



An Introduction to Cloud Cost Optimization

How to predict, purchase and manage your cloud computing expenses—and why it matters

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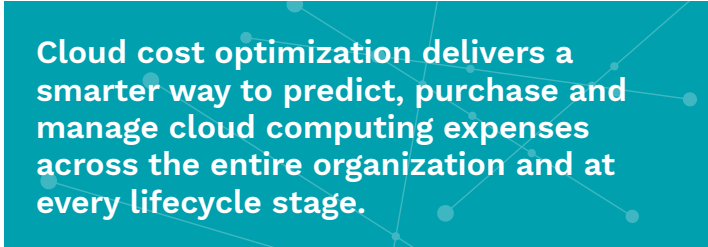


CURRENT CLOUD FINANCIAL MANAGEMENT

A seismic shift for finance and IT

For most organizations, cloud spending is now a significant part of the budget. This shift increases pressure on the current approach to IT finance. Gartner forecasts the worldwide public cloud services market to grow an additional 23.1 percent in 2021 to \$332.3 billion, up from \$270 billion in 2020.²

Yet as large as the move to include cloud solutions to a diversified application portfolio has been, businesses are just beginning to understand the impacts of this new technology on business planning and cost controls. The new landscape of cloud is driving a seismic shift for finance and IT. It's complicating the way companies plan, buy and use information technology, with significant financial implications.



Cloud cost optimization delivers a smarter way to predict, purchase and manage cloud computing expenses across the entire organization and at every lifecycle stage.

Here are some of the most prominent changes:

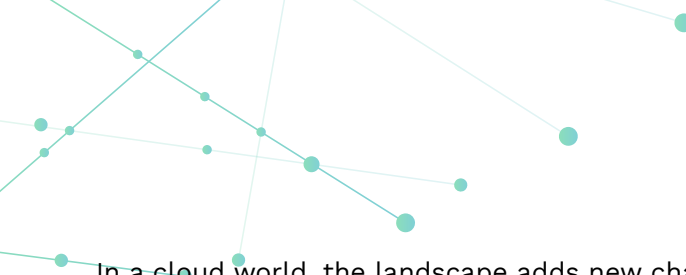
Deployment model: Diversification

Over the last decade, application deployments that were largely contained within one or more physical data centers have expanded with the increased consumption of SaaS business applications, creation of mobile customer applications, shifting of workloads closer to the manufacturing sites and bank branches, and the innovative use of automation to create private clouds.

This diversified infrastructure often found in mid-large enterprises is already complex. Adding public cloud consumption from IaaS to PaaS, for application deployment to data analytics, has introduced new dimensions to handling budgeting, forecasting, and capacity optimization.

Purchasing model: Products to services

When managing a traditional data center, IT purchases capacity in advance and sizes it to accommodate expected use over time. Periodically, and during performance-impacting outages, IT teams reassess capacity and purchase or upgrade equipment and software to support demand. Organizations once treated IT assets exclusively as capital equipment—a long-term investment like any other plant or equipment expense. This well-known formula was deeply established across IT, finance and operations and remains in place today for a significant portion of IT environments.



In a cloud world, the landscape adds new challenges. Companies must now purchase capabilities like compute, storage and databases as subscription services. Usage shifts to as-needed consumption, not unlike subscribing to a mobile phone service or drawing electrical power from a utility provider. While most infrastructure providers provide a spectrum of purchasing and consumption financial programs, often organizations have regulatory or other limitations on how they handle physical ownership of hardware.

Financial model: CapEx to OpEx

For traditional data center deployments, businesses buy and own IT products. They depreciate and amortize these assets on a set schedule as capital expenditures (CapEx).

Cloud computing, on the other hand, almost exclusively operates on a pay-per-use subscription basis, adding costs from a fixed capital investment to an ongoing monthly operating expense (OpEx) that fluctuates as the business consumes the service over time.

Cost structure: Fixed investment to variable expense

In traditional settings, organizations purchase IT assets like servers, storage and software with the expectation of three to five years of service before replacement. This enables companies to incur IT asset costs in significant but periodic chunks, with a known depreciation schedule.

Cloud costs use a different model. With cloud, it's not the upfront subscription that drives expense, but how the company uses and operates their assets over time. That leads to high variability. Every month, the cloud provider meters usage according to the amount, type and details of the cloud subscription plan. Complex variables measure resource reservations, usage rules and consumption commitment levels. It all adds up to cloud charges that can vary dramatically on a daily or hourly basis, all driven by company usage levels and consumption patterns.

Forecasting cycles: Annual to continuous

Companies typically set their IT budgets annually based on monthly spending predictions. That makes long-term planning critical to ensure adequate available resources and operating expenses between yearly IT budget cycles.

In a cloud world, on the other hand, companies consume cloud services through simple subscription purchases and generate spending through variable usage. This fluctuating use of resources and services adds risk

to monthly spending predictions. This requires IT and finance to shift from annual forecasting, to instead track, project and adjust estimated cloud expenses continuously, all while managing cloud usage to meet financial monthly and annual targets.

Control points: Few and siloed to multiple and cross-functional

In the traditional world, IT teams rely on a fixed set of physical, but virtually pooled resources and focus on optimizing usage over the lifecycle of those resources. They purchase capital equipment centrally via defined procurement processes, with limited options for ordering IT equipment outside of budget spending windows.

With cloud, by contrast, nearly anyone with privileges can purchase a subscription; the process is simple and frequently decentralized. Like most major infrastructure provider portfolios, a huge variety of storage, compute and other cloud services options exist, adding complexity to decision-making. A recent check of cloud providers' offerings showed more than one million different service combinations and permutations available to purchase. With easy access and a plethora of choices, various groups across the organization now make IT purchasing decisions. This presents many potential issues with IT cost governance and controls.

Cloud computing fundamentally changes IT financial management

Item	Traditional IT model	Cloud services model
Purchasing model	Acquisition of vendor products	Subscription to vendor products
Financial model	Full spectrum of finance options	Operating expense
Computing capacity	Fixed, predictable, and upgradable	Dynamic, variable, and auto-scalable
Forecasting cycles	Annual or longer	Continuous
Control points	Fewer and siloed	Multiple and cross-functional

The bottom line for IT? Typical periodic approaches to budget forecasting, cost analysis and financial management do not map well to cloud computing. The go-forward model requires continuous nontraditional planning, design, tracking and reporting across multiple teams in IT, finance and business stakeholder groups.

CLOUD COST OPTIMIZATION CHALLENGES

Financial complexities drive need for change

Cloud services add complexity to financial management in several ways. They complicate purchasing. They make it difficult to estimate application and service usage—especially for external use—and they require new rules for deployment, monitoring and optimization of that usage.

Here are some of the main challenges organizations experience as they add consumption of cloud environment and services:

Analysts estimate one-third of current cloud spend goes to waste.

Difficulty estimating cloud usage

User activity directly drives service consumption usage. Predicting consumption patterns into the future, especially outside of the enterprise environment, involves uncertainty and extrapolating complex trend lines.

Uncertain spending forecasts

Without constraints, cloud services could dramatically change budget planning. Company forecasts need frequent adjustments and flexibility to account for unusual events or external factors.

Complex procurement, purchasing and payment

Terms vary dramatically among cloud service providers. Companies can purchase using full, partial or no upfront payments. Likewise, they can pair a wide variety of discounts to usage commitments and service levels.

Difficulty scaling resources

The cloud provides far more options for resources, sizes and capacities to meet an organization's usage needs. Companies face a daunting array of choices and potential complexity when deploying cloud servers and storage. It's difficult to predict the cost impacts of design decisions involving automatic resizing of cloud resources that scale up and down as user needs change.

Inability to monitor consumption

Because metered usage and significant variability drives cloud costs, companies must monitor, track and adjust services continually to balance application needs and the type of service purchased. Optimal spending requires continuous feedback and tuning.

Lack of new processes

Given this environment of variable usage and continuous tuning, financial planners and systems designers need regular feedback from cloud operations monitors to feed updated forecasts into their planning processes.

Inability to allocate costs

Each cloud service generates metered usage billing and specific costs; tagging these resources with user account and cost center information is critical. This provides business owners and users with clear visibility to cost drivers so they can manage overall spending.

Cloud requires new controls and greater collaboration across the organization

Finance and IT leaders recognize that traditional processes are poorly suited for managing cloud spending. The sense of urgency is clear, with 73 percent recently citing cloud costs as their top priority.¹

With up to 30 percent of cloud cost spending going to waste, managing cloud costs is a top priority for adopters.¹

Surveys of IT executives identify several key issues:¹

- Cloud spending exceeds budget targets by 23 percent on average.
- Up to 30 percent of current cloud spending may be going to waste.

With cloud spending expected to increase nearly 20 percent in the next 12 months, not only do companies need new approaches, those changes are more urgent than ever.²

Key changes when moving to cloud:

- Cloud-specific cost governance policies and financial planning methods to avoid unplanned costs and budget overruns.
- New policies and buying techniques to optimize purchasing.
- Introduction of cloud planning principles to IT architecture teams, to optimize design choices.
- Increased usage tracking and cost visibility between functions, departments and projects.
- Continuous monitoring and reporting to optimize cloud usage and costs.
- Culture of cloud cost awareness throughout IT, finance and business stakeholder groups.

The variable nature of cloud services requires new types of continuous monitoring and increased cost visibility between functions, from finance and IT to development, engineering and operations. Actions taken in one functional area can significantly impact overall cost efficiency. Companies need to institute proper cloud cost management and control measures to manage these risks.

The flexible consumption model of cloud computing offers many appealing advantages. However, it also creates a number of challenges when forecasting costs and managing budgets, potentially resulting in considerable inefficiencies. Nearly 80 percent of cloud adopters identify managing complex new spending patterns as a top challenge; only security concerns rank higher.¹

Businesses that rely on the cloud to deliver products and services face additional challenges. Cloud costs can comprise a significant component of total costs-of-goods-sold (COGS), with big impacts on profit margins. This puts extra focus on effective cloud cost management.

In summary, existing policies and processes may not align with the variable nature of cloud usage and billing. Forecasting, budgeting and tracking cloud computing costs becomes difficult using traditional planning methods. Both finance and IT must learn new skills and adapt their processes as they ramp up new cloud services. The cloud necessitates continuous planning, monitoring and adjustments, with new types of collaboration across functions to manage financial complexities and reduce risks.

How well do you manage your cloud spending?

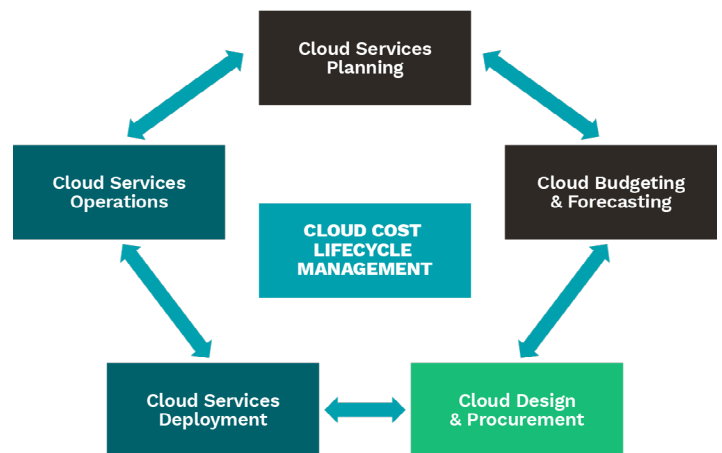
Assess your organization's cloud cost management capabilities with these questions. "No" answers highlight opportunity areas to enhance training, increase collaboration, and strengthen policies and controls.

	Yes	No
1. Can your finance team forecast cloud usage for the next three to six months?		
2. Are your IT/Ops teams trained on cloud usage models and cost implications?		
3. Do you have a cloud purchasing strategy to guide your spending?		
4. Are cloud resources tagged according to cost center and services owners?		
5. Are cost and scaling estimates part of cloud services plans and designs?		
6. Do you balance on-demand services with reservations and spot instances?		
7. Are cloud services and resources continuously reviewed for rightsizing?		
8. Do you monitor, track and report cloud costs, based on budget targets?		
9. Do you charge cloud costs to appropriate users and cost centers?		
10. Do you measure cloud cost KPIs across key stakeholder groups?		

To support cloud services adoption, finance teams need updated skills and enhanced cross-functional processes. New cloud management frameworks can provide a more unified and coordinated approach to planning, design, purchasing and operation of cloud services—all with financial optimization in mind. These frameworks help enterprise functions support effective cost management at each stage of the cloud deployment lifecycle.

- New mechanisms for continuous cost planning, tracking, monitoring and tuning.
- Greater organizational visibility to cloud usage, consumption and costs.
- Improved ability to meet budgets with fewer unexpected costs.
- A stronger foundation for well-managed cloud growth.

Cloud Cost Optimization Framework



Optimization requires a shift in three core areas of the cloud lifecycle:

- Along with new cloud management frameworks, a cultural shift must also occur. Organizations need to incorporate and embrace new methods of using cloud services, and recognize the key differences when adding cloud to a diversified IT environment. Teams from finance, architecture, engineering and operations will need to work more closely

together, moving away from highly structured and predictable models to ones that promote tightly integrated processes and more variable usage, continuous planning, monitoring and frequent tuning.

The flexible and scalable nature of cloud services—without prior capacity limits—makes these changes necessary. Usage fluctuations now drive considerable cost volatility. Cloud growth will reflect immediately in higher costs. A global understanding of how the company expects services to evolve becomes critical to accurate cost forecasts.

For example, when a company first deploys an application service in the cloud, the initial cost profile may not reflect user behavior accurately, especially as volumes increase over time. Changes in usage patterns and resource demands may require finance and engineering to select new pricing plans with customized capacity reservations, in order to reduce costs.

Likewise, operations teams may need to monitor and “rightsize” cloud services regularly to eliminate excess capacity and unused resources. Companies can also gain efficiencies through tiered services at high scale.

All teams will benefit from regular communication to ensure optimized costs and elimination of waste.

CLOUD PLANNING

Adopt new strategies to plan, buy and pay for cloud services

Services resource planning, forecasting, budgeting and procurement take on special significance with cloud deployments. A major factor in cloud cost optimization comes from how organizations plan, buy and pay for their cloud services. IT and finance need new thinking in their annual planning cycles.

Cloud cost forecasts now demand:

- Accurate predictions of monthly usage.
- New variables for purchasing strategies and consumption models.
- Resource reservations.
- Scaling expectations.

Purchasing strategies are key to cost-optimized cloud services. They start with familiarizing the finance and IT teams with the seemingly infinite variety of cloud subscription models and payment options.

Navigating cloud purchasing options

Cloud providers offer complex menus of service options with highly variable pricing and payment plans. Different cloud vendors also calculate fees differently, with a range of discounts and subscription contract terms. Packaging and prices change often. Finance and IT buyers who invest time to understand these new cloud purchasing models can significantly improve their cloud cost efficiency.

Some of these options include:

- On-demand purchasing.
- Different types of usage reservation commitments.
- Varying discounts.
- Payment upfront, partially or as used.

In addition to these factors, companies can source cloud services from a number of different regions with different prices.

Cloud planning: New skills and processes

- Define cloud cost governance policies, workflow and controls.
- Build strategy for cloud cost planning, forecasting, budgeting and chargebacks.
- Educate teams on cloud consumption models, pricing and payment plans.
- Set purchasing policies for cost-optimized cloud services.
- Learn tradeoffs and advantages of different resource types, such as on-demand and reserved.
- Implement cloud resource tagging to support cost reporting and allocation.
- Leverage monitoring tools to track spending and generate forecasts.
- Build collaboration processes between finance, IT and operations.

CLOUD ARCHITECTURE

Show how cloud architecture and design impact cloud costs

Cloud services are fundamentally flexible. Understanding how cloud architecture, design and consumption models can impact costs is key to effective cost management. This represents another change from traditional IT environments. Even with highly virtualized environments physical devices are typically purchased with extra capacity to handle usage fluctuations, and peak demand. This frequently results in significant overallocation, unused capacity and cost inefficiencies.

The constraints of fixed-asset IT systems don't apply in a cloud environment. Cloud capacity can be adjusted in real time, based on consumption patterns. Cloud architects can now design flexible, scalable services with variable costs, driven by user behavior, levels of consumption, scheduling availability and scaling potential. Resource planning in the cloud should be a continuous activity, driven by the architecture team, following procurement guidelines.

Purchasing policies should align and enable efficient cloud architecture and design. Cloud architects should select initial resource types and sizes to meet expected usage patterns, with scalability and costs in mind. The service can be designed to autoscale, adding resources automatically based on real-time capacity needs. Companies should continuously refine and modify cloud resources by type and size to match the evolving levels of the service, within established spending limits.

Cloud architecture: New skills and processes

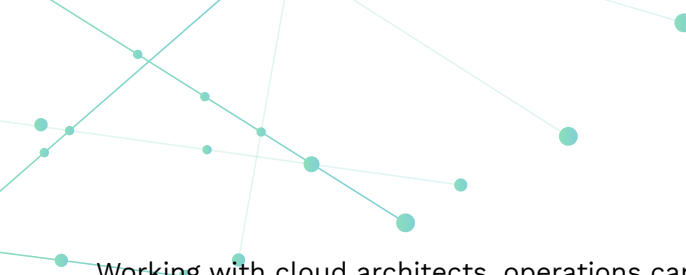
- Knowledge of cloud purchasing plans, pricing and consumption models.
- Understanding of workload resource utilization modeling and demand planning.
- Modeling cloud costs based on projected usage and growth.
- Designing cloud services based on needs for type and size, scalability and operating mode.
- Selecting a purchasing mode using best-fit pricing and payment model.
- Inclusion of cloud scalability approaches and resource tuning options.
- Process for optimizing services based on operational feedback.
- Tracking and analysis to measure consumption and user behaviors.
- Communication and collaboration to increase interaction with finance and operations.

CLOUD OPERATIONS

Build a culture of cloud financial awareness

The cloud operations team can also drive significant cost optimization by building a culture of financial accountability for cloud services. Unlike traditional steady-state systems, cloud services can be flexible, stateless, highly variable and nearly unlimited in scale. This requires IT operations to deploy sophisticated methods of operational awareness, usage tracking, performance reporting, ongoing tuning and cost controls.

The primary role of cloud operations is continuous usage and cost monitoring, anomaly detection and cost optimization tuning. Cursory systems checks or reactive reviews are insufficient. Cloud operations teams, working with their architect counterparts, must now define and tag each cloud resource with identifying information, allowing for fine-grained cost and usage tracking. Constant fluctuations in typical cloud services require continual monitoring to provide alerts and enable tuning. Reporting tools with budget threshold triggers are important to provide visibility to potential cost overruns.



Working with cloud architects, operations can monitor for rightsizing opportunities. Cloud usage data can provide early warning of cost exceptions, guiding decisions on cloud resource sizing and type, to avoid incorrectly provisioned resources. By identifying mismatches between usage levels and instance types, sizes and purchase class, companies can reassign cloud resources for improved cost efficiency.

Automated tools also help detect usage anomalies, report issues and take immediate corrective actions to reduce cost. With visibility to cloud usage, operators can proactively take steps to optimize cloud costs, such as managing resources by time of day, or in different regions. Communicating cost insights to teams in finance, architecture and IT can also provide valuable cost savings opportunities.

Cloud operations: New skills and processes

- Continuously monitor usage and costs to analyze trends and identify optimization opportunities.
- Perform ongoing resource rightsizing and adjust the consumption model to fit reservations and purchasing plans.
- Use automation for autoscaling, to tune changes to instance sizes and types, to terminate idle or orphaned instances and to change storage tiers.
- Report usage and spending data to finance, architects, account owners and stakeholders.

CASE STUDIES

Growing SaaS company sees unexpected cloud costs, margin pressure

Company

Software-as-a-Service company with large and growing customer base

Challenge

Rapid customer growth over several years resulted in disproportionate increases in cloud costs and higher COGS, threatening profit margins.

Solution

Business growth caused large increases in cloud usage. The company needed a new approach to manage cloud costs more effectively. Company management directed the IT, finance and product engineering teams to collaborate on integrating processes across cloud services functions to significantly reduce costs.

Key actions:

- Improve cloud cost awareness when planning, designing, forecasting and budgeting.
- Implement cloud resource tagging and monitoring strategies to track usage and costs.
- Move from on-demand pricing plans to one- and three-year reservations for specific resource classes, from compute and database resources to core SaaS products.
- Convert cloud storage from a high-cost resource tier to a multitiered service class model, based on use case requirements.
- Purchase nonproduction development and testing servers as spot instances.
- Implement ongoing monitoring and rightsizing of cloud instances.

Results

By implementing these changes, the SaaS company realized significant cost savings of almost 30 percent within six months.

Strategic benefits:

- Improved visibility to cloud costs and forecasted budget impacts.
- Planning, designing and operating cloud services with costs in mind.
- Selecting the most cost-efficient procurement option and instance configuration.
- Eliminating overcapacity and underused resources.

CASE STUDIES

Government agency adopts new cost management policies for move to cloud

Company

US municipal government agency

Challenge

Moving existing applications to the cloud and building new public services on cloud platforms created issues across the organization, from planning and budgeting to forecasting and chargebacks. Lack of visibility to costs and inability to implement chargebacks to business owners hampered efforts to fund and launch new cloud services.

Solution

The transition from fixed-cost IT services to the variable cost models of cloud services required the agency to implement fundamentally new planning and budgeting policies, with new cost control processes.

These included:

- Cloud governance policies with planning and budgeting procedures to forecast costs.
- Cultural awareness to design services and develop cloud apps with costs in mind.
- New IT and finance methods to model cloud usage over the lifetime of a service.
- Cloud cost metrics to track usage by cost center for forecasting and budgeting.
- Purchasing policies to support price-sensitive procurement of cloud services.

Results

By taking a more strategic and holistic approach to cloud planning, usage and expenses, the agency improved its ability to support cloud deployment, with required financial controls.

New capabilities allow them to:

- Develop services in the cloud with confidence in budget forecasts.
- Monitor cloud usage and project upcoming costs.
- Charge back cloud spending to appropriate cost centers.
- Plan, architect and design new cloud services with costs in mind.
- Identify best-fit cloud pricing and discounts for planned services.
- Promote agency goals with greater confidence in strategic investments.

Get started with cloud cost optimization

As cloud computing becomes widespread, organizations must invest in new skillsets, core processes and management tools that leverage these technologies.

For finance and IT teams, focusing on cost-effective cloud services can bring immediate and tangible benefits. Our experience shows that a comprehensive cloud cost optimization program can help organizations save up to 30 to 40 percent of their previous cloud spending.

Tap outside expertise to strengthen approach and accelerate benefits.

Specific improvement area	Possible savings
Cloud architecture and design optimization	10 to 20 percent
Cloud procurement, improved pricing and payment options	10 to 20 percent
Instance rightsizing and consumption optimization	10 to 15 percent
Cloud usage reporting and cost-tracking	5 to 10 percent
Cloud operations continuous optimization and tuning	5 to 10 percent

Set goals and expectations


Before launching a cloud cost management initiative, it's critical to align the organization on strategic goals and expectations.

Cost optimization initiatives are most often part of a larger business strategy that supports established financial objectives. These business initiatives frequently drive moves to cloud services.

Some typical examples include:

- Redesigning legacy applications for SaaS delivery.
- Rolling out new services on a cloud platform.
- Consolidating, moving or vacating data centers or co-location facilities.
- Supporting overall digital transformation with significant application replatforming.

To start, first clarify specific objectives with an assessment of current cloud cost optimization capabilities, processes and tools. Then, focus on a plan of action that sets expectations for progress.



Launching a cloud cost optimization initiative can be a significant undertaking. As with any strategic shift in IT services, moving to the cloud takes investments in people, relearning ways of communicating and changes to how the organization measures success. Achieving mature cloud cost optimization competencies is a multiyear transformation—not an immediate fix. Organizations can expect multiple phases of progress, with hurdles along the journey.

Likewise, cross-functional cooperation is essential. Cloud cost management is a truly interdisciplinary responsibility. Program governance and ownership are key. To drive commitment and long-term support, business leaders, IT managers and finance teams should all be equally invested as key stakeholders.

Make a build or buy decision for cloud cost optimization

Many adopters of cloud services develop their own approaches for optimizing cloud costs—building their own processes, using homegrown tools and learning lessons from unexpected spending, for example. This frequently becomes a difficult challenge if cloud costs accelerate faster than anticipated.

Fortunately, additional options now exist. As demand grows for cost-efficient cloud deployments, consultants and tool vendors now focus on cloud cost optimization and cloud lifecycle management.

Experienced advisors can provide strategic insights based on a range of implementation and real-world experience. Firms specializing in cloud cost improvement programs can help companies move quickly to adapt to new optimization approaches in a fast-changing environment. This enables finance and IT to confidently implement the new processes, skills and technologies needed for effective cloud cost management.

External advisors bring additional perspective to identify gaps, risks and opportunity areas. Specialists can evaluate an organization's cloud financial knowledge, planning processes, architecture and design methods and operational cost awareness. They can share examples from companies in different sectors and stages of maturity. Their cloud-specific frameworks can accelerate adoption and drive rapid results.

Checklist of cost optimization initiatives

Use this list as a starting point for cross-functional cloud cost management processes:

- Cloud strategy and governance policies, with cost management policies and controls.
- Organizational roles and responsibilities for cloud financial management.
- Cloud budgeting, forecasting, cost allocation and chargebacks.
- Employee training on cloud consumption models, pricing and purchasing.
- Cloud architecture policies for cost-effective design optimization.
- Strategy for cloud resource tagging, reservations and consumption plans.
- Cloud procurement processes including cost reporting, dashboards and KPIs.
- Plan for rightsizing, tuning, autoscaling, scheduling and terminating services.
- Cloud operations processes for monitoring, tracking and reporting.

Get started with Pythian

Connect with the data pros at Pythian. Get started with an in-depth readiness assessment of your cloud financial capabilities, and optimization opportunities.

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Lynda Partner is a self-professed data addict and experiences the power of data every day as Pythian's Senior Vice President of Products and Offerings. The author of Pythian's "Love Your Data" mantra, Lynda knows exactly how data can transform companies into competitive winners. She was the driving force behind Pythian's Analytics-as-a-Service practice and she works daily with companies around the world and across industries to turn data into insights, predictions and products. During her down time, she writes blogs and keeps her book Designing Cloud Data Platforms up to date, while plotting new ways to use data - only for good, of course.

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- 1 Flexera, "2021 State of the Cloud Report"
- 2 Gartner, "Gartner Forecasts Worldwide Public Cloud End-User Spending to Grow 18% in 2021", November 17, 2020
- 3 Flexera, "2021 State of the Cloud Report"



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ABOUT PYTHIAN

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