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The Total Economic Impact™ Of IBM® System Storage™ SAN Volume Controller

Multicompany Analysis

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Executive Summary

In June 2006, IBM commissioned Forrester Consulting to examine the total economic impact and potential return on investment (ROI) enterprises may realize by deploying the IBM System Storage SAN Volume Controller (SVC). SAN Volume Controller allows organizations to virtualize their storage infrastructure resulting in flexibility within the storage environment. This study illustrates the financial impact of virtualizing the storage environment through the use of SAN Volume Controller.

In conducting in-depth interviews with four existing customers, Forrester found that these companies achieved higher storage capacity utilization and improved administration efficiencies, as well as higher overall system availability.

Purpose

The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of SAN Volume Controller within their organizations. Forrester's aim is to clearly show all calculations and assumptions used in the analysis. Readers should use this study to better understand and communicate a business case for investing in IBM's SAN Volume Controller.

Methodology

IBM selected Forrester for this project because of its industry expertise in storage virtualization and Forrester's Total Economic Impact™ (TEI) methodology. TEI not only measures costs and cost reduction (areas that are typically accounted for within IT) but also weighs the enabling value of a technology in increasing the effectiveness of overall business processes.

For this study, Forrester employed four fundamental elements of TEI in modeling SAN Volume Controller:

1. Costs and cost reduction.
2. Benefits to the entire organization.
3. Flexibility.
4. Risk.

Given the increasing sophistication that enterprises have regarding cost analyses related to IT investments, Forrester's TEI methodology serves an extremely useful purpose by providing a complete picture of the total economic impact of purchase decisions. Please see Appendix C for additional information on the TEI methodology.

Approach

Forrester used a five-step approach for this study.

1. Forrester gathered data from existing Forrester research relative to the IBM SAN Volume Controller and the storage virtualization market in general.
2. Forrester interviewed IBM SAN Volume Controller marketing and sales personnel to fully understand the potential (or intended) value proposition of IBM storage solutions.

3. Forrester conducted a series of in-depth interviews with four organizations currently using IBM SAN Volume Controller.

4. Forrester constructed a financial model representative of the interviews. This model can be found in the TEI Framework section below.

5. Forrester created a composite organization based on the interviews and populated the framework using data from the interviews as applied to the composite organization.

Key Findings

Forrester's study yielded three key findings:

- **ROI:** Based on the interviews with the four existing customers, Forrester constructed a TEI framework for a composite organization (see Appendix A) and the associated ROI analysis illustrating the financial impact areas. As seen in Table 1, the risk adjusted ROI for our composite company is 53% with a breakeven point (payback period) of 1.4 years after deployment.

- **Benefits:** Benefits identified by the interviewed organizations included improved storage administration, higher storage capacity utilization, and improved system availability as a result of improved flexibility within the storage environment.

- **Costs:** Costs to implement SAN Volume Controller included the cost of appliance hardware and software, maintenance, and implementation and planning, as well as ongoing administration.

Table 1 illustrates the risk-adjusted cash flow for the composite organization, based on data and characteristics obtained during the interview process. Forrester risk-adjusts these values to take into account the potential uncertainty that exists in estimating the costs and benefits of a technology investment. The risk-adjusted value is meant to provide a conservative estimation, incorporating any potential risk factors that may later impact the original cost and benefit estimates. For a more in-depth explanation of risk and risk adjustments used in this study, please see the "Risk" section.

Table 1: Summary Financial Metrics, Composite Organization

Summary financial results	Original estimate	Risk-adjusted
ROI	83%	53%
Payback period (years)	1.2	1.4
Total costs (PV)	($581,225)	($616,256)
Total benefits (PV)	$1,061,106	$943,750
Total (NPV)	$479,881	$327,494
Internal rate of return (IRR)	75%	55%

Source: Forrester Research, Inc.

Forrester found higher ROIs were associated with organizations which had a greater number of applications accessing the storage environment, the need for changes in physical storage infrastructure, as well as the level of high cost storage handling multiple types of data.

Disclosures

The reader should be aware of the following:

- The study is commissioned by IBM and delivered by the Forrester Consulting group.
- IBM reviewed and provided feedback to Forrester, but Forrester maintained editorial control over the study and its findings and did not accept changes to the study that contradict Forrester's findings or obscure the meaning of the study.
- The customer names for the interviews were provided by IBM.
- Forrester makes no assumptions as to the potential return on investment that other organizations will receive. Forrester strongly advises that the reader should use their own estimates within the framework provided in the report to determine the appropriateness of an investment in IBM SAN Volume Controller.
- This study is not meant to be used as a competitive product analysis.

IBM SAN Volume Controller: Overview

According to IBM, SAN Volume Controller is designed to help an organization simplify its storage infrastructure, use storage resources more efficiently, improve personnel productivity, and increase application availability. SAN Volume Controller is designed to pool storage volumes from IBM and non-IBM disk arrays into a single reservoir of capacity that can be managed from a central point. SAN Volume Controller enables migrating data between disk arrays without disrupting the applications and moves copy services into the network where they can be applied across the entire storage reservoir.

Analysis

As stated in the Executive Summary, Forrester took a multistep approach to evaluate the impact that implementing SAN Volume Controller can have on an organization:

- Interviews with IBM marketing and sales personnel.
- In-depth interviews of four organizations currently using SAN Volume Controller.
- Construction of a common financial framework for the implementation of SAN Volume Controller.
- Construction of a composite organization based on characteristics of the interviewed organizations.

Interview Highlights

A total of four interviews were conducted for this study, involving representatives from the following companies (IBM customers based in the United States):

1. A state legislative government organization with 9 TB of storage under SAN Volume Controller control.
2. A US-based manufacturer of marine propulsion systems with manufacturing locations throughout the US, as well as in Mexico and the UK. The organization has an estimated 6,000 employees with 40 TB of storage under SAN Volume Controller control.
3. A regional healthcare organization located in the Midwestern US, employing roughly 9,000 employees. The organization has an estimated 32 TB under SAN Volume Controller control.
4. A US-based financial services organization located in the Midwestern US, employing roughly 3,000 employees with roughly 30 TB under SAN Volume Controller control.

The composite organization created from the results of the customer interviews represents a US-based financial services organization with roughly 3,000 employees and a total of 45 TB of storage existing within the environment. The organization decided to move to SAN Volume Controller as a way to control costs within their storage environment and maintain increased granularity over their storage assets. The organization had accumulated storage assets from multiple vendors over time and was looking for a way to control and pool those assets under a single management platform.

The four in-depth interviews uncovered cases where the interviewed organizations were able to use existing storage assets more efficiently to reduce the cost around storage growth and improve the

efficiency of storage administrators, while at the same time maintaining high levels of availability for end user applications. In particular, the organizations interviewed shared a set of common challenges that drove the calculations of benefits for the composite organization:

- **Rapid growth of storage.** All organizations noted demand for greater and greater storage resources had been a primary driver in making the move toward virtualization and SAN Volume Controller. Several of the organizations interviewed noted that prior to moving to SAN Volume Controller, storage TB growth of upwards of 50% per year.

- **Need for better storage capacity utilization.** As their storage environments grew, interviewed organizations also saw the need to pool their existing resources through virtualization, allowing them to better maximize the use of their existing assets by having the flexibility to shift data to less costly resources.

- **Need for greater storage cost efficiency.** Several organizations noted with storage growth there was increasing pressure to use the most cost efficient option for storage on the SAN. Having the choice to shift data to less costly storage depending upon changing business requirements allowed organizations to reduce the overall cost of their storage environment through increasing flexibility

- **Pressure to do more with existing staff.** Another common theme among the interviewed organizations was the need to control storage administration costs with increasing the amount of storage under management. Storage virtualization allowed the interviewed organizations to centralize their storage administration leading to higher levels of efficiency.

- **Growth of applications.** The growth of demand for storage also typically coincided with the growth of the number applications accessing the storage environment. With the increasing demand of the storage environment, organizations needed to maintain consistent levels of storage availability in the environment. Many organizations saw virtualization and SAN Volume Controller as a way to make necessary changes to the storage environment without impacting end user productivity.

TEI Framework

Introduction

From the information provided in the in-depth interviews, Forrester has constructed a TEI framework for those organizations considering implementation of SAN Volume Controller. The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that impact the investment decision.

Composite Organization

Based on the interviews with the four existing customers provided by IBM, Forrester constructed a TEI framework, a composite company, and an associated ROI analysis that illustrates the areas affected financially. The composite organization that Forrester synthesized from these results represents a US-based regional financial services organization with 3,000 employees and 30 TB of virtualized storage under SAN Volume Controller. See Appendix A for more details on the composite organization.

Framework Assumptions

Table 2 lists the discount rate used in the PV and NPV calculations and the time horizon used for the financial modeling.

Table 2: General Assumptions

Ref.	General assumptions	Value
	Discount rate	10%
	Length of analysis	Three years

Source: Forrester Research, Inc.

Organizations typically use discount rates between 8% and 16% based on their current environment. Readers are urged to consult with their finance departments to determine the most appropriate discount rate to use within their own organizations.

In addition to the financial assumptions used to construct the cash-flow analysis, Table 3 provides salary assumptions used within this analysis.

Table 3: Salary Assumptions

Ref.	Metric	Calculation	Value
A1	Hours per week		40
A2	Weeks per year		52
A3	Hours per year (M-F, 9-5)		2,000
A4	Hours per year (24x7)		8,736
A5	Storage administrator		$120,000
A6	Hourly	(A5/A3)	$60

Source: Forrester Research, Inc.

Costs

Costs around SAN Volume Controller include cost of hardware, software, maintenance, implementation, and ongoing administration. The actual cost of the solution will vary depending on the amount of storage under management with SAN Volume Controller as well as the level of virtualization undertaken by the organization.

SAN Volume Controller Software

SAN Volume Controller is an appliance-based product that requires that organizations purchase both hardware and software. Software is generally priced by the amount of storage under management of the SAN Volume Controller. Forrester assumes the composite organization purchases enough licenses to cover 40 TB worth of storage, which provides enough licenses for their existing 30 TB of baseline storage, as well as for storage growth. Software costs are tiered depending on the amount of storage under SAN Volume Controller control. For example, the license cost for the first 12 TB of storage is $7,000 per TB; $4,000 per TB for the next 20 TB; and $3,000 for the following 8 TB. No discounting is assumed although Forrester urges the reader to apply any discounts to their own analysis Table 4 illustrates the equation used.

Table 4: SAN Volume Controller Software Cost

Ref.	Metric	Calculation	Initial cost
A1	Cost per TB - Tier 1		$7,000
A2	Number of TB – Tier 1		12
A3	Cost per TB - Tier 2		$4,000
A4	Number of TB – Tier 2		20
A5	Cost per TB - Tier 3		$3,000
A6	Number of TB – Tier 3		8
A7	Number of TB		40
A8	Discount applied		0%
At	SAN Volume Controller software cost	[(A1*A2)+(A3*A4)+(A5*A6)]*(1-A8)	$188,000

Source: Forrester Research, Inc.

SAN Volume Controller Hardware Cost

The cost of hardware is another component of the investment cost of SAN Volume Controller. The hardware cost includes the cost of the appliance itself (priced by node), as well as the cost of a backup power supply (UPS) and master console. The composite organization will purchase four nodes at a total list price of $78,499. In addition, the composite organization will need to purchase four UPS devices (one per node) at a list price of $1,250. The organization will also need to purchase the master console at a list price of $7,499. As with the cost of SAN Volume Controller software, no discounting is assumed although Forrester urges the reader to apply any discounts to their own analysis. Table 5 illustrates the total hardware cost.

Table 5: SAN Volume Controller Hardware Cost

Ref.	Metric	Calculation	Initial cost
B1	Number of nodes purchased		4
B2	Discount applied		0%
B3	Total node cost		$ 78,499
B4	Cost per UPS		$ 1,250
B5	Cost of master console		$ 7,499
Bt	SAN Volume Controller hardware cost	(B3+(B4*B1)+B5)*(1-B2)	$ 90,998

Source: Forrester Research, Inc.

Annual Maintenance

The composite organization will have to incur the cost of maintenance for both hardware and software. For hardware, the annual maintenance of four nodes is $8,880 and $3,024 for four UPS devices (one per node). In addition, annual maintenance on the master console appliance is $1,104. For software, the cost of maintenance follows similar pricing as that of the overall license costs with different software maintenance costs broken down by tiers. In the case of the composite organization, the first 12 TB of storage will incur an annual maintenance cost of 1,400; the next 20 TB of storage will incur an annual maintenance cost of $800; and the remaining 8 TB will incur an annual maintenance cost of $600. In addition, the annual cost of maintenance will not begin to incur until the second year of analysis as the hardware has a one-year warranty and the license price for the software includes one year of maintenance. Table 6 illustrates the equation that was used.

Table 6: Annual Maintenance

Ref.	Metric	Calculation	Initial cost
C1	Annual maintenance - HW		
C2	SAN Volume Controller node		$8,880
C3	SAN Volume Controller UPS		$3,024
C4	SAN Volume Controller master console		$1,104
C5	Annual maintenance - SW		
C6	Maint. cost per TB – Tier 1		$1,400
A2	Number of TB - Tier 1		12
C7	Maint. cost per TB - Tier 2		$800
A4	Number of TB - Tier 2		20
C8	Maint. cost per TB - Tier 3		$600
A6	Number of TB - Tier 3		8
Ct	Annual maintenance cost	(C2+C3+C4)+[(C6*A2)+(C7*A4)+(C8*C9)	$50,608

Source: Forrester Research, Inc.

Implementation Cost

The interviewed organizations indicated that the implementation of the SAN Volume Controller was also a component of the overall investment cost. Most of the interviewed organizations indicated that they relied on their own internal staff for implementation. Initial implementation time to pilot stage was relatively quick, and the time to get to full production was between three and six months. Implementation costs include the cost to pilot and ramp up to the full production environment. In addition, the cost of implementation includes the cost to train the existing staff on the product. For the purpose of this analysis, two internal staff will be involved in implementation and training. The

staff will spend an estimated 40 hours each on implementation at a fully burdened hourly cost of $60. Table 7 illustrates the total implementation cost.

Table 7: Implementation Cost

Ref.	Metric	Calculation	Initial cost
D1	Hours		40
D2	Number of FTEs		2
D3	Hourly cost per FTEs		$ 60.00
Dt	Implementation cost	D2*D3*D3	$ 4,800

Source: Forrester Research, Inc.

Administrative And Support Costs

In addition to initial implementation costs, Forrester assumes that the ongoing costs to maintain the SAN Volume Controller platform are minimal relative to the overall cost of the SAN Volume Controller. Ongoing maintenance costs include the labor necessary to support and manage the virtualization environment and to add or move different amounts of storage within the storage pool. For the purpose of this analysis, the composite organization will allocate one staff member on average 20 hours per week to support and manage the SAN Volume Controller environment. Assuming a fully burdened cost of $60 per hour, we can calculate the total yearly cost of administration and support equates to $62,400. Table 8 illustrates the equation used.

Table 8: Administration And Support Costs

Ref.	Metric	Calculation	Initial cost
E1	Number of FTEs		1
E2	Hourly rate per person		$ 60
E3	Hours per week		20.0
E4	Number of weeks per year		52
Et	Administrative costs	E1*E2*E3*E4	$ 62,400

Source: Forrester Research, Inc.

Total Costs

The total cost for the composite organization for SAN Volume Controller is illustrated in Table 9.

Table 9: Total Costs – Non-Risk-Adjusted

Cash-flow analysis (original estimates)						
Costs	**Initial**	**Year 1**	**Year 2**	**Year 3**	**Total**	**Present value**
SVC software	(188,000)				(188,000)	(188,000)
SVC hardware	(90,998)				(90,998)	(90,998)
Annual maintenance			(50,608)	(50,608)	(101,216)	(79,847)
Implementation cost	(4,800)				(4,800)	(4,800)
Administrative costs	(62,400)	(62,400)	(62,400)	(62,400)	(249,600)	(217,580)
Total	($346,198)	($62,400)	($113,008)	($113,008)	($634,614)	($581,225)

Source: Forrester Research, Inc.

Benefits

The second component of this analysis looks at the potential benefits associated with an organization investing in storage virtualization and the SAN Volume Controller platform. Among the SAN Volume Controller customers interviewed, benefits included reduced hardware storage costs and improved administration efficiencies, as well as higher overall system availability.

Reduced Storage Management And Administration

A common theme among the interviewed organizations was whether virtualization was able to provide them with the ability to manage their growing assets more effectively with fewer staff. Ongoing tasks such as provisioning new storage assets, moving data between storage devices, and regular storage maintenance could be done from a centralized interface, reducing the amount of staff required for scheduled administration activities.

SAN Volume Controller customers indicated the impact of improved administration efficiency was seen through either a transfer of existing staff away from storage administration or an anticipated reduction in the growth of storage administration staff with the anticipated growth of storage. Based upon the findings of the interviewed organizations, the composite organization had a staff of three FTEs at a fully burdened salary of $120,000. By moving away from the previous storage management environment through virtualization, the organization was able to centralize their storage administration, reducing the level of staff resources to 1.5 FTEs. Table 10 illustrates the calculation used.

Table 10: Reduced Storage Management And Administration

Ref.	Metric	Calculation	Per period
A1	Original number of workers		3
A2	Number of workers (savings)		1.5
A3	Reduction in number of workers		50%
A4	Yearly rate per worker		$ 120,000
At	Reduction in storage management and administration cost	(A1-A2)*A4	$ 180,000

Source: Forrester Research, Inc.

Storage Hardware Cost Savings

A second common theme that drove interviewed organizations to virtualization and SAN Volume Controller was the improved flexibility for existing assets and future storage growth. For existing assets, organizations indicated improved flexibility to increase capacity utilization within the storage pool, using existing storage more efficiently rather than purchasing new storage. In addition, improved flexibility allows organizations to control their storage growth by rightsizing their environment to the storage needs of current applications.

To calculate immediate and future hardware cost savings for the composite organization, we first need to make assumptions around the existing and future cost of storage as well as the percent breakdown of storage by type.

Table 11 illustrates the projected cost of storage by type over a three-year period. Forrester assumes for the composite organization a 30% yearly reduction in the per TB cost of storage.

Table 11: Per TB Cost Of Storage

Ref.	Metric	Year 1	Year 2	Year 3
B1	Enterprise	$ 55,000	$ 38,500	$ 26,950
B2	Midrange	$ 25,000	$ 17,500	$ 12,250
B3	Low cost	$ 10,000	$ 7,000	$ 4,900

Source: Forrester Research, Inc.

Table 12 illustrates the percent storage allocation by type for the composite organization upon purchase of SAN Volume Controller.

Table 12: Storage Allocation By Type

Ref.	Metric	Value
C1	Enterprise	70%
C2	Midrange	20%
C3	Low cost	10%

Source: Forrester Research, Inc.

Improving existing storage utilization was one benefit cited by organizations interviewed. For the composite organization, we assume the organization initially managed 30 TB of storage under SAN Volume Controller. We assume with SAN Volume Controller, the organization can improve existing capacity by 30% across all storage types. By estimating the existing excess capacity by type and the average cost per TB, we can calculate the estimated savings from improved capacity by type. For example, the organization currently has 21 TB of enterprise class storage (30 TB*70%). We also assume 20% excess capacity among enterprise storage, or 4.2 TB (20%*21). Based on the interview findings, we assume the estimated improvement in capacity is 30% and can calculate the improvement in TB at 1.26 TB (4.2*30%). Finally, the per TB cost of storage in year 1 is $55,000, resulting in a calculated estimated savings for enterprise class storage, $69,300 (1.26*$55,000). We repeat the similar process for midrange and low-cost storage to calculate the total savings from improving capacity utilization. Table 13 illustrates the total savings.

Table 13: Savings From Improved Storage Utilization

Ref.	Metric	Calculation	Year 1
D1	Existing baseline storage (TB)		30
D2	Est. excess capacity - by type		
D3	Enterprise		20%
D4	Midrange		10%
D5	Low cost		15%
D6	Est. improvement in capacity utilization		30%
D7	Estimated savings		
D8	Enterprise	D1*B1*C1*D3*D6	$ 69,300
D9	Midrange	D1*B2*C2*D4*D6	$ 4,500
D10	Low cost	D1*B3*C3*D5*D6	$ 1,350
Dt	Improved storage utilization	D8+D9+D10	$ 75,150

Source: Forrester Research, Inc.

Once capacity utilization in the existing environment had been improved, we assume the composite organization can also see savings in terms of reduced cost of storage by controlling storage growth and maximizing future capacity. For the composite organization, we assume that prior to the purchase of SAN Volume Controller, the projected annual storage growth was 30% per year across all three classes of storage types. Based on the findings of the individual interviews, the composite organization can control capacity growth by an estimated 20%. This allows the organization to reduce the amount of storage purchased and realize savings in conjunction with declining per TB storage costs. For example, looking at year 2, the organization was anticipating storage growth of roughly 30% to a total of 39 TB (30*(1+30%)). Assuming from Table 12, 70% of storage is enterprise class storage, the amount of enterprise storage is projected to grow from 21 TB to 27 TB (70%*39TB) in Year 2. Assuming an estimated reduction in growth of 20%, we can calculate the total purchases for enterprise class storage of 1.3 TB (20%*30%*30*70%). Multiplying this with the Year 2 cost of enterprise storage ($38,500), we can calculate the total cost savings of $50,500. Table 14 illustrates the total savings.

Table 14: Savings From Storage Cost Avoidance

Ref.	Metric	Calculation	Year 1	Year 2	Year 3
E1	Projected annual storage growth			30%	30%
E2	Projected storage growth (TB)		30	39	51
E3	Enterprise		21	27	36
E4	Midrange		6	8	10
E5	Low cost		3	4	5
E6	Estimated reduction in growth			20%	20%
E7	Purchases avoided (TB)	E2*E1*E6		1.8	2.3
E8	Enterprise			1.3	1.6
E9	Midrange			0.36	0.5
E10	Low cost			0.18	0.2
Et	Reduced cost of storage	(B1*E8)+(B2*E9)+(B3*E10)		$56,070	$51,024

Source: Forrester Research, Inc.

Improved Application Availability

In addition to benefits within the IT environment, several organizations noted the positive impact of virtualization on the availability of data access to applications. In particular, organizations cited the ability to move application data between storage resources without having to take the application offline within a virtualized environment. By maintaining application availability to storage resources, organizations were able to maintain consistently high levels of uptime versus the environment prior to SAN Volume Controller. For the composite organization, on average 60% of the 2,000 workers that access data-driven applications can save 8 hours yearly as a result of reduced downtime. Assuming the hourly worker salary is $50 and roughly 50% of the time regained is translated into productive time, we can calculate a total annual savings of $240,000 (2,000*60%*$50*8*50%). We also assume benefits are reduced by 25% to take into account the time it takes fully implement the solution. Table 15 illustrates the total annual savings.

Table 15: Improved Application Availability

Ref.	Metric	Calculation	Per period
F1	Number of workers		2,000
F2	Avg. % of staff affected		60%
F3	Hourly rate per worker		50.00
F4	Number of hours (Saved)		8.0
F5	Productivity time regained		50%
Ft	Improved customer and end user availability to data driven applications	F1*F2*F3*F4*F5	$ 240,000

Source: Forrester Research, Inc.

Total Benefits

Table 16 illustrates the total benefits over a three-year period. Storage management efficiency savings were reduced by 50% in Year 1 to take into account the time to transfer staff to other IT functions.

Table 16: Total Benefits — Non-Risk-Adjusted

Cash-flow analysis (original estimates)						
Benefits	Initial	Year 1	Year 2	Year 3	Total	Present value
Reduction in storage management and administration cost		90,000	180,000	180,000	450,000	365,815
Improved storage utilization		75,150			75,150	68,318
Reduced cost of storage			56,070	51,024	107,094	84,674
Improved customer and end user availability to data-driven applications		180,000	240,000	240,000	660,000	542,299
Total		$345,150	$476,070	$471,024	$1,292,244	$1,061,106

Source: Forrester Research, Inc.

Risk

Forrester defines two types of investment risk associated with this analysis: implementation and impact risk. **Implementation risk** is the risk that a proposed technology investment may deviate from original resource requirements needed to implement and integrate the investment 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 technology investment resulting in lower overall total

benefits. The greater the uncertainty, the wider the potential range of outcomes for cost and benefit estimates. Quantitatively capturing investment risk, by directly adjusting the financial estimates, results in more meaningful and accurate estimates and a more accurate projection of the return on an investment.

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

- Installation and testing could demand more time for moving to a virtualized environment takes longer than originally anticipated.
- Acquisition costs could be higher than originally anticipated for both the SAN Volume Controller hardware and software.
- The administrative cost to support the SAN Volume Controller environment could be higher than originally anticipated.

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

- The amount of storage brought under control of SAN Volume Controller could be lower than originally anticipated.
- Movement of storage administration staff could take longer than originally anticipated leading to reduced administration cost savings.
- The amount of excess capacity reclaimed and the level of storage growth reduced could be lower than originally anticipated leading to reduced storage cost savings.
- The level of downtime reduced could be lower than originally anticipated.

Steps For Measuring Investment Risk

In order to calculate the final risk adjusted estimates, Forrester applies a multistep process examining the impact of bias and variance on cost and benefit estimates.

- **Step 1: Calculate original cost and benefit estimates.** This is the initial calculation of the cost and benefit estimates without accounting for the impact of investment risk.
- **Step 2: Calculate the impact of bias for cost and benefit estimates.** To account for the impact of bias (most organizations overestimate benefits and underestimate cost estimates), this step recalculates the original cost and benefit estimates by using the average of the original estimate (calculated in Step 1) and a low and a high estimate.
- **Step 3: Calculate variance for cost and benefit estimates.** This step measures the impact of variance on cost and benefit estimates. Variance is a measure of the possible range of outcomes for cost and benefit estimates. Higher variance implies a wider range of possible outcomes, increasing the uncertainty in cost and benefit estimates.

The three steps are used to identify and incorporate the full impact of risk as part of a technology decision. The tables below illustrate the impact of implementation and impact risk on cost and benefit estimates. For more information on the application of risk, please see Appendix D.

Table 17: Risk Adjustment — Cost

Costs	Step 1			Step 2		Step 3	
	Original estimate	High	Low	Bias adjustment		Risk-adjusted	
				%	Value	%	Value
SVC software	($188,000)	($188,000)	($188,000)	100%	($188,000)	100%	($188,000)
SVC hardware	($90,998)	($90,998)	($90,998)	100%	($90,998)	100%	($90,998)
Annual maintenance	($101,216)	($101,216)	($101,216)	100%	($101,216)	100%	($101,216)
Implementation cost	($4,800)	($6,000)	($4,200)	104%	($5,000)	104%	($5,200)
Administrative costs	($249,600)	($374,400)	($187,200)	108%	($270,400)	107%	($289,328)

Source: Forrester Research, Inc.

Table 18: Risk Adjustment — Benefit

Benefit	Step 1			Step 2		Step 3	
	Original estimate	High	Low	Bias adjustment		Risk-adjusted	
				%	Value	%	Value
Reduction in storage management and administration cost	$562,500	$562,500	$468,750	94%	$531,250	98%	$520,625
Improved storage utilization	$75,150	$80,160	$62,625	97%	$72,645	98%	$71,192
Reduced cost of storage	$107,094	$107,094	$107,094	100%	$107,094	100%	$107,094
Improved customer and end user availability to data-driven applications	$660,000	$660,000	$495,000	92%	$605,000	97%	$586,850

Source: Forrester Research, Inc.

Flexibility

Flexibility, as defined by Forrester's TEI methodology, represents an investment in additional capacity or agility today that can be turned into *future* business benefits at some additional cost. Flexibility benefits typically increase with the scalability of the technology investment. This provides an organization with the "right" or the ability to engage in future initiatives but not the obligation to do so. In the case of this investment, there are multiple scenarios in which a customer might choose to purchase SAN Volume Controller with the intention of future scalability within their storage environment. These may include the ability to quickly scale up the amount of storage under virtualization, the ability to easily shift data between different classes or storage, or to use FlashCopy to move storage easily between backup and primary.

While Forrester believes organizations who increase notebook adoption can take advantage of these flexibility options, quantification (using the financial industry standard Black-Scholes or the binomial option pricing models) of the additional value associated with these options for this customer would require scenario development and forward-looking analysis which is not available at this time.

The value of flexibility is unique to each organization, and the willingness to measure its value varies from company to company (see Appendix A for additional information regarding the flexibility calculation).

TEI Framework: Summary

Considering the financial framework constructed above, the results of the costs, benefits, flexibility, and risk sections using the representative numbers can be used to determine a return on investment, net present value, and payback period. Table 19 shows the consolidation of the numbers for the composite organization.

Table 19: Cash Flow Summary – Non Risk Adjusted

Cash-flow analysis (non-risk-adjusted)						
Project cash flow	**Initial**	**Year 1**	**Year 2**	**Year 3**	**Total**	**Present value**
Total costs	($346,198)	($62,400)	($113,008)	($113,008)	($634,614)	($581,225)
Total benefits		$345,150	$476,070	$471,024	$1,292,244	$1,061,106
Net savings	($346,198)	$282,750	$363,062	$358,016	$657,630	$479,881
ROI	83%					
Payback period (Years)	1.2					

Table 20 below shows the risk-adjusted values, applying the risk adjustment method indicated in the “Risks” section and the values from Tables 17 and 18 to the numbers in Tables 9 and 16.

Table 20: Cash Flow Summary – Risk Adjusted

Cash flow analysis (risk-adjusted)						
Project cash flow	**Initial**	**Year 1**	**Year 2**	**Year 3**	**Total**	**Present value**
Total costs	($356,530)	($72,332)	($122,940)	($122,940)	($674,742)	($616,256)
Total benefits		$308,042	$423,070	$418,024	$1,149,136	$943,750
Net savings	($356,530)	$235,710	$300,130	$295,084	$474,394	$327,494
ROI	53%					
Payback period (Years)	1.4					

It is important to note that values used throughout the TEI Framework are based on in-depth interviews with four organizations and the resulting composite organization built by Forrester. Forrester makes no assumptions as to the potential return that other organizations will receive within their own environment. Forrester strongly advises that readers use their own estimates within the framework provided in this study to determine the expected financial impact of implementing SAN Volume Controller.

Study Conclusions

Forrester's in-depth interviews with SAN Volume Controller's customers yielded several important observations:

- Based on information collected in interviews with current SAN Volume Controller customers, Forrester found that organizations can realize benefits in the form of improved storage administration, higher storage capacity utilization, and improved system availability as a result of improved flexibility of storage assets.

- Of the customers interviewed, several factors contributed to the difference in ROIs. Forrester found higher ROIs were associated with organizations with higher number and sizes applications to access, the need for changes in physical storage infrastructure, as well as the level of high-cost storage handling multiple types of data.

The financial analysis provided in this study illustrates the potential way an organization can evaluate the value proposition of SAN Volume Controller. Based on information collected in four in-depth customer interviews, Forrester calculated a three-year risk-adjusted ROI of 53% for the composite organization with a payback period of 1.4 years. All final estimates are risk-adjusted to incorporate potential uncertainty in the calculation of costs and benefits.

Based on these findings, companies looking to implement SAN Volume Controller can see quantitative benefits within their storage environments. Using the TEI framework, many companies may find the potential for a compelling business case to make such an investment.

Appendix A: Composite Organization Description

The composite organization created from the results of the customer interviews represents a US-based financial services organization with roughly 3,000 employees and a total of 45 TB of storage existing within the environment. The organization decided to move to SAN Volume Controller as a way to control costs within their storage environment and maintain increased granularity over their storage assets. The organization had accumulated storage assets from multiple vendors over time and was looking for a way to control and pool those assets under a single management platform.

The five in-depth interviews uncovered cases where the interviewed organizations were able to use existing storage assets more efficiently to reduce the cost around storage growth and improve the efficiency of storage administrators, while at the same time maintaining high levels of availability for end user applications. In particular, the organizations interviewed shared a set of common challenges that drove the calculations of benefits for the composite organization:

- Rapid growth of storage. All organizations noted demand for greater and greater storage resources had been a primary driver in making the move toward virtualization and SAN Volume Controller. Several of the organizations interviewed noted storage growth of upwards of 50% per year prior to moving to SAN Volume Controller.

- Need for better storage capacity utilization. As their storage environments grew, interviewed organizations also saw the need to pool their existing resources through virtualization, allowing them to better maximize the use of their existing assets by having the flexibility to shift data to less costly resources.

- Pressure to do more with existing staff. Another common theme among the interviewed organizations was the need to control storage administration costs with increasing amount of storage under management. Storage virtualization allowed the interviewed organizations to centralize their storage administration leading to higher levels of efficiency.

- Growth of applications. The growth of demand for storage also typically coincided with the growth of the number of applications accessing the storage environment. With the increasing demand of the storage environment, organizations needed to maintain consistent levels of storage availability on the environment. Many organizations saw virtualization and SAN Volume Controller as a way to make necessary changes to the storage environment without affecting end user productivity.

Appendix B: Total Economic Impact™ Overview

Total Economic Impact is a methodology developed by Forrester Research, Inc. 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.

The TEI methodology consists of four components to evaluate investment value: 1) benefits; 2) costs; 3) risks; and 4) flexibility. For the purpose of this analysis, the impact of flexibility was not quantified.

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 forms 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.

Risk

Risk measures 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 applies a probability density function known as "triangular distribution" to the values entered. At a minimum, three values are calculated to estimate the underlying range around each cost and benefit.

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 in time. However, having the ability to capture that benefit has a present value that can be estimated. The flexibility component of TEI captures that value.

Appendix C: Glossary

Discount rate: The interest rate used in cash-flow analysis to take into account the time value of money. Although the Federal Reserve Bank sets a discount rate, companies often set a 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 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 net present value of cash flows.

Payback period: The breakeven point for an investment. 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 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 Year 1 through Year 3 are discounted using the discount rate shown in Table 2 at the end of the year. Present value (PV) calculations are calculated for each total cost and benefit estimate. Net present value (NPV) calculations are not calculated until the summary tables and are the sum of the initial investment and the discounted cash flows in each year.

Example Table

Ref.	Category	Calculation	Initial cost	Year 1	Year 2	Year 3	Total

Source: Forrester Research, Inc.

Appendix D: Adjusting For Investment Risk (Example)

This example provides a high-level illustration of the measurement of investment risk to a single benefit estimate. The table below provides a high level overview of the following steps.

	Step 1			Step 2		Step 3	
Benefit	Original estimate	High	Low	Bias adjustment		Risk-adjusted	
				%	Value	%	Value
Benefit 1	$2,000	$2,400	$400	80%	$1600	87%	$1395

Step 1: Calculate Original Cost And Benefit Estimates

Suppose that an organization is trying to estimate the different types of benefits that might arise from a given technology investment. One potential expected benefit is savings per employee from the use of the technology. A sample benefit calculation is as follows:

Ref.	Metric	Calculation	Estimate
A1	Number of employees		200
A2	Savings per employee		$10
A3	Total yearly estimated savings	A1 * A2	$2,000

The $2,000 represents the organization's original estimate of the yearly impact of the technology investment.

Step 2: Calculate The Impact Of Bias For Cost And Benefit Estimates

In Step 2, we account for the impact of bias in our original cost and benefit estimates. To measure the impact of bias, we need to calculate the range of possible outcomes of our original estimate by estimating possible high/low variables around our original estimates.

Ref.	Metric	Calculation	Estimate	Low	High
A1	Number of employees per year		200		
A2	Savings per employee		$10		
A3	Total yearly estimated savings	A1 * A2	$2,000	$400	$2,400

B1	Bias-adjusted estimate	($2,000+$400+$2,400)/3	$1,600	

In the case of our example, we have calculated our original estimate ($2,000), our low estimate ($400), and our high estimate ($2,400). The unbiased estimate is calculated as the mean of the high and low estimates: [($2,000 + $1,200 + $2,400)/3 = $1,600]. The revised estimate is now $1,600. Reference A4 in the above table presents the revised estimate.

Step 3: Calculate The Impact Of Variance On Cost And Benefit Estimates

Once we have determined the impact of bias in our original estimates, the next step is to calculate the impact of variance. Variance measures the possible spread within our estimates. In the case of our example, the variance is based upon the low estimate ($400), the high estimate ($2,400), and the revised estimate ($1,600). A wider spread would create higher uncertainty, and as a result, greater risk.

To calculate the impact of variance, we need to use the following calculations:

$$\frac{\left[(Lx)^2+(x2)^2+(Hx)^2\right]-(Lx)*(x2)-(Lx)*(Hx)-(x2)*(x2)*(Hx)}{18}=Var(x2)$$

Where		
Lx	Low estimate	$400
X2	Revised (bias-adjusted) estimate	$1,600
Hx	High estimate	$2,400

$$\frac{\left[(400)^2+(1600)^2+(2400)^2\right]-(400)*(1600)-(400)*(2400)-(1600)*(2400)}{18}=168889$$

The standard deviation represents the square root of the variance:

$$\partial(x2)=\sqrt{Var(x2)}$$

$$\partial(x2)=\sqrt{168889}=411$$

The final calculation in our analysis is to create a measure for the impact of risk on the cost or benefit estimate. To do this, we use the following equation:

Risk impact: [(standard deviation of estimate)/ (unbiased estimate)] * ½

Risk impact = $1-\left[\frac{[\partial(x2)]}{x2}\right]*1/2$

Risk impact = $1-\left[\frac{411}{1600}\right]*1/2 = 1-12.8\% = 87.2\%$

The logic behind the equation for risk impact is as follows:

- We first divide the standard deviation into the unbiased estimate to get an estimate of the magnitude of the mean of the distribution to the possible spread of the distribution. This ratio allows us to compare the impact of risk multiple cost and benefit estimates by reducing them to a percentage.

- We next multiply the original ratio by ½ to measure only the likelihood of the potential downside of the estimate. Multiplying by ½ allows us to look at the part of the distribution where the likelihood that the costs will be higher than estimated (the right side of the distribution) or where benefits will be lower than originally estimated (the left side of a normal distribution).

The table below illustrates the progression of the original benefit estimate to the risk-adjusted benefit estimate, accounting for the impact of variance.

Impact of bias and risk	
Original estimate	$2,000
Revised estimate	$1,600
Risk-adjusted estimate	$1,395