A Forrester Total Economic Impact™
Study Commissioned By Mainstream Technologies
November 2017

The Total Economic Impact™ Of Mainstream Technologies' Custom Software Development

Cost Savings And Business Benefits Enabled By Mainstream's Custom Software

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ABOUT FORRESTER CONSULTING

Forrester Consulting provides independent and objective research-based consulting to help leaders succeed in their organizations. Ranging in scope from a short strategy session to custom projects, Forrester's Consulting services connect you directly with research analysts who apply expert insight to your specific business challenges. For more information, visit forrester.com/consulting.

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Key Benefits

Legacy system cost avoidance:
$1.7 million

Recaptured employee productivity over five years:
79,800 hours

"Mainstream is excellent at digging in to understand the intent of the programs. If you don't understand the business process, you really don't know if the program is working correctly."

Operations administrator, government agency

Executive Summary

Mainstream Technologies provides custom software development solutions to help its customers design strategic technology systems and business processes. Mainstream commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential return on investment (ROI) organizations may realize by engaging with Mainstream for a custom software development project. The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of a similar custom project within their own organizations.

To better understand the benefits, costs, and risks associated with this investment, Forrester interviewed one government agency that engaged with Mainstream to build a modern version of its database and redesign its internal processes to improve productivity and efficiency.

This system replaced the agency's outsourced legacy mainframe, which over the past several years had dramatically increased in cost. The system served as the central liaison for data used by 30-plus other agencies and over 100,000 government employees nationwide. Due to poorly designed and documented architecture, system downtime and errors were common issues for system users both within the agency and at other external government entities, who relied on consistent access to this critical data to support their key services. Internally, the agency's business processes were inefficient, manual, and heavily reliant on paper, and the agency also faced significant challenges in both hiring and retaining skilled COBOL (common business-oriented language) programmers due to a small, aging pool of qualified developers. The agency had already made one attempt to rebuild the system, but the other vendor the agency hired ultimately failed and no progress was made.

This agency turned to Mainstream to carefully analyze the architecture of its current system, observe its business processes, and interview stakeholders from across the process chain. Mainstream then developed a new system architecture that carefully replaced the database with no interruption in service to users. Mainstream simultaneously redesigned internal processes to improve productivity, and is engaged with the agency for three more years to improve many other processes agency-wide.

Key Findings

Quantified benefits. The interviewed organization experienced the following five-year risk-adjusted present value (PV) quantified benefits:

- **Reduced legacy system costs saved $1,732,593.** The government agency avoided significant increasing outsourced costs to support its legacy mainframe. The agency also eliminated a continuous form printer and decreased incremental printing costs by digitizing its processes.
- **Improved business process efficiency recaptured $1,048,325 in employee productivity.** The organization digitized and streamlined a key process to reduce the time to complete 40,000 annual manual entries by 15 minutes per record. Through its continued engagement with Mainstream over the next three years, the agency expects to extend similar savings across several other internal processes.

ROI
48%

Benefits PV
$3.5 million

NPV
$1.1 million

Payback
3 years

› **Reduced labor costs for hiring and overtime due to a larger applicant pool of C# developers saved $687,504 over five years.** With a larger pool of applicants, the agency could identify and place applicants faster in order to reduce internal overtime and save recruiting costs. This larger applicant pool also enabled the agency to bring in less experienced employees at a lower pay rate to perform the same work, reducing long-term human resources overhead.

Unquantified benefits for the agency. The interviewed organization expects the following benefits, which are not quantified for this study:

› **Reduced system downtime and errors resulting from excess points of failure will improve productivity for agency employees.**

› **Improved database security reduces the risk of breaches.**

› **Simplified web connectivity will enable faster integration with new or changing systems at other agencies.**

Unquantified benefits for other government entities. This project enables benefits for other government entities, ultimately reducing taxpayer costs. These are discussed, but not quantified in this study:

› **Reduced downtime and errors will improve productivity and outcomes for other taxpayer-funded entities and their employees.**

› **Cost savings for other government agencies were achieved by reduced per-transaction costs on millions of annual transactions.**

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

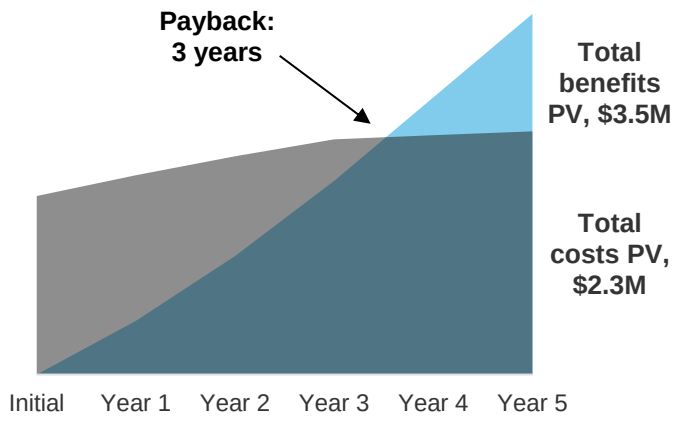
› **Custom software development costs of $2,072,462.**

› **Internal labor costs of $230,367 for due diligence, project management, testing, and systems administration.**

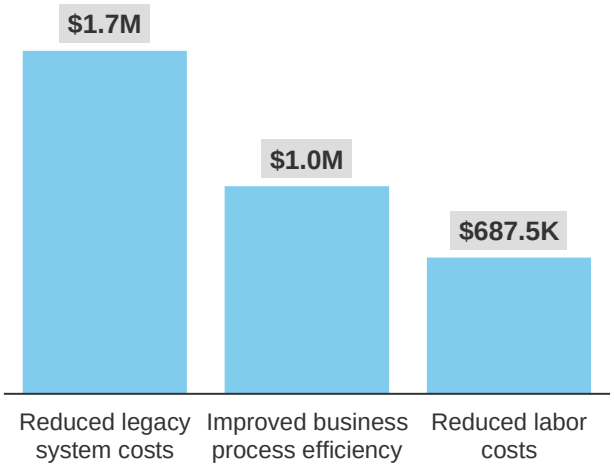
› **Hardware and software upgrades valued at $35,652.**

Forrester's interviews with an existing customer and subsequent financial analysis found that the interviewed organization experienced benefits of $3,468,423 over five years versus costs of $2,338,480, adding up to a net present value (NPV) of $1,129,943 and an ROI of 48%.

Financial Summary



Benefits (Five-Year)



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TEI Framework And Methodology

From the information provided in the interview, Forrester has constructed a Total Economic Impact™ (TEI) framework for those organizations considering implementing Mainstream Technologies' Custom Software Development.

The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that affect the investment decision. Forrester took a multistep approach to evaluate the impact that Mainstream Technologies' Custom Software Development can have on an organization:

The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

DUE DILIGENCE
Interviewed Mainstream Technologies stakeholders and Forrester analysts to gather data relative to Custom Software Development.

CUSTOMER INTERVIEW
Interviewed one organization using custom developed software to obtain data with respect to costs, benefits, and risks.

FINANCIAL MODEL FRAMEWORK
Constructed a financial model representative of the interview using the TEI methodology and risk-adjusted the financial model based on issues and concerns of the interviewed organization.

CASE STUDY
Employed four fundamental elements of TEI in modeling Mainstream Technologies' Custom Software Development's impact: benefits, costs, flexibility, and risks. Given the increasing sophistication that enterprises have regarding ROI analyses related to IT investments, Forrester's TEI methodology serves to provide a complete picture of the total economic impact of purchase decisions. Please see Appendix A for additional information on the TEI methodology.

The Custom Software Development Customer Journey

BEFORE AND AFTER THE CUSTOM SOFTWARE DEVELOPMENT INVESTMENT

Interviewed Organization

For this study, Forrester interviewed a government agency that worked with Mainstream Technologies to undergo a major custom software development project. This agency provides, among other services, a centralized database that connects the information systems of 30-plus other agencies and ultimately over 100,000 government employees. The data flowing through this system is sensitive and critical with a constant, direct impact on the operations of essential government services; affecting citizens nationwide from health and human services to public safety, and from due process to administrative operations. Approximately 65 employees at this agency handle database administration, including significant manual data entry and verification efforts.

Key Challenges

This government agency faced key cost, productivity, functionality, and personnel challenges with its existing mainframe and processes.

- **Legacy mainframe costs were increasing dramatically year over year.** The agency outsourced the storage and management of its database on a shared mainframe for approximately 30 years. Over the past several years, other organizations ceased their use of this outdated system, thereby putting more and more of the cost burden onto the agency. Costs had increased to over $32,500 per month, and were projected to continue to rise over 10% annually. This agency recognized it had no choice but to find a new solution.
- **The system was built in a poorly structured and inadequately documented COBOL code over a period of 30 years, leading to lost user productivity and major challenges for developers.** Developers found the code extremely difficult to work with, as the system became a "Frankenstein" of poorly documented work built up over 30 years. Any necessary changes were laborious and could have major unintended consequences. Not only was the code difficult to understand, as it often did not work as expected, but it caused time-consuming manual processes for the end users themselves to administer key services. As the operations administrator described it: "There are three ways that things work: the way the manual says it works, the way you think it works, and the way it actually works. One of the challenges is that this code is so old and the system so complex that we've struggled to discover how it really works."
- **The legacy system experienced significant downtime, had many points of error, and raised security concerns.** The system routinely would go down for approximately 1 hour almost every Sunday for maintenance, constantly disrupting critical end user work. Data was routed through extra, unnecessary steps in the mainframe that led to a high error rate. And while no breaches were known to have occurred, the COBOL system was not built with modern expectations for security and led to concerns about the potential for future breaches.

> "[Before Mainstream], data records spent more time sitting in somebody's inbox than it actually did to do the work. If the data was not yet entered and reviewed by a second person, it was in a suspended status so [our end users] didn't have access to it. The longer it stayed in that suspended status, the worse off we were."
>
> *Operations administrator, government agency*

> "[Our old system] would be out of service for almost every Sunday morning to do updates or maintenance."
>
> *Operations administrator, government agency*

> "We first worked with [another vendor] to start this effort, who was just converting the existing COBOL code. That company failed miserably, we didn't even get to first base."
>
> *Operations administrator, government agency*

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- **The agency struggled to identify and hire qualified COBOL programmers when faced with turnover.** New developers seldom learn COBOL programing, so it was expensive and time consuming to identify candidate hires. Those who were experienced in COBOL programming were often senior programmers, which drove increases in human resource overhead.
- **The agency's first attempt to move the database off the legacy mainframe was a failure.** The contracted vendor did not work to understand the processes behind the system, and simply sought to recreate the same system on different hardware. This effort would have only addressed the agency's mainframe costs and could not have aided in productivity or personnel changes, but ultimately, the vendor was unable to even replicate the system due to the poor documentation and architecture.

> "There are not many COBOL programmers out there anymore, and the ones we have are close to retirement. When they leave us, it will be very difficult to replace those folks, if not impossible."
>
> *Operations administrator, government agency*

Solution Requirements

The interviewed organization searched for a vendor who could:

- Carefully analyze the current system to understand how the processes worked and how the data connected across all 30-plus agencies, despite the poor architecture and documentation.
- Interview and observe the agency's employees to design a new database architecture and processes to drive improved productivity.
- Rebuild the database with a more modern code base, which would enable easier hiring of qualified programmers at a lower cost.
- Launch the new database without disrupting the work of the 30-plus other agencies and over 100,000 government employees who rely on the critical, sensitive information in real time. An outage or data inaccuracy could cause significant negative effects for American citizens.

> "Mainstream came highly regarded and they've been extremely good at digging in to understand what the intent of the programs truly are. There's a huge task to understand this business model that we've got, and if you don't understand the business process, you really don't know if the program is functioning correctly or not."
>
> *Operations administrator, government agency*

Key Results

Interviews with the government agency revealed that key results from its custom software development investment with Mainstream include:

- **Mainstream successfully rearchitected the agency's systems and launched the database with only 30 minutes of downtime and no adverse impacts on end users.** Where a previous vendor had failed, Mainstream was able to build out the new system, redesign processes, and connect with all 30-plus other agencies with no reduction in service. This was extremely important because significant downtime could not be tolerated as over 100,000 end users statewide rely on the critical, sensitive data that flows through the agency's system. The operations administrator described that "service was interrupted for less than 30 minutes when we flipped from one system to the other." He continued that this launch "was one of the rare occasions when it was virtually seamless to the end user."

> "We were providing continual service to our customers, and it was very smooth when we switched over to the new system. I've been here for nearly 35 years and worked on some big projects, and this was one of the rare occasions when it actually was virtually seamless to the end user."
>
> *Operations administrator, government agency*

- **Reimagined business processes significantly improved employee productivity and outcomes.** Previously, the agency processed over 40,000 annual record entries which involved one employee completing a cumbersome data entry process, printing, and putting it in a stack, while another employee would have to verify the record by using the printed copy. Mainstream digitized the process and created a new web form with an improved user interface for the data entry. This saved 15 minutes of work in employee productivity per record via reduced entry time and reduced verification effort. Additionally, the new process increased the speed at which the agency could process and verify records, thereby enabling end users at other government agencies to make faster and more informed decisions based on this critical data. Over the next three years, this agency will be actively engaged with Mainstream for the purpose of continuing to implement process change improvements and significant productivity enhancements.
- **Reduced hiring effort and costs achieved by switching to C# from the COBOL code base.** With a much larger pool of applicants qualified in C#, the agency can hire new employees more quickly, reducing recruiting expenses and overtime costs for current employees. Programmers qualified in C#, rather than COBOL, can be found with significantly lower salary expectations, reducing the overall agency overhead for human resources.
- **Improved system architecture enabled tightened data security, diminished downtime, reduced points of failure, and simplified integration with other systems.** The agency expects little to no downtime with its new system, as opposed to the 1 hour per week deficiency of the old mainframe. The new code base is built with modern security in mind, and routes data more efficiently between the other agencies' databases. As changes are made in the future, it will be easier to update existing integrations with other systems or to integrate with a new database, thanks to the simplified web service.
- **Cost savings passed on to other government entities through improved productivity and reduced transaction costs.** The agency reduced the per-transaction fees it charged other agencies to access data through its database; affecting more than 2 million transactions per year. By reducing system downtime, the agency also enabled productivity improvements for other agencies and the 100,000-plus employees who rely on the database throughout the day.

"We found processes that just weren't working the way we thought, so it allowed us to make them a lot more efficient. The end user thought that the program did one thing, the programmer thought it did another, and in reality, Mainstream found it was actually doing a third thing."

Operations administrator, government agency

"It will be easier to recruit folks that have the knowledge that we need [for the new system]."

Operations administrator, government agency

"We recouped some costs for local users and passed on savings to other government agencies that access our system. We're hopeful that we may be able to pass on more in the future."

Operations administrator, government agency

Financial Analysis

QUANTIFIED BENEFIT AND COST DATA

Total Benefits

REF.	BENEFIT	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL	PRESENT VALUE
Atr	Reduced legacy system costs	$378,290	$418,380	$462,175	$510,046	$559,359	$2,328,250	$1,732,593
Btr	Improved business process efficiency	$86,678	$186,358	$301,743	$434,712	$470,100	$1,479,590	$1,048,325
Ctr	Reduced labor costs	$102,420	$148,809	$196,418	$231,166	$267,268	$946,079	$687,504
	Total benefits (risk-adjusted)	$567,388	$753,546	$960,335	$1,175,923	$1,296,726	$4,753,919	$3,468,423

The table above shows the total of all benefits across the areas listed below, as well as present values (PVs) discounted at 10%. Over five years, the interviewed organization expects risk-adjusted total benefits to be a PV of $3,468,423.

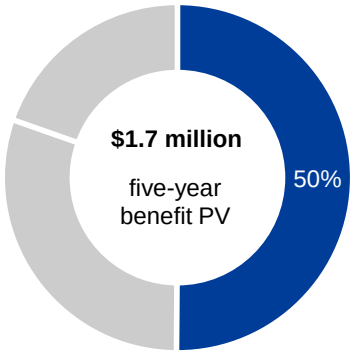
Reduced Legacy System Costs

The government agency interviewed for this study relied on a database system built 30 years ago that was housed on an outsourced mainframe. For decades, the cost of managing this mainframe was shared by many organizations, making it affordable for all involved. However, in recent years many organizations have abandoned the aging mainframe in favor of newer technologies, and the cost of the mainframe has had to be divided by fewer organizations. These costs reached $32,500 per month by 2017, and were projected to continue to rise as more organizations abandoned the system. The interviewed government agency recognized that it could not continue to bear this significant expense, and needed to act soon to avoid these ever-increasing costs. It turned to Mainstream to build a new version of this database and streamline its internal procedures in the process.

- The new database is housed in an on-premises environment already owned by the interviewed agency, enabling significant cost savings with no additional fixed costs or administration.
- Mainstream converted one manual business process to a paperless system, enabling the agency to eliminate a continuous form printer and avoid the associated maintenance, ink, paper, filing, and storage costs.
- In planned process improvements over the next three years, the agency expects to further reduce their reliance on paper to achieve cost savings and reduce its environmental impact. As the operations manager described, “In this first phase, we’ve eliminated some printing costs, and in future phases, we’ll continue to eliminate paper.”

Forrester has modeled this benefit using the following calculations and assumptions:

- The agency avoids monthly outsourced maintenance costs of $32,500, which are calculated with a conservative 10% annual increase to reflect the continually rising fees.
- The agency eliminated a continuous form printer, avoiding $5,000 in annual maintenance costs.



Reduced legacy system costs: **50%** of total benefits

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- The agency eliminated 80,000 pages of printing in Year 1 by digitizing one of its internal processes. It plans to continue to go paperless as it transforms other business processes in the next three years. Forrester has conservatively included the digitizing of one more process per year over the next three years, each assumed to be of equivalent size.

Forrester realizes that these cost saving projections may vary from what the agency will actually experience. Specific risk considerations include:

- The agency may have been charged higher or lower monthly rates than anticipated for the outsourced mainframe. Forrester believes that the calculation's 10% annual increase is conservative and real cost savings would likely have been even more significant.
- The quantity of revised internal processes and the amount of paper saved for each process could vary significantly. Although the variation for this aspect of cost savings could be either much larger or smaller than included, a minimal risk adjustment is included as the actual monetary value of print costs is dwarfed by mainframe cost savings.
- The government agency may discover that it needs to dedicate additional hardware or internal resources to the system, and recognizes that system maintenance is now squarely in its hands. As described by the operations manager: "In the past, our vendor was managing some of our data and processes, but now that responsibility is on us, and it's somewhat of a political risk. If something breaks in the middle of the night, we can't complain to our vendor."

To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a five-year risk-adjusted total PV of $1,732,593.

Impact risk is the risk that the business or technology needs of the organization may not be met by the investment, resulting in lower overall total benefits. The greater the uncertainty, the wider the potential range of outcomes for benefit estimates.

Reduced Legacy System Costs: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
A1	Cost avoidance of outsourced mainframe services	10% annual increase	$390,000	$429,000	$471,900	$519,090	$570,999
A2	Printing processes eliminated		1	2	3	4	4
A3	Annual records printed per process		80,000	80,000	80,000	80,000	80,000
A4	Printing costs avoided at 4 cents per page	A2*A3*$.04	$3,200	$6,400	$9,600	$12,800	$12,800
A5	Avoided maintenance for a continuous form printer		$5,000	$5,000	$5,000	$5,000	$5,000
At	Reduced legacy system costs	A1+A4+A5	$398,200	$440,400	$486,500	$536,890	$588,799
	Risk adjustment	↓5%					
Atr	**Reduced legacy system costs (risk-adjusted)**		**$378,290**	**$418,380**	**$462,175**	**$510,046**	**$559,359**

Improved Business Process Efficiency

The government agency partnered with Mainstream to rethink and redesign its internal business processes, which were an inefficient hodgepodge of steps accumulated over the decades that had never been carefully mapped out. As described during one interview, a two-step approach was required to "convert the code and the process the way it exists, but then in phase two, go back in and enhance that process." To understand the true nature of the processes and their end goals, "Mainstream met with the senior staff and spent time with the

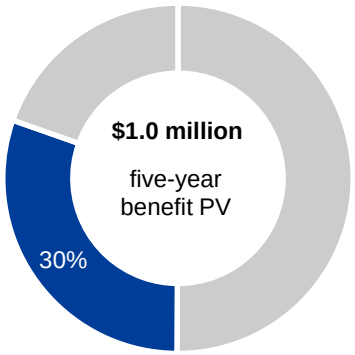
actual users of the system to understand what they do on a daily basis." Through this work, the government agency described that Mainstream "found things that just weren't working the way we thought they were and so, it allowed us to make those processes a lot more efficient."

- Mainstream has already digitized and streamlined one key business process. Previously, the agency processed 40,000 annual record entries which involved one employee completing a cumbersome data entry process, printing, and putting it in a stack, while another employee would have to verify the record using the printed copy. As described by the operations manager, "Mainstream converted the process into a web application with built in rules to make logical decisions based on the data that's entered or to offer suggestions to the data entry person for what should go into that particular field." This new system has a much more intuitive user interface for agency employees to key in data, saving significant time and effort.
- This new system also eliminated the paper process, and instead placed new records in a digital queue for verification. This process is easier for a second employee to complete, saving further time overall.
- The agency gained significant visibility into the newly digitized process as it can now accurately measure the number of records in the queue and track the amount of time it takes to enter and verify them.
- Ultimately, data is entered and verified faster, with less time spent in the queue. The end users at other agencies, who count on this information, have earlier access to it, enabling them to offer faster service with better data to their end constituents.
- For the next three years, Mainstream will continue to implement process change improvements and expects significant productivity enhancements across many additional processes as a result.
- The agency expects to integrate with new systems or update existing integrations annually as other organizations change their own systems. The new system's web service-based application program interfaces (APIs) enable faster and easier integration than previously possible.

To calculate this benefit, Forrester has modeled the following assumptions and risks:

- The agency has launched one process redesign and will conservatively launch at least one more per year for the next three years. While it is possible they may launch fewer, it is likely the actual number will be more than four rather than less.
- This first process involves manual input of 40,000 annual records with a 5% annual increase. Other processes are modeled with the same assumption. However, they will likely vary for each process.
- Fifteen minutes per manual entry is saved by the new process for employees. Other processes are assumed to have an equivalent time savings, but in reality, they will likely vary for each process.
- A conservative projection of three new or updated system integrations per year is included, yielding 40 hours of reduced labor per integration.
- The agency will not recapture all saved time in value-adding productivity. This model assumes a conservative 50% recapture rate.

The financial value of this benefit is projected to vary, as actual future process improvements and their benefits are unknown. To account for these risks, Forrester significantly adjusted this benefit downward by 25%, yielding a five-year risk-adjusted total PV of $1,048,325.



Improved business process efficiency: **30%** of total benefits

"With the newer program language and technology, it will be easier to make changes than in the past."

Operations administrator, government agency

"Mainstream met with the senior staff and spent time with the actual users of the system to understand what they do on a daily basis."

Operations administrator, government agency

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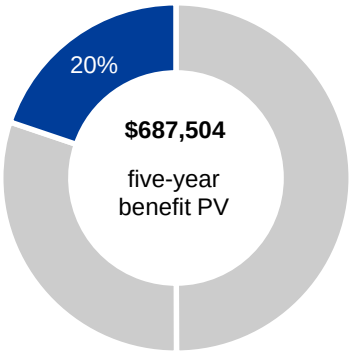
Improved Business Process Efficiency: Calculation Table							
REF.	**METRIC**	**CALC.**	**YEAR 1**	**YEAR 2**	**YEAR 3**	**YEAR 4**	**YEAR 5**
B1	Number of business processes streamlined		1	2	3	4	4
B2	Number of actions per process	5% annual increase	40,000	42,000	44,100	46,305	48,620
B3	Total number of actions	B1*B2	40,000	84,000	132,300	185,220	194,481
B4	Time saved per action (minutes)		15	15	15	15	15
B5	Hours saved for business process actions	B3*B4/60	10,000	21,000	33,075	46,305	48,620
B6	Total database integrations performed per year	3 per year	3	3	3	3	3
B7	Hours saved per integration with the new architecture's API		40	40	40	40	40
B8	Hours saved for integrations	B6*B7	120	120	120	120	120
B9	Total hours saved	B5+B8	10,120	21,120	33,195	46,425	48,740
B10	Percent recaptured	50%	5,060	10,560	16,598	23,213	24,370
B11	Amortized fully loaded salary	3% annual increase	$22.84	$23.53	$24.24	$24.97	$25.72
Bt	Improved business process efficiency	B10*B11	$115,570	$248,477	$402,323	$579,616	$626,800
	Risk adjustment	↓25%					
Btr	**Improved business process efficiency (risk-adjusted)**		**$86,678**	**$186,358**	**$301,743**	**$434,712**	**$470,100**

Reduced Labor Costs

As COBOL has fallen out of fashion with developers, it's become more difficult for the agency to find qualified employees when faced with turnover. As described by the operations manager: "There are not many COBOL programmers out there anymore, and the ones we have are close to retirement. When they leave us, it will be very difficult to replace those folks, if not impossible." As a result, it was both expensive and time-consuming to identify candidates, and those the agency found were often at senior levels, which drove increased human resource overhead. Rather than rebuild the COBOL system as other vendors proposed, Mainstream rearchitected the system using C# as it is a much more modern and commonly used language. This will enable easier and faster recruitment efforts, and the larger pool of C# developers allows the agency to employ less senior employees for equivalent work.

Forrester used the following approach to model this benefit:

- The agency is projected to experience a 20.4% annual rate of attrition, the average 2017 attrition rate for US government employees.
- The agency is projected to hire four new programmers per year, which is based on the average number of new hires made by this agency over the past five years, as shown in publicly available data.



Reduced labor costs: **20%** of total benefits

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- Using publicly available salary data for this government agency, Forrester calculated that C# developers could be hired for $17,700 less than their COBOL experienced peers.
- The agency can identify and place C# programmers more quickly; conservatively estimated at two months faster and increased by a rate of 10% annually as COBOL developers become even more rare.
- When current employees leave, and until a replacement is hired, other current employees must take on that work at an overtime hourly rate of 1.5x the average amortized salary of the agency's current employees.

Forrester realizes that the avoided costs for hiring and retaining employees may vary. Specific risk considerations include:

- The agency may experience a lower or higher rate of turnover, or it may hire a different number of employees than in their previous experiences, or as compared to national averages.
- The time savings to find a C# new hire versus a COBOL new hire may be lower or higher than projected.
- The gap between average pay for C# programmers and COBOL programmers may be lower than estimated based on present data.
- Not all aspects of current employee work may be maintained when turnover occurs, leading to lower than projected overtime costs.

To account for these risks, Forrester adjusted this benefit downward by 25%, yielding a five-year risk-adjusted total PV of $687,504.

Reduced Labor Costs: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
C1	Average attrition rate for government employees	Source: Bureau of Labor Statistics	20.4%	20.4%	20.4%	20.4%	20.4%
C2	Number of newly hired programmers with C# knowledge instead of COBOL	Source: agency's hiring history for past five years	4	4	4	4	4
C3	Total number of programmers with C# knowledge instead of COBOL	$C3_{PY}$*(1-C1)+C2	4	7	10	12	14
C4	Annual per-employee salary savings for C# versus COBOL programmers	Source: current range of agency's pay levels	$17,700	$17,700	$17,700	$17,700	$17,700
C5	Annual salary savings for C# programmers	C3*C4	$70,800	$123,900	$177,000	$212,400	$247,800
C6	Reduced number of days to replace employees with C# than COBOL	10% longer to replace per year	60	66	73	80	88
C7	Average employee overtime rate	150% of amortized salary	$34.25	$35.28	$36.34	$37.43	$38.55
C8	Avoided overtime due to faster placement of new employees	C6*C7 *8 hrs*4 hires	$65,760	$74,511	$84,890	$95,821	$108,557
Ct	Reduced labor costs	C5+C8	$136,560	$198,411	$261,890	$308,221	$356,357
	Risk adjustment	↓25%					
Ctr	**Reduced labor costs (risk-adjusted)**		**$102,420**	**$148,809**	**$196,418**	**$231,166**	**$267,268**

Unquantified Benefits To The Agency

The government agency experienced benefits which could not yet be quantified for this study, but were important nonetheless:

- **Reduced system downtime and errors resulting from excess points of failure improves productivity for agency employees.** The legacy system was taken down almost every Sunday for about an hour, and experienced intermittent downtime and unexpected failures due to its poor architecture.
- **Simplified web connectivity will enable faster and cheaper integration with new or changing systems.** As other agencies adopt new systems and change their needs, this agency's developers will be able to build the integration more quickly and with less labor cost due to improved web service APIs.
- **Improved database security reduces the risk of breaches.** The previous system was built 30 years ago, and did not take into account the significant security challenges modern systems face. Mainstream followed careful processes to ensure the system was built with modern security at the forefront.

Modernized architecture makes integration with external systems faster, easier, and cheaper.

"Our new system has better security than our old COBOL mainframe. When those systems were developed, security wasn't as big a concern as it is today."

Operations administrator, government agency

Unquantified Benefits To Taxpayers

Over 30 government entities, and their employees, rely on consistent access to the data in this agency's system. Improvements in the system have meaningful, measurable positive effects on the other organizations and the government as a whole. Ultimately, the taxpayers themselves benefit in both cost savings and improved services. As these benefits are not experienced by this agency itself, they cannot be quantified as part of the return on investment. However, Forrester believes that these benefits are an important part of the Total Economic Impact, and we have illustrated two sample benefits to show how to identify and measure the external benefits of Mainstream's software development.

Improved productivity and outcomes for external government entities and their employees.

The first such benefit is a measure of the improved productivity for the employees of other agencies. The new database system eliminates the need for weekly downtime of approximately 1 hour every Sunday, and significantly reduces the number of errors returned by the database during data retrieval. With better, faster, and more consistent access to data, the employees of external agencies can increase their productivity and ultimately deliver better service outcomes while reducing costs.

- This is a simplified, conservative calculation that only includes one-half of the eliminated downtime for weekly maintenance and does not include any savings for reduced errors and slowness in retrieving data throughout the week.
- The sample government agency used here is citizen-focused, with 6,800 staff in the field regularly interfacing with the public.
- Twenty percent of this workforce is estimated to be active at the time of the now-eliminated weekly downtime.
- The time savings have been recaptured at a rate of 50% for other productive work by this external agency,

External government agencies rely on fast, consistent access to this system for mission-critical service to American citizens, including health and human services, law enforcement, permit administration, and the judicial system.

It's important to note that the public also experiences better outcomes from this improvement in system stability, as services can be delivered faster and more consistently. As some of these services have direct health and safety impacts for individuals, this benefit has an extremely important, yet intangible, added value to the well-being of the public.

The following data table identifies a five-year calculation of the value in recaptured productivity experienced by this external agency. After levying a significant risk-adjustment of 20%, this calculation yields a five-year total PV $1,193,929.

Improved Government Employee Productivity: Sample Calculation Table*

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
EX1	Hours of reduced system downtime annually		24	24	24	24	24
EX2	Total number of users in one sample government agency		6,800	6,800	6,800	6,800	6,800
EX3	Number of hourly active users	20% of total users	1,360	1,360	1,360	1,360	1,360
EX4	Hours saved	EX1*EX3	32,640	32,640	32,640	32,640	32,640
EX5	Hours of productivity recaptured	50% recaptured	16,320	16,320	16,320	16,320	16,320
EX6	Average fully loaded hourly pay	3% annual increase	$22.84	$23.53	$24.24	$24.97	$25.72
EXt	Improved government employee productivity	EX5*EX6	$372,749	$384,010	$395,597	$407,510	$419,750
	Risk adjustment	↓20%					
EXtr	Improved government employee productivity (risk-adjusted)		**$298,199**	**$307,208**	**$316,477**	**$326,008**	**$335,800**

*Please note: This calculation is shown for illustrative purposes only, as the savings are not experienced by the agency itself. Rather, they are experienced by the government as a whole across many agencies. While this ultimately benefits taxpayers, this savings is not calculated as part of this specific agency's return on investment.

Reduced transaction fees for external government entities.

The new system built by Mainstream enabled the government agency to reduce the cost of its transactions, i.e., any time that another agency accesses data through its database. The agency passed this cost savings on to the other agencies by reducing the fee it charges other agencies from 4.72 cents to 3.5 cents per transaction. The agency identified that it processes several million transactions per year. This calculation utilizes a conservative estimate of 2 million transactions annually, with a cost savings per transaction of 1.22 cents.

The following data table demonstrates the cost savings achieved through the reduced per-transaction fees. After risk-adjusting the benefit down by 20% to reflect the variability in the number of transactions, this calculation yields a five-year total PV $73,996.

The agency reduced fees charged to other government entities by $.0122 per transaction.

Reduced Transaction Fees: Sample Calculation Table*							
REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
EX1	Number of transactions		2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
EX2	Savings per transaction		$.0122	$.0122	$.0122	$.0122	$.0122
EXt	Total reduced transaction fees	EX1*EX2	$24,400	$24,400	$24,400	$24,400	$24,400
	Risk adjustment	↓20%					
EXtr	Reduced transaction fees (risk-adjusted)		$19,520	$19,520	$19,520	$19,520	$19,520

*Please note: This calculation is shown for illustrative purposes only, as the savings are not experienced by the agency itself. Rather, they are experienced by the government as a whole across many agencies. While this ultimately benefits taxpayers, this savings is not calculated as part of this specific agency's return on investment.

Flexibility

The value of flexibility is clearly unique to each customer, and the measure of its value varies from organization to organization. There are multiple scenarios in which a customer might undergo a custom software development project with Mainstream and later realize additional uses and business opportunities, including:

- The APIs enable the agency to easily make information available to new systems and channels, including web and mobile clients.
- Identify additional systems as candidates for rearchitecting.
- Avoid the need to hire additional employees entirely through productivity improvements.
- Rethink the ways other agencies manage their data and approach the entire government data ecosystem around them with a new structure.

Flexibility would also be quantified when evaluated as part of a specific project (described in more detail in Appendix A).

Flexibility, as defined by TEI, represents an investment in additional capacity or capability that could be turned into business benefit for a 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.

Total Costs

REF.	COST	INITIAL	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL	PRESENT VALUE
Dtr	Custom software development	$1,490,000	$208,000	$208,000	$208,000	$50,000	$50,000	$2,214,000	$2,072,462
Etr	Internal labor	$210,137	$6,432	$6,626	$6,826	$2,857	$2,942	$235,820	$230,367
Ftr	Hardware and software upgrades	$15,750	$5,250	$5,250	$5,250	$5,250	$5,250	$42,000	$35,652
	Total costs (risk-adjusted)	$1,715,887	$219,682	$219,876	$220,076	$58,107	$58,192	$2,491,820	$2,338,480

Custom Software Development Costs

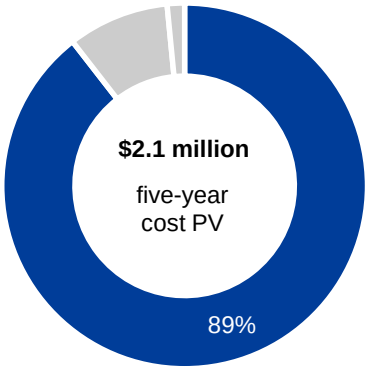
Mainstream Technologies charged fees in several categories for the custom software development project with this agency:

- System development fees consisted of actual project hours of effort delivered. Mainstream provided an initial price range for the estimated effort, and once development was complete, the remaining contract pricing was finalized. The final cost fell within Mainstream's initial quoted range for this project.
- Implementation fees to launch the new system and ensure all of the agency's employees were fully trained with the new architecture, and all end users and external agencies were successfully connected.
- Ongoing system maintenance delivered within a retainer of $50,000 of annual maintenance work.
- Three years of enhancements to redesign and streamline various business processes at the agency delivered through new interfaces and data procedures.

These categories yielded total present value costs of $1,340,000 for development, $150,000 for implementation, $189,539 for maintenance, and $392,923 for enhancements.

Mainstream's exact contract pricing is known and therefore this category is not risk-adjusted, yielding a five-year total PV of $2,072,462.

The table above shows the total of all costs across the areas listed below, as well as present values (PVs) discounted at 10%. Over five years, the interviewed organization expects risk-adjusted total costs to be a PV of more than $2.3 million.



Custom software development costs: **89%** of total costs

Custom Software Development Costs: Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
D1	Development		$1,340,000	$0	$0	$0	$0	$0
D2	Implementation & launch		$150,000	$0	$0	$0	$0	$0
D3	Maintenance		$0	$50,000	$50,000	$50,000	$50,000	$50,000
D4	Enhancements		$0	$158,000	$158,000	$158,000	$0	$0
Dt	Custom software development costs	D1+D2+ D3+D4	$1,490,000	$208,000	$208,000	$208,000	$50,000	$50,000
	Risk adjustment	0%						
Dtr	**Custom software development costs (risk-adjusted)**		**$1,490,000**	**$208,000**	**$208,000**	**$208,000**	**$50,000**	**$50,000**

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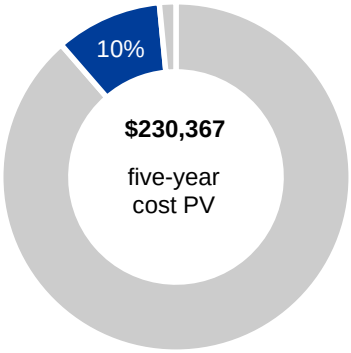
Internal Labor Costs

The government agency interviewed for this study devoted internal resources throughout the entire custom software development process.

- Sixty hours of internal vendor procurement and project scoping.
- Project management efforts conducted by four employees for approximately 15 hours per month for the 18-month development period. The agency continued to devote 1 hour per week towards project management with Mainstream after launch.
- One full-time internal IT resource completely dedicated to the project for the entire 18-month development period, with a minimal ongoing effort of 1 hour per week after launch.
- Significant testing completed by 19 employees for 12 hours per month over the 18-month development period. Ongoing testing for enhancements consumed one full day per year for the same 19 employees over the next three years.
- Internal labor cost based on current agency pay data at an average fully loaded hourly rate of $22.84 per hour, with a 3% annual raise.

This custom software development project took several months longer than anticipated due to forced delays from several external agencies. The new system needed to fully integrate with all the same systems as the legacy database, but certain other interfacing government agencies or their providers experienced delays during the integration process. While this was entirely out the control of either Mainstream or the interviewed agency, internal labor devoted to the project consumed more time than expected to deal with these issues. For custom development projects, projecting the actual length of time for development can be a major challenge especially when multiple parties are involved.

To account for this risk, Forrester adjusted this cost upward by 10%, yielding a five-year risk-adjusted total PV of $230,367.



Internal labor costs:
10% of total costs

Implementation risk is the risk that a proposed investment may deviate from the original or expected requirements, resulting in higher costs than anticipated. The greater the uncertainty, the wider the potential range of outcomes for cost estimates.

Internal Labor Costs: Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
E1	Hours of testing		4,104	152	152	152	0	0
E2	Hours of due diligence		60	0	0	0	0	0
E3	Hours of internal project management		1,080	52	52	52	52	52
E4	Hours of internal IT resource		3,120	52	52	52	52	52
E5	Total internal hours	E1+E2+E3+E4	8,364	256	256	256	104	104
E6	Fully loaded hourly employee salary	3% annual raise	$22.84	$22.84	$23.53	$24.24	$24.97	$25.72
Et	Internal labor	E5*E6	$191,034	$5,847	$6,024	$6,205	$2,597	$2,675
	Risk adjustment	↑10%						
Etr	**Internal labor (risk-adjusted)**		**$210,137**	**$6,432**	**$6,626**	**$6,826**	**$2,857**	**$2,942**

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Hardware And Software Upgrades

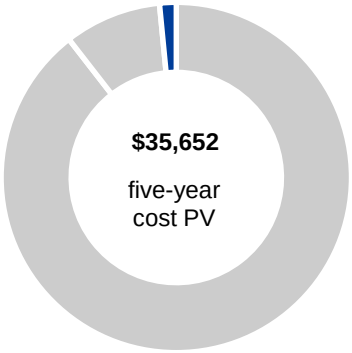
The interviewed government agency already had the necessary on-premises environment for the new system designed by Mainstream Technologies. However, the agency made two upgrades to assist in the endeavor:

- A one-time $15,000 hardware upgrade to increase on-premises storage capacity.
- Upgraded license to systems administration software for the on-premises environment, which increased the agency's annual subscription costs by $5,000.

Forrester recognizes that this cost could vary depending on the agency's future system needs. Specific assessed risks include:

- On-premises hardware may need to be further upgraded for additional storage or performance.
- Additional software may be needed to manage the on-premises environment or integrate with other external systems.

To account for these risks, Forrester adjusted this cost upward by 5%, yielding a five-year risk-adjusted total PV of $35,652.



Hardware and software upgrades: **1%** of total costs

Hardware And Software Upgrades: Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
F1	License for software upgrade		$0	$5,000	$5,000	$5,000	$5,000	$5,000
F2	Hardware upgrade		$15,000	$0	$0	$0	$0	$0
Ft	Hardware and software upgrades	F1+F2	$15,000	$5,000	$5,000	$5,000	$5,000	$5,000
	Risk adjustment	↑5%						
Ftr	**Hardware and software upgrades (risk-adjusted)**		**$15,750**	**$5,250**	**$5,250**	**$5,250**	**$5,250**	**$5,250**

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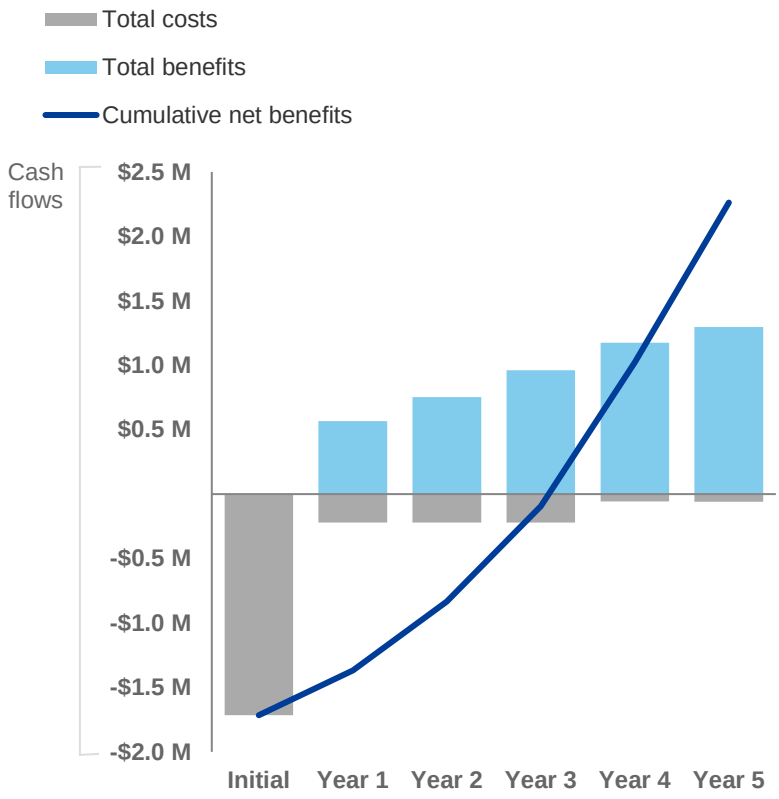
Financial Summary

CONSOLIDATED FIVE-YEAR RISK-ADJUSTED METRICS

Cash Flow Chart (Risk-Adjusted)



The financial results calculated in the Benefits and Costs sections can be used to determine the ROI, NPV, and payback period for the interviewed organization's investment. Forrester assumes a yearly discount rate of 10% for this analysis.

These risk-adjusted ROI, NPV, and payback period values are determined by applying risk-adjustment factors to the unadjusted results in each Benefit and Cost section.

Cash Flow Table (Risk-Adjusted)

	INITIAL	YEAR 1	YEAR 2	YEAR 3	YEAR 3	YEAR 3	TOTAL	PRESENT VALUE
Total costs	($1,715,887)	($219,682)	($219,876)	($220,076)	($58,107)	($58,192)	($2,491,820)	($2,338,480)
Total benefits	$0	$567,388	$753,546	$960,335	$1,175,923	$1,296,726	$4,753,919	$3,468,423
Net benefits	($1,715,887)	$347,706	$533,670	$740,259	$1,117,817	$1,238,534	$2,262,099	$1,129,943
ROI								48%
Payback period								3 years

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Mainstream Technologies' Custom Software Development: Overview

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

Mainstream Technologies offers enterprise class custom software solutions that deliver strategic advantages to your business. Mainstream is an extension of your staff, giving you the ability to dynamically allocate effort based on business demands without the need for a long-term commitment.

Your business depends on software and the insights it provides into your day-to-day activities. New software can help you maximize mobile, cloud, social, and big data technologies to accelerate your processes and serve your customers better.

If software is strategic to your business success, Mainstream Technologies can help you get the most from it.

Advances in technology are reshaping how companies look at their technology and how it can be used to create strategic advantages. The traditional IT infrastructure is shifting into commodity services through virtualization, software-as-a-service, and mobility. Mobile apps and big data are enabling companies to develop deeper and more focused insights into their business and significantly improve their decision-making abilities.

The right technology strategy can help you take advantage of these changes:

- Improve your systems and maximize your existing information to work better for you.
- Integrate multiple, siloed data sources into single, integrated views.
- Reduce the time it takes to bring new features and actionable insights to users.
- Increase your visibility into the software development process so the risk of wasted effort is minimized.
- Ensure higher-quality results and better user experiences by welcoming change throughout the development life cycle.

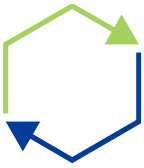
Appendix A: Total Economic Impact

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.

Total Economic Impact Approach

Benefits represent the value delivered to the business by the product. The TEI methodology places 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.

Costs consider all expenses necessary to deliver the proposed value, or benefits, of the product. The cost category within TEI captures incremental costs over the existing environment for ongoing costs associated with the solution.



Flexibility represents the strategic value that can be obtained for some future additional investment building on top of the initial investment already made. Having the ability to capture that benefit has a PV that can be estimated.

Risks measure the uncertainty of benefit and cost estimates given: 1) the likelihood that estimates will meet original projections and 2) the likelihood that estimates will be tracked over time. TEI risk factors are based on "triangular distribution."

The initial investment column contains costs incurred at "time 0" or at the beginning of Year 1 that are not discounted. All other cash flows are discounted using the discount rate at the end of the year. PV calculations are calculated for each total cost and benefit estimate. NPV calculations in the summary tables are the sum of the initial investment and the discounted cash flows in each year. Sums and present value calculations of the Total Benefits, Total Costs, and Cash Flow tables may not exactly add up, as some rounding may occur.

PRESENT VALUE (PV)

The present or current value of (discounted) cost and benefit estimates given at an interest rate (the discount rate). The PV of costs and benefits feed into the total NPV of cash flows.

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.

RETURN ON INVESTMENT (ROI)

A project's expected return in percentage terms. ROI is calculated by dividing net benefits (benefits less costs) by costs.

DISCOUNT RATE

The interest rate used in cash flow analysis to take into account the time value of money. Organizations typically use discount rates between 8% and 16%.

PAYBACK PERIOD

The breakeven point for an investment. This is the point in time at which net benefits (benefits minus costs) equal initial investment or cost.