FORRESTER®

The Total Economic Impact™ Of AWS Cloud Operations

Cost Savings And Business Benefits
Enabled By Operating On AWS

MAY 2022

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Executive Summary

> Coupling lower costs with improved performance and resiliency, the move to the cloud is well-recognized as a path to IT modernization in an open and more extensible architecture compared to legacy environments. AWS provides cloud services, and AWS Cloud Operations can optimize IT to improve management, security, and operations, and deliver faster environment creation and application development. This can contribute to increased revenue through improved user experience and decreased time-to-market.

Many organizations implement AWS to run key infrastructure and application workloads — for some organizations, it's their only cloud provider. AWS Cloud Operations (AWS Cloud Ops) helps organizations meet foundational requirements to optimize their AWS investment with improved security, identity, management, networking, and operations. AWS Cloud Ops is made up of multiple services which help organizations run their AWS public cloud service provider environments. These native AWS services support cloud and hybrid functions across the organization, including governing user identity and access, networking, operations, security, management, and governance. AWS Cloud Ops provides the foundation for a build-and-iterate environment whether customers are provisioning new environments or scaling existing workloads and applications on AWS.

AWS commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential return on investment (ROI) enterprises may realize by deploying AWS Cloud Ops.[1] The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of AWS Cloud Ops on their organizations.

To better understand the benefits, costs, and risks associated with this investment, Forrester interviewed five decision-makers with experience using AWS Cloud Ops services to reduce costs and improve IT management efficiency. For the purposes of this study, Forrester aggregated the interviewees'

TEI STUDY KEY STATISTICS

Return on investment (ROI)
241%

Net present value (NPV)
$20.31M

experiences and combined the results into a single composite organization with $7 billion in revenue and 200 core IT, DevOps, and site reliability engineering (SRE) professionals.

Prior to using AWS services, interviewees described issues such as difficulty provisioning, inefficient and siloed application development, deployments that resulted in errors, and downtime in mission-critical applications.

After the shift to AWS, optimizing their cloud environment with native AWS services helped interviewees' organizations enable time savings in faster provisioning of workloads, faster DevOps processes, improved developer and DevOps integration, and improved time-to-market, which contributed to revenue growth. Development of applications and product features with AWS automations led to improved uptime and cost reductions in controlling instance utilization.

Total benefits present value

$28.8 million

KEY FINDINGS

Quantified benefits. Three-year, risk-adjusted present value (PV) quantified benefits of an optimized cloud environment for the composite organization include:

- **Faster deployment of workloads to production with AWS services, saving $3.1 million over three years.** Migrating existing workloads to AWS and managing them using AWS Cloud Ops is easier, faster, and more cost effective for the composite organization. Security and operational parameters are now templatized and automated. In total, this permits the composite organization's IT staff to deploy workloads to production over 97% faster than in its previous environment.

- **Faster application and feature development enables $14.5 million over three years.** AWS Cloud Ops increases the speed of application production and improvement cycles, transforming the approach from sprints that take several weeks to a continuous integration and continuous delivery (CI/CD) pipeline.

- **Reduces downtime of AWS services, avoiding significant lost revenue of $7.8 million over three years.** AWS services improves uptime of more than four hours of revenue-generating applications during peak hours, resulting in fewer incidents in reduced reliability and availability of

critical systems, as well as reduced exposure to security breaches.

- **Better management of workloads through AWS services utilization, enabling cost savings of $3.4 million over three years.** AWS Cloud Ops provides detailed instance utilization management as well as the ability to schedule instance downtime in nonpeak periods. AWS templates and automations permitted the creation of controls for unused Amazon Elastic Cloud Compute (EC2) instances, leading to cost savings.

> **"We have been able to develop modern systems on modern technology like AWS and, therefore, modern products and experiences for our customers. The AWS environment and services have not only transformed what we do with efficiency, but also what we can create."**
>
> *Chief architect, financial services*

Unquantified benefits. Benefits in this study that could not be quantified from the decision-maker interviews, because they have not been quantified yet or are difficult to attribute, include the following:

- **AWS services were a catalyst for improving IT skills.** AWS and AWS Cloud Ops created an opportunity for a shift in responsibilities as manual tasks became automated and employees could focus on higher-value work. AWS skills became a critical aspect to recruit and develop next-generation talent and capabilities in the

workforce, incentivized through creative hackathon events and promotion of innovation enabled by AWS.

- **AWS has become a trusted partner.** Interviewees leaned on AWS for networking and architecture expertise as they built and maintained environments in AWS. Organizations could stand up services quickly in many regions. DevOps groups drew from AWS expertise to run small, distributed scrum teams through best practices. AWS also responded quickly to feature and roadmap requests.

Costs. Risk-adjusted PV costs for the composite organization include:

- **Initial costs of less than $605,000 to plan, acquire, and implement service and application development.** There are initial costs associated with planning out requirements of the AWS environment and training employees on new processes for development and support. The composite organization has a six to nine month planning process including migration, change management, and other tasks involving several senior IT people, equating to one FTE for three months with a salary of $175,000, as well as initial IT workforce skills.

- **Cost of AWS Cloud Ops totaling $7.8 million.** AWS Cloud Ops helps the composite organization meet foundational requirements to optimize its AWS investment. More than 80 different services are available to meet the needs of individual organizations. For the composite organization, some services are available at no additional cost, while others included costs based on utilization.

The decision-maker interviews and financial analysis found that a composite organization experiences benefits of $28.75 million over three years versus costs of $8.44 million, adding up to a net present value (NPV) of $20.31 million and an ROI of 241%.

> **"Basic building blocks like identities, access management, monitoring, the networking elements are all preset and predefined, including the security guardrails we require. Application teams are set to quickly spin up and productionize work. We can get to development, QA, preproduction, and the CI/CD process much more quickly ."**
>
> *VP, technology, business information services*

ROI
241%

BENEFITS PV
$28.75M

NPV
$20.31M

Benefits (Three-Year)

FTE savings to set up and productionize workloads — $3.1M

Value of efficient DevOps practices and improved developer productivity — $14.5M

Revenue loss avoided with improved uptime — $7.8M

Cost savings of AWS services with controlled unused instances — $3.4M
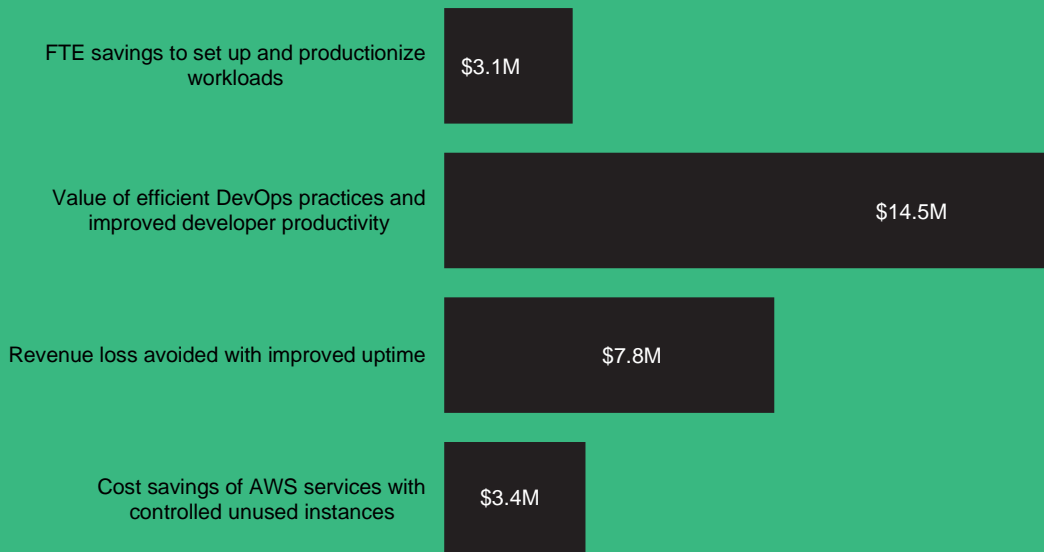
"We started building our own internal capabilities with small workloads and scaled into what we wanted to do with AWS services. The improved operational performance, stability, and time-to-market quickly proved itself."

— Chief information security officer, energy

TEI FRAMEWORK AND METHODOLOGY

From the information provided in the interviews, Forrester constructed a Total Economic Impact™ framework for those organizations considering an investment in AWS services.

The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that affect the investment decision. Forrester took a multistep approach to evaluate the impact that AWS can have on an organization.

DISCLOSURES

Readers should be aware of the following:

This study is commissioned by AWS and delivered by Forrester Consulting. It is not meant to be used as a competitive analysis.

Forrester makes no assumptions as to the potential ROI that other organizations will receive. Forrester strongly advises that readers use their own estimates within the framework provided in the study to determine the appropriateness of an investment in AWS Cloud Ops.

AWS reviewed and provided feedback to Forrester, but Forrester maintains editorial control over the study and its findings and does not accept changes to the study that contradict Forrester's findings or obscure the meaning of the study.

AWS provided the customer names for the interviews but did not participate in the interviews.

DUE DILIGENCE
Interviewed AWS stakeholders and Forrester analysts to gather data relative to AWS services.

DECISION-MAKER INTERVIEWS
Interviewed five decision-makers at organizations using key AWS services to obtain data with respect to costs, benefits, and risks.

COMPOSITE ORGANIZATION
Designed a composite organization based on characteristics of the interviewees' organizations.

FINANCIAL MODEL FRAMEWORK
Constructed a financial model representative of the interviews using the TEI methodology and risk-adjusted the financial model based on issues and concerns of the interviewees.

CASE STUDY
Employed four fundamental elements of TEI in modeling the investment impact: benefits, costs, flexibility, and risks. Given the increasing sophistication of ROI analyses related to IT investments, Forrester's TEI methodology provides a complete picture of the total economic impact of purchase decisions. Please see Appendix A for additional information on the TEI methodology.

The AWS Cloud Ops Customer Journey

Drivers leading to the AWS Cloud Ops investment

Interviews			
Role	**Industry**	**Region**	**Revenue**
Chief architect	Financial services	North America	$11.7B
Chief information security officer	Energy	APAC	$8.8B
Chief technology officer	Automotive services	North America	$7.0B
VP, technology	Business information services	North America	$6.4B
Director, technology operations	Financial technology	North America	$600M

KEY CHALLENGES

Before investing in their shift to the AWS cloud, the interviewees' IT groups supported a computing environment of on-premises legacy infrastructure, applications, and databases. The interviewed decision-makers were unable to upgrade existing infrastructure to optimize and support a more modern and extensible infrastructure, including improved management, security, and automation. The chief information security officer for the energy firm related, "We realized that, as a business, technology was central to what we do, yet we were not sufficiently agile or positioned to innovate in our previous model."

Previous environments also created time-to-market issues, ultimately affecting the interviewees' organizations' competitiveness. Data centers required a lengthy process to provision new workloads. The chief information security officer for the energy firm said, "In our environment prior to AWS, we had a terrible run with stability and, as a result, devoted significant staff resources on incident management and firefighting."

Security issues resulted in too much downtime, including during peak times, and directly affected revenue-generating applications. The chief information security officer for the energy firm

continued: "Guarding against security incursions was onerous. We had to invest in very expensive security services for log monitoring and analysis, now these are replaced by AWS automation and scripts."

Moreover, the routines to develop and run applications were siloed between developers and implementers with minimal interaction. The chief technology officer at the automotive services firm said: "We were not on modern platforms. Developers wrote code without access to APIs. The Ops team owned deployment, and the application didn't always interface well with the hosting environment."

Finally, managing change to develop the IT workforce considering the skills needs of workload production and DevOps in a payment-as-a-service (PaaS) environment was an important challenge to manage with the implementation of AWS Cloud Ops. The vice president from the business information services firm said, "We had to focus our talent on customer-visible elements and value adds to our products."

INVESTMENT OBJECTIVES

The interviewees' organizations searched for a cloud environment that could not only deliver an infrastructure platform but also help them optimize and automate tasks to improve operations, including

security and application development and delivery. They wanted a solution to help them:

- **Provision applications and workloads faster and easier than in previous environments.** Interviewees sought improved efficiency. The VP of technology for the business information services organization described, "Within AWS, we have a secure environment for application developers to spin up servers and environments, which saves significant time over the data center model where we used to wait for months."

- **Provide foundational capabilities to reduce effort and standardize tasks.** The chief technology officer at the automotive services organization said: "Areas we used to have to worry about and apportion resources to are handled entirely within AWS. For instance, teams spend little time on security patching, and we don't have to spend time in planning cycles with any security backlog. Compliance has gone up and it's without additional labor resources."

- **Focus IT teams on higher-value goals.** By freeing IT from more rudimentary tasks, staff were enabled to concentrate on business and product innovation better. The chief technology officer at the automotive services firm said, "Because of our account structure and how assets get enabled and provisioned is preconfigured with security and compliance already in place with AWS services, our teams are more focused on product development."

- **Support their cloud-native strategy for existing applications and new development.** The chief architect for the financial services firm related: "We focused on the cloud for new builds, but also had to optimize our migrated applications with AWS services. We could make existing applications run more efficiently."

- **Implement modern approaches in application development to enable innovation.**

Interviewees sought a set of native AWS services optimized and automated procedures to shorten the timeframe for developing applications and features, as well as remove barriers between developers writing code and operations engineers working to deploy it successfully. The director of technology operations at the financial technology organization described: "The speed to deploy, even if the developer code is not perfect, is worth it in AWS. Their services let us overcome any issues quickly. Compared to perfecting a three-week deployment sprint, now I can deploy right away and make changes in a functional deployment."

- **Create a more visible, stable, and secure**

> **"With AWS services we realized an important objective: Optimizing our migrated applications to become more cloud native frees up our operations engineers."**
>
> *VP, technology, business information services*

environment. Interviewees related the importance of AWS Cloud Ops in improving visibility to cloud operations, and the capabilities to keep it more stable and secure. As described by the chief information security officer at the energy firm, "From the core of how we build all of our infrastructure with AWS CloudFormation, we've rebuilt our approach to operations and security, which was a huge management task previously."

The VP of technology from the business information services firm related how AWS provided greater visibility and easier management to monitor and ensure a secure network: "AWS toolsets provide centralized security and incident management, as well as manage security holistically with certificate and CloudWatch logs."

- **Enable cost savings by running instances more efficiently.** Interviewees sought to optimize costs for migrated applications as well as create value in cloud-native applications. As the chief architect from the financial services firm described, "With AWS services, we can optimize our new builds as well as our migrated applications to run more efficiently, which takes less run time and saves on compute cost."

- **Develop IT skills and solutions amid changing roles from supporting data center to cloud computer management**. Finally, interviewees' goals included developing their teams' IT skills amid changing roles from supporting data center to cloud management, and leaned on AWS's experience with agile development teams and solution architects.

COMPOSITE ORGANIZATION

Based on the interviews, Forrester constructed a TEI framework, a composite company, and a ROI analysis that illustrates the areas financially affected. The composite organization is representative of the five decision-makers that Forrester interviewed and is used to present the aggregate financial analysis in the next section. The composite organization has the following characteristics:

Description of composite. The composite organization represented in this study is a dynamic, global, $7 billion dollar organization with a core of 200 IT professionals, including IT administrators, developers, DevOps, and engineers. It is transitioning existing applications and workloads from on-prem data centers to the AWS cloud, and leverages AWS

services, such as AWS CloudFormation and Amazon CloudWatch, for provisioning and monitoring environments, as well as deployment automation services, such as AWS CodePipeline, AWS CodeCommit, and AWS CodeDeploy. With its increased maturity, the composite organization embarks on developing cloud-native applications.

The company's products and revenue depend on continuous improvement and development cycles to its apps, features, and products, and therefore relies on fast, high-volume DevOps cycles for its applications. The IT staff supporting this role has leveraged training across the spectrum of AWS services to help realize their capabilities and benefits for the organization.

Deployment characteristics. The composite organization is actively deploying a range of AWS service capabilities to efficiently deploy workloads, monitor and maintain security, manage networking, and preserve operational health of AWS services. The composite's deployment optimizes time-to-value in new applications, and is engaged in DevOps strategies to ensure high uptime with rapid and successful deployments.

Key assumptions
- **$7 billion in revenues**
- **200 core IT professionals**
- **Transitioning on-prem and developing cloud-native applications**
- **Using AWS services, including:**
  - **Security**
  - **Identity**
  - **Operations**
  - **Management**
  - **Networking**

Analysis Of Benefits

Quantified benefit data as applied to the composite

Total Benefits						
Ref.	Benefit	Year 1	Year 2	Year 3	Total	Present Value
Atr	FTE savings to set up and productionize workloads	$1,228,500	$1,228,500	$1,228,500	$3,685,500	$3,055,098
Btr	Value of efficient DevOps practices and improved developer productivity	$5,827,500	$5,827,500	$5,827,500	$17,482,500	$14,492,130
Ctr	Revenue loss avoided with improved uptime	$3,155,394	$3,155,394	$3,155,394	$9,466,182	$7,846,997
Dtr	Cost savings of AWS services with controlled unused instances	$1,350,000	$1,350,000	$1,350,000	$4,050,000	$3,357,250
	Total benefits (risk-adjusted)	$11,561,394	$11,561,394	$11,561,394	$34,684,182	$28,751,475

FTE SAVINGS TO SET UP AND PRODUCTIONIZE WORKLOADS

Evidence and data. AWS services, particularly AWS CloudFormation, enabled interviewees to set up and provision workloads with simple templates and automations for network, operational, and security configurations much faster than with legacy systems. Interviewees noted time savings of more than 95% in configuring environments, which freed the IT team for more valuable tasks. Interviewed decision-makers shared examples of specific benefits from using the AWS CloudFormation service, such as the following:

- The chief architect at the financial services firm noted: "Previously, we had to set everything in our legacy framework with the right network and get functions covering server, network, security, and architecture involved. This is now automated using standards and configurations in AWS and the people in these functions now do more valuable things."

- The chief technology officer at the automotive services firm described: "The old days of waiting for environments, waiting for configurations, or working with the system admin, they just don't happen in this world. Our development team can

decide to experiment with a service and pull it into a product, and they can do this right away. Anything that needed to coordinate with operations and others has all disappeared with AWS services."

Modeling and assumptions. For the composite organization, Forrester assumes:

- The end-to-end time savings include the time from server procurement to provisioning in the previous on-prem environment compared to the time required for deployments with AWS services.

- Cost savings for the composite organization are significant with AWS based on savings reported by interviewees. Cost savings begin with the first AWS deployment due to its greater efficiency and lower cost.

Risks. The savings may vary with the size of the existing team of network engineers that are involved in setting up and provisioning on-prem deployments.

Results. To account for this risk, Forrester adjusted this benefit downward by 10%, yielding a three-year, risk-adjusted total PV (discounted at 10%) of $3.1 million.

FTE Savings To Set Up And Productionize Workloads

Ref.	Metric	Source	Year 1	Year 2	Year 3
A1	FTE network engineers required to provision on-premises workloads	Interviews	10	10	10
A2	Network engineer fully burdened annual salary	Composite	$140,000	$140,000	$140,000
A3	On-premises provisioning costs before AWS tools	A1*A2	$1,400,000	$1,400,000	$1,400,000
A4	Provisioning time savings with AWS Cloud Ops	Interviews	97.5%	97.5%	97.5%
A5	Provisioning costs with AWS tools	A3*(1-A4)	$35,000	$35,000	$35,000
At	FTE savings to set up and productionize workloads	A3-A5	$1,365,000	$1,365,000	$1,365,000
	Risk adjustment	↓10%			
Atr	FTE savings to set up and productionize workloads (risk-adjusted)		$1,228,500	$1,228,500	$1,228,500
	Three-year total: $3,685,500		**Three-year present value: $3,055,098**		

VALUE OF EFFICIENT DEVOPS PRACTICES AND IMPROVED DEVELOPER PRODUCTIVITY

Evidence and data. Deployment automation and performance monitoring capabilities of AWS Cloud Ops supported the development of an efficient DevOps practice. For the interviewees' organizations, this resulted in faster application, feature, and product development, as well as improved application quality and developer and engineer skills. Such efficiencies created developer and engineer productivity savings, as well as faster time-to-market revenue benefits.

Prior to optimizing their AWS environment with AWS services, application development and deployment teams had separate and distinct roles that resulted in longer production milestones for app and feature launches, which could hamper production, slow down deployment, and reduce deployment success. The director of technology operations at the financial

technology organization said, "Time losses in production stemmed from not communicating clearly to the ops team what configurations, edits, and deletes in code need to go specifically in what repository."

Integrated software development and DevOps helped the organization transform to faster and more reliable application and feature deployment. The chief architect at the financial services firm said, "Our app developers can now focus solely on capabilities and the product itself, and not worry about the low-level aspects following up within the operation to perfect code."

With AWS services supporting DevOps, including AWS CodePipeline, AWS CodeCommit, and AWS CodeDeploy, interviewees realized a continuous improvement and development cycle leading to fast and reliable deployments for applications and

Ref.	Metric	Source	Year 1	Year 2	Year 3
Value Of Efficient DevOps Practices And Improved Developer Productivity					
B1	Software developer team size	Composite	100	100	100
B2	Developer feature output gain with AWS Cloud Ops	Interviews	12.5%	12.5%	12.5%
B3	Developer average fully burdened annual salary	Composite	$130,000	$130,000	$130,000
B4	Subtotal: Savings from improved feature development	B1*B2*B3	$1,625,000	$1,625,000	$1,625,000
B5	Time-to-market improvement of three months contribution to revenue growth	Assumption	$950,000	$950,000	$950,000
B6	DevOps team size	Composite	100	100	100
B7	DevOps productivity improvement with AWS Cloud Ops automations	Interviews	30.0%	30.0%	30.0%
B8	DevOps average fully burdened salary	Interviews	$130,000	$130,000	$130,000
B9	Subtotal: Productivity improvement from DevOps automations	B6*B7*B8	$3,900,000	$3,900,000	$3,900,000
Bt	Value of efficient DevOps practices and improved developer productivity	B4+B5+B9	$6,475,000	$6,475,000	$6,475,000
	Risk adjustment	↓10%			
Btr	Value of efficient DevOps practices and improved developer productivity (risk-adjusted)		$5,827,500	$5,827,500	$5,827,500
	Three-year total: $17,482,500		**Three-year present value: $14,492,130**		

features. The director of technology operations at the financial technology organization said, "We've transformed from discrete sprints to a continuous pattern of improvement in the AWS environment that lets us not only deliver features faster, but also fix issues quicker."

The chief architect at the financial services firm said: "AWS allows our talent to test and learn a lot faster. Our rapid pace for prototyping has increased by a factor of 10 with the agility and scale of AWS services."

Modeling and assumptions. For the composite organization, Forrester assumes:

- Capabilities with AWS services lead to a 12.5% improvement in productivity.

- Faster development and DevOps processes lead to faster and more successful deployments. Forrester assumes a three-month time-to-market improvement leading to a conservative revenue enhancement of less than 1%.

- Integration of development and DevOps along with task automations helps development operations engineers save significant time, equal to 30 FTEs.

Risks. The value of productivity and time-to-market benefits from improved development and DevOps will vary with:

- The maturity of an organization's development and operations practices in previous environments.

- The improvement in feature output timelines with AWS Cloud Ops as well as the number of hours saved in successful deployment.

- The value of the faster and richer app feature sets that contribute to organizational revenue gains.

Results. To account for these risks, Forrester adjusted this benefit downward by 10%, yielding a three-year, risk-adjusted total PV of $14.5 million.

REVENUE LOSS AVOIDED WITH IMPROVED UPTIME

Evidence and data. Interviewees shared that AWS Cloud Ops services have enabled improved security and uptime, resulting in avoided cost and revenue losses. Prior to these foundational services, the interviewees' organizations experienced significant outages due to issues of system reliability and security incidents that created mission-critical events.

After implementation, annual system downtime was reduced to minutes for some interviewees, enabled by Amazon CloudWatch app performance observability and early interventions. Additionally, services such as Amazon Macie and Amazon GuardDuty monitored logs, identity, and access management to mitigate threats. Examples shared by interviewed decision-makers include:

- The VP of technology at the business information services firm said: "Site reliability engineers don't have to stare into a dashboard all day waiting to react. Now, if there is a failure in service, the instance is replaced automatically."

- The chief information security officer at the energy firm related: "Our operational stability has been transformed by AWS, especially on the part of improved security. Priority 1 or 2 incidents have come down 90% in the past two years."

Modeling and assumptions. For the composite organization, Forrester assumes:

- About 65% of downtime events happen during peak hours, and that 50% of events during peak hours impact revenue-generating applications.

- Downtime during off-peak does not impact revenue enough to include here.

- AWS services helps reduce peak, mission-critical downtime by 90%.

Risks. The reduction in downtime and revenue loss will vary with:

- The number and duration of incidents experienced prior to AWS services.

- Whether these outages are during peak times and affect mission-critical and revenue-affecting workloads.

Results. To account for these risks, Forrester adjusted this benefit downward by 10%, yielding a three-year, risk-adjusted total PV of $7.8 million.

Revenue Loss Avoided With Improved Uptime					
Ref.	**Metric**	**Source**	**Year 1**	**Year 2**	**Year 3**
C1	Hours of downtime per year prior to AWS Cloud Ops (includes security and system reliability incidents)	Composite	15	15	15
C2	Percent of downtime during peak hours	Composite	65%	65%	65%
C3	Reduction in time following AWS	Interviews	90%	90%	90%
C4	Percent of events that are mission-critical (impacting revenue)	Composite	50%	50%	50%
C5	Company revenue	Composite	$7 billion	$7 billion	$7 billion
Ct	Revenue loss avoided with improved uptime	C1*C2*C3*C4/8,760	$3,505,993	$3,505,993	$3,505,993
	Risk adjustment	↓10%			
Ctr	Revenue loss avoided with improved uptime (risk-adjusted)		$3,155,394	$3,155,394	$3,155,394
	Three-year total: $9,466,182			**Three-year present value: $7,846,997**	

COST SAVINGS OF AWS SERVICES WITH CONTROLLED UNUSED INSTANCES

Evidence and data. AWS services enabled interviewees' organizations to manage cloud instances as well as the timing of planned downtime in nonpeak periods. These services and automations permitted the creation of controls for unused EC2 instances, creating savings from their nominal utilization cost that would otherwise occur.

The chief architect at the financial services firm said, "The ability to schedule shutting down of instances on weekends and overnight creates significant savings for us."

The chief technology officer at the automotive services firm said, "We have much more transparency about what we are consuming and how to minimize cloud costs."

Modeling and assumptions. For the composite organizations, Forrester assumes that 2.5% of the total cloud compute spend in AWS, which is $60 million, is saved with AWS services to monitor instance use and the ability to control unused instances during nonpeak periods.

Risks. The percent reduction in costs AWS services affords will vary with the extent of nonpeak periods for organizations.

Results. To account for these risks, Forrester adjusted this benefit downward by 10%, yielding a three-year, risk-adjusted total PV of $3.4 million.

Cost Savings Of AWS Services With Controlled Unused Instances					
Ref.	**Metric**	**Source**	**Year 1**	**Year 2**	**Year 3**
D1	Control of unused EC2 instances cost via AWS Cloud Ops	Interviews	$1,500,000	$1,500,000	$1,500,000
Dt	Cost savings of AWS services with controlled unused instances	D1	$1,500,000	$1,500,000	$1,500,000
	Risk adjustment	↓10%			
Dtr	Cost savings of AWS services with controlled unused instances (risk-adjusted)		$1,350,000	$1,350,000	$1,350,000
	Three-year total: $4,050,000			Three-year present value: $3,357,250	

UNQUANTIFIED BENEFITS

Interviewed decision-makers identified additional benefits they have not had time to quantify or are difficult to attribute to a specific process. Unquantified benefits include the following:

- **AWS services were a catalyst for improving IT skills.** Interviewed decision-makers emphasized the value AWS services enabled to develop employee skills, leveraging modern toolsets and capabilities. The chief architect at the financial services firm noted: "While it is a task to upskill 300 people, we no longer go to a third-party consultant to manage skills needs and development. Beyond the learning and training, we've taken it a step further to scale our teams' development ourselves by allowing staff to promote their work through prototypes and hackathons. This creates an in-depth set of skills." This also leads to improved recruiting opportunities as top talent are more interested in working at an organization with mature development processes.

- **AWS has become a trusted partner.** The VP of technology from the business information services firm described the strength and depth of the partnership with AWS, saying: "AWS is great to collaborate with. They have a lot of internal expertise, so we leverage their solution architects and extended product teams, and they provided great feedback to our DevOps. AWS takes our input and needs for feature development."

    The chief technology officer at the automotive services firm said: "AWS is also running a large number of independent and empowered scrum teams [just like us], so we get to learn about their management and CI/CD strategies. How they approach things has helped us manage our widespread developer environment."

FLEXIBILITY

TEI flexibility benefits describe the opportunities organizations can enable to gain additional benefits from potential future investments, and its value is unique to each customer. There are multiple scenarios in which a customer might implement AWS Cloud Ops and later realize additional uses and business opportunities, including:

- **Fluidity in production environment, user testing and system testing.** Interviewees noted that AWS Cloud Ops services enabled their organizations to implement flexibility and multitasking in their deployment and testing across the operation. "We can now be active-active when we need to with the total visibility of AWS services. For instance, we don't impact user acceptance testing during business rollouts at the same time we are doing disaster recovery testing," said the chief architect for the financial service firm.

- **Flexibility in planning and development for organizational growth in the AWS environment.** Interviewees also noted the flexibility created without setting concrete growth plans and supporting budgets. The chief architect at the financial services firm said: "We no longer have concerns about scale, rollouts, time-to-value, budgets, or visibility to our planning and costs. With AWS services, the whole planning cycle is flexible, we have the capability in-house to develop and be creative. We can start with a smaller footprint and then scale as the business scales. AWS services enable us to work around the needs of the business and not the needs of the process."

- **Flexibility to extend production quickly and easily in new markets in ways not possible before AWS services.** AWS services permitted organizations to flexibly grow in markets with minimal cost. The VP of technology at the business information services firm said: "With

AWS's easy setup, we can stand up a product quickly and inexpensively in a region and make that sale without building all the infrastructure. We can spin up an instance there and give a demonstration of the user experience in that market, because that is what it actually is."

Flexibility would also be quantified when evaluated as part of a specific project (described in more detail in Appendix A).

Analysis Of Costs

■ Quantified cost data as applied to the composite

Total Costs

Ref.	Cost	Initial	Year 1	Year 2	Year 3	Total	Present Value
Etr	Implementation, planning, and change management costs	$519,805	$73,700	$18,425	$3,685	$615,615	$604,801
Ftr	Cost of services for operating on AWS	$0	$3,150,000	$3,150,000	$3,150,000	$9,450,000	$7,833,584
	Total costs (risk-adjusted)	$519,805	$3,223,700	$3,168,425	$3,153,685	$10,065,615	$8,438,385

IMPLEMENTATION, PLANNING, AND CHANGE MANAGEMENT COSTS

Evidence and data. Interviewees noted that, with a change in the context of the IT teams supporting legacy applications, networks, systems, and processes, the role and skills of these teams to optimize their AWS cloud environment with native AWS services also changed.

The implementation process began with a small senior management team to plan out internal processes to realize the advantages of the DevOps opportunities, as well as the skills and role development needed from these teams. Developer, DevOps, and security engineer training on major AWS services in networking, operations, management, and security was included. Interviewees described a six-month, part-time commitment for implementation with more intensive FTE engagement in the upfront planning and initial skills development.

The director of technology operations at the financial technology organization said, "In our setting, we've managed a talent transformation from one supporting more traditional network operations to one of engineering operations and support, and how operations in the cloud fit into the software development lifecycle."

The chief information security officer for the energy firm stated: "Our team needs changed significantly. We've gone from almost no internal DevOps capability to a robust team that is hands-on skilled to build and run apps."

The chief technology officer at the automotive services organization said, "We're big on pushing for certifications as we skill up, especially for new projects."

Modeling and assumptions. For the composite organization, Forrester assumes:

- The up-front investment includes planning, migration, change management, and other tasks involving several senior IT people, equating to one FTE for three months with a salary of $175,000.

- Many in the IT workforce invest one week of training on AWS services in the initial implementation with a smaller number of IT employees continuing with shorter training sessions over time.

Risks. The risks that may cause to these costs to vary include:

- The length of time for resource, team, and operational planning specific to each organizational context.

- The degree to which an organization's IT team leverages training required for the adoption of AWS services.

Results. To account for these risks, Forrester adjusted this cost upward by 10%, yielding a three-year, risk-adjusted total PV (discounted at 10%) of $605,000.

Implementation, Planning, And Change Management Costs						
Ref.	**Metric**	**Source**	**Initial**	**Year 1**	**Year 2**	**Year 3**
E1	Initial agile/cloud tools utilization — change management senior team	Interviews	$43,750			
E2	IT all-workforce roles using AWS tools	Composite	200	200	200	200
E3	Percent of IT workforce upskilled	Interviews	80%	20%	5%	1%
E4	Number of IT upskilled	E2*E3	160	40	10	2
E5	Training/utilization hours per employee	Composite	40	25	25	25
E6	Average fully burdened hourly salary for IT workforce utilizing AWS tools	Composite	$67	$67	$67	$67
E7	Training costs	E4*E5*E6	$428,800	$67,000	$16,750	$3,350
Et	Implementation, planning, and change management costs	E1+E2	$472,550	$67,000	$16,750	$3,350
	Risk adjustment	↑10%				
Etr	Implementation, planning, and change management costs (risk-adjusted)		$519,805	$73,700	$18,425	$3,685
	Three-year total: $615,615			**Three-year present value: $604,801**		

COST OF SERVICES FOR OPERATING ON AWS

Evidence and data. Interviewees deployed AWS services to optimize their AWS cloud deployments and meet overarching requirements to establish needs across:

- Security.

- Identity.

- Management.

- Networking.

- Operations.

Across these five domains, organizations could take advantage of some 80 different AWS services, depending on their use case. Some of these services were no additional cost; others had pricing parameters based on utilization (pay as you go).

Modeling and assumptions. Forrester assumes an average across all the paid services across the AWS service domains based on resource utilization.

Management and operations services are the largest cost categories for the composite organization. Networking and security services are the next largest cost components.

The smallest cost component for the composite organization is in services related to user identity and access management. Many of these are provided to customers at no additional cost.

Risks. Other organizations may have a differing set of service requirements and resource demand elements affecting the total price of AWS services.
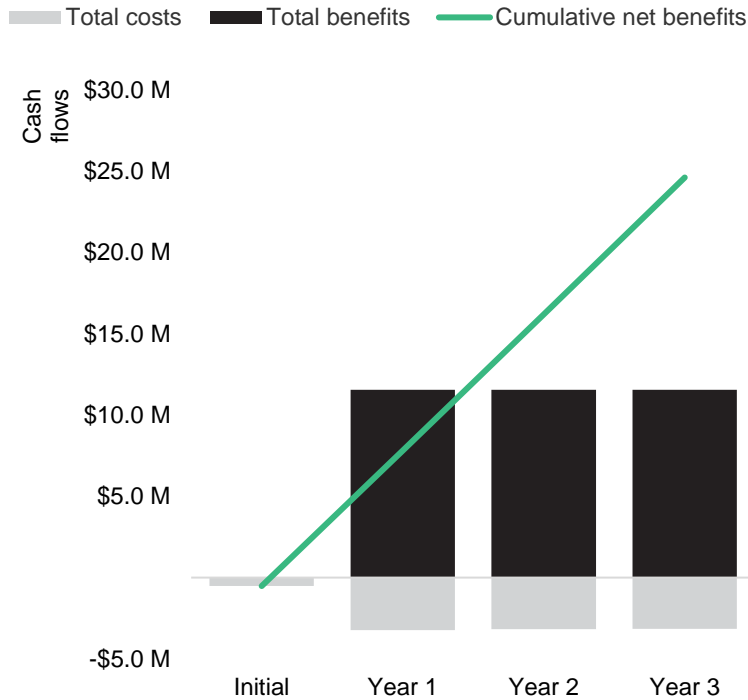
Results. To account for these risks, Forrester adjusted this cost upward by 5%, yielding a three-year, risk-adjusted total PV of $7.8 million.

Cost Of Services For Operating On AWS						
Ref.	**Metric**	**Source**	**Initial**	**Year 1**	**Year 2**	**Year 3**
F1	Cost of services for operating on AWS	Composite	$0	$3,000,000	$3,000,000	$3,000,000
Ft	Cost of services for operating on AWS	F1	$0	$3,000,000	$3,000,000	$3,000,000
	Risk adjustment	↑5%				
Ftr	Cost of services for operating on AWS (risk-adjusted)		$0	$3,150,000	$3,150,000	$3,150,000
	Three-year total: $9,450,000			**Three-year present value: $7,833,584**		

Financial Summary

CONSOLIDATED THREE-YEAR RISK-ADJUSTED METRICS

Cash Flow Chart (Risk-Adjusted)

The financial results calculated in the Benefits and Costs sections can be used to determine the ROI and NPV for the composite organization's investment. Forrester assumes a yearly discount rate of 10% for this analysis.

These risk-adjusted ROI and NPV values are determined by applying risk-adjustment factors to the unadjusted results in each Benefit and Cost section.

Cash Flow Analysis (Risk-Adjusted Estimates)						
	Initial	**Year 1**	**Year 2**	**Year 3**	**Total**	**Present Value**
Total costs	($519,805)	($3,223,700)	($3,168,425)	($3,153,685)	($10,065,615)	($8,438,385)
Total benefits	$0	$11,561,394	$11,561,394	$11,561,394	$34,684,182	$28,751,475
Net benefits	($519,805)	$8,337,694	$8,392,969	$8,407,709	$24,618,567	$20,313,090
ROI						241%

Appendix A: Total Economic Impact

Total Economic Impact is a methodology developed by Forrester Research that enhances a company's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

TOTAL ECONOMIC IMPACT APPROACH

Benefits represent the value delivered to the business by the product. The TEI methodology places equal weight on the measure of benefits and the measure of costs, allowing for a full examination of the effect of the technology on the entire organization.

Costs consider all expenses necessary to deliver the proposed value, or benefits, of the product. The cost category within TEI captures incremental costs over the existing environment for ongoing costs associated with the solution.

Flexibility represents the strategic value that can be obtained for some future additional investment building on top of the initial investment already made. Having the ability to capture that benefit has a PV that can be estimated.

Risks measure the uncertainty of benefit and cost estimates given: 1) the likelihood that estimates will meet original projections and 2) the likelihood that estimates will be tracked over time. TEI risk factors are based on "triangular distribution."

The initial investment column contains costs incurred at "time 0" or at the beginning of Year 1 that are not discounted. All other cash flows are discounted using the discount rate at the end of the year. PV calculations are calculated for each total cost and benefit estimate. NPV calculations in the summary tables are the sum of the initial investment and the discounted cash flows in each year. Sums and present value calculations of the Total Benefits, Total Costs, and Cash Flow tables may not exactly add up, as some rounding may occur.

PRESENT VALUE (PV)

The present or current value of (discounted) cost and benefit estimates given at an interest rate (the discount rate). The PV of costs and benefits feed into the total NPV of cash flows.

NET PRESENT VALUE (NPV)

The present or current value of (discounted) future net cash flows given an interest rate (the discount rate). A positive project NPV normally indicates that the investment should be made, unless other projects have higher NPVs.

RETURN ON INVESTMENT (ROI)

A project's expected return in percentage terms. ROI is calculated by dividing net benefits (benefits less costs) by costs.

DISCOUNT RATE

The interest rate used in cash flow analysis to take into account the time value of money. Organizations typically use discount rates between 8% and 16%.

PAYBACK PERIOD

The breakeven point for an investment. This is the point in time at which net benefits (benefits minus costs) equal initial investment or cost.

Appendix B: Endnotes

[1] Total Economic Impact is a methodology developed by Forrester Research that enhances a company's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

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