

A Forrester Total Economic
Impact™ Study
Commissioned By
Dell

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The Total Economic Impact™ Of Dell FX2 Architecture

Cost Savings And Business Benefits
Enabled By FX2 Architecture

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Executive Summary

Dell commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential return on investment (ROI) enterprises may realize by deploying FX2 architecture. The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of FX2 architecture on their organizations.

To better understand the benefits, costs, and risks associated with an FX2 architecture implementation, Forrester interviewed several customers with multiple years of experience using FX2 architecture. The Dell PowerEdge FX2 architecture provides a flexible, modular platform that can be easily customized to match the requirements of specific data center workloads. The FX2 chassis is a 2U rack-based computing platform that combines the density and efficiencies of blades with the simplicity and cost advantages of rack-based systems. The FX2 hosts flexible blocks of server and storage resources while providing efficiencies through shared power, networking, IO, and management within the chassis itself.

Prior to using FX2 architecture, the interviewed organizations had standard rack server environments to support fast-paced business growth. The organizations ran into several challenges scaling their prior environments, including significant space requirements, the need to overprovision capacity upfront instead of adding capacity as needed, challenges with cable and power management, and time spent on installation, configuration, and remote management. The organizations wanted to standardize on a platform that could provide higher density and simpler management in order to more effectively support business growth. With modular infrastructure and several options available, the FX2 architecture allows the organizations to scale infrastructure as business needs change. The organizations no longer need to purchase idle capacity, and with improved management and automation they can install and configure additional capacity quickly. The added density of FX2 architecture components allows the organizations to reduce space requirements significantly, and the IO aggregators (IOAs) simplify cable management and network deployment. The embedded management tools provide efficiencies with shared management within the chassis, automation, and improved remote capabilities. Overall, FX2 architecture enables the organizations to cost-effectively scale infrastructure resources to support business agility and growth.

“One of the challenges we have as a rapidly growing company is that we want to optimize on space and power, and we saw FX2 architecture as an opportunity to reduce our recurring space and power costs without compromising on performance.”

— Vice president of technical operations

FX2 ARCHITECTURE PROVIDES CAPACITY COST SAVINGS, SPACE SAVINGS, AND MANAGEMENT EFFICIENCIES

Our interviews with three customers and subsequent financial analysis found that a composite organization based on these interviewed organizations experienced the risk-adjusted ROI and benefits shown in Figure 1. The composite organization analysis points to benefits of \$17,274,819 over three years versus costs of \$10,959,583, adding up to a net present value (NPV) of \$6,315,236. See Appendix A for a description of the composite organization.

FIGURE 1

Financial Summary Showing Three-Year Risk-Adjusted Results

**ROI:
58%**

**NPV:
\$6,315,236**

**Space savings
with density:
▼ 50%**

**Acquisition
cost savings:
▼ 15%**

Source: Forrester Research, Inc.

Disclosures

The reader should be aware of the following:

- › The study is commissioned by Dell 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 FX2 architecture.
- › Dell 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 provided the customer names for the interviews but did not participate in the interviews.

TEI Framework And Methodology

INTRODUCTION

From the information provided in the interviews, Forrester has constructed a Total Economic Impact (TEI) framework for those organizations considering implementing Dell FX2 architecture. The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that affect the investment decision, to help organizations understand how to take advantage of specific benefits, reduce costs, and improve the overall business goals of winning, serving, and retaining customers.

APPROACH AND METHODOLOGY

Forrester took a multistep approach to evaluate the impact that Dell FX2 architecture can have on an organization (see Figure 2). Specifically, we:

- › Interviewed Dell marketing and sales personnel, along with Forrester analysts, to gather data relative to FX2 architecture and the marketplace for FX2 architecture.
- › Interviewed three organizations currently using FX2 architecture to obtain data with respect to costs, benefits, and risks.
- › Designed a composite organization based on characteristics of the interviewed organizations (see Appendix A).
- › Constructed a financial model representative of the interviews using the TEI methodology. The financial model is populated with the cost and benefit data obtained from the interviews as applied to the composite organization.
- › Risk-adjusted the financial model based on issues and concerns the interviewed organizations highlighted in interviews. Risk adjustment is a key part of the TEI methodology. While interviewed organizations provided cost and benefit estimates, some categories included a broad range of responses or had a number of outside forces that might have affected the results. For that reason, some cost and benefit totals have been risk-adjusted and are detailed in each relevant section.

Forrester employed four fundamental elements of TEI in modeling Dell FX2 architecture'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 B for additional information on the TEI methodology.

FIGURE 2

TEI Approach



Source: Forrester Research, Inc.

Analysis

COMPOSITE ORGANIZATION

For this study, Forrester conducted a total of three interviews with representatives from the following companies:

- › An advertising and marketing company based in the United States with over 150 employees and over \$30 million in revenue. The organization has been using FX2 architecture for one year.
- › A media organization with 300 employees and \$300 million in revenue. The organization has been using FX2 architecture for 10 months.
- › A school district with 3,000 employees, over 20,000 students, and 30 schools and facilities.

Based on the interviews, Forrester constructed a TEI framework, a composite company, and an associated ROI analysis that illustrates the areas financially affected. The composite organization that Forrester synthesized from these results represents an organization with the following characteristics:

- › The organization provides advertising software based on big data analytics.
- › The organization has approximately 230 employees and \$57 million in revenue in Year 1, and annual revenue is growing at an average of 10% year over year.
- › The organization used standard rack servers in its prior environment and has four colocation facilities, three of which are remote.
- › The organization standardized on FX2 architecture for incremental growth. Each year, it purchases 300 FC630 servers, 75 FX2 chassis, and 150 IO aggregators to support business needs. The organization runs at close to 100% utilization and purchases capacity as needed. The organization did not replace legacy infrastructure with FX2 architecture.

“It is as if FX2 architecture is specifically designed for us. It is an amazing fit to what we do. It’s almost as if Dell read our mind and said, ‘This is what the high-compute rack should look like when it’s not a blade system and when it’s not some general 1U servers.’”

~ Vice president of IT

INTERVIEW HIGHLIGHTS

Situation

Prior to investing in FX2 architecture, the interviewed organizations noted several key business challenges that required a new approach to infrastructure management, including:

- › The interviewed organizations were growing at a fast pace and needed to make significant infrastructure investments to support business demand. The organizations sought an infrastructure option that could provide this scale more affordably. The organizations wanted an infrastructure option that could provide density and efficiencies in power consumption.
- › With this growth in the infrastructure environment, the organizations wanted to ensure that management of local and remote colocation facilities would not become too complex or time-consuming. The organizations sought an infrastructure solution that could provide shared management and better remote management to help reduce time and costs.
- › The interviewed organizations needed to be flexible enough to support business agility. This meant faster provisioning and reduced downtime in order to speed time-to-market and make sure that systems were more available.

Solution

The interviewed organizations selected FX2 architecture for its:

- › Density and ability to mix and match servers.
- › Cable management and reduced number of ports.
- › Efficient power consumption and power management capabilities.
- › Dell Chassis Management Controller and Dell Remote Access Controller (iDRAC), which provide configuration, shared management, and remote management.

Results

The interviews revealed that:

- › **FX2 architecture provides several areas of cost savings due to high density and improved cable and power management.**

All of the interviewed organizations noted a number of cost savings benefits associated with FX2 architecture compared with their prior environments. The most significant was a 50% or higher reduction in space needed for the same capacity with FX2 architecture. For those interviewees with infrastructure in colocation facilities, this meant an immediate cost savings in space and power. Additionally, reducing the number of ports and IO adapters, as well as reducing redundant componentry, directly translated into lower power consumption. Importantly, the organizations noted that these savings did not have an impact on performance.

- › **FX2 architecture simplifies IT management.** All of the interviewed organizations also noted the improvement in management with FX2 architecture. Dell Chassis Management Controller allows for managing multiple systems at the same time. The organizations automated a lot of processes to speed up the configuration and installation of additional capacity. The organizations can configure hundreds of servers in a short amount of time. The organizations also use iDRAC to simplify remote management and Dell ProSupport to service remote locations without requiring additional time or cost for internal staff or third parties.

- › **FX2 architecture supports business agility and flexibility.** The interviewed organizations wanted to standardize on one platform that could meet business needs. With FX2 architecture, the organizations are able to respond quickly to business demand without overprovisioning. The organizations are able to keep utilization rates high, and when new infrastructure is needed they can simply add additional FX2 architecture components. The improvements in management with FX2 architecture allow infrastructure teams to quickly add resources as they are needed, and the smaller modular FX2 architecture components allow organizations to add only the capacity that they need instead of investing in large deployments.

“Once we get our FX servers, they immediately go into the chassis with nothing special, no clinical installation, no cable work, nothing. They just go in very much like a blade system but without being a blade system, without the complexity of a blade system, without all of the issues of a blade system.”

~ Vice president of IT

BENEFITS

The composite organization experienced a number of quantified benefits in this case study.



Acquisition Cost Savings — Prior Cost Avoided

An immediate benefit to the composite organization was the cost savings on the acquisition of infrastructure capacity when purchasing the FX2 architecture components compared with the prior rack server environment. This is due to the superior density and efficiency of FX2 architecture. For the same amount of capacity, the organization purchases fewer servers, needs fewer cables and fewer ports for networking, and purchases less redundant componentry with FX2 architecture compared with the prior environment. The result is that the organization can save 15% in acquisition costs with FX2 architecture versus rack servers. Additionally, the organization no longer needs to overprovision capacity. With FX2 architecture, the organization purchases capacity with business growth and has a utilization rate close to 100%.

In order to account for this 15% cost savings on acquisition, we have modeled the total acquisition cost for the prior environment in Table 1. These acquisition costs are 15% higher than the FX2 architecture costs on the cost side of our model, in Table 6. When calculating the ROI, these two tables net out to the 15% overall savings, which is equivalent to \$1.7 million in savings over three years. Additionally, in order to account for the elimination of overprovisioning, we have shifted some of the costs in Table 1 to prior years in order to model the upfront purchases the organization made in the prior environment. Because we limit our analysis to three years, the Year 3 total is lower to reflect that 50% of the Year 3 capacity was purchased at the end of Year 2, and the fact that we are not including Year 4 upfront purchases in our model. This is a conservative approach to modeling the benefit of eliminating overprovisioning, since we assume that the organization purchases the same amount of capacity as it does with FX2 architecture. In reality, many organizations purchase more capacity than they need when they make purchases upfront because it can be difficult to estimate the capacity needed, and there can be maintenance costs associated with that idle capacity. With FX2 architecture, the organization only purchases capacity with growth, so the amount of capacity necessary is much clearer.

Interviewed organizations provided a range of acquisition savings percentages, which can vary based on the prior environment costs. To compensate, this benefit was risk-adjusted and reduced by 3%. The risk-adjusted total benefit resulting from acquisition cost savings over the three years was \$12.65 million. See the section on Risks for more detail.

TABLE 1

Acquisition Cost Savings — Prior Cost Avoided

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3
At	Acquisition cost savings — prior cost avoided		\$2,159,515	\$4,679,029	\$5,399,029	\$2,879,515
	Risk adjustment	↓3%				
Atr	Acquisition cost savings — prior cost avoided (risk-adjusted)		\$2,094,729	\$4,538,659	\$5,237,059	\$2,793,129

Source: Forrester Research, Inc.



Colocation Cost Savings

The composite organization has its infrastructure in four colocation facilities. The organization can more densely populate existing infrastructure and reduce the amount of redundant power components with FX2 architecture. With the density of FX2 architecture, the organization is able to achieve a 50% space savings in its colocation facilities compared with the prior rack server environment. The organization makes the same incremental FX2 architecture investment each year, so each year the organization can avoid an additional 12 cabinets' worth of space compared with the prior environment. At an average of \$2,500 per month per cabinet, the organization saves \$360,000 in Year 1 and \$1.08 million by Year 3.

Interviewed organizations provided a range of space savings with FX2 architecture compared with the prior environment due to differences in the prior infrastructure. Additionally, organizations have different pricing for colocation facilities, which can affect the magnitude of this benefit. To compensate, this benefit was risk-adjusted and reduced by 3%. The risk-adjusted total benefit resulting from colocation cost savings over the three years was \$1.68 million. See the section on Risks for more detail.

TABLE 2
Colocation Cost Savings

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3
B1	Average price per month per cabinet (with power) in colocation center			\$2,500	\$2,500	\$2,500
B2	Cabinets saved with FX2 architecture			12	24	36
Bt	Colocation cost savings	$B1 * 12 * B2$	\$0	\$360,000	\$720,000	\$1,080,000
	Risk adjustment	↓3%				
Btr	Colocation cost savings (risk-adjusted)		\$0	\$349,200	\$698,400	\$1,047,600

Source: Forrester Research, Inc.



Improved Time-To-Market

The composite organization can respond faster to business needs with the more modular, flexible FX2 architecture. When business needs demand more infrastructure, the organization can quickly order and configure additional FX2 architecture components. In the prior environment, the organization would spend an average of six weeks from purchase through installation of additional capacity. With FX2 architecture, it takes an average of three weeks to purchase and configure additional capacity. The organization estimates that this three-week savings affects five projects per year and that 30% of this savings is attributable to the FX2 architecture investment. With an average 20% gross margin, this means that the improved time-to-market attributable to FX2 architecture is worth almost \$1.2 million per year in incremental gross profit by Year 3.

Time-to-market benefits can be difficult to measure due to the number of technology investments and process improvements that can contribute to efficiencies. Organizations may see different savings based on variability in the prior environment, the effect on time-to-market due to the FX2 architecture investment, and the number of projects each year where FX2 architecture provides improvements. To compensate, this benefit was risk-

adjusted and reduced by 10%. The risk-adjusted total benefit resulting from improved time-to-market over the three years was \$2.42 million. See the section on Risks for more detail.

TABLE 3
Improved Time-To-Market

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3
C1	Annual revenue	10% growth yoy		\$57,000,000	\$62,700,000	\$68,970,000
C2	Number of weeks saved per project with faster provisioning			3	3	3
C3	Number of projects per year			5	5	5
C4	Amount of benefit attributable to Dell FX2 architecture			30%	30%	30%
C5	Average gross margin			20%	20%	20%
Ct	Improved time-to-market	$(C1/52)*C2*C3*C4*C5$	\$0	\$986,538	\$1,085,192	\$1,193,712
	Risk adjustment	↓10%				
Ctr	Improved time-to-market (risk-adjusted)		\$0	\$887,885	\$976,673	\$1,074,340

Source: Forrester Research, Inc.



Management Time Savings

Compared with its prior environment, the composite organization is able to achieve overall IT process efficiencies related to its FX2 architecture investment. The organization can provision systems much faster due to faster installation times compared with its prior standard rack servers and because there are fewer ports to provision. Additionally, the organization can leverage iDRAC to build a lot of automation for system provisioning. The chassis management also allows for managing multiple systems at the same time. Each year, the organization saves 300 hours related to the installation of its FX2 architecture purchase for the year. It also saves time on management, and this time savings grows each year as the server environment grows. iDRAC also allows for remote management, so the organization saves time by not having to always travel to a data center. The composite also pays for Dell ProSupport, which augments the organization's staff, particularly at remote locations, when components need to be replaced. The cost savings related to this improved remote management are \$65,000 in Year 1, increasing to \$195,000 in Year 3.

Interviewed organizations provided a range of management time savings related to installation efficiencies and remote cost savings. To compensate, this benefit was risk-adjusted and reduced by 3%. The risk-adjusted total benefit resulting from management time savings over the three years was \$524,144. See the section on Risks for more detail.

TABLE 4
Management Time Savings

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3
D1	Full-time equivalent (FTE) hours saved per year on management			1,300	1,800	2,050
D2	Average hourly fully loaded compensation			\$72	\$72	\$72
D3	Productivity capture			75%	75%	75%
D4	Remote cost savings			\$65,000	\$130,000	\$195,000
Dt	Management savings	$(D1 \times D2 \times D3) + D4$	\$0	\$135,200	\$227,200	\$305,700
	Risk adjustment	↓3%				
Dtr	Management savings (risk-adjusted)		\$0	\$131,144	\$220,384	\$296,529

Source: Forrester Research, Inc.

Total Benefits

Table 5 shows the total of all benefits across the four areas listed above, 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 \$17 million.

TABLE 5
Total Benefits (Risk-Adjusted)

Ref.	Benefit Category	Initial	Year 1	Year 2	Year 3	Total	Present Value
Atr	Acquisition cost savings — prior cost avoided	\$2,094,729	\$4,538,659	\$5,237,059	\$2,793,129	\$14,663,576	\$12,647,449
Btr	Colocation cost savings	\$0	\$349,200	\$698,400	\$1,047,600	\$2,095,200	\$1,681,722
Ctr	Improved time-to-market	\$0	\$887,885	\$976,673	\$1,074,340	\$2,938,898	\$2,421,503
Dtr	Management time savings	\$0	\$131,144	\$220,384	\$296,529	\$648,057	\$524,144
	Total benefits (risk-adjusted)	\$2,094,729	\$5,906,887	\$7,132,516	\$5,211,599	\$20,345,731	\$17,274,819

Source: Forrester Research, Inc.

COSTS

The composite organization experienced a number of costs associated with the FX2 architecture investment. These represent the mix of internal and external costs experienced by the composite organization for implementation and ongoing maintenance associated with the solution.



Dell FX2 Architecture Investment

The composite organization purchased 300 FC630 servers, 75 FX2 chassis, and 150 IO aggregators in each year of the three-year analysis in order to support business growth. In the first year, the organization purchased 20% of its investment for the year upfront, shown below in the “Initial” column. In years 1 through 3, the organization purchased servers, chassis, and IOAs as they were needed. In the year of purchase, the composite pays the purchase price plus the first year of Dell ProSupport. In subsequent years, the organization pays for the yearly support cost. Dell’s support infrastructure has allowed the organization to save costs required to service infrastructure in remote colocation facilities. The prices below represent standard configurations, include support costs, and are discounted an average of 37% off list price.

Infrastructure costs vary from organization to organization, considering different configurations, volume discounts, what other products may be purchased from the same vendor, and other discounts. To compensate, this cost was risk-adjusted up by 3%. The risk-adjusted cost of the FX2 architecture investment over the three years was \$10.94 million. See the section on Risks for more detail.

TABLE 6

Dell FX2 Architecture Investment

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3
E1	FC630 costs		\$660,840	\$2,643,360	\$3,855,000	\$4,405,800
E2	FX2 costs		\$37,995	\$151,980	\$221,625	\$253,275
E3	IOA costs		\$35,400	\$141,600	\$206,550	\$236,100
Et	Dell FX2 architecture investment	E1+E2+E3	\$734,235	\$2,936,940	\$4,283,175	\$4,895,175
	Risk adjustment	↑3%				
Etr	Dell FX2 architecture investment (risk-adjusted)		\$756,262	\$3,025,048	\$4,411,670	\$5,042,030

Source: Forrester Research, Inc.



Implementation And Management Time

The composite organization has had rolling FX2 architecture investments based on growth since the initial FX2 architecture purchase. With the initial investment, the organization spent a few hours on automation and configuration. With Dell’s remote management capabilities and a lot of the configuration automated, the organization spends little time standing up its FX2 architecture components. Initially, the organization spends 12 hours on installing the initial 20% of the Year 1 FX2 architecture investment and spends an additional 8 hours on automation. In Year 1, the organization spends 48 hours on installing the remainder of its Year 1 investment. In years 2 and 3, the organization spends 60 hours on racking and cabling related to the FX2 architecture investment, and across all years the organization spends 40 hours on configuration and management. As one

organization noted, “I could not have scaled as quickly as I did without the level of remote management and IT management that Dell provides with the FX2 architecture.” The composite did not require any formal training as part of the investment.

Implementation and management time is variable from organization to organization, considering how much is managed in-house and resource skill levels, among other factors. To compensate, this cost was risk-adjusted up by 3%. The risk-adjusted cost of implementation and management time over the three years was \$19,117. See the section on Risks for more detail.

TABLE 7
Implementation And Management Time

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3
F1	FTE hours per year for installation		20	48	60	60
F2	FTE hours per year on ongoing management			40	40	40
F3	Average hourly fully loaded compensation		\$72	\$72	\$72	\$72
Ft	Implementation and management time	$(F1+F2)*F3$	\$1,440	\$6,336	\$7,200	\$7,200
	Risk adjustment	↑3%				
Ftr	Implementation and management time (risk-adjusted)		\$1,483	\$6,526	\$7,416	\$7,416

Source: Forrester Research, Inc.

Total Costs

Table 8 shows the total of all costs as well as associated present values (PVs), discounted at 10%. Over three years, the composite organization expects risk-adjusted total costs to be a PV of just under \$11 million.

TABLE 8
Total Costs (Risk-Adjusted)

Ref.	Cost Category	Initial	Year 1	Year 2	Year 3	Total	Present Value
Etr	Dell FX2 architecture investment	\$756,262	\$3,025,048	\$4,411,670	\$5,042,030	\$13,235,011	\$10,940,466
Ftr	Implementation and management time	\$1,483	\$6,526	\$7,416	\$7,416	\$22,841	\$19,117
	Total costs (risk-adjusted)	\$757,745	\$3,031,574	\$4,419,086	\$5,049,446	\$13,257,852	\$10,959,583

Source: Forrester Research, Inc.

FLEXIBILITY

Flexibility, as defined by TEI, represents an investment in additional capacity or capability that could be turned into business benefit for some future additional investment. This provides an organization with the “right” or the ability to engage in future initiatives but not the obligation to do so. There are multiple scenarios in which a customer might choose to implement FX2 architecture and later realize additional uses and business opportunities. Flexibility would also be quantified when evaluated as part of a specific project (described in more detail in Appendix B).

While this study focuses solely on incremental investments related to growth, some organizations may replace existing infrastructure with FX2 architecture to achieve additional benefits related to increased density, improved power and cable management, and more efficient infrastructure installation and management.

RISKS

Forrester defines two types of risk associated with this analysis: “implementation risk” and “impact risk.” Implementation risk is the risk that a proposed investment in FX2 architecture may deviate from the original or expected requirements, resulting in higher costs than anticipated. Impact risk refers to the risk that the business or technology needs of the organization may not be met by the investment in FX2 architecture, resulting in lower overall total benefits. The greater the uncertainty, the wider the potential range of outcomes for cost and benefit estimates.

TABLE 9
Benefit And Cost Risk Adjustments

Benefits	Adjustment
Acquisition cost savings	↓ 3%
Colocation cost savings	↓ 3%
Improved time-to-market	↓ 10%
Management time savings	↓ 3%
Costs	Adjustment
Dell FX2 architecture investment	↑ 3%
Implementation and management time	↑ 3%

Source: Forrester Research, Inc.

Quantitatively capturing implementation risk and impact risk by directly adjusting the financial estimates results provides more meaningful and accurate estimates and a more accurate projection of the ROI. In general, risks affect costs by raising the original estimates, and they affect benefits by reducing the original estimates. The risk-adjusted numbers should be taken as “realistic” expectations since they represent the expected values considering risk.

The following impact risks that affect benefits are identified as part of the analysis:

- › Acquisition cost savings and colocation cost savings are dependent on the comparison between the prior environment and the FX2 architecture environment. Organizations may have different types and configurations of prior servers, different prior networking and redundant componentry, and different colocation providers. These factors will affect how much is

saved on acquisition with FX2 architecture, how much space is saved in colocation facilities, and the cost savings associated with saved colocation space based on differences in colocation pricing.

- › Time-to-market benefits can be difficult to measure due to the number of technology investments and process improvements that can contribute to efficiencies. Organizations may see different savings based on differences in the prior infrastructure environment, prior purchase processes, the ability to accurately measure the effect on time-to-market due to the FX2 architecture investment, and the ability to distinguish the number of projects each year where FX2 architecture provides improvements.
- › Interviewed organizations provided a range of management time savings related to installation efficiencies and remote cost savings. This can vary based on how much is managed in-house versus through third parties, the use of tools like iDRAC to leverage shared management and automation, the number of remote locations the organization has, and prior processes related to remote management.

The following implementation risks that affect costs are identified as part of this analysis:

- › FX2 architecture costs can vary considering different configurations, different server or IO choices, volume discounts, whether the organization has purchased other products from the vendor, and other discounts.
- › Implementation and management time is variable from organization to organization, considering differences in how much infrastructure is managed in-house and with third parties, resource skill levels, and the size of the FX2 architecture investment.

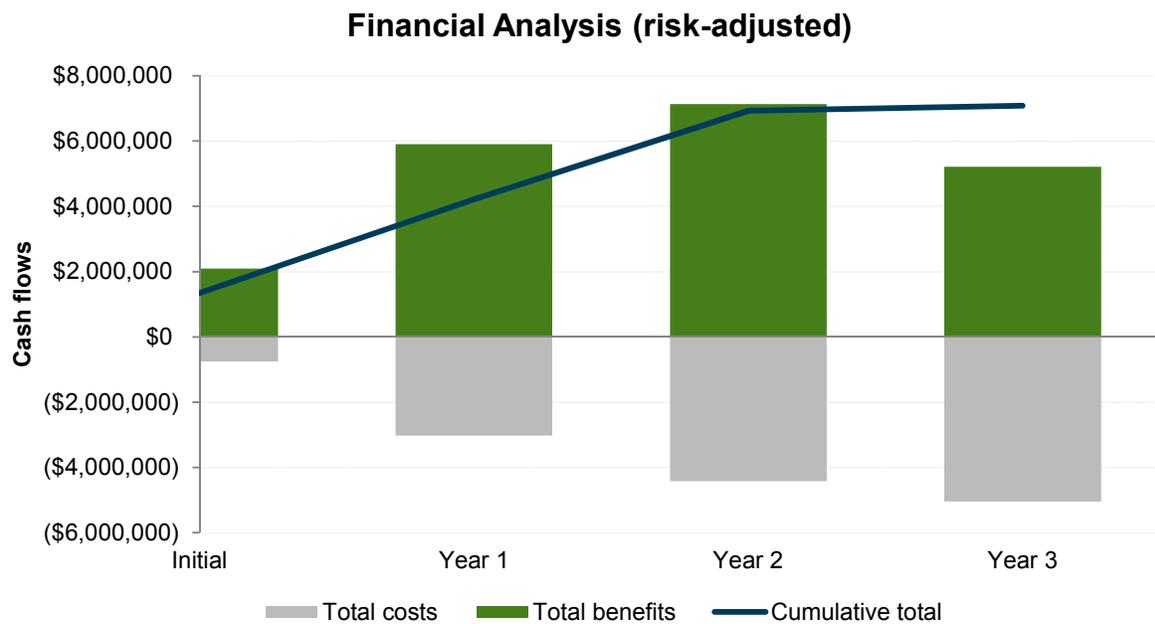
Table 9 shows the values used to adjust for risk and uncertainty in the cost and benefit estimates for the composite organization. Readers are urged to apply their own risk ranges based on their own degree of confidence in the cost and benefit estimates.

Financial Summary

The financial results calculated in the Benefits and Costs sections can be used to determine the ROI and NPV for the composite organization's investment in FX2 architecture.

Table 10 below shows the risk-adjusted ROI and NPV values. These values are determined by applying the risk-adjustment values from Table 9 in the Risks section to the unadjusted results in each relevant cost and benefit section.

FIGURE 3
Cash Flow Chart (Risk-Adjusted)



Source: Forrester Research, Inc.

TABLE 10
Cash Flow (Risk-Adjusted)

	Initial	Year 1	Year 2	Year 3	Total	Present Value
Costs	(\$757,745)	(\$3,031,574)	(\$4,419,086)	(\$5,049,446)	(\$13,257,852)	(\$10,959,583)
Benefits	\$2,094,729	\$5,906,887	\$7,132,516	\$5,211,599	\$20,345,731	\$17,274,819
Net benefits	\$1,336,984	\$2,875,313	\$2,713,429	\$162,152	\$7,087,879	\$6,315,236
ROI						58%

Source: Forrester Research, Inc.

Dell FX2 Architecture: Overview

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

Built on new 13th generation Dell PowerEdge technology, FX2 architecture re-interprets the server and combines rack and blade technologies, allowing you to incrementally add or swap small IT building blocks, including servers with different processor architectures and memory sizes, direct attached storage units, IO modules, all into a 2U rack mount and rack-managed chassis.

By combining concepts from traditional blade and hyper-scale architecture technologies with proven rack-based approaches to management and cabling, the FX2 architecture is designed to appeal to both customers new to modular infrastructure and customers who are experienced with using shared infrastructure.

The Dell FX2 architecture consists of several components:

- › The PowerEdge FX2 Enclosure is a 2U chassis that supports all the different resource blocks you need to power your environment and applications. The FX2 fits servers, storage, and networking into one easy-to-manage chassis, sliding components into half-height sleds that connect to the shared infrastructure via a flexible IO fabric. The blocks share power, networking, I/O fabric, PCIe fabric, and have the ability to share management capabilities through the FX2 enclosure like a typical blade server, or can be managed on a per-node basis, like a traditional rack server.
- › With the PowerEdge FD332, a half-width storage block, comes a scale-out computing solution that's truly flexible, housing up to 16 direct-attached small form factor storage devices. Dense environments in need of a software-defined storage solution, such as VMware Virtual SAN or Microsoft Storage Spaces shine with the FD332 storage.
- › FX2 architecture has a number of servers to choose from. Built on the Intel Atom processor C2000 product family, the PowerEdgeFM120X4 is a cost-effective and highly dense option for workloads such as Web server hosting. The PowerEdge FC430 is perfect for those with an emphasis on high reliability, density, and IO throughput. The FC630, a half-width, half-height server block, has powerful Intel Xeon E5-2600 v3 processors and a large memory footprint ideal for powering a heavy virtualization environment or business intelligence applications. The full-width, half-height PowerEdge FC830 fits up to four processors in its server block and boasts dense compute and memory scalability along with an expandable storage subsystem. This makes it the perfect choice for large enterprise data centers running intense CPU and memory-hungry applications.
- › The FN IO Module (FN IOM) is designed specifically for the PowerEdge FX2 chassis, part of the PowerEdge FX2 architecture. Supporting up to two FN IOMs per chassis, the FX2 modular infrastructure also includes up to 8 x 10GbE internal ports, plus redundant cooling fans and power supplies.

Appendix A: Composite Organization Description

For this TEI study, Forrester has created a composite organization to illustrate the quantifiable benefits and costs of an FX2 architecture investment. The composite is intended to represent an organization that provides advertising software, has 230 employees, has \$57 million in revenue in Year 1, and is based on characteristics of the interviewed customers.

Prior to making its FX2 architecture investment, the organization was using 1U rack servers and had four colocation facilities, three of which were remote. The organization was growing rapidly, at 10% year-over-year average growth, and needed to make the right infrastructure investments to support its fast-growing big data products.

In purchasing FX2 architecture, the composite organization has the following objectives:

- › Cost-effectively expand its infrastructure environment to support growth and performance while minimizing its footprint in its colocation facilities, including reducing overprovisioning.
- › Simplify management of its infrastructure environment, particularly at remote locations,. This will help achieve efficiencies in installation and configuration times, in order to improve time-to-market and reduce downtime with faster support.
- › Invest in infrastructure that provides flexibility and agility to support fast-paced business growth overall.

For the purpose of the analysis, Forrester assumes that the organization standardized on the FX2 architecture portfolio for all future infrastructure growth but did not replace legacy infrastructure in its environment. The organization purchased FC630 servers, FX2 chassis, and IO aggregators, and made the same incremental investment in each year of the analysis. The organization also purchased Dell ProSupport to reduce the need to rely on internal staff or third parties to service its colocation facilities. The organization has close to 100% utilization of its FX2 architecture components and purchases additional components throughout each year as required by business growth.

FRAMEWORK ASSUMPTIONS

Table 11 provides the model assumptions that Forrester used in this analysis.

The discount rate used in the PV and NPV calculations is 10%, and the time horizon used for the financial modeling is three years. Organizations typically use discount rates between 8% and 16% based on their current environment. Readers are urged to consult with their respective company's finance department to determine the most appropriate discount rate to use within their own organizations.

TABLE 11
Model Assumptions

Ref.	Metric	Calculation	Value
X1	Hours per week		40
X2	Weeks per year		52
X3	Hours per year (M-F, 9-5)		2,080
X4	Average annual fully loaded compensation		\$150,000
X5	Hourly fully loaded compensation	(X4/X3)	\$72

Source: Forrester Research, Inc.

Appendix B: Total Economic Impact™ Overview

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. TEI assists technology vendors in winning, serving, and retaining customers.

The TEI methodology consists of four components to evaluate investment value: benefits, costs, flexibility, and risks.

BENEFITS

Benefits represent the value delivered to the user organization — IT and/or business units — by the proposed product or project. Often, product or project justification exercises focus just on IT cost and cost reduction, leaving little room to analyze the effect of the technology on the entire organization. The TEI methodology and the resulting financial model place 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. Calculation of benefit estimates involves a clear dialogue with the user organization to understand the specific value that is created. In addition, Forrester also requires that there be a clear line of accountability established between the measurement and justification of benefit estimates after the project has been completed. This ensures that benefit estimates tie back directly to the bottom line.

COSTS

Costs represent the investment necessary to capture the value, or benefits, of the proposed project. IT or the business units may incur costs in the form of fully burdened labor, subcontractors, or materials. Costs consider all the investments and expenses necessary to deliver the proposed value. In addition, the cost category within TEI captures any incremental costs over the existing environment for ongoing costs associated with the solution. All costs must be tied to the benefits that are created.

FLEXIBILITY

Within the TEI methodology, direct benefits represent one part of the investment value. While direct benefits can typically be the primary way to justify a project, Forrester believes that organizations should be able to measure the strategic value of an investment. Flexibility represents the value that can be obtained for some future additional investment building on top of the initial investment already made. For instance, an investment in an enterprisewide upgrade of an office productivity suite can potentially increase standardization (to increase efficiency) and reduce licensing costs. However, an embedded collaboration feature may translate to greater worker productivity if activated. The collaboration can only be used with additional investment in training at some future point. However, having the ability to capture that benefit has a PV that can be estimated. The flexibility component of TEI captures that value.

RISKS

Risks measure the uncertainty of benefit and cost estimates contained within the investment. Uncertainty is measured in two ways: 1) the likelihood that the cost and benefit estimates will meet the original projections and 2) the likelihood that the estimates will be measured and tracked over time. TEI risk factors are based on a probability density function known as "triangular distribution" to the values entered. At a minimum, three values are calculated to estimate the risk factor around each cost and benefit.

Appendix C: Glossary

Discount rate: The interest rate used in cash flow analysis to take into account the time value of money. Companies set their own discount rate based on their business and investment environment. Forrester assumes a yearly discount rate of 10% for this analysis. Organizations typically use discount rates between 8% and 16% based on their current environment. Readers are urged to consult their respective organizations to determine the most appropriate discount rate to use in their own environment.

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.

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.

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.

Return on investment (ROI): A measure of a project's expected return in percentage terms. ROI is calculated by dividing net benefits (benefits minus costs) by costs.

A NOTE ON CASH FLOW TABLES

The following is a note on the cash flow tables used in this study (see the example table below). The initial investment column contains costs incurred at "time 0" or at the beginning of Year 1. Those costs are not discounted. All other cash flows in years 1 through 3 are discounted using the discount rate (shown in the Framework Assumptions section) at the end of the year. PV calculations are calculated for each total cost and benefit estimate. NPV calculations are not calculated until 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.

TABLE [EXAMPLE]

Example Table

Ref.	Metric	Calculation	Year 1	Year 2	Year 3

Source: Forrester Research, Inc.