The Total Economic Impact™ of Deploying Sun Ray™ Thin Clients

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Executive Summary

Introduction

Sun Microsystems commissioned Forrester Research, Inc. to examine the total economic impact (TEI) of deploying Sun's Sun Ray™ thin-client (TC) technology in an environment that had primarily PC's. This report highlights the benefits of deploying Sun Ray clients as demonstrated from the interviews and analysis of four organizations. The report examines the estimated return on investment (ROI) for a composite organization and represents the aggregate, composite 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 (sometimes referred to as total cost of ownership (TCO))

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.

The reader should be aware of the following disclosures associated with this study:

- The study is commissioned by Sun Microsystems and delivered by Forrester Consulting.

- Sun reviewed this document 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 customers were provided to Forrester by Sun.

- Forrester makes no assumptions as to the potential return on investment that other organizations will receive within their own environment. Forrester strongly advises that reader should use their own estimates within the framework provided in the report to determine the appropriateness of an investment in Sun Ray.

Brief Description of the Sun Ray Thin-Client Solution

According to Sun, Sun Ray is a tested, tuned and documented thin-client solution consisting of a Sun Ray client, Sun Ray Server Software (SRSS), and Sun servers. Implementations can range from a small network within a single office, to an environment where Sun Rays 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 compute resources secured in a central, remote location.

With Sun Ray, users can access virtually any application environment, either natively or via products such as Tarantella or Citrix. Because the applications, data, and operating system reside on the server, the Sun Ray client requires no administration at the desktop and a user's session is hosted and maintained on the server. This centralization of data, applications, and operating system, creates a "stateless" desktop environment that is both secure and efficient to maintain. These attributes lead to potential reductions in administrative overhead (Sun

indicates that in their internal deployment they have one administrator for 2,000 Sun Ray desktops) and power consumption, since the Sun Ray 1 only consumes 13watts of electricity, versus 80 watts (typical) for a PC.

All Sun Ray clients have a built-in smart card reader. Smart cards can be used to enable "Hot desking," the ability for a user to move from one Sun Ray to another, (e.g., changing offices, going to the next building to work, etc) and gain access to the same session exactly where the user left off. Java cards can be used to provide an increased level of security with biometric authorization (biometric data is stored on the card and validated against the user), and can be used as "e-purses," that is storing cash value on the card. At the most basic level smart cards can be used as employee badges.

Summary Findings

Our research and interviews with the four organizations show that implementing the Sun Ray solution can provide benefits to organizations in:

- The ability to reduce the support and administrative costs by standardizing most users on a Sun Ray platform. Both the stateless Sun Ray client and the ability to maintain control over their environment was a large factor that drove benefits to the organization.

- The ability to create a stateless and mobile environment allowing users to switch easily and efficiently between Sun Ray clients.

- The ability to set policies centrally allows the user's environment to be minimally impacted by external threats. This, in turn, leads to minimized downtime on the end-user environment.

As part of this analysis, Forrester took data received from the interviewed organizations to construct a composite ROI based model. This ROI based model is used to create a "composite organization," which is explained in subsequent sections of this report. The summary findings based on the model of the composite organization are as follows:

- For our composite organization, the risk-adjusted three-year ROI was 31 percent and the non-risk-adjusted ROI was 43 percent (see Tables 1 and 2).

- The net present value (NPV) of the three-year, risk-adjusted cash outflows associated with implementing and maintaining this solution were $421,989.

- The NPV of the three-year, risk-adjusted benefits associated with this solution were $726,024 for the *IT organization*.

- The NPV of the three-year, risk-adjusted benefits associated with this implementation were $1,052,848 for the *business unit*.

- Total risk-adjusted benefits were $1,778,872. Total risk adjusted costs in Sun Ray equated to $1,356,883.

- Risk-adjusted payback period was within 26 months.

Table 1: Composite Organization Financial Summary — Non Risk-Adjusted Values (000)

	Year 1	Year 2	Year 3	Total Cash Flow	NPV
Investment	$1,403,001	$47,985	$50,671	$1,501,657	$1,321,730
IT Benefits	$178,240	$373,280	$390,920	$942,440	$764,236
Business Benefits	$262,260	$550,745	$578,282	$1,391,287	$1,128,051
Net Value	($962,501)	$876,040	$918,532	$832,071	$570,557
ROI	43%				
Payback Period	25 Months				
NPV Discount Rate	10%				

Source: Forrester Research, Inc.

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

	Year 1	Year 2	Year 3	Total Cash Flow	NPV
IT Costs	$1,406,740	$48,172	$50,867	$1,505,779	$1,356,883
IT Benefits	$169,328	$354,616	$371,374	$895,318	$726,024
Business Benefits	$244,776	$514,029	$539,730	$1,298,535	$1,052,848
Net Value	($992,636)	$820,473	$860,237	$688,074	$421,989
Risk-Adjusted ROI	31%				
Payback Period	26 Months				
NPV Discount Rate	10%				

Source: Forrester Research, Inc.

In presenting a composite organization, we hope to show the logic and calculations for an organization considering migration to a thin client environment. The assumptions in the calculations that follow are based upon the interviews with organization that have 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 interviews, we have discovered the following:

- Reduction in support around the management of an end-user device represents a significant portion of the benefits received by the composite organization.

- The impact of training on the end user environment is a key component achieving full end user end benefits. Users that are familiar with a standard network PC environment will need have a fair degree of education around the movement to a server centric environment. While this is a factor for any PC to thin client migration, the need for training of the end users cannot be understated to achieve the expected benefits.

- Accurate planning of user requirements is another factor that can ensure benefits will be realized as expected.

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.

Summary Conclusions

When an organization considers a capital investment, it must balance the potential return against risks that that return will be achieved. A completely risk-free investment, such as a government bond, can generate in the neighborhood of 2.5 percent per year of risk-free return. When considering competing investment opportunities, organizations often set a "hurdle rate" that the investment must exceed to balance increased risk. For short-term cash investments, financial officers might consider a hurdle rate of 5 percent on their investment to compensate for risk. Likewise, investment in capital improvements, such as plant upgrades, usually requires 10 percent to 15 percent expected returns to be justified. Forrester finds that the IT expenditures often require an expected return of two to three times this rate, or about 30 percent, to be considered. While thin client technology is not the panacea for all business ills, when there are defined business needs and clear actions that will result from its implementation, significant direct business benefits can be achieved.

While choice of business platforms were primarily made within IT, it is important to understand the potential benefits that accrue to the entire organization. In particular, the decision to implement a solution in this area must be embraced by the business users to accrue any or all of the potential business benefits.

As with any vendor solution, the risks of achieving increased efficiency, lower cycle times and increased performance and reliability must be measured and quantified. It is possible that the risk associated with the costs and benefits may lower the original benefits estimate significantly, potentially resulting in a minimal or negative ROI. It is therefore necessary to quantify all the risks related to cost and benefit estimates.

TEI™ Interview Highlights

As previously mentioned, Forrester's TEI conclusions are derived in large part from information received in a series of interviews with executives and personnel at four organizations that have deployed the Sun Ray thin client solution.

Industries represented by these four organizations include: education, manufacturing and government. A brief description of each organization follows:

- Company A, a non US-based manufacturing and distribution organization

- Company B, a US-based academic institution

- Company C, a global technology manufacturing organization

- Company D, a branch of the federal government.

The ROI projections and analysis for the four interviewed companies and the composite organization are summarized in Figure 1. Estimates for each customer are based upon initial data received from each of the four clients. As the data set is limited, organizations should not use these findings as a guide of industry returns and readers are advised to apply their own estimates in modeling their own unique returns.

Figure 1: Return on Investment of Interviewed and Composite Organizations
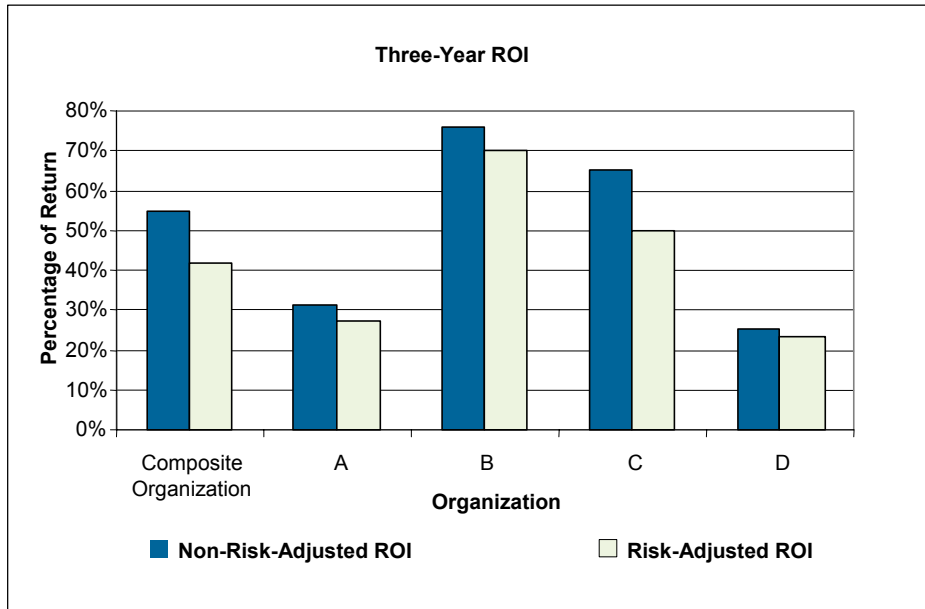
Source: Forrester Research, Inc.

Forrester observed several common characteristics across the organizations interviewed, including:

- Most clients had a heterogeneous environment prior to the implementation of Sun Ray clients, consisting of legacy client/server devices and networked PC's.

- The majority of the organizations interviewed anticipated a reduction in administrative and support costs and was a key driver in increasing the size of the Sun Ray platform.

- All organizations saw mobility of their end users as a factor to move toward a stateless client. However, access of users outside of the internal network was limited.

- Network security, both in terms of protection of the network and unauthorized access is a critical component to ongoing operations.

From these common value statements, Forrester was able to extrapolate and generate a potential ROI for a composite organization that is considering integrating Sunray into their existing network environment.

Interview Highlights — Organization A

Organization A is a non US based manufacturing and distribution organization, looking to replace their existing legacy "green screen" thin clients. The organization has a total of 300 distribution centers as well as a central headquarters and manufacturing location. Each distribution center has between 6 and 10 Sun Ray thin clients. This migration was coupled with the installation of a company wide ERP solution.

Following the implementation, the organization realized the following benefits:

- Improved access and mobility to customer records.

- Speed of implementation and deployment of devices to distribution centers.

- Enabling faster integration of the ERP solution throughout the organization.

Table 3: Organization 'A' Financial Summary

Organization A	
ROI	30%
Risk-adjusted ROI	28%

Source: Forrester Research, Inc.

Interview Highlights — Organization B

This US academic institution was looking for a way to expand access of its existing network while maintaining cost control over the management of its existing infrastructure. Prior to the implementation of the solution the organization had thin client as well as PC desktop solutions within the labs and in individual offices and wanted to replace their existing workstations with 200 Sun Ray devices.

Following the implementation, the following benefits were realized:

- Improved mobility to staff and students within the campus environment. The organization noted that the ability of users to move from device to device greatly enhances the end-user experience as well as user productivity.

- Reduced desktop and administration with its Sun Ray clients compared to the desktop PCs that were previously used within the environment.

- The movement away from desktops significantly reduced the time and effort required by the IT staff to respond to the effects of viruses. As all information is centrally located, the ability to control and protect improved IT efficiency.

Table 4: Organization 'B' Financial Summary

Organization B	
ROI	76%
Risk-adjusted ROI	70%

Source: Forrester Research, Inc.

Interview Highlights — Organization C

This manufacturing organization needed a way to manage its internal engineering group's desktop resources while providing bandwidth and flexibility for future changes. In this environment Sun Ray thin clients are used as technical workstations for software development and layout activities, and in fact replaced some UNIX based workstations with PC based deployment The organization had both thin-client and desktop solutions in place and was migrating to Sun Ray as a way to standardize certain portions of its end-user community.

Following the implementation, the following benefits were realized:

- Reduction in support and administrative requirements for the end-user environment.

- Improved flexibility and scalability for end users that required various bandwidth requirements.

- Improved interoperability as a result of a standardized platform.

Table 5: Organization 'C' Financial Summary

Organization C	
ROI	65%
Risk-adjusted ROI	50%

Source: Forrester Research, Inc.

Interview Highlights — Organization D

This organization is a branch of the federal government and had deployed Sun Ray thin clients within remote locations throughout the globe. The department was looking for a standardized, stateless client to deploy within its environment while maintaining strict security between networks.

Following the implementation, the following benefits were realized:

- Establishment of multiple separate networks tied to a single desktop platform.

- Reduced administration and installation costs.

- Improved desktop footprint by converging separate workstations handling multiple networks into a single platform.

Table 6: Organization 'D' Financial Summary

Organization D	
ROI	25%
Risk-adjusted ROI	22%

Source: Forrester Research, Inc.

Findings and Analysis — Composite Organization

Introduction to Composite Organization

The model presented is designed to facilitate the quantification and evaluation of Sun Ray in your organization. In this composite organization analysis, we present calculations for key benefits and costs encountered in the interviewed organizations and data that is representative of what we heard during the interviews. We recommend that an organization reviews the benefits, costs, assumptions and data for their own environment prior to calculating the return of Sun Ray on their own organization.

Description of Composite Organization

Although the organizations interviewed were in different industries and were of different sizes, there were common characteristics. From the similarities noted, a composite organization was created that had the following characteristics:

- The composite organization operates within the financial services vertical with offices primarily located in the United States and Canada.

- The organization currently has a total of 1,500 employees spread located both in the central office as well as 11 remote satellite offices with an average of 100 employees per office. Of those 1,500 employees, 75 percent will be transferred over to Sun Ray

- Prior to the implementation of Sun Ray, the organization currently had networked PCs as well as existing thin-client technology. The organization wanted to consolidate on the Sun Ray platform.

- The decision to move to Sun Ray was determinant in large part on the presence of existing network capacity to move most of the end users computing power to the server. In most cases of a Sun Ray deployment, upgrading bandwidth would not be needed as Sun Ray requires an average network speed of 128 kbs/ per second. However, environments that did not have extra capacity would find significant increases to build out their existing network infrastructure.

- Due to the mobility of end users, users share devices within the network. This will be the case prior to and after the implementation of Sun Ray.

Security was also an issue for the organization where users were responsible for handling confidential financial records.

The composite organization consisted of an environment of primarily networked PCs and other thin-client devices. The organization wanted to consolidate on a single thin-client device for the bulk of its employees by providing a single secure and mobile solution for desktop environments. As the organization had multiple types of devices that they were consolidating from, the costs and benefits reflected the individual makeup of the end-user base. Organizations that have different user characteristics will expect returns.

To start the analysis, we fist need to describe the makeup of the organization. Table 7 provides the initial assumptions of the end-user population.

Table 7: Basic Assumptions

Assumption	Value
Total number of end users	2,000
Yearly growth rate of users	5%
Percent of workers that are mobile and/or not be migrated	25%
Percent of those users that will be migrated	75%
Net users migrated	1,500
Users not migrated	500

Source: Forrester Research, Inc.

From these basic assumptions, we assume that the overall end user population is roughly 2,000 employees. The organization plans on adding employees at a growth rate of roughly 5 percent per year both at headquarters as well as at satellite offices. Of those 2,000 employees it is assumed that 25 percent will not be migrated to the Sun Ray clients. Potential reasons for not migrating this subset of users include: users are highly mobile outside of the network, or users that require only laptops. Table 8 illustrates the breakdown in usage by users over three years of analysis.

Table 8: Usage by Users Over Three Years

Users by Type	Percentage	Year 1	Year 2	Year 3
Thin clients	40%	600	630	662
PC-based device	60%	900	945	992
Total	100%	1,500	1,575	1,654

Source: Forrester Research, Inc.

The 1,500 employees consisted of users that used either network PCs or thin clients. We assume, for the purpose of this analysis that, as in the previous environment, multiple employees would share the same device. This is more the case with the thin-client platform where we assume that the ratio of users to devices is 1:5. For the network PCs the ratio is lower at 1:1. Table 9 and 10 illustrate a breakdown in the number of users and devices.

Table 9: Number of Devices by User

Number of Devices by Type	Annual Growth	Year 1	Year 2	Year 3
Thin-clients	5%	400	420	441
PC-based device	5%	800	840	882
Total		1,200	1,260	1,323

Source: Forrester Research, Inc.

The ratio was calculated by dividing the number of employees per desktop client by the number of desktop clients.

Table 10: Ratio of Employees per Device

Ratio of Employees per Device	Average	Year 1	Year 2	Year 3
Thin clients	1.5	1.5	1.5	1.5
PC	1.1	1.1	1.1	1.1
Average	1.3	1.3	1.3	1.3

Source: Forrester Research, Inc.

From this set of characteristics, Forrester Research projected the impact of implementing the Sun Ray solution at this organization. Changes to the revenue stream of the organization, IT costs, options and flexibility were estimated. Risk factors that would cause the actual results to vary from these estimates were considered.

Benefits and Savings Opportunities of Implementing a Sun Ray Solution

For the composite organization, the following assumptions regarding the benefit estimates were made:

- The organization is transitioning from a heterogeneous environment of both thin clients and networked PCs to primarily a homogenous Sun Ray environment.

- The need to control the desktop administration costs, to have a consistent security standard across the environment and to improve the mobility of users within the network.

- Desktop administration was one of the areas expected to receive savings, especially in terms of improving the overall efficiency of staff. Reducing the amount of time it takes to support an end user onsite impacts both the productivity of the end user as well as the desktop administrator. For this analysis, we assume that there will be benefits to the organization in terms of efficiency of IT as well as end-user time. We assume, based on client interviews that the current cost to support a user per month with the heterogeneous environment is $45 for the thin-client device and $65 for networked PCs. We assume based on data received from client interviews that with the stateless environment, the new average cost to support an end user will be reduced to $35. While these estimates are based on a limited data set, readers should apply their own estimates for support to their own economic analysis. The primary for this reduction is the movement to a pure stateless desktop environment, reducing the need for potential integration conflicts by the end users. In addition, the fact that no data resides on the devices makes the replacement of damaged devices relatively efficient (see Table 11). We assume, for the purpose of this analysis, that these savings will begin six months into the first year of analysis.

Table 11: Cost Structure

Cost Structure — Existing Devices	Year 1	Year 2	Year 3	Total	NPV
Thin clients	$216,000	$226,800	$238,140	$680,940	$562,720
PC-based device	$624,000	$655,200	$687,960	$1,967,160	$1,625,635
Total	$840,000	$882,000	$926,100	$2,648,100	$2,188,355
Cost Structure — Sun Ray	**Year 1**	**Year 2**	**Year 3**	**Total**	**NPV**
Sun Ray replacing TC	$168,000	$176,400	$185,220	$529,620	$437,671
Sun Ray replacing PC	$336,000	$352,800	$370,440	$1,059,240	$875,342
Total	$504,000	$529,200	$555,660	$1,588,860	$1,313,013
Support Cost Savings	**Year 1**	**Year 2**	**Year 3**	**Total**	**NPV**
Sun Ray replacing TC	$24,000	$50,400	$52,920	$151,320	$125,049
Sun Ray replacing PC	$144,000	$302,400	$317,520	$907,920	$750,293
Total Savings	*$168,000*	*$352,800*	*$370,440*	*$891,240*	*$722,615*

Source: Forrester Research, Inc.

- *Improved Mobility*: The presence of a pure stateless client within the environment has the effect of increasing the ease with which users can travel throughout the network. Since all data is stored centrally, the ability to efficiently access information by end users can increase the productivity of end users as they travel throughout the network. This is compounded by the fact that users in this environment are highly mobile, commuting between the central office and branch offices but also that the ratio of users to desktop devices makes sharing of workstations mandatory. Therefore, the ability of users to quickly access their data from any workstation can increase the productivity over their current environment. These estimates are calculated as the time it takes for a user to initially log into their computer and to open a specific desktop application. Table 12 illustrates the assumptions used to quantify this benefit.

Table 12: Metrics for Mobility

Metric	Measure
Average time it takes to get to home state (minutes)	
Before	5
After	2
Percent savings	150%
Number of login/logouts per week	15
Total time per week (minutes)	45
Number of weeks	50
Average time per year per user (hours)	38
Productivity time regained	30%
Time regained (hours)	11.25

Source: Forrester Research, Inc.

From these assumptions, we can calculate the actual benefits that can accrue from an increase in productivity. We assume that each user can potentially save 11.25 hours per year in increased productivity. Based on the assumed migration schedule, the total benefit is seen in Table 13.

Table 13: Total Benefit of Assumed Migration Schedule

Savings Based on Migration of User	Year 1	Year 2	Year 3	Total	NPV
Number of TC users that are mobile	$90,865	$190,817	$200,358	$482,041	$390,837
Number of PC users that are mobile	$58,413	$122,668	$128,802	$309,883	$251,252
Total savings	$149,279	$313,486	$329,160	$791,924	$642,090

Source: Forrester Research, Inc.

- *Improved Security*: The introduction of Sun Ray led to two separate enhancements of building a consistent level of security. In the first case, the movement of data to a centrally located repository has the effect of minimizing the impact of a potential virus to the end users. Administrators can more closely maintain and control the network with all information centrally located rather than distributed to each users' workstation. For the purpose of this analysis, we assume that the movement toward a pure thin-client model retaining the same end user operating system and applications can reduce the impact of a potential virus attack on the end user as well improving the efficiency of IT. Table 14 illustrates the assumptions used for improving the efficiency of IT.

Table 14: Assumptions for Improving Efficiency of IT

Reduction in Attacks	Measure
Number of virus attacks received within the past year	20
Percentage of those attacks that directly affected the end user	40%
IT cost to restore from attacks	
Average FTE commitment	0.1
Percentage of commitment from senior administrator	20%
Percentage of commitment from junior administrator	80%
Total impact before the introduction of Sun Ray	$51,200
Percentage reduction of attacks moving to server-based computing	40%
Total savings	$20,480

Source: Forrester Research, Inc.

From these assumptions, we assume that the positive impact to IT can be roughly $20,000 per year. We assume that as it takes time for the devices to be fully operational, the benefit in the first year was reduced by 50 percent (see Table 15).

Table 15: IT Savings

IT Savings — Reduction in Attacks	Year 1	Year 2	Year 3	Total	NPV
Total savings	$10,240	$20,480	$20,480	$51,200	$41,622

Source: Forrester Research, Inc.

The improvement of security can also positively impact the productivity of the end user. Not having to feel the impact of a virus attack can ultimately improve the way that end users do their job. Table 16 illustrates the assumptions used as part of this estimate.

Table 16: End-User Savings From Reduction in Attacks

Area of Savings	Savings
Number of attacks that impact end users	8
Percentage of users that are typically affected	75%
Length of outage (hours)	2
Average productivity lost from outage	20%
Time lost per user per year (hours)	4
Total savings per user	$151

Source: Forrester Research, Inc.

Based on the savings per end user of $151, it is possible to come up with a total benefit to the end-user organization based on the migration of end users (see Tables 17 and 18).

Table 17: End-User Savings

End-User Savings From Reduction in Attacks	Year 1	Year 2	Year 3	Total	NPV
Number of TC users that are mobile	$45,192	$94,904	$99,649	$239,745	$194,385
Number of PC users that are mobile	$67,788	$142,356	$149,474	$359,618	$291,577
Total savings	$112,981	$237,260	$249,123	$599,363	$485,962

Source: Forrester Research, Inc.

Table 18: Total Benefits

Total Benefits/Savings	Year 1	Year 2	Year 3	Total	NPV
Support cost savings	$168,000	$352,800	$370,440	$891,240	$722,615
Total savings mobility	$149,279	$313,486	$329,160	$791,924	$642,090
IT savings — reduction in attacks	$10,240	$20,480	$20,480	$51,200	$41,622
End-user savings from reduction in attacks	$112,981	$237,260	$249,123	$599,363	$485,962
Total benefits	$440,500	$924,025	$969,202	$2,333,727	$1,892,288

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.

Tables 19 and 20 illustrate the migration path of users away from the legacy desktop systems.

Table 19: Migration of Devices

Migration of Devices	Year 1	Year 2	Year 3
Thin-client device	400	20	21
PC-based device	800	40	42
Total	1,200	60	63

Source: Forrester Research, Inc.

Table 20: Migration of Users

Migration of Users	Year 1	Year 2	Year 3
Thin client	600	30	32
PC	900	45	47
Total	1,500	75	79

Source: Forrester Research, Inc.

The impact of cost is accrued in several areas, including hardware, software, installation and training:

Hardware: The cost of hardware represents the largest part of the investment in the Sun Ray solution. The cost of hardware consisted primarily of the cost of the Sun Ray client and Sun Server. Table 21 illustrates the unit cost of the different types of hardware. We assume that for the Sun Ray 1, monitors that were in the legacy environment can be reused and no additional investment will be required.

Table 21: Types of Devices

Type of Devices Bought	Client Hardware per Device	% Discount	Accessories	% Discount	Total cost
Sun Ray 1	$359	10%	$45	10%	$328
Sun Ray 100	$659	10%	$45	10%	$598
Sun Ray 150	$1,050	10%	$45	10%	$950
Sun V250 Server	$6,000	10%	N/A	N/A	$5,400

Source: Forrester Research, Inc.

For this analysis, we assume that a combination of different devices will be purchased. Table 22 illustrates the different types of devices and their associated cost that will be procured. For this analysis, we have broken down number of devices that are replacing either thin-client or PC-based devices.

Table 22: Costs of Devices

Procurement — Client Devices	Year 1	Year 2	Year 3	Total
Sun Ray replacing TC	400	20	21	441
Sun Ray 1	350	18	18	386
Sun Ray 100	40	1	1	42
Sun Ray 150	10	1	2	13
Sun Ray replacing PC	1,500	75	79	1,654
Sun Ray 1	1,400	70	75	1,545
Sun Ray 100	50	3	2	55
Sun Ray 150	50	2	2	54
Sun Servers	38	0	0	38

Source: Forrester Research, Inc.

Table 23: Procurement Costs

Procurement Costs	Year 1	Year 2	Year 3	Total	NPV @ 10%
Sun Ray Replacing TC	$148,059	$7,444	$8,393	$163,896	$140,751
Sun Ray 1	$114,660	$5,897	$5,897	$126,454	$109,110
Sun Ray 100	$23,904	$598	$598	$25,099	$22,225
Sun Ray 150	$9,495	$950	$1,899	$12,344	$9,417
Sun Ray replacing PC	$535,995	$26,624	$27,664	$590,283	$509,271
Sun Ray 1	$458,640	$22,932	$24,570	$506,142	$435,898
Sun Ray 100	$29,880	$1,793	$1,195	$32,868	$28,645
Sun Ray 150	$47,475	$1,899	$1,899	$51,273	$44,729
Sun Servers	$205,200	$0	$0	$205,200	$186,545
Total Procurement Costs	*$889,254*	*$34,068*	*$36,058*	*$959,379*	*$836,568*

Source: Forrester Research, Inc.

Software: In addition to desktop and server hardware, we assume that the composite organization will be required to acquire additional software licenses for the new Sun Ray solution. Since the previous environment consisted of legacy thin client and networked PCs, we assume that there are some legacy licenses that will be transferred over to the new Sun Ray clients. In constructing their own economic analysis of the migration to Sun Ray, clients are urged to input their own specific values into the model. Table 24 illustrates the cost of the licenses for the server operating system (OS), thin-client licenses, as well as license for desktop productivity suite.

Table 24: Costs of Licenses for Server OS

Server Software	Cost per Server
Additional cost of Sun Ray server software	$45
Additional cost of Tarantella	$20
Additional cost of MS server	$40
Per User Costs — Client Licenses	**Cost per User**
Additional cost of Office CAL	$599
Additional cost of OS CAL	$120
Additional cost of Tarantella	$200
Total	$919

Source: Forrester Research, Inc.

Table 25 illustrates the additional number of licenses that are required for the new Sun Ray solution.

Table 25: Additional Number of Licenses Required

Number of Existing Access Licenses	Percent	Number		
Thin-client device	60%	240		
PC-based device	100%	800		
	Number of licenses required in new environment		Additional Microsoft licenses	Tarantella licenses
Sun Ray replacing TC	330		90	90
Sun Ray replacing PC	800		0	800
Total	1,130		90	890

Source: Forrester Research, Inc.

Tables 26 and 27 show the total licensing costs for both client and server that are accrued as a result of the migration.

Table 26: Total Licensing Costs for Client Licenses

Total Cost — Client Licenses	Year 1	Year 2	Year 3	Total	NPV
Additional cost of Office CAL	$53,910	$0	$0	$53,910	$49,009
Additional cost of OS CAL	$10,800	$0	$0	$10,800	$9,818
Additional cost of Tarantella	$178,000	$0	$0	$178,000	$161,818
Total	$242,710	$0	$0	$242,710	$220,645

Source: Forrester Research, Inc.

Table 27: Total Licensing Costs for Server Licenses

Total Cost — Server Licenses	Year 1	Year 2	Year 3	Total	NPV
Sun Ray Server	$54,000	$2,700	$2,835	$59,535	$49,091
Tarantella	$17,800	$0	$0	$17,800	$16,182
Microsoft	$3,600	$0	$0	$3,600	$3,273
Total	$75,400	$2,700	$2,835	$80,935	$68,545

Source: Forrester Research, Inc.

Installation: Another component of the investment in the Sun Ray solution is the labor cost required to implement the devices. The primary cost driver within this category is the cost of IT labor resources devoted to the implementation and installation of these devices. The cost of installation can be divided into several different categories: planning, procurement, configuration, installation and disposal of legacy devices (see Table 28).

Table 28: Migration Estimates for Sun Ray

Ref.	Migration Estimates — Sun Ray	Estimate	Equation Used	Calculated Estimate
E1	Total FTE requirement devoted to p*lanning*	0.05		
E2	Percent time senior administrator	60%		
E3	Percent time junior administrator	40%	(E1*E2*D3)+(E1*E3*D5)	
E4	IT labor cost — planning			$4,600
E5	Total FTE requirement devoted to *procurement*	0.025		
E6	Percent time senior administrator	30%		
E7	Percent time junior administrator	70%	(E5*E6*D3)+(E5*E7*D5)	
E8	IT labor cost – testing			$2,150
E9	Total FTE requirement devoted to *configuration*	0.1		
E10	Percent time senior administrator	40%		
E11	Percent time junior administrator	60%	(E9*E10*D3)+(E9*E11*D5)	
E12	IT labor cost — configuration			$8,800
E13	Total FTE requirement devoted to *deployment*	1		
E14	Percent time senior administrator	30%		
E15	Percent time junior administrator	70%	(E13*E14*D3)+(E13*E15*D5)	
E16	IT labor cost — installation			$86,000
E17	Total FTE requirement devoted to *disposal*	0.025		
E18	Percent time senior administrator	20%		
E19	Percent time junior administrator	80%	(E17*E18*D3)+(E17*E19*D5)	
E20	IT labor cost — distribution			$2,100
Total labor costs — installation				$103,650

Source: Forrester Research, Inc.

Training: The cost to train the end users on the new solution represents the final cost category. We assume that the cost of training includes both end user as well as IT training on the new solution. The individual cost categories are outlined in Table 29.

Table 29: Individual Cost Categories

Ref.	Training — Sun Ray	Estimate	Equation Used	Calculated Estimate
G1	Daily cost of training — IT	$800		
G2	Number of days required — IT	2		
G3	Number of IT resources trained	10		
G4	*By Type*			
G5	Number of senior administrators trained	1		
G6	Total lost productivity — senior administrator		G2*8*G5*D4	$615
G7	Number of junior administrators trained	3		
G8	Total lost productivity — junior administrator		G2*8*G7*D6	$1,846
G9	Number of help desk analysts trained	6		
G10	Total lost productivity — help desk analysts		G2*8*G9*D8	$2,769
G11	Number of end users trained	1,200		
G12	Hours of training time	3		
G13	Total lost productivity — end user		G11*G12*D10	$138,462
Total labor costs — training				$143,692

Source: Forrester Research, Inc.

Table 30 summarizes the total investment cost for the Sun Ray solution. Customers indicated to us cost categories that had been avoided in part due to the previous configuration. These include not having to extend network environment since they felt that they had adequate capacity to handle the new solution.

Table 30: Total Investment Cost

Total Cost of Migration	Year 1	Year 2	Year 3	Total	NPV
Total procurement costs	$889,254	$34,068	$36,058	$959,379	$836,568
Total licensing costs	$289,400	$2,700	$2,835	$294,935	$263,091
Total labor costs — installation	$94,014	$4,701	$4,936	$103,650	$93,060
Total labor costs — training	$130,333	$6,517	$6,842	$143,692	$129,011
Total	$1,403,001	$47,985	$50,671	$1,501,657	$1,321,730

Source: Forrester Research, Inc.

Flexibility Associated With Sun Ray

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 it's most basic function, that is as an employee badge that provides building access and that can be used with Sun Ray 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 on 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.

Lastly, 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.

Risks Associated With Estimates of Costs and Benefits

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 Sun Ray 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

- 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 our composite organization, Forrester applied low to moderate risk factors to each cost and benefit.

Risk Calculation Example

Risks-to-benefits consider all possible risks to each benefit. (Likewise, risks-to-costs consider all possible risks to each cost.) Using probability density functions, we create a triangular distribution range of three values, including a low estimate, a most-likely estimate and a high estimate. For example, in our composite organization, we included a risk adjustment for IT cost savings of $764,236 (non risk-adjusted). For this savings category, the risks-to-savings ranged from a low estimate of 84 percent of the $609,308, suggesting an inability to realize 100 percent of the savings, to a high of 111 percent ($804,529), indicating a possible slight overachievement of the savings. Using triangular distribution, we sum the three possibilities of low, most likely and high and divide by three to get the mean (or risk-adjusted cost savings) of $726,024 ($609,308 + 726,236 + $804,529 = $2,178,073 / 3 = $726,024). Figure 2 illustrates the concept of triangular distribution, and the vertical line in the center represents the expected value of $726,024. In our composite organization, all costs and benefits were adjusted for risk.

Figure 2: Risk Adjustment Calculation Example
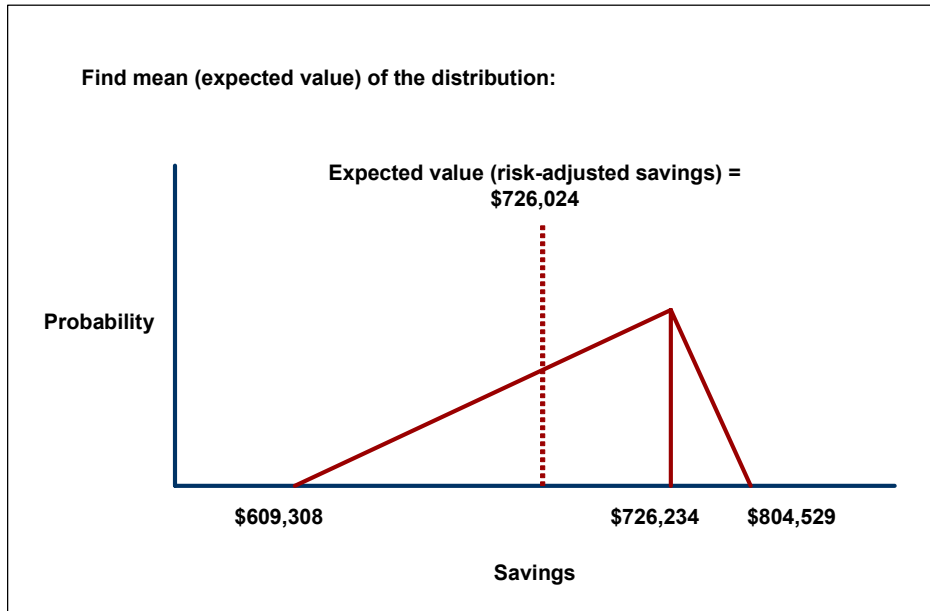
Source: Forrester Research, Inc.

For our composite organization, the following values were used in the risk-adjustment calculations (see Appendix A for specific detail on the risk-adjustment calculations):

Risks to costs:

- Best case values are 90 percent of the non-risk-adjusted cost estimates
- Worst case values are 120 percent of non-risk-adjusted cost estimates

Risks to benefits:

- Best case values are 125 percent of the non-risk-adjusted benefit estimates
- Worst case values are 60 percent of non-risk-adjusted benefit estimates

Appendix A: Total Economic Impact™ Primer

Total Economic Impact™ is primarily a common language tool, designed to capture and properly communicate the value of IT initiatives in a common business language. In so doing, TEI considers four elements of any initiative:

1. Benefits

2. Costs (sometimes referred to as total cost of ownership (TCO))

3. Flexibility

4. Risk

Figure 3 shows the TEI methodology conceptually. Benefits, flexibility and costs are considered, through the filter of risk assessment, in determining an expected ROI for any given initiative.

Figure 3: Total Economic Impact™ Methodology
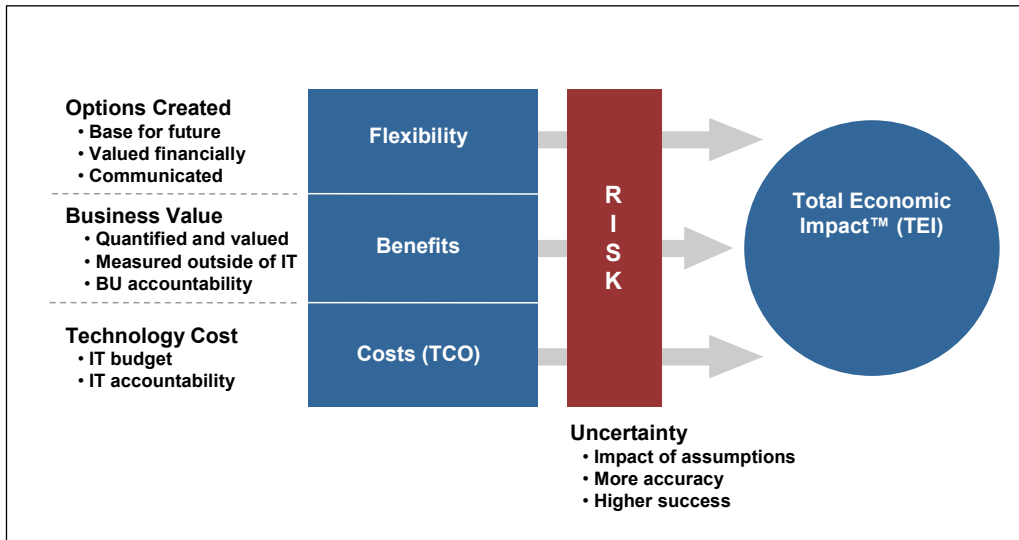
Source: Forrester Research, Inc.

Benefits

Benefits represent the *value* delivered to the business by the proposed project. Oftentimes, IT project justification exercises focus on cost (e.g., TCO) and cost reductions. Among industry leaders, IT is deployed as an offensive weapon, with value expectations greater than simple cost reduction, especially when those cost reductions tend to focus within IT. TEI captures the value proposition of the proposed project by measuring the benefits against the incurred costs.

All benefits captured by TEI must be traceable back to one or more critical success factors (CSFs). These CSFs are directly linked to a higher-level business strategy. If a proposed technology investment generates benefits that cannot be satisfactorily linked to a CSF, then it will not be included as a benefit for the organization in the model. In these cases, TEI requires that the benefit be discarded.

Under TEI, benefits may only accrue to the business units. "Benefits" derived through cost reductions within IT accrue as negative TCO to the IT budget, thereby showing a reduced TCO. (TCO is considered by TEI to be a single-dimension, cost-centric focus on the IT budget.)

The TEI process begins with a discovery of potential benefit areas. A representative from the organization under examination who has the ability to capture the benefit in question must validate each benefit captured during discovery. In other words, values cannot arbitrarily be assigned to a benefit if that person is not in a position to deliver that benefit should the project be approved. Additionally, projects that are expected to deliver business value require some effort on the part of the business to realize that value. That effort may be in the form of training, organizational change or a modification of existing business processes. Therefore, TEI requires dialog with the business leaders actually responsible for making the necessary changes, in order to capture the proposed benefit during the justification phase. TEI captures this dialog in the form of the names of the individuals, which validates the value calculation of each benefit.

Within TEI, each benefit entered has a specific capture date. Although the benefit may be captured over time, TEI requires the specification of a date when most of the benefit has been captured. TEI will then place the value delivered in the appropriate time frame within the project.

Costs

Costs represent 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. Additionally, costs consider all the investment and expenses necessary to deliver the value proposed.

Flexibility

Flexibility, as defined by TEI, represents investing in additional capacity that can, for some future additional investment, be turned into business benefit — for instance, an investment in an enterprisewide upgrade of the desktop word processor application where the primary driver may be standardization (to increase efficiency) and licensing (to decrease IT costs). However, a collaborative workgroup feature may translate into greater worker productivity when the organization is ready to absorb the discipline necessary to capture that benefit. The collaboration feature does not promise benefit during this phase of the project and must be captured later, incorporating additional investment, most likely in the form of training. However, the existence of the option has a present value that can be estimated. The flexibility component of TEI captures that value.

Flexibility can also be calculated by acknowledging that management has several decision points along the way for any given project. At each point, management can steer the project to a different outcome or cancel it altogether. Many net present value evaluations fail to take this management flexibility into account. Since TEI's flexibility component uses the industry standard Black-Scholes options formula, the management flexibility factor is taken into consideration.

TEI divides a project into multiple phases. The first phase is considered the "benefits" phase — it is the phase expected to deliver the primary benefits. The benefits phase is usually no more than one budget cycle long and is the primary reason the project is being considered. All other phases are "options" or "flexibility" phases. For additional investment at some point in the future, business benefit can be captured during these "options" phases. TEI applies the Black-Scholes options pricing equation to all phases other than the benefits phase. The Black-Scholes equation uses five inputs to calculate the present-day value of flexibility or options:

1. The value, or business benefit, that can be captured when the option is exercised; this value is expressed in present value terms.
2. The time, to the date, at which point the option or flexibility expires. Expiration could be due to business changes or technology obsolescence.
3. The cost of the investment to exercise the option and capture benefit.
4. The risk-free interest rate (typically, the interest rate of government securities is used).
5. The volatility of the industry or sector; TEI uses the volatility of the stock prices within the market sector as this input.

Risk

Risks are used to widen the possible outcomes of the 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.

Risks-to-benefits consider all possible risks to each possible benefit. Likewise, risks-to-costs consider all possible risks to each possible cost. Then, a range is chosen by applying best judgment for each cost and benefit, based on the set of risks assigned to each cost and benefit. The range is entered in the form of a low estimate, a most likely value and a high estimate. For example, the risks to a cost may result in a range from the expected value as the low estimate, to two times the expected value as the high for a particular cost (representing a potential two times cost overrun).

TEI applies a probability density function known as "triangular distribution" to the values entered. The expected value — the mean of the distribution — are 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.

Typical project risk factors to consider include the following:

- *Vendors*: The risk that the vendor of a product or technology may need to be replaced at some point during the project duration

- *Products*: The risk that a product will not deliver the functionality expected

- *Architecture*: The risk that the current product architecture will not allow future infrastructure decisions and changes

- *Culture*: The risk that an organization will be unable to absorb the new technology or adapt to its implementation

- *Delays*: The impact on revenues of a project delay or cancellation

- *Size*: The direct correlation of project risk to the size of the project, as measured by application size or budget