A Forrester Total Economic Impact™ Study

Commissioned By

Cleversafe

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The Total Economic Impact™ Of Cleversafe, An IBM Company

Cost Savings And Business Benefits Enabled By Cleversafe Object Storage

FORRESTER®

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Executive Summary

Cleversafe commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential return on investment (ROI) that enterprises may realize by using Cleversafe object storage. The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of Cleversafe to reduce the cost of storing massive data sets required for the collection and analysis of big data.

To better understand the benefits, costs, and risks associated with object storage, Forrester interviewed an existing customer using Cleversafe. Cleversafe's object storage technology replaces traditional RAID systems using technologies that offer the same levels of availability and data protection with significantly lower overhead.

Cleversafe object storage dramatically reduces the cost for massive storage implementations.

The costs and benefits for a Cleversafe customer with an average of 6 PBs of data, based on customer interviews, include:

- **Reduced storage costs: $14.1 million.**
- **Reduced storage admin needs: $1 million.**
- **Implementation costs: $156,688.**
- **Tape archive cost: $4.7 million.**

Prior to adopting Cleversafe, the customer that Forrester interviewed had 6 petabytes (PBs) of data configured on high-performance redundant RAID storage systems. Because of the redundant systems and the overhead required for RAID configurations, the customer required 15 PBs of raw storage for 6 PBs of data. By moving to Cleversafe, the customer reduced its storage to 7.2 PBs of raw storage with equivalent levels of data protection.

CLEVERSAFE COSTS 72% LESS THAN EQUIVALENT RAID SOLUTIONS

Our interview with an existing customer and subsequent financial analysis found that the customer experienced the risk-adjusted ROI benefits and costs shown in Figure 1. Forrester built a three-year model based on the customer's experience with Cleversafe.

The Cleversafe customer had 3 PBs of data in Year 1, 6 PBs in Year 2, and 12 PBs in Year 3. The total investment in Cleversafe over three years totaled just over $6 million and replaced a redundant RAID configuration with a total cost of more than $21.9 million. The cost of using Cleversafe was only 28% of an equivalent RAID configuration.

The customer also incurred indirect costs for architecting and implementing the Cleversafe object storage solution and creating a tape archive of the data. The ROI, including all benefits and costs, was 210%.

FIGURE 1
Financial Summary Showing Three-Year Risk-Adjusted Results

Return on investment: 210%	$/PB/month for RAID: $34,603	$/PB/month of Cleversafe: $20,000	Payback period: 7.3 months

Source: Forrester Research, Inc.

› **Benefits.** The organization experienced the following risk-adjusted benefits:

- **Reduced cost of storage.** The cost over three years that the customer would have spent for its previous RAID storage less the investment required to purchase Cleversafe. At a price of $1.20 per GB for three years, the organization avoided paying more than $21.7 million for RAID systems and invested just over $6 million, for a total reduction in costs over three years of more than $15.8 million. With a risk adjustment of 10%, the risk adjusted total savings was $14.1 million (see page 7 for more detail).
- **Reduced need for storage administrators.** By eliminating petabytes of RAID, the organization also avoided the cost of storage admins. At a rate of one storage admin per 2 PBs and a reduced need for more than 15 PBs of raw storage, the organization reduced its need for eight storage admins, resulting in a cost savings over three years of more than $1 million.

› **Costs.** The organization experienced the following risk-adjusted costs:

- **Indirect cost to architect and implement object storage.** To facilitate the migration from RAID to object storage, the customer engaged two storage architects for “a few months.” More significantly, the organization required a senior software engineer for six to seven months of development time to adapt applications to work with the object storage environment. The total indirect cost was $156,688.
- **Incremental cost of tape archive.** The customer maintains a tape archive of the data as an emergency backup to the Cleversafe system. The archive costs more than $4.7 million over three years.

Disclosures

The reader should be aware of the following:

› The study is commissioned by Cleversafe 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 Cleversafe.

› Cleversafe 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.

› Cleversafe provided the customer names for the interview but did not participate in the interview.

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 Cleversafe. The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that affect the investment decision.

APPROACH AND METHODOLOGY

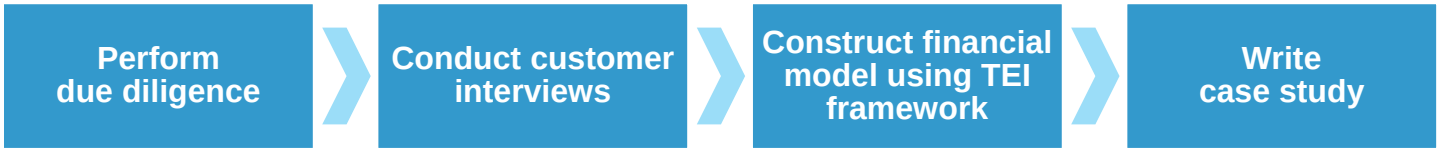
Forrester took a multistep approach to evaluate the impact that Cleversafe can have on an organization (see Figure 2). Specifically, Forrester:

- Interviewed Cleversafe marketing, sales, and consulting personnel, along with Forrester analysts, to gather data relative to storage technologies and the marketplace for object storage.
- Interviewed an organization currently using Cleversafe to obtain data with respect to costs, benefits, and risks.
- Constructed a financial model representative of the interview using the TEI methodology. The financial model is populated with the cost and benefit data obtained from the interview.
- Risk-adjusted the financial model based on issues and concerns highlighted in the interview. 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 Cleversafe: benefits, costs, flexibility, and risks.

Given the increasing sophistication that enterprises have regarding ROI analyses related to IT investments, Forrester's TEI methodology serves to provide a complete picture of the total economic impact of purchase decisions. Please see Appendix A for additional information on the TEI methodology.

FIGURE 2
TEI Approach



Source: Forrester Research, Inc.

Analysis

INTERVIEW HIGHLIGHTS

To create the supporting analysis, Forrester interviewed an organization that collects, aggregates, and makes available to the public a select set of national econometric data. While the organization manages a wide range of data sets, the interview focused on a single set of data and the impact of using Cleversafe to displace existing RAID systems.

Situation

Before implementing Cleversafe, the organization had the following characteristics:

- The organization maintained a unique set of national econometric data that was multiple petabytes in size.
- The data set doubles annually in size — the doubling pattern has lasted 10 years and is expected to continue.
- The overhead for using redundant RAID systems required 2.5 times the amount of raw storage per usable storage. In other words, 6 PBs of data required 15 PBs of storage.
- The cost of storage on RAID systems was unsustainable.In other words, within a few years, the cost of storing the data would outweigh the financial benefits dervied from having the data in the first place.

> *"The data that we manage is doubling annually. Using RAID storage, the cost of storing the data would have exceeded the value of the data in the first place."*
>
> ~ Director, infrastructure at Cleversafe customer

Solution

The organization replaced its RAID system with Cleversafe object storage. At the beginning of Forrester's three-year model, the data was 3 PBs. The data doubled each year to 6 PBs and 12 PBs in Years 2 and 3, respectively. As an emergency backup, the organization also created an archive of the data on tape.

Results

The interview revealed that:

- **Cleversafe object storage provides similar data resiliency without redundant systems.** By shifting from redundant RAID systems in two physical locations to a Cleversafe configuration in three physical locations, the organization maintained the same level of data resiliency. When using RAID, the organization required 2.5 PBs of raw storage for each petabyte of data. Cleversafe object storage required only 1.2 PBs of raw storage per petabyte of data.
- **Object storage requires changes to existing applications.** The organization assigned a senior application developer to make the necessary modifications to internal systems and applications. In total, the developer spent seven months making updates. The organization told Forrester that other operational changes were nominal.

> *"With Cleversafe, we have a more affordable way to scale our data needs as we begin to think about exabyte levels of data."*
>
> ~ Director, infrastructure at Cleversafe customer

BENEFITS

The interviewed organization experienced a number of quantified benefits in this case study:

- Reduced cost of storage.
- Reduced need for storage admins.

Reduced Cost Of Storage

Before implementing Cleversafe, the organization stored the data on redundant RAID storage systems. The overhead of RAID on two redundant systems required 2.5 PBs of raw storage for every petabyte of data. Forrester used a price of $1.20 per GB over three years for the RAID systems, resulting in a price of $34,603 per PB per month for the financial model. Forrester also used the constant prices over three years, which eliminated any bias in the model due to the price of physical storage devices.

The customer told Forrester that it experiences a 20% overhead with Cleversafe, meaning that 6 PBs of data requires 7.2 PBs of storage. From interviews, Forrester used a price of $20,000 per PB per month as a target price for the Cleversafe system, resulting in a price of more than $6 million over three years in the financial model. By replacing RAID with a Cleversafe solution, the organization eliminated the need for the RAID systems, saving a total of more than $15.7 million over three years.

In risk-adjusting the cost of RAID storage, Forrester used a medium value of 10% to indicate that readers of this study should generally indicate a similar savings when eliminating redundant RAID storage systems. The final risk-adjusted benefit of avoiding the cost of RAID storage was more than $14.1 million.

TABLE 1
Reduced Cost Of Storage

Ref.	Metric	Calculation	Year 1	Year 2	Year 3
A1	Petabytes of data	From interviews	3	6	12
A2	Raw storage required for redundant RAID	A1*2.5	7.5	15	30
A3	Cost per month per GB (RAID)	$1.20/GB 3 years	$0.033	$0.033	$0.033
A4	Cost per month per PB (RAID)	A3* 1,048,576	$34,603	$34,603	$34,603
A5	Total cost of pre-existing RAID system	A2*A4*12	$3,114,271	$6,228,541	$12,457,083
A6	Cleversafe storage required (PBs)	A1*1.2	3.6	7.2	14.4
A7	Cost per month per PB (Cleversafe)	From interviews	$20,000	$20,000	$20,000
A8	Total cost of Cleversafe storage	A6*A7*12	$864,000	$1,728,000	$3,456,000
At	Avoided cost of RAID Storage	A5-A8	$2,250,271	$4,500,541	$9,001,083
	Risk adjustment		↓ 10%		
Atr	Avoided cost of RAID storage (risk-adjusted)		$2,025,244	$4,050,487	$8,100,975

Source: Forrester Research, Inc.

Reduced Need For Storage Admins

As the organization transitioned this data set on an object storage implementation from Cleversafe, it dramatically reduced the petabytes of raw storage. Table 2 shows the amount of reduced raw storage — 3.9 PBs in Year 1 and 7.8 PBs in Year 2, with the total increasing to 15.6 PBs in Year 3.

The result is a reduced need for eight storage admins by the third year. At an average salary of $85,000, the total savings is more than $1.1 million. Among other tasks, storage admins replace physical drives that fail. A multipetabyte environment involves hundreds, if not thousands, of physical disk drives; statistically speaking, several drives will fail every day. In a RAID configuration, failing drives must be replaced so that the data can be reconstructed. When moving to Cleversafe's object storage environment, the storage systems reconfigures around failing drives, and replacing disk drives can be a proactive task that is planned and scheduled rather than reacting to the failing devices of the day. Similarly, using object storage eliminates the need for planned downtime, reacting to systemwide outages, or even moving the location of multipetabyte data sets.

Forrester calculated the savings as an indirect benefit, but in actuality, the organization indicated that it was already shorthanded with storage admins. Because of the avoided cost, the organization was able to delay hiring additional admins or redeploy current admins to other storage needs within the organization.

To risk-adjust the level of storage admins, Forrester applied a medium risk factor of 10% because the ratio of storage admins per TB of storage was changing rapidly. The final risk-adjusted benefit was more than $1 million. See the section on Risks for more detail.

TABLE 2
Reduced Need For Storage Admins

Ref.	Metric	Calculation	Year 1	Year 2	Year 3
B1	Reduced RAID storage (raw PBs)		7.5	15.0	30.0
B2	Added object storage (raw PBs)		3.6	7.2	14.4
B3	Reduction in raw storage (PBs)	B1-B2	3.9	7.8	15.6
B4	Storage admin FTEs avoided	B3/2	2	4	8
B5	Averaged burdened salary		$85,000	$85,000	$85,000
Bt	Reduced need for storage admins	B4*B5	$170,000	$340,000	$680,000
	Risk adjustment		🡻 10%		
Btr	Reduced need for storage admins (risk-adjusted)		$153,000	$306,000	$612,000

Source: Forrester Research, Inc.

Unquantified Benefits

In addition to the benefits quantified thus far, Forrester's interview with a Cleversafe customer highlighted additional benefits that we are unable to quantify. Forrester was unable to quantify these benefits because the customer did not have enough documentation to demonstrate realizing the results or the customer was just beginning to realize a benefit that the company anticipates but hasn't yet realized. These unquantified benefits include:

- **Reduced need for data center floor space.** The reduced need for petabytes of storage eliminated the need for physical space in data centers to locate the storage. The organization is currently unable to quantify this value because it did not physically move the RAID systems from its data centers but redeployed the same storage into other databases. The organization expects to realize a financial impact by avoiding the purchase of RAID storage for one to two years.
- **Less power and cooling expense.** Eliminating petabytes of storage will reduce the related electrical costs to run and cool the equipment. The estimated financial impact of these savings has yet to be calculated.
- **Increased employee productivity.** The organization reports that the intuitive approach of Cleversafe software allows storage architects and administrators to scale and manage the storage environment more easily, freeing up time to be spent on solving other mission-critical tasks.
- **Always-on availability, meaning zero planned or unplanned storage downtime**. Because Cleversafe provides availability during planned and unplanned downtime, the organization will be able to avoid downtime, even when the organization is moving or consolidating data centers. The estimated financial impact of these savings has yet to be calculated.
- **Easier support for security policy management.** The organization expects to realize benefits from Cleversafe's zero-touch encryption and security methodologies, which provides enhanced levels of information security for certain types of unstructured and regulated data.

Total Benefits

Table 3 shows the total of all benefits as well as present values (PVs) discounted at 10%. Over three years, the organization expects risk-adjusted total benefits to be a PV of more than $12.1 million.

TABLE 3
Total Benefits (Risk-Adjusted)

Ref.	Benefit	Initial	Year 1	Year 2	Year 3	Total	Present Value
Atr	Reduce cost of storage	$0	$2,025,244	$4,050,487	$8,100,975	$14,176,706	$11,275,023
Btr	Reduced need for storage admins	$0	$153,000	$306,000	$612,000	$1,071,000	$851,788
	Total benefits	**$0**	**$2,178,244**	**$4,356,487**	**$8,712,975**	**$15,247,706**	**$12,126,811**

Source: Forrester Research, Inc.

COSTS

The organization experienced a number of costs associated with Cleversafe:

- Indirect cost to architect and implement object storage.
- Incremental cost of tape archive.

Indirect Cost To Architect And Implement Object Storage

The customer told Forrester that the migration from RAID to object storage was relatively painless. The transition required about three months for three storage architects to plan and execute the change. In addition, the organization engaged one of its senior developers for seven months to modify applications to operate with an object storage environment and other related programing updates. Using an average burdened salary of $85,000 for the three storage admins and $125,000 for the developer, Forrester calculated that the organization incurred an indirect cost of $136,250.

Because of the nature of this customer's applications, it is likely that other organizations could face a much costlier task of reworking applications to function with object storage. Forrester applied a 15% risk factor to this cost, which raises the estimated transition cost to $156,688.

TABLE 4
Indirect Cost To Architect And Implement Object Storage

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3
C1	Burdened salaries of three storage architects	$85,000*3	$255,000			
C2	Three months	3/12	25%			
C3	Burdened salary of senior developer		$125,000			
C4	Seven months	7/12	58%			
Ct	Indirect cost to architect and implement object storage	(C1*C2)+(C3*C4)	$136,250			
	Risk adjustment		↑ 15%			
Ctr	Indirect cost to architect and implement object storage (risk-adjusted)		$156,688			

Source: Forrester Research, Inc.

Incremental Cost Of Tape Archive

The customer collects, aggregates, and makes available a unique set of public econometric data. Because no other copy or archive of the data exists, the organization was uncomfortable relying on a single copy of the data, regardless of today's high level of storage reliability or promises of algorithms that allow data to be recovered. As a result, the customer invests in a tape archive of the data.

The archive has a 5% overhead, meaning that 6 PBs of data requires 6.3 PBs of tape at a price for tape of $17,000 per month per PB, which results in a total three-year cost of more than $4.7 million.

In risk-adjusting the cost of the tape archive, Forrester adds 5% to the cost, indicating that other organizations should experience a similar result but perhaps an overhead higher than 5% due to the nature of their data. Forrester's risk-adjusted total over three years for the tape archive was just over $4.8 million.

TABLE 5
Incremental Cost Of Tape Archive

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3
D1	Petabytes of data			3	6	12
D2	PBs of tape required	D1*1.05		3.15	6.3	12.6
D3	Cost per month per PB			$17,000	$17,000	$17,000
Dt	Incremental cost of tape archive	D2*D3*12		$642,600	$1,285,200	$2,570,400
	Risk adjustment		↑ 5%			
Dtr	Incremental cost of tape archive (risk-adjusted)			$674,730	$1,349,460	$2,698,920

Source: Forrester Research, Inc.

Total Costs

Table 6 shows the total of all costs as well as associated present values, discounted at 10%. Over three years, the composite organization expects total costs of more than $4.8 million, with a net present value of more than $3.9 million.

TABLE 6
Total Costs (Risk-Adjusted)

Ref.	Cost	Initial	Year 1	Year 2	Year 3	Total	Present Value
Ctr	Indirect cost to architect and implement object storage	$156,688	$0	$0	$0	$156,688	$156,688
Dtr	Incremental cost of tape archive	$0	$674,730	$1,349,460	$2,698,920	$4,723,110	$3,756,386
	Total costs	**$156,688**	$674,730	$1,349,460	$2,698,920	$4,879,798	$3,913,073

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 Cleversafe 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 A). Benefits that provide flexibility are:

- Redeploying administrative assets toward addressing other, mission-critical needs of the business.
- Managing data center consolidations or relocations with less risk and lower cost.
- Reducing the need for additional security policies and software tools.

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 Cleversafe 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 object storage, resulting in lower overall total benefits. The greater the uncertainty, the wider the potential range of outcomes for cost and benefit estimates.

Table 7 shows the values used to adjust for risk and uncertainty in the cost and benefit estimates for the interviewed organization. Readers are urged to apply their own risk ranges based on their own degree of confidence in the cost and benefit estimates.

TABLE 7
Benefit And Cost Risk Adjustments

Benefits	Adjustment
Reduced cost of storage	↓ 10%
Reduced need for storage admins	↓ 10%
Costs	**Adjustment**
Indirect cost to architect and implement object storage	↑ 15%
Incremental cost of tape archive	↑ 5%

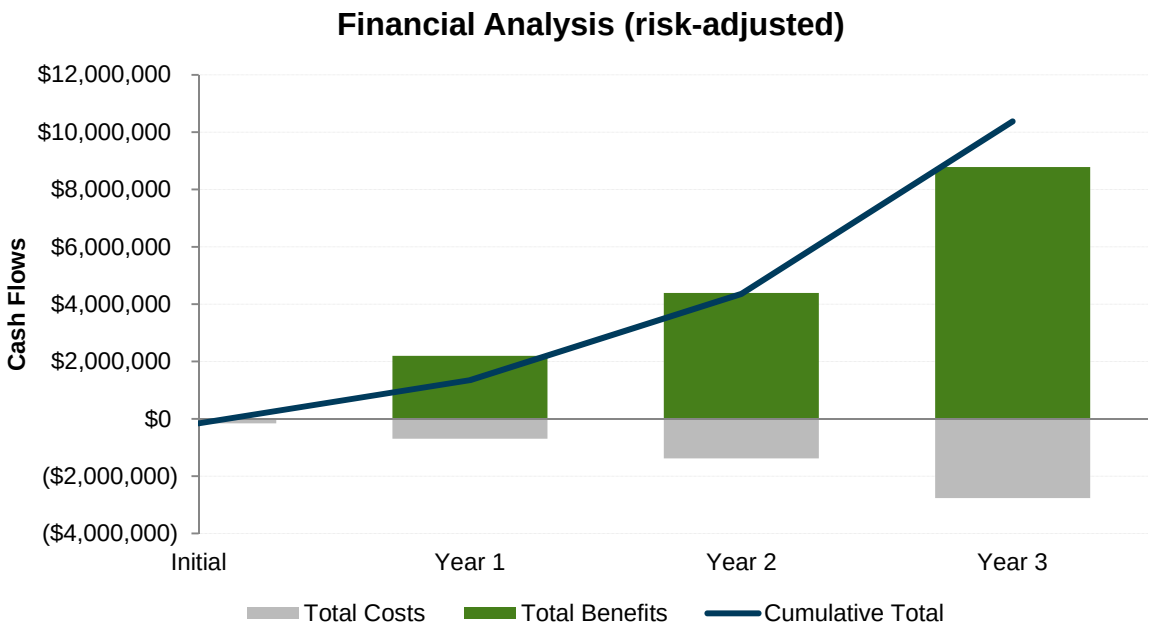
Source: Forrester Research, Inc.

Financial Summary

The financial results calculated in the Benefits and Costs sections can be used to determine the ROI, NPV, and payback period for the organization's investment.

Table 8 below shows the risk-adjusted ROI, NPV, and payback period values. These values are determined by applying the risk-adjustment values from Table 7 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 8
Cash Flow (Risk-Adjusted)

	Initial	Year 1	Year 2	Year 3	Total	Present Value
Costs	($156,688)	($674,730)	($1,349,460)	($2,698,920)	($4,879,798)	($3,913,073)
Benefits	$0	$2,178,244	$4,356,487	$8,712,975	$15,247,706	$12,126,811
Net benefits	($156,688)	$1,503,514	$3,007,027	$6,014,055	$10,367,908	$8,213,738
ROI						210%
Payback period						7.3 months

Source: Forrester Research, Inc.

Cleversafe: Overview

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

The rapid growth of unstructured data has introduced a big data challenge that is difficult for enterprise and service provider organizations to control. Cost and complexity have seriously affected resource management, taking a larger-than-planned-for chunk out of budgets as companies struggle to come to terms with managing terabytes, petabytes, exabytes, and even zettabytes of data.

Cleversafe's mission is to solve the unstructured data management challenges of immense scale, security, and accessibility for organizations whose livelihoods depend on it. Cleversafe software was created to manage these vast stores of data economically and securely. Cleversafe delivers a petabyte and beyond webscale solution for data storage, from traditional content like documents to new content like photos, videos, and even genomics codes.

Cleversafe is the leading webscale storage platform that eliminates the challenges of storage at scale. It partners with forward-thinking enterprises and service providers to scale their unstructured data storage infrastructure beyond traditional boundaries and deliver new cost, capacity, and accessibility milestones for data-driven enterprises.

Cleversafe is the only software-based webscale and object-based storage innovator that eliminates the challenges of data storage at petabyte and beyond scale. Here are five reasons why Cleversafe technology resonates with enterprise and service provider customers:

1. **Petabyte and beyond scalability.** Only Cleversafe has multiple customers each managing hundreds of petabytes of storage in production environments. The algorithms it employs are infinitely scalable. Cleversafe is currently partnering with a customer on a Zettabyte Excellence initiative.
2. **Twenty-five times more data managed per administrator.** Manageability is essential to achieving scale. Cleversafe's software approach is intuitive and allows for storage architects and administrators to both scale and manage their storage environment with great efficiency.
3. **Zero-touch encryption and security.** Cleversafe delivers new levels of unstructured data security out of the box. You select your style of deployment, which determines your security and reliability all at the same time. Cleversafe provides) encryption without any effort whatsoever. This helps customers achieve new levels of information security critical for certain types of unstructured and regulated data they look to retain for long periods of time.
4. **Always-on availability, which means zero planned or unplanned downtime.** Cleversafe delivers new levels of data reliability and accessibility appropriate for long-lasting unstructured data. Unlike other vendors, Cleversafe delivers availability during planned and unplanned downtime, even providing 100% availability for customers moving or consolidating entire data centers.
5. **Eighty percent reduced long-term cost of ownership.** Cleversafe's unique approach to storage efficiency delivers both capex and opex savings over other on-premises and public cloud offerings. Cleversafe's software-defined approach lets customers utilize commodity hardware to reach new levels of total cost of ownership. In addition, its solution becomes more and more efficient over time as data grows in size, so while the environment may grow, so does storage efficiency — resulting in increasing customer return on investment.

Cleversafe is partnering with enterprise and service provider customers to address their needs for storage beyond scale in the following vertical markets:

Financial services and insurance	Media and entertainment	Healthcare and life sciences
Oil and gas	Federal government	

Appendix A: 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

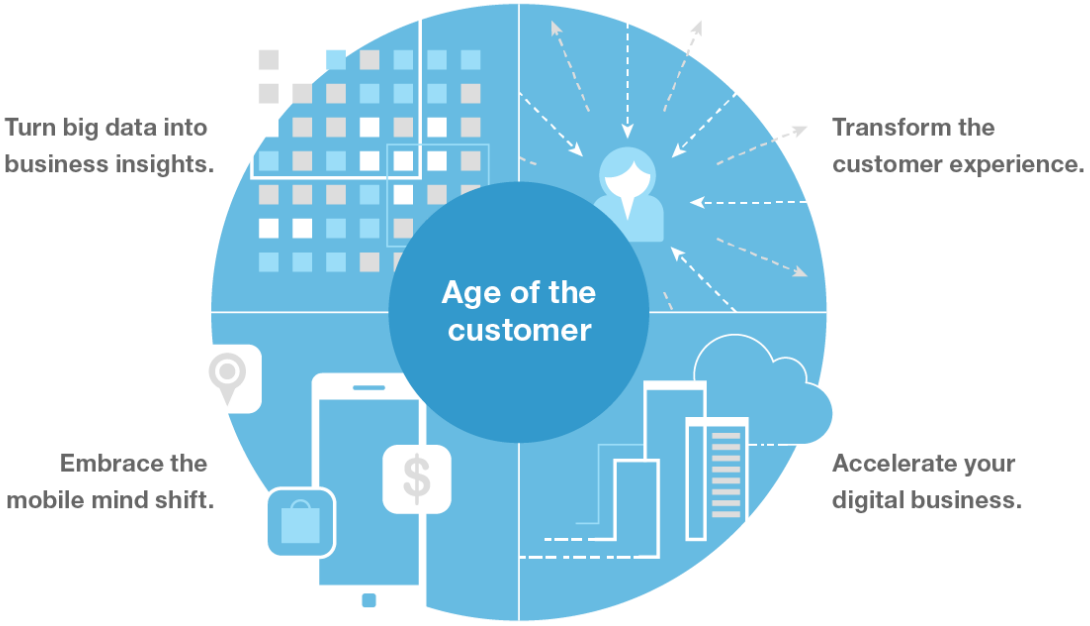
Risks measure the uncertainty of benefit and cost estimates contained within the investment. Uncertainty is measured in two ways: 1) the likelihood that the cost and benefit estimates will meet the original projections and 2) the likelihood that the estimates will be measured and tracked over time. TEI 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 B: Forrester And The Age Of The Customer

Your technology-empowered customers now know more than you do about your products and services, pricing, and reputation. Your competitors can copy or undermine the moves you take to compete. The only way to win, serve, and retain customers is to become customer-obsessed.

A customer-obsessed enterprise focuses its strategy, energy, and budget on processes that enhance knowledge of and engagement with customers and prioritizes these over maintaining traditional competitive barriers.

CMOs and CIOs must work together to create this companywide transformation.



Forrester has a four-part blueprint for strategy in the age of the customer, including the following imperatives to help establish new competitive advantages:

Transform the customer experience to gain sustainable competitive advantage.

Accelerate your digital business with new technology strategies that fuel business growth.

Embrace the mobile mind shift by giving customers what they want, when they want it.

Turn big data into business insights through innovative analytics.

FORRESTER®

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.