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The Total Economic Impact™ of Deploying a Sun Ray Environment With Sun Secure Global Desktop Software

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TABLE OF CONTENTS

Executive Summary	3
Introduction.....	3
Key Findings	3
Disclosures.....	5
Sun Ray Solution and Sun Secure Global Desktop: Overview	6
TEI™ Interview Highlights.....	6
Findings and Analysis	7
Benefits And Savings Opportunities Of Implementing Sun Ray clients With SGD	7
Costs To Implement The Sun Ray Solution.....	10
Flexibility Associated With Sun Ray Thin Clients And SGD.....	15
Risk.....	16
TEI Framework: Summary.....	19
Study Conclusions.....	20
Appendix A: Total Economic Impact™ Overview	21
Benefits	21
Cost	21
Risk.....	21
Appendix B: Glossary.....	22
Appendix C: Adjusting For Investment Risk (Example).....	23

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Executive Summary

Introduction

In April 2006, Sun Microsystems commissioned Forrester Research to examine the total economic impact (TEI) of deploying Sun's Sun Ray thin-client (TC) technology in combination with Sun Secure Global Desktop (SGD) software. This report highlights the benefits of deploying a Sun Ray environment with SGD as demonstrated from the interviews and analysis of an organization implementing both solutions. The report examines the estimated return on investment (ROI) for the organization and represents the findings derived from the interviews and analysis process, as well as the independent research of Forrester Research.

Forrester Research was selected for this project because of our Total Economic Impact™ (TEI) analysis methodology, which 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. Forrester's TEI methodology is a way of quantifying the full impact of a technology investment by considering four elements of any initiative:

1. Benefits
2. Costs
3. Flexibility
4. Risk

Given the increasing sophistication that enterprises have regarding cost analysis 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.

Key Findings

Our research and interviews with the customer organization show that implementing a Sun Ray environment in combination with SGD can provide benefits to organizations in:

- The need to access client/server based applications while remaining fairly mobile within the networked environment. This allowed the organization to maximize the value of using these applications while at the same time ensuring improvements of end user access.
- Allowing the organization to purchase more cost-effective devices compared with traditional PC-based devices. The organization noted the need for durable and easily replaceable devices due to the specific needs of their environment. This resulted in lower hardware costs compared with the organization's PC investments in the past. In addition, the move to a client/server environment allowed the organization to experience additional cost savings by reducing the number of desktop licenses.
- The combination of a Sun Ray thin client solution in combination with SGD allowed the organization to achieve an integrated platform for access an array of client server applications, maximizing IT's support efficiency around application delivery.

As part of this analysis, Forrester took data received from the interviewed organization to construct a ROI-based model. The summary findings based on the model of the customer organization are as follows:

- For the organization, the risk-adjusted three-year ROI was 47% and the non-risk-adjusted ROI was 37% (see Tables 1 and 2).
- Risk-adjusted payback period was within 1.8 years.

Table 1: Customer Organization Financial Summary — Non-Risk-Adjusted Values

Cash Flow Analysis (Non-Risk-Adjusted)						
Project Cash Flow	Initial	Year 1	Year 2	Year 3	Total	Present Value
Total costs	(\$181,925)	(\$10,980)	(\$5,000)	(\$5,000)	(\$202,905)	(\$199,795)
Total benefits		\$115,120	\$119,150	\$120,088	\$354,358	\$293,349
Net savings	(\$181,925)	\$104,140	\$114,150	\$115,088	\$151,453	\$93,554
ROI	47%					
Payback period	1.7					

Source: Forrester Research, Inc.

Table 2: Customer Organization Financial Summary — Risk-Adjusted Values

Cash Flow Analysis (Risk-Adjusted)						
Project Cash Flow	Initial	Year 1	Year 2	Year 3	Total	Present Value
Total costs	(\$181,925)	(\$10,980)	(\$5,000)	(\$5,000)	(\$202,905)	(\$199,795)
Total benefits		\$108,013	\$111,900	\$111,463	\$331,376	\$274,417
Net savings	(\$181,925)	\$97,033	\$106,900	\$106,463	\$128,471	\$74,622
ROI	37%					
Payback period	1.8					

Source: Forrester Research, Inc.

In presenting this sample organization, we hope to show the logic and calculations for an organization considering migration to an environment of Sun Ray clients in combination with SGD. The assumptions in the calculations that follow are based on the interviews with an organization that has undergone this migration. However, it is important to remember that organizations, needs, and environments vary and the most relevant numbers are those that take your own situation into account.

From our customer interview, Forrester discovered the following:

- The primary driver for the organization around implementing Sun Ray clients in combination with SGD is to maximize access to client/server applications. Increasing

access allowed the organization to significantly improve its operational processes around patient and drug records management.

- The organization saw the need for the investment to maximize its existing IT resources efficiently by centralizing around its client/server-based applications.
- The organization wanted to also leverage its existing hardware and software assets

ROI will vary significantly from one organization to the next. Organizations should use Forrester's research as a guide in their decision-making process when considering this or any solution.

Disclosures

The reader should be aware of the following:

- The study is commissioned by Sun and delivered by the Forrester Consulting group.
- Sun 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 obscures the meaning of the study.
- The customer name for the interviews were provided by Sun.
- Forrester makes no assumptions as to the potential return on investment that other organizations will receive. Forrester strongly advises that the reader should use his or her own estimates within the framework provided in the study to determine the appropriateness of an investment in the Sun Ray solution.
- The study is not meant to be used as a competitive product analysis.

Sun Ray Solution and Sun Secure Global Desktop: Overview

According to Sun, the Sun Ray solution is a tested, tuned and documented thin-client solution consisting of a Sun Ray client, Sun Ray Software (SRS), and Sun servers. Implementations can range from a small network within a single office to an environment where Sun Ray clients are deployed over multiple locations to multiple end user groups. Sun Ray clients can be installed on existing networks with other types of clients and can also be deployed over a wide-area network (WAN) with computer resources secured in a central, remote location.

Sun Secure Global Desktop Software provides secure access to server-based applications running on Microsoft Windows, Solaris, Linux, HP-UX, AIX, mainframe, and midrange systems from a wide variety of client platforms and devices. The software Web-enables legacy applications quickly without costly rewrites and delivers those applications side-by-side with modern server-based applications. This allows for consolidation of critical applications and data onto highly reliable, centrally maintained servers and off individual desktop and laptop computers, improving manageability while increasing flexibility.

TEI™ Interview Highlights

As previously mentioned, Forrester's TEI conclusions are derived in large part from information received in a series of interview with executives and personnel at a customer organization which has deployed Sun Ray clients in combination with SGD.

Forrester observed several important characteristics in the organization interviewed, including:

- The client had a heterogeneous environment prior to the implementation of Sun Ray clients, consisting of legacy client/server devices and primarily networked PCs.
- The interviewed organization anticipated a reduction in administrative and support costs, a key driver in increasing the size of the Sun Ray platform.
- The organization saw mobility of its end users as a factor to move toward a stateless client. However, access of users outside of the internal network was limited.

From these value statements, Forrester was able to extrapolate and generate a potential ROI for an organization that is considering integrating Sun Ray clients into its existing network environment.

The interviewed organization is a midsized European hospital providing inpatient and outpatient services. The hospital currently employs approximately 493 members of staff and 64 medical specialists who access the central network through a combination of Sun Ray devices, network PCs, and mobile clients. Regulations now require that the organization maintain strong management controls over patient and drug records throughout the network.

Following the Sun Ray implementation, the organization realized the following benefits:

- Reduced hardware and software license costs
- Maximizing IT efficiency
- Ensuring end user access leading to higher business continuity

Findings and Analysis

To start the analysis, we first need to describe the makeup of the organization. Table 3 provides the initial assumptions of the end user population. It is assumed that all salary estimates are fully burdened salary.

Table 3: Basic Assumptions

Number of users	200
Salary: end user	\$120,000
Salary: IT administrator	\$50,000
Hours per year	2,000

Source: Forrester Research, Inc.

From these basic assumptions, we assume that the overall end user population is roughly 200 employees. The 200 employees consisted of users that used either network PCs or thin clients.

From this set of characteristics, Forrester Research projected the impact of implementing the Sun Ray solution and SGD within the organization. Risk factors that would cause the actual results to vary from these estimates were considered.

Benefits And Savings Opportunities Of Implementing Sun Ray clients With SGD

For the organization, we made the following assumptions regarding the benefit estimates:

- The organization is transitioning from a heterogeneous environment of both thin clients and networked PCs to primarily a homogenous Sun Ray environment.
- The organization saw the need to add flexibility to the existing environment while at the same time being able to control applications and network resources from a centralized location.
- The organization wanted end users to be able to access specific client/server application within a mobile-based environment to achieve further savings around drug reclamation and patient monitoring.

The first component of this analysis looks at the potential benefits associated with an organization standardizing its environment onto a combination of SGD and Sun Ray devices. Benefits were derived from a heterogeneous environment where applications were accessed both locally as well as through the network. The benefits Forrester identified were in the form of:

- Improved hardware and software utilization by reducing the cost of software licensing costs and the overall cost of hardware.
- Improved efficiencies by IT and end user staff.
- Enhanced access to client/server applications leading to reduced cost of drug and patient management.

This section illustrates the possible ways to quantify the impact of these benefits for the sample organization and is based on information collected during the interview process. Readers are advised to enter their own estimates to generate a potential return for their organizations.

Forrester assumes that benefits can begin to accrue in the first year of analysis (Year 1) to take into account the time to implement.

Improved Hardware and Software Utilization

The interviewed organization indicated that one area of value around Sun Ray clients and SGD is the ability of the organization to reduce the software licensing costs and the overall cost of software. The organization indicated that the hardware cost of the Sun Ray desktop and laptop devices were roughly 30% of the cost of a comparable desktop device. This was attributable to the estimated length of time between hardware refreshes as well as the reduction in the number of devices that needed to be purchased due in part to hot-desking of multiple users on a single machine. Therefore, the benefit was estimated in each year as the cost of the PCs for one-third of the Sun Ray users. This was equal to a cost savings of \$19,920.

Table 4: Hardware Cost Savings

Ref.	Metric	Calculation	Year 1
A1	Estimated cost of traditional desktop		\$1,660
A2	Estimated savings: percent		30%
A3	Estimated savings	A1*A2	\$498
A4	Number of devices		40
A5	Reduced hardware cost	A3*A4	\$19,920

Source: Forrester Research, Inc.

In the case of software, the organization indicated that it could reduce the number of desktop application licenses within their environment through a shift to Sun Ray clients and SGD. Allowing users within the organization access to these applications through a client/server environment rather than having them reside on the individual users desktop reduced the number of desktop licenses within the organization. For the purpose of this analysis, we assume the annual per license cost to the organization is \$260. Assuming in the first year the organization is able to reduce the number of licenses by 20, increasing to 40 in Years 2 and 3, the total savings to the organization equates to \$5,200 (\$260*20) in Year 1 and \$10,400 (\$260*40) in Years 2 and 3.

Table 5: Software Utilization Savings

Ref.	Metric	Calculation	Year 1	Year 2	Year 3
B1	Annual Software Cost		260		
B2	Number of licenses reduced		20	40	40
B3	Software utilization savings	B1*B2	\$5,200	\$10,400	\$10,400

Source: Forrester Research, Inc.

Improved IT Efficiencies

Another area of savings for the organization was around its operations and support requirements for the desktop environment. The sample company estimates that up to eight additional IT staff would be needed to maintain the environment if the Sun Ray platform were not being used. This was primarily due to the increasing complexity and support requirements of a decentralized end user environment. At a fully burdened annual rate of \$50,000 per staff person, the total annual savings is \$19,688 by the third year — this is ramped up over the three years from \$18,750 in the second year.

Table 6: Improved IT Efficiencies

Ref.	Metric	Calculation	Year 1	Year 2	Year 3
C1	Existing IT support staff		15	15.8	16.5
C2	Estimated yearly growth rate of staff		5%	5%	5%
C3	Estimated reduction of staff growth			50%	50%
C4	Estimated yearly growth rate of staff			2.5%	2.5%
C5	Average salary: operations			\$50,000	\$50,000
C6	Operational staff efficiency	$(C2-C4)*(C1*C5)$	-	\$18,750	\$19,688

Source: Forrester Research, Inc.

Improved End User Process Efficiency

One benefit cited by the organization was the increased access that the Sun Ray solution, in combination with SGD, can provide to end users. Prior to the investment in Sun, the organization suffered from difficulty in keeping track and management of drug and patient information. The move to Sun Ray clients and SGD allowed many more users to access patient information reducing the burden on administration staff by giving access of patient records directly to end users. This in turn increased the amount of funding the hospital was able to receive from the government, ultimately raising the value per employee. Users could now access patient and drug record from multiple locations within the hospital, improving the overall efficiency of the management process.

Table 7: Improved End User Efficiency

Ref.	Metric	Calculation	Year 1
D1	Number of workers		200
D2	Hourly rate per worker		\$60
D3	Number of hours (saved)		15
D4	Percent time captured transferred to realizable savings		50%
D5	Total yearly savings	$D1*D2*D3*D4$	\$90,000

Source: Forrester Research, Inc.

Total Benefits

The total benefits associated with the organization’s use of the Sun Ray clients and SGD platform are illustrated in Table 8. The point at which the sample organization received positive payback on their investment was a year after the initial deployment.

Table 8: Total Benefits, Non-Risk-Adjusted

Cash Flow Analysis (Original Estimates)						
Benefits	Initial	Year 1	Year 2	Year 3	Total	Present Value
Reduced hardware cost		19,920			19,920	18,109
Software utilization savings		5,200	10,400	10,400	26,000	21,136
Incremental output per worker		90,000	90,000	90,000	270,000	223,817
Operational staff efficiency			18,750	19,688	38,438	30,287
Total		\$115,120	\$119,150	\$120,088	\$354,358	\$293,349

Source: Forrester Research, Inc.

Costs To Implement The Sun Ray Solution

Costs, or IT impact, are calculated as a change in costs primarily to IT as a result of the introduction of the technology to the given organization. Therefore, the purchase of the Sun Ray solution, as with another desktop investment, initially affects IT costs negatively, because the implementation requires incremental spending for both hardware, licensing, as well as labor costs related to the implementation. This is offset by future IT efficiencies resulting from the reduction in desktop administration.

Costs of implementing the Sun Ray solution included the following:

- Purchase of Sun Ray devices
- Maintenance
- Sun Server
- Implementation Services
- Training

Sun Ray Costs

The interviewed organization purchased a combination of Sun Ray Desktop devices along with mobile Comet laptops. The average stated cost of the complete Sun Ray desktop device was \$1,260, while the Comet laptop device was \$1,500. For the purpose of this analysis, we assume

that the organization purchases 20 desktop devices and 25 laptop devices to add to its existing desktop asset inventory. Table 9 and 10 illustrate the total cost of the devices.

Table 9: Desktop Costs Sun Ray Clients

Ref.	Metric	Calculation	Initial
A1	Cost of Sun Ray desktop (V170)		\$1,260
A2	Number of devices purchased		20
A3	Estimated discount		20%
A4	Cost of accessories		\$ -
A5	Estimated discount: accessories		0%
At	Sun Ray desktop cost	$(A1 \cdot A2) \cdot (1 - A3) + (A2 \cdot A4) \cdot (1 - A5)$	\$20,160

Source: Forrester Research, Inc.

Table 10: Desktop Costs Sun Ray Clients

Ref.	Metric	Calculation	Initial
B1	Tadpole Comet laptop devices		\$ 1,500
B2	Number of devices purchased		25
B3	Estimated discount		30%
Bt	Comet laptop cost	$B1 \cdot B2 \cdot (1 - B3)$	\$26,250

Source: Forrester Research, Inc.

Smart Card Costs

The cost of Sun Ray platform includes the costs of the smart cards for Sun Ray users. For the purpose of this analysis, we assume that the cost of the smart cards average \$35 per user and the organization will purchase a total of 55 smart cards for their users. Table 11 illustrates the cost to the organization.

Table 11: Smart Card Costs

Ref.	Metric	Calculation	Per Period
C1	Number of Smart Cards purchased		55
C2	Cost per user		\$35
C3	Estimated discount		0%
Ct	SGD cost	$C1 * C2 * (1 - C3)$	\$1,925

Source: Forrester Research, Inc.

SGD Costs

SGD costs incurred by the organization include the license costs of the SGD product itself. For the purpose of this analysis, we assume that the organization purchases a total of 20 licenses at a total cost of \$299 per license. Table 12 illustrates the cost to the organization.

Table 12: SGD Costs

Ref.	Metric	Calculation	Year 1	Year 2	Year 3	Total	Present Value
D1	Cost of license for connecting to Windows, Unix, AS/400, and mainframe servers		\$299				
D2	Number of license keys required		20				
D3	SGD license cost	$D1 * D2$	\$5,980			\$5,980	\$5,436

Source: Forrester Research, Inc.

Software Support Costs

The organization also incurred costs associated with maintenance and support of the Sun environment. The organization indicated that it purchased three-year support upfront at a total cost of \$3,990. Table 13 provides an illustration of the calculation used.

Table 13: Software Support Costs

Ref.	Metric	Calculation	Initial
E1	Three-year support per user		\$399
E2	Discount applied		0%
E3	Number of licenses		10
E4	Software support cost	$E1 * E2 * (1 - E3)$	\$3,990

Source: Forrester Research, Inc.

Server Hardware Costs

The organization also had to incur costs around the purchase of additional servers to run the Sun Ray clients and SGD platform. These servers were purchased in conjunction with the overall move to Sun Ray clients and SGD and are included in the overall investment cost. Apart from the direct cost of the server, the organization incurred annual server maintenance costs of roughly \$5,000 per year. Table 14 illustrates the calculation used.

Table 14: Server Hardware Costs

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3	Total
F1	Cost per server		\$60,000				
F2	Number of servers		2				
F3	Discount applied		30%				
F4	Estimated annual maintenance			\$5,000	\$5,000	\$5,000	
F5	Sun Server cost	$F1 * F2 * (1 - F3) + F4$	\$84,000	\$5,000	\$5,000	\$5,000	\$99,000

Source: Forrester Research, Inc.

Implementation Costs

The implementation period for the Sun Ray clients consisted of the six months prior to the actual installation and the year months following it. It was estimated that half a full-time equivalent was required during this period in order to support users while they adjusted to the new platform. This came to a total of \$25,600 over the first year. Table 15 illustrates the calculation used.

Table 15: Implementation Costs

Ref.	Metric	Calculation	Initial
G1	Hour per FTE		160
G2	Total number of FTEs		2
G3	Hourly FTE cost		\$80
G4	Implementation and planning	$G1 * G2 * G3$	\$25,600

Training Costs

The users underwent training on the new Sun Ray clients; it was estimated that each Sun Ray user had an average of 3 hours of training at a cost of \$100 per hour. For the 200 users, that is a total cost of \$20,000.

Table 16: Training Cost

Ref.	Metric	Calculation	Initial
H1	Number of people		200
H2	Cost per person		\$100
H3	Hours		1
H4	Training fees	$H1 * H2 * H3$	\$20,000

Source: Forrester Research, Inc.

Total Costs

The total cost for the sample organization to implement the Sun platform is illustrated in Table 17.

Table 17: Total Costs, Non-Risk-Adjusted

Cash Flow Analysis (Original Estimates)						
Costs	Initial	Year 1	Year 2	Year 3	Total	Present Value
Sun Ray desktop cost	(20,160)				(20,160)	(20,160)
Comet laptop cost	(26,250)				(26,250)	(26,250)
SGD cost	(1,925)				(1,925)	(1,925)
SGD license cost		(5,980)			(5,980)	(5,436)
Software support cost	(3,990)				(3,990)	(3,990)
Sun server cost	(84,000)	(5,000)	(5,000)	(5,000)	(99,000)	(96,434)
Implementation and planning	(25,600)				(25,600)	(25,600)
Training fees	(20,000)				(20,000)	(20,000)
Total	(\$181,925)	(\$10,980)	(\$5,000)	(\$5,000)	(\$202,905)	(\$199,795)

Source: Forrester Research, Inc.

Flexibility Associated With Sun Ray Thin Clients And SGD

Flexibility, as defined by TEI, represents the value of the options created by the technology platform. When one considers an investment, one can look at both the immediate benefits and the possibility of adapting that investment to meet unanticipated or potential needs. For example, if one buys a house, one will receive the benefit of living in it. If the house that was purchased can also be expanded to meet a changing family need, that extra option is of value to the original purchaser and makes the house more valuable than just the direct benefits imply. TEI attempts to put a value on these options, since they represent an additional asset that the organization has obtained as a result of implementing the basic technology platform.

These benefits could be turned into additional business benefits, depending on the future business needs of the organization. These potential benefits include taking advantage of the capability of the Java card, which can also be used as the employee badge for: 1) enhanced security via storage of biometric data on the card for strong authentication; 2) placement of PKI certificates on the card for authentication; or 3) placement of cash value on the card for commerce.

The value of flexibility is clearly unique to each organization and the willingness of each organization to measure the value of flexibility varied considerably from organization to organization. For the purpose of this analysis, we have assumed that the composite organization has decided to use the Java card (smart card) for its most basic function, that is as an employee badge that provides building access and that can be used with Sun Ray clients to enable "hot desking" (session mobility).

With any option, just as with the example of the option to expand a house, taking advantage of these options will require a second investment. We can estimate this cost and use it to value the options created, as with the value of the new house, or the additional business produced by the option.

Likewise, if the second investment is not made, due to business conditions not being in favor of the option's exercise, the option of flexibility will "expire" worthless. For the purpose of analysis here, two budget cycles, or two years, is often used as a good first step in looking at this expiration date for the option. The fact that this secondary project may or may not be funded in two budget cycles is reflected in the value of the option benefit.

Last, to value the option, we must consider the base value of money — which is reflected in the risk-free rate of return on capital — and the volatility or uncertainty about future conditions and needs. If an organization has clarity about future and there is little or no volatility, then a financial analysis of future spending becomes a net present value calculation. If there is uncertainty, then purchasing or obtaining options to hedge future business risks creates added value.

Risk

Risk-adjusted and non-risk-adjusted ROI are both discussed in this study. The assessment of risks provides a range of possible outcomes based on the risks associated with IT projects in general and specific risks relative to desktop and infrastructure projects. In our research, we discovered that implementing the Sun Ray solution depends in large part on end user acceptance.

Risk factors are used in TEI to widen the possible outcomes of the costs and benefits (and resulting savings) associated with a project. Since the future cannot be accurately predicted, there is risk inherent in any project. TEI captures risk in the form of risks-to-benefits and risks-to-costs.

The following general risks (which apply to most IT projects) were considered in this report:

- Lack of corporate discipline in creating processes and procedures to best take advantage of the benefits.
- Lack of appropriate training for IT and end user personnel who will be responsible for achieving and optimizing the benefits from Sun Ray thin clients.
- Failure to reduce administrative and capital cost savings
- Internal inertia, conflicting priorities, and turnover reducing the organization's ability to achieve the benefits.

The following risks associated with thin-client implementation were considered in this report:

- There is a risk that costs will be greater than anticipated. Experience indicates that project size will be a significant risk factor for cost.
- There is a risk that benefits will not be realized as estimates will not be tracked and not translated directly to quantifiable savings within the organization.

If a risk-adjusted ROI still demonstrates a compelling business case, it raises confidence that the investment is likely to succeed since the risks that threaten the project have been taken into consideration and quantified. The risk-adjusted numbers should be taken as realistic expectations, since they represent the expected value considering risk. Assuming normal success at mitigating all

risk, the risk-adjusted numbers should more closely reflect the expected outcome of the investment. For the sample organization, Forrester applied low to moderate risk factors to each cost and benefit. For more information on the risk calculation, please see Appendix B.

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 costs), 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 18: Risk Adjustment — Costs

Cash Flow Analysis (Risk-Adjusted Estimates)						
Costs	Initial	Year 1	Year 2	Year 3	Total	Present Value
Sun Ray desktop cost	(20,160)				(20,160)	(20,160)
Comet laptop cost	(26,250)				(26,250)	(26,250)
SGD cost	(1,925)				(1,925)	(1,925)
SGD license cost		(5,980)			(5,980)	(5,436)
Software support cost	(3,990)				(3,990)	(3,990)
Sun server cost	(84,000)	(5,000)	(5,000)	(5,000)	(99,000)	(96,434)
Implementation and planning	(25,600)				(25,600)	(25,600)
Training fees	(20,000)				(20,000)	(20,000)
Total	(\$181,925)	(\$10,980)	(\$5,000)	(\$5,000)	(\$202,905)	(\$199,795)

Source: Forrester Research, Inc.

Table 19: Risk Adjustment — Benefits

Cash Flow Analysis (Risk Adjusted Estimates)						
Benefits	Initial	Year 1	Year 2	Year 3	Total	Present Value
Reduced hardware cost		18,813			18,813	17,103
Software utilization savings		5,200	10,400	10,400	26,000	21,136
Incremental output per worker		84,000	84,000	84,000	252,000	208,896
Operational staff efficiency			17,500	17,063	34,563	27,282
Total		\$108,013	\$111,900	\$111,463	\$331,376	\$274,417

Source: Forrester Research, Inc.

TEI Framework: Summary

Considering the representative numbers in the financial framework constructed above, the results of the “Costs,” “Benefits,” and “Risk” sections can be used to determine a return on investment, net present value, and payback period. Table 20 shows the consolidation of these numbers for the sample organization.

Table 20: Total Costs And Benefits, Non-Risk-Adjusted

Cash Flow Analysis (Non-Risk-Adjusted)						
Project Cash Flow	Initial	Year 1	Year 2	Year 3	Total	Present Value
Total costs	(\$181,925)	(\$10,980)	(\$5,000)	(\$5,000)	(\$202,905)	(\$199,795)
Total benefits		\$115,120	\$119,150	\$120,088	\$354,358	\$293,349
Net savings	(\$181,925)	\$104,140	\$114,150	\$115,088	\$151,453	\$93,554
ROI	47%					
Payback period	1.7					

Source: Forrester Research, Inc.

Table 21 below shows the risk-adjusted values, applying the risk-adjustment method indicated in the “Risks” section and the values from Tables 18 and 19 to the numbers in Table 20.

Table 21: Total Costs And Benefits, Risk-Adjusted

Cash Flow Analysis (Risk-Adjusted)						
Project Cash Flow	Initial	Year 1	Year 2	Year 3	Total	Present Value
Total costs	(\$181,925)	(\$10,980)	(\$5,000)	(\$5,000)	(\$202,905)	(\$199,795)
Total benefits		\$108,013	\$111,900	\$111,463	\$331,376	\$274,417
Net savings	(\$181,925)	\$97,033	\$106,900	\$106,463	\$128,471	\$74,622
ROI	37%					
Payback period	1.8					

Source: Forrester Research, Inc.

It is important to note that values used throughout the TEI framework are based on in-depth interviews with a sample organization. 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 purchasing the Sun platform.

Study Conclusions

Based on information collected in interviews with a current Sun customer, Forrester found that organizations that implement the Sun Ray solution, along with SGD, can realize significant benefits in the form of savings from decreased hardware expense, improved administration, and improved end user access.

The in-depth interviews uncovered that using Sun Ray clients in conjunction with SGD can drive efficiencies both inside and outside of the IT organization to realize the following benefits:

- Improved hardware utilization by extending the lifecycle of current IT assets.
- Improved efficiencies by IT and end user staff
- Enhanced access to client server applications leading to reduced cost of drug and patient management

The Sun platform was installed in less than three months and creates an environment which requires significantly less expensive hardware and internal maintenance. Overall, the Sun solution provided a significant return on investment for the sample company.

The financial analysis provided in this study illustrates the process for an organization to evaluate the value proposition of the Sun Ray solution in its environment. Based on information collected in in-depth interviews with an Sun customer, Forrester calculated a three-year risk-adjusted ROI for the sample organization of 37%, with a payback after 1.8 years. All final estimates are risk-adjusted to incorporate potential uncertainty in the calculation of costs and benefits. The calculation for ROI was based on the specific incremental costs and benefits from implementing the Sun Ray solution.

Based on these findings, companies looking to use the Sun Ray solution can see the potential of significant IT and organizational benefits. Using the TEI framework, many companies may find the potential for a compelling business case to make such an investment.

Appendix A: Total Economic Impact™ Overview

Total Economic Impact (TEI) 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. The TEI methodology consists of three components to evaluate investment value: benefits, cost, and risk.

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 expenses and cost reduction, leaving little room for analysis of the impact of the technology to the entire organization. The TEI methodology and resulting financial model places equal weight on the measures of benefits and of costs, allowing for a full examination of the impact 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 directly back to the bottom line.

Cost

Cost represents the investment necessary to capture the value, or benefits, of the proposed project. IT or the business units may incur costs. These may be in the form of fully burdened labor, subcontractors, or materials. Costs consider all the investment and expenses necessary to deliver the value proposed. 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 is the third component of the TEI methodology. Risk is a measurement of the uncertainty to benefit and cost estimates contained within the investment. Uncertainty is measured two ways: the likelihood that the cost and benefit estimates will meet the original projections as well as 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 estimate. The expected value — the mean of the distribution — is used as the risk-adjusted cost or benefit number. The risk-adjusted costs and benefits are then summed to yield a complete risk-adjusted summary and ROI.

Appendix B: 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 separate rate based on their business and investment environment; such rates typically vary from 4% to 16%. For this analysis, Forrester assumes a yearly discount rate of 10%. Readers are urged to consult their organization 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. Payback will vary by type of investment considered. Generally, the larger the up-front investment, the longer it will take to receive a positive payback. For example, infrastructure-based investments may see positive payback in 18 to 24 months, while upgrades to an existing application may see payback in 12 months or less.

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 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 one through three are discounted at the end of the year using the discount rate shown in Table 2. 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	Year 0	Year 1	Year 2	Year 3	Total

Appendix C: 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.

Benefit	Step 1			Step 2		Step 3	
	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:

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

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

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

The standard deviation represents the square root of the variance:

$$\hat{\sigma}(x2) = \sqrt{Var(x2)}$$

$$\hat{\sigma}(x2) = \sqrt{168889} = 411$$

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)] * 1/2

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

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

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 it to a percentage.
- We next multiply the original ratio by 1/2 to measure only the likelihood of the potential downside of the estimate. Multiplying by 1/2 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 benefits that are 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