

A Forrester Total Economic Impact™ Study
Commissioned By Red Hat Consulting
June 2018

The Total Economic Impact™ Of Red Hat Consulting's Container Adoption Program And Red Hat Open Innovation Labs

Cost Savings And Business Benefits Of Operationalizing The Use Of Containers, Microservices, And DevOps To Modernize And Streamline Application Delivery

Table Of Contents

Executive Summary	1
Key Findings	1
TEI Framework And Methodology	4
Customer Journey: Transforming The Application Development Life Cycle	5
Interviewed Organizations	5
Key Challenges	5
Collaboration With Red Hat Consulting	6
Key Results	6
Composite Organization	7
Analysis Of Benefits	8
Application Planning, Design, And Documentation Savings	8
Reduced Initial Application Development, Testing, And Deployment Costs	10
Application Upgrade, Maintenance, And Management Efficiencies	11
Infrastructure Utilization Efficiency Savings	12
Flexibility	13
Analysis Of Costs	14
Red Hat Fees	14
OpenShift Container Platform Implementation Costs	15
Opportunity Costs of Training	16
Ongoing Operations And Administration Costs	17
Financial Summary	18
Red Hat Consulting's Container Adoption Program And Open Innovation Labs: Overview	19
Appendix A: Total Economic Impact	20
Appendix B: Endnotes	21

Project Director:
Adam Schlegel

ABOUT FORRESTER CONSULTING

Forrester Consulting provides independent and objective research-based consulting to help leaders succeed in their organizations. Ranging in scope from a short strategy session to custom projects, Forrester's Consulting services connect you directly with research analysts who apply expert insight to your specific business challenges. For more information, visit forrester.com/consulting.

© 2018, Forrester Research, Inc. All rights reserved. Unauthorized reproduction is strictly prohibited. Information is based on best available resources. Opinions reflect judgment at the time and are subject to change. Forrester®, Technographics®, Forrester Wave, RoleView, TechRadar, and Total Economic Impact are trademarks of Forrester Research, Inc. All other trademarks are the property of their respective companies. For additional information, go to forrester.com.

Executive Summary

Key Benefits



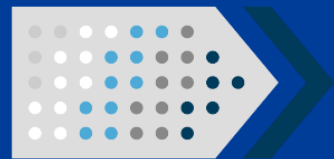
Planning, documentation, and design savings:

80%+



Application development, testing, and deployment cycle cost reductions:

60%+



Application upgrade, maintenance, and management efficiencies:

50%+

In the race to deliver transformative business change, application development and delivery leaders are looking to modern tools and processes that can support both brownfield evolution of existing legacy monolithic applications and greenfield development of new solutions.¹ The use of containers and container orchestration tools, which help developers build and release code faster, is providing a strong avenue for organizations to build winning digital customer and employee experiences. While container adoption has historically been limited to proof-of-concepts and pilots, usually involving only a handful of applications, today, containers are a key supporting block for agile and DevOps methodologies. In fact, over half of developers and IT leaders now consider themselves highly skilled with containers and are actively adopting container platform strategies.²

With its container adoption program and Red Hat® Open Innovation Labs residencies, Red Hat Consulting provides organizations with the advanced container platform (Red Hat OpenShift® Container Platform), approach, professional services, change management, and support needed to modernize and streamline application delivery processes. These solutions enable organizations to rapidly operationalize the use of containers, microservices, and DevOps into their application development life cycle.

Red Hat commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study to examine the potential return on investment (ROI) enterprises may realize by investing in its container adoption program and Open Innovation Labs. The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of Red Hat Consulting's solutions on their organizations.

To better understand the benefits, costs, and risks associated with this investment, Forrester interviewed five Red Hat customers with experience using its container adoption program and OpenShift Container Platform, including several customers who attended its Open Innovation Labs residency. Prior to working with Red Hat, these organizations struggled with expensive, slow, and inefficient legacy systems that inhibited their ability to effectively bring new applications and feature releases to market. By working with Red Hat's services teams, interviewees transformed their application development and delivery life cycles, accelerating time-to-market, reducing costs, and enabling winning digital customer and employee experiences.

Key Findings

Quantified benefits. The following risk-adjusted present value (PV) quantified benefits are representative of those experienced by the companies interviewed:

- › **Developers reduced the time required to plan, document, and design each application by over 80%.** After institutionalizing the collaborative and integrated application planning processes learned through Red Hat Consulting's container adoption program and Open Innovation Labs, the organization transformed the initial application requirements gathering, planning, and documentation phase of the software application life cycle into a focused, agile approach, saving one to three months of time and resulting in three-year present-value (PV) adjusted cost savings of approximately \$2.0 million.



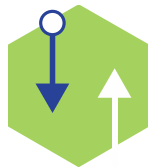
ROI
120%



Benefits PV
\$10.1 million



NPV
\$5.5 million



Payback
17 months

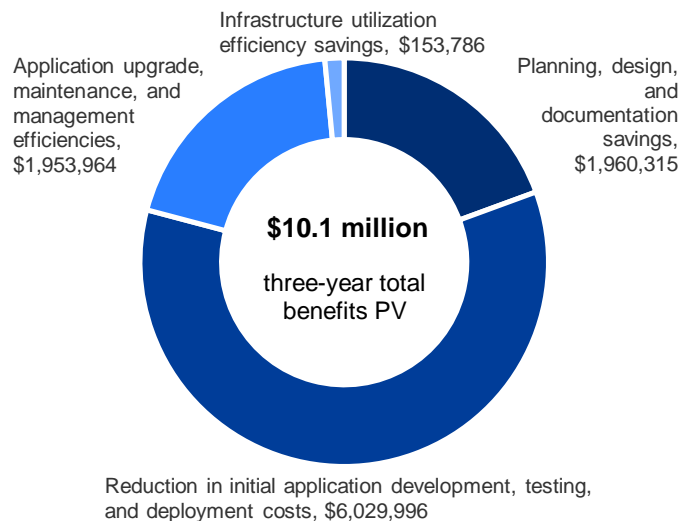
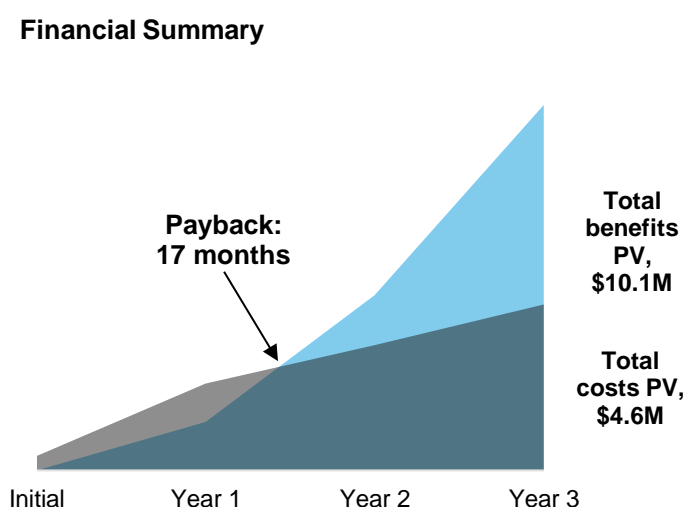
- › **Developers accelerated application development, testing, and deployment cycles, slashing initial build costs of applications by more than 60%.** The introduction and application of DevOps, microservices, and containerization using the OpenShift Container Platform allowed projects to fail faster while breaking down functional silos in IT, saving the organization a three-year PV of over \$6.0 million.
- › **Developers accelerated release cycles while reducing application update and maintenance costs by over 50%.** The combined agility benefits delivered by both containers and microservices accelerated release cycles while reducing ongoing application updates, feature releases, and maintenance, saving the organization a three-year PV of nearly \$2.0 million.
- › **Improved infrastructure utilization and consolidation using containers allowed developers to cut the virtual machine (VM) footprint for each application in half.** The resulting three-year infrastructure savings totaled a PV of \$154K.

Costs. A composite organization, based on the interviewed organizations and described in greater detail later in this study, experienced the following risk-adjusted PV costs over the three-year analysis:

- › Red Hat fees, including OpenShift Container Platform subscriptions, professional services, and Open Innovation Labs residency, totaled \$1.9M.
- › Implementation costs, including the internal engineering resource costs required to support the implementation of the OpenShift Container Platform and the cost of hardware for its development and production environments, amounted to a three-year PV of \$356K.
- › The organization incurred internal training costs of \$129K.
- › The internal resource costs for the core team required to manage and run its OpenShift Container Platform clusters totaled a three-year PV of \$2.2M.

Forrester's interviews with five existing Red Hat customers and subsequent financial analysis found that the composite organization based on these interviewed organizations experienced benefits of \$10.1M over three years versus costs of \$4.6M, adding up to a net present value (NPV) of \$5.5M and an ROI of 120%.

Financial Summary



Unquantified benefits. The interviewed organizations experienced the following benefits, which are not quantified for this study. While these benefits were significant to interviewees, they are not reflected in the financial model due to lack of consistent metrics or key performance indicators (KPIs) needed to measure the improvements:

- › **Improved customer and employee satisfaction.** Interviewees observed a noticeable improvement in customer satisfaction, largely driven by a decrease in time required to deliver application updates, fixes, and new features.
- › **Enhanced software quality.** Organizations could improve the effectiveness of software testing by using CI/CD to run code more frequently in smaller batches. This resulted in fewer bugs and defects deployed to production.

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

TEI Framework And Methodology

From the information provided in the interviews, Forrester has constructed a Total Economic Impact™ (TEI) framework for those organizations considering investing in Red Hat Consulting's container adoption program and Red Hat Open Innovation Labs.

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 Red Hat's services can have on an organization:



DUE DILIGENCE

Interviewed Red Hat stakeholders and Forrester analysts to gather data relative to container technologies, the OpenShift Container Platform, and Red Hat's container adoption program and Red Hat Open Innovation Labs.



CUSTOMER INTERVIEWS

Interviewed five organizations using Container Adoption and/or Red Hat Open Innovation Labs to obtain data with respect to costs, benefits, and risks.



COMPOSITE ORGANIZATION

Designed a composite organization based on typical 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 elements of TEI in modeling Red Hat's Container Adoption and Open Innovation Labs services impact: benefits, costs, flexibility, and risks. Given the increasing sophistication that enterprises have regarding ROI analyses, 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 Red Hat Consulting 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 Red Hat Consulting's container adoption program & Red Hat Open Innovation Labs.

Red Hat Consulting 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.

Red Hat Consulting provided the customer names for the interviews but did not participate in the interviews.

Customer Journey: Transforming The Application Development Life Cycle

BEFORE AND AFTER THE RED HAT CONSULTING INVESTMENT

Interviewed Organizations

For this study, Forrester conducted five interviews with Red Hat's customers that used its container adoption program, including a customer who attended several Red Hat Open Innovation Labs residencies. Interviewed customers had the following characteristics:

INDUSTRY	SIZE	DEVELOPMENT & IT OPERATIONS TEAM	TITLE
Airline	<1K employees	<100 employees	IT manager
Financial services	\$1B to \$5B revenue 1K to 5K employees	<100 employees	Head of software architecture
Transportation	\$500M to \$1B revenue 1K to 5K employees	>1K employees	Product owner
Financial services	\$1B to \$5B revenue 1K to 5K employees	<100 employees	Infrastructure architecture manager
Financial services	<1K employees	<100 employees	Chief information officer

Key Challenges

Prior to working with Red Hat Consulting, interviewees spoke of several challenges and pain points hampering their business transformation initiatives:

- › **Legacy tools and software development processes made it difficult to effect change and to quickly respond to evolving customer needs.** The chief information officer at a financial services company shared: "I think the ability to deliver change for our organization was just too slow. We are on a transformational journey to make ourselves more digital, and our legacy systems were holding us back. Our teams were just continuing to work in the same old way with the same slow processes. . . . We had to find a way to work better, faster, and smarter so that we could deliver transformational change for our businesses and, ultimately, our customers."
- › **Monolithic applications became increasingly burdensome and expensive to manage as organizations sought to build competitive advantage.** Interviewees increasingly struggled to maintain, update, and put out new feature releases for legacy, monolithic applications, inhibiting their ability to deliver winning digital customer experiences. An IT manager for an airline loyalty program described, "[Our] old legacy application was a huge and complex system, which made it difficult to develop, implement, and maintain new features." He continued: "First we asked ourselves how we could cluster some things into smaller applications. Then one partner recommended using microservices, and that discussion eventually led to us adopting Red Hat's container solutions."

"We were being held back by a core legacy system that was over 30 years old. We wouldn't be here today if we continued to work in the old way."

*Chief information officer,
financial services*



- › **Lack of a DevOps culture led to misalignment between IT and the lines of businesses.** One interviewee described a desire to use learnings from working with Red Hat Open Innovation Labs to drive cultural change within the organization: “We just lacked the necessary knowledge and skill sets around container adoption, orchestration, and governance to really bolster developer and operations efficiencies. We were desperate for a new development approach.”

“Teams within IT were just throwing things over the fence to each other, which became too inefficient. We needed to automate some of our manual [software] development life cycle activities.”

Head of software architecture, financial services



Collaboration With Red Hat Consulting

The interviewed organizations specified the following reasons for choosing to engage with Red Hat Consulting:

- › **Red Hat offered a way to facilitate a rapid transfer of knowledge and best practices to the organizations’ developers and IT staff.** One interviewee explained, “I believe Red Hat Open Innovation Labs is a massive opportunity for rapid transformational change for a small group of people who can then help drive that change through the rest of the organization.”
- › **Red Hat delivered a comprehensive end-to-end solution to drive business transformation.** One interviewee described: “There were other platforms that were simple and easy to use, but they had limitations. We wanted to have a single solution that everyone could buy into.” He continued, “With Red Hat, we believed we could use it across all of our systems and we wouldn’t need to buy anything else.”

“Red Hat is the only one to do an innovation lab and have a fast-tracked rollout of their systems where they come and help drive the transformational change for you.”

Chief information officer, financial services



Key Results

The interviews revealed that key results from investments in Red Hat’s container adoption program and Red Hat Open Innovation Labs residency include:

- › **Accelerated application release cadence.** In the old way of doing things, regression testing new product features on their applications could take organizations up to two months, with several additional months required to build the services and infrastructure required to run the app. Red Hat helped streamline application delivery processes, accelerating time-to-market for new application and product features. The IT manager of an airline loyalty program described, “Development and testing is easier because you’re doing it in smaller batches and deployment can be done at the push of a button.”
- › **Faster time-to-market for new applications and features.** One interviewee estimated that new applications and product feature releases were being delivered four to 10 times faster using Red Hat’s tools and modern development processes relative to the legacy development tools and processes.

“With our old way of doing things, it took a minimum of six months to take an app from idea to production. Now it’s possible to bring an app to production in two to four weeks.”

IT manager, airline loyalty program



- › **Better collaboration between development and operations teams.** An information technology company experienced a significant reduction in downtime required for application deployment, resulting in labor cost savings: “Our downtime went from several hours per week to mere minutes. Releases can now be deployed within production, which means no more weekend work!”
- › **Reduced risk.** The IT manager of an airline loyalty program explained, “The risks of deploying an update decrease significantly [using microservices] since a small portion of the product is affected.”
- › **Improved asset utilization.** With Red Hat, organizations could improve their asset utilization, significantly reducing their infrastructure footprint. One interviewee stated, “We were able to nearly halve the number of virtual machines per app for those developed with containers and microservices.”
- › **Reduced application development life cycle costs.** The introduction of containers, the OpenShift Container Platform, microservices, DevOps, and other tools and processes for modern application delivery helped organizations reduce application development costs by as much as 75%, while concurrently reducing operations costs by as much as 70%.

“Our downtime went from several hours per week to mere minutes. Releases can now be deployed within production faster, which means no more weekend work.”

*Head of software architecture,
financial services*



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 five 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:

- › The organization is a regional financial services enterprise with \$4B in annual revenue and 2,000 employees, including 100 developers and IT operations staff.
- › Its existing application portfolio consisted of 150 applications (both core and supporting) with 50 new applications and workloads to be built annually over the three-year analysis.
- › The organization engaged Red Hat Consulting to conduct a pilot program to build a small number of new applications and refactor several legacy monolithic applications using Red Hat OpenShift Container Platform, microservices, and DevOps processes.
- › Additionally, the organization had limited DevOps and agile methodology skill sets prior to engaging Red Hat. As such, the organization decided to send a multidisciplinary team of developers, engineers, product leads, and agile practitioners to Red Hat Open Innovation Labs residency to catalyze its digital business transformation. The organization used a train-the-trainer and change-agent strategy to operationalize and institutionalize the modern application development techniques instilled through the residency.



Key assumptions

Regional financial services enterprise with:

- \$4 billion in annual revenue
- 2,000 employees
- 100 development and IT operations staff
- 300 applications existing and on the company’s road map

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	Planning, design, and documentation savings	\$356,933	\$866,837	\$1,223,770	\$2,447,539	\$1,960,315
Btr	Reduction in initial application development, testing, and deployment costs	\$990,360	\$2,605,590	\$3,961,440	\$7,557,390	\$6,029,996
Ctr	Application upgrade, maintenance, and management efficiencies	\$103,163	\$707,400	\$1,697,760	\$2,508,323	\$1,953,964
Dtr	Infrastructure utilization efficiency savings	\$17,290	\$59,280	\$118,560	\$195,130	\$153,786
	Total benefits (risk-adjusted)	\$1,467,745	\$4,239,107	\$7,001,530	\$12,708,382	\$10,098,061

Application Planning, Design, And Documentation Savings

Organizations interviewed for this study were plagued by slow software development life cycles; weighed down by redundant, legacy technologies; hampered by misalignment between IT and the lines of business; and challenged with skill gaps around containers, microservices, DevOps, and continuous delivery. Several organizations leveraged Red Hat Open Innovation Labs to empower small groups of developers, engineers, product leads, and agile practitioners to digitally transform their organizations.

The business benefits of Red Hat Open Innovation Labs began with the initial requirements gathering, planning, design, and documentation phase of the software development life cycle. Interviewees convened multidisciplinary teams of developers, IT operations staff, release and test managers, business product owners, and agile practitioners to learn and institutionalize modern application development techniques. Participants further leveraged Open Innovation Labs to plan and design new applications and to redesign and refactor legacy applications, with one organization delivering 15 microservices and five external system connections as part of its first Open Innovation Labs residency. Most notably, these residencies fostered more collaborative and integrated application planning processes that dropped the initial application requirements gathering, planning, design, and documentation phase of the software application life cycle from an average of two to four months, to two weeks or less following the Open Innovation Labs residency.

In modeling the impact of the modern application design techniques instilled in the composite organization's Open Innovation Labs residency, Forrester made the following assumptions from our research:

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 be a PV of more than \$10 million.



10 weeks in application planning, design, and documentation time savings, per application

- › The organization grew the percentage of new applications in its pipeline that it built with containers, microservices, and other modern development techniques over the analysis period, from 10% of new applications in Year 1 to 35% in Year 3. The number of new applications built using these modern software development life cycle processes are represented in row A3 in the table below.
- › The organization also modernized and refactored legacy monolithic applications using containers, microservices, and DevOps practices. It rebuilt a total of 12 legacy applications over the three-year analysis, as demonstrated in row A4 in the table below.
- › The organization benefited from the skills learned in Red Hat Open Innovation Labs, including getting the lines of business, IT operations, and security teams aligned during initial project planning. The organization further improved the planning process by using agile techniques, impact mapping, and event storming to design each application with a multidisciplinary team at the table. This reduced the average planning and design phase of the application life cycle from 12 weeks to two weeks, saving the organization, on average, \$56,656 for each project.

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.

Each organization's existing application planning and DevOps maturity will impact the magnitude of this benefit category. To account for these uncertainties, Forrester adjusted this benefit downward by 10%, yielding a three-year risk-adjusted total PV of just under \$2.0 million.

Application Planning, Design, And Documentation Savings: Calculation Table					
REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
A1	Number of new applications built, annually	Assumption	50	50	50
A2	Percentage of new applications built with containers	Interview	10%	25%	35%
A3	Number of new applications built using containers and microservices	Interview	5	13	18
A4	Number of legacy applications modernized and refactored with containers, per year	Assumption	2	4	6
A5	Time to plan, document, and design each application (before state), in weeks	Interview	12	12	12
A6	Time to plan, document, and design each application after Open Innovation Lab, in weeks	Interview	2	2	2
A7	Legacy weekly rate for multidisciplinary design team		\$8,071	\$8,071	\$8,071
A8	Modern weekly rate for multidisciplinary design team		\$20,098	\$20,098	\$20,098
A9	Planning, documentation, and design savings, per app	$(A5 \cdot A7) - (A6 \cdot A8)$	\$56,656	\$56,656	\$56,656
At	Planning, design, and documentation savings	$A9 \cdot (A3 + A4)$	\$396,592	\$963,152	\$1,359,744
	Risk adjustment	↓10%			
Atr	Planning, design, and documentation savings (risk-adjusted)		\$356,933	\$866,837	\$1,223,770

Reduced Initial Application Development, Testing, And Deployment Costs

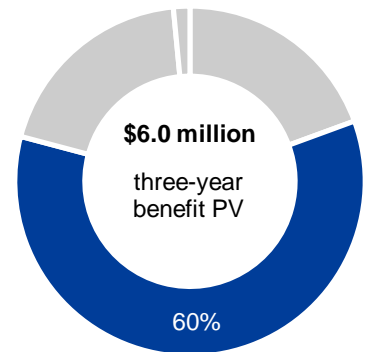
Interviewees benefited immensely from Red Hat Consulting's introduction of containers, OpenShift Container Platform, microservices, DevOps, and other tools and processes adopted to modernize and streamline application delivery. Prior to using Red Hat's services and OpenShift Container Platform, interviewees' legacy development tools and processes were a strategic inhibitor, requiring manual processes across misaligned stakeholders, slowing time-to-market for applications in their pipelines. Similar challenges plagued legacy applications: Interviewees indicated that they were difficult to develop, maintain, and update, as new features would require a minimum of one to two months of regression testing, driving product innovation to a standstill.

By aligning key stakeholders and standardizing on a modern set of development tools and processes, organizations could automate and expedite the development, testing, and deployment processes for bringing new applications to market and for modernizing and containerizing legacy applications on their road maps. By accelerating feedback and release cycles, simplifying testing requirements leveraging microservices, and reducing the IT operations resources required to create, configure, and deploy infrastructure, time-to-market for applications built with these modern techniques was between four to 10 times faster relative to their legacy processes. Application development costs for the initial build decreased by an estimated 50% to 80%, compared to the average development costs of using their legacy tools and processes.

For the composite organization, Forrester assumes that:

- › The number of new and legacy applications built represented a fraction of the organization's total application pipeline as discussed in the benefit category above. The number of applications built, tested, and deployed each year is represented in rows B1 and B2 below.
- › Prior to adopting the modern application tools and processes introduced by Red Hat, the composite organization spent, on average, \$262K to build, test, and deploy each application it delivered for the business. This cost included the fully loaded resource costs for a multidisciplinary team consisting of developers and IT operations staff working in conjunction with a release manager, test manager, and Certified Scrum Product Owner over a period of 24 weeks, the average project length discovered in Forrester's interviews.
- › Following Red Hat Open Innovation Labs residency and container adoption program engagements, including the deployment of the OpenShift Container Platform into production, the organization built microservices that it brought to production in two to four weeks. Interviewees revealed initial application development cost reductions of 50% to 75%. This analysis expects reductions of 60% in Year 1 growing to 70% by Year 3, as containers, microservices, and DevOps processes mature.

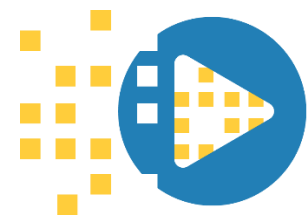
The reduction in software development expense will vary with the number of software development resources used and the fully loaded compensation for each software development team resource, which varies across regions, industries, and skill levels. To account for these uncertainties, Forrester adjusted this benefit downward by 10%, yielding a three-year risk-adjusted total PV of over \$6.0 million.



60% of total benefits



60% to 70% reduction in application development, testing, and deployment costs



Four to 10 times faster time-to-market with modern, containerized applications

Reduced Initial Application Development, Testing, And Deployment Costs: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
B1	Number of new applications built using containers and microservices	A3	5	13	18
B2	Number of legacy application modernized and refactored with containers, per year	A4	2	4	6
B3	Reduction in development costs	Interview	60%	65%	70%
B4	Average application development cost		\$262,000	\$262,000	\$262,000
Bt	Reduction in initial application development, testing, and deployment	$(B1+B2)*B3*B4$	\$1,100,400	\$2,895,100	\$4,401,600
	Risk adjustment	↓10%			
Btr	Reduction in initial application development, testing, and deployment (risk-adjusted)		\$990,360	\$2,605,590	\$3,961,440

Application Upgrade, Maintenance, And Management Efficiencies

The modern application delivery efficiencies gained through Red Hat Open Innovation Labs, container adoption program, and the OpenShift Container Platform extended well beyond the initial build into the software development life cycle. Organizations interviewed by Forrester had struggled with slow time-to-market for new product features, updates, security patches, and bug fixes prior to using Red Hat's services, residency, and platform. With a prior inability to speed up the rate of deploying code into production in a continuous manner, interviewees had been unable to accelerate their release cycles or to improve their release cadence, causing application backlogs, creating poor user and customer experiences, and inhibiting business innovation.

Organizations realized powerful agility benefits by breaking down applications into granular, separately deployable microservices that were packaged, tested, and run using containers. These agility benefits accelerated release cycles while reducing ongoing application update, feature release, and maintenance costs. For instance, using their legacy development tools and processes, organizations needed to retest the full functionality of new application releases, often requiring as much as two months for regression testing. The use of microservices and containers enabled customers to be more focused in their testing efforts, automating and standardizing code promotion processes, eliminating time-consuming and manual firewall requests, simplifying hardware provisioning and system patching, and consolidating dynamic application scaling procedures. These application development and maintenance efficiencies, combined with the overall application performance quality improvements delivered through the transformative change enabled through Red Hat's services, delivered software application life cycle savings of up to 70% per year for one interviewed organization.

In modeling the impact of the modern software application life cycle management techniques learned through Red Hat's Container Adoption engagements and Open Innovation Labs residencies, Forrester made the following assumptions:

"We're working toward being able to release every day for customer-facing applications. It's still a little ways off, but in the next year or so, we should be in a position where we could release into production as often as the customer needs us to."

IT manager, airline



- › For applications in production, the composite organization spent, on average, 25% of the original application development costs on new feature releases, software patches, and bug and error troubleshooting and remediation. This equated to \$65,500 in average annual application update and maintenance costs, per application. In calculating the magnitude of this benefit for your own organization, apply the fully loaded team cost, including developers, agile practitioners, product owners, testing and release managers, and IT operations staff, required to upgrade and maintain each of your applications.
- › Annual application upgrade and maintenance costs reductions were 25% in Year 1, which reflected the time needed to operationalize the DevOps and modern application delivery techniques learned through Red Hat's services and residencies. This grew to 60% in Year 3 of the analysis.

“The combination of microservices and containers is providing us with higher-quality applications that are easier to troubleshoot, making our reaction times faster. Over time, we expect operations savings between 50% and 70% as a lot of classical operations tasks are automated.”

IT manager, airline



Efficiency gains in the software development life cycle will vary depending on the maturity of the tools, processes, and skill sets of each organization prior to using Red Hat's container adoption program and Open Innovation Labs. To account for this variability, Forrester adjusted this benefit downward by 10%, yielding a three-year risk-adjusted total PV of just under \$2.0 million.

Application Upgrade, Maintenance, And Management Efficiencies: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
C1	Number of application in production	Interview	7	24	48
C2	Annual application management and maintenance as a percentage of development	Assumption	25%	25%	25%
C3	Annual application management and maintenance costs, per app	B4*C2	\$65,500	\$65,500	\$65,500
C4	Reduction in application management and maintenance costs using modern application		25%	50%	60%
Ct	Application upgrade, maintenance, and management efficiencies	C1*C3*C4	\$114,625	\$786,000	\$1,886,400
	Risk adjustment	↓10%			
Ctr	Application upgrade, maintenance, and management efficiencies (risk-adjusted)		\$103,163	\$707,400	\$1,697,760

Infrastructure Utilization Efficiency Savings

Interviewees also benefited from improved infrastructure utilization and consolidation that went beyond the infrastructure cost savings delivered through virtualization. By packaging code along with its dependencies and removing the need for its own operating system (OS) instances and support libraries, organizations could use less infrastructure or fit more instances of application onto a given hardware footprint. One interviewed company would have reserved and provisioned two or three times as many hardware resources using its legacy development approaches with its monolithic applications, with many of these virtual machines being significantly underutilized.

A recent Forrester Consulting case study, which included a survey of 179 IT and development decision makers, indicated that 78% of surveyed organizations have increased their server efficiency and utilization using containers and another 78% have reduced their costs².

For the composite organization, Forrester assumes that:

“OpenShift clusters are much more cost-efficient than what we were using before. With our legacy system, we needed a lot more servers, many of which were underutilized.”

Product manager, information technology



- › Each of the organization’s legacy, monolithic applications ran, on average, on eight virtual machines prior to adopting containers, microservices, and the OpenShift Container Platform.
- › Following the adoption of modern application development techniques instilled through Red Hat’s consulting engagements and residencies, the organization rebuilt containerized microservices that ran on a significantly smaller infrastructure footprint. The model assumes that each new application ran, conservatively, on four virtual machines. Forrester learned that several organizations saw even larger reduction in their infrastructure footprints.
- › The average cost of a virtual machine used for this study was \$650.

To account for variability in exact infrastructure cost savings across interviewed organizations, Forrester adjusted this benefit downward by 5%, yielding a three-year risk adjusted total PV of \$154K.

Infrastructure Utilization Efficiency Savings: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
D1	Total number of applications modernized and in production		7	24	48
D2	Average number of VMs per app before Red Hat		8	8	8
D3	Average number of VMs per app after Red Hat		4	4	4
D4	Number of VMs eliminated or avoided	D1*(D2-D3)	28	96	192
D5	Price per VM	Interview	\$650	\$650	\$650
Dt	Infrastructure utilization efficiency savings	D4*D5	\$18,200	\$62,400	\$124,800
	Risk adjustment	↓5%			
Dtr	Infrastructure utilization efficiency savings (risk-adjusted)		\$17,290	\$59,280	\$118,560

Flexibility

The value of flexibility is clearly unique to each customer, and the measure of its value varies from organization to organization. There are multiple scenarios in which a customer might choose to leverage Red Hat’s container adoption program and Open Innovation Labs residency and later realize additional uses and business opportunities, including:

- › **Building or refactoring a larger number of applications using the OpenShift Container Platform.** Interviewees stated that they initially only built 10% of their new applications every year with containers. However, as these organizations continued to improve their comfort level and understanding of the technology, the percentage of new applications built with containers increased. Likewise, many organizations gradually increased the number of legacy applications modernized using containers with each subsequent year of experience.
- › **Creating new applications or features.** Reduced downtime and less time spent penetration testing and setting up environments allows for more time to be spent developing new applications or implementing innovative product features that improve existing applications. The result could be fewer bugs, an improved customer experience, or new revenue opportunities.

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.

Flexibility would also be quantified when evaluated as part of a specific project.

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	Red Hat fees	\$0	\$1,496,970	\$350,000	\$350,000	\$2,196,970	\$1,913,098
Ftr	OpenShift Container Platform implementation costs	\$355,722	\$0	\$0	\$0	\$355,722	\$355,722
Gtr	Opportunity costs of training	\$38,555	\$0	\$46,266	\$69,399	\$154,220	\$128,932
Htr	Ongoing operations and administration costs	\$0	\$712,800	\$891,000	\$1,069,200	\$2,673,000	\$2,187,669
	Total costs (risk-adjusted)	\$394,277	\$2,209,770	\$1,287,266	\$1,488,599	\$5,379,912	\$4,585,421

Red Hat Fees

Interviewees paid Red Hat professional services fees for their Container Adoption consulting engagements and Open Innovation Labs residencies. Additionally, to implement the modern application development techniques learned through these services, each organization incurred subscription fees for the OpenShift Container Platform. Red Hat fees cover the following:

- › Recurring annual subscription fee for Red Hat OpenShift Container Platform support.
- › One-time fee for Red Hat professional service support to integrate and implement the OpenShift Container Platform into the organization's broader suite of systems.
- › One-time fees to participate in two Red Hat Open Innovation Labs residencies.
- › Several Container Adoption engagements that helped the organization institutionalize modern application development skills and augment its existing staff on several active application development initiatives.

The fees used in Forrester's model represent the higher end of the reported scale; thus Forrester made no risk adjustment to the model. Actual fees incurred will vary based on the following factors:

- › Number of developers and IT staff using the OpenShift Container Platform.
- › Size and complexity of the organization's existing infrastructure.
- › The organization's decision to participate in Red Hat Open Innovation Labs.

The combined Red Hat fees yielded a three-year total PV of \$1.9M.

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 be a PV of nearly \$4.6M.

Red Hat Fees: Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3
Et	Red Hat fees			\$1,496,970	\$350,000	\$350,000

OpenShift Container Platform Implementation Costs

To deploy the OpenShift Container Platform into production, organizations made infrastructure investments and dedicated several internal resources to assist in deployment. While the initial implementation generally took several months to complete, organizations often continued to work diligently in maturing their container platform strategies.

For the composite organization, Forrester estimates that the total duration of the implementation took six months with three engineering and development resources dedicating 100% of their time toward piloting the OpenShift Container Platform as part of a proof-of-concept and later deploying it into production.

Forrester used the following data to model implementation costs:

- › Hardware costs included \$25K of additional development environment infrastructure and \$25K of additional production environment infrastructure.
- › The composite organization dedicated three internal engineering and development FTEs over a period of six months at a blended average fully burdened monthly compensation rate of \$15,188, resulting in internal labor costs of \$273K.

The following factors may affect the actual OpenShift Container Platform implementation costs and timelines experienced by other organizations:

- › Availability of internal resources and/or further outsourcing needs.
- › Variability in the fully burdened compensation paid out to engineers and developers.
- › Size and complexity of the organization's existing infrastructure.

To account for these uncertainties, Forrester adjusted this cost upward by 10%, yielding a three-year risk-adjusted total PV of \$356K.



Six months
Total implementation duration

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.

OpenShift Container Platform Implementation Costs: Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3
F1	Additional hardware to support OpenShift Container Platform		\$50,000			
F2	Number of engineers and developers involved in implementation		3			
F3	Implementation duration (months)		6			
F4	Engineer/developer monthly rate		\$15,188			
Ft	OpenShift Container Platform implementation costs	$F1+(F2*F3*F4)$	\$323,384	\$0	\$0	\$0
	Risk adjustment	↑10%				
Ftr	OpenShift Container Platform implementation costs (risk-adjusted)		\$355,722	\$0	\$0	\$0

Opportunity Costs of Training

In addition to training provided by Red Hat, organizations felt that it was necessary to allow their developers to spend several days learning how to use the OpenShift Container Platform. Due to the accelerated transfer of knowledge made possible by Red Hat Consulting's container adoption program and Open Innovation Labs, the composite organization could fully train its developers and IT staff to be up and running within five days following systems integration. The composite organization trained 10 full-time equivalents (FTEs) on how to use the Red Hat OpenShift Container Platform in Year 1 of the analysis following two successful Open Innovation Labs residencies. In subsequent years, this training duration decreased to three days as the organization increased the sophistication of its internal processes and developed a base of knowledge around the use of containers. One interviewee described, "We began to run workshops for new developers where we would review the process and any key learnings and pitfalls as an onboarding exercise."

"We began to run workshops for new developers where we would review the process, key learnings, and any pitfalls as an onboarding exercise."

Chief information officer,
financial services



Forrester used the following data to model training costs:

- › The initial training period consisted of 10 DevOps and IT FTEs in internal training sessions for five consecutive days at a fully burdened daily compensation rate of \$701, yielding total training costs of \$35K prior to Year 1.
- › An additional 10 DevOps and IT FTEs were added for training purposes at the start of each subsequent year as the organization built a larger portion of its app portfolio using containers, microservices, and DevOps. As such, the organization trained 20 FTEs in Year 2 and 30 FTEs in Year 3. The training duration in years 2 and 3 decreased from five days to three days as the organization became increasingly proficient with the use of containers. The resulting training costs in years 2 and 3 were \$42K and \$63K, respectively.

The following factors may affect the actual training costs and timeline experienced by other organizations:

- › The number of FTEs who require training.
- › Variability in the fully burdened compensation rate of trained employees.

To account for these uncertainties, Forrester adjusted this cost upward by 10%, yielding a three-year risk-adjusted total PV of \$129K.

Opportunity Costs Of Training: Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3
G1	Number of DevOps and IT FTEs involved in training		10		20	30
G2	Training duration (days)		5		3	3
G3	IT/DevOps daily rate (fully burdened)		\$701		\$701	\$701
Gt	Opportunity costs of training	$G1 * G2 * G3$	\$35,050	\$0	\$42,060	\$63,090
	Risk adjustment	↑10%				
Gtr	Opportunity Costs Of Training (risk-adjusted)		\$38,555	\$0	\$46,266	\$69,399

Ongoing Operations And Administration Costs

Active maintenance, configuration, and management of the OpenShift Container Platform were ongoing efforts that required organizations to assign a core team of IT operations professionals solely to the management of the platform. Some organizations exclusively used internal resources for ongoing operations and administration while other organizations turned to external providers. Several organizations used a combination of internal and external resources to fulfill more narrowly defined operational functions.

In modeling ongoing operations and administration costs, Forrester assumed the composite organization commissioned an IT operations team consisting of six FTEs spending 100% of their time running OpenShift Container Platform clusters at a fully loaded salary of \$162K per employee, per year.

Actual ongoing OpenShift Container Platform operations, management, and administrative costs will vary depending on each organization’s container platform strategy and its decision on whether to use internal or outsourced resources. To account for these uncertainties, Forrester adjusted this cost upward by 10%, yielding a three-year risk-adjusted total PV of \$2.2M.

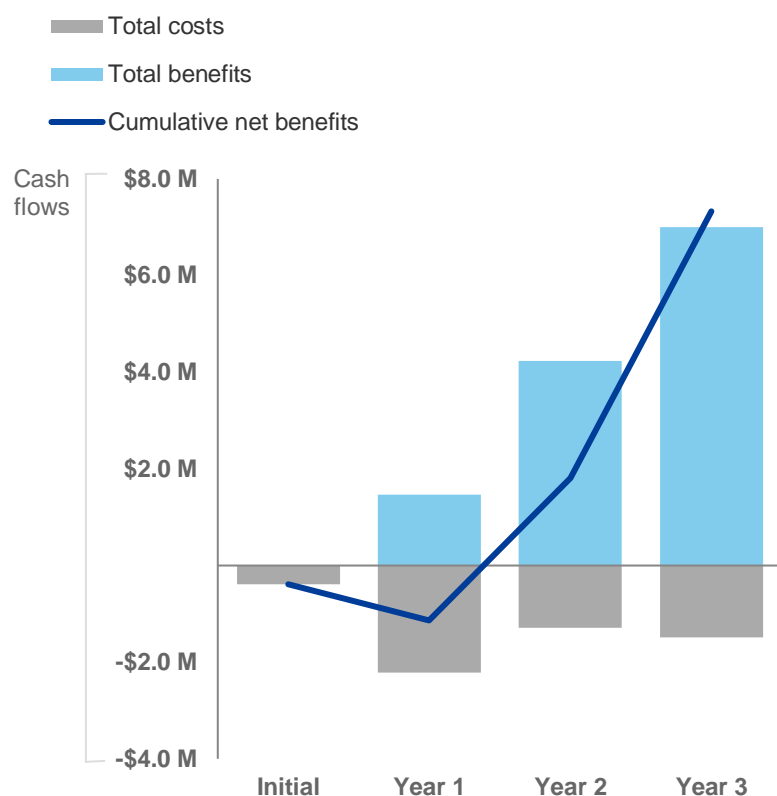
Ongoing Operations And Administration Costs: Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3
H1	Number of FTEs to run OpenShift Container Platform clusters			4	5	6
H2	Fully loaded IT operations salary			\$162,000	\$162,000	\$162,000
Ht	Ongoing operations and administration costs	H1*H2		\$648,000	\$810,000	\$972,000
	Risk adjustment	↑10%				
Htr	Ongoing operations and administration costs (risk-adjusted)		\$0	\$712,800	\$891,000	\$1,069,200

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 ROI, NPV, and payback period 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	(\$394,277)	(\$2,209,770)	(\$1,287,266)	(\$1,488,599)	(\$5,379,912)	(\$4,585,421)
Total benefits	\$0	\$1,467,745	\$4,239,107	\$7,001,530	\$12,708,382	\$10,098,061
Net benefits	(\$394,277)	(\$742,025)	\$2,951,841	\$5,512,931	\$7,328,469	\$5,512,640
ROI						120%
Payback period						17.0 months

Red Hat Consulting's Container Adoption Program And Open Innovation Labs: Overview

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

Red Hat Consulting Container Adoption Program

The Red Hat Consulting container adoption program puts organizations on a path to modernizing application delivery through efficient use of container and container orchestration technologies. With emphases on continuous improvement around platform infrastructure, deployment automation, and application development initiatives, the container adoption program helps organizations spend less time on firefighting and manual IT craft work and more time discovering and delivering business value.

Red Hat Open Innovation Labs

Red Hat Open Innovation Labs is an immersive residency-style consulting engagement where Red Hat subject matter experts work one-on-one with customer teams to rapidly develop new applications or modernize existing ones. Red Hat Open Innovation Labs brings together an open source technology stack, alongside process and culture — underscored by open principles — to help customers learn how to build applications the Red Hat way and deliver business innovation to the organization.

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: “Monoliths Benefit From Both Containers And Microservices,” Forrester Research, Inc., June 26, 2017.

² Source: “Accelerate Your Path To Innovation With Containers,” a commissioned study conducted by Forrester Consulting on behalf of Red Hat, March 2018.