

A Forrester Total Economic Impact™
Study Commissioned By Dell and Intel
April 2020

The Total Economic Impact™ Of Dell EMC Ready Solutions For HPC

Cost Savings And Business Benefits
Enabled By Ready Solutions For HPC

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Executive Summary

Benefits



4x increase in compute power



15% acceleration in research value recognition



25% reduction in required support

High-performance computing (HPC) is the convergence of clusters of computational nodes, high volumes of storage, and bandwidth that results in the fastest possible computing for complex problem solving. HPC demand is steadily growing as enterprises increasingly rely on sophisticated data analysis, modeling, and simulation to find answers to big questions and to make big decisions. While most existing use cases have been centered around solving for mathematical models and simulation of complex systems, there has been rapid growth in demand for artificial intelligence (AI) use cases.¹

Dell EMC Ready Solutions for HPC enables organizations to accelerate their science, engineering, analytics, and AI initiatives with a diverse portfolio of products and services curated for individual HPC workload requirements. The portfolio contains a wide selection of price and performance optimized hardware, management and orchestration software, and domain-specific services.

Dell Technologies and Intel commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential return on investment (ROI) enterprises may realize by deploying Dell EMC Ready Solutions for HPC. The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of Ready Solutions for HPC on their organizations.

To better understand the benefits, costs, and risks associated with this investment, Forrester interviewed several customers with years of experience using Ready Solutions for HPC. These organizations used Dell's HPC solutions to conduct scientific research, advance AI studies, process seismographic data, and assess financial risk on a global scale.

Prior to using Dell EMC Ready Solutions for HPC, the customers used a mixture of homegrown and legacy HPC systems. These alternatives proved difficult to maintain and did not meet the firms' growing compute demands.

Key Findings

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

- › **More iterations and faster time-to-value.** Having tailor-made systems with increased compute power decreased the amount of time needed to solve problems, run experiments, and train models. Faster data throughput allowed organizations to accelerate the time-to-market for new products and services underpinned by HPC research.
- › **Increased research efficiency.** Interviewees stated that their organizations' researchers and data scientists spent more time conducting research and less time waiting for results with their new Dell HPC systems. Increased compute power allowed them to analyze larger data sets at faster speeds, and homogeneous use-case-specific systems ensured they spent less time on configuration.



ROI
111%



Benefits PV
\$61 million



NPV
\$32 million



Payback
11 months

- › **Reduced engineering time.** Dell Technologies provided organizations with systems built for their range of specific use cases as well as ongoing support from its HPC and AI Centers of Excellence. With the right tools, and expert support, organizations required less internal support than they needed with previous homegrown solutions.
- › **Reduced operating costs.** Dell's HPC systems were more efficient than previous solutions the organizations used, requiring less floorspace for hardware and consuming less energy for power and cooling. Having more efficient systems reduced organizational spend needed to operate the HPC environments.

Unquantified benefits. The interviewed organizations experienced the following benefits, which are not quantified for this study:

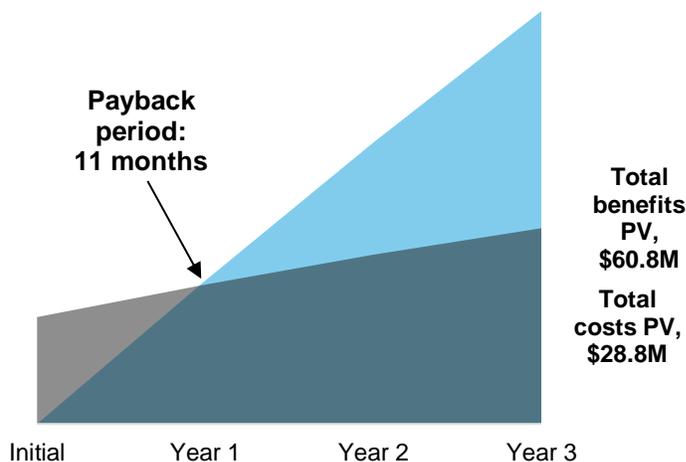
- › **Improved prestige.** Having the newest HPC deployments led to increased organizational prestige and it improved the ability to attract top-tier talent. Organizations in higher education also improved their ability to win grants.
- › **Flexible lease models enable organizational agility.** Dell Technologies offers organizations the option to lease HPC equipment, allowing them to remain agile and scale their deployments up or down in accordance with current needs.

Costs. The interviewed organizations experienced the following risk-adjusted PV costs:

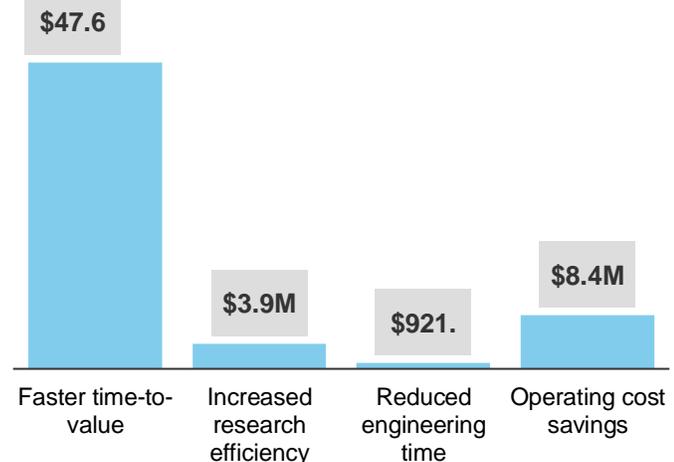
- › **Fees to Dell.** Organizations pay Dell for the design and deployment of HPC systems. Hardware prices will depend on size and configuration of systems, which vary by use case. Additionally, organizations paid Dell for ongoing maintenance, support, and upgrades.

Forrester's interviews with four existing customers and subsequent financial analysis found that a composite organization based on these interviewed organizations would experience benefits of \$60,762,191 over three years versus costs of \$28,805,973, adding up to a net present value (NPV) of \$31,956,218 and an ROI of 111%.

Financial Summary



Benefits (Three-Year)



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 implementing Dell EMC Ready Solutions For HPC.

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 Dell EMC Ready Solutions For HPC can have on an organization:



DUE DILIGENCE

Interviewed Dell Technologies stakeholders and Forrester analysts to gather data relative to Ready Solutions For HPC.



CUSTOMER INTERVIEWS

Interviewed four organizations using Ready Solutions for HPC to obtain data with respect to costs, benefits, and risks.



COMPOSITE ORGANIZATION

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



FINANCIAL MODEL FRAMEWORK

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



CASE STUDY

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

DISCLOSURES

Readers should be aware of the following:

This study is commissioned by Dell Technologies and Intel 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 Dell Ready Solutions For HPC.

Dell Technologies 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.

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

The Dell EMC Ready Solutions For HPC Customer Journey

BEFORE AND AFTER THE READY SOLUTIONS FOR HPC INVESTMENT

Interviewed Organizations

For this study, Forrester conducted four interviews with Dell EMC Ready Solutions for HPC customers. Interviewed customers include the following:

INDUSTRY	REGION	INTERVIEWEE	HPC USE CASE
Financial services	Headquartered in United States	Senior vice president of IT	Anti-fraud and money laundering
Oil and gas services	Headquartered in United States	Global supplier manager IT hardware	Seismology and geophysics
Research university	United Kingdom	Head of research computing platforms	Center of excellence for all university research
National laboratory	China	Director of artificial intelligence and advanced computing	Artificial intelligence

Key Challenges

Prior to investing in Dell EMC Ready Solutions for HPC, organizations experienced a number of pain points and challenges. These issues delayed their abilities to conduct research and created unnecessary costs.

- Cobbled-together, unoptimized HPC environments.** Organizations used a combination of purchased and homegrown HPC solutions to conduct research. The mixture of different vendors and solutions — many of which were not designed specifically for their use cases — caused inefficiencies and required frequent reconfigurations. The director of artificial intelligence and advanced computing at a national laboratory stated: “There are three parts of AI research: data, algorithms, and computing power. Traditionally, our engineers have been responsible for designing good algorithms. However, to design a good algorithm, it requires strong computing power. Before Dell HPC, the engineers needed to build this out, and it is not where their strengths lay. To complete a configuration for one server, it could require more than a week of our engineer’s time. This is where Dell comes into the picture. It provided professional services in hardware and software configuration which ensured a good computing environment so our engineers can focus on algorithm design instead of the operations.”

“For me, it’s not just about the systems environment. It’s about the support services. It’s about the professional services, the training, and the knowledge transfer. It’s about accessibility when we have an issue or even just a general question.”

Senior vice president of IT, financial services



“Dell HPC is very easy to use for AI researchers. Even for students who just started AI research, they can learn quickly in one to two weeks.”

Director of artificial intelligence and advanced computing, national laboratory



- › **Increasing volume and complexity of HPC work.** Interviewed organizations stated that the volume and complexity of work being done with their HPC solutions continuously increased and subsequently required expansions of capacity and capability. Legacy solutions could not keep up with increased demand, requiring further investment and/or stifling innovation. Furthermore, interviewees from global organizations expressed a desire to scale operations — an infeasible task with their legacy homegrown solutions. The senior vice president of IT for a financial services firm explained: “Because of our global scope, scalability is absolutely key. We do some intensive stress testing to look at volume, to look at bursting, to look at how this is going to be addressed. So, it’s key to have a partner to help us with the performance and to show what the bandwidth and the latency is and that we’re not going to have any degradation of performance because of all this.”
- › **Inefficient legacy systems.** Outdated HPC environments took up an inordinate amount of space and required substantial expenditures in power and cooling. An interviewee in oil and gas services said: “An important piece for us was the reduction of floor space. These deployments can take up a lot of floor space. We were also looking to reduce power and cooling costs with more efficient hardware.”

“A purchasing requirement is that we write a specification of the system — of its features and functions — and then it gets published and vendors can respond. Dell is always competitive on price, but it also provides all the features. There is value added by the vendor relationship as well. Dell has labs that we can use for benchmarking and testing, and our teams work closely with them to design systems. We can architect systems and they build and benchmark it.”

Head of research computing platforms, research university



Solution Requirements

The interviewed organizations defined a specific set of criteria when evaluating HPC providers for their deployments:

- › A partner that would help design and deploy an HPC solution with the customer’s specific use cases in mind.
- › An efficient solution that would require less floor space and energy than previous solutions.
- › More computing power to handle the increased volume and complexity of work.
- › Flexible financing options.

The interviewed organizations selected Dell Technologies due the ability to provide a preconfigured and certified HPC solutions optimized for their needs.

Key Results

The interviews revealed that key results from the Dell EMC Ready Solutions for HPC investment include:

- › **A cohesive, purpose-built HPC solution.** Partnering with Dell Technologies, organizations developed and deployed systems designed for their specific use cases and workloads. Furthermore, new systems provided significant increases in performance. The head of research computing platforms at a research university stated: “With the latest system, we have increased the number of cores per server, and the development in the architecture of the CPUs improved performance in each core by 30%. There was a definitive, noticeable difference. We had feedback from users telling us their hubs were running a lot faster now.”

“One of our goals was to be able to submit the performance score for our supercomputer to compete in the TOP500. The deadline was in early November, and Dell was able to meet that deadline. This was a huge achievement considering we only placed the order for the system in September.”

Head of research computing platforms, research university



- › **Accelerated time-to-value.** Improved performance and capabilities of HPC environments meant organizations could generate models and run experiments faster than with previous systems. Furthermore, the advanced capabilities allowed organizations to analyze larger data sets, uncovering valuable insights that would otherwise go unnoticed.
- › **Reduction in support costs.** Having a state-of-the-art system custom designed for their workloads reduced organizations' need to perform frequent reconfigurations. Organization also reduced the required support staff using Dell's HPC Centers of Excellence.
- › **Reduction in operating costs.** New HPC systems provided a more proficient utilization of data center floorspace and lowered consumption of power and cooling. More efficient systems allowed organizations to scale down commercial leases.

Composite Organization

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

- › It's a global Fortune 500 company with \$10 billion in annual revenue and \$1.5 billion in new annual revenue is related to research and development conducted using HPC systems.
- › It employs a team of 100 data scientists, 20 business analysts, and 20 IT support staff members dedicated to their HPC deployment.
- › Prior to investing in Dell EMC Ready Solutions for HPC, the organization maintained a combination of homegrown solutions as well as HPC solutions built by other vendors.
- › As part of its larger IT environment, the organization has an annual lease obligation of \$5 million and power and cooling costs of \$2.5 million.

"I value [Dell's] willingness to be a true partner beyond just hardware and software. Dell's ability to really measure our success was a component of its success. The basic fact is that Dell can deliver on performance reliability and security...[they] can support us through any type of regulatory exam and even external audit. The ability to help me frame the right type of automated reporting and then help me customize, bringing in best practices that they can offer...[is why we bought it.]"

*Senior vice president of IT,
financial services*



Key assumptions

\$1.5 billion in new revenue informed by HPC research

100 HPC researchers

20 business analysts

20 HPC IT support staff

Analysis Of Benefits

QUANTIFIED BENEFIT DATA AS APPLIED TO THE COMPOSITE

Total Benefits

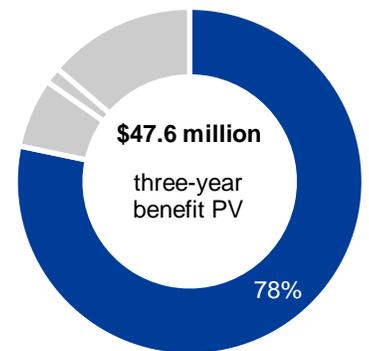
REF.	BENEFIT	YEAR 1	YEAR 2	YEAR 3	TOTAL	PRESENT VALUE
Atr	Faster time-to-value	\$19,125,000	\$19,125,000	\$19,125,000	\$57,375,000	\$47,561,044
Btr	Increased research efficiency	\$1,577,000	\$1,577,000	\$1,577,000	\$4,731,000	\$3,921,766
Ctr	Reduced engineering time	\$370,500	\$370,500	\$370,500	\$1,111,500	\$921,379
Dtr	Operating cost savings	\$2,137,500	\$3,443,750	\$4,750,000	\$10,331,250	\$8,358,002
	Total benefits (risk-adjusted)	\$23,210,000	\$24,516,250	\$25,822,500	\$73,548,750	\$60,762,191

Faster Time-To-Value

Having new and advanced hardware benchmarked for their needs allowed organizations to analyze more data faster. All respondents indicated that their HPC solutions from Dell Technologies were faster and more reliable than prior solutions, enabling their researchers to run more experiments and train models more quickly. The acceleration of research and ability to analyze larger data sets enabled organizations to recognize value at a faster rate through new product or services, improvements, or avoidance of organizational risk.

- › The financial services firm used the HPC deployment to analyze global financial transactions for fraudulent activity. The senior vice president of IT said: “In the prior state, we were able to get some results. [We didn’t get] too many. [It was] perhaps three times a week. Now with our Dell configuration, we’re able to get several sets of different results within the same day so that we can work on them on a regional basis — a consolidated global view like a heat map. In anti-money laundering, when we’re looking at near real-time transactions, if we’re seeing a consistent sort of growing pattern, we need to attack that. We need to get to the local country officers and the local authorities very quickly. The longer we go without having that insight, the more likely we’re not going to capture any of this and we’re going to be tracking it from yards behind. The value to my company is getting closer to where and when any pattern is developing, raising an alarm, and acting on it. We’re minimizing fraud, write-offs, and fraudulent transactions. We’re talking hundreds of millions of dollars in cost avoidance.”
- › The oil and gas services firm used its Dell HPC environment to interpret seismological data with insights packaged and sold to clients. The global supplier manager IT hardware explained: “The improved compute power has improved the time it takes for our geologists to run their models and simulations. The businesses we have require this data to be available, and we provide seismic interpretations to our clients. We can perform this work four times faster than we did with the previous solution. This has also increased our capacity because we did have capacity issues in the past. We would have geologists working for a whole day on a single customer’s work, which resulted in high turnaround. But now they can run multiple simulations for multiple clients at once.”

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 \$60 million.



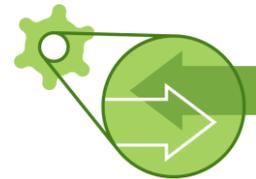
**Faster time-to-value:
78% of total benefits**

- › The national laboratory uses Dell HPC for deep learning research. The director of artificial intelligence and advanced computing said: “We use HPC for image and video intelligent recognition. Before, we needed a week to generate a model on a non-GPU (graphics processing unit) HPC. And if the researchers needed to adjust the model, it required another week. If we wanted a perfect model, it required one to two months in many cases. Now, with Dell HPC, we can generate a model within two to three days. So, in the long run, we can generate scientific results sooner.”
- › The research university offered its HPC deployments to departments within the university, government initiatives, and private organizations with ad hoc research requests. The head of research computing platforms said: “Having systems such as ours and the high-profile position within the HPC industry is a good selling point for us when attracting commercial customers. Being able to provide the latest technologies wrapped into a good quality service makes it much easier to attract those customers.”

The composite organization uses a Dell Technologies HPC deployment for research and development of new products and services, as well as to leverage data gleaned from exiting offerings to further improve them for customers. Continual improvement of existing products and services along with new offerings allow the organization to stay competitive in its market and generate new revenue annually.

- › The composite organization generates \$1.5 billion annually from HPC-informed initiatives such as data services, new product development, and product improvement.
- › The increased compute power supplied by its Dell HPC deployment accelerates development through faster simulations and the ability to analyze larger data sets.
- › The composite organization has average operating margins of 10%.

Organizations will leverage HPC solutions in varying ways for different use cases. While interviewees pointed to new business ventures and improved offerings due to their Dell Technologies HPC investments, the financial impacts varied widely. Furthermore, external factors and varying internal talent can impact development and sales of new products. To account for these risks, Forrester adjusted this benefit down by 15%, yielding a three-year risk-adjusted total PV of \$47,561,044.



4x increase in compute power

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.

Faster Time-To-Value: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
A1	New value from research initiatives		\$1,500,000,000	\$1,500,000,000	\$1,500,000,000
A2	Acceleration factor from Dell HPC		15%	15%	15%
A3	Operating margin		10%	10%	10%
At	Faster time-to-value	$A1 \cdot A2 \cdot A3$	\$22,500,000	\$22,500,000	\$22,500,000
	Risk adjustment	↓15%			
Atr	Faster time-to-value (risk-adjusted)		\$19,125,000	\$19,125,000	\$19,125,000

Increased Research Efficiency

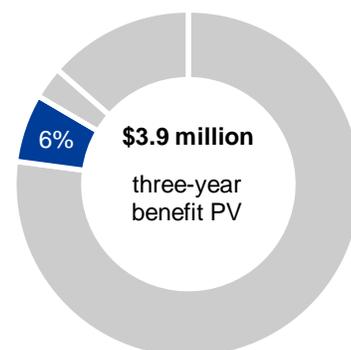
A major benefit of improved computing power is the ability to run models faster and have researchers and staff spending less time waiting for results. Researchers and scientists at interviewed organizations were able to spend more time on value-creating activities instead of waiting for results. Furthermore, the Dell Technologies HPC solutions designed and benchmarked for specific use cases resulted in researchers spending less time on configuration. Organizations also automated tasks — something that was not possible with prior solutions — which saved additional time.

- › The director of artificial intelligence and advanced computing said, “Our scientists and researchers can spend more time on research and improve the iteration of science.”
- › The senior vice president of IT explained: “There’s two to three hours a week savings just on being able to rework results without waiting for them to be delivered. It’s the speed of what all this HPC aggregation can deliver to them quicker than with our prior state. There is so much that can be done in parallel so they don’t have that waiting time or downtime. It’s huge because they are expensive, and we want every minute of them. We’re also increasing our automation anywhere and everywhere we can. You do need human intelligence at several points in the process, but the introduction of automation helps us. We’ve automated the reconciliation of data feeds because of misalignment of data dictionary and data fields. By automating that process alone, it easily saves 10 to 12 hours a week for our business analysts.”

The composite organization employs a team of 100 data scientists and 20 business analysts. With Dell’s HPC solution, the organization can save 8 hours per researcher and 4 hours per business analyst a week that would normally be spent waiting on results or other low-value tasks. In modeling this benefit, Forrester assumes:

- › Fully loaded annual researcher salary of \$156,000 and business analyst salary of \$100,000.
- › Productivity recapture rate of 50%.

Forrester recognizes that the increased research efficiency benefit will vary based on prior state benchmarks, specific use cases, and prevailing labor rates. To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year risk-adjusted total PV of \$3,921,766.



Increased research efficiency: **6%** of total benefits

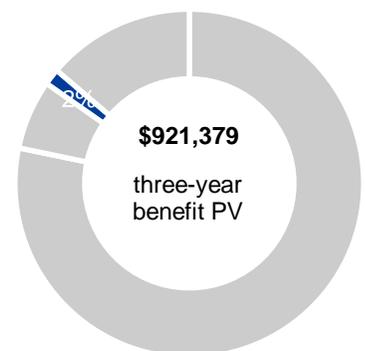
Increased Research Efficiency: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
B1	Number of research/data scientist on staff		100	100	100
B2	Weekly time savings per data scientist (hours)		8	8	8
B3	Researcher salary		\$156,000	\$156,000	\$156,000
B4	Productivity recapture		50%	50%	50%
B5	Number of business analysts		20	20	20
B6	Weekly time savings per business analyst (hours)		4	4	4
B7	Business analyst salary		\$100,000	\$100,000	\$100,000
B8	Productivity recapture		50%	50%	50%
Bt	Increased research efficiency (rounded)	$(B1*(B2*52)*(B3/2080)*B4)+(B5*(B6*52)*(B7/2080)*B8)$	\$1,660,000	\$1,660,000	\$1,660,000
	Risk adjustment	↓5%			
Btr	Increased research efficiency (risk-adjusted)		\$1,577,000	\$1,577,000	\$1,577,000

Reduced Engineering Time

Upgrading HPC deployments with Dell EMC Ready Solutions reduced the support requirements for organizations. Interviewees found that having customer-built systems from a trusted provider ensured that their staff members would spend less time on configuration for their workloads. Furthermore, organizations relied on Dell's professional services and Centers of Excellence to deploy and maintain systems.

- › The global supplier manager of IT hardware explained: "When we purchase something from Dell, Dell sends the pieces to its integration partner who integrates and assembles the equipment before it reaches us. We usually do not use our resources. We've done studies having internal resources do configuration versus having Dell perform it, and Dell falls in the range of 18% to 20% faster. We don't have a lot of IT support for the data centers. It's a small team, and we would pretty much need to hire many more resources dedicated to maintenance. In terms of efficiencies, you can say that having a third party like Dell is a saver. It's highly recommended to go with the supplier."
- › The director of artificial intelligence and advanced computing said, "Every time we have a deployment, Dell will have people come in to conduct training and explain the hardware and software in detail."



Reduced engineering time: **2%** of total benefits

- › The head of research computing platforms explained: “In terms of headcounts, I think the greatest help we get is through the kind of streamlined processes Dell has on maintenance of the hardware. You could rely on traditional support, but we’ve found that becomes quite costly and time-intensive. We’ve worked with Dell to streamline this [and to training] local staff. My technicians do certifications on different Dell platforms, and when there is an issue or fault, we can solve most of them by ourselves. We can also arrange our own replacement parts. We’re able to save on FTEs and spend less time.”

The composite organization had a team of 20 IT employees supporting its HPC environment before investing in Dell EMC Ready Solutions. But legacy homegrown systems proved difficult to maintain and lacked education support from vendors. With Dell, the organization requires 25% fewer support FTEs as HPC solutions come specifically designed for the organization’s workloads. Furthermore, Dell provides the organization with educational programs and ad hoc professional services to aid in deployment and maintenance of systems.

- › Forrester assumes a fully burdened support staff salary of \$78,000.

Forrester recognizes that reduction in engineering time may vary based on size and scope of deployment, as well as prior state deployments. To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year risk-adjusted total PV of \$921,379.

Reduced Engineering Time: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
C1	Support staff required to maintain legacy system		20	20	20
C2	Reduction in necessary support		25%	25%	25%
C3	Support staff salary		\$78,000	\$78,000	\$78,000
Ct	Reduced engineering time	$C1 * C2 * C3$	\$390,000	\$390,000	\$390,000
	Risk adjustment	↓5%			
Ctr	Reduced engineering time (risk-adjusted)		\$370,500	\$370,500	\$370,500

Operating Cost Savings

Organizations articulated that older HPC systems were less efficient in energy consumption and floorspace requirements. As Dell’s new HPC solutions provide denser clusters, organizations were able to provide the same — or more — computing power while taking up less floorspace. Additionally, new HPC hardware is more efficient in power and cooling energy consumption, further reducing operating costs.

The composite organization maintains multiple data centers globally, with floorspace allocated for HPC hardware. In deploying new Dell HPC solutions, the composite organization can reduce floorspace required for HPC hardware by up to 75% over three years. The composite organization reduces power and cooling spend by 50% over the three-year period.

- › Forrester assumes average annual lease obligations of \$5 million dedicated to HPC hardware. This lease is reduced over a three-year period as the organization has long-term obligations it cannot terminate immediately.

- › Forrester assumes an annual power and cooling spend of \$2.5 million from HPC usage. This is reduced over a three-year period as legacy hardware is retired.

Forrester recognizes that reduction in operating costs time may vary based on size and scope of deployments, as well as prior state deployments. To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year risk-adjusted total PV of \$8,358,002.

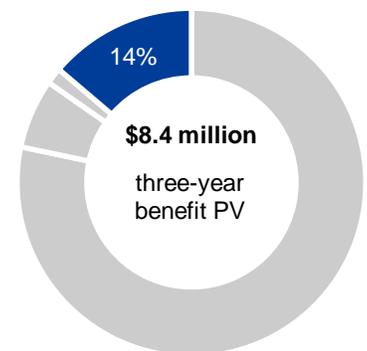
Operating Cost Savings: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
D1	Average annual lease spend for legacy compute environment		\$5,000,000	\$5,000,000	\$5,000,000
D2	Reduction in required floor space with Dell HPC		25%	50%	75%
D3	Annual compute power and cooling spend		\$2,500,000	\$2,500,000	\$2,500,000
D4	Reduction in power and cooling with Dell HPC		40%	45%	50%
Dt	Operating cost savings	$(D1 \cdot D2) + (D3 \cdot D4)$	\$2,250,000	\$3,625,000	\$5,000,000
	Risk adjustment	↓5%			
Dtr	Operating cost savings (risk-adjusted)		\$2,137,500	\$3,443,750	\$4,750,000

Unquantified Benefits

Interviewees highlighted a number of benefits that could not be quantified for the study:

- › **Improved prestige.** Having the newest HPC deployments led to increased organizational prestige and improved the organizations' ability to attract top-tier talent. Organizations in higher education also improved their ability to win grants. The head of research computing platforms explained: "[TOP500] is a high-profile list, especially for an institution that aspires to provide national services. That way, we are able to attract a lot more funding because we are not actually funded by the university, but by a majority from grants. Having a very large supercomputer gives us that good reputation. We're building our reputation on what we do and how we do it."
- › **Flexible lease models enable organizational agility.** Dell Technologies offers organizations the option to lease HPC equipment, allowing them to remain agile and scale their deployments up or down in accordance with current needs. The global supplier manager of IT hardware stated: "The lease is a good option. We have three-year leases, and when the lease expires, we can go month to month. This is good in an industry where you can experience a downturn. You have the option instead of being committed to a very long-term situation. The option gives us flexibility."



Reduced operating costs
14% of total benefits

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	HPC hardware and maintenance	\$15,750,000	\$5,250,000	\$5,250,000	\$5,250,000	\$31,500,000	\$28,805,973
	Total costs (risk-adjusted)	\$15,750,000	\$5,250,000	\$5,250,000	\$5,250,000	\$31,500,000	\$28,805,973

HPC Hardware And Maintenance

Dell Technologies offers a variety of pricing models for its Dell EMC Ready Solutions offerings. Cost vary widely, based on the scope and usage of and design of specific systems.

Beyond HPC hardware, Dell Technologies offers professional implementation services, maintenance, upgrades, and education.

The composite organization spends \$15 million upfront for HPC hardware, design, and implementation services. Once deployed, the organization pays \$5 million annually for support and upgrades.

Costs will vary based on specific HPC deployment and terms of contract. To account for these risks, Forrester adjusted this cost upward by 5%, yielding a three-year risk-adjusted total PV of \$28,805,973.

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 more than \$28 million.

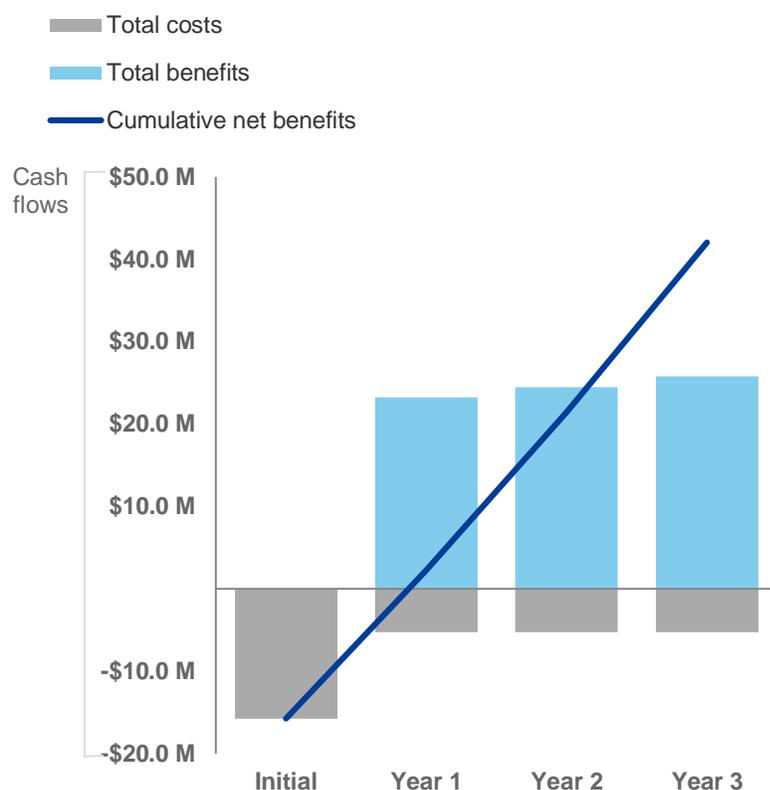
HPC Hardware And Maintenance: Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3
E1	Upfront hardware and deployment		\$15,000,000			
E2	Annual hardware and service costs			\$5,000,000	\$5,000,000	\$5,000,000
Et	HPC hardware and maintenance	E1+E2	\$15,000,000	\$5,000,000	\$5,000,000	\$5,000,000
	Risk adjustment	↑5%				
Etr	HPC hardware and maintenance (risk-adjusted)		\$15,750,000	\$5,250,000	\$5,250,000	\$5,250,000

Financial Summary

CONSOLIDATED THREE-YEAR RISK-ADJUSTED METRICS

Cash Flow Chart (Risk-Adjusted)



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



These risk-adjusted 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	(\$15,750,000)	(\$5,250,000)	(\$5,250,000)	(\$5,250,000)	(\$31,500,000)	(\$28,805,973)
Total benefits	\$0	\$23,210,000	\$24,516,250	\$25,822,500	\$73,548,750	\$60,762,191
Net benefits	(\$15,750,000)	\$17,960,000	\$19,266,250	\$20,572,500	\$42,048,750	\$31,956,218
ROI						111%
Payback period						11.0 months

Dell EMC Ready Solutions For HPC: Overview

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

Description of the Vendor's product and features. Table or chart inclusion optional as needed.

Dell Technologies understands that designing an optimized solution starts with the target workload and use case. So, we take the time to understand your business goals and your environment. We then take a solution-level approach to your HPC project that results in an optimal solution of workstations, servers, networking, storage, and software, rounded out with the services and support you need to succeed.

Dell EMC Ready Solutions for HPC, AI, and Data Analytics are optimized rack-level systems with servers, software, networking, storage, and services designed to let you "just add data." These scalable architectures are built with best-in-class solution stacks to deliver speed, confidence, and savings.

- Dell EMC Ready Solutions for HPC are scalable systems tested and tuned for specific vertical-market applications such as life sciences, digital manufacturing, and research.
- Dell EMC Ready Solutions for AI help make AI simpler with designs enabling you to get faster, deeper insights delivered with proven AI expertise.
- Dell EMC Ready Solutions for Data Analytics speed time-to-insight with architectures, integrated systems, and services optimized for big data analytics.
- Dell EMC Ready Solutions for HPC Storage make it easier to unlock the value of your data with scalable systems for NFS, Lustre, PixStor, and/or BeeGFS storage.

From design and implementation to support and systems management, Dell Technologies offers a comprehensive services portfolio for data analytics, HPC, and AI, including on-premises and managed systems, as well as those in the cloud. Dell Technologies partners with you every step of the way, linking people, processes, and technology to accelerate innovation and enable optimal business outcomes.



Access the worldwide [Customer Solution Centers](#) (remote access available) where world-class IT experts collaborate with you to share best practices, facilitate in-depth discussions of effective business strategies, and help your business become more successful and competitive. Dell Technologies Customer Solution Centers help reduce the risks associated with new technology investments and can help improve speed and ease of implementation.

Intel collaborates with Dell Technologies to democratize, optimize, and advance HPC. Dell Technologies and Intel create HPC and AI solutions with Intel® inside. Solutions include Intel® Scalable Processors, Optane® Memory, SSDs, FPGAs, and software optimizations.

INTEL HPC PRODUCTS AND TECHNOLOGY



Intel® Xeon® Scalable Processors

Drive actionable insight, count on hardware-based security, and deploy dynamic service delivery with Intel® Xeon® Scalable processors.

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Intel® Deep Learning Boost (Intel® DL Boost)

Intel® Xeon® Scalable processors take embedded AI performance to the next level with Intel® Deep Learning Boost (Intel® DL Boost).

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Intel® Optane™ Technology

We're enabling solutions that unleash CPU utilization, reduce bottlenecks, and deliver unprecedented insights from large datasets.

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Intel® Omni-Path Architecture (Intel® OPA)

Intel® Omni-Path Architecture (Intel® OPA) lowers system TCO while providing reliability, high performance, and extreme scalability.

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Intel® FPGAs

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[Learn more >](#)



Intel® Ethernet Network Adapter

Intel® Ethernet Network Adapters, Controllers, and Accessories deliver services efficiently and cost-effectively in the data center.

[Learn more >](#)



HPC Software and Tools

Modernize your code for today's and tomorrow's hardware using advanced tools that help build, debug, and tune your applications.

[Learn how >](#)

Dell Technologies has built a nexus of collaboration in the industry at the Dell Technologies [HPC and AI Innovation Lab](#) in Austin, Texas. The 13,000-square-foot data center houses thousands of servers, a TOP500 cluster, and a wide range of storage and network systems. The Zenith cluster is the result of a partnership between Dell and Intel®. On the TOP500 list of fastest supercomputers in the world, teams use it for benchmarking, workload evaluations, and a wide range of artificial intelligence, high performance data analytics, and high-performance computing projects.

Zenith includes Intel Xeon® Scalable Processors, Omni-Path fabric architecture, data center storage solutions, FPGAs, adapters, software, and tools. Projects underway include image classification to identify disease in X-rays, MRI scan matching to thoughts and actions and building faster neural networks to drive recommendation engines.

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: “Now Tech: AI Infrastructure, Q1 2020,” Forrester Research, Inc., February 7, 2020.