



The Total Economic Impact™ of Using ThoughtWorks' Agile Development Approach

January 20, 2004

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Executive Summary

Introduction

In August of 2003, ThoughtWorks commissioned Forrester Research to examine the Total Economic Impact™ (TEI) of an organization engaging with ThoughtWorks for a software development project using an agile approach. .

This report highlights the benefits and costs of engaging with ThoughtWorks as demonstrated from the interviews and analysis of four separate organizations. The report examines the estimated return on investment (ROI) and represents the aggregate findings derived from the interviews and analysis process, as well as the independent research of Forrester. The focus of this report is to provide organizations that are considering engaging with ThoughtWorks and using agile techniques with a model to evaluate their own potential ROI.

Forrester was selected for this project because of its 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 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

Enterprises are increasingly sophisticated 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.

As part of the objective nature of this study, Forrester discloses that:

- The study is commissioned by ThoughtWorks and delivered using Forrester's TEI methodology.
- ThoughtWorks 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 contradicted Forrester's findings or obscured the meaning of the study.
- ThoughtWorks provided the customer names for the interviews.
- Forrester makes no assumptions as to the potential ROI that other organizations will receive within their own environment. Forrester strongly advises that readers should use their own estimates within the framework provided in the report to determine the appropriateness of a ThoughtWorks agile-based engagement.

Brief Description of ThoughtWorks Agile Development Methodology

ThoughtWorks has invested heavily in a consistent methodology for software development and project management, based largely on agile development techniques. All consultants are trained in the methodology and share best practices across engagements. ThoughtWorks' overall goals with this methodology are to reduce project risk by enabling visibility into the development process and responsiveness to evolving requirements, and to deliver high quality software in less time and using fewer resources.

Some of the key components of the ThoughtWorks methodology are:

- *Short cycles:* Deliver working code to the business users in regular, short iterations (two to four weeks), ensuring quick feedback and quality assurance and reducing inaccurate status reporting.
- *Test-first development:* Building test cases and scripts as requirements are defined, prior to developing code.
- *Continuous integration:* Rebuilding and automatically testing the code base after every code change, to address issues immediately and support distributed parallel development.
- *Refactoring:* Improving upon the design of existing code, to support new requirements and/or improve existing capability.
- *Empowered team:* Allowing developers, analysts and testers to “own” the project and work directly with business representatives to prioritize key requirements and resolve issues.
- *Reduction of project risk:* Reducing the likelihood of late delivery by driving close collaboration with the business, ensuring that the key project risks are identified and mitigated at the start of the project

Recently, ThoughtWorks has extended its methodology to address offshore development issues (technical, management and cultural). In addition, having completed projects of 120 staff and up, it has demonstrated the ability for its agile processes to scale to large distributed teams.

Summary Findings

Developing a TEI model involves a two-step process. First, Forrester interviewed four customers (provided by ThoughtWorks) that had used ThoughtWorks as part of an agile development project. Data provided by each of the customers allowed Forrester to project a three-year ROI of between 23 percent and 66 percent. Forrester used the interview process to understand the distinct cost and value statements that the organizations saw as a result of these projects. Forrester then constructed a representative model based on those individual cost and value statements. The representative model makes up the main body of this report and should be used by readers as a guide when determining the ROI for their own organizations.

While the role of ThoughtWorks varied by client organization (e.g., project rescue, new project development, training and mentoring), all clients saw the value of ThoughtWorks in helping to meet their stated business objectives:

- Organizations, regardless of the type of ThoughtWorks engagement, saw two key value propositions:
 1. The quality of the ThoughtWorks staff and their ability to handle difficult projects drove **efficiency** within the organization, reducing the potential for defects and rework down the road. Improved visibility into project progress as well as use of automated tools such as Cruise Control further minimized unforeseen defects. There is an assumption in all of the organizations that were interviewed that the projects were complex and the likelihood of defects and errors would be higher than a typical development project deployed within the organization.

2. The use of an agile methodology, requiring close communication between IT and business stakeholders, **delivered key business requirements — and thus benefits — sooner.** Business users had control from the start of the project, ensuring that key business requirements would be met. Several customers noted that prioritizing benefits upfront was a key component in seeing the value of ThoughtWorks’ solution.
 - The impact of *distributed* agile development on projects varied. One organization stated that an offshore component was valuable in addressing staffing necessities rather than budget issues. Another organization felt that it was too early to determine the benefits or costs of distributed agile development. All organizations felt that work divided between the ThoughtWorks and client’s sites was well managed.
 - The use of an agile development methodology was relatively new. Most clients hoped that they could further leverage ThoughtWorks’ experiences on future internal development efforts.
 - Organizations had several different alternatives to engaging with ThoughtWorks. Examples included using more of their in-house development staff, using previously engaged outside consulting firms or abandoning the project altogether.
 - All customers cited ThoughtWorks’ technical expertise (e.g., J2EE, .NET, distributed architectures) as being a key part of the selection criteria. In particular, the quality and experience of the staff was a key differentiator when compared to alternative solutions.
 - Several organizations were impressed by ThoughtWorks’ willingness to share risks on the project. All noted ThoughtWorks’ willingness to stand behind its commitment to agile development approaches.

Forrester defined a “composite” organization, representing the key criteria of ThoughtWorks customers (see section below). Tables 1 and 2 summarize the financial findings from the representative organization. The financial estimates around the composite organization were based on common benefit and cost estimates pooled from the interview process. How these financial metrics are calculated is explained in subsequent sections. The risk-adjusted values reflect the inherent uncertainty that is present around making projections of cost and benefit. It reflects a more conservative value and takes into account any potential uncertainties that were present at the time of estimation.

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

	Year 1	Year 2	Year 3	Total Cash Flow	NPV
ThoughtWorks cost	\$2,437,500	\$812,500	\$0	\$3,250,000	\$2,887,397
Benefits attributable to ThoughtWorks	\$2,620,000	\$590,000	\$1,240,000	\$4,450,000	\$3,801,052
Net Value	\$182,500	-\$222,500	\$1,240,000	\$1,200,000	\$913,655
Non risk-adjusted ROI	32%				
Payback Period	within 24 months				
NPV Discount Rate	10%				

Source: Giga Research, a wholly owned subsidiary of Forrester Research, Inc.

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

	Year 1	Year 2	Year 3	Total Cash Flow	NPV
ThoughtWorks cost	\$2,478,125	\$826,042	\$0	\$3,304,167	\$2,935,520
Benefits attributable to ThoughtWorks	\$2,611,267	\$588,033	\$1,235,867	\$4,435,167	\$3,788,382
Net Value	\$133,142	-\$238,008	\$1,235,867	\$1,131,000	\$852,862
Risk Adjusted ROI	29%				
Payback Period	within 24 months				
NPV Discount Rate	10%				

Source: Giga Research, a wholly owned subsidiary of Forrester Research, Inc.

For our composite organization, the risk-adjusted three-year ROI was 29 percent. When 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 already been taken into consideration and quantified.

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 other agile development solution.

Summary Conclusions

When an organization considers a capital investment, it must balance the potential return against the potential risk or uncertainty that that investment creates. 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 in order 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 12 percent expected returns to be justified. Forrester finds that IT expenditures often require an expected return of two times this rate, or about 20 percent, to be considered. The organizations interviewed by Forrester all showed actual or expected returns on their investments in ThoughtWorks that ranged from 29 percent to 64 percent on a risk-adjusted basis and from 31 percent to 66 percent on a non risk-adjusted basis. It is clear that these companies found an expected return, even on a risk-adjusted basis, which exceeds the standard hurdle rate for technology investments¹.

While agile development is by no means an adequate solution for all projects, findings from this report indicate that there are a number of different cases where agile development can result in a significant advantage in terms of (1) driving efficiency into the application development process and (2) increasing the time to benefits by reducing errors and changes brought about by unforeseen changes in business requirements. Using a subset of the results from the interviewed organizations, Forrester projects that a composite organization facing some of the same business and IT pressures will likewise achieve an ROI greater than most standard IT hurdle rates, and such an investment will pay back its investment in a period of between 13 and 15 months of use.

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.

¹ Comparisons to hurdle rates are often done using non risk-adjusted estimates, because the setting of the hurdle rate assumes the inherent risks to the investment and its benefits.

Findings and Analysis — Composite Organization

Description of Composite Organization

This section illustrates how an organization may go about constructing an ROI analysis for engaging with ThoughtWorks for agile development. This model was created as a result of discussions with several ThoughtWorks customers to determine the underlying costs and benefits of engaging with ThoughtWorks for agile development. Data contained within this model is based on information received from each of the interview participants within the study and represents a composite data set to populate the model. Since the sample size was limited, data and the financial ROI should not in any way be seen as validation of the potential return that a given organization may achieve from the use of ThoughtWorks. Organizations must use their own data to determine their own potential return.

The ThoughtWorks model is based on a core set of assumptions regarding the representative organization. In order to build these assumptions, Forrester has taken characteristics from each of the companies interviewed to build a composite organization.

The composite organization and sample project have the following characteristics:

- The organization is a Global 1000 regional financial services institution based primarily in the United States. The organization has roughly \$4 billion in annual sales and has a total employee count of 30,000 worldwide. These estimates coincide with characteristics of interviewed customers. The interviewed customers had annual revenue between 1 billion and 20 billion dollars and between 15,000 and 60,000 employees.
- The organization has a centrally located IT development and support staff. It currently uses external consultants for a significant portion of its development effort, in part because of recent reductions in the size of the development staff.
- For the sample project, the company needed to combine a number of legacy customer support applications coupled with added functionality made possible by new development into a single environment. The company viewed the portfolio of legacy applications as costly for IT to support, constraining the productivity of customer support personnel, and limiting in flexibility related to future functionality. The new effort required both distributed application development and integration with existing applications. It would primarily be used by internal staff, and would access internal and potentially external databases.
- The organization considered the new development project to be complex since it impacted many different technologies and users as well as requiring consolidation of a number of legacy applications. In addition, the organization wanted to develop the new application on J2EE, enabling future expansion but adding to the complexity of the platform compared to previous internally built projects. The organization had limited experience with next generation distributed technologies (service oriented architectures based on Java and .NET) architecture and development.
- The application was assumed to be rolled out over a period of two years with the majority of functionality (i.e., 60 percent or more) delivered in the first year.
- The organization had a choice whether to develop the solution in-house using a traditional consultancy for development support or to have ThoughtWorks take on most of the development work.
- The organization also saw the engagement with ThoughtWorks as a test of an agile methodology. If successful, components of agile methodologies could be applied on subsequent internally driven application development projects.

- The project will be measured on a three-year investment life cycle.

Based on these assumptions, it is possible to construct a financial model that examines the costs and benefits of moving forward with a ThoughtWorks solution.

Costs of the ThoughtWorks Contribution

The cost of ThoughtWorks consulting fees is a part of the overall cost of the project. Thus, it is necessary to first describe the specific cost structure around the individual project. For the purpose of this analysis, we make the following assumptions around the cost of the project and the cost of ThoughtWorks’ contribution:

- The project has a two-year cost projection of an estimated \$5 million. This includes the cost of internal and external staff, training, hardware and software improvements. The cost of the project is accrued into the first two years with 75 percent in the first year and 25 percent in the second year. As a result, the total cost allocation in year one is \$3.75 million and in year two \$1.25 million. This includes the costs attributed to ThoughtWorks’ services. This estimate is based upon interviewed customers that stated that the overall cost of the project involving ThoughtWorks was between \$1 million and \$6 million.
- The ThoughtWorks cost component was estimated to be 65 percent of the overall cost of the project. This includes the billable cost of ThoughtWorks staff as well as the indirect costs of planning for and managing of the ThoughtWorks relationship. Table 1 illustrates the ThoughtWorks and non-ThoughtWorks cost components of the project. We assume a 10 percent discount rate on the cost of capital for the representative organization.

Table 3: Overall Project Cost — ThoughtWorks vs. Internal Project Cost

	Year 1	Year 2	Year 3	Total	NPV
ThoughtWorks Cost	\$2,437,500	\$812,500	\$ -	\$3,250,000	\$2,887,397
Internal Cost	\$1,312,500	\$437,500	\$ -	\$1,750,000	\$1,554,752
Total Project Cost	\$3,750,000	\$1,250,000		\$5,000,000	\$4,442,149

Source: Giga Research, a wholly owned subsidiary of Forrester Research, Inc.

For the purpose of this analysis, we assume that the ThoughtWorks cost will be used as a basis for the investment in the ROI calculation. Forrester understands that ThoughtWorks’ contribution toward overall project cost will vary by organization. However, this model should be used as a starting point for organizations that are building their own justification model.

Benefits and Savings of Engaging With ThoughtWorks Agile Development

In speaking with customers, Forrester encountered several common benefits, in two general categories. First, ThoughtWorks teams drove efficiency within the customer’s IT shop by minimizing the potential that unforeseen changes or errors would increase in overall project cost. In addition, moving critical functionality to the start of the project had the effect of increasing the speed with which benefits were achieved. This second benefit can potentially impact areas outside of IT since benefits attributable to the entire organization will be realized sooner.

IT project efficiency: Organizations stated that even though their initial impression was that the ThoughtWorks component would come in at a higher initial cost than existing alternatives (e.g., in-house development, previously employed consultants), the efficiency created by the ThoughtWorks engagement resulted in lower overall cost. This was primarily a result of two factors. First, the quality of the ThoughtWorks employees and

their existing knowledge base reduced the amount of development errors and downstream changes compared to previous development projects. This in turn increased the productivity of the customer’s development staff and allowed the organization to devote fewer internal resources over the life of the project.

Several customers cited percent reductions in cost and errors between a ThoughtWorks project over those of a similar sized project that had not been driven by ThoughtWorks. While it is difficult to attribute a common cost savings to multiple projects, it is possible to provide a range of different cost savings that clients observed or estimated. Taking one set of client metrics as an example, we can see potential areas of improvement around project costs. Table 4 illustrates the percent reduction in defects and delay comparing a project deployed prior to ThoughtWorks to a project driven by ThoughtWorks.

Table 4: ThoughtWorks Contribution to IT Efficiency

Improved Efficiency	% Reduction
Total defects	63%
Critical defects	79%
Effort	62%
Duration	69%

Source: Giga Research, a wholly owned subsidiary of Forrester Research, Inc.

Using the assumption that a ThoughtWorks engagement leads to a reduced effort of 62 percent, we can estimate the cost differential between the ThoughtWorks and non-ThoughtWorks solution. Using the sample \$5 million engagement (net present value of \$4.4 million), as stated above, the cost of a comparatively complex project would be roughly a net present value of \$7 million, 57% more expensive than the ThoughtWorks solution. Table 5 illustrates these savings. For this analysis, it is assumed that the direct cost per hour per resource is less for the alternative; the fact that the organization would have to devote more resources to the project increases its overall cost compared to the ThoughtWorks solution.

Table 5: Project Efficiency Savings With ThoughtWorks

	Year 1	Year 2	Year 3	Total	NPV
Cost with ThoughtWorks	\$3,750,000	\$1,250,000	\$0	\$5,000,000	\$4,442,149
Cost with alternative	\$4,370,000	\$2,490,000	\$1,240,000	\$8,100,000	\$6,962,209
Savings from ThoughtWorks	\$620,000	\$1,240,000	\$1,240,000	\$3,100,000	\$2,520,060

Source: Giga Research, a wholly owned subsidiary of Forrester Research, Inc.

Time to benefit: In addition to driving IT efficiency, ThoughtWorks’ use of agile development speeds up the time to implementation and therefore allows the organization to realize benefits sooner. Organizations indicated several factors that led to this benefit. First, ThoughtWorks’ ability to understand the business needs upfront and help their clients to prioritize specific functionality allowed key benefits to be realized early. This created further buy-in from the business side and reduced the risk of scope creep. In addition, ThoughtWorks’ experienced staff were adept at handling difficult projects, thus reducing the risk that project benefits may not be achieved.

For the purpose of this analysis, the following steps were used to determine the magnitude of this benefit for the representative organization. First, it is necessary to understand the amount of benefits created as a result of the overall project. Table 6 illustrates the percent breakdown of benefits resulting from the overall customer support project.

Table 6: Percent Breakdown of Benefits for Overall Development Project

Benefits of application	
Reduced IT support costs	40%
Improved end-user productivity	50%
Flexibility to address future needs	10%
Total	100%

Source: Giga Research, a wholly owned subsidiary of Forrester Research, Inc.

For this analysis, Forrester assumes that the organization expects to achieve roughly a 34 percent return on the overall project. So for example, if the cost of the overall project was estimated to be \$5 million, the benefits would equate to roughly \$6.7 million ($(6.7-5)/5 = 34\%$). Table 7 illustrates the cash flow that is achieved from the overall project.

Table 7: Project Cash Flow With ThoughtWorks

With ThoughtWorks	Year 1	Year 2	Year 3	Total	NPV
Cost of project	\$3,750,000	\$1,250,000	\$0	\$5,000,000	\$4,442,149
Benefits received	\$4,000,000	\$1,350,000	\$1,350,000	\$6,700,000	\$5,766,341
Cash flow	\$250,000	\$100,000	\$1,350,000	\$1,700,000	\$1,324,192

Source: Giga Research, a wholly owned subsidiary of Forrester Research, Inc.

We therefore assume that roughly \$4 million are realized in benefits in the first year of analysis, and \$1.3 million in subsequent years.

Conversely, if the representative organization chose not to engage with ThoughtWorks, the time to realize benefits would be lengthened, therefore reducing the total amount of benefits achieved within the three-year time frame and extending the payback for the project.

Several organizations specifically noted that time to benefit was a key determinant in choosing ThoughtWorks. A few indicated that through the presence of ThoughtWorks, the project was able to move their time to benefits from six to 18 months compared to previous non ThoughtWorks projects. If we make the assumption for the representative organization that the benefits will be delayed six months using an alternative, similar sized project, the cash flow for that project appears in Table 8.

Table 8: Project Cash Flow With Alternative Development Solution

With Alternative	Year 1	Year 2	Year 3	Total	NPV
Cost of project	\$4,370,000	\$2,490,000	\$1,240,000	\$8,100,000	\$6,962,209
Benefits received	\$2,000,000	\$2,000,000	\$1,350,000	\$5,350,000	\$4,485,349
Cash flow	-\$2,370,000	-\$490,000	\$110,000	-\$2,750,000	-\$2,476,860

Source: Giga Research, a wholly owned subsidiary of Forrester Research, Inc.

The decrease in benefits as well as increase in cost from reduction in efficiency causes this project to realize a negative return on its investment. Benefits are created, but they are less than in the ThoughtWorks case and costs are higher due in part to the reduced efficiency as compared to the ThoughtWorks project.

The resulting net present value savings for both IT efficiency and time-to-market savings equate to \$3,801,052 over three years, which is the difference in the cash flow between Table 7 and Table 8.

Flexibility Associated With ThoughtWorks Agile Development

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.

The value of flexibility is clearly unique to each organization, and the willingness of each organization to measure the value of flexibility varies considerably from organization to organization. For the purpose of this analysis, we have assumed that the composite organization sees the value of flexibility in the ways described above.

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 the 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.

An example of the flexibility value that can be achieved is examining the subsequent impact that ThoughtWorks and agile development, in general, has on future projects. First, several clients mentioned that they hope to leverage the experience learned by engaging with ThoughtWorks for subsequent projects. The ability to leverage has a value into the future since the organization can further drive efficiencies within its processes. In addition, one organization noted that several of the techniques around project management can be translated to subsequent projects.

In both of these examples, the flexibility value was created as a result of reuse of both ThoughtWorks' and agile development practices on subsequent projects. While the value of flexibility does represent part of the overall value proposition of ThoughtWorks, Forrester chose not to place a specific value on the amount of flexibility created for the representative organization since most organizations had only engaged ThoughtWorks for a single project and, as a result, it was too early to tell the long-term impact of ThoughtWorks and agile on subsequent projects. As organizations begin to use agile and ThoughtWorks' best practices on subsequent projects, the flexibility value will be realized.

Risks Associated With Estimates of Costs and Benefits

Risk-adjusted and non risk-adjusted ROI are both discussed in this study. Risk assessments provide a range of possible outcomes, based on the risks associated with IT projects in general and specific risks relative to moving

toward a new technology solution. In this study, Forrester discovered that engaging with ThoughtWorks was a relatively low-to-medium risk endeavor, as expressed by the interviewed organizations as compared to similar past projects that were undertaken without ThoughtWorks assistance.

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 were considered in this report:

- Lack of organizational buy-in to measure and track specific benefits created by engaging with ThoughtWorks
- Lack of sufficiently trained internal staff to interact and meet the requirements of a ThoughtWorks-driven project
- Failure to reduce, transfer or redeploy IT support and business unit headcount made redundant in a ThoughtWorks driven project
- Changing external market conditions that may decrease time-to-market benefit estimates

The following risks associated with distributed development projects were considered in this report:

1. There is a risk that costs will be greater than anticipated. Experience indicates that implementing projects across two or more sites will be a significant risk factor for cost. Large teams add even more risk.
2. There is a risk that benefits will not be realized as expected due to the distributed nature of the project.

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 composite organization, Forrester applied low-to-moderate risk factors to each cost and benefit. As an example, we will show the risk calculation for the cost savings benefits of ThoughtWorks agile development.

Risk Calculation Example

Risks-to-benefits analyses consider all possible risks to each benefit. (Likewise, risks-to-costs analyses 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 benefits of \$3,801,052.

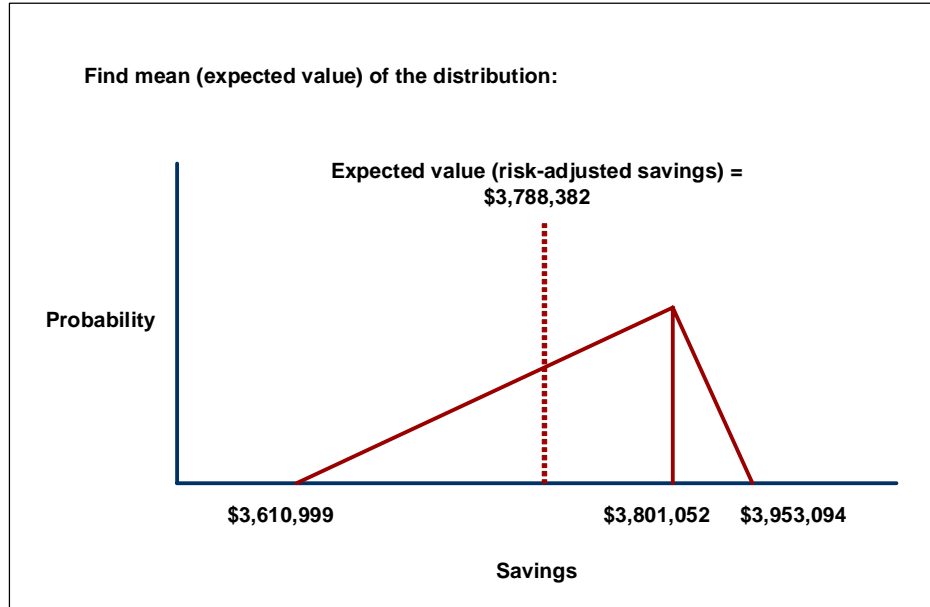
For this savings category, the risks-to-savings ranged from:

- Low estimate of 95 percent of the \$3,801,052 (\$190,053)
- High estimate of 104 percent (\$3,953,094)

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 \$3,788,382 ($\$3,610,999 + 3,801,052 + \$3,953,094 = \$11,365,145 / 3 = \$3,788,382$).

Figure 1 illustrates the concept of triangular distribution, and the vertical line in the center represents the expected value of \$3,788,382. In our composite organization, all costs and benefits were adjusted for risk.

Figure 1: Risk Adjustment Calculation Example



Source: Giga Research, a wholly owned subsidiary of Forrester Research, Inc.

For the composite organization, the following values were used in the risk-adjustment calculations (see Appendix for further information about the measurement of risk within the TEI model).

Risks to Costs:

- Best Case values are 95 percent of the non-risk-adjusted cost estimates.
- Worst Case values are 110 percent of non-risk-adjusted cost estimates.

Risks to Benefits:

- Best Case values are 95 percent of the non-risk-adjusted benefit estimates.
- Worst Case values are 104 percent of non-risk-adjusted benefit estimates.

Conclusions

This report is meant to provide the reader with a framework in examining the costs and benefits of engaging with ThoughtWorks using agile development. Data derived from individual customer interviews corroborates Forrester Research findings around the potential for agile development to drive further cost efficiencies within a given environment. The core tenets of agile development — short iterative cycles, empowered teams, constant reprioritization of requirements and strong business participation — all lead to increased benefits. Delivering core requirements in shorter time frames leads to increased financial benefits. Increasing team efficiency reduces both development and maintenance costs, and frees the development organization to address other projects. Each of these can be quantified using Forrester’s TEI model.

Not every project is a good fit for agile development, but ThoughtWorks has demonstrated that applying agile processes and strong project management can clearly be a benefit to high-risk projects. Its emphasis on hiring and retaining highly skilled staff is also a key success factor.

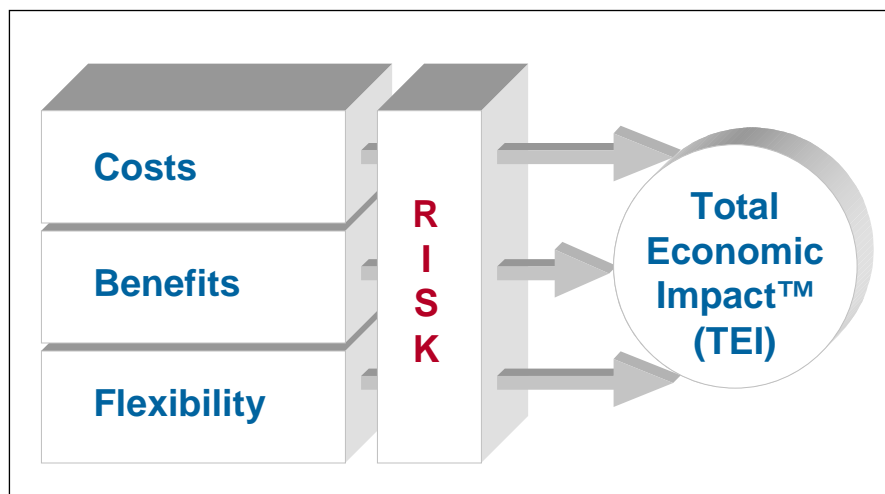
Appendix A: Total Economic Impact™ Primer

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 2: TEI Conceptual Diagram



Source: Giga Research, a wholly owned subsidiary of 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 — 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.

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