A Forrester Total Economic Impact™
Study Commissioned By Google
February 2019

The Total Economic Impact™ Of Google App Engine

Cost Savings And Business Benefits Enabled By App Engine, A Managed Application Development Platform

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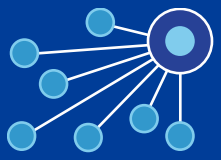
Key Benefits



Improved productivity for application development:
$2,767,219

Increased profit due to improved scaling:
$526,860

Reduced recruiting and onboarding cost for developers and DevOps professionals:
$712,734

Executive Summary

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

Google App Engine provides a managed application development cloud platform. App Engine allows its customers to focus on building their applications while Google handles the back-end infrastructure and scaling. To better understand the benefits, costs, and risks associated with this investment, Forrester interviewed three customers with a minimum of two years of experience using App Engine.

Prior to using App Engine, the interviewed organizations were looking for a development platform on which to build applications. They reviewed several options but ultimately decided on App Engine due to their desire to focus on the business application instead of the underlying infrastructure, especially given the expected spikes in traffic for their applications.

For organizations with unpredictable demand spikes or considering a greenfield development platform, Google App Engine provides increased benefits and ROI compared to other development alternatives, such as containers, virtual machines (VMs), on-premises servers, or some combination thereof. As these organizations move into lower levels of developer abstraction (i.e., fewer managed services compared to Google App Engine — see figure below), the required underlying infrastructure and platform engineering effort will increase, along with an increased effort to scale due to additional provisioning requirements.[1] This increased effort, reduction in ease of flexible scalability, and potential decrease in the benefits identified in this case study mean that as organizations decide to move into lower levels of abstraction, the associated benefits identified in this case study and the ROI will decrease as less time is spent on the business application itself.

Forrester developed a composite organization based on data gathered from the customer interviews to reflect the total economic impact that Google App Engine could have on an organization. The composite organization is representative of the organizations that Forrester interviewed and is used to present the aggregate financial analysis in this study. All values are reported in risk-adjusted three-year present value (PV) unless otherwise indicated.

The composite organization is pursuing a greenfield deployment with 50 developers and two DevOps engineers; it expects frequent spikes in demand. The composite organization compared its expected benefits with GAE to a do-it-yourself (DIY) approach to platform-as-a-service (PaaS), a development alternative using containers, VMs, on-premises servers, or some combination thereof (i.e., “PaaS for DevOps and IT ops pros” at a lower level of abstraction as identified in the figure below).[2]

Key Findings

Quantified benefits. The following benefits reflect the financial analysis associated with the composite organization.

ROI
118%

Benefits PV
$9.0 million

NPV
$4.9 million

- **Improved application development productivity totaling $2.8M.** Interviewed organizations found that their developers spend less time on platform engineering, configuration, and maintenance tasks with App Engine, which allows them to spend more time writing code. Developers have experienced fewer bugs, reduced rework, and found that coding is faster.
- **Increased profit of $527K through improved scaling.** Interviewed organizations found that with App Engine's automatic scaling, they can expect double the year-over-year growth compared to scaling a DIY PaaS solution (i.e., "PaaS for DevOps and IT ops pros" at a lower level of abstraction as identified in the figure below). By leveraging App Engine, organizations don't need to devote resources to scaling activities.
- **Avoided DevOps hiring resulting in $2.7M in payroll cost avoidance.** Interviewed organizations were able to develop and manage workflows with over 70% fewer resources compared to the requirements of managing a DIY PaaS solution. This has allowed the organizations to scale without hiring additional headcount. App Engine enables leaner teams and allows developers to perform a wider range of tasks.
- **Reduced recruiting and onboarding costs totaling $713K in cost avoidance.** Organizations require fewer developers and DevOps resources with App Engine compared to a DIY PaaS solution, reducing the number of developers and DevOps personnel who are hired. In addition to needing fewer resources, the onboarding and training program for App Engine is simpler and faster than a DIY PaaS alternative.
- **Avoided alternate platform costs of $2.3M.** Organizations would need to pay monthly or annual fees for a DIY PaaS platform. Alternate solutions also have different cost distributions from App Engine. GAE costs are discussed below.

Unquantified benefits. The interviewed organizations experienced additional qualitative benefits. These are not quantified in the financial analysis but were mentioned as significant benefits by customers:

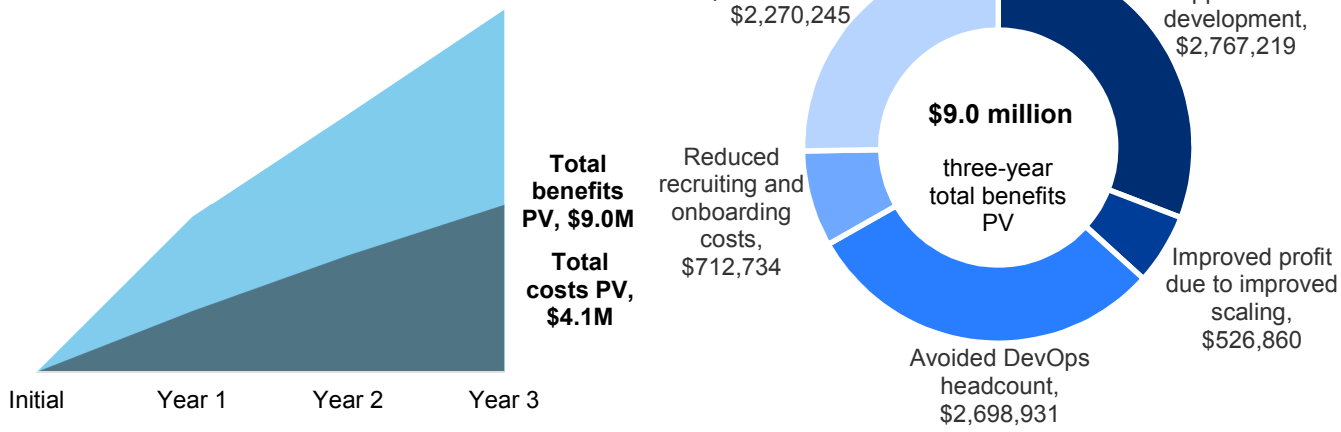
- **Reliability of Google infrastructure.** Organizations feel confident that Google's infrastructure provides a powerful, reliable, and secure environment in which to build their applications, allowing developers to focus on valuable tasks that impact their customers.
- **Integration with other Google Cloud Platform products and services.** Organizations often leveraged multiple Google Cloud Platform services and noted the benefits of seamless integration between the products.

Costs. The following costs reflect the financial analysis associated with the composite organization.

- **Google App Engine costs totaling $4.1 million over three years.** Costs for Google App Engine are paid monthly based on usage.

Forrester's interviews with three existing customers and subsequent financial analysis found that an organization based on these interviewed organizations experienced benefits of $8,975,989 over three years versus costs of $4,118,227, adding up to a net present value (NPV) of $4,857,762 and an ROI of 118%.

Financial Summary



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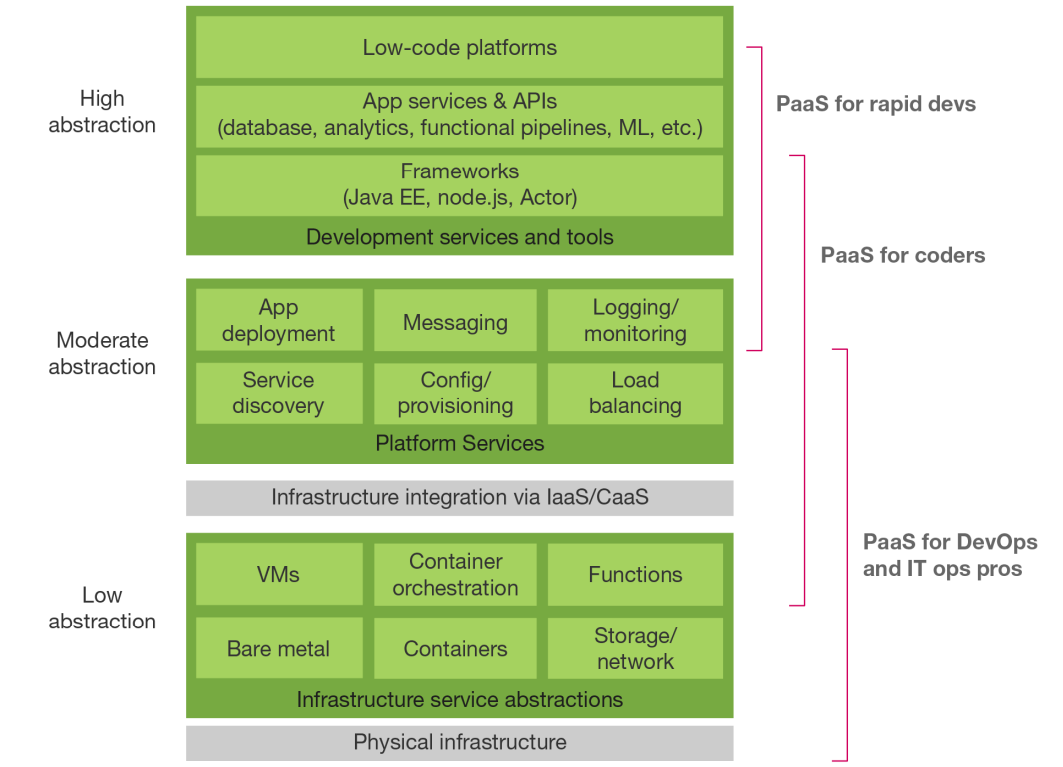
PaaS Provides Three Levels Of Abstraction For Different AD&D Pros

The Three Faces Of Platform-As-A-Service



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TEI Framework And Methodology

From the information provided in the interviews, Forrester has constructed a Total Economic Impact™ (TEI) framework for those organizations considering implementing Google App Engine.

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 Google App Engine can have on an organization:

The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

DUE DILIGENCE
Interviewed Google stakeholders and Forrester analysts to gather data relative to App Engine.

CUSTOMER INTERVIEWS
Interviewed three organizations using App Engine to obtain data with respect to costs, benefits, and risks.

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

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

DISCLOSURES

Readers should be aware of the following:

This study is commissioned by Google 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 report to determine the appropriateness of an investment in Google App Engine.

Google 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.

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

The App Engine Customer Journey

BEFORE AND AFTER THE APP ENGINE INVESTMENT

Interviewed Organizations

For this study, Forrester conducted three interviews with Google App Engine customers. Each customer measured its App Engine "usage" by number of demands or requests experienced on a monthly basis. Interviewed customers include the following:

INDUSTRY	REGION	INTERVIEWEE	NUMBER OF MONTHLY REQUESTS
Mobile entertainment	EMEA	Senior director of technology	350 million
Online telecommunications	North America	Technology lead / software developer	270 million
Content management services (CMS)	North America	Software engineer	500,000

Key Challenges

Before the investment in App Engine, interviewees described the following challenges they were trying to address:

- **Planning for significant and unpredictable increases in demand.** Interviewed organizations did not want to deal with the costs or complexities associated with remediating reliability and scale issues. A software developer in the CMS industry said: "As our customers grow, we grow. As we close deals, we can have significant increases in the traffic to the platform, so we needed something that could accommodate without the need to add or provision additional on-premises servers."
- **Desire to focus on application development and adding business value.** Organizations wanted their top talent focused on adding business value and improving their core products, rather than spending time and energy building and maintaining a platform. A senior director of technology in the mobile entertainment industry said that his company "chose App Engine as a platform that lets you focus mostly on business logic and not low-level details. Generally, our goal was not to have any systems administrators in the company."
- **Cost and availability of engineering talent.** A software developer in the CMS industry said that if his organization did not use App Engine, "we would have had to hire as we grew to scale to more customers and more traffic. We would have to hire more DevOps engineers; we would have to hire more people who can fundamentally understand how to orchestrate that type of networking, design it, architect it, and build it. We would have had to have DevOps engineers on call and be able to support that infrastructure and make sure it's always available. We would have had to build out a whole software reliability engineer role. With App Engine, we don't need any of that."

> "Now, with App Engine, you can deploy with one command."
>
> *Senior director of technology, mobile entertainment industry*

> "We chose App Engine so we could offload the maintenance workload and focus on what matters to us — improving our product for our customers."
>
> *Technology lead and software developer, online telecommunications industry*

Key Results

The interviews revealed that the investment in App Engine provided an intuitive, simple, and reliable platform. App Engine addressed the challenges interviewees were facing and provided additional benefits as well:

INTUITIVE PLATFORM

- **Easy and quick onboarding for new engineers.** A software developer in the CMS industry explained: "As the team grows and scales, we will have varying levels of developer skill sets. I want juniors to be able to come in and be able to deploy codes to our staging environment on day one. With GAE, the onboarding is simple; I can give them the command, and they don't have to think about the details underneath. I have the confidence that there are not going to be any 'gotchas' in that process."
- **Higher confidence level for developers.** A software developer in the CMS industry said: "With App Engine, I can run one command and know that command will not finish out and tell me it's done until it has done all the proper checks and is getting a healthy response form the pod. The confidence level is just so much higher with App Engine."
- **Improved developer velocity from fewer interruptions to developers.** A software developer in the CMS industry said: "A major argument for App Engine is that it increases development velocity when compared to alternate solutions. It removes those issues and interruptions that crop up in other environments, and that allows developers to get into a flow."

SIMPLICITY

- **Faster time-to-market.** The technology lead and software developer in the online telecommunications industry said: "We definitely got our product out faster because of App Engine, probably in the order of months. Then, once deployed, App Engine let us scale and build out new features rather than actually scaling up the infrastructure, which can be a big challenge as your business grows."
- **Simplified environment with less on-premises hardware.** A senior director of technology in the mobile entertainment industry said: "App Engine allows us to simplify our environment quite a lot. We don't have any customer-facing servers on-prem here, and everything is in one place, so we don't have to do many multicloud deployments."
- **More flexible developer resources.** A senior director of technology in the mobile entertainment industry said: "The same developers that are doing R&D are also doing DevOps because it's so simple. We don't need dedicated people or resources to take care of application maintenance. The same guys can now develop new code, then easily deploy, monitor, and troubleshoot things."

RELIABILITY

- **Effortless and reliable scaling.** A technology lead and software developer in the online telecommunications industry said: "Something App Engine does phenomenally well is their auto-scaling ability. It works really well. At the end of the day, if you need to keep going, you just keep paying, and it keeps handling everything. That's been a big benefit as we've been able to just keep focusing on our core business and cranking out features for our users."

> "With App Engine, we have been able to simplify our environment. We still set up our applications; we still define our container files. We just don't have to deal with the networking side of the cluster."
>
> *Content developer, CMS industry*

> "The auto-scaling was a great thing for us. We usually see a big jump in traffic when a new game is released, and with App Engine, we never had to worry about adding machines in advance to accommodate."
>
> *Senior director of technology, mobile entertainment industry*

> "We definitely got our product out faster because of App Engine, probably in the order of months. Then, once deployed, App Engine let us scale and build out new features rather than actually scaling up the infrastructure, which can be a big challenge as your business grows."
>
> *Technology lead and software developer, online telecommunications industry*

› **Reliable uptime and data recovery.** A technology lead and software developer in the online telecommunications industry said: "If we didn't have App Engine, we would have had 10 times more outages. Human error, our own servers going down, there are so many things that can happen. It's pretty amazing what the Google engineering team can do and how quickly they can move traffic around when they need to. And, if we do experience an outage, all of our data is safe on the Google servers and is delivered to our customers once we are back online."

> "It's been a very easy-to-use system. You can get complicated with it if you want, but it's easy to get up and running out of the gate."
>
> *Technology lead and software developer, online telecommunications industry*

Composite Organization

Based on the interviews, Forrester constructed a TEI framework, a composite company, and an associated ROI analysis that illustrates the areas financially affected. The composite organization is representative of the three companies that Forrester interviewed and is used to present the aggregate financial analysis in the next section. The composite organization that Forrester synthesized from the customer interviews has the following characteristics:

Description of composite. The composite organization is planning to develop a new business application and has decided to use Google App Engine as the development platform. It uses 50 developers initially, growing to 55 and 60 developers in Years 2 and 3, respectively. The organization also uses two DevOps engineers, increasing to three in Year 3. The composite expects the application traffic to have frequent spikes in demand.

The composite organization compared its expected benefits with GAE to a "DIY" approach to PaaS, a development alternative using containers, VMs, on-premises servers, or some combination thereof (i.e., "PaaS for DevOps and IT ops pros" at a lower level of abstraction as identified in the figure below).

Key assumptions

- 50 developers
- Two DevOps engineers
- Greenfield deployment
- Frequent spikes in demand

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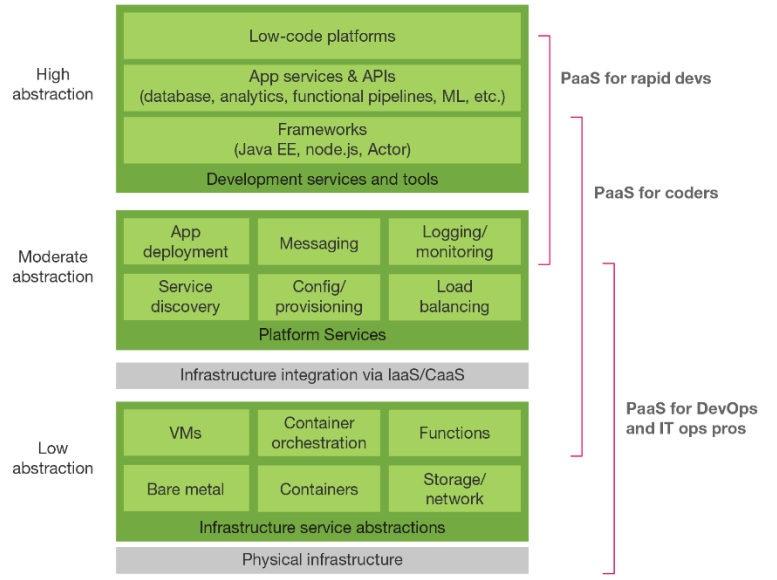
The Three Faces Of Platform-As-A-Service



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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	Improved productivity for application development	$1,017,450	$1,119,195	$1,220,940	$3,357,585	$2,767,219
Btr	Improved profit due to improved scaling	$0	$212,500	$467,500	$680,000	$526,860
Ctr	Avoided DevOps headcount	$1,085,280	$1,085,280	$1,085,280	$3,255,840	$2,698,931
Dtr	Reduced recruiting and onboarding costs	$616,096	$96,749	$96,749	$809,594	$712,734
Etr	Avoided alternative platform costs	$1,497,600	$576,000	$576,000	$2,649,600	$2,270,245
	Total benefits (risk-adjusted)	**$4,216,426**	**$3,089,724**	**$3,446,469**	**$10,752,619**	**$8,975,989**

The table above shows the total of all benefits across the areas listed below, as well as present values (PVs) discounted at 10%. Over three years, the composite organization expects risk-adjusted total benefits to have a PV of nearly $9.0 million.

Benefit 1: Improved Productivity For Application Development

Interviewed organizations found that their developers were spending less time on platform engineering and maintenance tasks with Google App Engine. Developers experienced fewer bugs, reduced rework, and found that coding was faster.

Based on the customer interviews, Forrester estimates for the composite organization:

- With App Engine, the number of developers increases from 50 to 60 over three years to keep pace with application development growth.
- Developers would spend 40% of their time on platform engineering tasks with a DIY PaaS solution.
- Developers spend 20% of their time on platform engineering tasks with App Engine.

This benefit can vary due to uncertainty related to:

- The alternative development environment.
- Productivity and experience of developers.

To account for these risks, Forrester adjusted this benefit downward by 15%, yielding an annual benefit ranging from $1,017,450 with 50 developers in Year 1 to $1,220,940 with 60 developers in Year 3, with a three-year risk-adjusted total PV of nearly $2.8 million.

Application developers spend less time on platform engineering with Google App Engine.

Impact risk is the risk that the business or technology needs of the organization may not be met by the investment, resulting in lower overall total benefits. The greater the uncertainty, the wider the potential range of outcomes for benefit estimates.

Benefit 1: Improved Productivity For Application Development Calculation Table					
REF.	**METRIC**	**CALC.**	**YEAR 1**	**YEAR 2**	**YEAR 3**
A1	Number of developers	Composite organization	50	55	60
A2	Amount of time developers would spend on platform engineering with DIY PaaS solutions	Composite organization	40%	40%	40%
A3	Amount of time developers spend on platform engineering with GAE	Composite organization	20%	20%	20%
A4	Developer fully burdened annual salary	Forrester assumption	$119,700	$119,700	$119,700
At	Improved productivity for application development	A1*(A2-A3)*A4	$1,197,000	$1,316,700	$1,436,400
	Risk adjustment	↓15%			
Atr	**Improved productivity for application development (risk-adjusted)**		**$1,017,450**	**$1,119,195**	**$1,220,940**

Benefit 2: Increased Profit Due To Improved Scaling

Interviewed organizations described the costs and challenges involved with scaling and maintaining DIY PaaS solutions that would impact the overall profit margin of their applications. One major challenge is predicting demand following a new release or update or after onboarding a new customer, and then setting up the environment to be able to accommodate the demand spikes. The costs associated with scaling the DIY PaaS solution include:

- Purchasing, provisioning, and maintaining on-premises servers.
- Scaling and testing the environment to prevent issues and avoid downtime.
- Constant (24x7) monitoring and support.

With Google App Engine, organizations do not need to plan for or accommodate spikes in traffic because App Engine automatically scales to meet demand. Additionally, the flexibility to meet unexpected demand results in increased revenue growth.

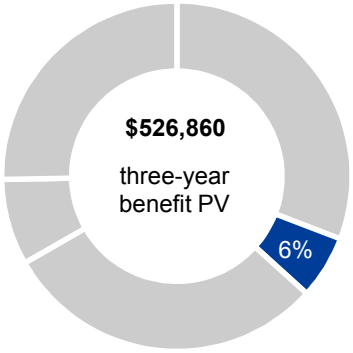
Based on the customer interviews, Forrester estimates that the composite organization:

- First realizes revenue in Year 2.
- Would see revenue growth of 10% YoY with a DIY PaaS solution.
- Experiences revenue growth of 20% YoY with Google App Engine.

This benefit can vary due to uncertainty related to:

- Profit margin on DIY PaaS solution.
- Scale and efficiency of on-premises solution.

To account for these risks, Forrester adjusted this benefit downward by 15%, yielding an annual benefit ranging from $212,500 in Year 2 to $467,500 in Year 3, with a three-year risk-adjusted total PV of $526,860.



Increased profit due to improved scaling: **6%** of total benefits

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Benefit 2: Increased Profit Due To Improved Scaling Calculation Table					
REF.	**METRIC**	**CALC.**	**YEAR 1**	**YEAR 2**	**YEAR 3**
B1	Expected annual profit while on DIY PaaS solutions	10% growth YoY	$0	$2,500,000	$2,750,000
B2	Annual profit while on GAE due to improved scaling capabilities	20% growth YoY	$0	$2,750,000	$3,300,000
Bt	Improved profit due to improved scaling	B2-B1	$0	$250,000	$550,000
	Risk adjustment	↓15%			
Btr	**Improved profit due to improved scaling (risk-adjusted)**		**$0**	**$212,500**	**$467,500**

Benefit 3: Avoided DevOps Headcount

Interviewed organizations described the following benefits related to the number of DevOps engineers required with Google App Engine versus a DIY PaaS solution:

- With a DIY PaaS solution, organizations expected to hire a full DevOps team responsible for setting up a comprehensive workflow that starts with developers writing code and moves through packaging, testing, deployment, and production.
- Finding talent with this skill set is difficult, expensive, and time-consuming.

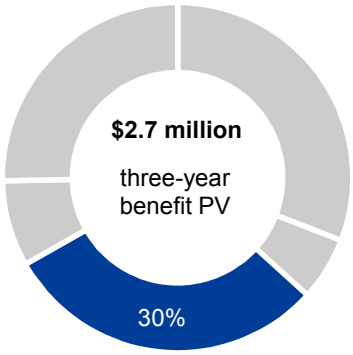
Based on the customer interviews, Forrester estimates for the composite organization:

- Ten DevOps engineers would be needed to plan and execute the development workflow on a DIY PaaS solution.
- App Engine requires two DevOps engineers to manage and execute the workflow.
- The fully burdened DevOps engineer salary is $159,600 per year.

This benefit can vary due to uncertainty related to:

- Number of DevOps engineers required for a DIY PaaS deployment.
- Number of DevOps engineers required with App Engine.
- Fully burdened DevOps engineer salary.

To account for these risks, Forrester adjusted this benefit downward by 15%, yielding an annual benefit of $1,085,280, with a three-year risk-adjusted total PV of nearly $2.7 million.



Avoided DevOps headcount: **30%** of total benefits

Google App Engine requires at least 70% fewer DevOps resources.

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Benefit 3: Avoided DevOps Headcount Calculation Table					
REF.	**METRIC**	**CALC.**	**YEAR 1**	**YEAR 2**	**YEAR 3**
C1	Planned total need for DevOps engineers with DIY PaaS solutions	Composite organization	10	10	11
C2	Number of DevOps engineers with GAE	Composite organization	2	2	3
C3	DevOps engineer fully burdened annual salary	Forrester assumption	$159,600	$159,600	$159,600
Ct	Avoided DevOps headcount	(C1-C2)*C3	$1,276,800	$1,276,800	$1,276,800
	Risk adjustment	↓15%			
Ctr	**Avoided DevOps headcount (risk-adjusted)**		**$1,085,280**	**$1,085,280**	**$1,085,280**

Benefit 4: Reduced Recruiting And Onboarding Costs

Interviewed organizations described the following benefits related to recruiting and onboarding developer and DevOps talent:

- Organizations require fewer developers and DevOps resources with App Engine versus a DIY PaaS solution because App Engine is a managed platform that provides auto-scaling and other services.
- The onboarding and training program for App Engine is significantly simpler and faster than a DIY PaaS alternative. A senior director of technology in the mobile entertainment industry said: “From my current team, nobody had experience with App Engine before coming here. It is very easy to onboard people. We had people doing deployments on their second day of work.”

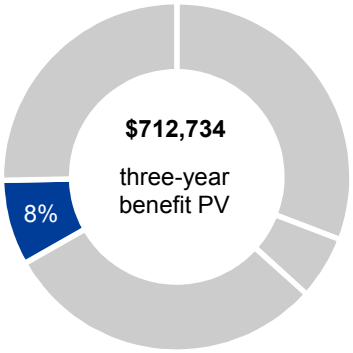
Based on the customer interviews, Forrester estimates for the composite organization:

- Using App Engine requires 52 developers and DevOps personnel in Year 1, while a DIY PaaS solution requires a 60-person team.
- There is a 10% churn rate.
- The total cost to recruit and hire a new developer or DevOps professional is $75,000 per hire.
- New hires earn a fully burdened annual salary of $119,700.
- App Engine requires one day of training and onboarding as opposed to a 15-day training and onboarding program for a DIY PaaS solution.

This benefit can vary due to uncertainty related to:

- Size of developer and DevOps team required.
- Annual salary for developers and DevOps professionals.
- Cost to recruit developers and DevOps professionals.
- Training and onboarding required for a DIY PaaS solution.

To account for these risks, Forrester adjusted this benefit downward by 20%, yielding an annual benefit ranging from $616,096 at the onset of an application development project to $96,749 annually once underway, with a three-year risk-adjusted total PV of $712,734.



Reduced recruiting and onboarding costs: **8%** of total benefits

Google App Engine requires over 10% fewer developer and DevOps resources.

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Benefit 4: Reduced Recruiting And Onboarding Costs Calculation Table					
REF.	**METRIC**	**CALC.**	**YEAR 1**	**YEAR 2**	**YEAR 3**
D1	Total developers and DevOps engineers with DIY PaaS solutions	A1 + C1	52	57	63
D2	Total developers and DevOps engineers with GAE	A1 + C2	60	65	71
D3	Employee churn rate	Forrester assumption	10%	10%	10%
D4	New employees due to churn, with GAE	D1*D3, rounded	5	6	6
D5	New employees due to churn, with DIY PaaS solutions	D2*D3, rounded	6	7	7
D6	Additional DevOps hires in Year 1 with DIY PaaS solutions	C1-C2	8	0	0
D7	Recruiting costs per new employee	Forrester assumption	$75,000	$75,000	$75,000
D8	*Subtotal: Recruiting costs with GAE*	*D4*D7*	*$375,000*	*$450,000*	*$450,000*
D9	*Subtotal: Recruiting costs with DIY PaaS solutions*	*(D5+D6)*D7*	*$1,050,000*	*$525,000*	*$525,000*
D10	Number of days for onboarding, with GAE	Composite organization	1	1	1
D11	Number of days for onboarding, with DIY PaaS solutions	Composite organization	15	15	15
D12	Developer fully burdened annual salary	Forrester assumption	$119,700	$119,700	$119,700
D13	Developer fully burdened hourly salary	D12/2,080, rounded	$58	$58	$58
D14	*Subtotal: Annual onboarding cost, with GAE*	*D4*D10*D13*(8 hours per day)*	*$2,320*	*$2,784*	*$2,784*
D15	*Subtotal: Annual onboarding cost, with DIY PaaS solutions*	*(D5+D6)*D11*D13*(8 hours per day)*	*$97,440*	*$48,720*	*$48,720*
Dt	Reduced recruiting and onboarding costs	(D9-D8) + (D15-D14)	$770,120	$120,936	$120,936
	Risk adjustment	↓20%			
Dtr	**Reduced recruiting and onboarding costs (risk-adjusted)**		**$616,096**	**$96,749**	**$96,749**

Benefit 5: Avoided Alternative Platform Costs

Interviewed organizations described the following benefits related to avoided monthly platform subscription costs:

› Alternate DIY PaaS solution would require a monthly or annual subscription fee to leverage the platform.

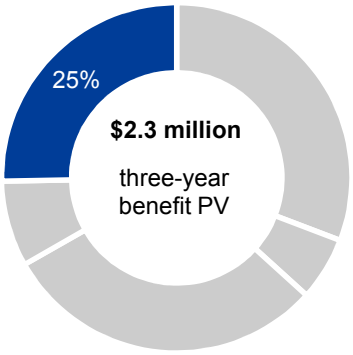
Based on the customer interviews, Forrester estimates for the composite organization:

› An alternate platform would cost about $156,000 per month in Year 1 and $60,000 per month in subsequent years. GAE costs are discussed in the Analysis Of Costs section.

This benefit can vary due to uncertainty related to:

› Subscription cost of alternate DIY PaaS solution.

To account for these risks, Forrester adjusted this benefit downward by 20%, yielding an annual benefit ranging from $1,497,600 in Year 1 to $576,000 in subsequent years, with a three-year risk-adjusted total PV of nearly $2.3 million.



Avoided alternative platform costs: **25%** of total benefits

Benefit 5: Avoided Alternate Platform Costs Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
E1	Monthly alternative platform cost	Composite organization	$156,000	$60,000	$60,000
Et	Avoided alternative platform costs	E1*12	$1,872,000	$720,000	$720,000
	Risk adjustment	↓20%			
Etr	**Avoided alternative platform costs (risk-adjusted)**		**$1,497,600**	**$576,000**	**$576,000**

Unquantified Benefits

While there were strong and quantifiable benefits the interviewed organizations observed by using Google App Engine, they experienced significant qualitative benefits as well. These could potentially be quantified in a financial analysis if given the appropriate data and metrics.

› **Size, power, and reliability of Google infrastructure.** Organizations referenced the confidence and security that they felt working within Google's infrastructure as opposed to a DIY PaaS solution. By building on Google's platform, developers and business managers have confidence that their applications will not experience outages, that their sensitive data is safe and securely stored, and that should any problems arise, they have the support of Google's engineering team to respond quickly and provide solutions.

› **Integration with other Google Cloud Platform products and services.** Organizations often leveraged multiple Google Cloud Platform services and noted the benefits of seamless integration between the products.

Organizations can focus on optimizing experiences for their customers with the confidence that Google is managing the back end.

Flexibility

The value of flexibility is clearly unique to each customer, and the

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measure of its value varies from organization to organization. There are multiple scenarios in which a customer might choose to implement App Engine and later realize additional uses and business opportunities, including:

- **Responsiveness and flexibility of Google's developers.** Interviewed organizations described having a good relationship with the App Engine team and appreciated Google's willingness to work with clients to solve challenges and discuss plans for future updates to the platform. Organizations appreciate the fact that Google is responsive and attentive to their needs; organizations feel like they are partners, rather than customers.
- **Alignment to Google's long-term vision of software development and deployment.** A software developer in the CMS industry said: "I fundamentally agree with the velocity and processes that Google has laid out with App Engine and the Google Cloud Platform in general. This is how software should be delivered."
- **Google infrastructure.** Google is continuously working to improve its products for its customers. Developing in the Google cloud gives organizations the opportunity to explore and capitalize on new features as they are released and to participate in design and testing of new features and products.

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

Flexibility, as defined by TEI, represents an investment in additional capacity or capability that could be turned into business benefit for a future additional investment. This provides an organization with the "right" or the ability to engage in future initiatives but not the obligation to do so.

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
Ftr	Google App Engine costs	$0	$1,656,000	$1,656,000	$1,656,000	$4,968,000	$4,118,227
	Total costs (risk-adjusted)	**$0**	**$1,656,000**	**$1,656,000**	**$1,656,000**	**$4,968,000**	**$4,118,227**

Cost 1: Google App Engine Costs

Interviewed organizations paid Google App Engine costs monthly based on their actual usage.

Based on the customer interviews, Forrester estimates for the composite organization an average of $120,000 in monthly costs. There are minimal startup and ongoing maintenance costs, which are included in the calculated subscription fee for simplicity.

This cost can vary due to uncertainty related to demand and subsequent subscription fees.

To account for these risks, Forrester adjusted this cost upward by 15%, yielding an annual cost of $1,656,000, with a three-year risk-adjusted total PV of over $4.1 million.

The table above shows the total of all costs across the areas listed below, as well as present values (PVs) discounted at 10%. Over three years, the composite organization expects risk-adjusted total costs to have a PV of more than $4.1 million.

Implementation risk is the risk that a proposed investment may deviate from the original or expected requirements, resulting in higher costs than anticipated. The greater the uncertainty, the wider the potential range of outcomes for cost estimates.

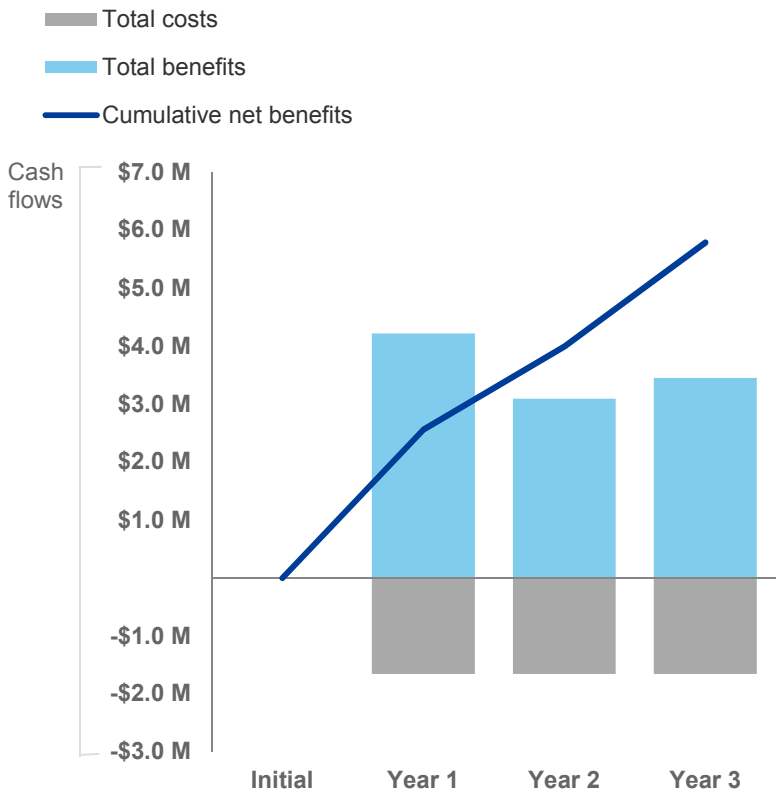
Cost 1: Google App Engine Costs Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3
F1	Monthly GAE costs in production	Composite organization		$120,000	$120,000	$120,000
Ft	GAE costs	F1*12		$1,440,000	$1,440,000	$1,440,000
	Risk adjustment	↑15%				
Ftr	**GAE costs (risk-adjusted)**		**$0**	**$1,656,000**	**$1,656,000**	**$1,656,000**

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, NPV, and payback period for the composite organization's investment. Forrester assumes a yearly discount rate of 10% for this analysis.

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

Cash Flow Table (Risk-Adjusted)

	INITIAL	YEAR 1	YEAR 2	YEAR 3	TOTAL	PRESENT VALUE
Total costs	$0	($1,656,000)	($1,656,000)	($1,656,000)	($4,968,000)	($4,118,227)
Total benefits	$0	$4,216,426	$3,089,724	$3,446,469	$10,752,619	$8,975,989
Net benefits	$0	$2,560,426	$1,433,724	$1,790,469	$5,784,619	$4,857,762
ROI						118%

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Google App Engine: Overview

The following information is provided by Google. Forrester has not validated any claims and does not endorse Google or its offerings.

Fully managed serverless application platform

Build and deploy applications on a fully managed platform. Scale your applications seamlessly from zero to planet scale without having to worry about managing the underlying infrastructure. With zero server management and zero configuration deployments, developers can focus only on building great applications without the management overhead. App Engine enables developers to stay more productive and agile by supporting popular development languages and a wide range of developer tools.

Open & familiar languages and tools

Quickly build and deploy applications using many of the popular languages like Java, PHP, Node.js, Python, C#, .Net, Ruby and Go or bring your own language runtimes and frameworks if you choose. Get started quickly with zero configuration deployments in App Engine. Manage resources from the command line, debug source code in production and run API backends easily using industry leading tools such as Cloud SDK, Cloud Source Repositories, IntelliJ IDEA, Visual Studio and PowerShell.

Just add code

Focus just on writing code, without the worry of managing the underlying infrastructure. With capabilities such as automatic scaling-up and scaling-down of your application between zero and planet scale, fully managed patching and management of your servers, you can offload all your infrastructure concerns to Google. Protect your applications from security threats using App Engine firewall capabilities, Identity and Access Management (IAM) rules, and managed SSL/ TLS certificates.

Pay only for what you use

Choose to run your applications in a serverless environment without the worry of over or under provisioning. App Engine automatically scales depending on your application traffic and consumes resources only when your code is running. You will only need to pay for the resources you consume.

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] Source: “The Three Faces Of Platform-As-A-Service,” Forrester Research, Inc., June 21, 2017.

[2] Source: Ibid.