FORRESTER®

The Total Economic Impact™ Of Red Hat Services And Support For OpenShift

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

MAY 2022

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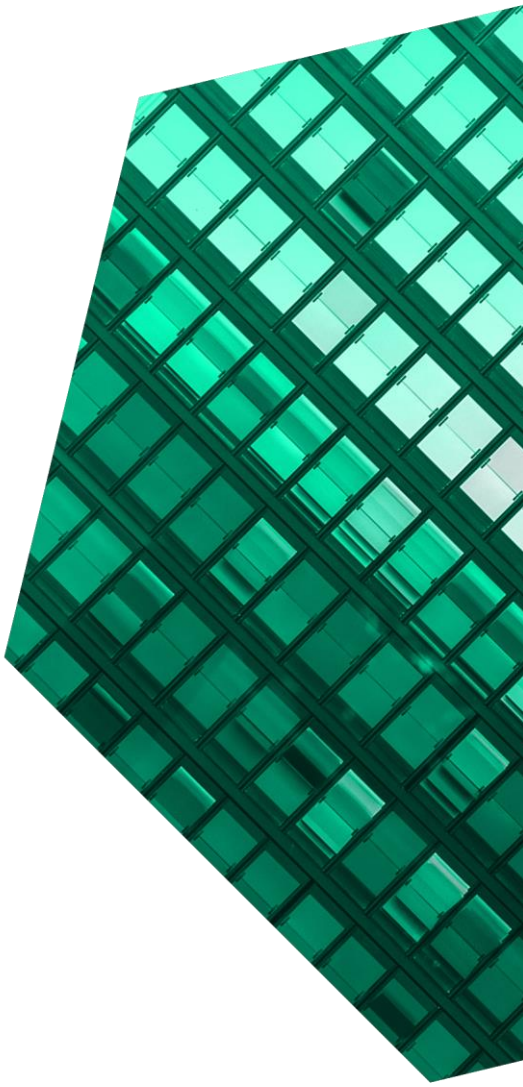
Consulting Team: Sam Conway



Executive Summary

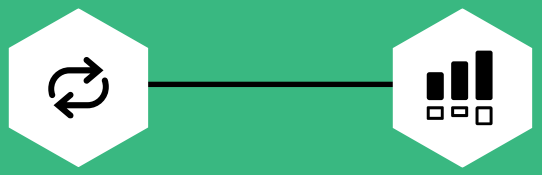
Software containers are a versatile tool that aid organizations in accelerating software development, improving infrastructure efficiency, and transforming legacy applications. Organizations can use containers to break apps into separately deployable microservices to reduce dependencies and package application code for legacy monolithic applications to improve runtime, and the portability of containers enables organizations to recognize benefits on-premises, in the cloud, or at the edge.

Red Hat's Services and Support offerings for Red Hat OpenShift provides organizations with an advanced container platform called Red Hat OpenShift and the approaches, training courses, consulting 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 lifecycles.

Red Hat commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential return on investment (ROI) enterprises may realize by utilizing Red Hat's Services and Support offerings for Red Hat OpenShift.[1] The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of Red Hat's services on their organizations.

To better understand the benefits, costs, and risks associated with this investment, Forrester interviewed six decision-makers with experience using Red Hat Services and Support offerings for Red Hat OpenShift, including Red Hat Consulting's Container Adoption Journey, Red Hat Training, and Red Hat Technical Account Management. Additionally, Forrester surveyed 163 decision-makers with experience using Red Hat Open Innovations Labs, Red Hat Container Adoption Journey, and Red Hat OpenShift managed services. For the purposes of this study, Forrester aggregated the experiences of the interviewed and surveyed decision-makers and combined the results into a single composite organization.

KEY STATISTICS



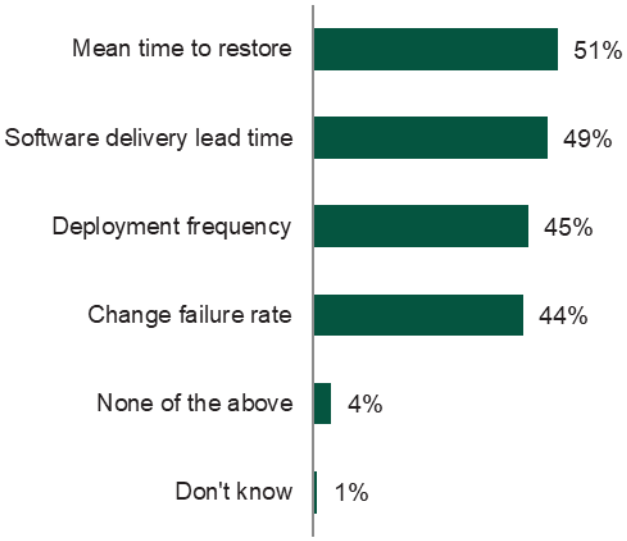
Return on investment (ROI)
703%

Net present value (NPV)
$39.1 million

Interviewees said that prior to using OpenShift and Red Hat Services and Support, their organizations struggled to adopt enterprise-wide processes for containerization and development with decentralized development teams using myriad solutions. The organizations looked to Red Hat OpenShift as a single system on which to build common standards and protocols for application development and deployment.[2]

After investing in Red Hat, the organizations introduced streamlined processes for application development and deployment, which accelerated time-to-market and improved management, scalability, and stability. Red Hat OpenShift also afforded the organizations the ability to develop for and deploy on multiple environments, which greatly improved organizational agility.

"Which of these software delivery metrics have improved based on implementing Red Hat OpenShift?"



Base: 162 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

"The idea behind bringing in OpenShift as the orchestrator is that it grants us a single pane of glass to manage, monitor, secure, and scale. It also allows us to run where we need to run. It opened up the public cloud or private cloud, and it gives us agnosticism when it comes to where something is running. If it runs on OpenShift, it can run wherever we have OpenShift. It gave us a level of flexibility, resiliency, and scalability that we didn't have in the past."

Director of infrastructure engineering, healthcare

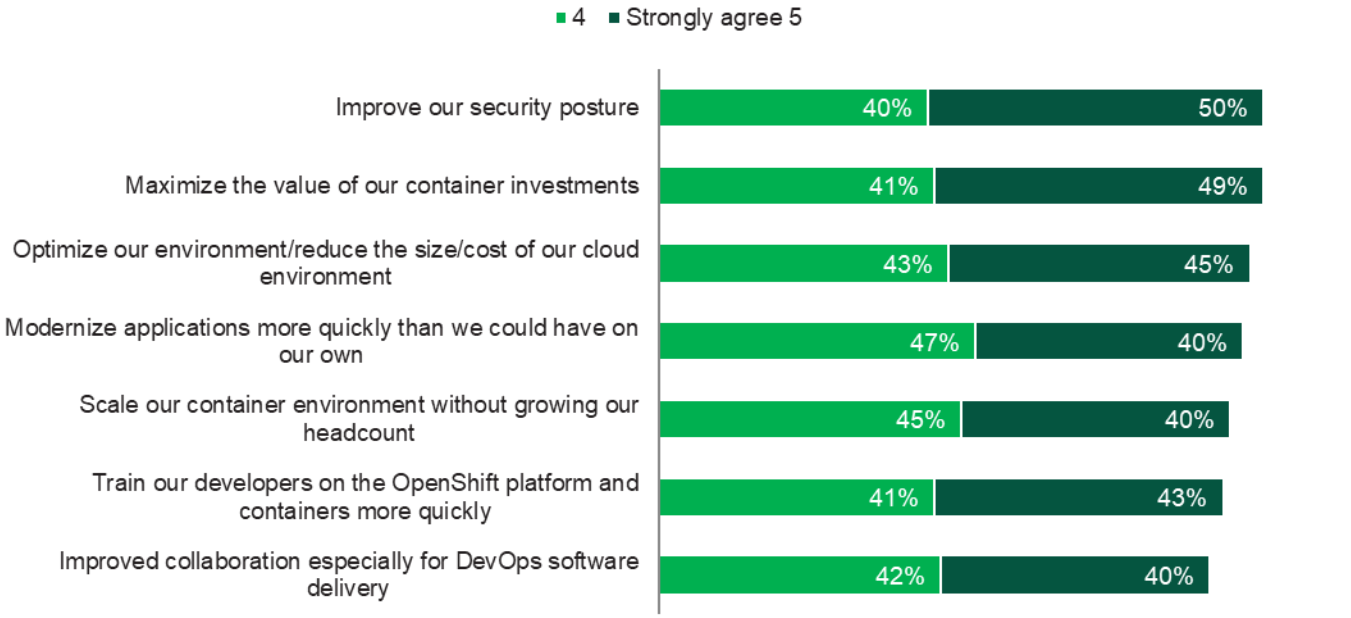
KEY FINDINGS

Quantified benefits. Risk-adjusted present value (PV) quantified benefits include:

- **Developer time required to plan, document, and design each application reduced by 85%.** Through Red Hat Services and Support, interviewees' organizations learned how to take a more collaborative and integrated approach to application planning. They applied these learnings to the initial application planning and documentation phases of the software application lifecycle, which enabled a more agile and accelerated process. For the composite organization, the reduced effort is worth $14.5 million during a three-year period.
- **Reduced infrastructure provisioning time by 35%.** Interviewees' organizations worked with Red Hat Services to create new automations for provisioning application architecture. New automations reduced burdens on infrastructure teams supporting application delivery, and the composite organization sees time savings worth $8.3 million over three years.
- **Reduced initial application development, testing, and deployment costs by 20%.** Red Hat Services aided interviewees' organizations in standardizing on a modern set of development tools and processes. This enabled the organizations to automate and accelerate the development, testing, and deployment processes for bringing new applications to market and containerizing legacy applications. Reduced development costs for the composite organization are worth $12.5 million during a three-year period.

- **Reduced application management and maintenance costs by up to 60% using modern application development techniques.** Interviewees' organizations centralized their DevOps teams and harnessed the agility of containers and microservices to accelerate release cycles and to reduce costs associated with ongoing application updates and maintenance. The composite organization saves $8.6 million during a three-year period.
- **Improved infrastructure utilization and reduced virtual machine footprint by 50%.** Working with Red Hat, interviewees' organizations used containers to optimize the number of instances that fit into a given hardware footprint. For the composite organization, infrastructure utilization improvements are valued at more than $700,900 during a three-year period.
- **Self-service and automation reduce helpdesk tickets by 15%.** Working with Red Hat Services, interviewees' organizations created self-service portals for developers and automations for select issue resolution. Additionally, the organizations recognized improved uptime and stability for applications developed on and modernized using Red Hat OpenShift, which further reduced helpdesk volume. For the composite organization, the reduction in helpdesk tickets is worth $181,500 during a three-year period.

"On a scale of "1" to "5," where "1" means "Strongly disagree" and "5" means "Strongly agree," how much do you agree with the following statements? Red Hat OpenShift combined with Red Hat Consulting services helped us to…"



Base: 151 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

Unquantified benefits. Benefits that are not quantified for this study include:

- **Improved customer and employee satisfaction.** Having modern tools and processes improved employee satisfaction, while more frequent updates, fixes, and new feature rollouts increased customer satisfaction.
- **Improved software quality and reduced vulnerabilities.** Interviewees' organizations improved testing by running more code in smaller batches, resulting in fewer defects, bugs, and vulnerabilities deployed to production.

Costs. Risk-adjusted PV costs include:

- **Red Hat fees of $2.4 million.** This cost includes fees paid to Red Hat for OpenShift subscriptions, professional services, and technical account management (TAM).
- **Red Hat OpenShift implementation costs of $356,000.** These are internal costs incurred for additional hardware and FTEs involved in implementation.
- **Training costs of $129,000.** These are internal costs associated with training DevOps and IT personnel.
- **Ongoing operations and administration costs of $2.7 million.** These are internal costs for FTEs running Red Hat OpenShift clusters.

The financial analysis which is based on the decision-maker interviews and survey found that a composite organization experiences benefits of $44.7 million over three years versus costs of $5.6 million, adding up to a net present value (NPV) of $39.1 million and an ROI of 703%.

ROI
703%

BENEFITS PV
$44.7 million

NPV
$39.1 million

PAYBACK
<6 months

Benefits (Three-Year)

TEI FRAMEWORK AND METHODOLOGY

From the information provided in the interviews and survey, Forrester constructed a Total Economic Impact™ framework for those organizations considering an investment in Red Hat Services and Support.

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 Consulting's Container Adoption Journey and Training curriculum and Technical Account Management can have on an organization.

DUE DILIGENCE

Interviewed Red Hat stakeholders and Forrester analysts to gather data relative to Red Hat Services and Support for OpenShift.

DECISION-MAKER INTERVIEWS AND SURVEY

Interviewed six decision-makers and surveyed 163 decision-makers at organizations using Red Hat Consulting's Container Adoption Journey and Red Hat's Training curriculum to obtain data with respect to costs, benefits, and risks.

COMPOSITE ORGANIZATION

Designed a composite organization based on characteristics of the interviewed and surveyed decision-makers.

FINANCIAL MODEL FRAMEWORK

Constructed a financial model representative of the interviews and survey using the TEI methodology and risk-adjusted the financial model based on issues and concerns of the decision-makers.

CASE STUDY

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

The Red Hat Services And Support For OpenShift Customer Journey

Drivers leading to the Red Hat investment

KEY CHALLENGES

Forrester interviewed six decision-makers and surveyed 163 decision-makers with experience using Red Hat Consulting's Container Adoption Journey and Red Hat Training at their organizations. For more details on these individuals and the organizations they represent, see Appendix B.

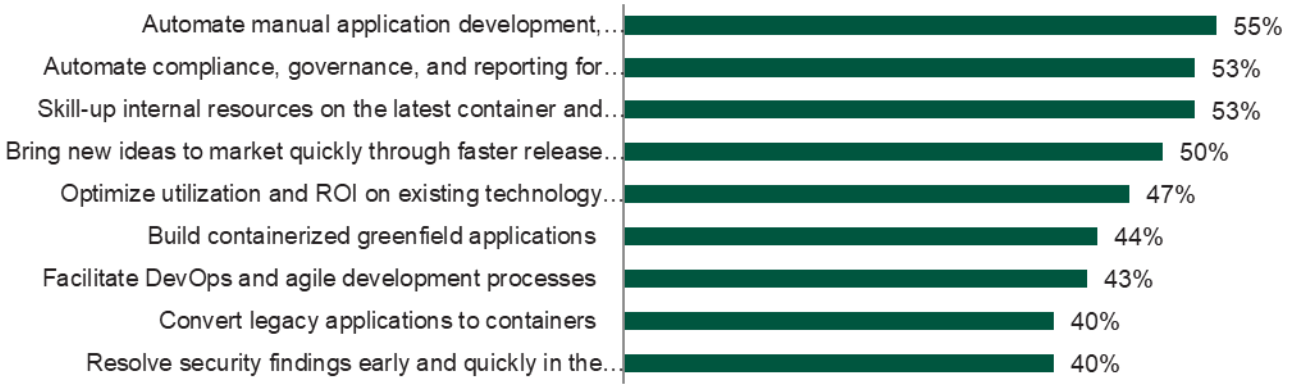
Prior to engaging with Red Hat Services, interviewees' organizations struggled with digital transformation initiatives and faced common challenges, including:

"We had 14 different containerized platforms running in various locations. It was extremely painful."

Director of application and support, database, and middleware engineering, healthcare

- **Legacy solutions required intensive maintenance and management.** Several interviewees noted that prior to using Red Hat OpenShift, their organizations used bespoke development platforms that required significant management overhead. The maintenance and management of these legacy platforms sapped internal resources and slowed application development and modernization. A head of CTO compute architecture for a media and technology firm explained: "There were a lot of bespoke platforms that we built, and [we] had this kind of integration of various components. This required a lot of help and continuous maintenance and updates."

"What key goals/challenges did your organization hope to address? My organization decided to invest in Red Hat OpenShift to . . ."



Base: 163 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

- **Lack of common standards and practices.** Interviewees said development teams worked in silos, often using different tools and standards that caused myriad operational issues and difficulties in completing transformational projects. A director of infrastructure engineering for a healthcare firm said: “We had a bunch of different development teams developing in different containerized platforms [and] not following any standards, policies, or procedures. So, we were seeing really mixed results in our efforts towards containerization.”
- **Failed internal containerization and modernization projects.** Interviewees’ and respondents’ organizations attempted to modernize and migrate legacy applications with middling results. Legacy tools and a lack of institutionalized DevOps practices extended timelines and hindered results. A VP of infrastructure, planning, and engineering for a financial services firm said: “We seriously considered stopping altogether. It was incredibly stressful because it was a major commitment, and we could not get the stability we wanted. The entire project was at risk. It would have led to abandonment and just going back to the sort of traditional use and developing use of environments.”

COMPOSITE ORGANIZATION

Based on the interviews and survey, Forrester constructed a TEI framework, a composite company, and an ROI analysis that illustrates the areas financially affected. The composite organization is representative of the six decision-makers that Forrester interviewed and the 163 decision-makers that Forrester surveyed and is used to present the aggregate financial analysis in the next section. The composite organization has the following characteristics:

Description of composite. The composite organization is a B2B firm with global operations. Prior to working with Red Hat Services, the composite organization attempted to undertake containerization and modernization efforts with myriad tools in a siloed development environment. The organization has an existing portfolio of 500 legacy applications with 50 new applications built annually.

Deployment characteristics. The composite organization adopts Red Hat OpenShift as its backbone for application development and engages Red Hat Services to create a scaled container strategy and institutionalized modern DevOps and agile methodologies.

Key assumptions

- **50 new applications built annually**
- **10% to 75% of new applications built with containers**
- **500 legacy applications**
- **5% to 50% of legacy portfolio modernized annually**
- **$250,000 average application development costs**

Analysis Of Benefits

Quantified benefit data as applied to the composite

Total Benefits

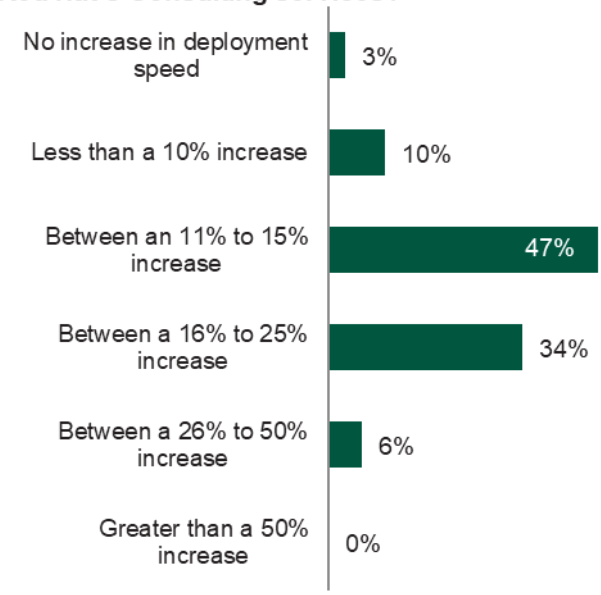
Ref.	Benefit	Year 1	Year 2	Year 3	Total	Present Value
Atr	Planning, design, and documentation savings	$1,529,583	$4,792,694	$12,134,694	$18,456,972	$14,468,410
Btr	Infrastructure provisioning time savings	$872,308	$2,733,231	$6,920,308	$10,525,846	$8,251,205
Ctr	Reduction in initial application development, testing, and deployment	$1,012,500	$4,230,000	$10,710,000	$15,952,500	$12,462,904
Dtr	Application update, management, and maintenance savings	$421,875	$2,643,750	$8,032,500	$11,098,125	$8,603,376
Etr	Infrastructure utilization efficiency savings	$74,100	$232,180	$587,860	$894,140	$700,916
Ftr	Helpdesk cost savings	$14,459	$72,293	$144,585	$231,336	$181,519
	Total benefits (risk-adjusted)	$3,924,825	$14,704,148	$38,529,947	$57,158,919	$44,668,330

PLANNING, DESIGN, AND DOCUMENTATION SAVINGS

Evidence and data. Interviewees' and respondents' organizations leveraged Red Hat Consulting's professional services and training to teach internal teams modern application techniques and to further organizational adoption of Red Hat OpenShift. These multidisciplinary teams of developers, IT operations staff members, release and test managers, business-product owners, and agile practitioners utilized Open Innovation Labs and employed learnings to create a more collaborative and integrated application planning process.

- Organizations leveraging Red Hat Consulting reduced the initial requirements gathering, planning, design, and documentation phase of the software application life cycle by an average of 10 weeks.

"You noted that Red Hat OpenShift helped you modernize applications more quickly than you could on your own. Using your best estimate, what is the percentage increase in speed needed to deploy your applications because of Red Hat's Consulting services?"



Base: 132 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

- More than 75% of survey respondents said their organizations participated in Open Innovation labs to aid internal development teams. Nearly half of survey respondents said their organizations increased deployment speeds by 11% to 15%.

Modeling and assumptions. In modeling planning, design, and documentation savings benefits for the composite organization, Forrester makes the following assumptions:

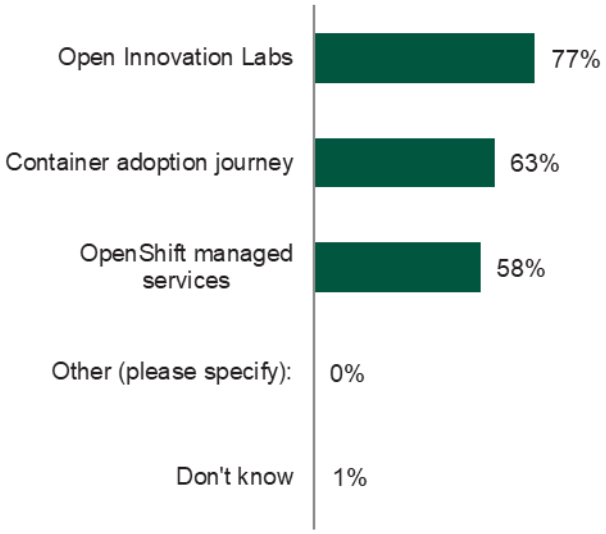
- The composite organization develops 50 new applications per year. In Year 1, 10% of new applications are built with containers. This percentage increases to 75% by Year 3 with maturity of use.
- At initial adoption, the composite has a portfolio of 500 legacy applications. The organization modernizes and refactors 5% of this portfolio in Year 1 and accelerates modernization efforts by Year 3 to 50% of the remaining portfolio as teams adopt modern processes and as internal skills grow.
- The average weekly wage costs for a modern multidisciplinary team are $20,098. This includes developers, IT operations staff members, release and test managers, business product owners, and agile practitioners who would be involved in project delivery. For an explanation of weekly costs see Appendix B.
- Eighty-seven percent of survey respondents said they agree or strongly agree that working with Red Hat Consulting helped their firm modernize applications more quickly than they could have on their own. Additionally, 82% said they agree or strongly agree that Red Hat Consulting helped improve collaboration for DevOps software delivery.

Risks. Forrester recognizes that planning, design, and documentation savings will vary by organization. Specific considerations include:

- Existing application planning and DevOps maturity.
- Prevailing labor rates.

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

"Which of these other Red Hat services has your organization engaged with?"



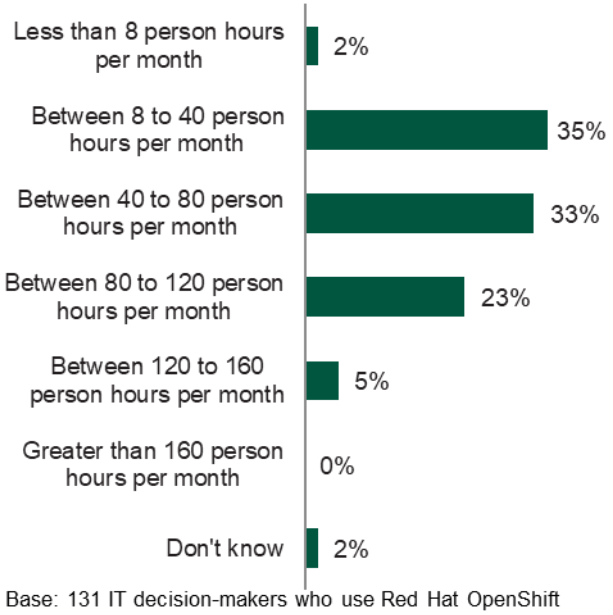
Base: 163 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

Planning, Design, And Documentation Savings					
Ref.	**Metric**	**Source**	**Year 1**	**Year 2**	**Year 3**
A1	Number of new applications built per year	Assumption	50	50	50
A2	Percent of new applications built with containers	Assumption	10%	35%	75%
A3	Number of new applications built using containers and microservices	A1*A2	5	18	38
A4	Number of legacy applications	Assumption	500	475	399
A5	Percent of legacy applications modernized and refactored with containers per year	Assumption	5%	16%	50%
A6	Number of legacy applications modernized and refactored with containers per year	A4*A5	25	76	200
A7	Average time spent planning, designing, and documenting a new application before Red Hat (weeks)	Interviews	12	12	12
A8	Reduction in weekly time to plan, design, and document each application after Open Innovation Lab	Interviews	85%	85%	85%
A9	Time to plan, design, and document each application after Open Innovation Lab (weeks)	A7*(1-A8)	2	2	2
A10	Legacy weekly cost for multidisciplinary design team	Composite – See Appendix B	$8,071	$8,071	$8,071
A11	Modern weekly cost for multidisciplinary design team	Composite – See Appendix B	$20,098	$20,098	$20,098
A12	Planning, design, and documentation savings per app	(A7*A10)-(A9*A11)	$56,651	$56,651	$56,651
At	Planning, design, and documentation savings	A11*(A3+A6)	$1,699,537	$5,325,216	$13,482,994
	Risk adjustment	↓10%			
Atr	Planning, design, and documentation savings (risk-adjusted)		$1,529,583	$4,792,694	$12,134,694
	Three-year total: $18,456,972			**Three-year present value: $14,468,410**	

INFRASTRUCTURE PROVISIONING TIME SAVINGS

Evidence and data. Interviewees' organizations worked with Red Hat's consulting teams to identify redundant or labor-intensive provisioning processes and to develop automations to reallocate labor towards other critical business needs. Interviewees noted that Red Hat OpenShift enabled their organizations to orchestrate provisioning in a more effective manner.

"You noted that Red Hat OpenShift automated previously manual, labor-intensive IT operational processes. How many person hours are saved each month?"



Base: 131 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

- A head of CTO compute architecture at a media and technology firm explained: "Server provisioning was not easy. [We] had to write [our] own orchestration layer to spin up when [we] needed it, then layer on top of the image with [a programming language], and then layer on top of [our] application. All of those things are basically solved with a container orchestration platform. You immediately replace all of the custom controllers."
- Red Hat OpenShift automated previously manual, labor-intensive IT operational processes and 96% of survey respondents said it saved at least 8 person hours per month.

Modeling and assumptions. In modeling infrastructure time savings for the composite organization, Forrester assumes:

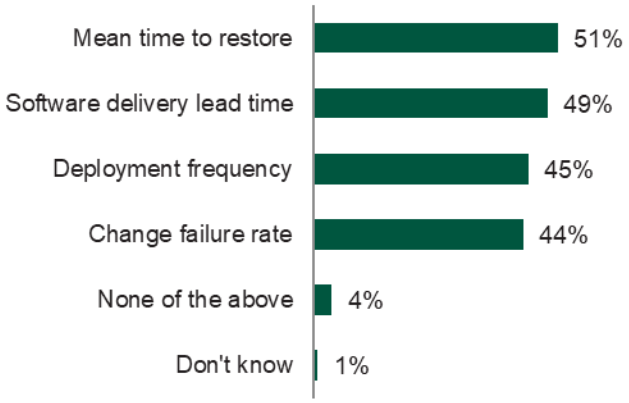
- The number of new infrastructure requests correlates to the amount of new application and legacy modernization projects using containers.
- The average fully burdened hourly infrastructure FTE rate is $58.

Risks. Forrester recognizes that infrastructure provisioning savings will vary by organization. Specific considerations include:

- Existing application planning and infrastructure support tools.
- Prevailing labor rates.

Results. To account for these risks, Forrester adjusted this benefit downward by 10%, yielding a three-year, risk-adjusted total PV of $8.3 million.

"Which of these software delivery metrics have improved based on implementing Red Hat OpenShift?"



Base: 162 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

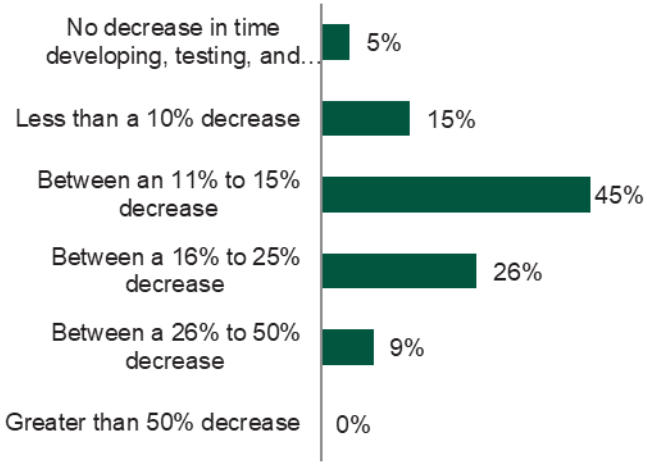
Infrastructure Provisioning Time Savings					
Ref.	**Metric**	**Source**	**Year 1**	**Year 2**	**Year 3**
B1	Number of new infrastructure requests per year	A3+A6	30	94	238
B2	Average FTE hours required to provision infrastructure before Red Hat	Interviews	1,600	1,600	1,600
B3	Reduction in provisioning time due to automations and efficiency gains recognized by engaging with Red Hat	Interviews	35%	35%	35%
B4	Infrastructure provisioning time savings	B1*B2*B3	16,800	52,640	133,280
B5	Average fully burdened hourly infrastructure FTE salary	Assumption	$58	$58	$58
Bt	Infrastructure provisioning time savings	B1*B2*B3*B4	$969,231	$3,036,923	$7,689,231
	Risk adjustment	↓10%			
Btr	Infrastructure provisioning time savings (risk-adjusted)		$872,308	$2,733,231	$6,920,308
	Three-year total: $10,525,846			**Three-year present value: $8,251,205**	

REDUCTION IN INITIAL APPLICATION DEVELOPMENT, TESTING, AND DEPLOYMENT

Evidence and data. Interviewees said their organizations worked with Red Hat Consulting to learn and adopt best practices to modernize and streamline application delivery by using Red Hat OpenShift, containers, and microservices. By adopting modern tools and DevOps processes, these organizations broke free of manual processes and aligned stakeholders to accelerate the time-to-market for applications in their organizations' pipelines.

By aligning key stakeholders on a modern set of development tools and processes, the organizations could automate and expedite the development, testing, and deployment processes for bringing new applications to market and for modernizing and containerizing legacy applications.

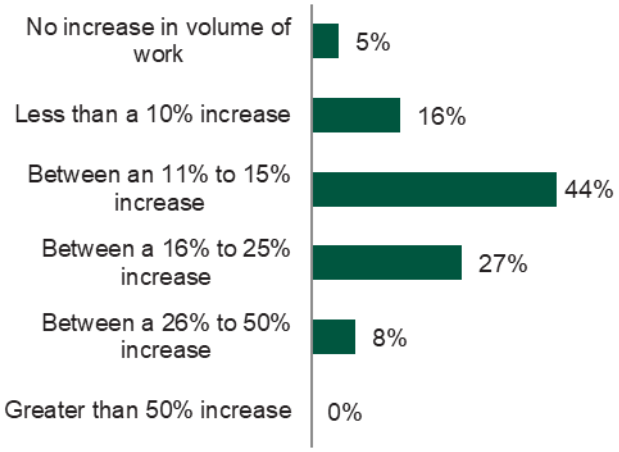
"You noted that Red Hat OpenShift reduced the amount of time spent developing, testing, and deploying each of the applications. Using your best estimate, what has been the percentage decrease each month?"



Base: 139 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

- Survey respondents said Red Hat OpenShift decreased the time spent developing, testing, and deploying applications, and 79% of respondents said their organization saw decreases of at least 11% to 15%.

"Based on the reduced amount of time spent developing, testing, and deploying each of the applications, what has been the percentage increase in volume of work able to be handled by developers and testers each month?"



Base: 132 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

- A director, application and support, database, and middleware engineering explained: "OpenShift gave us a true 'write once, run anywhere' environment. The level of effort for our application team is to write it once and run it anywhere, and that's huge. There's no going back and forth having to rewrite to use specific CSP (cloud service provider) calls. It gives us a very clean and easy deployment, release, and update pathway."
- A head of CTO compute architecture detailed: "Before, everything was bespoke and [in] different languages. Now, it's pretty simple and very much codified, and the startup time is faster once you have the container locally."

Modeling and assumptions. In modeling the reduction in initial application development, testing, and deployment for the composite organization, Forrester assumes:

- The number of new and legacy applications utilizing containers represents a fraction of the organization's total application pipeline.
- Prior to adopting Red Hat OpenShift and modern DevOps processes introduced by Red Hat, the composite organization spent an average of $250,000 to build, test, and deploy each application. This includes developers, IT operations staff members, release and test managers, business product owners, and agile practitioners who would be involved in project delivery.
- The improvement in application development and testing increases from 15% to 20% by Year 3 as containers, microservices, and DevOps processes mature.

Risks. Forrester recognizes that initial application development, testing, and deployment savings will vary by organization. Specific considerations include:

- Size and salary of software development teams.

Results. To account for these risks, Forrester adjusted this benefit downward by 10%, yielding a three-year, risk-adjusted total PV of $12.5 million.

"[With Red Hat] it became a much smoother chain of custody and smoother process to go from inception to deployment."
Director of infrastructure engineering, healthcare

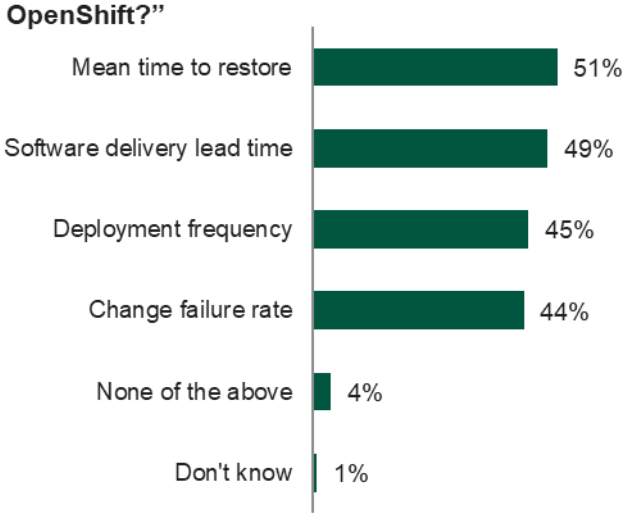
Reduction In Initial Application Development, Testing, And Deployment					
Ref.	**Metric**	**Source**	**Year 1**	**Year 2**	**Year 3**
C1	Number of applications in production	B1	30	94	238
C2	Improved application development and testing due to Red Hat	Interviews	15%	20%	20%
C3	Average application development costs	Composite	$250,000	$250,000	$250,000
Ct	Reduction in initial application development, testing, and deployment	C1*C2*C3	$1,125,000	$4,700,000	$11,900,000
	Risk adjustment	↓10%			
Ctr	Reduction in initial application development, testing, and deployment (risk-adjusted)		$1,012,500	$4,230,000	$10,710,000
	Three-year total: $15,952,500			**Three-year present value: $12,462,904**	

APPLICATION UPDATE, MANAGEMENT, AND MAINTENANCE SAVINGS

Evidence and data. Interviewees said the application delivery benefits extended beyond the initial build into the application development lifecycle. The adoption of Red Hat OpenShift and partnership with Red Hat Consulting aided the organizations in accelerating the time-to-market for new product features, updates, patches, and bug fixes. Harnessing the capability of containers to separate applications into granular microservices, the organizations accelerated release cycles by packaging, testing, and deploying components separately.

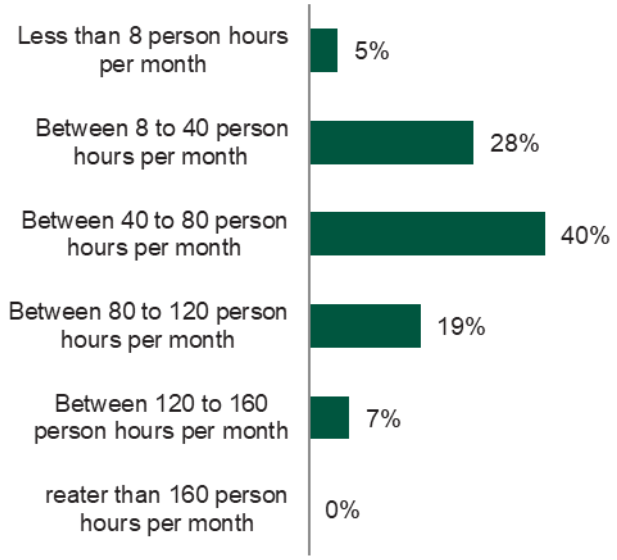
- A director of infrastructure engineering said: "The beauty of it is when we had all these multiple different systems out there running, each of those teams had to have their own people to support that system. And my team then had to support the underlying infrastructure of all these disparate systems, which cost time and money. When we centralized underneath [Red Hat] OpenShift, we were able to centralize our DevOps team or pipeline team that would manage the deployments into [Red Hat] OpenShift. We were then able to manage the infrastructure, the DevOps team was able to manage the deployments and pipelines, and the application teams were then freed up from any infrastructure or pipeline work to do what they're paid to do: develop the application."

"Which of these software delivery metrics have improved based on implementing Red Hat OpenShift?"



Base: 162 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

"You noted that Red Hat OpenShift reduced developer wait times and other project delays. How many total person hours are saved each month?"



Base: 135 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

- Forty percent of surveyed decision-makers said that after their organizations adopted Red Hat, their firm saw a reduction of developer wait times by 40 to 80 hours each month. An additional 26% of respondents said their firm saw upwards of 80 hours in savings per month.
- Nearly half of surveyed decision makers said Red Hat OpenShift improved each software delivery metric that their organization tracked, with mean-time-to-restore being the most impacted (51% of respondents) and deployment frequency seeing the largest improvement (99% improvement).
- Interviewees highlighted that their organizations' more efficient developer teams could complete more work while avoiding additional headcount. Further, 27% of survey respondents noted that Red Hat Consulting services helped their organization scale its container environment without growing headcount.
- A head of section, DevOps platform said: "In the old environment, releases were not so frequent. [We] would not do releases very often, and when [we] did, it often did not go well. My team wasted a lot of time trying to figure out what went wrong."

"What is the percentage change in each of these software metrics as a result of Red Hat OpenShift?"

	% increase
Deployment frequency	99%
Software delivery lead times	75%
Change failure rate	74%
Mean time to restore	72%

Modeling and assumptions. In modeling application update, management, and maintenance savings for the composite organization, Forrester assumes:

- The number of new and legacy applications utilizing containers represents a fraction of the composite's total application pipeline.
- The composite's annual application management and maintenance costs represent 25% of development spend.
- Application update, management, and maintenance savings increase from 25% to 60% by Year 3 as containers, microservices, and DevOps processes mature.

Risks. Forrester recognizes that application update, management, and maintenance savings will vary by organization. Specific considerations include:

- Existing skill sets.
- Legacy tools and processes.

Results. To account for these risks, Forrester adjusted this benefit downward by 10%, yielding a three-year, risk-adjusted total PV of $8.6 million.

Application Update, Management, And Maintenance Savings

Ref.	Metric	Source	Year 1	Year 2	Year 3
D1	Total number of applications modernized and in production	B1	30	94	238
D2	Annual application management and maintenance as a percentage of development spend	Assumption	25%	25%	25%
D3	Annual application management and maintenance costs per app	C3*D2	$62,500	$62,500	$62,500
D4	Reduction in application management and maintenance costs using modern application development techniques	Interviews	25%	50%	60%
Dt	Application update, management, and maintenance savings	D1*D3*D4	$468,750	$2,937,500	$8,925,000
	Risk adjustment	↓10%			
Dtr	Application update, management, and maintenance savings (risk-adjusted)		$421,875	$2,643,750	$8,032,500
	Three-year total: $11,098,125			**Three-year present value: $8,603,376**	

INFRASTRUCTURE UTILIZATION EFFICIENCY SAVINGS

Evidence and data. By packaging code along with its dependencies and removing the need for its own operating system (OS) instances and support libraries, interviewees' organizations used less infrastructure or fit more instances of applications onto a given hardware footprint.

- Interviewees noted that the average number of virtual machines (VMs) required per application was halved after working with Red Hat Consulting. This led to an average requirement of four VMs per application.
- The majority of survey respondents said their organization saw a decrease in its cloud-environment spending after working with Red Hat Consulting. Forty-four percent of those organizations saw between an 11% to 15% reduction, while 91% of respondents said their firm recognized some level of reduction.

Modeling and assumptions. In modeling infrastructure utilization efficiency savings for the composite organization, Forrester assumes:

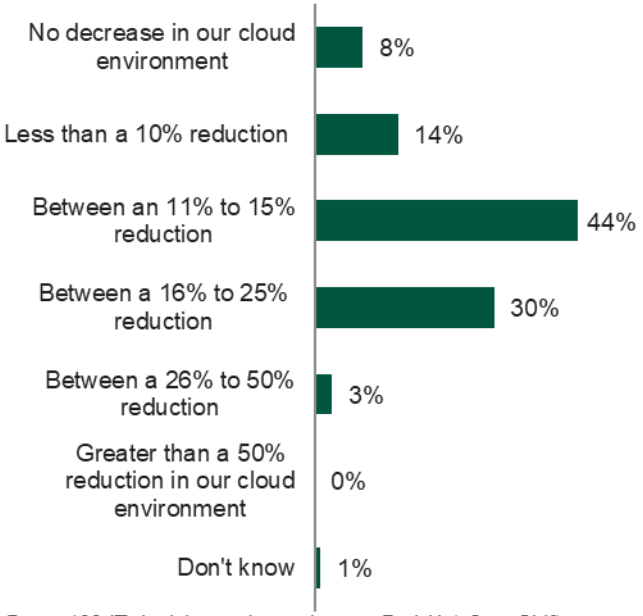
- The number of new and legacy applications utilizing containers represents a fraction of the composite's total application pipeline.
- The average price per VM is $650.

Risks. Forrester recognizes that infrastructure utilization efficiency savings will vary by organization. Specific considerations include:

- Existing application dependencies and infrastructure utilization rates.

Results. To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year, risk-adjusted total PV of $700,900.

"You noted that Red Hat OpenShift helped you optimize your environment by reducing the size of your cloud environment. Using your best estimate, what is the percentage reduction in your cloud environment due to Red Hat Consulting services?"



Base: 133 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

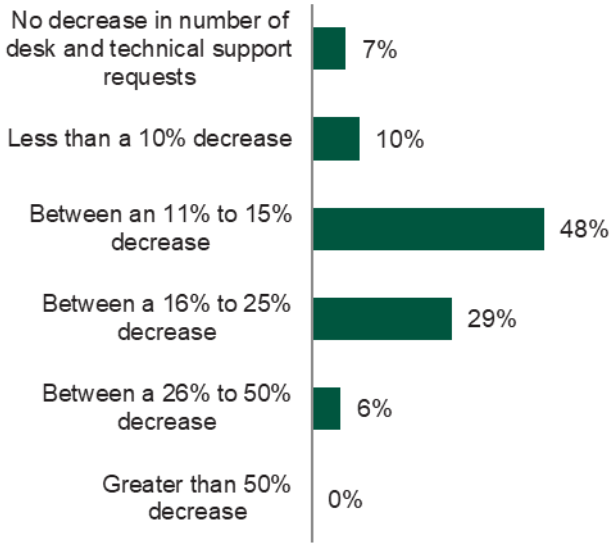
Infrastructure Utilization Efficiency Savings					
Ref.	**Metric**	**Source**	**Year 1**	**Year 2**	**Year 3**
E1	Total number of applications modernized and in production	B1	30	94	238
E2	Average number of VMs per app before Red Hat	Interviews	8	8	8
E3	Average number of VMs per app after Red Hat	Interviews	4	4	4
E4	Number of VMs eliminated or avoided	E1*(E2-E3)	120	376	952
E5	Price per VM	Assumption	$650	$650	$650
Et	Infrastructure utilization efficiency savings	E4*E5	$78,000	$244,400	$618,800
	Risk adjustment	↓5%			
Etr	Infrastructure utilization efficiency savings (risk-adjusted)		$74,100	$232,180	$587,860
	Three-year total: $894,140			**Three-year present value: $700,916**	

HELPDESK COST SAVINGS

Evidence and data. Interviewees' organizations created several features, like self-service portals and automated issue resolutions, to reduce helpdesk volume and to improve developer efficiencies. Additionally, the improved stability of Red Hat OpenShift over prior environments meant that developers experienced fewer issues that would require helpdesk intervention.

- Survey respondents said their firms experienced a drop in helpdesk and technical support requests. Ninety-three percent of respondents said their organization saw some reduction in requests, with 48% seeing between an 11% to 15% decrease.
- Survey respondents said they not only saw a drop in total requests, but a reduction in time required to fulfill remaining requests. Eighty-four percent of respondents said their firm experienced a decrease of at least 11%.

"You noted that Red Hat OpenShift reduced the number of desk and technical support requests. Using your best estimate, what has been the percentage decrease each month?"



Base: 138 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

Modeling and assumptions. In modeling helpdesk savings for the composite organization, Forrester assumes:

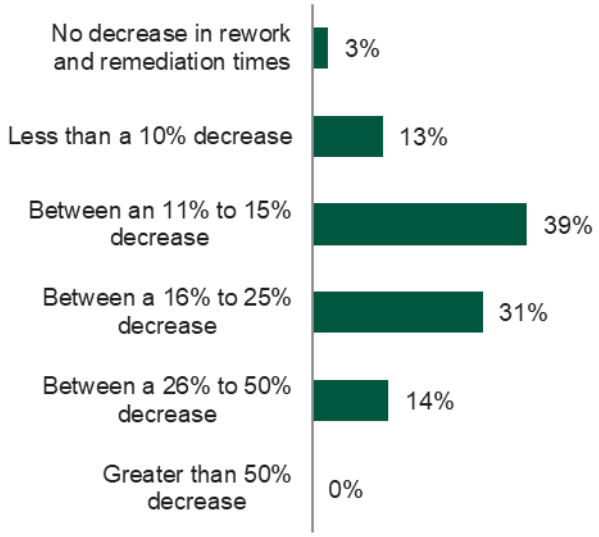
- The number of helpdesk tickets applicable to containerized applications accelerates during the three-year period as container adoption grows and more legacy applications are modernized.
- The average time to resolve a helpdesk ticket is 8 hours.
- Support team members have a blended average hourly rate of $50.
- The composite organization reduces helpdesk tickets by 15% with self-service portals, automated resolution tools, and improved platform stability.

Risks. Forrester recognizes that helpdesk savings will vary by organization. Specific considerations include:

- Legacy platform state and related support costs.
- The ability to implement self-help tools.

Results. To account for these risks, Forrester adjusted this benefit downward by 15%, yielding a three-year, risk-adjusted total PV of $181,500.

"How has the time required to resolve a help desk or technical support request changed due to adopting Red Hat OpenShift?"



Base: 128 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

Helpdesk Cost Savings

Ref.	Metric	Source	Year 1	Year 2	Year 3
F1	Number of helpdesk tickets	Survey	281	1,404	2,808
F2	Average time to resolve a helpdesk ticket	Interviews	8	8	8
F3	Blended FTE salary	Assumption	$50	$50	$50
F4	Reduction in helpdesk tickets	Interviews	15%	15%	15%
Ft	Helpdesk cost savings	F1*F2*F3*F4	$17,010	$85,050	$170,100
	Risk adjustment	↓15%			
Ftr	Helpdesk cost savings (risk-adjusted)		$14,459	$72,293	$144,585
	Three-year total: $231,336			**Three-year present value: $181,519**	

UNQUANTIFIED BENEFITS

Additional benefits that customers experienced but were not able to quantify include:

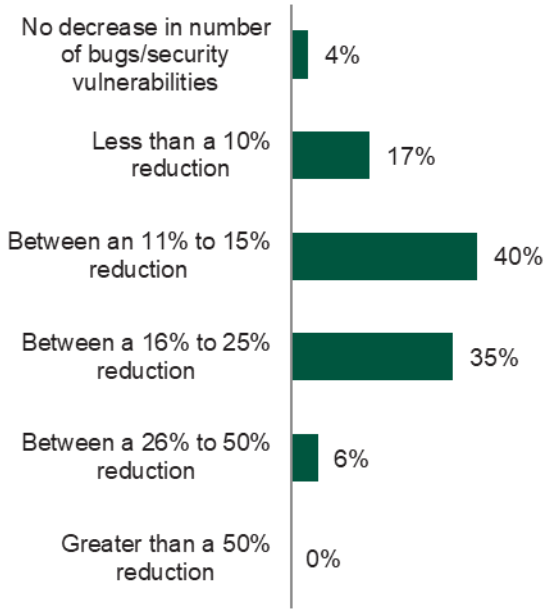
- **Improved customer and employee satisfaction.** More than 90% of survey respondents said working with Red Hat Services led to improved customer and employee satisfaction. Providing employees with robust tools and modern training improved job satisfaction, and the increased frequency of updates and releases improved product quality for customers.

"On a scale of "1" to "5," where "1" means "Strongly disagree" and "5" means "Strongly agree," how much do you agree with the following statements? Engaging with Red Hat Consulting services has…"

Base: 151 IT decision-makers who use Red Hat Open Shift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

- **Improved software quality and reduced vulnerabilities.** Having the ability to run code more frequently in small batches reduces the likelihood of deploying bugs, defects, and vulnerabilities to production. Survey respondents highlighted that Red Hat Service helped reduce the number of bugs or vulnerabilities and improved the number of applications able to pass a security audit.

"You noted that Red Hat OpenShift reduced the number of bugs or security vulnerabilities identified before production. Using your best estimate, what is the percentage reduction in the number of bugs or security vulnerabilities identified before production due to Red Hat Consulting services?"



Base: 139 IT decision-makers who use Red Hat OpenShift
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

FLEXIBILITY

The value of flexibility is unique to each customer. There are multiple scenarios in which a customer might implement Red Hat Consulting's Services and Support and later realize additional uses and business opportunities, including:

- **Building or refactoring a larger portion of applications using Red Hat OpenShift.** The adoption rate of the composite organization is based on target numbers from interviewees from organization's that initially only built 10% of their new applications using containers. Interviewees noted that this number improved with maturity of usage. Cloud-native or more agile companies may be comfortable adopting containers at a higher rate, which could accelerate the recognition of benefits.
- **Engaging Red Hat OpenShift cloud services for additional savings.** Red Hat OpenShift cloud services is an enterprise-grade application development platform that is hosted and managed by Red Hat and public cloud providers. By having Red Hat manage their Red Hat OpenShift environments, organizations can focus even more time on DevOps improvements to further accelerate application development. Furthermore, organizations can recognize operational savings beyond automations and practice improvements by offloading additional infrastructure management.

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

Analysis Of Costs

Quantified cost data as applied to the composite

Total Costs							
Ref.	**Cost**	**Initial**	**Year 1**	**Year 2**	**Year 3**	**Total**	**Present Value**
Gtr	Red Hat fees	$0	$1,747,000	$499,000	$499,000	$2,745,000	$2,375,485
Htr	Red Hat OpenShift implementation costs	$355,722	$0	$0	$0	$355,722	$355,722
Itr	Training costs	$38,555	$0	$46,266	$69,399	$154,220	$128,932
Jtr	Ongoing operations and administration costs	$0	$880,000	$1,100,000	$1,320,000	$3,300,000	$2,700,826
	Total costs (risk-adjusted)	$394,277	$2,627,000	$1,645,266	$1,888,399	$6,554,942	$5,560,965

RED HAT FEES

Evidence and data. Interviewees said their organizations paid Red Hat professional services fees for their Container Adoption consulting engagements and Training. Additionally, each organization incurred subscription fees for Red Hat OpenShift and TAM support to implement the modern application development techniques learned through these services.

Modeling and assumptions. In modeling fees for the composite organization, Forrester assumes:

- The composite pays recurring annual Red Hat OpenShift and TAM fees.
- The composite pays a one-time fee for Red Hat Consulting services support to integrate and implement Red Hat OpenShift.
- The composite pays one-time fees to participate in Open Innovation Labs.

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

- Number of Red Hat OpenShift users.
- The size and complexity of the organization's existing infrastructure.
- Participation in Red Hat Open Innovation Labs.

Results. To account for these risks, Forrester did not adjust this cost, yielding a three-year, risk-adjusted total PV (discounted at 10%) of $2.4 million.

"We use [Red Hat] training. The best way to learn is by having an experienced consultant sitting by and helping you."
Head of section, DevOps platform, government

Red Hat Fees						
Ref.	**Metric**	**Source**	**Initial**	**Year 1**	**Year 2**	**Year 3**
G1	Red Hat fees	Interviews		$1,747,000	$499,000	$499,000
Gt	Red Hat fees	G1	$0	$1,747,000	$499,000	$499,000
	Risk adjustment	0%				
Gtr	Red Hat fees (risk-adjusted)		$0	$1,747,000	$499,000	$499,000
	Three-year total: $2,745,000			**Three-year present value: $2,375,485**		

RED HAT OPENSHIFT IMPLEMENTATION COSTS

Evidence and data. To deploy Red Hat OpenShift into production, interviewees' organizations made infrastructure investments and dedicated several internal resources to assist in deployment. The initial implementations generally took several months to complete.

Modeling and assumptions. In modeling implementation costs for the composite organization, Forrester assumes:

- The composite organization invests in an additional $50,000 of development and production environment infrastructure.
- The composite organization dedicates three engineering and developer FTEs to the implementation process during the course of six months. The team members have an average monthly wage rate of $15,188.

Risks. Organizations may experience differing Red Hat OpenShift implementation costs based on:

- Prevailing wage rates.
- Availability and skill sets of internal resources.
- The size and complexity of deployment.

Results. To account for these risks, Forrester adjusted this cost upward by 10%, yielding a three-year, risk-adjusted total PV of $356,000.

Red Hat OpenShift Implementation Costs

Ref.	Metric	Source	Initial	Year 1	Year 2	Year 3
H1	Additional hardware to support Red Hat OpenShift	Interviews	$50,000			
H2	Number of engineers and developers involved in implementation	Composite	3			
H3	Implementation duration (months)	Composite	6			
H4	Engineer/developer monthly rate	Assumption	$15,188			
Ht	Red Hat OpenShift implementation costs	H1+(H2*H3*H4)	$323,384	$0	$0	$0
	Risk adjustment	↑10%				
Htr	Red Hat OpenShift implementation costs (risk-adjusted)		$355,722	$0	$0	$0
	Three-year total: $355,722			**Three-year present value: $355,722**		

TRAINING COSTS

Evidence and data. In addition to training provided by Red Hat, interviewees' organizations felt that it was necessary to allow their developers to spend several days learning how to use Red Hat OpenShift.

Modeling and assumptions. In modeling training costs for the composite organization, Forrester assumes:

- Due to the accelerated transfer of knowledge made possible by Red Hat Consulting's Container Adoption Journey and TAM, the composite organization functionally trains its developers and IT staff within five days of systems integration.
- The initial training includes 10 DevOps and IT FTEs in internal training sessions for five consecutive days. An additional 10 DevOps and IT FTEs are added for training purposes at the start of each subsequent year as the organization builds a larger portion of its app portfolio using containers, microservices, and DevOps. As such, the organization trains 20 FTEs in Year 2 and 30 in Year 3. The training duration in Years 2 and 3 decreases from five days to three days as the organization becomes increasingly proficient with the use of containers.
- Trainees have an average daily rate of $701.

Risks. Organizations may experience variable training costs based on:

- The number of FTEs requiring training.
- Prevailing labor rates.

Results. To account for these risks, Forrester adjusted this cost upward by 10%, yielding a three-year, risk-adjusted total PV of $129,000.

Training Costs

Ref.	Metric	Source	Initial	Year 1	Year 2	Year 3
I1	Number of DevOps and IT FTEs involved in training	Interviews	10		20	30
I2	Training duration (days)	Composite	5		3	3
I3	IT / Dev Ops Daily Rate (fully burdened)	Assumption	$701		$701	$701
It	Training costs	I1*I2*I3	$35,050	$0	$42,060	$63,090
	Risk adjustment	↑10%				
Itr	Training costs (risk-adjusted)		$38,555	$0	$46,266	$69,399
	Three-year total: $154,220			**Three-year present value: $128,932**		

ONGOING OPERATIONS AND ADMINISTRATION COSTS

Evidence and data. Interviewees said performing active maintenance, configuring, and managing Red Hat OpenShift are ongoing efforts that require organizations to assign a core team of IT operations professionals solely to the management of the platform.

Organizations could eliminate some or all operations and administration costs by engaging Red Hat OpenShift cloud services.

Modeling and assumptions. In modeling ongoing operations and administration costs for the composite organization, Forrester assumes:

- The composite dedicates up to six FTEs to run Red Hat OpenShift clusters by Year 3,
- The fully burdened annual rate of one of these FTEs is $200,000.

Risks. Ongoing costs will vary by organization. Specific risk considerations include:

- The size and complexity of deployment.
- The container platform management strategy.

Results. To account for these risks, Forrester adjusted this cost upward by 10%, yielding a three-year, risk-adjusted total PV of $2.7 million.

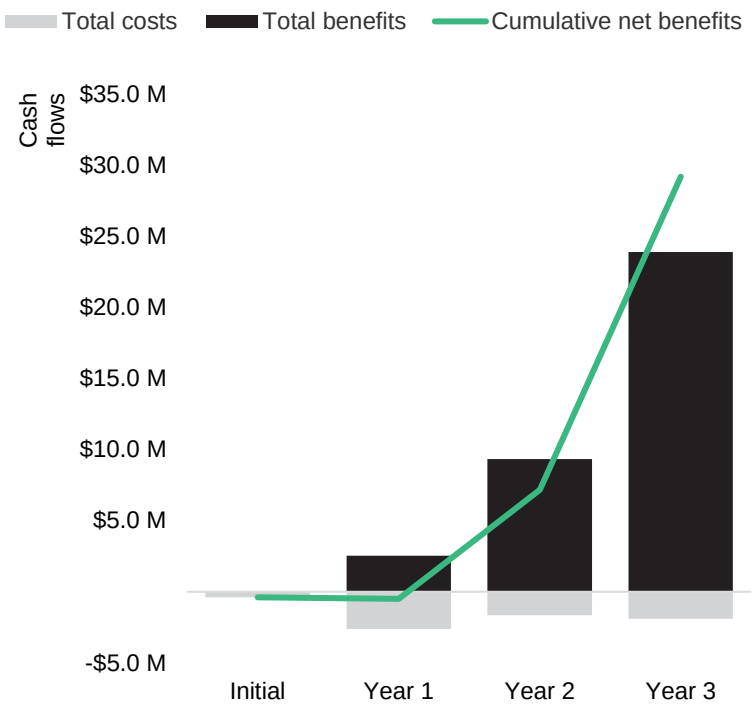
Ongoing Operations And Administration Costs

Ref.	Metric	Source	Initial	Year 1	Year 2	Year 3
J1	Number of FTEs to run Red Hat OpenShift clusters	Composite		4	5	6
J2	Fully loaded IT operations salary	Assumption		$200,000	$200,000	$200,000
Jt	Ongoing operations and administration costs	J1*J2		$800,000	$1,000,000	$1,200,000
	Risk adjustment	↑10%				
Jtr	Ongoing operations and administration costs (risk-adjusted)		$0	$880,000	$1,100,000	$1,320,000
	Three-year total: $3,300,000			**Three-year present value: $2,700,826**		

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 Analysis (Risk-Adjusted Estimates)

	Initial	Year 1	Year 2	Year 3	Total	Present Value
Total costs	($394,277)	($2,627,000)	($1,645,266)	($1,888,399)	($6,554,942)	($5,560,965)
Total benefits	$0	$3,924,825	$14,704,148	$38,529,947	$57,158,919	$44,668,330
Net benefits	($394,277)	$1,297,825	$13,058,882	$36,641,548	$50,603,977	$39,107,365
ROI						703%
Payback						<6 months

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: Tables And Figures-

Interviewed Decision-Makers

Interviewee(s)	Industry	Region	Revenue
Head of section, DevOps platform	Government	EMEA	$132 million
Director of infrastructure engineering	Healthcare	United States	$9.9 billion
Director of application and support, database, and middleware engineering	Healthcare	United States	$9.9 billion
VP of infrastructure, planning, and engineering	Financial services	Canada	$14.7 billion
Director of PaaS, application platform, and database services	Financial services	Canada	$14.7 billion
Head of CTO compute architecture	Media and technology	Global	$11 billion

Legacy Team Cost

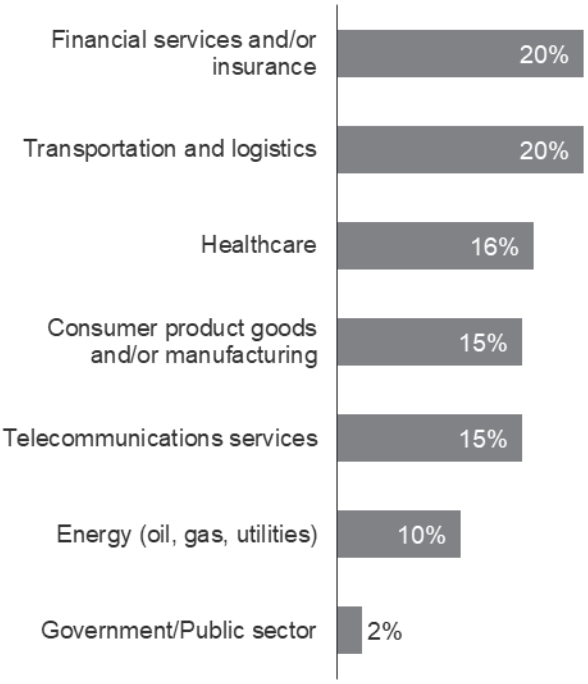
Role	Quantity	Weekly cost	Number of weeks
Developer	3	$3,504.81	6
IT operations	1	$2,289.21	2
Release manager	1	$2,472.68	2
Test manager	1	$2,389.94	2
Certified scrum product owner	1	$2,432.13	8
Total cost: $96,847.23			
Weekly cost: $8,070.60			

Modern Team Cost

Role	Quantity	Weekly cost	Number of weeks
Developer	3	$3,504.81	1
IT operations	1	$2,289.21	1
Release manager	1	$2,472.68	1
Test manager	1	$2,389.94	1
Certified scrum product owner	1	$2,432.13	1
Total cost: $20,098.39			
Weekly cost: $20,098.39			

Survey Demographics

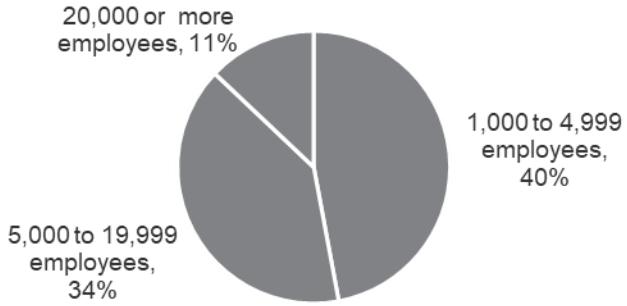
"Which of the following best describes the industry to which your company belongs?"



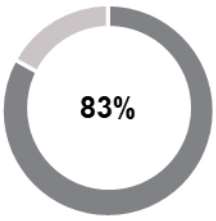
"In which country are you located?"

37%	United States
17%	United Kingdom
17%	France
20%	Germany
9%	Canada

"Using your best estimate, how many employees work for your firm / organization worldwide?"



"Please indicate your level of responsibility for infrastructure virtualization in your company:"



I have primary responsibility for selecting, deploying, and managing infrastructure virtualization technologies. It is a primary element of my job

Base: 163 IT decision-makers who use Red Hat OpenShift
(percentages may not total 100 because of rounding)
Source: A commissioned study conducted by Forrester Consulting on behalf of Red Hat, October 2021

Appendix C: Supplemental Information

Related Forrester Consulting Material
"The Total Economic Impact™ Of Red Hat OpenShift Cloud Services," a commissioned study conducted by Forrester Consulting on behalf of Red Hat, December, 2021

Appendix D: Endnotes

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

[2] "Application" is defined as a program or piece of software designed and written to fulfill a particular purpose. These can be built in a monolithic fashion in which the user interface and data access codes are combined into a single platform, or as microservices – smaller independent units that carry out every application process as a separate service.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