a Public Cloud vendor would replace it with AWS; in both cases, AWS ranked #2 behind Azure; ii) Cloud users' focus on cost management and performance optimization largely dovetails with recent commentary from AWS mgmt.; the company stated at 2Q23 earnings that while customers remain focused on value, they are beginning to shift focus from cost optimization to bringing new workloads to the cloud (underscoring the long-term opportunity, in our view); iii) AWS custom silicon is seeing healthy adoption, as 33% of respondents report using Graviton, up from 9% of respondents who utilized Graviton in our 2022 survey. Of note, another 25% of respondents in our '22 survey stated they were actively looking to adopt Graviton at the time, underscoring how quickly these custom chips are gaining traction.

Additionally, our forecast calls for AWS Operating Income (GAAP) to rise from ~$22.1BN in '23E to $53.0BN in '28E, a ~19% CAGR '23E-'28E. Overall, we see Operating Income (GAAP) margins rising from 24.2% in '23E to 27.4% in '28E.

AWS P&L 2022-2028E ($, MM)

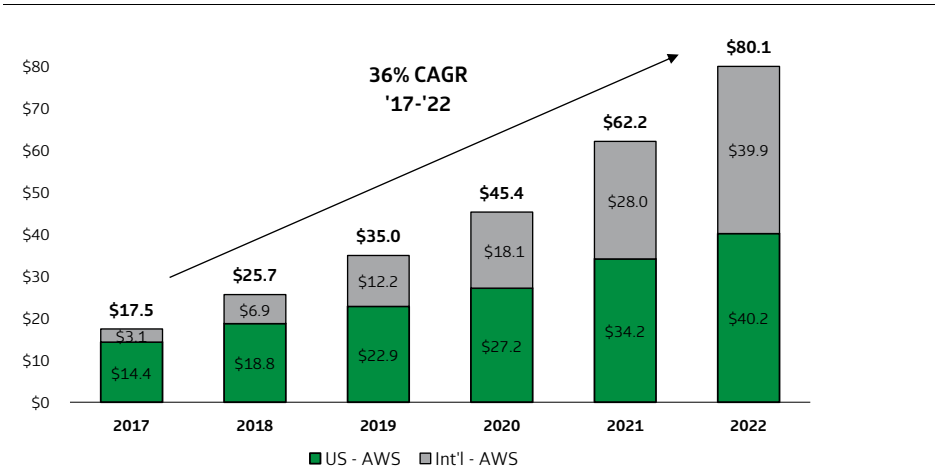
	2022	2023E	2024E	2025E	2026E	2027E	2028E	CAGR '23E-'28E
Revenue	$80,096	$91,248	$106,235	$124,214	$144,614	$167,642	$193,499	16.2%
- Opex	50,309	59,782	68,292	78,285	89,502	101,918	115,566	14.1%
Operating Income (Non-GAAP)	**$29,787**	**$31,466**	**$37,943**	**$45,928**	**$55,112**	**$65,725**	**$77,933**	**19.9%**
- SBC	6,946	9,404	11,566	14,288	17,350	20,881	24,945	21.5%
Operating Income (GAAP)	**$22,841**	**$22,062**	**$26,377**	**$31,640**	**$37,762**	**$44,844**	**$52,988**	**19.2%**
- Taxes	3,426	3,309	3,957	4,746	5,664	6,727	7,948	19.2%
Net Income	**$19,415**	**$18,753**	**$22,421**	**$26,894**	**$32,098**	**$38,117**	**$45,040**	**19.2%**
EBITDA Calculation								
Operating Income	$29,787	$31,466	$37,943	$45,928	$55,112	$65,725	$77,933	19.9%
+ D&A	12,827	16,130	20,652	26,058	32,428	39,831	48,323	24.5%
= EBITDA	**$42,614**	**$47,596**	**$58,595**	**$71,987**	**$87,540**	**$105,556**	**$126,256**	**21.5%**
Change - Y/Y								
Revenue	28.8%	13.9%	16.4%	16.9%	16.4%	15.9%	15.4%	
Operating Expenses	27.7%	18.8%	14.2%	14.6%	14.3%	13.9%	13.4%	
Operating Income (Non-GAAP)	30.7%	5.6%	20.6%	21.0%	20.0%	19.3%	18.6%	
Operating Income (GAAP)	23.3%	(3.4)%	19.6%	20.0%	19.3%	18.8%	18.2%	
EBITDA	19.0%	11.7%	23.1%	22.9%	21.6%	20.6%	19.6%	
AWS Margins								
Operating Income Margin (GAAP)	28.5%	24.2%	24.8%	25.5%	26.1%	26.7%	27.4%	
Incremental Oper Inc. Margin (GAAP)	24.1%	(7.0)%	28.8%	29.3%	30.0%	30.8%	31.5%	
EBITDA Margin	53.2%	52.2%	55.2%	58.0%	60.5%	63.0%	65.2%	
Incremental EBITDA Margin	38.0%	44.7%	73.4%	74.5%	76.2%	78.2%	80.1%	

Source: TD Cowen; Company reports

AWS: International vs US Revenue Mix

Below we show our estimate for US vs. International revenue mix for AWS, reflecting the growing contribution of the non-US portion of the business over time. International revenue of ~$3.1BN in 2017 made up ~18% of AWS topline, growing to ~$39.9BN in 2022, or ~50% of overall AWS revenue. Over that period, AWS (overall) grew at a 36% CAGR, vs. a much higher 67% CAGR for International.

AMZN AWS Revenue Mix, US vs. International (in $BN, 2017-2022)



Source: TD Cowen; Company reports.

Assessing AWS Capital Intensity Relative to eCommerce/Other Capital Investment

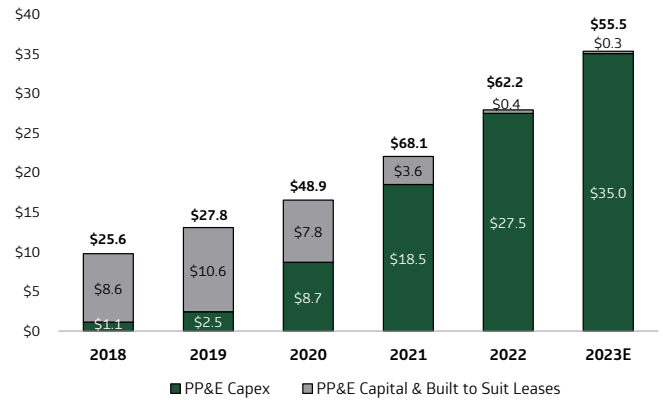
Amazon began to disclose AWS capital expenditures following the segment financial breakout in '15. As seen in the Figure below, AWS pure capex in '22 was ~$27.5BN or ~34% of AWS sales, well above the ~30% of sales in '21 and 19% level in '20. This step up demonstrates the ongoing shift in the capital allocation for AWS, which historically had used capital leases to support its infrastructure growth. If we include capital lease and built to suit lease spending, AWS total capital investment in '22 was ~$27.9BN, or ~35% of AWS sales, in line with '21 level of ~35% and slightly below '20 level of 36%.

From a mix perspective, AWS total capital investment relative to investment in AMZN's retail biz has increased coming out of COVID, as AMZN grows into the square footage ramp from their historical COVID-era fulfillment expansion. Meanwhile, we expect AWS demand growth to outpace that of eCommerce in coming years. AWS recorded $27.9BN of total capital investment (capex + leases) in '22, accounting for ~44.9% of AMZN's total 2022 capital investment of ~$62.2BN, up from 32.4% of total AMZN capital investment in '21. Over the next 3 years, we expect AWS capital investment to sit at roughly 60-70% of total company investment.

AWS margins held up nicely coming out of COVID, with reported Op Income margin of 28.8% in '22, down only slightly vs 29.8% in '21 and above pre-pandemic levels (26.3% in '19); looking ahead, we estimate AWS op margins in '23E will step down to 24.2%, largely reflecting investments behind growth given the considerable longer-term opportunity as workloads move to the Cloud. Beginning next year, we expect Op Margins to rise sequentially over a multi-year period, surpassing 27% by '28E. Meanwhile, AWS's backlog continues to expand, reaching $132.1BN by the end of 2Q23, or +32% y/y (and vs $80BN at year end '21) as contract length of 3.6 years in 2Q23 has declined somewhat vs 3.9 years in 2Q22.

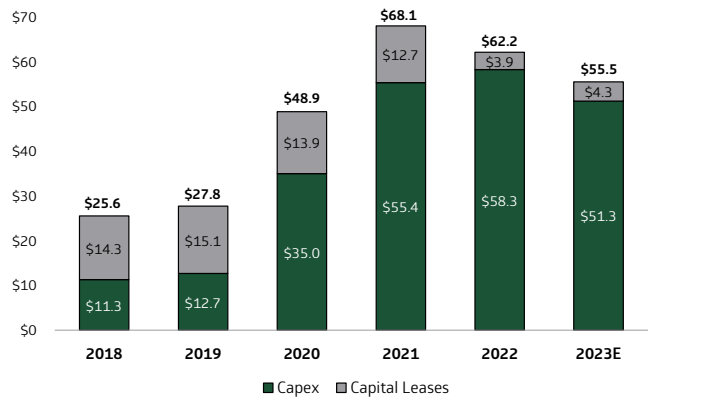
We forecast total AMZN capital investment of $55.5BN in '23E to decline 10.7% y/y, including pure capex, capital leases & built to suit leases following an 8.7% reported decline in '22. This decline reflects a substantial step down in retail capital investment as the company digests the elevated, COVID-era investment in '20 & '21 that drove an 89% increase in retail square footage over the period.

AMZN: AWS PP&E Capex vs. Capital Leases '18-23E ($, BN)



Source: Company reports and TD Cowen.

AMZN: Total Capital Investment (Capex+Leases) '18-23E ($, BN)



Source: Company reports and TD Cowen. Note: "Capital investment" includes PP&E Capex plus Capital Leases and Built to Suit leases.

AMZN Sum of the Parts Analysis

We now value AWS at ~$879BN (midpoint) based on our Sum of the Parts analysis, ascribing ~15.0x EV/EBITDA multiple (midpoint) on our 2024 EBITDA estimate of ~$59BN, which seems reasonable, given EBITDA CAGR of ~22% from '23E-'28E per our estimates.

AMZN Sum of the Parts Analysis, 2024E

	Operating		Multiple			Enterprise Value 2024E			
	Metric	2024E	Low	High	Avg	Low	High	Avg	Memo
AMZN eCommerce	GMV	$796,394	1.00x	1.50x	1.25x	$796,394	$1,194,590	$995,492	~12% GMV CAGR '23-'28; Implies ~1.25x GMV at Midpoint
AWS	EBITDA	$58,595	12.5x	17.5x	15.0x	$732,439	$1,025,415	$878,927	~22% EBITDA CAGR '23-'28; implies 8x EV/Sales on our '24 est's
AMZN Subscriptions	Revenue	$44,796	4.0x	6.0x	5.0x	$179,185	$268,778	$223,982	NFLX trades at ~5x EV/Sales and EV/sub of $745 on our '24 est's
AMZN Advertising	Revenue	$52,617	4.0x	6.0x	5.0x	$210,466	$315,699	$263,083	Estimate ~13% AMZN Ad Rev CAGR '23-'28; GOOG & META Trade at ~5x EV / Net Rev on our '24 est's
Physical Stores	Revenue	$21,702	1.0x	1.0x	1.0x	$21,702	$21,702	$21,702	Assume 1x EV/Sales
Other (MGM, etc.)	Revenue	$5,551	1.5x	2.0x	1.8x	$8,327	$11,102	$9,715	AMZN acquired MGM for $8.5BN
= Total EV						**$1,948,513**	**$2,837,287**	**$2,392,900**	
- Corporate						$25,000	$25,000	$25,000	
- Net Debt (Cash) - Avg '23-'24						($80,709)	($80,709)	($80,709)	
= Equity Value						**$2,004,222**	**$2,892,996**	**$2,448,609**	
/ Diluted Shares						10,431.3	10,431.3	10,431.3	
= Equity Value/Share						**$192.13**	**$277.34**	**$234.74**	
x SOTP Discount						15.0%	15.0%	15.0%	
= Equity Value/Share						**$163.31**	**$235.74**	**$199.53**	

Source: TD Cowen.

Alphabet – Google Cloud (GCP)

Google Cloud Platform had a solid showing in our annual survey, although a gap remains between GCP and market leaders AWS and Azure. In terms of overall awareness, GCP remained in fourth place in this year's survey, with awareness of 56% falling from 61% last year. GCP awareness was strongest in the SMB cohort, where awareness expanded to 64%, up vs. 62% last year and landing in the third ranked spot behind AWS and Azure.

Per our survey, GCP usage rose among both Enterprise and Mid-Market firms; Enterprise usage of 36% grew vs. 34% last year while Mid-Market usage of 45% grew from 39% in '22. Meanwhile, SMB usage of 41% was flat vs. the prior year. 52% of current GCP users expect to add a cloud provider to their suite (vs. 31% among all respondents), while a lower 41% of GCP users plan to replace one of their cloud providers, lower than the 45% and 61% of AWS and Azure users who said the same, respectively. When we asked respondents which provider they would add or replace, 30% of respondents stated they plan to add GCP, while 10% said they expect to replace an existing provider with GCP.

GOOG's Cloud growth has slowed in recent quarters amid broader industry cost optimization among businesses. Nonetheless, we expect continued robust topline growth amid secular expansion in the business, including positive trajectory with enterprise customers (who tend to sign long-term deals). We also expect GOOG will benefit from ramping Gen AI implementation. Per our survey, we found that 74% of respondents are either highly considering or have already allocated a portion of their IT budget to Generative AI related offerings. GOOG's AI offerings include Duet AI, which features AI tools like coding asst., chatbot support, and content creation, and Vertex, a cloud-based platform that allows developers the ability to create their own user applications on top of ~100 foundation models. For more color on GOOG's Gen AI offerings, see our 9/1 note.

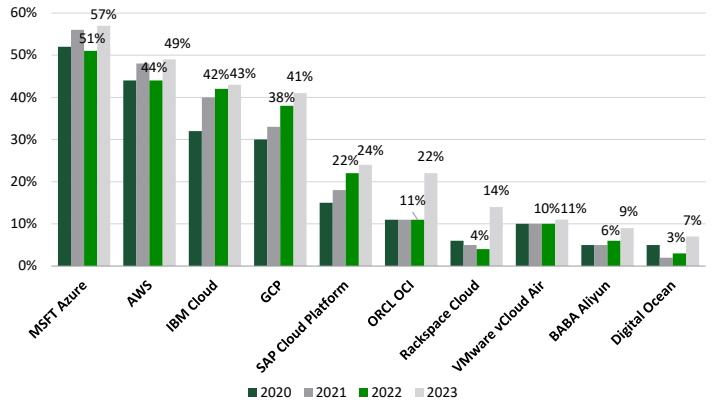
GOOG's Cloud business reported $15.5BN of revenue in 1H23, up 28.0% y/y. Cloud also had ~$60.6BN in contract backlog in 2Q23 vs. $51.2BN as of the year ago period. We expect GOOG will generate Cloud revenue of $33.3BN in '23, +26.9% y/y and growing to $74.8 BN by '27, a 23.3% 5-year CAGR. Mgmt. has called out GCP as the primary driver, growing faster than Cloud overall, even as users optimize their cloud spend. GOOG's Cloud biz reported Operating Income (GAAP) of $395MM in 2Q23, turning positive vs ($590MM) in 2Q22. We expect the Cloud segment will report Op. Income of $1.71BN in '23, rising to 13.8BN in '27.

Enterprise Software (Wood): Top 15 Takeaways + IaaS/PaaS Forecasts

1) **Healthy Growth in Public Cloud Spending.** The median expectation among respondents for Cloud spending is for 30% Y/Y growth in 2023, a modest deceleration following 35% in our 2022 survey. Of note, 90% of respondents expect no change or increased spend in the next year or next five years, with only 10% expecting reduced spend. This shows an outlook for relatively durable spending intentions and likely better than current investment sentiment.

2) **Azure Leads in Cloud Usage.** 57% of respondents use MSFT Azure (vs. 51% last year), which compares to AWS at 49% (44% last year), IBM at 43% (42% last year), GCP at 41% (38% last year), SAP at 24% (22% last year), and OCI at 22% (11% last year). By cohort, Azure had 51% in SMB, 56% in mid-market, and 60% in enterprise, with enterprise well above AWS at 37%. IBM Cloud ranked #3 with 43%, while GCP ranked #4 with 41%.

Figure 19 : Which of the following public cloud providers do you currently use?



Source: TD Cowen, Altman Solon. Note: Data values are displayed for last two years

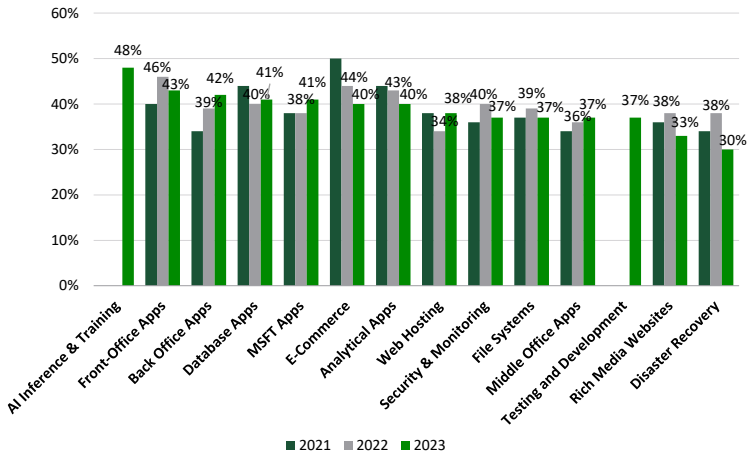
3) **OCI Saw the Biggest Increase in Usage.** OCI's usage rate increased by 11pp (or up ~2x) over the past year with 22% of respondents now using it (vs. 11% last year). Mid-Market drove the increase with a 14pp increase to 26%, followed by a 9pp increase to 25% in SMB and an 8pp increase to 17% in Enterprise. As companies adopt a multi-cloud strategy we think OCI could see increased adoption. Moreover, OCI's AI training and inference price-performance advantages (via its RDMA network) make it especially attractive to embrace for AI workloads.

4) **Multi-Cloud Usage Meaningfully Rose.** 39% of respondents are now using 3 public cloud vendors, up from 23% in 2022 and 15% in 2021. Only 16% are using one public cloud, down from 33% and 37% over the last two years. We think this bodes well for challengers in the market as they look to gain some share.

5) **Customers More Inclined to Threaten Switching Vendors, Azure Higher on the List.** 34% of current Azure users are likely to add another cloud provider in the next two years (vs. 48% last year), 31% are expecting to replace Azure (vs. 13% last year), and 35% expect no change (vs. 39% last year). AWS had 29% add, 26% replace, and 45% no change. GCP had 35% add, 26% replace, and 38% no change. Results for "add" down-ticked across the board vs. last year, while "replace" all up-ticked. We think this demonstrates that companies are more inclined to threaten switching vendors in order to position for more price negotiation leverage, which may be more common in a multi-cloud landscape.

6) **AI Inference & Training Workloads Lead Cloud Migration Ranking.** AI Inference & AI Training (not included in last year's survey) took the #1 spot in terms of non-cloud apps expected to transition to cloud within the next two years. 48% of respondents highlighted AI Inferencing & AI Training migrating within the next two years.

Figure 20 : % of workloads not currently cloud supported that are expected to be migrated within the next two years



Source: TD Cowen, Altman Solon. Note: Data values are displayed for last two years

7) **Front-Office Apps Migration Priority Remained High but Down-Ticked Y/Y.** Front-Office Apps were the #2 ranked workload expected to migrate to cloud within the next two years, with 43% of respondents (vs. #1 and 46% last year). This points to a high investing priority around the broader Cloud CRM market, though it does reveal some Y/Y pressure from macro headwinds.

8) **Back-Office App Migration Priority Meaningfully Rose in Ranking.** Back-Office Apps (ERP, SCM, HCM, Financials) were the #3 most likely workload to transition to cloud over the next two years (out of 14 different workload categories), a meaningful increase from #8 last year and #11 two years ago. 42% believe Back Office Apps

will transition within two years (vs. 38% last year); while 38% expect Back Office Apps will transition in over two years (vs. 41% last year).

9) **Database Migration Priority Was Relatively Unchanged.** 41% of respondents indicated they expect Database apps to transition from on-prem to the cloud within 2 years, slightly above 40% last year. Workload shift destinations include Private Clouds (+4%), Public Cloud (+3%) and SaaS (+2%), away from Colocation (-4%) and On-Premise (-4%). This points to interest in embracing a variety of cloud deployment types, which bodes well for both cloud-natives and legacy platforms.

10) **Analytical Apps Migration Priority Down-Ticked Y/Y.** 40% of respondents indicated they expect analytical apps (i.e., BI, Data Warehousing) to transition from on-prem to the cloud within 2 years, a decline from 43% in last year's survey. This ranked #7 in priority (out of 14 different workload types), down from #3 last year. We think this down-tick reflects the optimization pressures that have proliferated over the last year, as well as greater reluctance to switch vendors given this typically requires higher transition costs. We are however encouraged by data points that suggest optimization headwinds are abating.

11) **Cost Optimizations Are Largely Expected To Be Complete Within 6 Months.** In addition to the 12% of respondents that already completed their cost optimizations, 63% of respondents indicated they expect to finish cost optimizations within the next 6 months, with 31% expecting to finish in the next 3 months. Optimizations were most prevalent with Mid-Market respondents as 44% cited more cost optimizations than normal, compared to 42% in Enterprise and 37% in SMB. Overall, survey responses suggest that optimization headwinds are set to ease over the next couple of quarters, a positive development for the hyperscalers as well as for Data Cloud and Observability vendors with consumption-based models (i.e. SNOW, DDOG, CFLT).

12) **Optimization Strategies Vary, But Most Should Allow for Spend Re-Acceleration.** The more commonly cited cost optimization strategies tended be methods where spend can easily re-ramp. For instance, 42% reduced storage usage, 34% reduced compute usage, and 30% cut back on ML workloads, all of which we think could dialed back up with natural data volume growth and investments in newer AI/ML use-cases. However, some cost optimization strategies may have longer-lasting impacts. For instance, 40% lowered rates by renegotiating contracts, 33% moved workloads back on-prem, and 24% reduced seat counts.

13) **High Propensity To Spend On AI:** ~75% of respondents are current users or plan to use generative AI within the next 3 years. 33% of respondents have already allocated budget to generative AI, and another 41% are highly considering allocating budget within the next year. In addition, 32% of respondents have been or plan to build on a commercially packaged LLM (such as GPT-4 or Amazon Titan) while 28% prefer open-source LLMs (like Meta's Llama or TII's Falcon). Only 12% plan on utilizing a self-built LLM. Overall, the fact that so many respondents have already carved out budgets for AI is an encouraging sign for vendors that are rolling out new AI products and positioning for new growth levers.

14) **Stabilization for On-Prem Workloads.** 29% of workloads are on-prem today (vs. 30% last year), and that is expected to decline to 26% 5 years from now (vs. 25% last year). This demonstrates a greater level of maturity of cloud migrations, though the trend is still for more workloads to migrate in the years ahead.

15) **New Considerations for SaaS Migrations.** File Systems (58% v. 58% last year), AI Inference & AI Training (58%), E-Commerce (56% vs. 59% last year), Database Apps (54% vs. 57% last year), Front-Office Apps (53% vs. 52% last year), and Back-Office Apps (51% vs. 44% last year) all had over half of respondents consider switching to a SaaS Supported model in the future. The high priority for File Systems suggests there is still a lot of on-prem workloads to tackle for Cloud Storage and Data Cloud vendors. This data also represents another proof point that Back-Office migration priority is rising as it increased 7pp Y/Y in this survey question.

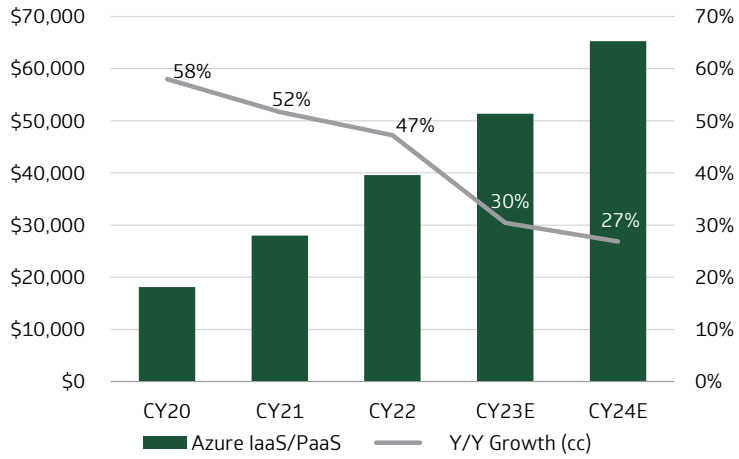
See Figures 21-24 below for our covered companies' Cloud IaaS/PaaS revenue.

Figure 21 IaaS/PaaS Revenue for MSFT, ORCL, SAP ($ Millions)

	CY20	CY21	CY22	CY23E	CY24E
Azure IaaS/PaaS (est.)	**$18,118**	**$27,984**	**$39,594**	**$51,356**	**$65,276**
Y/Y Growth (cc)	*58%*	*52%*	*47%*	*30%*	*27%*
OCI IaaS/PaaS	**$1,812**	**$2,344**	**$3,454**	**$5,665**	**$8,326**
Y/Y Growth (cc)	*9%*	*27%*	*52%*	*64%*	*47%*
SAP Cloud IaaS/PaaS	**N/A**	**$2,264**	**$2,567**	**$3,226**	**$4,166**
Y/Y Growth (cc)			*22%*	*36%*	*27%*

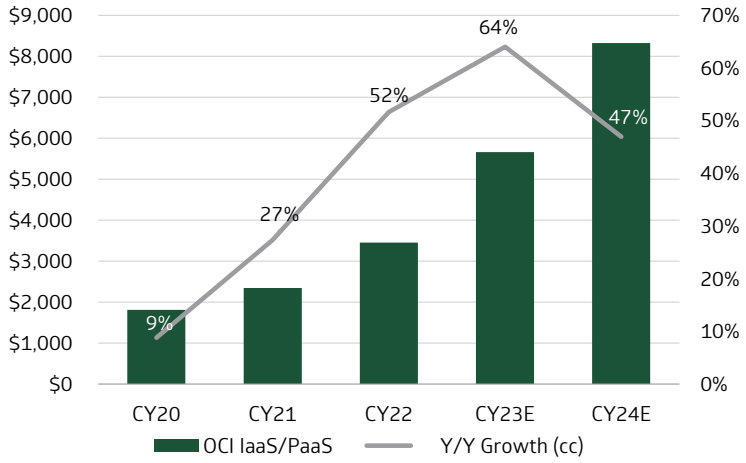
Source: TD Cowen, Company Filings

Figure 22 Azure Estimated IaaS/PaaS Revenue (excludes SaaS components) ($ Millions)



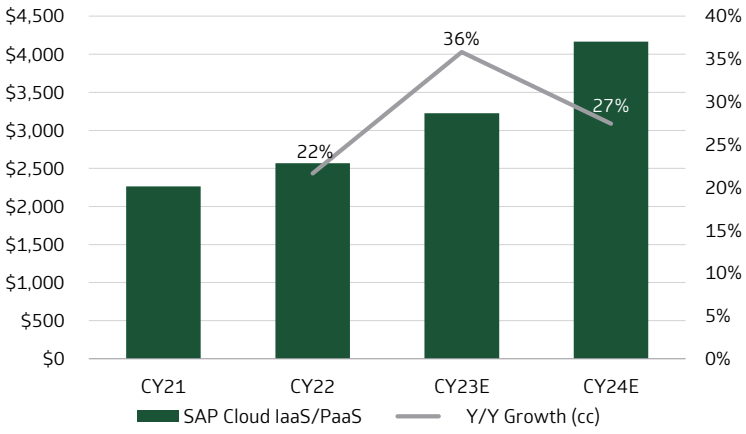
Source: TD Cowen, Company Filings

Figure 23 OCI IaaS/PaaS Revenue ($ Millions)



Source: TD Cowen, Company Filings

Figure 24 SAP Cloud IaaS/PaaS Revenue ($ Millions)



Source: TD Cowen, Company Filings

Implications for IT Services (Bergin)

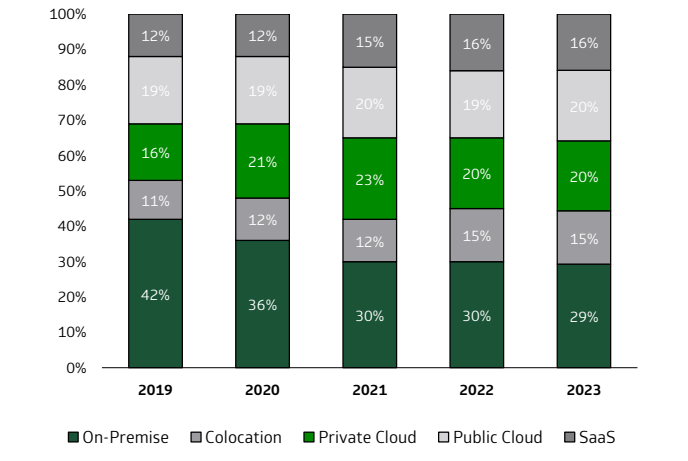
Overall: Cost Optimization Focus Supports Value Prop for Diversified Services Vendors

Demand for cloud services and the development of increasingly complex cloud environments continues, underpinning spend tailwinds for IT Services over time. However, cost optimization signals were more prevalent in the 2023 survey. Diversified IT Services vendors with scaled offshore footprints remain better positioned to weather the broader spend slowdown and stand to benefit from vendor consolidation as enterprise clients seek cost rationalization. Based on the survey, most cost optimization efforts materialized in late-2022/early-2023, with the bulk expected to be completed within the next 6 months. Gen AI survey data reflects palpable interest in the new technology, though the shape of the initial adoption curve in certain areas (such as Customer Service) give us more reason to question consensus views. We believe the evolving AI wave will serve as a net benefit to IT (& BPM) Services providers over the next 2-3 years as enterprise clients continue to lean on capable 3rd party providers to help construct and implement technology spend initiatives.

Cloud Migration Continues but Workload Shifts Away from On-Premise Slows

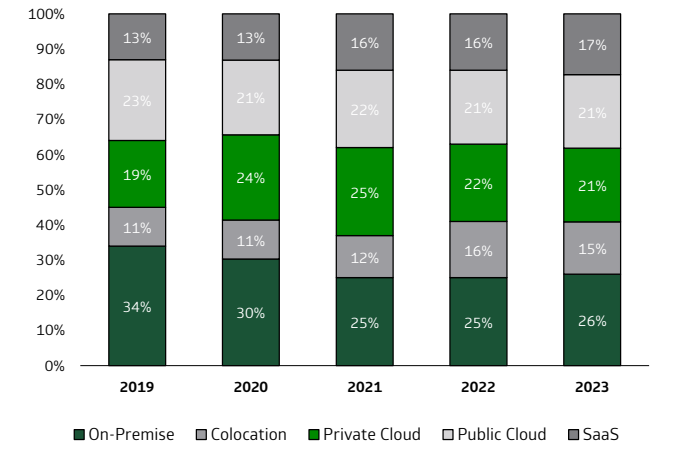
Cloud migration has served as a secular headwind for on-premise infrastructure for the past decade, however our survey reflects an apparent stabilization in the mix (both in where current mix was conveyed and the outlook 5 years from now). In our 2023 survey, 29% of respondent workloads are supported by on-premise infrastructure in the US, down -1 pt vs. 2022. As of 2023, the 5-year expectation for on-premise mix was 26%, marking a 1 pt uptick vs. the prior year. Despite workload shifts, on-premise infrastructure is not going to disappear entirely due to factors such as ROI considerations, data privacy, and business continuity. This counters a consensus view that has weighed on legacy data center businesses, such as KD (not covered) and DXC that has recently been able to slow the rate of decline in its ITO (on-prem) business.

Figure 25 What % of your workloads are supported by each infrastructure type (now)?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

Figure 26 What % of your workloads are supported by each infrastructure type? (5 years from now)?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

Cost Climbs to the Top of the 3rd Party Selection Criteria List

When asked about the top factors in selecting 3rd party support vendors, cost management saw the highest prevalence of 1st place responses (41%). This aligns with the cost optimization theme that has been prevalent this year after being a lower priority in recent years. Diversified IT Services vendors such as ACN and INFY are positioned to show better resiliency amid the current dynamic given their established offerings and scaled offshore footprints can be leveraged by clients to support cloud optimization initiatives. Performance optimization ranked #2 (38%) for the second consecutive year and Service provider selection & environment design ranked #3 (35%).

Figure 27 What are the top factors when selecting a 3rd party support vendor?

Weighted Rank*		% 1st Place	% 2nd Place
1	Cost management	41%	25%
2	Performance optimization	38%	39%
3	Service provider selection & environment design	35%	37%

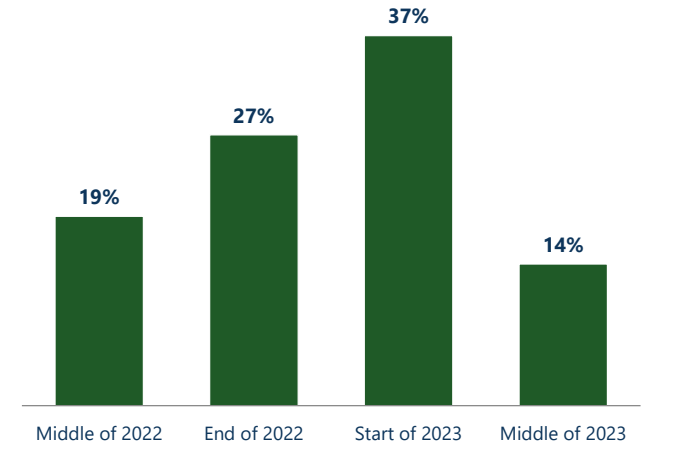
Weighted Rank*	2022 Survey n=136	% 1st Place	% 2nd Place
1	Security & compliance	36%	29%
2	Performance optimization	36%	40%
3	Monitoring & support	28%	43%

Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=152 (2023 survey); N= 136 (2022 survey)

The Majority of Cost Optimization Work is Expected to be Finished in the Next 6 Months

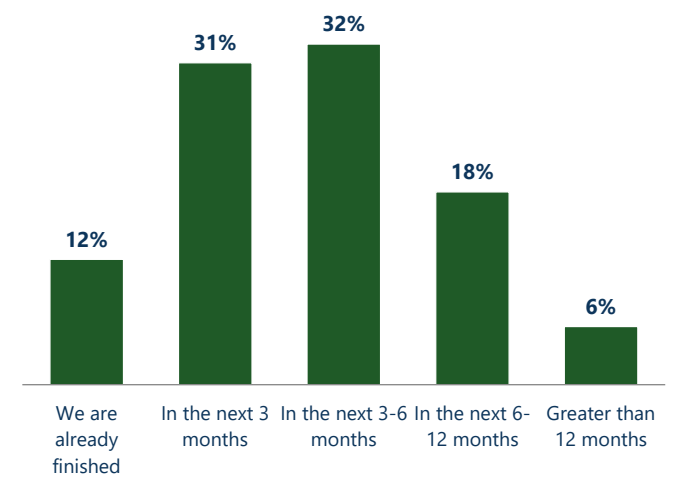
Cost optimizations for 83% of the respondents began in the middle of 2022 and continued through the start of 2023. This aligns with bookings trends seen by several IT Services vendors where weakness emerged towards the latter part of 2022 and into early-2023. Roughly 2/3 of respondents are expected to finish cost optimization actions during the next 6 months. It's worth noting that only 12% of respondents have finished their cost optimization activities which speaks to the limited visibility that remains an issue for IT Service providers in the coming quarters, particularly as it relates to shorter-term discretionary work in areas such as strategy consulting, tech advisory, digital engineering, etc. Ongoing cost optimization actions will continue to weigh on IT Services vendors with exposure to these areas, including ACN's Consulting practice, EPAM, GLOB, DAVA, GDYN, and TWKS.

Figure 28 When did the cost optimizations roughly start?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=563

Figure 29 When do you expect the cost optimization to be finished?

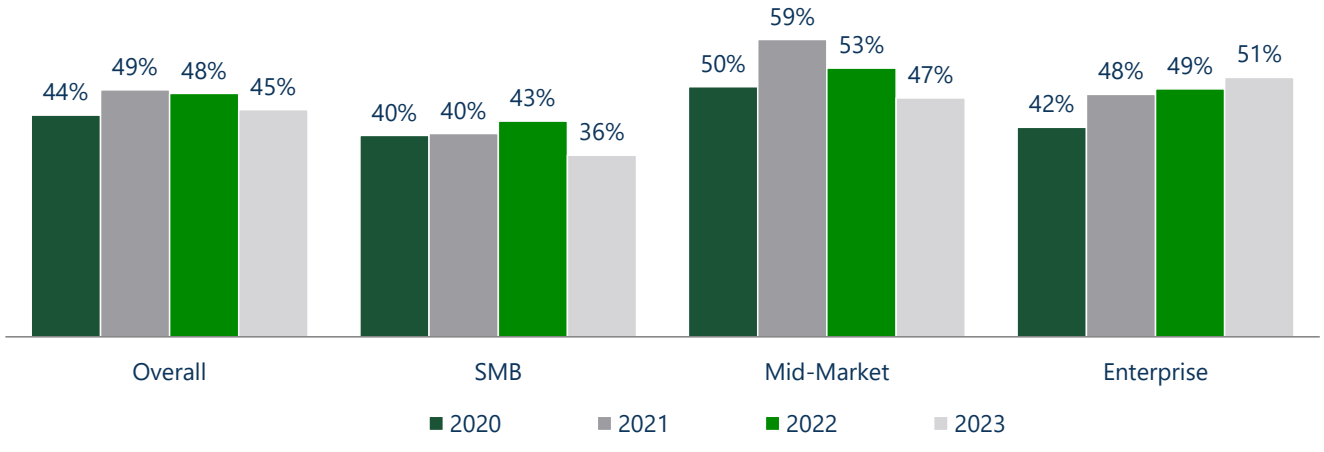


Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=563

Ongoing Workload Migration Apt to Support Incremental Needs for IT Services Vendors

The infrastructure options that businesses use to host applications and workloads has evolved, setting up incremental opportunities for IT Services vendors to leverage their capabilities – advise/consult, migrate, run – to support clients. Over the past 2 years, 45% of respondents migrated workloads away from the cloud, driven by enterprise (51%) and mid-market (47%) organizations.

Figure 30 Have you migrated any workloads in the last 2 years away from the public cloud?

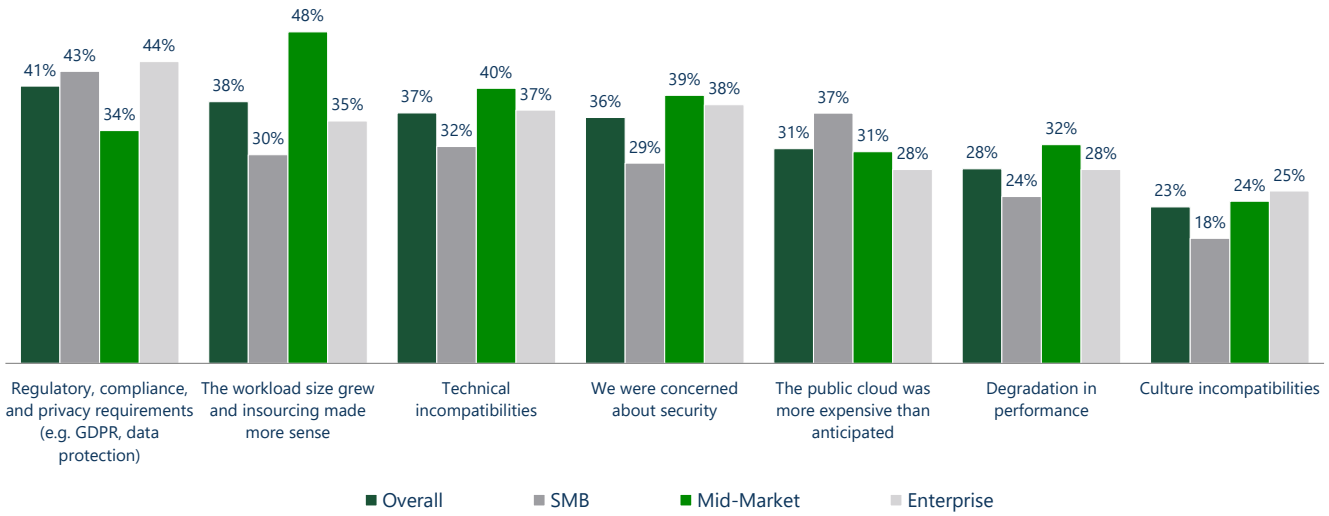


Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

The primary reason behind the decision to migrate workloads away from the public cloud was driven by regulatory, compliance and privacy requirements (41%), with Enterprise leading at 44%. In addition, 59% of respondents selected at least 1 cost related concern, with 38% citing the workload size grew and insourcing made more sense, and 31% citing the public cloud was more expensive than anticipated. Over the

past year, macro uncertainty has resulted in client IT wallet re-prioritization, with cost optimization emphasized in lieu of discretionary services.

Figure 31 Why did you migrate away from the public cloud?



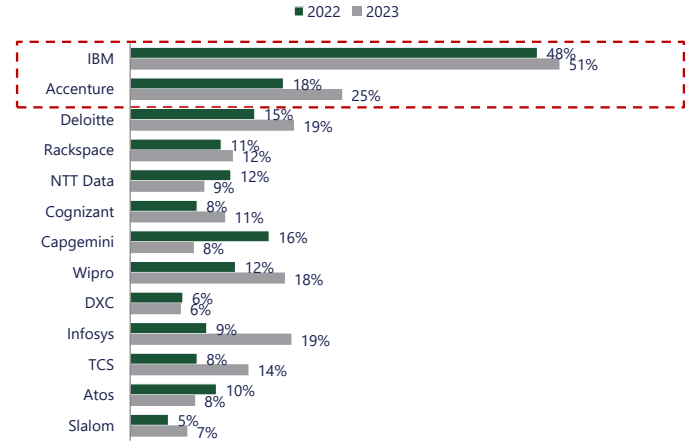
Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=306

Leading IT Services Vendors around the Cloud

The most cited IT Services vendors used among survey participants were IBM (51%) and Accenture (25%). These bellwethers are well-positioned to cross-sell their services within organizations given their size and breadth. As well, larger diversified IT Services companies should benefit from the vendor consolidation trend that has become more prevalent over the past year as clients use vendor rationalization as a tool to drive cost efficiencies.

Over the next 12 months, participants anticipate a relatively tight dispersion on spend change by provider, with expectations for increased spend ranging from 4.1% to 6.9%. Respondents expect the highest level of spend increase with Wipro (6.9%), Capgemini (6.8%), and TCS (6.5%). Meanwhile, ACN (5.6%) was inline with the group average.

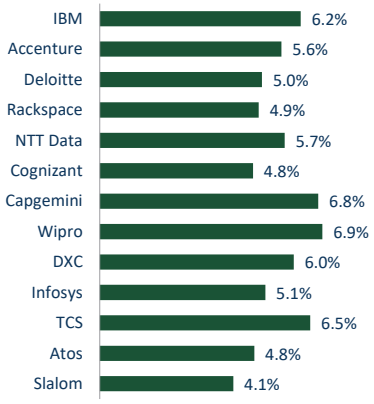
Figure 32 Which IT Services vendor(s) does your organization use for support/management of cloud infrastructure?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=652

Note: Only includes respondents that had 3rd party support for cloud infra management

Figure 33 How do you expect your spend to change over the next 12 months with (each selected) services providers?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=648

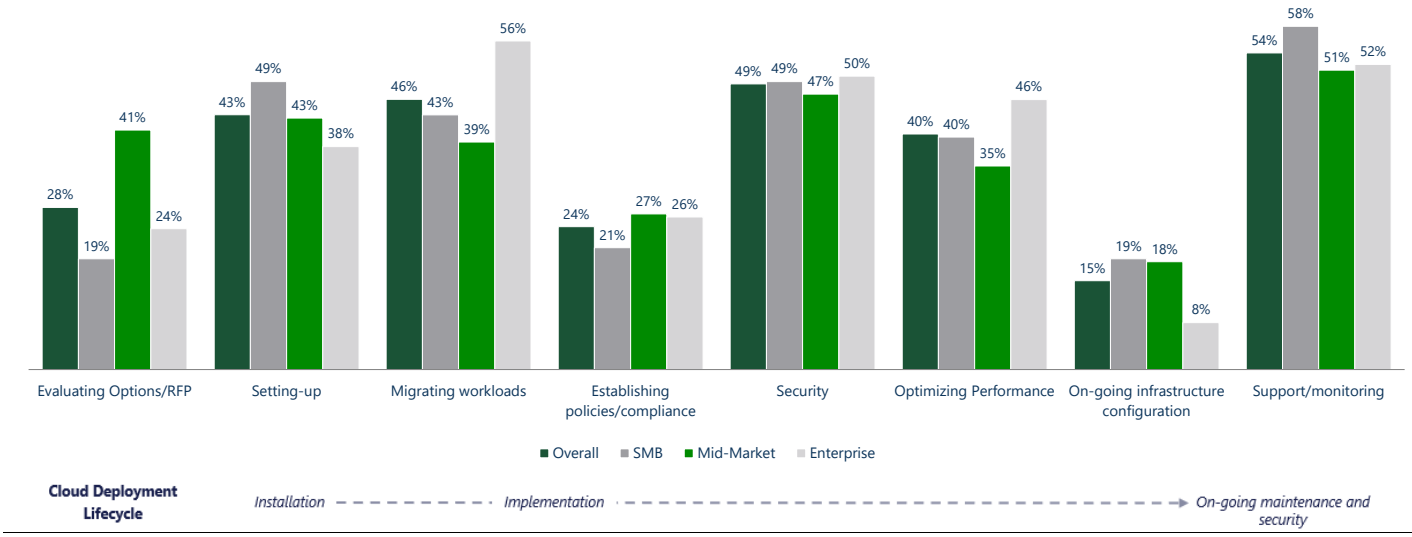
Note: Only includes respondents that had 3rd party support for cloud infra management

Broad Need for Help Across Cloud Deployment Lifecycle Support 3rd Party Providers

When participants were asked where they would require assistance in cloud deployment, there was a broad need across the cloud deployment lifecycle; this is consistent with the prior 5 surveys. The complexity of cloud deployments benefits 3rd party IT Services providers that tailor offerings around the lifecycle of cloud implementation. This broader demand spectrum in the cloud has driven digital product engineering vendors (EPAM, GLOB, etc.) to lean into capabilities beyond custom software development, growing their exposure to certain SaaS vendor specialists to capture revenue adjacencies in the cloud.

For enterprises, migrating workloads was ranked as the top area for assistance (56%), reflecting the significant activity required to execute a workload shift that internal client IT functions are often not equipped to do on their own. Support/monitoring was the second most cited need amongst enterprises (52%) suggesting organizations need ongoing managed services post cloud deployment to maintain uptime and other efficiencies. Large-scale multinational and offshore IT Services providers are equally positioned to benefit from such tailwinds. Security for enterprises (50%) was third most cited as the prevalence of cyber-attacks remains a wider concern. This benefits the large multinational IT Services providers, such as ACN and IBM, who have built out security practices as an adjacency to their IT Services and consulting offerings due to ever-increasing cyber security considerations/requirements within IT. It's worth highlighting enterprises ranked optimizing performance (46%) fourth; it remains top of mind as client organizations seek actions to help navigate a tighter technology budget.

Figure 34 Where would you need help in planning a cloud deployment?

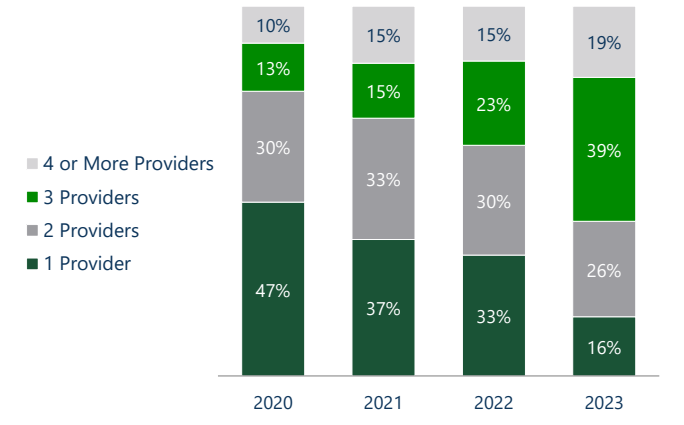


Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=152

Multi-Cloud Usage Takes Notable Step Higher

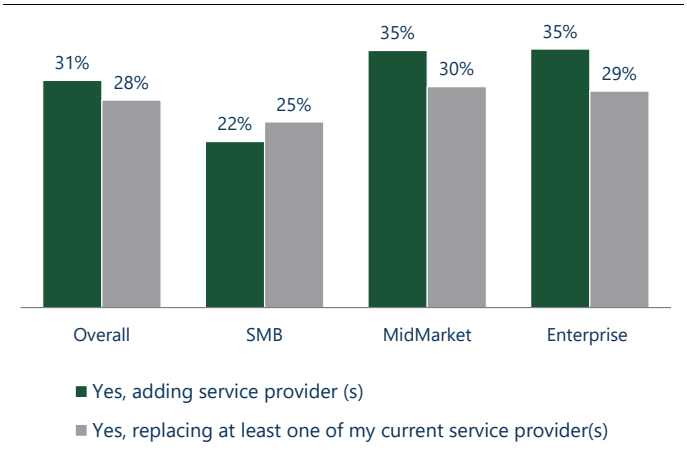
The percentage of multi-cloud users increased 16 pts y/y to 84% in 2023. Respondents are using a median of 3 cloud providers. In addition, 31% of companies (35% of enterprises) expect to add another cloud provider over the next 2 years, while 28% (29% of enterprises) expect to replace their existing cloud provider. The growing level of multi-cloud use supports the notion that rising complexity in cloud environments will provide ongoing support for IT Services vendors even after an initial migration.

Figure 35 How many cloud providers do you currently use?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=581

Figure 36 Do you expect to add to or replace your cloud provider in the next two years?

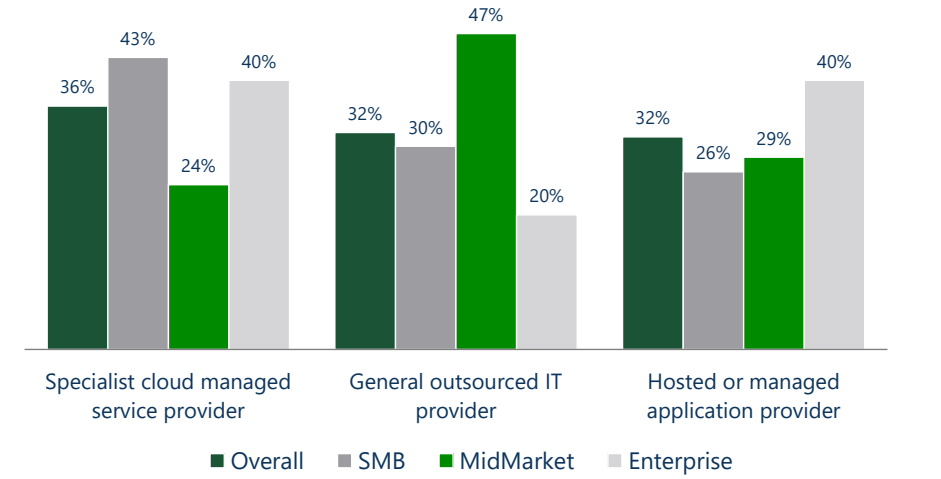


Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=varies

Specialist Cloud Managed Services Providers Most Commonly Used by Client Orgs

Among 3rd party usage, specialist cloud managed service providers represented the largest share of the work. In 2023, 36% of participants (40% of enterprises) who used a 3rd party for managed cloud infrastructure did so with specialist cloud service providers. As it relates to our coverage, we've seen organic and inorganic investments by Digital services providers such as EPAM, GLOB, DAVA, and TWKS with a focus on implementation services within the enterprise SaaS ecosystem. In addition, while GDYN is the smallest pure play Digital services vendor under coverage, we believe the company outpunches its weight with hyperscalers such as Google, reflected in its prolific tier rankings across its partnerships.

Figure 37 What type of 3rd party do you currently use to manage your cloud?

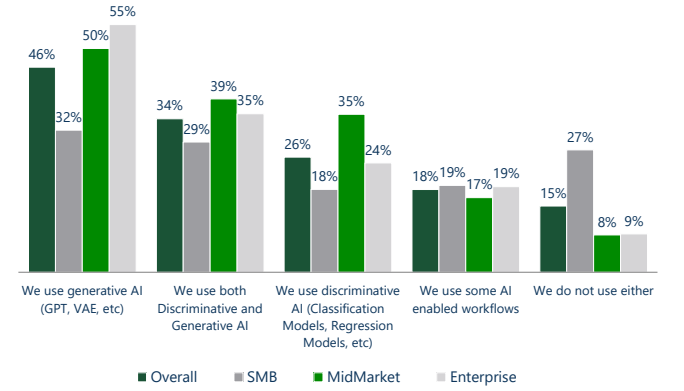


Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=152

Gen AI Interest is Palpable Among Respondents

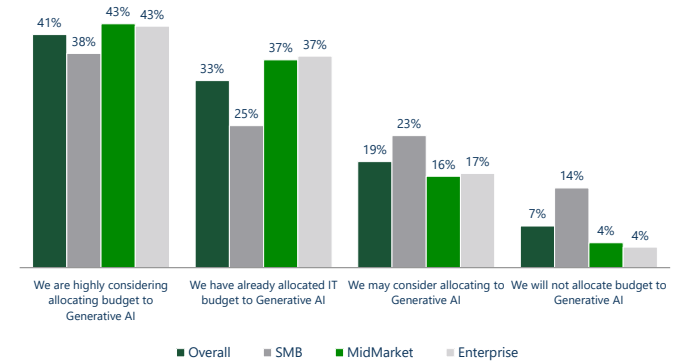
Generative AI usage in enterprise respondents (55%) stood above discriminative AI (35%), reflecting strong interest in the next generation of AI technology. However, the prevalence of gen AI use in these organizations is difficult to measure based on this data. 19% of enterprise respondents use some AI enabled workflows, representing attractive untapped opportunities but it also the slower pace of adoption that remains a reality. 80% of enterprises have allocated or are highly considering allocating budget to Generative AI this year or next, an indication that supports strategy consultants such as Accenture as boards and C-suites lean on their advisory capabilities to help ideate, plan and execute Gen AI initiatives.

Figure 38 Do you currently use AI in your organization?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

Figure 39 | Is your organization considering allocating budget to generative AI spending this year or next?



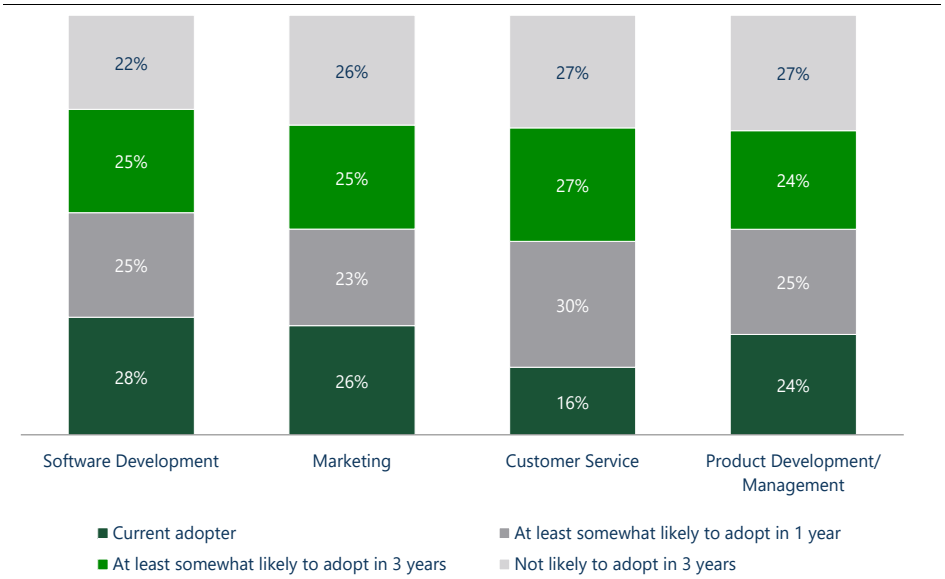
Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

Software Development is Currently the Most Common Gen AI Adoption Use Case

The most common area of gen AI adoption is currently visible in software development (28%). Software, including AI solutions, has increasingly been used as a tool to drive higher productivity across the programming lifecycle, including coding, testing, etc. Services vendors such as GLOB have been building their own tools to drive improved productivity internally for several years and has an established portfolio (Globant X) of solutions. We remain hesitant that gen AI in software development will meaningfully disrupt PxQ models in IT Services over the medium-term given the nascent ability to build and iterate complex enterprise-grade applications remains limited. On the current adopter status, Marketing ranked 2nd (26%) and Product Development/Management ranked 3rd (24%).

Interestingly, Customer Service had the lowest current adoption (16%) despite being commonly identified as an area that is most at risk to cannibalization from gen AI. While the use cases for gen AI across customer service channels such as call centers make sense – supported by the view that 30% of respondents are at least somewhat likely to adopt gen AI in Customer Service in 1 year – the lower level of current adopters reinforces our view that the enterprise adoption curve will be more prolonged than the consensus views. Clients remain reticent on gen AI directly touching end consumers given the inherent shortcomings (hallucinations, lack of empathy, etc.) associated with the emerging technology.

Figure 40 What is your adoption status of Generative AI in the following areas?

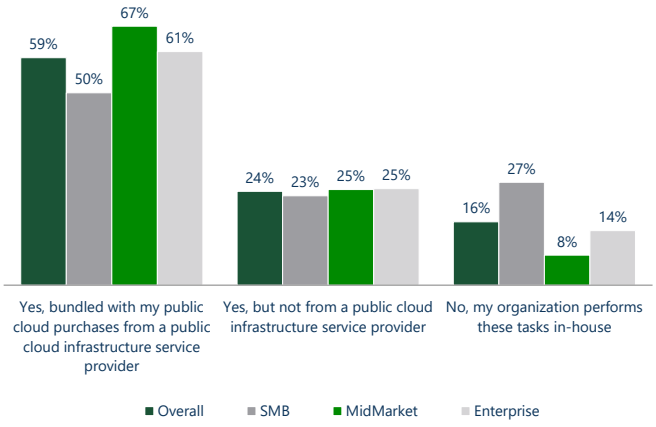


Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

Supporting Public Cloud Infrastructure is Less Likely to be Done In-House

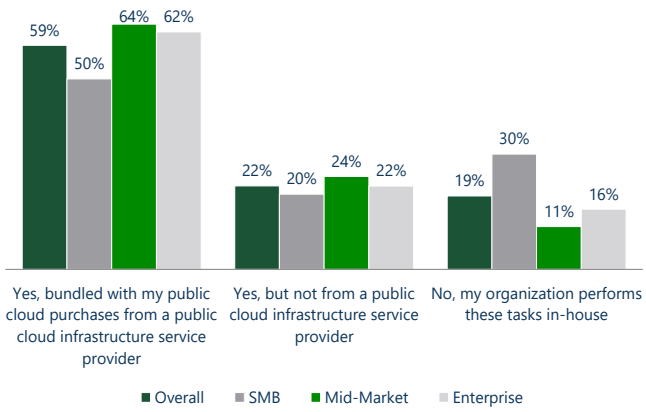
Public cloud infrastructure support for project-based professional services (one-time) and managed services (recurring) is most commonly part of a bundle with public cloud purchases from a public cloud infrastructure provider. In recent years, most Services vendors have leaned into their hyperscaler partnerships to be better positioned to capture work that becomes available through this channel. A diversified partnership strategy is apt to be most beneficial given the higher prevalence of multi-cloud vendor use. Meanwhile, 25% of enterprise respondents purchase project-based professional services away from a public cloud infrastructure provider and 22% purchase project-based managed services away from a public cloud infrastructure provider. The in-house response rates for enterprises across both activities were the lowest (14% - professional services / 16% - managed services) reflecting a lack of internal IT capabilities at client organizations given it is often not part of their core competencies.

Figure 41 Does your org purchase any 3rd party project-based professional services to support public cloud infra?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

Figure 42 Does your org purchase any 3rd party project-based managed services to support public cloud?

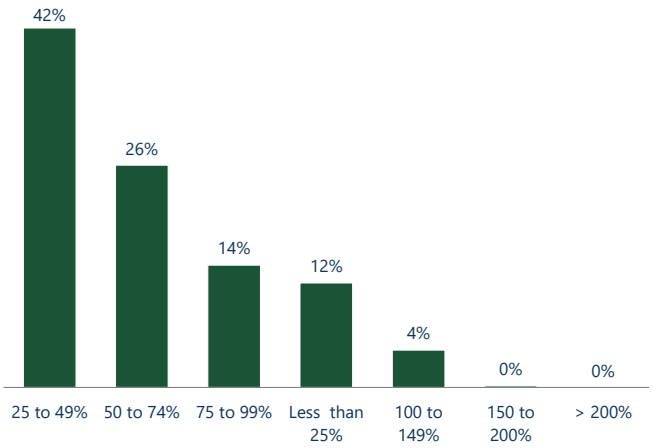


Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

Project-Based Professional Services is a Meaningful Portion of Public Cloud Spend

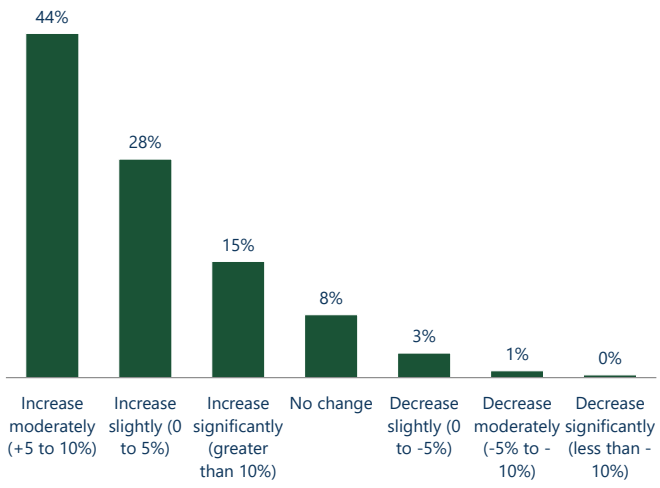
The weighted average spend on project-based professional services was 52% of total public cloud infrastructure spend. Over the next 3 years, 87% of respondents expect to increase spend on project-based professional services, a positive indication for vendors with hyperscaler relationships. Project-based services tend to be more discretionary in nature, but this outlook underpins our structural view that the tailwind from cloud-enabled services is apt to support opportunities in areas such as CX/UX, data management, etc. as macro uncertainty dissipates. This would most directly benefit digital product engineering vendors such as EPAM, GLOB, DAVA, GDYN, and TWKS.

Figure 43 What did your org spend on project-based professional services as a % of total public cloud infra spend? (by % of respondents)



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=568

Figure 44 How do you anticipate this spending will change in the coming 3 years? (by % of respondents)



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=568

Implications For Third-Party Data Center Operators (Elias)

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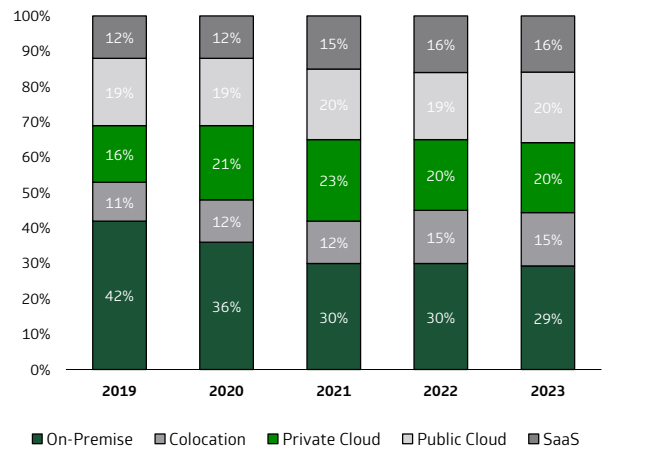
Share Of Colocation Workloads Remained Stable Y/Y; View Positively Given Absolute Workload Growth

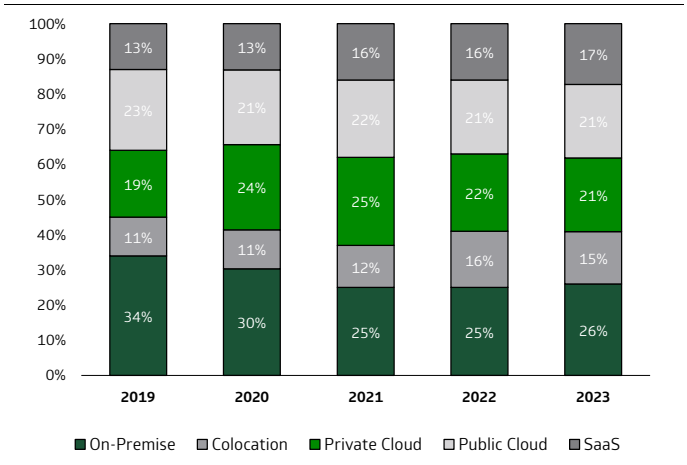
Over the past few years, we have asked enterprise survey respondents to classify the type of infrastructure used to support their workloads. The survey data from Altman Solon suggests that organizations tend to rely on a mix of cloud providers and third-party colocation providers rather than manage workloads on-premise. To that point, as seen in Figure 45 below, on-premise workloads have declined to 29% in 2023 from 30% in 2022 and 42% in 2019. Importantly, as the share of on-premise workloads has declined, the share of workloads living in a colocation environment has increased to 15% in 2023 from 11% in 2019, although the share remained flat Y/Y. This increased share of workloads is supportive of the continued enterprise outsourcing trend as well as the adoption of hybrid multi cloud. Furthermore, when enterprise respondents were asked to describe their mix of infrastructure five years from now, respondents noted that they expect 15% of their workloads to live in a colocation environment. To the extent this proves to be correct, we would view it as positive considering the absolute number of workloads continues to grow, which suggests that the enterprise colocation market should grow in-line with that of broader workloads, driving continued dollar revenue growth for third-party data center operators such as Digital Realty (DLR, Market Perform, Elias) and Equinix (EQIX, Outperform, Elias).

Figure 45 What % of your workloads are supported by each infrastructure type (now)?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

Figure 46 What % of your workloads are supported by each infrastructure type? (5 years from now)?



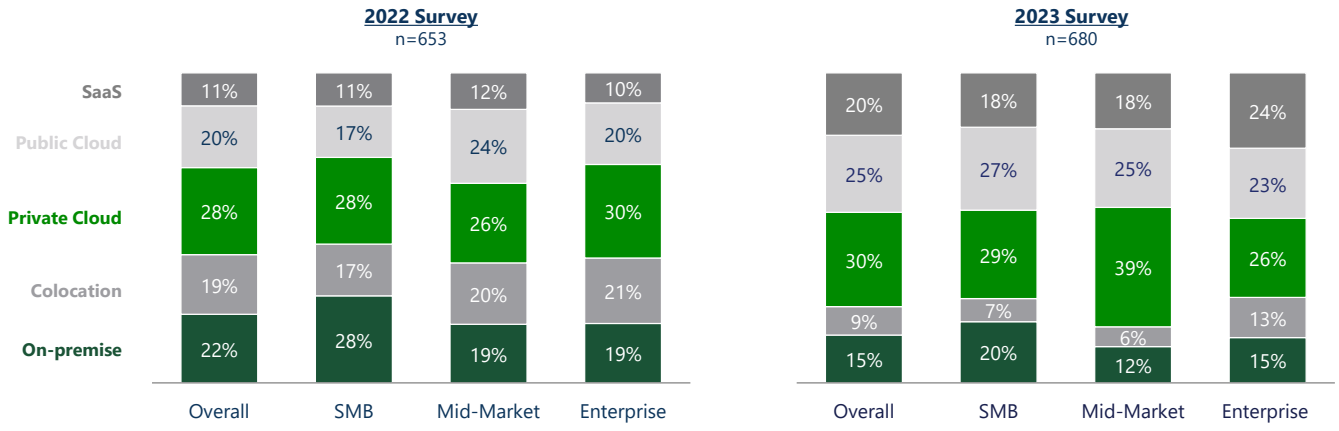
Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

Furthermore, the expected percentage of workloads supported by on-premise infrastructure in the next five years is expected to decline further to 26% in 2028 from 29% in 2023. Both the actual and expected share of on-premise workloads have declined since 2019, and since 2021, a stabilization has occurred with actual on-premise workloads representing ~30% of total workloads. To that point, at Equinix's 2023 Analyst Day mgmt. noted that customer commitment to digital transformation is driving a continued migration from on-premise data centers to a hybrid multi-cloud architecture. As such, the company is investing in automation to enable this digital transformation through offering an "online shopping" type of experience for digital infrastructure customers. To that point, Equinix's portal orders have grown 25% Y/Y and now represent ~20% of the company's bookings.

Demand For New Colocation Workloads Decreasing, While Demand For Public And Private Cloud Increasing

When SMB, Mid-Market, and Enterprise customers were asked where they would most likely deploy a new workload this year, as shown in the figure below, new workload demand for colocation decreased to 9% in 2023 from 19% in 2022, a decline of 10%. The change in demand for colocation was most drastic among Mid-Market customers, decreasing to 6% in 2023 vs. 20% in 2022, a decline of 14%. To that point, as demand for colocation among Mid-Market customers has decreased, the demand for public cloud deployments increased and the demand for private cloud deployments among Mid-Market customers increased significantly to 39% from 26%.

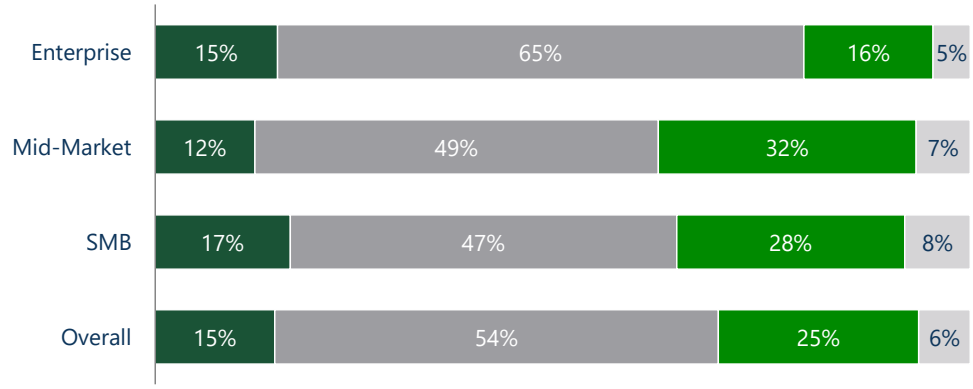
Figure 47 If you had to deploy a new application this year, where would you be most likely to deploy the new workload?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=653 / N=680

Separately, as shown in the figure below, of the respondents who leverage on-premise infrastructure, 80% of enterprise respondents noted that they are leveraging less than 50% of their on-premise infrastructure, which is up from 52% in our survey last year. This suggests to us that the on-premise infrastructure that enterprises have is increasingly underutilized. This is an important dynamic to highlight given the less on-premise infrastructure is utilized, the more likely that this infrastructure is to be cost inefficient, which serves as a further catalyst for workload migration to colocation or other environments.

Figure 48 Of your on-prem physical footprint, what % is being utilized? (n=647)



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=647

Price Is The Top Criteria When Selecting A Colocation Provider

When asked what the top criteria were in selecting a colocation provider, SMB, Mid-Market, and Enterprise respondents were unanimous that "Price" was the primary selection criteria, as shown in the figure below, followed by "Availability/Uptime" and "Physical Security". Interestingly, when compared to last year's survey, Price, Availability/Uptime, and Physical Security were listed as the top three criteria, however in this year's survey, Price moved up to the top criteria with Availability/Uptime moving into second place. In our view, this aligns with commentary we have heard both from data center operators as well as other enterprises as they began "tightening their belts" on cost in late 2022 and into 2023 as the economic environment slowed. To that point, during our meeting with Equinix mgmt. following 2Q23 earnings, mgmt. noted that enterprise customers are showing "a degree of caution" in their buying decisions as "choppy" macro conditions have driven these companies to make more thoughtful budget decisions. Separately, as we have previously noted, a tsunami of demand has hit the data center market in the last several months. Generative AI represents the strongest demand tailwind for data centers. To that point, interviewees from our Communications Infrastructure Summit noted that in terms of near term industry challenges, utility constraints are rampant in both the U.S. and globally, while adding that the continued growth in compute will drive greater stress on power grids, thus making power availability a major factor in site selection.

Figure 49 What are the top three criteria for selecting a colocation provider? (n=522)

Criteria	Overall	SMB	Mid-Market	Enterprise
Price	1	1	1	1
Availability/Uptime	2	2	2	2
Physical security	3	3	4	3
Number of network providers available	4	6	3	5
Financial resources of provider	5	4	4	5
Compliance certification	6	4	7	4
Number of cloud on-ramps available	7	8	6	9
Disaster recovery/business continuity	8	7	10	8
Customer Ecosystem	9	10	7	7
Geographic footprint of provider	10	9	9	10
Other	11	11	11	11

Note: Top 3 Criteria in 2022 were the same, in a different order (Price, Physical Security, and Availability/Uptime)

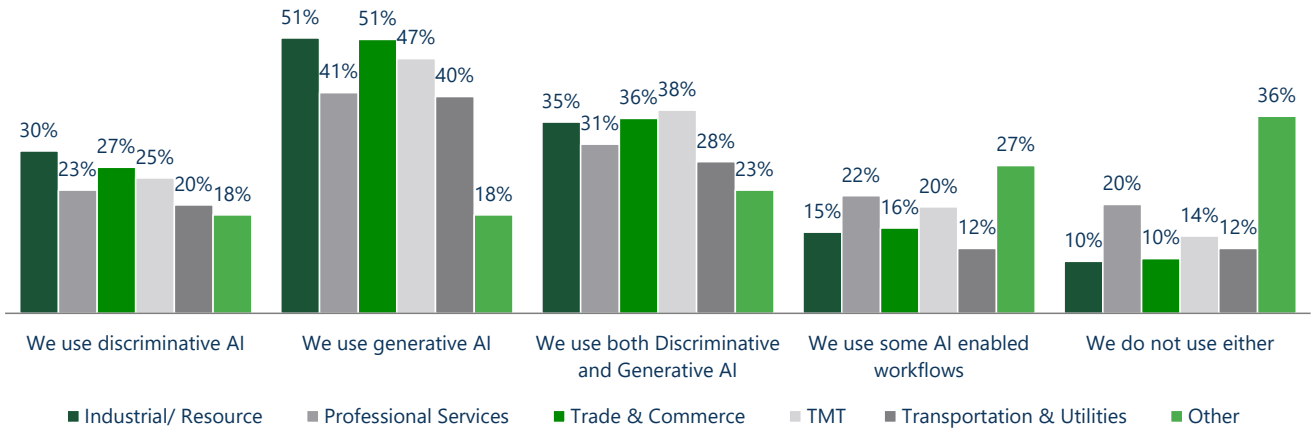
Note: Darker shade of blue indicates higher ranking

Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=522

AI Integration Is Industry-Agnostic, Businesses Of All Sizes Are Allocating Budget Toward Generative AI Spending

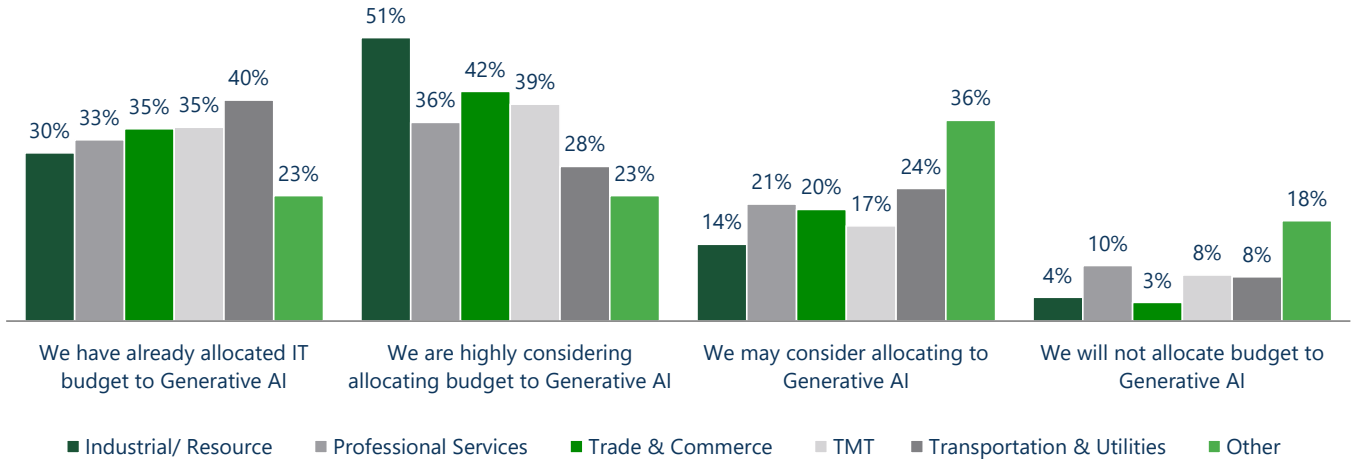
As aforementioned, Generative AI is driving significant demand for data center capacity. However, AI is not only a major concern of hyperscale customers, but according to the July 2023 Altman Solon Cloud Survey, "AI is top of mind across sectors". As the figure below demonstrates, when asked if AI is currently used in the organization, Industrial/Resource, TMT, Professional Services, and Trade & Commerce companies all use Artificial Intelligence within their own organizations in some capacity. To that point, companies across a variety of sectors are utilizing AI within their organizations, and the topic of Generative AI is a significant topic of discussion as it relates to budgeting. In Figure 51, the only vertical of companies that plans not to allocate any budget toward AI is Non-Profit and Life Science organizations. Meanwhile, at the low-end, 40% of Transportation and Utility respondents note that they already utilize Generative AI and at the high-end, 51% of Industrial, Resource, and Trade & Commerce companies note that they currently utilize Generative AI. Furthermore, to the extent that Generative AI is not useful for any company questioned in the survey, at least 80% of respondents outside of the "Other" category are utilizing *some* form of AI-enabled workflows.

Figure 50 AI Usage by Sector



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Figure 51 Gen AI Budget Allocation by Sector



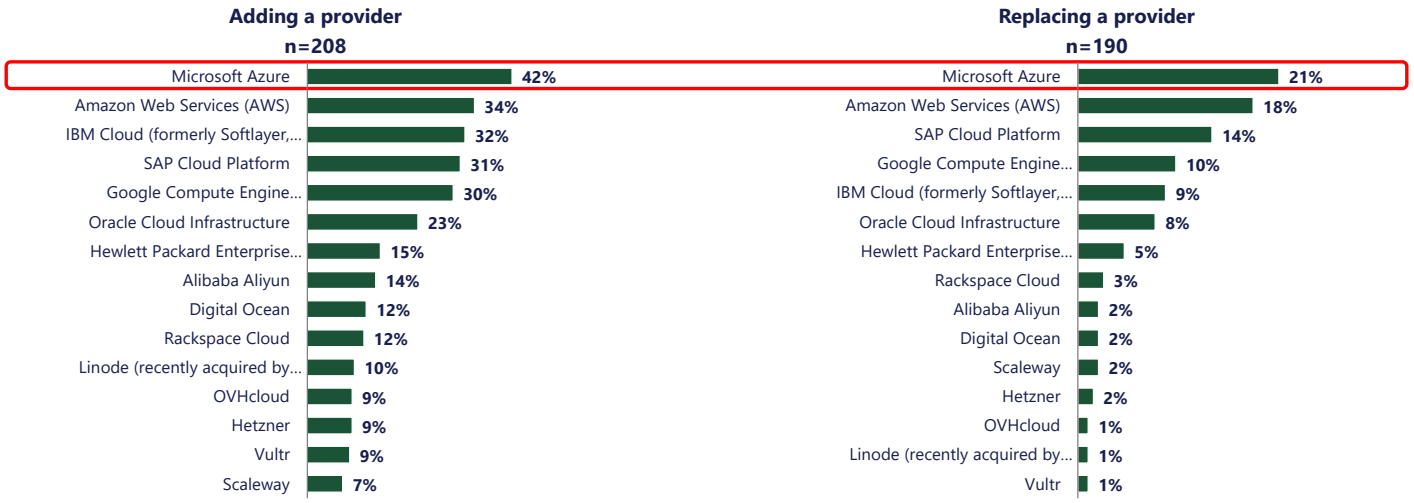
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Akamai's Cloud Computing Platform Appears Well Positioned For Future Growth

As shown in the figure below, 10% of survey respondents noted that they are planning on adding Akamai's (AKAM, Outperform, Elias) cloud computing platform Linode to their list of cloud providers. Conversely, only 1% of respondents noted that they plan on replacing Linode with services from another provider. At our TD Cowen TMT Conference, Akamai mgmt. noted that part of its Compute strategy is to offer a low-cost alternative that provides core cloud functionality, and benefit current Delivery customers looking to save on egress fees that would otherwise be paid to hyperscalers. Strategic pricing options to attract new customer acquisition aligns with survey data in Figure 53 that shows "Cost" is the foremost reason that customers choose a specific cloud service

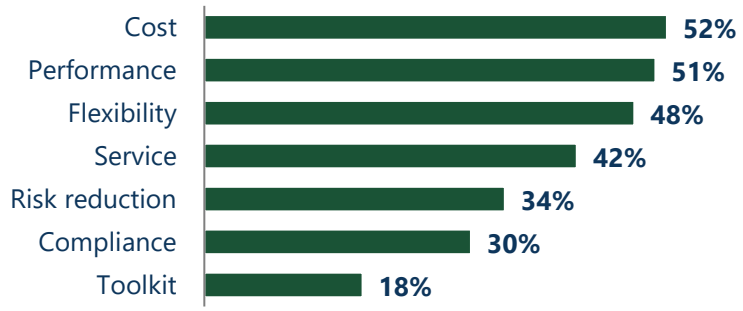
provider. This dynamic in our view is advantageous to Akamai as a low-cost cloud computing provider. Furthermore, the survey data suggests to us that Linode is well positioned for future growth as it ramps and scales its data footprint and cloud availability across more markets.

Figure 52 Which Public Cloud provider are you planning on adding/replacing your current provider with?



Source: TD TD Cowen / Altman Solon Cloud Survey, July 2023. N=208 / N=190

Figure 53 Why have you chosen your public cloud service provider? (n=680)



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680

Implications for Semiconductors (Ramsay)

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We view the datacenter market as perhaps the most important of the key growth verticals within our semiconductor investing framework (Automotive, Edge/IoT. Industrials, Gaming being the others) Incremental to our view from this survey data is the belief in the continued growth of the traditional server market in light of GenAI.

Traditional Cloud Server Market NOT Ex-Growth Due To AI

A frequent topic of conversation since the blowout NVIDIA earnings and guidance earlier this year has been whether the rise of accelerated computing and AI spelled the end for CPU-based cloud computing growth. In our view, while capex has hugely shifted toward Gen-AI servers near-term, these fears are overblown both from a medium- and longer-term perspective as we believe traditional cloud computing spend will return to an equilibrium of steady growth over time.

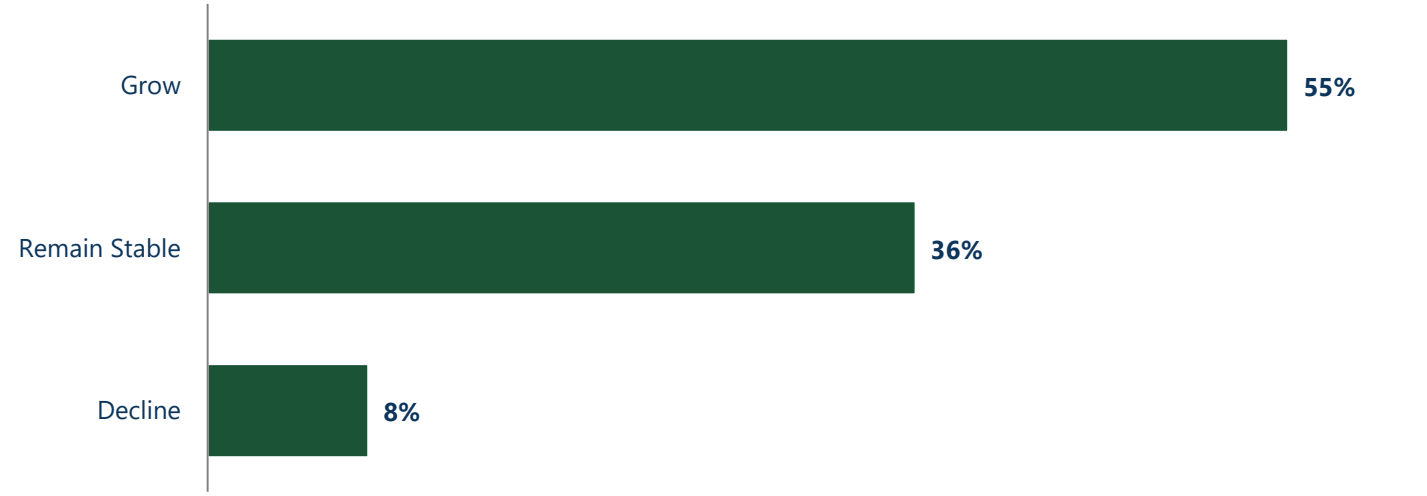
In the intermediate term of 1-3 years, we recognize that many of the cloud hyperscalers appear to have increased their investment in AI-related spend (acceleration and networking) at the expense of more traditional compute. In our view this trend is not sustainable for longer than a few quarters, as much of the everyday infrastructure of the cloud (such as bare metal server instances for traditional workloads) still require upgrades to take advantage of the latest interconnect, memory, and CPUs from Intel, AMD, and others. Thus, we interpret the eventual return of spending for AMD and Intel's server businesses as a "when" rather than an "if," but at a slower pace certainly than in the early days of cloud computing.

Furthermore, in the longer term we view the heightened attention on AI as part of an already ongoing trend towards acceleration garnering a greater share of silicon spend in the datacenter. In fact, in our March 2022 deep-dive in NVIDIA's long-term opportunity (**here**), we wrote: "As AI and other high-performance compute applications proliferate and both cloud hyperscalers and enterprises continue to invest in acceleration, we believe CPU's share of datacenter is likely to decline in favor of GPU and networking." Further, at their June 2022 Analyst Day, AMD themselves described a long-term datacenter TAM in which ~51% was GPU & AI, while only 33% was Server CPU.

While the trend towards acceleration has accelerated (sorry), we continue to believe "share decline" does not equal "ex-growth." In fact, despite our expectations for CPU share of silicon spend declining to ~29% in 2030 (from >50% in 2022), that still represents a 10% CAGR over the seven years from 2024 to 2030.

Recent survey results appear to support this view, per the figure below, with more than half of respondents expecting the traditional server market to grow and >80% expecting either growth or stability (with concepts such as CPU core counts and ASP not within the purview of the question, it is difficult to parse what respondents view would be on the traditional *CPU* market).

Figure 54 Survey Respondents Largely Expect Traditional Server to Continue to Grow



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680

Implications for Storage Hardware (Krish Sankar)

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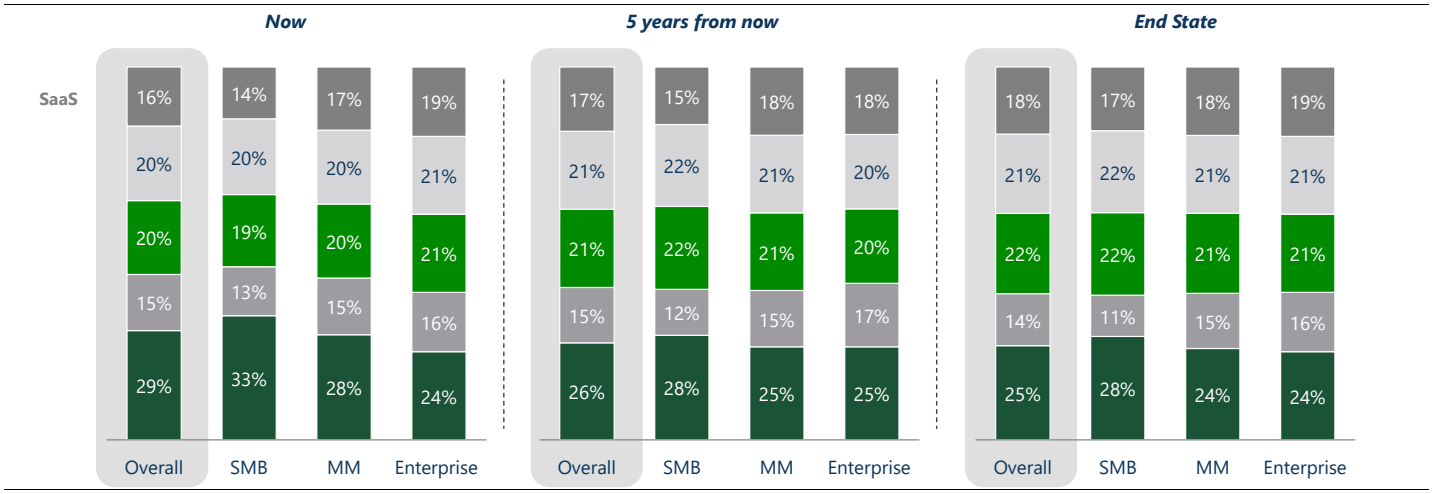
We see the trend of stabilizing on-prem mix at the cloud as positive for our enterprise coverage (PSTG, NTAP). Specifically, survey respondents indicated that their workload distribution is ~30% today on-prem but will decline towards 25% in 5-years. This decline will be primarily driven by small and medium sized companies compared to Enterprise customers who see on-prem mix remaining similar to today at 25%. We think this stabilization at the enterprise level is most positive for NTAP, which has higher enterprise exposure vs PSTG and DELL. Market share dynamics for NTAP remain key focus for us as the company seems to be losing share against PSTG. We also point to NTAP benefiting from increased File Systems use cases in the public cloud, and the migration towards the public cloud, which enterprise customers cited as the most challenging technical area. Cloud software represents 10% of NTAP's total revenues.

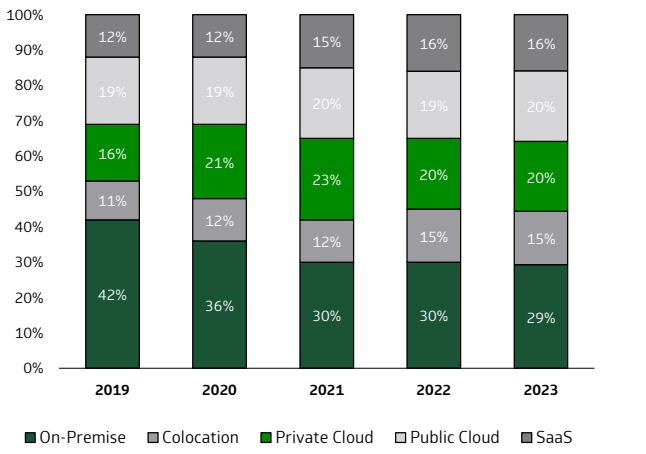
PSTG has higher exposure than NTAP to SMB and Mid-sized companies, but even that aspect of the market seems to have declined at a lower rate when compared to survey results last year. Additionally, we note that PSTG is gaining momentum within enterprises where the company today has almost 60% of Fortune 500 as customers, which compares to 45% three years ago.

Figure 55 Enterprise On-Prem Workloads Seems to Have Stabilized and Better than Last Year's Survey - *What % of your workloads are supported by each infrastructure type?*



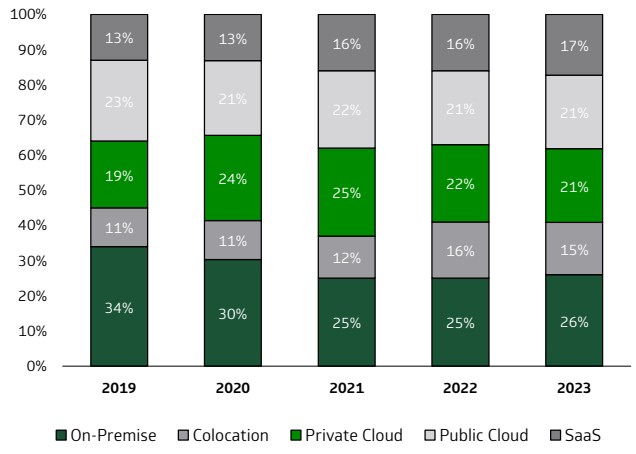
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680

Figure 56 What % of your workloads are supported by each infrastructure type (now)?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

Figure 57 What % of your workloads are supported by each infrastructure type? (5 years from now)?

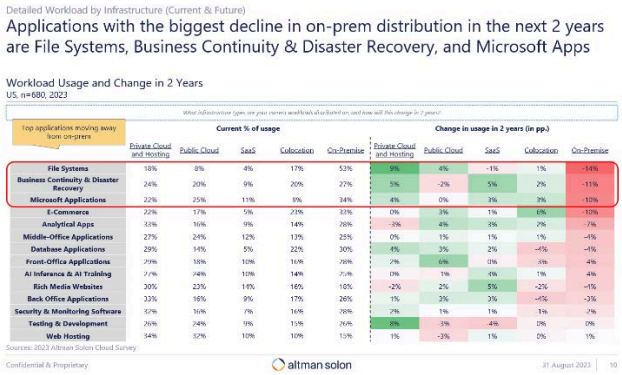


Source: TD Cowen / Altman Solon Cloud Survey, July 2023; N=680

Our public cloud survey indicates that **File Systems** will witness the highest percentage increase of adoption by the public cloud ergo the highest decrease in on-premises usage. Net-net, we think this bodes well for NetApp's cloud business, which our field work indicates have the best cloud file systems software. NetApp has partnerships with the three big public cloud providers, Azure through Azure NetApp Files, AWS through Amazon FSx for ONTAP (introduced in September 2021), and Google Cloud Volumes (a marketplace product). Here, it's worth noting that NetApp's partnership with Azure and AWS is not limited to selling the product on the marketplace but extends to co-developing the product and AWS/Azure salesforce actively promoting the product to their end-customers. For Google, our understanding is that the product is only listed on the marketplace at this stage.

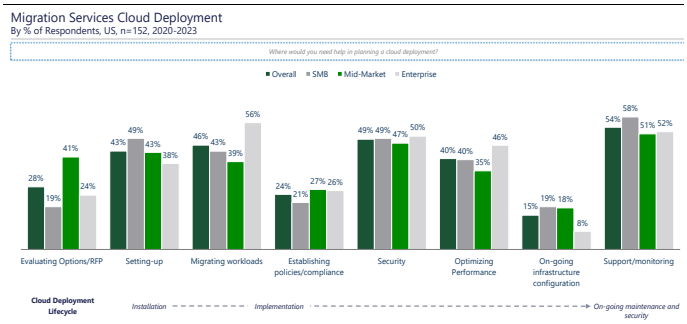
From a revenue mix perspective, cloud revenues correspond to 10% of total revenues for NTAP. We note that 75% of the cloud business is related to cloud storage (primarily File system at Azure and AWS) with the rest (25%) related to cloud optimization services, which have been under pressure last 3-4 quarters due to competitive market dynamics, we believe.

Figure 58 - File Systems Usage in Public Cloud Remains Highest Growth Area (+ve for NTAP's ANF and FSx), On-Prem Decline Offsets Some of That Though Net-Impact Remains Positive



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680

Figure 59 – This Year, We See Notable Jump in Enterprises Indicating They Need Help in Migrating Workloads to the Cloud (50% in 2023 vs 40% of 2022 Respondents). Positive for PSTG and NTAP Cloud Software Businesses



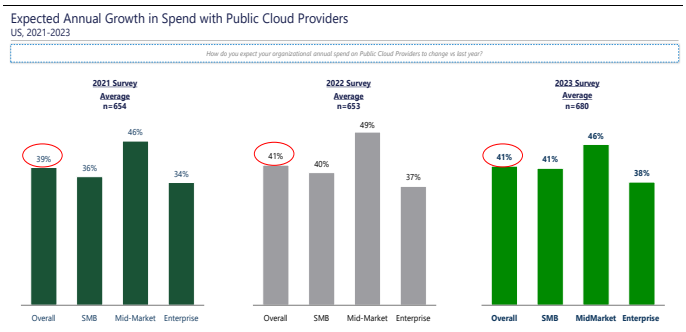
TD Cowen / Altman Solon Cloud Survey, July 2023. N=152

On-Prem Resiliency is Positive for NTAP/PSTG and Continued Public Cloud Growth is Positive for WDC and STX HDD Business

More than 90% of data stored in the public cloud is stored on HDDs. We see that trend continuing particularly as NAND to HDD price ratio bottom is now behind us (which affects more sentiment than actual fundamentals, in our view). We describe our HDD thesis deeply in our "Harnessing the Power of Heat" Ahead of the Curve report.

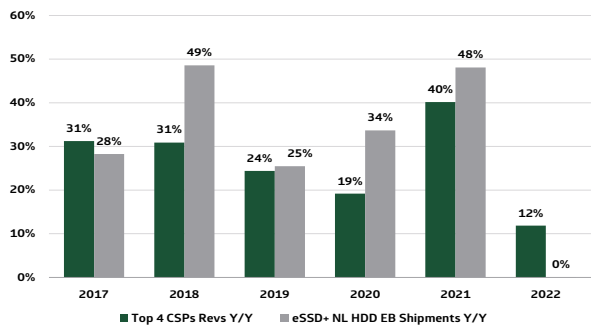
We expect nearline shipments to correspond to 70-75% of STX and WDC C24E HDD shipments, up from 50-55% in C19.

Figure 60 – Survey Respondents See Public Cloud Spending Growth in Line with Prior Years



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=654 / N=653 / N=680

Figure 61 – Nearline HDD and eSSDs Track Cloud Revenue Growth. 2022 is an Anomaly Given High HDD/SSD Inventory Levels



Source: Company Data (STX, WDC, MSFT, AMZN, GOOGL, Meta)

Implications for Cybersecurity & Information Security (Shaul Eyal)

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Threat Environment Remains Hostile; AI and ML Increase Risk

Cybersecurity risk remains elevated even though cyber threats from the Russia/Ukraine conflict have receded from the headlines. At the same time, digital transformation and the migration of workloads to the cloud becomes remain priorities for many enterprises. Respondents indicated that cybersecurity remains high on respondents the priority lists. AI and ML carry the potential to heighten the risks posed by bad actors, but also have the potential to enhance cyber-defense capabilities.

Identity, and Regulation and Compliance Rising In Importance

Identity is rising in importance as one of the key attack vectors leading to successful cybersecurity compromises. Across the globe, governments and regulatory agencies are responding to the hostile threat environment and the risks posed to citizens, critical infrastructure and organizations by introducing new requirements that carry significant potential penalties. For example, the EU's Digital Operational Resilience Act, which sets uniform requirements for the security of network and information systems of entities in the financial sector, and new SEC cybersecurity rules, implemented in 2023, requiring prompt and periodic disclosures of material cybersecurity events.

On-Premise Not Likely To Disappear

Respondents once again indicated that some data and computing resources are likely to remain on-premise instead of shifting to the Cloud, driven by requirements related to compliance and data sovereignty. As a result organizations will need to implement cybersecurity infrastructure to protect these data and computing resources.

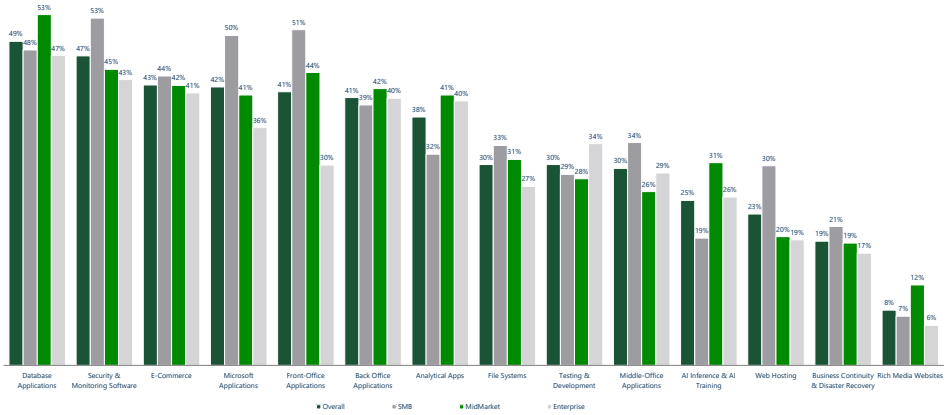
Key Attributes Of Leading Cybersecurity Vendors

In our view, best-positioned cybersecurity vendors are those that have (1) presented visions for AI and ML in the context of overall strategy and specifically as these technologies impact product roadmaps. (2) demonstrated an ability to leverage emerging security approaches, e.g. edge computing, ZTNA, SD-WAN, (3) enabled customer flexibility such as hybrid or multi-cloud approaches, and (4) articulated a strategy to leverage the channel.

Macro Backdrop Reflects Incrementally Conservative Buyer Behavior

The majority of cybersecurity vendors in our universe continue to report stable demand and healthy demand, and most are executing well and posting solid results. Still, compared to previous years, many companies in our space are reporting incrementally conservative customer buying behavior reflected in elevated deal scrutiny, especially for larger deals, and elongated sales cycles.

Figure 62 Which workloads does your organization use? - Security Among The Most Common Workloads

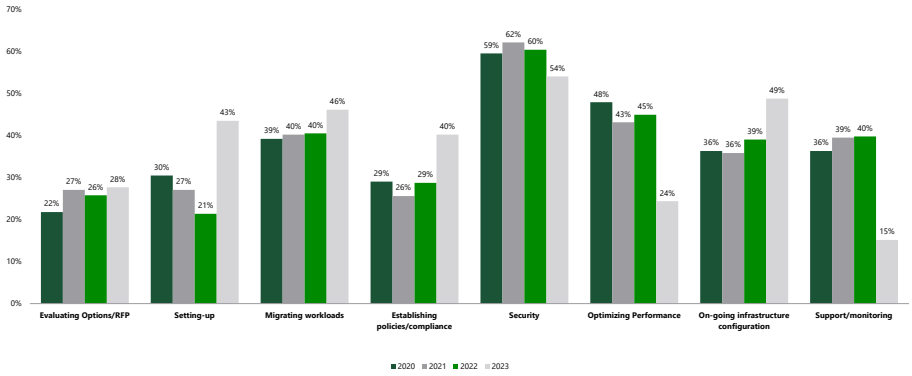


Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680

Cybersecurity Ranks 2nd Among Workload Frequency

Including all organization sizes, Security and Monitoring Software ranked second among the most commonly used workloads with 47% of respondents overall.

Figure 63 Where would you need help in planning a cloud deployment? (By year)

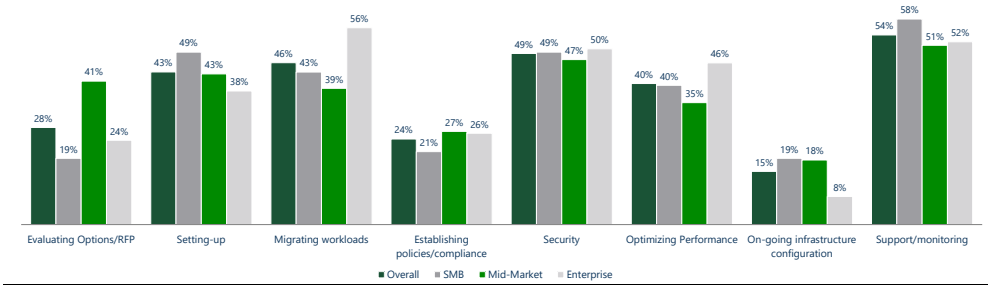


Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=152

From 2020-2023, Security Remained The Leading Concern For Cloud Deployment

Although down y/y, security retained its position as the leading concern for planning a Cloud deployment.

Figure 64 Organizations Of All Sizes Need Help With Cloud Security Deployments - *Where would you need help in planning a cloud deployment?*



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=152

Cybersecurity Remains Mission Critical

Across all organizational sizes, roughly half of respondents identified security as an area requiring cloud deployment assistance, ranging from 47% for mid-market firms to 50% for enterprises.

Figure 65 On Premise Security Likely To Persist

Workload Usage and Change in 2 Years
US, n=680, 2023

What infrastructure types are your current workloads distributed on, and how will this change in 2 years?

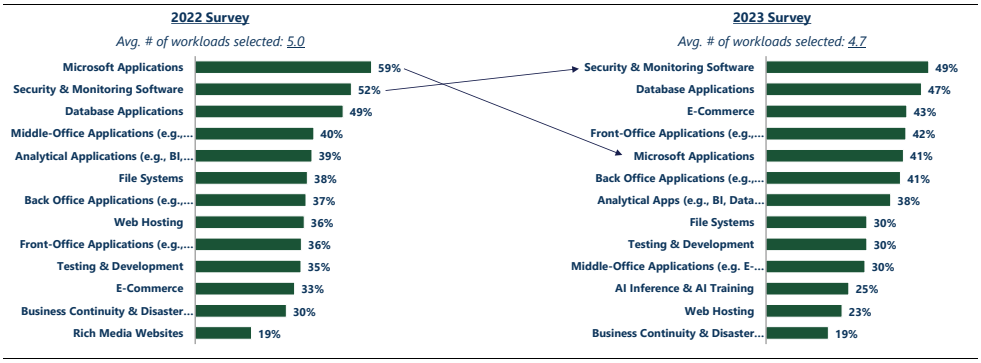
Top applications moving away from on-prem	Current % of usage					Change in usage in 2 years (in pp.)				
	Private Cloud and Hosting	Public Cloud	SaaS	Colocation	On-Premise	Private Cloud and Hosting	Public Cloud	SaaS	Colocation	On-Premise
File Systems	18%	8%	4%	17%	53%	9%	4%	-1%	1%	-14%
Business Continuity & Disaster Recovery	24%	20%	9%	20%	27%	5%	-2%	5%	2%	-11%
Microsoft Applications	22%	25%	11%	9%	34%	4%	0%	3%	3%	-10%
E-Commerce	22%	17%	5%	23%	33%	0%	3%	1%	6%	-10%
Analytical Apps	33%	16%	9%	14%	28%	-3%	4%	3%	2%	-7%
Middle-Office Applications	27%	24%	12%	13%	25%	0%	1%	1%	1%	-4%
Database Applications	29%	14%	5%	22%	30%	4%	3%	2%	-4%	-4%
Front-Office Applications	29%	18%	10%	16%	28%	2%	6%	0%	-3%	-4%
AI Inference & AI Training	27%	24%	10%	14%	25%	0%	-1%	3%	1%	-4%
Rich Media Websites	30%	23%	14%	16%	18%	-2%	2%	5%	-2%	-4%
Back Office Applications	33%	16%	9%	17%	26%	1%	3%	3%	-4%	-3%
Security & Monitoring Software	32%	16%	7%	16%	28%	2%	1%	1%	-1%	-2%
Testing & Development	26%	24%	9%	15%	26%	8%	-3%	-4%	0%	0%
Web Hosting	34%	32%	10%	10%	15%	1%	-3%	1%	0%	1%

Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680

On Premise Security Likely To Remain A Key Deployment Mode

For many organizations, on-premise security deployments will likely remain core components of security infrastructure, sustained by considerations such as compliance or data sovereignty. The survey indicates that, for Security & Monitoring Software, Private Cloud and Hosting is the most prevalent deployment modality, as indicated by 32% of respondents, and On Premise deployment was indicated by 28%. The survey also indicates that over the next 2 years, On-Premise deployment is expected to fall by 2%. Compared to most other application classes, the pace of security migration away from On-Premise is modest.

Figure 66 Workloads Supported by IT

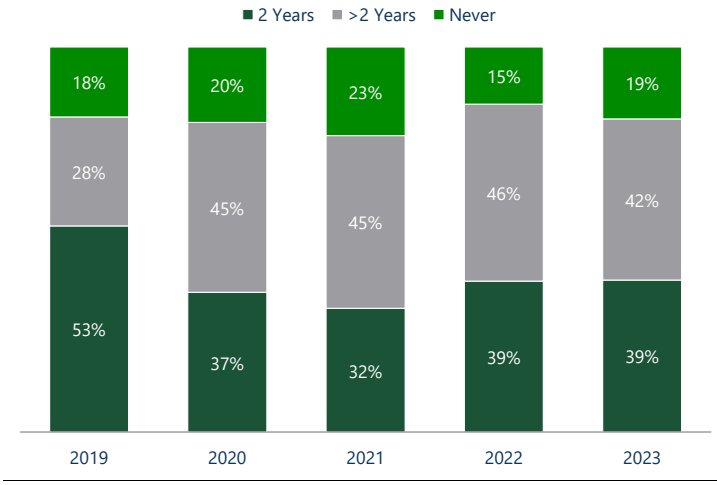


Source: TD Cowen / Altman Solon Cloud Survey, 2023. N=680

Security Is The Highest Workload Supported By IT

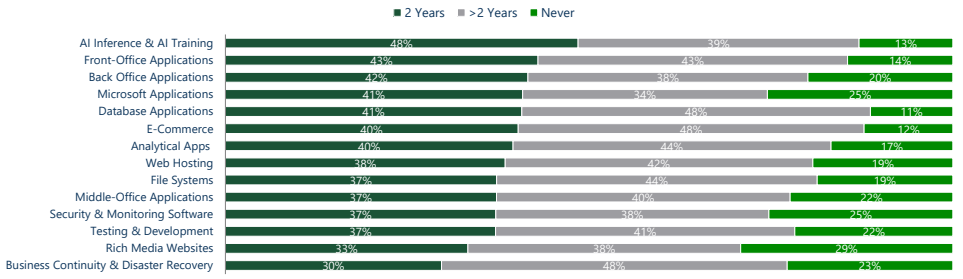
Security & Monitoring Software is the highest ranked Workload in terms of IT department support, rising one ranking level compared to 2022. Reflecting the significant risks posed by security failures, 49% of respondents reported that their firm's IT department supports security and monitoring, down from 52% in 2022.

Figure 67 Some Workloads Are Not Likely To Move To The Cloud - *When do you expect to migrate workloads not currently cloud supported?*



Source: TD Cowen / Altman Solon Cloud Survey, 2023. N=680

Figure 68 Security Workloads Are Among The Least Likely To Migrate To The Cloud - *When do you expect to migrate workloads not currently cloud supported?*

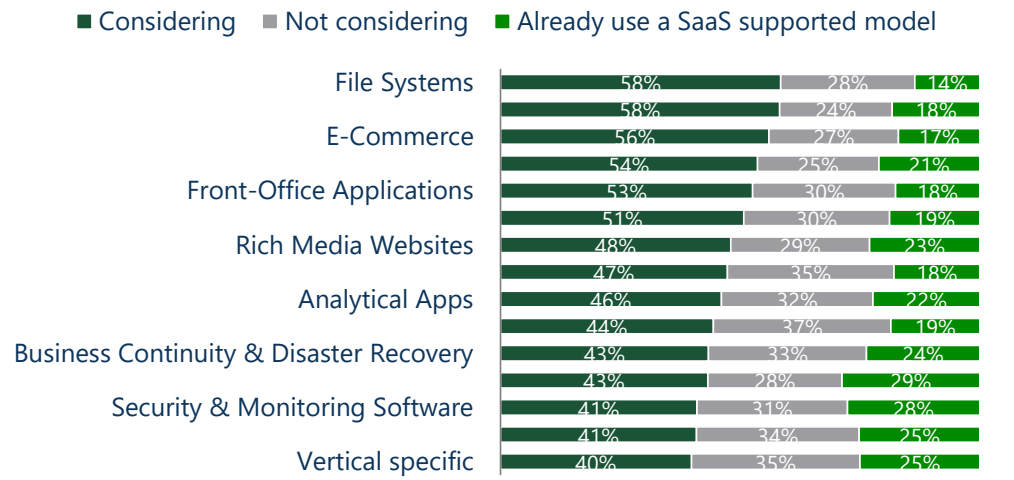


Source: TD Cowen / Altman Solon Cloud Survey, 2023. N=680

Regulatory And Data Sovereignty Requirements Restrict Security Cloud Migration

Approximately 25% of respondents expect that security workloads will never be migrated to the Cloud.

Figure 69 Most Organizations Using Or Considering SaaS Security - *Are you considering switching to a SaaS supported model in the future for any of your workloads?*

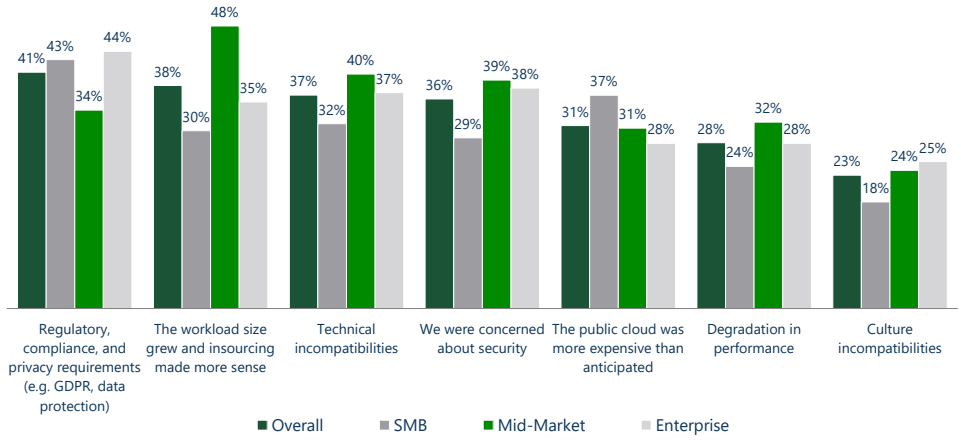


Source: TD Cowen / Altman Solon Cloud Survey, 2023. N varies by workload.

Most Respondents Using or Considering SaaS For Security

Approximately 69% of respondents reported either already using or currently considering a SaaS solutions for Security and Monitoring, with 28% already using SaaS supported security models and 41% considering its use.

Figure 70 Why did you migrate away from the public cloud?

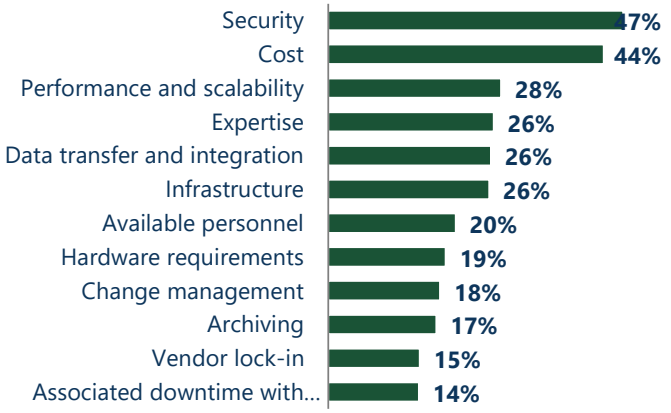


Source: TD Cowen / Altman Solon Cloud Survey, 2023; N=306.

Regulatory and Compliance, A Cybersecurity Priority, Was The Top Impetus For Migration Away From Public Cloud

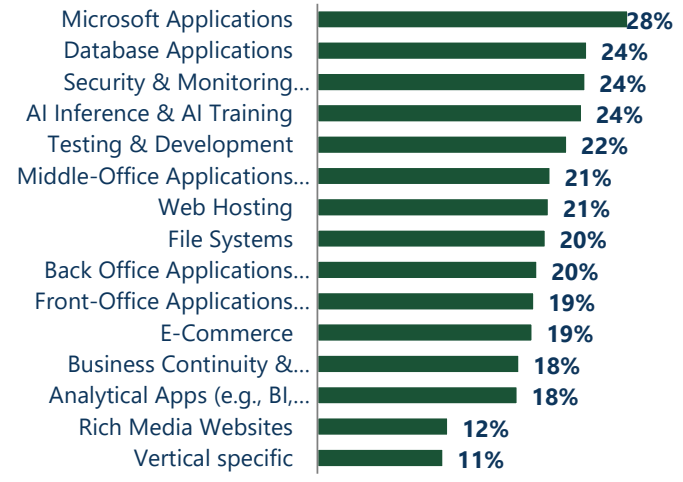
For SMB and Enterprise, security was the primary driver of migration away from Public Cloud. Cost remains a key driver as 59% of respondents identified a cost related concern.

Figure 71 What are the top 3 challenges in migrating workloads away from the public cloud?



Source: TD Cowen / Altman Solon Cloud Survey, 2023. N=680

Figure 72 What type of workloads are you considering moving to on-premise/migrating away from the public cloud?



Security Concerns Inhibit Migration Away From Public Cloud

Respondents ranked security as the top challenge (47%) in migrating away from the Public Cloud, and ranked Security & Monitoring Software as 3rd (47%) as the type of workload considered for moving away from the Public Cloud to on premises.

Figure 73 Cloud Vendors Most Frequently Chosen For Security Workloads

Multiple Cloud Vendor Workload Distribution
US, n=509, 2023

Which cloud vendor do you use for which workload?

	File Systems	E-Commerce	Database Applications	Back Office Applications	Front-Office Applications	Analytical Apps	Security & Monitoring Software	Testing & Development	Middle-Office Applications	AI Inference & AI Training	Business Continuity & Disaster Recovery	Microsoft Applications	Rich Media Websites	Web Hosting	Vertical specific
Amazon Web Services (AWS)	35%	27%	26%	24%	20%	24%	19%	16%	13%	15%	22%	18%	18%	33%	24%
Microsoft Azure	26%	18%	16%	19%	20%	20%	22%	23%	28%	21%	25%	42%	18%	18%	14%
(GCE)/Google Cloud Platform	18%	19%	17%	20%	21%	18%	16%	19%	14%	19%	14%	12%	10%	14%	14%
IBM Cloud	13%	17%	21%	15%	15%	14%	16%	14%	19%	13%	17%	10%	10%	16%	10%
SAP Cloud Platform	2%	5%	4%	5%	8%	6%	6%	11%	9%	9%	5%	4%	9%	5%	10%
Oracle Cloud Infrastructure	2%	4%	7%	4%	4%	6%	7%	5%	4%	7%	9%	4%	4%	7%	5%

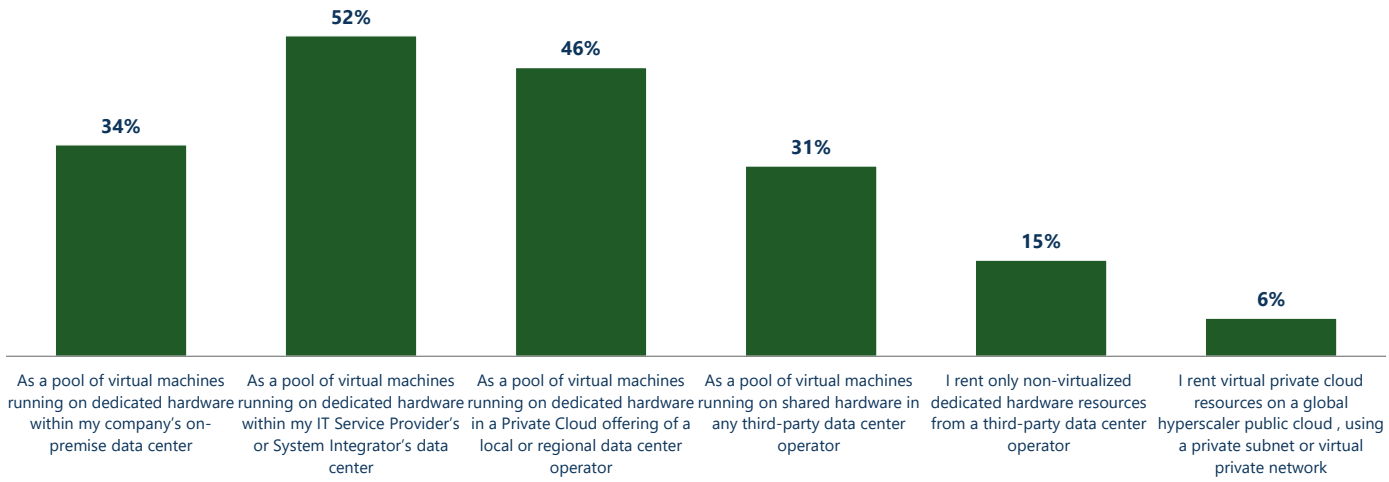
Source: TD Cowen / Altman Solon Cloud Survey, 2023. N=509

Vendors Most Frequently Chosen For Security & Monitoring Workloads

Microsoft Azure with 22% and Amazon AWS with 19% ranked highest as cloud security services vendors most frequently selected for Security & Monitoring workloads.

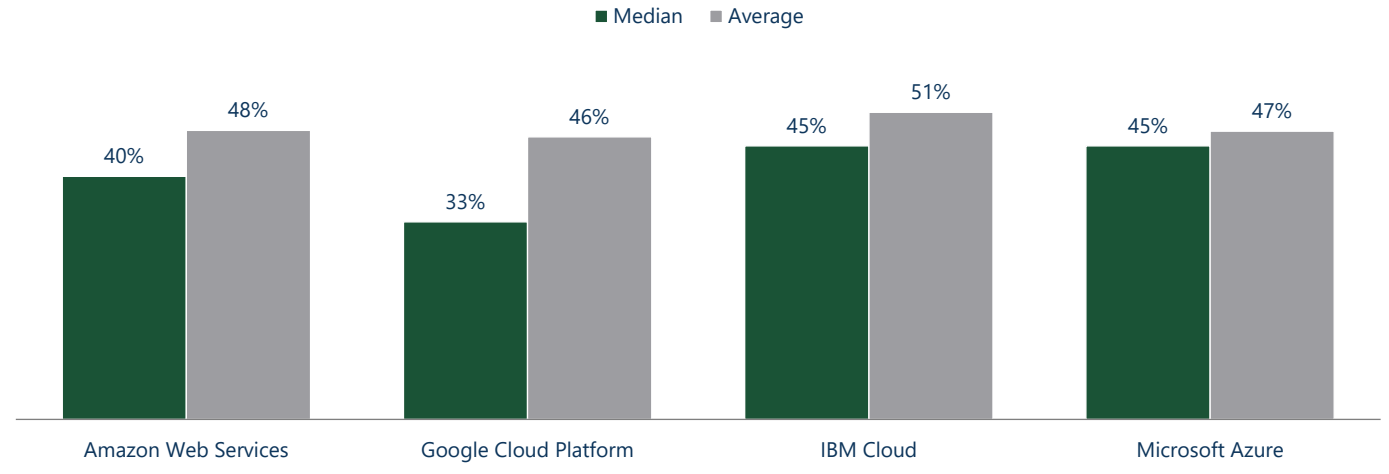
Public Cloud Survey Data - Appendix

Figure 74 Which of the following models best describes how your Private Cloud and/or Hosting is deployed?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=588.

Figure 75 How do you expect your organizational annual spend on Public Cloud Providers to change vs last year?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N varies by provider.

Figure 76 What percentage of your organization's current workloads do you never expect to transition to cloud?

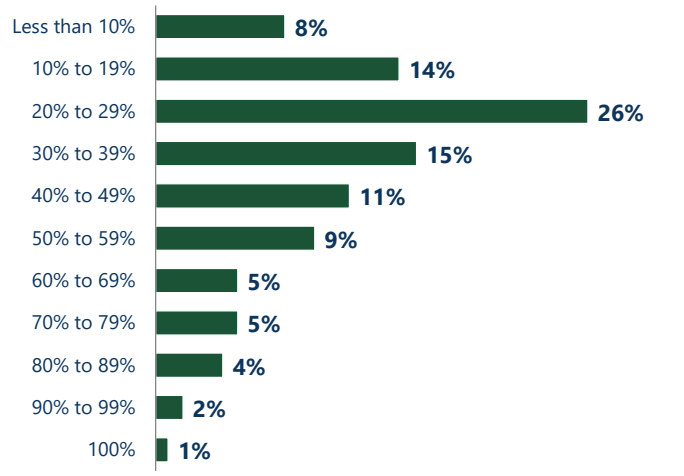
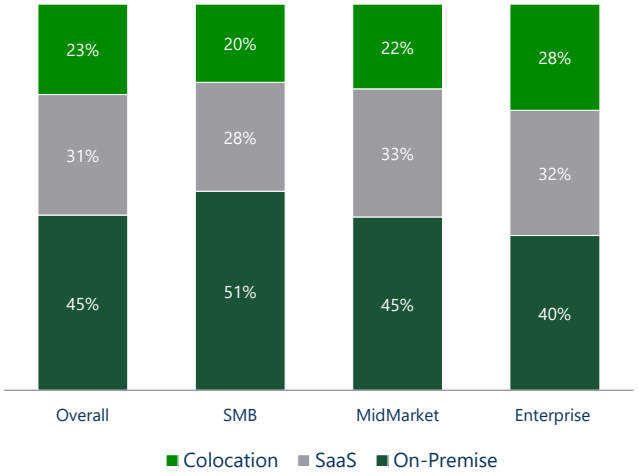
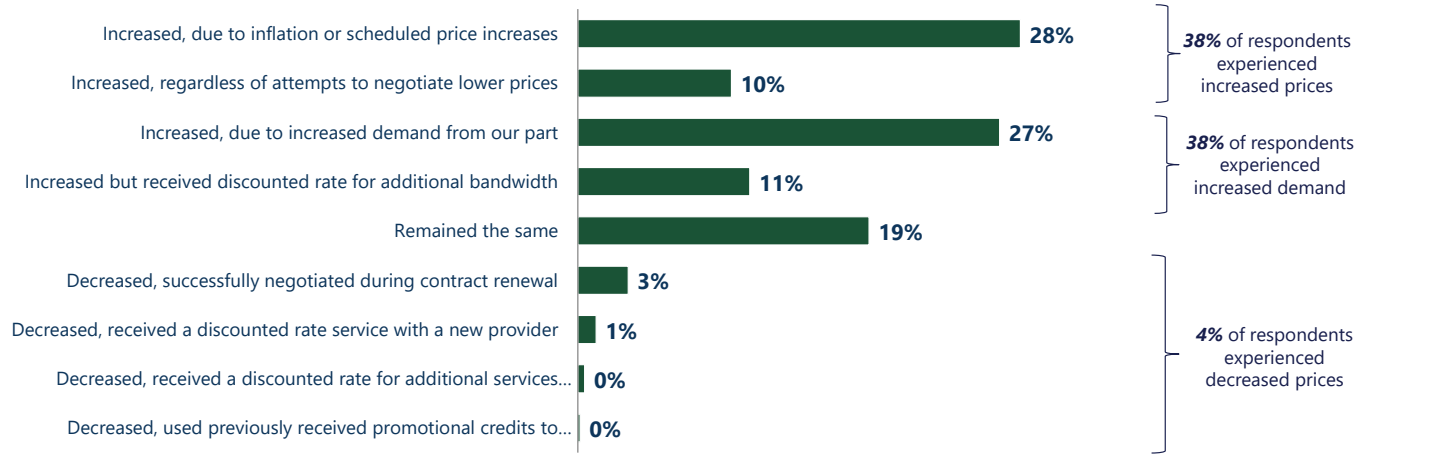


Figure 77 Of your workloads that are not suited to the cloud, where do you expect them to be held?



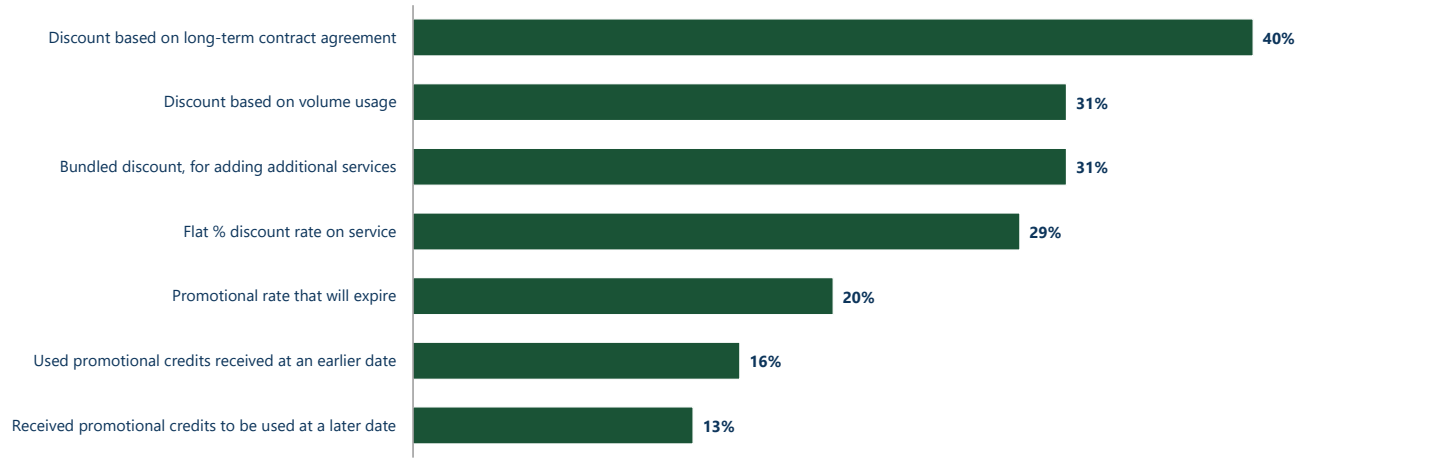
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Figure 78 In the past year, how have your public cloud prices changed and what are some reasons prices may have changed?



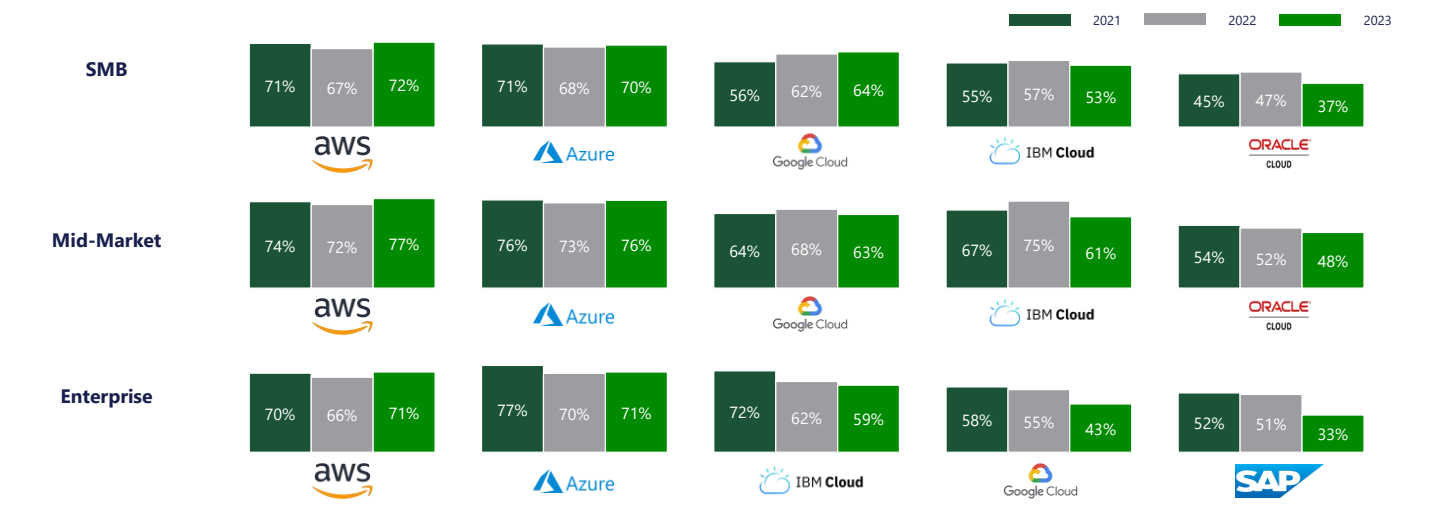
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Figure 79 When purchasing public cloud services, have you received alternative pricing rates or methods?



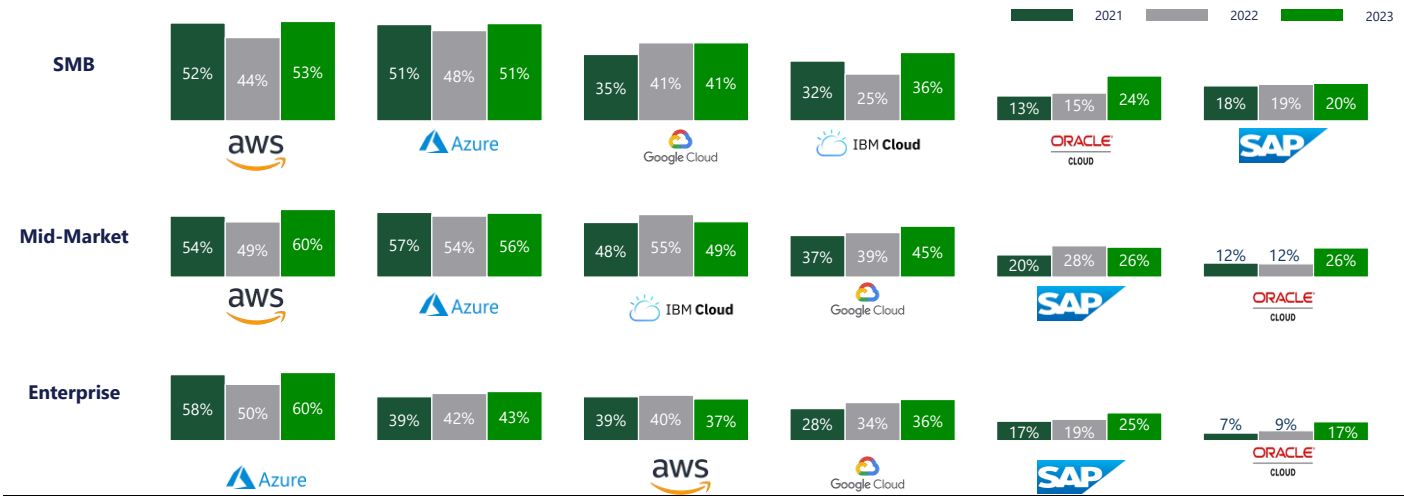
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=45.

Figure 80 Which of the following 3rd party cloud providers are you familiar with?



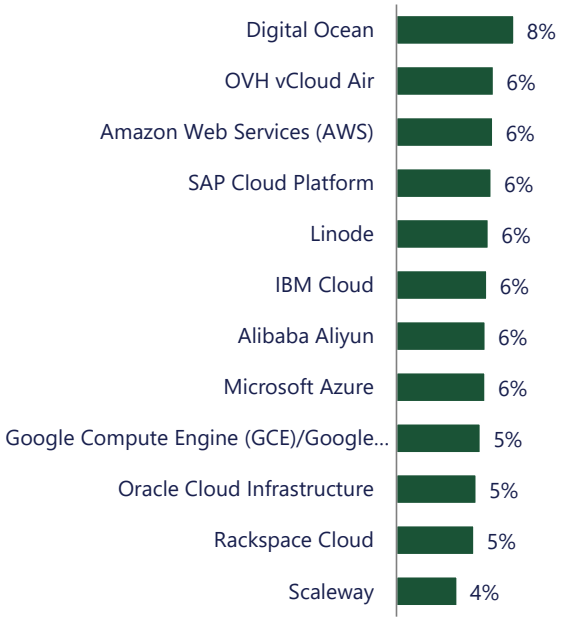
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Figure 81 Which of the following public cloud service providers do you currently use?



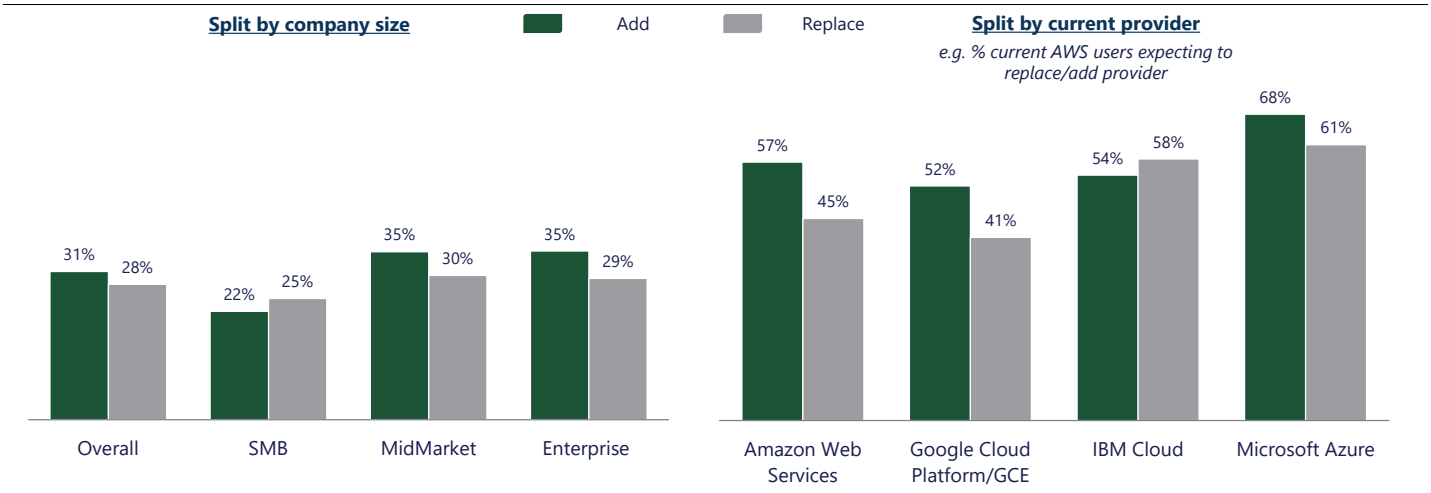
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Figure 82 How do you anticipate provider spend will shift in the coming year?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=581.

Figure 83 Do you expect to add or to replace your cloud provider in the next two years?



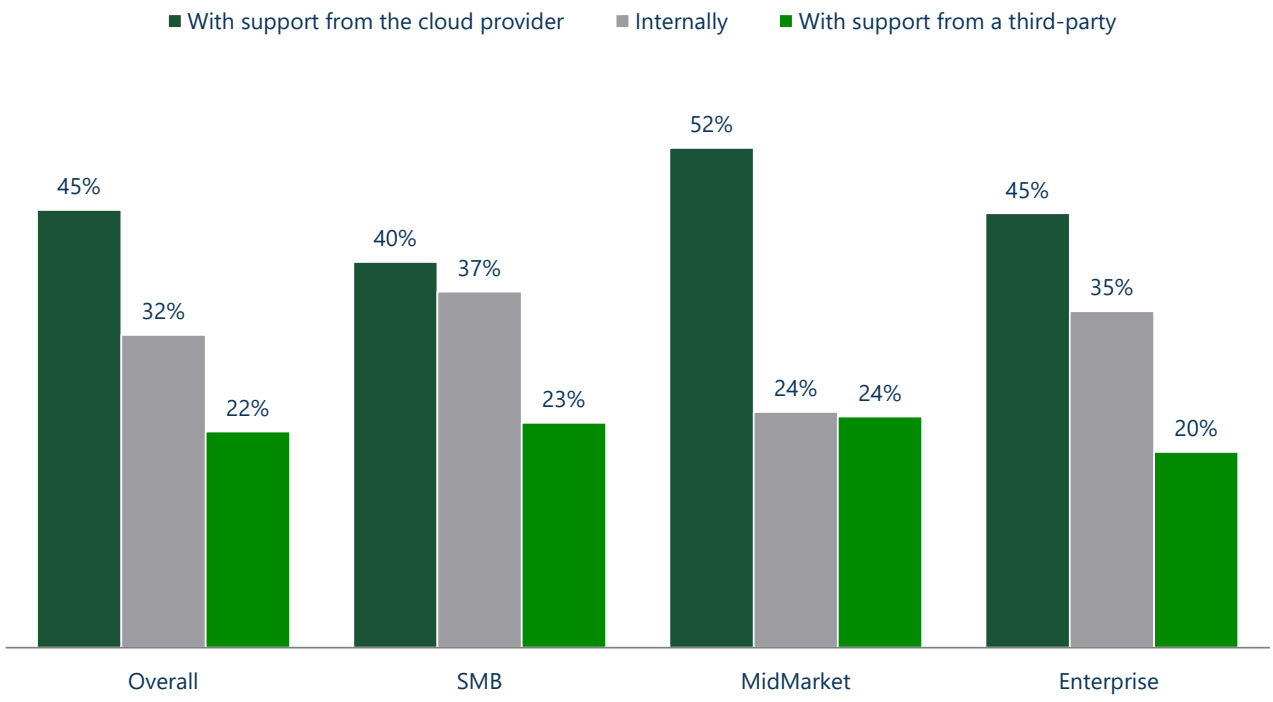
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680. N varies

Figure 84 For each infrastructure type, how does your organization purchase the services today?

	Direct	Indirect				
2023 Survey						
	Directly from Service Provider	Value Added Reseller	System integrator/IT provider	Managed Service Provider	Telecom service provider	Data center infrastructure provider
Co-location	31%	26%	17%	19%	6%	n/a
Private Cloud and Hosting	34%	21%	19%	17%	6%	4%
Public Cloud	38%	20%	14%	18%	7%	4%
SaaS	35%	21%	18%	17%	4%	6%
2022 Survey						
Co-location	41%	15%	9%	24%	11%	n/a
Private Cloud and Hosting	29%	16%	7%	18%	12%	19%
Public Cloud	29%	13%	8%	20%	14%	16%
SaaS	34%	15%	9%	18%	7%	18%
Change from 2022 to 2023						
Co-location	-10%	11%	8%	-5%	-4%	n/a
Private Cloud and Hosting	5%	5%	11%	-1%	-6%	-14%
Public Cloud	9%	6%	6%	-2%	-7%	-12%
SaaS	0%	6%	9%	-1%	-2%	-12%

Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Figure 85 How does your organization support / manage your cloud infrastructure?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=415.

Figure 86 What are the top factors when selecting a 3rd party support vendor?

Weighted Rank*	2023 Survey n=152	% 1st Place	% 2nd Place
1	*Cost management*	*41%*	*25%*
2	*Performance optimization*	*38%*	*39%*
3	*Service provider selection & environment design*	*35%*	*37%*

Weighted Rank*	2022 Survey n=136	% 1st Place	% 2nd Place
1	*Security & compliance*	*36%*	*29%*
2	*Performance optimization*	*36%*	*40%*
3	*Monitoring & support*	*28%*	*43%*

Source: TD Cowen / Altman Solon Cloud Survey, July 2023.

Figure 87 What services do you currently use to connect to your cloud network infrastructure?

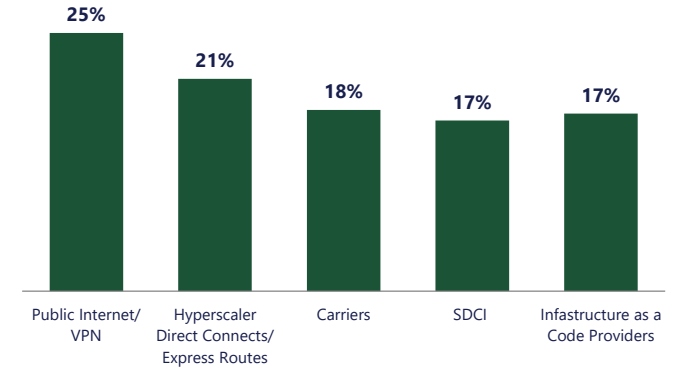
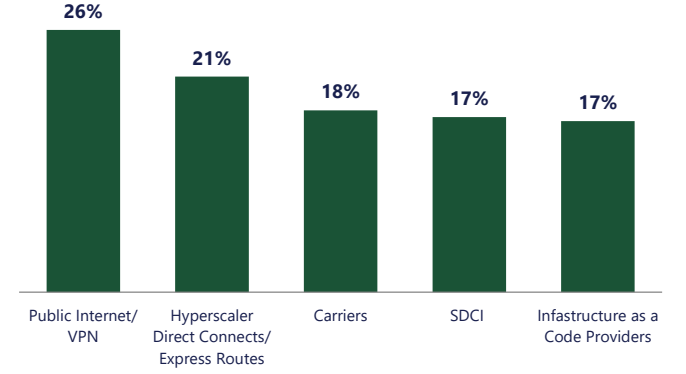
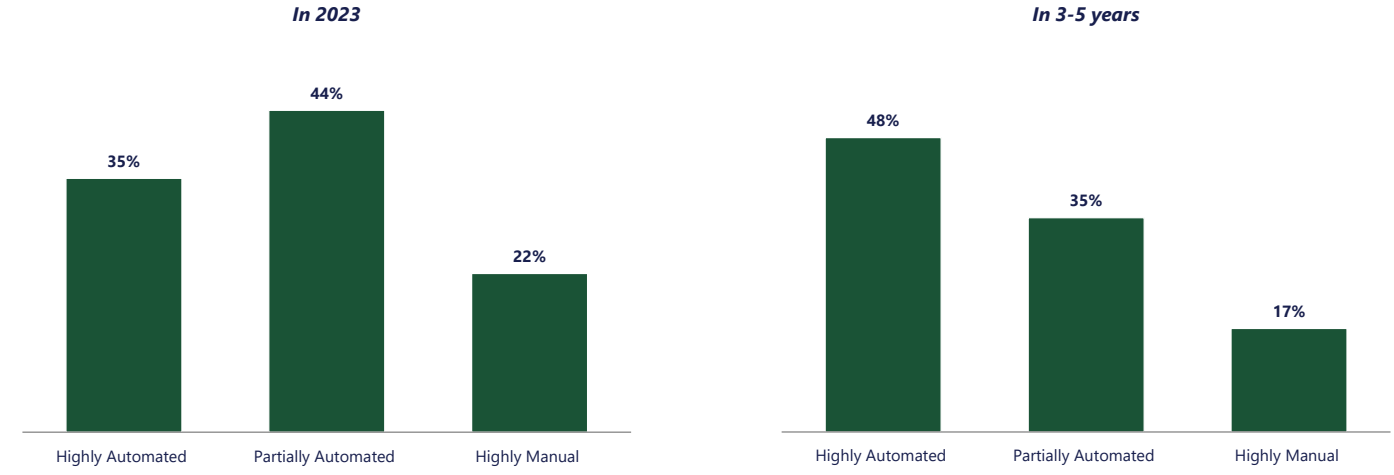


Figure 88 What services do you expect to use to connect to your cloud network infrastructure in 3-5 years?



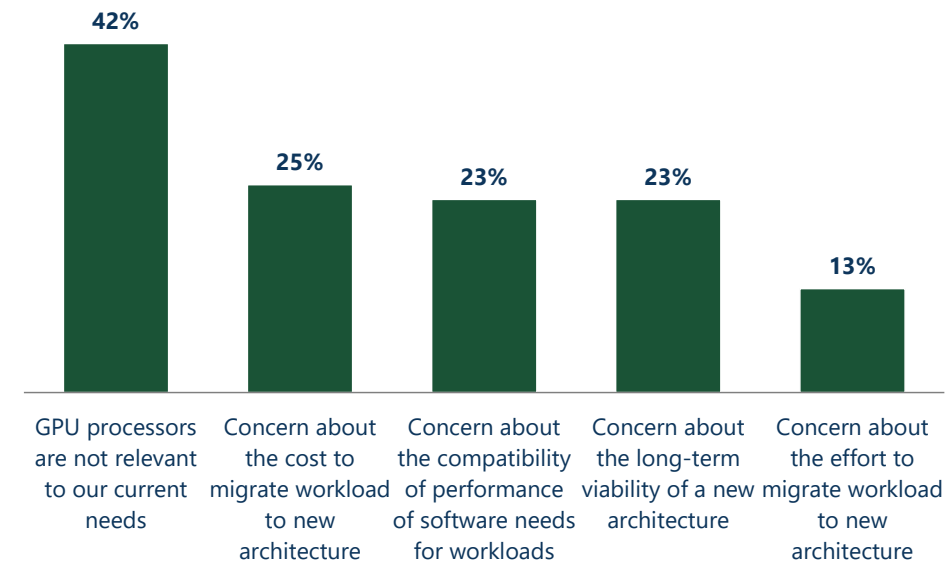
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Figure 89 How automated is your cloud network architecture?



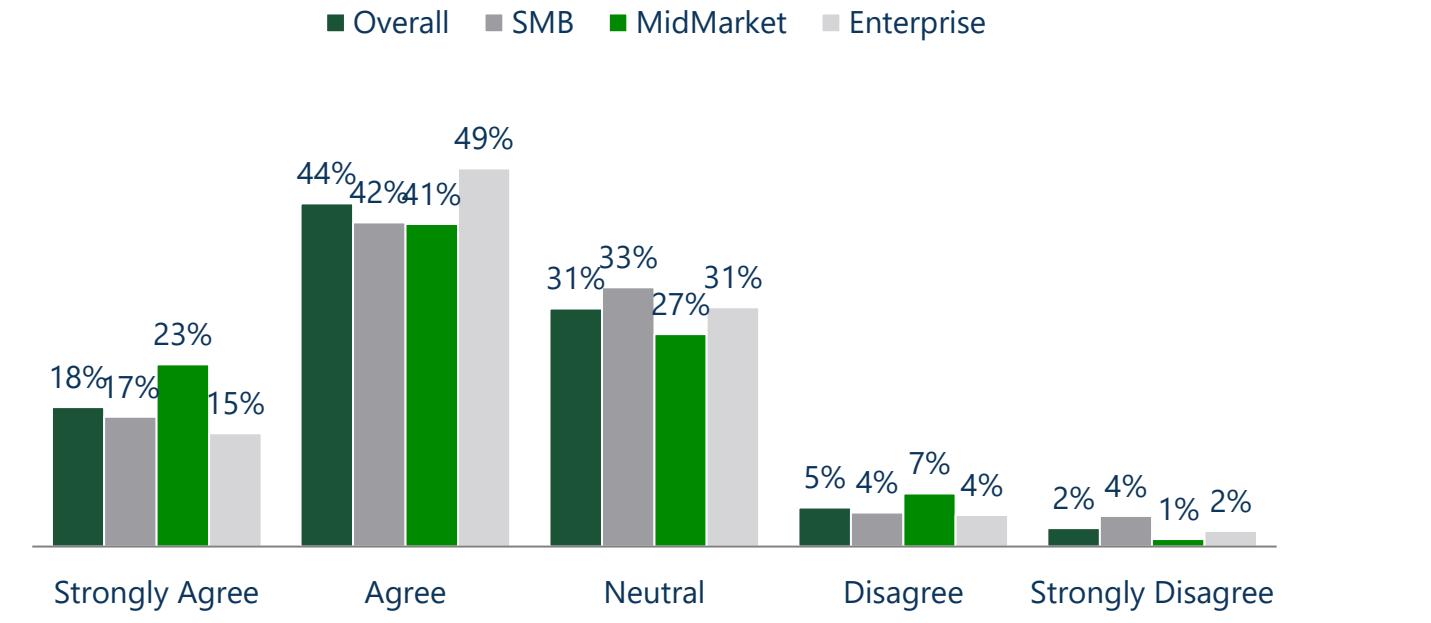
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Figure 90 What are your reasons for not switching to GPU processors or custom chips?



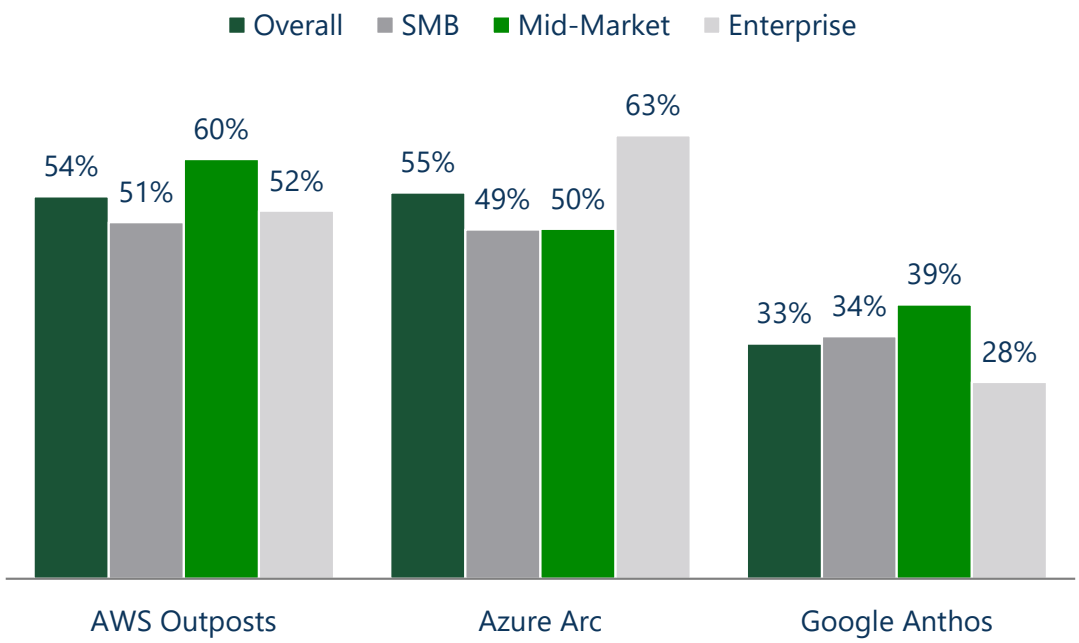
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=112.

Figure 91 If a cloud provider were to provide infrastructure in a local zone closer to my organization, I would consider switching to that provider?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Figure 92 Please select which on-premise cloud as a service solution(s) you currently use?

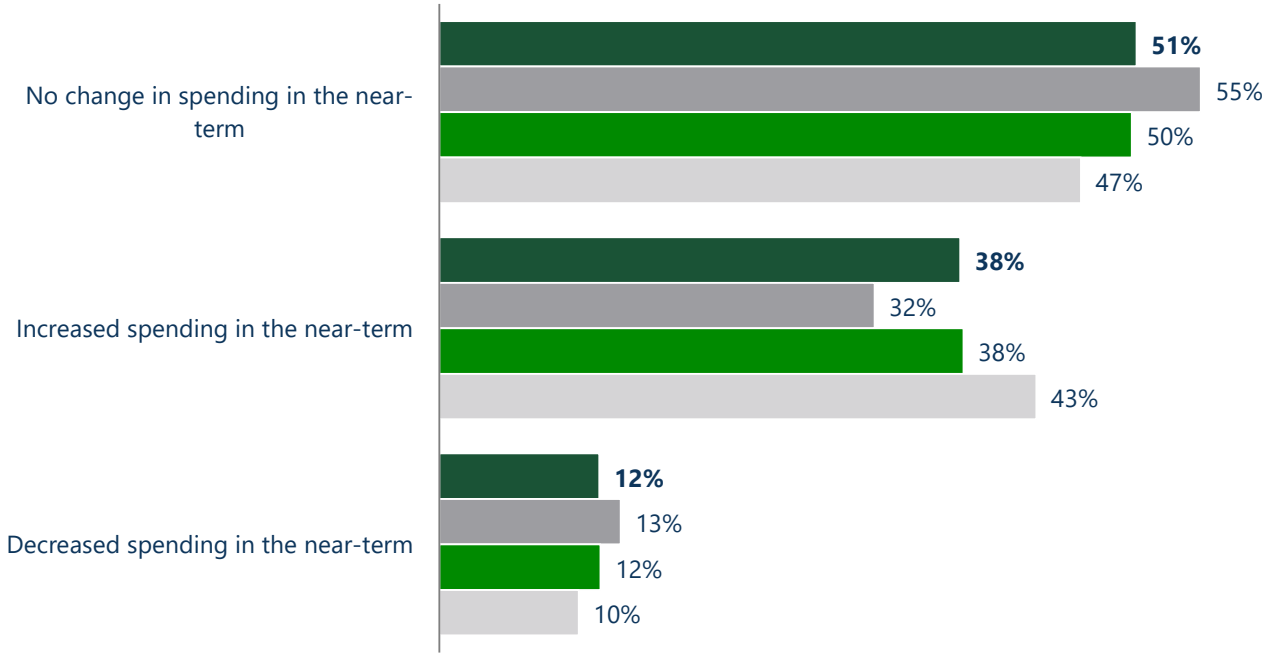


Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680 / N=495

Figure 93 What are the reasons behind using OpCaaS?

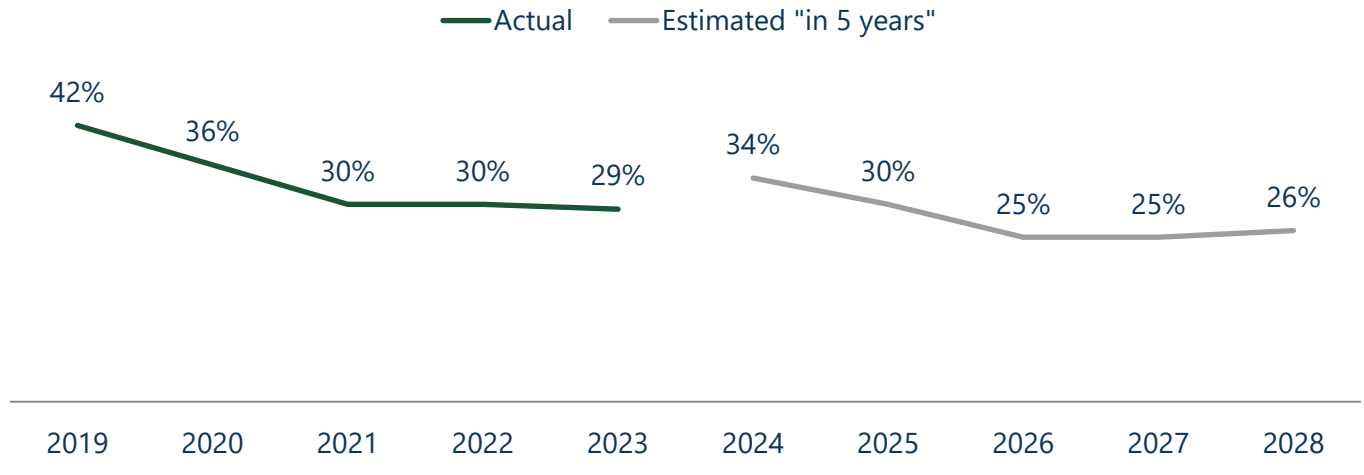
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=498.

Figure 94 How have macroeconomic events changed your near-term plan for cloud spending?



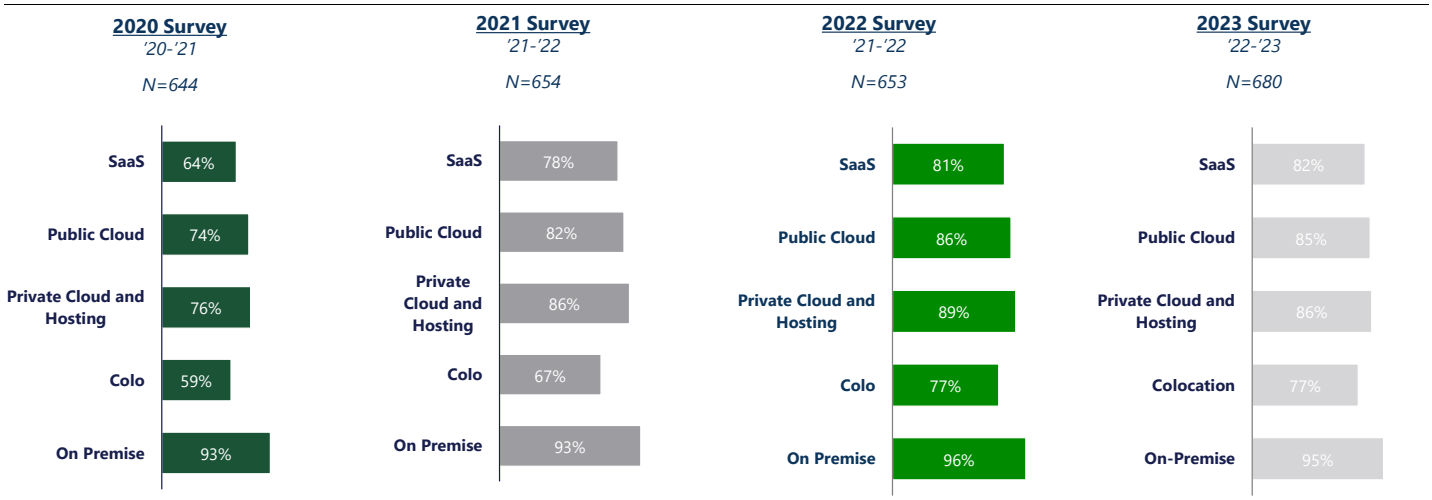
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Figure 95 What % of your workloads are supported by on-premise infrastructure?



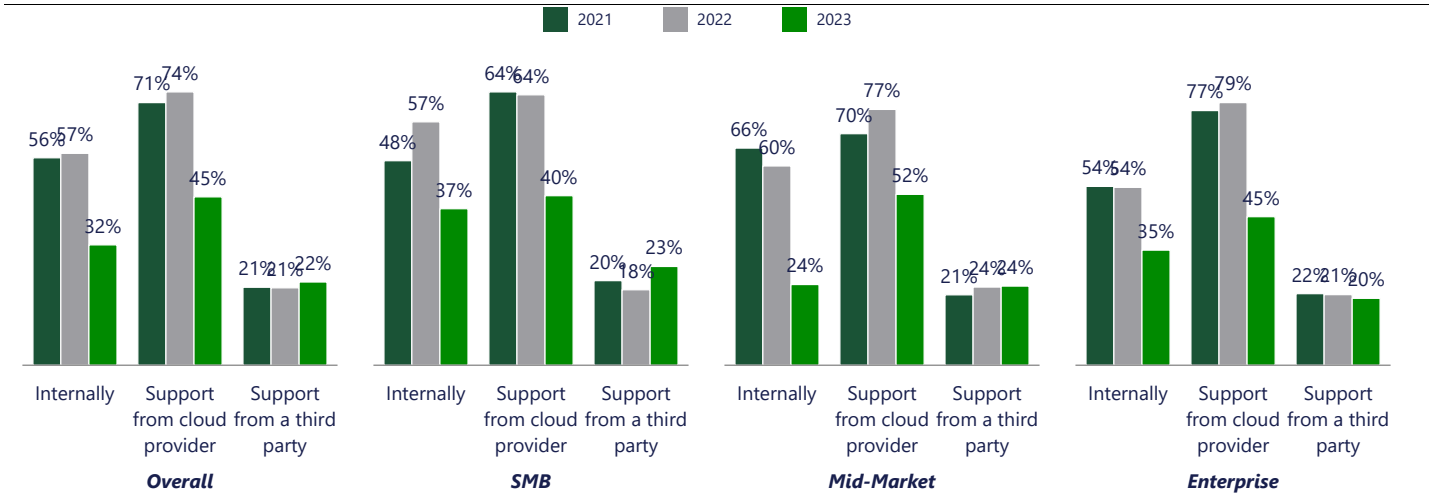
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=644.

Figure 96 % of Survey Respondents who reported a particular infrastructure type used in their organization



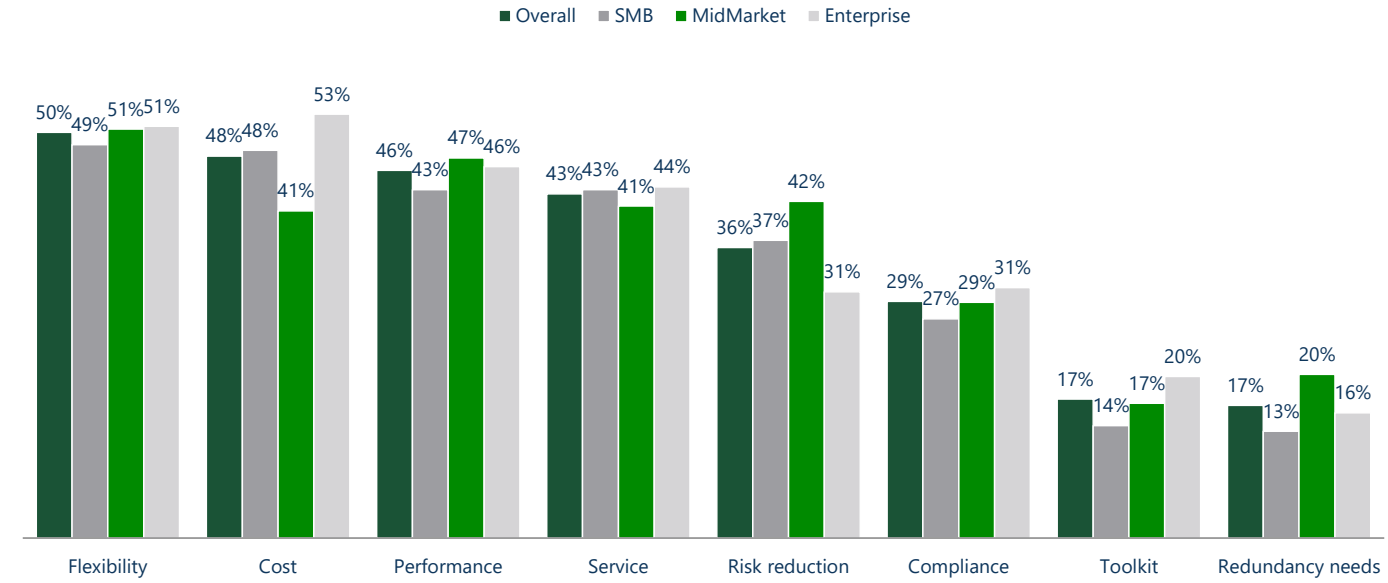
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=644 / N=654 / N=653 / N=680

Figure 97 How does your organization support / manage your cloud infrastructure?



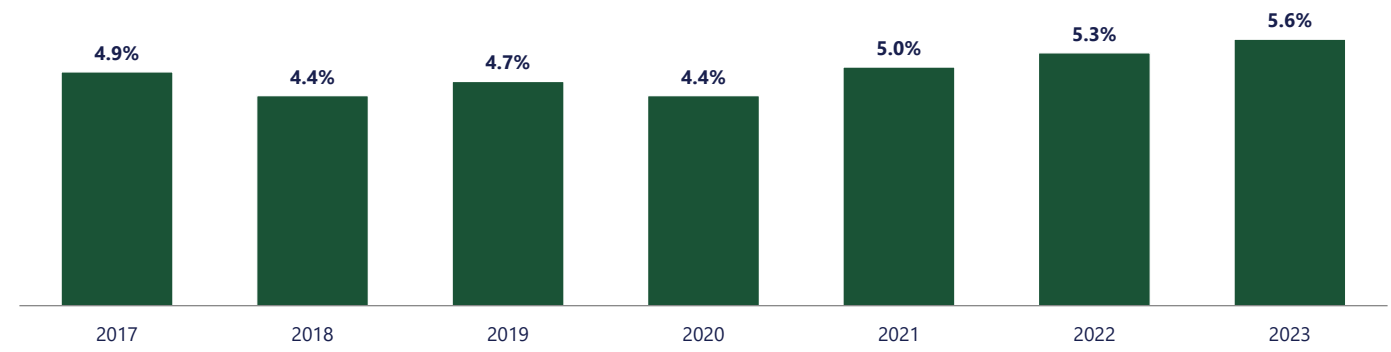
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=415.

Figure 98 Why has your organization chosen to use multiple cloud service providers?



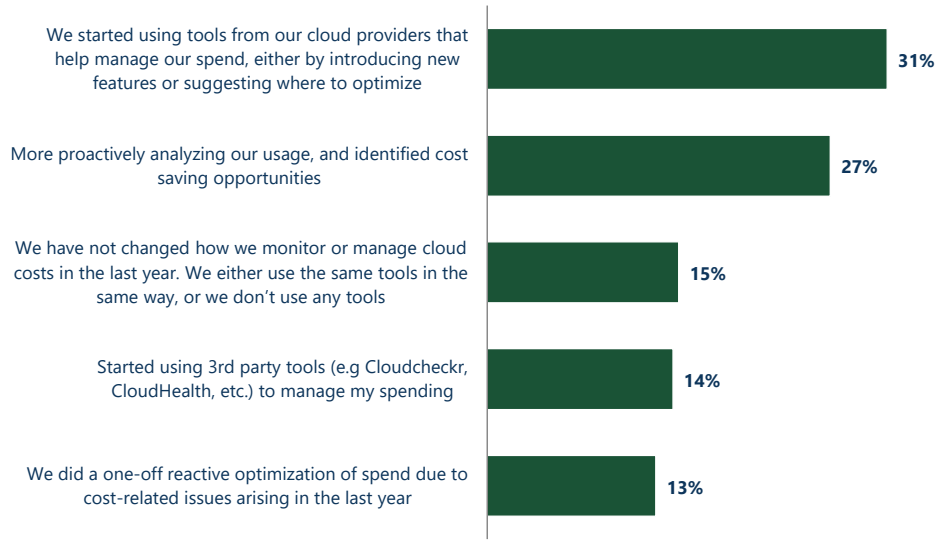
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=509.

Figure 99 How do you expect your spend on 3rd party infrastructure service providers to change in 2023 as compared to 2022?



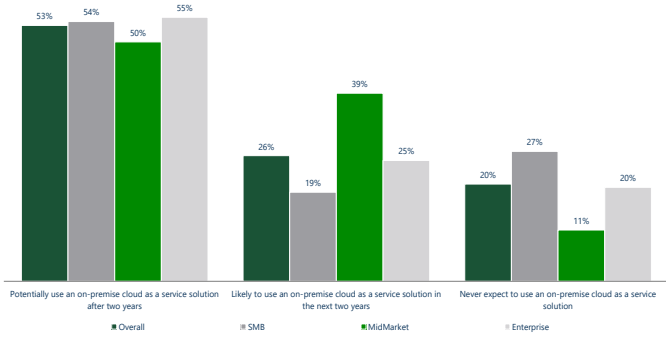
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N= 680.

Figure 100 Have you or your organization taken any initiatives to better understand how much you spend on public cloud?



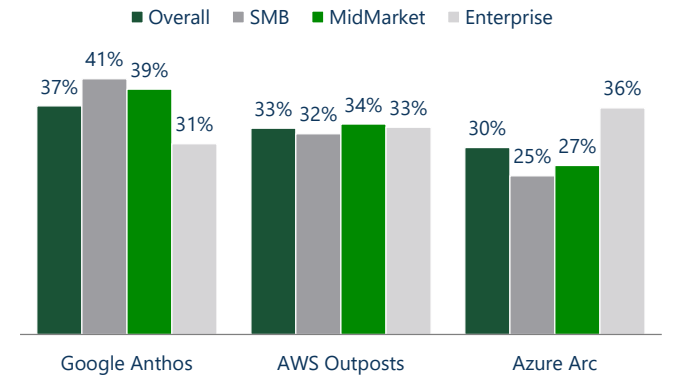
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=680.

Figure 101 How likely are you to use an on-premise cloud as a service solution in the next two years?



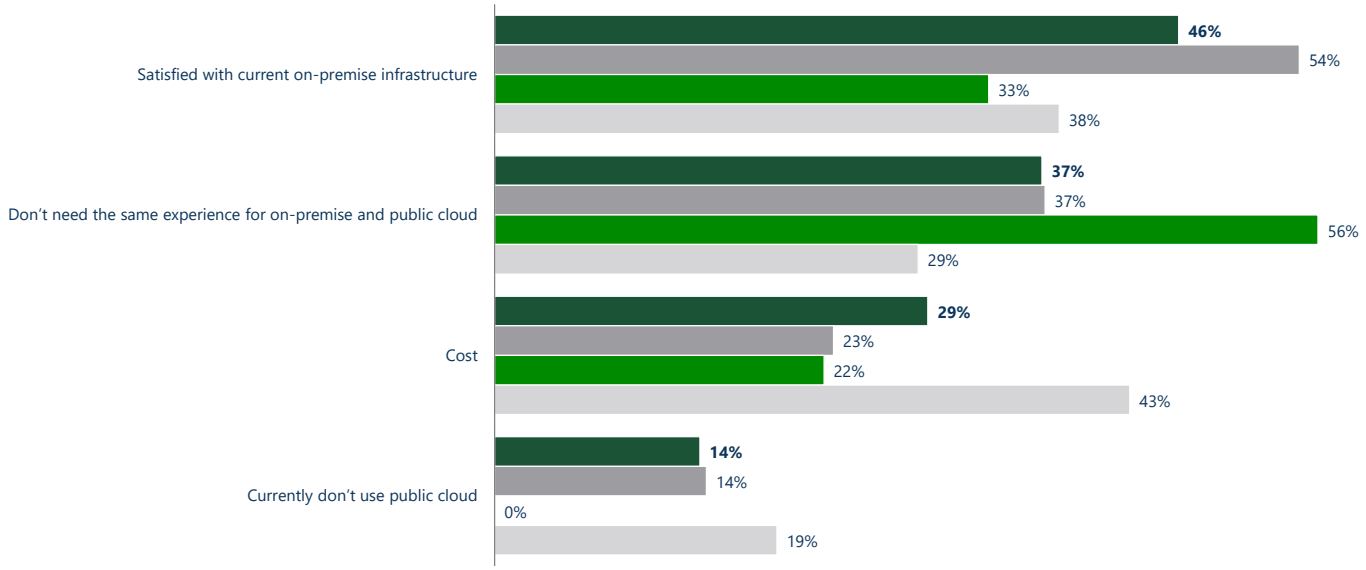
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=320.

Figure 102 Which on-premise cloud as a service solution provider are you most likely to use?



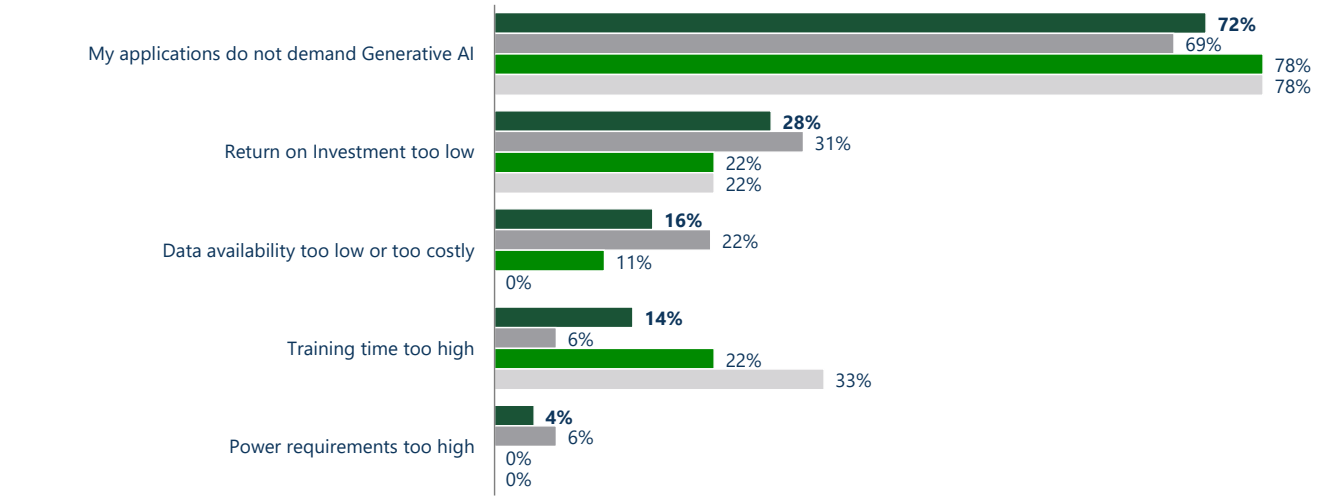
Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=615.

Figure 103 Why do you never expect to use on-premise as a service solutions?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=65.

Figure 104 Why are you not invested in or evaluating Generative AI?



Source: TD Cowen / Altman Solon Cloud Survey, July 2023. N=50.

Ticker	Rating	Price*	Price Target
AMZN	Outperform	$129.12	$165.00
EQIX	Outperform	$731.91	$822.00
MSFT	Outperform	$317.01	$390.00
DXC	Market Perform	$20.30	$25.00
SAP	Market Perform	$132.65	$140.00
DAVA	Outperform	$55.87	$70.00
ORCL	Outperform	$109.03	$137.00
NVDA	Outperform	416.10	$600.00
EPAM	Market Perform	$261.00	$252.00
WDC	Outperform	$45.14	$50.00
PSTG	Outperform	$34.63	$50.00
CRM	Market Perform	$206.43	$230.00
TWLO	Market Perform	$59.29	$60.00
CTSH	Market Perform	$69.61	$70.00
MRVL	Outperform	$52.30	$65.00
DDOG	Outperform	$88.76	$120.00
TENB	Outperform	$45.66	$55.00
CFLT	Outperform	$29.41	$40.00
CRWD	Outperform	$162.57	$180.00
DELL	Market Perform	$70.05	$58.00
NET	Outperform	$57.76	$80.00
TWKS	Market Perform	$4.16	$6.00
ZS	Outperform	$151.71	$195.00
OKTA	Outperform	$80.68	$100.00
GOOG	Outperform	$131.25	$150.00
DLR	Market Perform	$123.24	$108.00
ACN	Market Perform	$316.09	$312.00
MPWR	Outperform	$449.29	$625.00
AMD	Outperform	$96.20	$135.00
LSCC	Outperform	82.72	$105.00
GLOB	Outperform	$199.66	$205.00
WDAY	Outperform	$230.82	$270.00
IFX.GR	Outperform	€31.40	€42.00
STX	Outperform	$65.90	$78.00
NTAP	Outperform	76.02	$90.00
SNOW	Outperform	$149.70	$205.00
INFY	Market Perform	$17.78	$16.00
GDYN	Market Perform	$11.94	$11.00
HUBS	Outperform	$482.39	$625.00
HCP	Outperform	$23.00	$33.00
META	Outperform	$299.08	$365.00
CHKP	Outperform	$137.40	$160.00
CYBR	Outperform	$167.67	$195.00
FTNT	Market Perform	$58.24	$70.00
PANW	Outperform	$228.51	$295.00
VRNS	Outperform	$30.54	$37.00
S	Outperform	$15.80	$20.00

**As of 09/22/2023*

VALUATION METHODOLOGY AND RISKS

Valuation Methodology

Computer Services & IT Consulting:

We use forward P/E and EV/EBITDA multiples to value the companies in the Computer Services industry. We support our valuation with cash per share analysis.

We make investment recommendations on certain early stage, pre-revenue companies based upon an assessment of their business model, technology, probability of market success, and the potential market opportunity, balanced by an assessment of applicable risks. Such companies may not be assigned a price target.

Cybersecurity & Information Security:

Our valuation methodology is primarily based on Enterprise Value to Free Cash Flow (EV/FCF), followed by Price-to-Earnings (P/E). However, this varies by company; for instance, we will often use Enterprise Value to Revenue (EV/Revs) or a discounted cash flow (DCF) analysis for software companies that are primarily subscriptions-based, or for growth companies that have recently entered the public equity markets.

We make investment recommendations on certain early stage, pre-revenue companies based upon an assessment of their business model, technology, probability of market success, and the potential market opportunity, balanced by an assessment of applicable risks. Such companies may not be assigned a price target.

Data Centers:

Our valuation methodology consists of an absolute and relative value approach. We arrive at a fair value utilizing either 1) a five-year discounted cash flow (DCF), 2) a segmented sum-of-parts (SOP) analysis, or 3) a segmented hybrid valuation using both a SOP and a NAV analysis. Our relative value approach takes into account EV/EBITDA, EV/FRE, P/FFO, P/AFFO, dividend yield, cap rates, P/FCF, P/FRE, and when applicable P/E.

We make investment recommendations on certain early stage, pre-revenue companies based upon an assessment of their business model, technology, probability of market

success, and the potential market opportunity, balanced by an assessment of applicable risks. Such companies may not be assigned a price target.

E-Commerce:

Our valuation methodology is primarily based on Discounted Cash Flow analysis, comparable company multiples such as EV/FCF, EV/EBITDA, and P/E, and sum-of-the-parts analysis (for companies with ownership stakes in other equities or significant assets such as patents/ IP). However, this varies by company; for instance, we will often use EV/Revenue for high-growth companies that have recently entered the public equity markets.

We make investment recommendations on certain early stage, pre-revenue companies based upon an assessment of their business model, technology, probability of market success, and the potential market opportunity, balanced by an assessment of applicable risks. Such companies may not be assigned a price target.

IT Hardware:

Our valuation methodology is primarily based on a P/E multiple applied to our out year EPS forecast. In some cases we employ a sum-of-the-parts (SOTP) calculation where an appropriate P/E multiple is applied to forward earnings projections for the different business segments, plus estimated excess net cash per share.

We make investment recommendations on certain early stage, pre-revenue companies based upon an assessment of their business model, technology, probability of market success, and the potential market opportunity, balanced by an assessment of applicable risks. Such companies may not be assigned a price target.

Internet & New Media:

Our valuation methodology is primarily based on Discounted Cash Flow analysis, comparable company multiples such as EV/FCF, EV/EBITDA, and P/E, and sum-of-the-parts analysis (for companies with ownership stakes in other equities or significant assets such as patents/ IP). However, this varies by company; for instance, we will often use EV/Revenue for high-growth companies that have recently entered the public equity markets.

We make investment recommendations on certain early stage, pre-revenue companies based upon an assessment of their business model, technology, probability of market success, and the potential market opportunity, balanced by an assessment of applicable risks. Such companies may not be assigned a price target.

Semiconductors:

Our valuation methodology is primarily based on forward P/E multiples plus cash followed by EV/EBITDA. In many cases, we use EV/sales as a third methodology.

We make investment recommendations on certain early stage, pre-revenue companies based upon an assessment of their business model, technology, probability of market success, and the potential market opportunity, balanced by an assessment of applicable risks. Such companies may not be assigned a price target.

Software:

Our valuation methodology is primarily based on Enterprise Value to Free Cash Flow (EV/ FCF), followed by Price-to-Earnings (P/E). However, this varies by company; for instance, we will often use Enterprise Value to Revenue (EV/Revs) or a discounted cash flow (DCF) analysis for software companies that are primarily subscriptions-based, or for growth companies that have recently entered the public equity markets.

We make investment recommendations on certain early stage, pre-revenue companies based upon an assessment of their business model, technology, probability of market success, and the potential market opportunity, balanced by an assessment of applicable risks. Such companies may not be assigned a price target.

Storage & Peripherals:

Our valuation methodology is primarily based on EV/EBITDA followed by forward P/E multiples. In many cases we use EV/FCF as a third methodology.

We make investment recommendations on certain early stage, pre-revenue companies based upon an assessment of their business model, technology, probability of market success, and the potential market opportunity, balanced by an assessment of applicable risks. Such companies may not be assigned a price target.

Investment Risks

Computer Services & IT Consulting:
Global economic growth could impact discretionary spending
The IT Services industry is sensitive to global economic growth. During a downturn or a recession, clients tend to reduce discretionary spending, which would have a direct negative impact on revenue growth at global and offshore IT Services vendors.
Wage inflation
If wage costs increase at a faster rate than billing rates, IT Services vendors will experience a negative effect on margins and profitability. In addition, if wage costs will increase at a faster rate than the historical average, the vendors' services could become less attractive for N.A. and European clients, which will impact efficiency, utilization and profitability. In addition, the issuance of stock based compensation for IT professionals could result in dilution to shareholders.
Foreign exchange risk
While the companies' consolidated financial statements are reported in U.S. dollars, a portion of the revenues (varies by company) is generated in other currencies (euros, INR, British pounds, etc.). In addition, in most cases, costs are not incurred in U.S. dollars. For example, the offshore vendors incur most of their costs in INR. This creates a currency and hedging risk.

Cybersecurity & Information Security:

The global economy or specific end markets significantly worsen, contracting IT spending and impairing software growth. The rate of SaaS/Cloud adoption slows, resulting in prolonged sales cycles and higher-than-anticipated quarterly volatility across much of our coverage universe. Competition increases materially, driving deflationary pricing pressure and compressing margins. In particular, innovation by new entrants in the software sector often produces solutions with similar or better functionality at materially lower prices than incumbents' legacy offerings.

Data Centers:

Risks Include: (1) Communication Infrastructure stocks can be more sensitive to movements (or expectation of movements) in interest rates with higher/lower rates often leading to an outsized decrease/increase in stock price; (2) rapidly changing/disruptive technology, new product/service offerings, and evolving industry/technology standards could have an impact on demand and/or pricing; and (3) deterioration in the macro environment both domestically and internationally could lead to a reduction in demand and a consequent impact on valuation multiples.

E-Commerce:

The industry in which our companies operate is fiercely competitive and technological change is rapid. All of our companies face the risk that they are unable to keep pace with new innovations or that new innovations impact competitive positioning. Our companies are international operators and are therefore exposed to currency fluctuations and other factors associated with operating in a foreign territory. Finally, our names sit within traditional commerce and retail space and are exposed to the same seasonality and macro trends as the rest of the industry, including competition from offline retailers.

IT Hardware:

The IT Hardware industry has a strong correlation to PC, Server units and global GDP trends. We expect Hardware industry revenues to be a little less cyclical in nature going forward rise in servers. However, the Shift in consumer sentiment, technological changes and global GDP can have a meaningful impact on demand from time to time.

Internet & New Media:

The industry in which our companies operate is fiercely competitive and technological change is rapid. All of our companies face the risk that they are unable to keep pace with new innovations or that new innovations impact competitive positioning. Additionally, our companies are international operators and are therefore exposed to currency fluctuations and other factors associated with operating in a foreign territory. Finally, our names sit within the advertising industry more broadly and are exposed to the same seasonality and macro trends as the rest of the group, including competition from TV and other offline channels.

Semiconductors:

The semiconductor industry is cyclical and has strong correlation to global GDP. If global growth slows, consumer demand and IT spending could impact our forecasts. Additionally, pricing pressure is severe in certain parts of the market, particular those that are consumer focused.

Software:

The global economy or specific end markets significantly worsen, contracting IT spending and impairing software growth. The rate of SaaS/Cloud adoption slows, resulting in prolonged sales cycles and higher-than-anticipated quarterly volatility across much of our coverage universe. Competition increases materially, driving deflationary pricing pressure and compressing margins. In particular, innovation by new entrants in the software sector often produces solutions with similar or better functionality at materially lower prices than incumbents' legacy offerings.

Storage & Peripherals:

The HDD industry is highly levered to global PC shipments (>50% of units) and IT spending. If global growth slows, consumer demand and IT spending could wane and negatively impact our forecasts. Additionally, solid state drives (SSDs) are encroaching on the notebook PC and mission-critical enterprise HDD market. While HDD makers also develop enterprise SSDs, greater than expected SSD cannibalization in notebooks could result in volume and margin deleverage for HDD players.

ADDENDUM

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Distribution of Ratings/Investment Banking Services (IB) as of 06/30/23

Rating	Count	Ratings Distribution	Count	IB Services/Past 12 Months
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