A Forrester Total Economic Impact™ Study Prepared For Conformiq

The Total Economic Impact Of Conformiq Tool Suite

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Executive Summary

In December 2010, Conformiq commissioned Forrester Consulting to examine the total economic impact and potential return on investment (ROI) enterprises may realize by deploying Conformiq Tool Suite (CTS). The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of the CTS on their organizations.

Conformiq Tool Suite Increases Software Test Process Efficiency

Our interview with an existing Conformiq customer and subsequent financial analysis found that the organization experienced the risk-adjusted ROI, costs, and benefits shown in Table 1.

Table 1
Three-Year Risk-Adjusted Sales ROI[1]

ROI	Payback period	Total benefits (PV)	Total costs (PV)	Net present value
396%	3.5 months	$6,396,565	($1,288,794)	$5,107,771

Source: Forrester Research, Inc.

- **Benefits.** The organization we interviewed experienced the following benefits:
  - **Test engineer efficiency gains of $668,049 for new test designs.** When designing and executing new test designs, the organization experienced a 30% efficiency gain for the engineers working on the project. This equates to a 42.9% productivity increase.
  - **Test engineer efficiency gains of $5,728,516 when reusing existing test designs.** When modifying existing test designs for new test scenarios, the engineers experienced efficiency gain of up to 84%, which equates to a 525% productivity gain.
- **Costs.** The organization we interviewed experienced the following costs:
  - **Software license fee of $1,131,518.** The license fee represents 10 concurrent CTS seats and is the total cost for the three-year analysis time frame.
  - **Consulting and training expense of $152,230.** Services expense was required to help the organization integrate CTS into its environment and train its test engineers.
  - **CTS management labor expense of $5,046.** The organization required approximately 1 labor hour weekly to maintain the CTS software.

Factors Affecting Benefits And Costs

Table 1 illustrates the risk-adjusted financial results that were achieved by the organization. The risk-adjusted values take into account any potential uncertainty or variance that exists in estimating the costs and benefits, which produces more conservative estimates. The following factors may affect the financial results that an organization may experience:

- The efficiency gains will vary with the amount of test design reuse that is possible, the ability of the software test organization to successfully integrate CTS into its test processes, and the relative skills of the test engineers.
- The cost to integrate CTS into the test environment and train the test engineers will vary from organization to organization.

Disclosures

The reader should be aware of the following:

- The study is commissioned by Conformiq and delivered by the Forrester Consulting group.
- Forrester makes no assumptions as to the potential return on investment that other organizations will receive. Forrester strongly advises that readers should use their own estimates within the framework provided in the report to determine the appropriateness of an investment in Conformiq Tool Suite.
- Conformiq reviewed and provided feedback to Forrester, but Forrester maintains editorial control over the study and its findings and does not accept changes to the study that contradict Forrester's findings or obscure the meaning of the study.
- The customer names for the interviews were provided by Conformiq.

TEI Framework And Methodology

Introduction

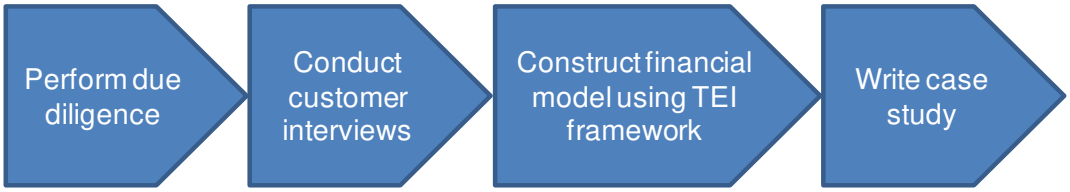
From the information provided in the interviews, Forrester has constructed a Total Economic Impact™ framework for those organizations considering implementing Conformiq Tool Suite. The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that affect the investment decision.

Approach And Methodology

Forrester took a multistep approach to evaluate the impact that Conformiq Tool Suite can have on an organization (see Figure 1). Specifically, we:

- Interviewed Conformiq marketing and sales personnel and Forrester analysts to gather data relative to Conformiq Tool Suite and the marketplace for automated software test suites.
- Interviewed one organization currently using Conformiq Tool Suite to obtain data with respect to costs, benefits, and risks.
- Constructed a financial model representative of the interviews using the TEI methodology. The financial model is populated with the cost and benefit data obtained from the interviews.

Figure 1
TEI Approach



Source: Forrester Research, Inc.

Forrester employed four fundamental elements of TEI in modeling the economics of Conformiq Tool Suite:

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

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

Analysis

Interview Highlights

A single interview was conducted for this study, involving representatives from a very large global manufacturer of telecommunications equipment. We interviewed the manager in charge of overall resource planning, test development, and operations for a software test team. This software test team was made up of approximately 20 test engineers. All the test engineers performed a variety of tasks, including test design, implementation, execution, and results analysis. This particular team was responsible for the functional testing of TCP/IP protocols that were implemented on different hardware platforms. The protocols and hardware were designed to fulfill specific customer functional requirements.

The organization had been using Conformiq Test Suite for three years. Prior to using CTS, the test team spent a significant amount of time organizing and managing its test cases. It had developed a high level of automation for managing its test cases and felt that it had a "good test framework to do this automation . . . and it was good at that."

Generally, the organization wished to increase the productivity of its test engineers. More specifically, the test team found that the hardware platforms on which the TCP/IP protocols ran changed often in response to customer requests and changing functional requirements, which triggered a retesting of the software. The retesting required that modifications be made to underlying test scripts. These hardware changes were numerous and frequent, resulting in rapid growth in the number of test scripts that needed to be maintained. The maintenance and updating of test scripts placed a significant overhead burden on the test engineers, and the organization wanted a solution that would reduce the maintenance burden and allow the test engineers to spend their time on more productive work.

The organization asked Conformiq to perform a proof-of-concept (PoC) test as part of its evaluation process. For the PoC, a single Conformiq engineer was able to replicate an entire existing test scenario in two weeks, a task that would have required many test engineers working for several weeks to develop and execute.

It took approximately five months for the organization to integrate CTS into its environment. During this time, the test engineers went through intensive training while performing a pilot project with CTS.

After integrating CTS into its environment, completing the necessary training, and becoming familiar with the tool, the organization experienced the following benefits:

- **Improved test suite maintenance efficiency.** CTS provided the organization with a single structured framework for performing software testing. The organization found that it is very easy to make changes to test models and generate new test suites in response to hardware or software changes. According to the manager whom we interviewed, "There is very little maintenance on the test suite that we need to do . . ."

- **Greater test coverage.** The tool automatically generates test or "corner" cases that the test engineers would not have thought of or have had time to generate in the traditional test environment. Forrester notes that "corner" cases can be expensive to build manually, and having these generated automatically generates additional cost savings that are not evaluated in this study.
- **Earlier-identified faults.** The organization is able to detect faults earlier when compared to its traditional software testing methodologies. This allows the test team to provide feedback to the software designers earlier in the process, which enables the organization to meet its delivery deadlines more easily. Forrester notes that it is less expensive to fix bugs when they are caught earlier, and the organization has received the benefit of this.
- **Improved agility in responding to customer requirements.** CTS allowed the organization to make rapid changes to test suites in response to changing customer requirements, without impacting delivery deadlines. The test manager told us, "[We] did a major project where we spent around 7,000 hours on doing both modeling and testing where the customer had changed requirements two or three times, and we still managed to keep the schedule [without] having any major effect on the resources."
- **Feedback into the functional design process.** Because CTS is a state machine, it requires that its inputs be set up precisely in order to test the required functionality accurately. This, in turn, requires that the functional requirements are described accurately. The test team found that it can more easily discover errors and inaccuracies in the functional requirements and is now able to clarify the requirements to the customers and correct design errors with system designer engineers earlier in the test/fix process.
- **Increased employee motivation.** The test team manager said that the test engineers' motivation had increased when using CTS to perform their work because they spend less time on mundane tasks, are able to work more effectively, and can undertake a wider variety of tasks.
- **Decreased documentation overhead.** In the traditional test environment, documentation was written manually. CTS performs this function automatically, resulting in 10% to 20% time savings for new test projects.

Framework Assumptions

Table 2 provides the model assumptions that Forrester used in this analysis. To convert the test engineer monthly pay to a fully loaded salary in US dollars, we added a 31% overhead (Table 2, A4) and local-currency-to-US-dollar conversion rate of 0.14, yielding a fully loaded annual salary of $77,275 (A5). All consulting expenses were supplied to Forrester in euros, which were converted to US dollars with an exchange rate of 1.3 (A3).

Table 2
Model Assumptions

Ref.	Metric	Calculation	Value
A1	Number of working hours annually		2,000
A2	Assumed local currency/$US exchange rate		0.14
A3	Assumed euro/$US exchange rate		1.30
A4	Salary overhead multiplier (payroll tax)		31%
A5	Test engineer fully loaded annual pay rate ($US)		$77,275
A6	Test engineer fully loaded hourly pay rate ($US)	A5/A1	$38.64

Source: Forrester Research, Inc.

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

Costs

The organization incurred costs in the following areas:

- License fees.
- Consulting and training expense.
- Internal labor for maintaining the CTS environment.

No additional hardware was purchased because the organization had the required servers on hand.

Annual License Fees

Conformiq license fees vary with the number of seats used. The license fees were supplied to Forrester by Conformiq and reflect an average of 10 seats annually. The license fees are $455,000 annually (see Table 3).

Table 3
License Fees

Ref.	Metric	Calculation	Per period	Year 1	Year 2	Year 3	Total
B1	Annual license fees (euro)		€350,000				
B2	Euro/$US exchange rate	A2	1.3				
Bt	Annual software license expense	B1*B2	$455,000				
Bto	Total (original)		$0	($455,000)	($455,000)	($455,000)	($1,365,000)

Source: Forrester Research, Inc.

Consulting And Training Expense

The organization incurred significantly higher consulting and training expense during Year 1. These expenses were calculated by taking the consulting and training expense at the time of interview (Year 3) and increasing them according to the number of consulting and training hours consumed in Years 1 and 2. This yields a total consulting expense of $164,970 (see Table 4). All consulting and training hour data was supplied by Conformiq.

Table 4
Consulting And Training Expense

Ref.	Metric	Calculation	Per period	Year 1	Year 2	Year 3	Total
C1	Annual consulting and training expense (euro)		€27,000				
C2	Euro/$US exchange rate	A2	1.3				
Ct	Annual consulting and training expense	C1*C2	$35,100				
Cto	Total (original)		$0	($87,750)	($42,120)	($35,100)	($164,970)
	Percentage of consulting hours consumed			250%	120%	100%	

Source: Forrester Research, Inc.

Labor To Maintain CTS

The organization found that the effort needed to maintain the CTS environment was minimal, requiring 1 hour per week. This equates to $2,009 annually (see Table 5).

Table 5
Labor To Maintain CTS

Ref.	Metric	Calculation	Per period	Year 1	Year 2	Year 3	Total
D1	Number of maintenance hours required per week		1.0				
D2	Test engineer hourly pay rate	A6	$38.64				
Dt	Labor to maintain Conformiq Test Suite software	D1*D2*52	$2,009				
Dto	Total (original)		$0	($2,009)	($2,009)	($2,009)	($6,027)

Source: Forrester Research, Inc.

Total Costs

The total three-year cost that the organization incurred was $1,535,997 (see Table 6).

Table 6
Total Costs

Costs	Initial	Year 1	Year 2	Year 3	Total
Annual software license expense		(455,000)	(455,000)	(455,000)	(1,365,000)
Annual consulting and training expense		(87,750)	(42,120)	(35,100)	(164,970)
Labor to maintain Conformiq Test Suite software		(2,009)	(2,009)	(2,009)	(6,027)
Total		($544,759)	($499,129)	($492,109)	($1,535,997)

Source: Forrester Research, Inc.

Benefits

During the interview, Forrester identified numerous benefits that the organization experienced (see the Interview Highlights section). The benefits that we were able to economically quantify were in the area of increased labor efficiency. We were unable to calculate the economic benefits associated with identifying design flaws earlier or clarifying customer specifications due to lack of relevant data. However, we recognize that cost of fixing bugs and rectifying design mistakes is considerably more expensive when done later in the process.[2] Using CTS allowed the test team to catch these mistakes earlier, saving the organization and its customers the inevitable rework expense. We did not calculate the economic value of reduced documentation overhead because this benefit is included in the overall labor efficiency benefits.

Labor Efficiency Gains For New Test Designs

The test team manager explained to us that compared to their traditional test methods, CTS resulted in an overall labor efficiency gain of 30% for a project requiring new test designs. In this case, an efficiency gain means that the test engineers were able to complete their tasks in 30% fewer hours, freeing up time to do more testing.

To calculate the economic value of this gain, we assumed that 10 test engineers work on new test designs at any given time. It is important to note that not all the engineers are using CTS at the same time and the efficiency gain applies to all 10 test engineers as a group. We did not break out the increased labor efficiencies into specific testing tasks because we were unable to obtain task-specific data. The 30% efficiency gain equates to a productivity increase of 1.429 or 42.9% (see Table 7, E5). The reported efficiency gain includes time used for management overhead and other nonproductive tasks. We discounted the economic value in Year 1 by 37% because it took the organization four to five months to ramp up to full productivity with CTS. The total value of the economic benefit is $869,343.

Table 7
Labor Productivity Increase For New Test Designs

Ref.	Metric	Calculation	Per period	Year 2	Year 3	Total
E1	Number of test engineers		10			
E2	Number of working hours per year	A1*E1	20,000			
E3	Percentage efficiency gain using CTS		30%			
E4	Additional time available per 1,000 hours worked (hours)	1,000*E3	300			
E5	Productivity gain per 1,000 hours worked	1,000/(1,000-E4)	1.429			
E6	Test engineer hourly rate	A6	$38.64			
E7	Percentage captured		100%			
Et	Productivity gain — new test designs	E2*(E5-1)*E6*E7	$331,178			
Eto	Total (original)		$206,987	$331,178	$331,178	$869,343
	Percentage recognized		63%	100%	100%	

Source: Forrester Research, Inc.

Labor Efficiency Gains For Test Design Reuse

In this case, the test engineers experienced labor productivity gains resulting from reusing existing test designs. This test scenario resulted from minor design changes to the hardware or the TCP/IP protocol stacks, which required changes to the original test design scripts. We learned that in this scenario, what used to take a team of test engineers 1,000 hours to perform was reduced to two test engineers working for two weeks or 160 hours. This equates to a productivity gain of 84%. As in the case of new test designs, the freed-up time was used to do more testing.

The calculated productivity gain is 5.25 or 525% (see Table 8, F4). Because the data was reported to us as a time reduction needed to perform a specific task and did not account for any management overhead, we assume that 70% of the freed-up time is used productively. We discounted the economic value in Year 1 by 37% because it took the organization four to five months to ramp up to full productivity with CTS. The total value of the economic benefit is $7,454,619.

Table 8
Labor Productivity Gains For Test Design Reuse

Ref.	Metric	Calculation	Per period	Year 2	Year 3	Total
F1	Number of testers		10			
F2	Total number of working hours per year	A1*F1	20,000			
F3	Time needed to perform tasks using CTS per 1,000 hours worked (hours)		160			
F4	Productivity gain per 1,000 hours worked	1,000/F3-1	5.25			
F5	Test engineer hourly rate	A6	$38.64			
F6	Percent captured		70%			
Ft	Productivity gain — reusing existing test designs	F2*F4*F5*F6	$2,839,855			
Fto	Total (original)		$1,774,909	$2,839,855	$2,839,855	$7,454,619
	Percentage recognized		63%	100%	100%	

Source: Forrester Research, Inc.

Total Benefits

The total benefits experienced by the organization are $8,323,962 (see Table 9).

Table 9
Total Benefits

Benefits	Initial	Year 1	Year 2	Year 3	Total
Labor efficiency gain — new test designs		206,987	331,178	331,178	869,343
Labor efficiency gain — test design reuse		1,774,909	2,839,855	2,839,855	7,454,619
Total		$1,981,896	$3,171,033	$3,171,033	$8,323,962

Source: Forrester Research, Inc.

Flexibility

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

The organization has made substantial investments in CTS in other software teams, almost doubling its original investment. While we are unable to quantify the benefits experienced in other parts of the organization, we assume that these benefits were similar in nature to those described here.

Risk

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

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

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

- The number of consulting hours needed to integrate CTS into the test process and train engineers.
- The number of hours needed to maintain the CTS environment.

The following impact risk that affects benefits are identified as part of the analysis:

- The efficiency gains will vary according to the amount of test protocol reuse and the test engineers' ability to effectively leverage the capabilities of CTS.

Table 10 shows the values used to adjust for risk and uncertainty in the cost and benefit estimates. The TEI model uses a triangular distribution method to calculate risk-adjusted values. To construct the distribution, it is necessary to first estimate the low, most likely, and high values that could occur within the current environment. The risk-adjusted value is the mean of the distribution of those points. Readers are urged to apply their own risk ranges based on their own degree of confidence in the cost and benefit estimates.

Table 10
Cost And Benefit Risk Adjustments

Costs	Low	Most likely	High	Mean
Consulting and training expense	100%	100%	125%	108%
Labor to maintain Conformiq Test Suite software	98%	100%	105%	101%
Benefits	**Low**	**Most likely**	**High**	**Mean**
Efficiency gain — new test designs	80%	100%	103%	94%
Efficiency gain — test design reuse	80%	100%	103%	94%

Source: Forrester Research, Inc.

Financial Summary

The financial results calculated in the Costs and Benefits sections can be used to determine the return on investment, net present value, and payback period for the organization's investment in Conformiq Tool Suite. These are shown in Table 11 below.

Table 11
Cash Flow — Non-Risk-Adjusted

Cash flow — Original estimates						
	Initial	Year 1	Year 2	Year 3	Total	Present value
Benefits	$0	$1,981,896	$3,171,033	$3,171,033	$8,323,962	$6,804,856
Costs	$0	($544,759)	($499,129)	($492,109)	($1,535,997)	($1,277,468)
Net benefits	$0	$1,437,137	$2,671,904	$2,678,924	$6,787,965	$5,527,388
ROI	433%					
Payback period (months)	3.3					

Source: Forrester Research, Inc.

Table 12 below shows the risk-adjusted ROI, NPV, and payback period values. These values are determined by applying the risk-adjusted values from Table 10 in the Risk section to the cost and benefits numbers in Tables 6 and 9.

Table 12
Cash Flow — Risk-Adjusted

Cash flow — Risk-adjusted estimates						
	Initial	Year 1	Year 2	Year 3	Total	Present value
Benefits	$0	$1,862,982	$2,980,771	$2,980,771	$7,824,524	$6,396,565
Costs	$0	($551,799)	($502,519)	($494,937)	($1,549,255)	($1,288,794)
Net benefits	$0	$1,311,183	$2,478,252	$2,485,834	$6,275,269	$5,107,771
ROI	396%					
Payback period (months)	3.5					

Source: Forrester Research, Inc.

Appendix A: Total Economic Impact™ Overview

Total Economic Impact is a methodology developed by Forrester Research that enhances a company's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

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

Benefits

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

Costs

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

Risk

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

Flexibility

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

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

Appendix 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 discount rate based on their business and investment environment. Forrester assumes a yearly discount rate of 10% for this analysis. Organizations typically use discount rates between 8% and 16% based on their current environment. Readers are urged to consult their respective 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.

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

A Note On Cash Flow Tables

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

Table [Example]
Example Table

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

Source: Forrester Research, Inc.

Appendix C: Endnotes

[1] Forrester risk-adjusts the summary financial metrics to take into account the potential uncertainty of the cost and benefit estimates. For more information on risk, please see page 13.

[2] The cost of fixing bugs goes from $139 during requirements phase to $14,103 during the maintenance phase. For more information, see Caper Jones, *Software Assessments, Benchmarks, and Best Practice,"* Addison Wesley, 2001.