

# The Use of Return on Investment (ROI) in the Performance Measurement and Evaluation of Information Systems

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# Abstract

## **The Use of Return on Investment (ROI) in the Performance Measurement and Evaluation of Information Systems**

Performance measurement and program evaluation are essential for accountable and transparent delivery of public services to Ontarians. Evaluation of the existing information systems and making investment decisions on new acquisitions should be based on a rigorous and quantifiable analysis of the benefits and costs. Return on Investment (ROI) is arguably one of the most popular metrics, and ROI analysis (when applied correctly) is a powerful tool in making informed decisions. This presentation explores a wide variety of the approaches to calculating ROI of an information management system. Attendees will find practical answers to the questions: What is ROI? What types of ROI exist? What are the benefits of using ROI metrics? What are the limitations of the ROI approach? In this session, several concrete examples of the application of the ROI will be reviewed. Although the focus of the presentation is made on the information systems/solutions, most considerations of ROI use are generic and applicable in any field.

# Contents

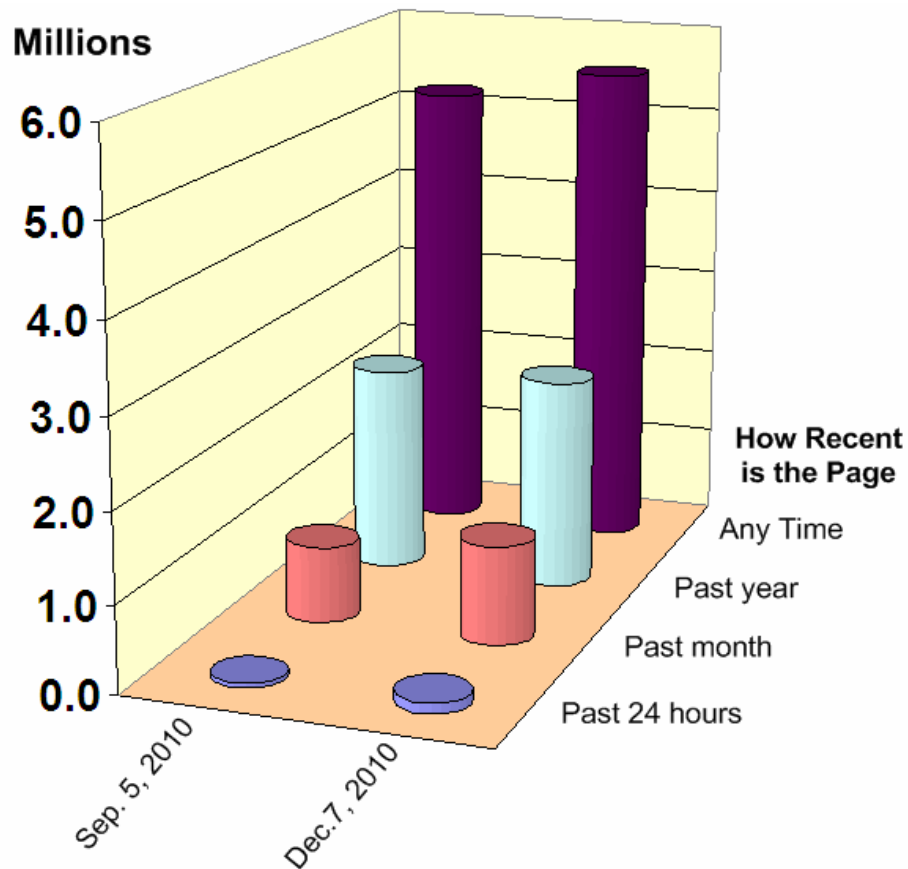
- Purpose
- What is ROI?
- How it is calculated?
- What are the benefits of using ROI metric?
- What are the limitations of the ROI?
- What types of ROI exist?

# Learning Objectives

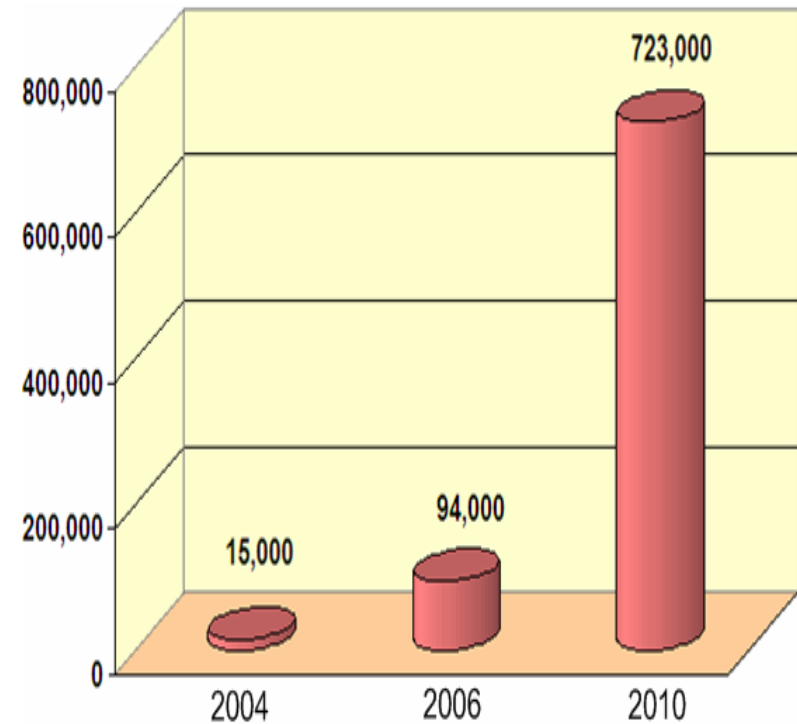
- Understand ROI concept, ROI types and variations.
- Avoid common pitfalls and mistakes in calculating ROI.
- Know the limitations of the “power” of the ROI and keep your ROI-based recommendations meaningful.
- Understand the place of the ROI metric in a framework of the business value measures.

# ROI – a Buzz Word

- Google search:  
“Return on Investment” ROI



- Google search:  
“ROI Calculator”



Source of data for 2004 and 2006: <http://www.information-age.com/articles/294191/perception-and-deception.shtml>

# Views on ROI Vary

- **ROI analysis is a powerful tool** for measuring the net financial benefits of an investment and is commonly used by business-oriented organizations when evaluating where to spend their resources.

Source: [http://www.rti.org/pubs/issuebrief\\_3.pdf](http://www.rti.org/pubs/issuebrief_3.pdf)

- **ROI is arguably the most popular metric** to use when comparing the attractiveness of one IT investment to another.
- **ROI is a key metric used by CIOs** to help quantify the potential success of an IT or business project.

Source: <http://searchcio.techtarget.com/resources/Return-on-investment>

- **Forget ROI**

“The best, most innovative IT improvements have no ROI. There was no decent ROI on installing the first Wang word processor in the 1970s or the first PC to run VisiCalc in the 1980s or the first Linux server for corporate Web sites in the 1990s.

... If we let the ROI Wormtongues rule the day, this decade will never see an analogue to the technological achievements of past decades.

...wisdom can't be reduced to an ROI calculation”.

Mark Hall *Computerworld*, 2003

<http://www.computerworld.com/action/article.do?command=viewArticleTOC&specialReportId=180&articleId=78516>

# Scope of the Exercise

- High-level business analysis. No accounting details.
- Most considerations are applicable to both public and private sectors. Examples, are geared towards public sector environment.
- Most considerations of the ROI use are generic and applicable in any field. However, the focus is made on the Information Systems/Solutions.
- For the same reasons, there is no description of the specific areas of the ROI use, e.g.
  - ROI of Social Media
  - ROI of user experience
  - ROI of Knowledge Management

All of the above areas have their own specific measures of the benefits and costs, description of which would obscure the demonstration of the main ROI qualities and characteristics.
- Presentation deals with ROI at a conceptual level. Issues of implementing processes of ROI assessments are out of the scope.
- Multiple sources from academic and trade literature were reviewed and analyzed.

# What is ROI?

- **ROI – Investopedia**

A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. To calculate ROI, the benefit (return) of an investment is divided by the cost of the investment; the result is expressed as a percentage or a ratio.

The return on investment formula:

$$\text{ROI} = \frac{\text{Gain from Investment} - \text{Cost of Investment}}{\text{Cost of Investment}}$$

Source: <http://www.investopedia.com/terms/r/returnoninvestment.asp>

- **ROI – Wikipedia**

In finance, **rate of return (ROR)**, also known as **return on investment (ROI)**, **rate of profit** or sometimes just **return**, is the ratio of money gained or lost (whether realized or unrealized) on an investment relative to the amount of money invested. The amount of money gained or lost may be referred to as interest, profit/loss, gain/loss, or net income/loss. The money invested may be referred to as the asset, capital, principle, or the cost basis of the investment. ROI is usually expressed as a percentage.

Source: [http://en.wikipedia.org/wiki/Rate\\_of\\_return](http://en.wikipedia.org/wiki/Rate_of_return)



# More ROI Definitions

- **Another definition**

ROI analysis is a form of cost-benefit analysis that measures the costs of a program (i.e., the investment) versus the financial return realized by that program.

Source: <http://www.cdc.gov/leanworks/resources/glossary.html>

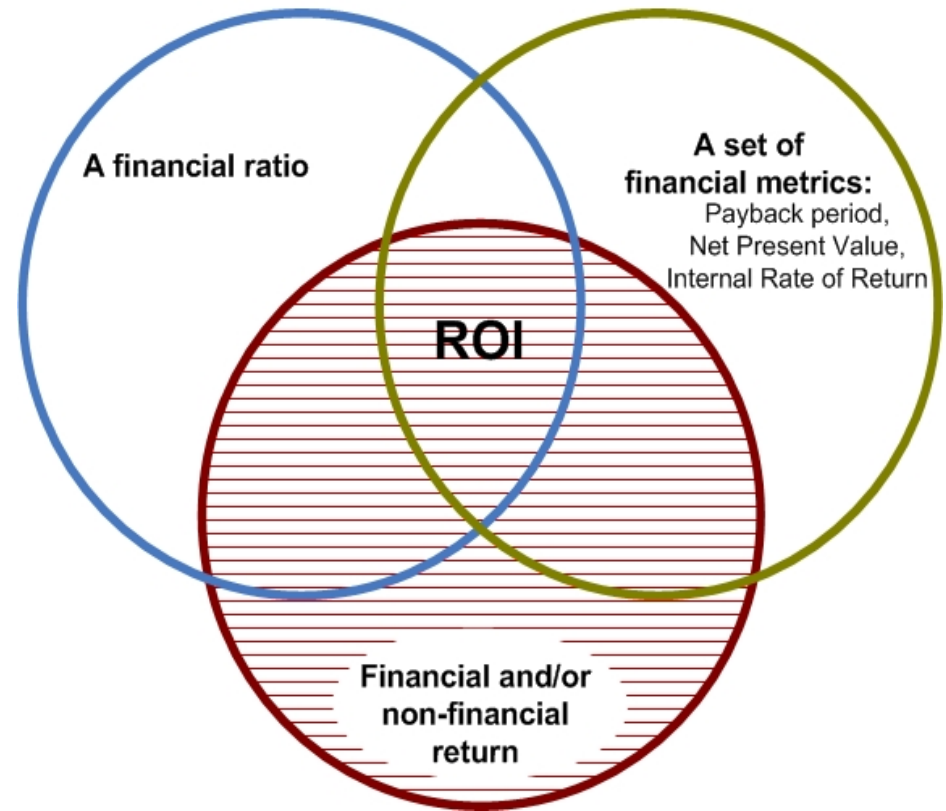
- **ROI** - “a bang for the buck”.

Source: wisdom of the crowd

# Comment on the ROI Definition

- Definition on a previous slide from the Investopedia treats ROI as a measure / metric / ratio / number.
- At the same time, very often return on investment is understood as a “method” or “approach” – “ROI analysis”. In this meaning, ROI or “ROI Analysis” includes not only an “ROI ratio” but also several other financial measures (e.g. Internal Rate of Return - IRR, Net Present Value - NPV, payback period, etc.), which are collectively called “ROI”.
- Finally, in some cases return on investment is understood as any kind (financial or non-financial) of return / effect / result.
- This presentation is focused on the ROI as an individual measure. Other measures of the ROI analysis are referred to as ROI-related measures, and are not included in a prime scope.

## Return on Investment



# Purpose of the ROI Use

- Provide rational for the future investments and acquisition decisions. Project prioritization/ justification.
  - To facilitate informed choices about which projects to pursue (which solutions to implement).
- Evaluate existing systems. Project post-implementation assessment.
  - To facilitate informed decisions within the process of evaluating existing projects/solutions.
- Performance management of the business units and evaluation of the individual managers in decentralized companies.
  - Often called Du Pont method – by the name of the company which first implemented it. Considered a default standard in the 1960s – 70s.
  - This type of use is out of scope for the presentation.

# ROI - Many Types and Hundreds of Versions

- Information search on the ROI retrieved hundreds of academic and business publications describing many ROI types and hundreds of versions.
- Multiple interpretations of what ROI is, and how it should be calculated lead to arguments between the authors on what's right and wrong.
- Approach of this presentation is to avoid getting into this “right or wrong” discussion.
- This presentation is based on identifying some key attributes and grouping/classifying ROI versions/types by these attributes.
- ROI taxonomy is presented.

# The World of “Return on Investment” (ROI)

## ROI Taxonomy

	Traditional ROI	ROI Extensions	ROI Virtualizations	ROI Imitations
What is it?	$ROI[T] = \frac{\sum_i FinRet(i) - \sum_j Cost(j)}{\sum_j Cost(j)} \times 100\%$ <p><i>FinRet</i> – Financial Return</p>	$ROI[E] = \mathfrak{S}\left(ROI[T]_{est}, t, Risk\right)$	$ROI[V] = \Psi\left(ROI[E], \$B\right)$	<p>Subcategory 1. Use the ROI term for the measures which have little or nothing to do with ROI. The purpose is to cash in on the seemingly positive credibility of the ROI term. Typical for this group of measures is understanding of the ROI as “any benefit”.</p> <p>Subcategory 2. Paradoxically enough, this group attempts NOT to use the ROI term (at least in the titles). They actually use ROI method (or very similar) under different names claiming that they’ve overcome the ROI deficiencies/limitations (e.g. their measures are multi-dimensional).</p> <p>Can be based on ANY Return / Benefit / Impact.</p> <p>Retrospective and Predictive.</p>
How it is measured?	Profitability based on “hard” dollars.	Profitability based on dollar estimates.	Profitability based on a mix of “hard” dollars, dollar estimates and “dollarized” assessments of intangibles.	
What is the time frame?	Retrospective.	Retrospective and Predictive.	Retrospective and Predictive.	
What is the level of accuracy?	As precise as accounting records are.	Uncertainty increases due to estimation errors.	Indeterminate. Open to subjective perceptions and interpretations.	
Accountability and transparency?	Accounting records (official financial documents or accounting systems) are used as sources of cost and return data. Full transparency and accountability.	Certain level of accountability may be preserved, if cost and return estimates are included in the planning financial documents and periodically reviewed. Limited transparency due to the subjectivity of predictions.	Data used in calculations (especially Returns) is not recorded in the official accounting systems. Prone to uncontrolled subjectivity.	

# Traditional ROI

# Traditional ROI

What is it?	$ROI[T] = \frac{\sum_i FinRet(i) - \sum_j Cost(j)}{\sum_j Cost(j)} \times 100\%$
How it is measured?	Profitability based on “hard” dollars.
What is the time frame?	Retrospective.
What is the level of accuracy?	As precise as accounting records are.
Accountability and transparency?	Accounting records (official financial documents or accounting systems) are used as sources of cost and return data. Full transparency and accountability.

# Typical ROI Components - Costs

IT Infrastructure	<ul style="list-style-type: none"> <li>• <b>Software/Licenses</b> - initial and annual maintenance.</li> <li>• <b>Hardware</b> - if IS run in-house (e.g. purchasing and installation of new servers).</li> <li>• <b>Hosting</b> - if IS provided as Software as a Service by the third party.</li> </ul>
Labour	<ul style="list-style-type: none"> <li>• <b>Direct Operating Expenses (DOE). Salaries and Wages plus Benefits for FTEs</b> – Journalled to I&amp;IT Cluster. Include funds transferred to MGS Central Cluster.</li> <li>• <b>Consultant Services (ODOE). FFS.</b> – Installation, configuration, software customization, integration that requires skills not available within the I&amp;IT Cluster.</li> </ul>
Training	<ul style="list-style-type: none"> <li>• IT personnel training by the third party.</li> <li>• Program area end-user training by the third party.</li> </ul>



# Typical ROI Components – Costs. Scenario 1

IT Infrastructure	<ul style="list-style-type: none"> <li>• <b>Software/Licenses</b> - initial and annual maintenance.</li> <li>• <b>Hardware</b> - if IS run in-house (e.g. purchasing and installation of new servers).</li> <li>• <b>Hosting</b> - if IS provided as Software as a Service by the third party.</li> </ul>	<p style="text-align: right;"><b>\$100,000</b></p> <p style="text-align: center;">-</p> <p style="text-align: right;"><b>\$75,000</b></p>
Labour	<ul style="list-style-type: none"> <li>• <b>Direct Operating Expenses (DOE). Salaries and Wages plus Benefits for FTEs</b> – Journalled to I&amp;IT Cluster. Include funds transferred to MGS Central Cluster.</li> <li>• <b>Consultant Services (ODOE). FFS.</b> – Installation, configuration, software customization, integration that requires skills not available within the I&amp;IT Cluster.</li> </ul>	<p style="text-align: right;"><b>\$230,000</b></p> <p style="text-align: right;"><b>\$150,000</b></p>
Training	<ul style="list-style-type: none"> <li>• IT personnel training by the third party.</li> <li>• Program area end-user training by the third party.</li> </ul>	<p style="text-align: right;"><b>\$10,000</b></p> <p style="text-align: right;"><b>\$15,000</b></p>

**Total: \$580,000**

## Typical ROI Components – Financial Benefits. Scenario 1

Cost Savings	<ul style="list-style-type: none"> <li>• Three FTEs reduced – Salaries and Wages plus Benefits for 3 FTEs</li> </ul>	<b>\$210,000</b>
Cost Avoidance	<ul style="list-style-type: none"> <li>• Hiring of Two FTEs (which was planned to operate the old system) was halted - Salaries and Wages plus Benefits for 2 FTEs</li> </ul>	<b>\$140,000</b>
Revenue enhancement	<ul style="list-style-type: none"> <li>• Additional revenues were gained due to better targeted marketed and advertising</li> </ul>	<b>\$300,000</b>
Revenue protection	<ul style="list-style-type: none"> <li>• Imminent fine was avoided (due to demonstrated compliance with regulatory requirements)</li> </ul>	<b>\$20,000</b>

**Total: \$670,000**

# ROI Calculation Example – Scenario 1 (continued)

$$\text{ROI [T]} = \frac{\sum[\$240,000 + \$140,000 + \$300,000 + \$20,000] - \sum[\$175,000 + \$380,000 + \$25,000]}{\sum[\$175,000 + \$380,000 + \$25,000]} \times 100\% = \mathbf{15.5\%}$$

The numerator represents the net benefit, calculated as the sum of positive impacts (Cost savings, Cost Avoidance, Revenue enhancement, Revenue protection) minus the sum of negative impacts (IT Infrastructure, Labour, Training).

The denominator represents the total investment, which is the sum of IT Infrastructure, Labour, and Training costs.

# Why ROI is so Popular?

## 1. Objective Reasons for the Traditional ROI Popularity

- Anecdotal evidence of the successful use.
- Easy to understand and straightforward.
- Easy to compute.
- Encourages prudent detailed financial analysis.
- Encourages cost efficiency and focuses on one of the main corporate metrics – profitability.
- Being based on the accounting records, provides objective outputs.
- Data used is available in the accounting system or official documentation.
- Permits comparisons of profitability of dissimilar businesses/projects.
- Promotes accountability. Transparent collection and use of official financial data contributes to responsible behaviours of those involved in data collection and evaluations.
- Encourages project teams and finance/accounting practitioners to collaborate.

# Why ROI is so Popular? (continued)

## 2. Subjective Reasons for the Traditional ROI Popularity

**“Perception is Reality”**


- Seems familiar from college textbooks.
- Feels familiar from personal investment experience.
- Seemingly easy to collect and process data.
- Use of data and math makes creates anticipation of an accurate and definitive result.
- Single number result – flattering to the mind.
- Provides quantifiable evidence of value.
- Single measure offers seemingly global evaluation of performance.

# ROI Speaks for Itself. Case 1

Project	ROI
Project A	70%
Project B	30%

- What will be the ROI analysis recommendation for the projects in the table?

## ROI Speaks for Itself. Case 1 (continued)

Project	ROI
Project A 	70%
Project B	30%

- What's ROI analysis recommendation for the projects in the table?
- ROI for Project A is more than two times higher than for Project B.
- ROI verdict is clear – *invest in Project A.*

## ROI Speaks for Itself. Case 1 (continued)

Project	ROI	Net Return	Investment
Project A ✓	70%	\$7,000	\$10,000
Project B	30%	\$30,000	\$100,000

- What's ROI analysis recommendation for the projects in the table?
- ROI for Project A is more than two times higher than for Project B. ROI verdict is clear – *invest in Project A.*
- However, look at the actual numbers of the return and investment. The amount of profit from the Project B is more than four times higher.



## ROI Speaks for Itself. Case 1 (continued)

Project	ROI	Net Return	Investment
Project A ✓	70%	\$7,000	\$10,000
Project B	30%	\$30,000	\$100,000



- What's ROI analysis recommendation for the projects in the table?
- ROI for Project A is more than two times higher than for Project B. ROI verdict is clear – *invest in Project A.*
- However, look at the actual numbers of the return and investment. The amount of profit from the Project B is more than four times higher.
- **Diagnosis 1:** ROI focuses on maximizing the return-investment ratio. ROI fails to guide towards the profit maximization.

## ROI Speaks for Itself. Case 2

Project	ROI
Project A	7%
Project B ✓	70%

- What will be ROI analysis recommendation for the projects in the table?
- ROI for Project B is ten times higher than for Project A.
- ROI verdict is clear – *invest in Project B.*

## ROI Speaks for Itself. Case 2 (continued)

Project	ROI	Net Return	Investment
Project A	7%	\$7,000	\$100,000
Project B ✓	70%	\$700,000	\$1,000,000



- What will be ROI analysis recommendation for the projects in the table?
- ROI for Project B is ten times higher than for Project A. ROI verdict is clear – *invest in Project B*.
- However, Project B requires \$1,000,000 investment. Is it available?
- **Diagnosis 2:** ROI analysis doesn't incorporate means to evaluate projects based on the viability of the gross investments needed (estimate availability of funds).

## ROI Speaks for Itself. Case 3

Project	ROI	Net Return	Investment
Project A	7%	\$7,000	\$100,000
Project B ✓	70%	\$700,000	\$1,000,000

- What's ROI analysis recommendation for the projects in the table?
- ROI for Project B is ten times higher than for Project A. Also, required funding (\$1M) is available.
- ROI verdict is clear – *invest in Project B.*

## ROI Speaks for Itself. Case 3 (continued)

Project	ROI	Net Return	Investment	Project Risk (probability of success)
Project A	7%	\$7,000	\$100,000	0.9
Project B ✓	70%	\$700,000	\$1,000,000	0.1



- What's ROI analysis recommendation for the projects in the table?
- ROI for Project B is ten times higher than for Project A. Also, required funding (\$1M) is available. ROI verdict is clear – *invest in Project B.*
- However, Project B has very low probability of success, and Project A is almost guaranteed.
- **Diagnosis 3:** ROI analysis doesn't incorporate means to evaluate projects based on the delivery risks.

## ROI Speaks for Itself. Case 4

Project	ROI	Net Return	Investment	Project Risk (probability of success)
Project A	7%	\$7,000	\$100,000	0.75
Project B ✓	70%	\$700,000	\$1,000,000	0.75

- What's ROI analysis recommendation for the projects in the table?
- ROI for Project B is ten times higher than for Project A. Also, required funding (\$1M) is available. Risks are the same for both projects.
- ROI verdict is clear – *invest in Project B.*

## ROI Speaks for Itself. Case 4 (continued)

Project	ROI	Net Return	Investment	Project Risk (probability of success)	Project Payback Period
Project A	7%	\$7,000	\$100,000	0.75	3 months
Project B ✓	70%	\$700,000	\$1,000,000	0.75	97 months



- What's ROI analysis recommendation for the projects in the table?
- ROI for Project B is ten times higher than for Project A. Also, required funding (\$1M) is available. Risks are the same for both projects.
- ROI verdict is clear – *invest in Project B.*
- **Diagnosis 4:** ROI analysis doesn't incorporate means to evaluate projects based on the payback period.

## ROI Speaks for Itself. Case 5

Project	ROI	Net Return	Investment	Project Risk (probability of success)	Project Payback Period
Project A	7%	\$7,000	\$100,000	0.75	10 months
Project B ✓	70%	\$700,000	\$1,000,000	0.75	10 months

- What's ROI analysis recommendation for the projects in the table?
- ROI for Project B is ten times higher than for Project A. Also, required funding (\$1M) is available. Risks and payback periods are the same for both projects.
- ROI verdict is clear – *invest in Project B.*



## ROI Speaks for Itself. Case 5 (continued)

Project	ROI	Net Return	Investment	Project Risk (probability of success)	Project Payback Period	Strategic priority and Regulatory Requirement
Project A	7%	\$7,000	\$100,000	0.75	10 months	#1, Yes
Project B ✓	70%	\$700,000	\$1,000,000	0.75	10 months	#10, No

- What's ROI analysis recommendation for the projects in the table?
- ROI for Project B is ten times higher than for Project A. Also, required funding (\$1M) is available. Risks and payback periods are the same for both projects.
- ROI verdict is clear – *invest in Project B.*
- **Diagnosis 5:** ROI analysis has no means to align to strategy and regulatory compliance.

# ROI Analysis Limitations and Misuse

- In the preceding cases, it was demonstrated that even in rather simple situations ROI analysis may lead to questionable if not completely wrong results and recommendations.
- ROI is a metric designed for a certain purpose – assess the profitability or financial efficiency.

# The Biggest Myth About ROI

- **ROI is a single number...**

- It has been demonstrated in the previous slides that ROI being presented as a single number has many uncertainties which make the number actually meaningless...
- To provide a meaningful context for business decisions, ROI number **MUST** be accompanied with a detailed description of the terms, conditions and assumptions under which the ROI calculations were conducted and at least 5 – 10 additional numeric characteristics of the ROI business case.
  - Note: When ROI is provided as a single number, it doesn't mean that those who perform analysis don't know about other factors. They just "assume" that all other factors are the same for the compared projects.

# No Generally Accepted Rules

- There are no standard rules for calculating ROI. Generic direction is to include all costs and all related benefits.
- As a result:
  - Any case has its own specifics.
  - Comparison of the ROI calculations gained in different projects and by different teams/consultants is not possible (even if the same technology solution was implemented in similar environments).
  - For the ROI be considered meaningful, it must be accompanied by a detailed description of all components of costs and benefits that were used for calculations and how values of these components were derived.
  - Lack of the ROI standard and rules makes selection of the ROI costs and benefits components subjective and the result prone to human error or pure judgment.
  - If ROI inputs may be to a certain extent subjective, then the accuracy of result of the calculations is also questionable. The implied rigor of the whole ROI process is inappropriate.

# Inherent ROI Limitations

- ROI is a ratio:
  - ROI focuses on maximizing the return-investment ratio. ROI fails to guide towards the profit maximization.
  - ROI analysis doesn't incorporate means to evaluate projects based on the viability of the gross investments needed (estimate availability of funds).
- ROI analysis has no means to align to organization's business strategy and regulatory compliance.
- ROI is a financial measure, focused on the profitability.
- ROI doesn't tell anything neither about systems' effectiveness (how good is the system at what it is supposed to be doing), nor about systems' efficiency (what the system is doing per dollar).

# Traditional ROI Wrap-Up

- ROI tells nothing about how good you are at what you do.
  - How close you are in achieving your goals?
  - How advanced you are in moving along your strategy?
- **The only exception is when you are in the business of making money. And the only measure of what you do is “profitability”.**  
**Possible but not very easy to find.....**

# ROI Extensions

# ROI Extensions

- ROI Extensions have been created with a purpose of fixing some deficiencies of the Traditional ROI and widening the area of the ROI use.

What is it?	$ROI[E] = \mathfrak{S} \left\{ ROI[T]_{est}, t, Risk \right\}$
How it is measured?	Profitability based on dollar estimates. (Although “hard” dollars also can be included.)
What is the time frame?	Retrospective and Predictive.
What is the level of accuracy?	Uncertainty increases due to estimation errors.
Accountability and transparency?	Certain level of accountability may be preserved, if cost and return estimates are included in the planning financial documents and periodically reviewed. Limited transparency due to the subjectivity of predictions.



# Estimating Costs

- Cost estimates are predictions/approximations of the monetary resources needed to complete the initiative.
- Accuracy of estimates depends on the phase of the life cycle of the initiative. May vary depending on cost type.
  - Initiation phase – rough order of magnitude (ROM) – range of +/-50%.
  - Later could narrow - range of +/-10%.
- Tools and Techniques (PMBOK):
  - Expert judgment
  - Analogous estimating
  - Parametric estimating
  - Bottom-up estimating
  - Three-point estimates, etc.

# Estimating Financial Returns

- Estimates of financial returns are predictions/approximations of the monetary returns expected to be generated by the initiative.
- Accuracy of estimates varies.
- Same tools and techniques as used to estimate costs.
- Estimating financial returns is usually a more complex and less accurate process compared to costs estimation.
  
- Often, due to human nature, costs tend to be underestimated and returns tend to be overestimated.
- The only way to keep these “natural” things under control is to document the process and results and keep “estimators” accountable for the numbers: incorporating ROI numbers in the planning financial documents and periodic review/auditing of the actual data.

# Effect of Time: Time Value of Money

- Time value of money is based on the notion that future dollars are worth less than current dollars.

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Future Value (FV)</b>	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
<b>Present Value (PV)</b>	\$1,000	\$962	\$925	\$889	\$855	\$822

Formula to calculate Present Value:

$$PV = FV / (1 + \text{Rate})^n$$

- Rate – discount rate (the same as interest rate)
- n – number of periods.

# Time Value of Money (continued)

		Year 1	Year 2	Year 3	Year 4	Year 5
<b>Returns</b>	Simple	\$0.3	\$0.4	\$0.5	\$0.7	\$1.0
	Simple Cumulative	\$0.3	\$0.7	\$1.2	\$1.9	\$2.9
	Time Adjusted	\$0.29	\$0.37	\$0.44	\$0.60	\$0.82
	Adjusted Cumulative	\$0.3	\$0.7	\$1.1	\$1.7	\$2.5
	<b>ROI Simple</b>	<b>-70%</b>	<b>-36%</b>	<b>0%</b>	<b>46%</b>	<b>107%</b>
	<b>ROI Time Adjusted</b>	<b>-70%</b>	<b>-38%</b>	<b>-4%</b>	<b>38%</b>	<b>93%</b>
<b>Costs</b>	Simple	\$1.0	\$0.1	\$0.1	\$0.1	\$0.1
	Simple Cumulative	\$1.0	\$1.1	\$1.2	\$1.3	\$1.4
	Time Adjusted	\$0.96	\$0.09	\$0.09	\$0.09	\$0.08
	Adjusted Cumulative	\$1.0	\$1.1	\$1.1	\$1.2	\$1.3

# Multi-Period ROI

<b>Scenario 1</b>	Returns	90				<b>ROI<sub>1</sub> = 50%</b>
	Costs	60	$\frac{90 - 60}{60} \times 100\%$			
<b>Scenario 2</b>	Returns	90	30	30	30	<b>ROI<sub>2</sub> = 150%</b>
	Costs	60	20	20	20	
			$\frac{30 - 20}{20} \times 100\%$ ↓ 50%	$\frac{30 - 20}{20} \times 100\%$ ↓ 50%	$\frac{30 - 20}{20} \times 100\%$ ↓ 50%	
<b>Scenario 3</b>	Returns	90	0	30	60	<b>ROI<sub>3</sub> = 450%</b>
	Costs	60	30	20	10	
			$\frac{0 - 30}{30} \times 100\%$ ↓ -100%	$\frac{30 - 20}{20} \times 100\%$ ↓ 50%	$\frac{60 - 10}{10} \times 100\%$ ↓ 500%	
<b>Scenario 4</b>	Returns	90	0	30	60	<b>ROI<sub>4</sub> = 50%</b>
	Costs	60	30	20	10	
	Cumulative Returns		0	30	90	
	Cumulative Costs		30	50	60	
	Cumulative ROI		$\frac{0 - 30}{30} \times 100\%$ ↓ One-year -100%	$\frac{30 - 50}{50} \times 100\%$ ↓ Two-year -40%	$\frac{90 - 60}{60} \times 100\%$ ↓ Three-year 50%	
			<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Multi-Year</b>

# Risks in the ROI Context

- RISK is an event or condition that, if it occurs, has a positive or negative effect on costs or financial returns of the initiative.
  - Examples:
    - OPS salaries will be frozen. So the FTE costs that were calculated with inclusion of a certain percentage of increase year to year will not be correct. If this event occurs, cost of FTEs labour will be decreased. ROI will increase. (Positive risk)
    - A project involving a deep customization of a new type of software performed by external consultants may result in extension of the needed consultants' hours – increase of costs. Decrease of ROI. (Negative risk)

# Risk-Adjusted ROI

- Risk probability and impact assessment

- E.g. there is a risk of 2-month overrun of the activity with probability 0.5.

Risk-Adjusted Cost = Initial estimate + 0.5 x (2-month labour cost)

- Scenarios method

- PERT approach:

(best case + worst case + 4 x most likely case estimates) / 6

- Forrester approach:

E.g. Value of initial estimate 4.0 FTEs (or corresponding dollar value) - used as “most likely” or expected value.

Forrester uses a risk factor of 125% (5.0 FTEs) on the high end, 100% (4.0 FTEs) as the most likely, and 75% of 3.5 FTEs on the low end.

Risk-adjusted value is 4.167 FTEs as the mean.

Jeffrey North “The Total Economic Impact Of Salesforce CRM Customer Service & Support” Forrester Consulting, 2009.

[https://www.salesforce.com/assets/pdf/misc/WP\\_Forrester\\_Eco\\_Impact.pdf](https://www.salesforce.com/assets/pdf/misc/WP_Forrester_Eco_Impact.pdf)

# ROI Error Sensitivity

- ROI is as accurate as are the values of the costs and returns we use in the formula.

If we estimated Costs as  $X1$  and real costs are  $X2$ . We made an error (e.g. due to uncertainty of the future vendor prices), which can be characterised by the absolute error  $\Delta = X1 - X2$  or relative error  $\Delta/X1$  (which will be used in the scenario below). This error than will affect the ROI magnitude – so called propagation of uncertainty.

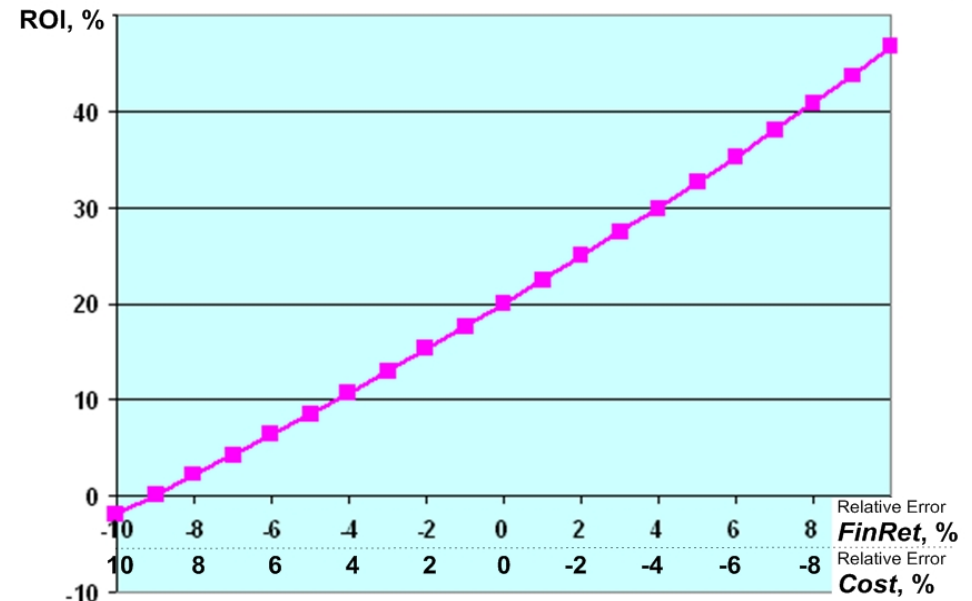
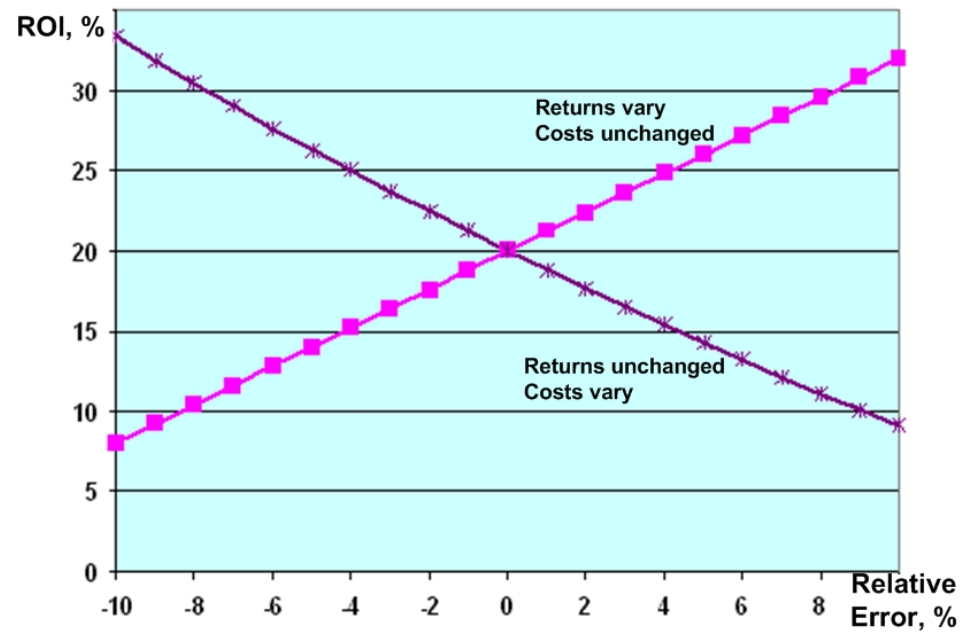
- The scenario:
  - Costs - \$500,000.
  - Returns - \$600,000.
  - Hence, ROI = 20%.
- Assume relative errors of costs and returns estimates +/-10%.
- What will be the ROI, if we factor in the errors/uncertainties?



# ROI Error Sensitivity

(continued)

- The diagram (right top) shows two (2) lines:
  - “Reddish” – shows ROI for the case when Costs were predicted with zero error, and the relative error for the Returns changes from -10% to +10%.
  - “Darker” - shows ROI for the case when Returns were predicted with zero error, and the relative error for the Costs changes from -10% to +10%.
- For these cases – ROI (from originally estimated 20%) will be floating in the range from 8 to 33%.
- The effect of the errors will be maximized, when the Returns errors would be negative (-10%), and Costs errors would be positive (+10%). This is illustrated on the next diagram (right bottom). ROI range is getting even broader from -2% to around 50%. Note that at some “worst case” point, ROI becomes “negative”.
- Observations from this exercise:
  - ROI is not prone from errors. Unavoidable uncertainties/errors of estimating costs and returns propagate through the ROI formula and affect the result.
  - “Precise” ROI is more an exception than the rule. “Precise” ROI numbers with decimal places are mystery.
  - To make sense, ROI number should be accompanied with characteristics of the accuracies of costs and returns estimates.



# ROI Virtualizations

# ROI Virtualizations

What is it?	$ROI[V] = \Psi \{ROI[E], \$B\}$
How it is measured?	Profitability based on a mix of “hard” dollars, dollar estimates and “dollarized” assessments of intangibles.
What is the time frame?	Retrospective and Predictive.
What is the level of accuracy?	Indeterminate. Open to subjective perceptions and interpretations.
Accountability and transparency?	Data used in calculations (especially Returns) is not recorded in the official accounting systems. Prone to uncontrolled subjectivity.

# Intangibles

- Intangible costs and benefits are difficult and sometimes impossible to fix with a dollar value.

[http://www.justthefactstv.com/cis235/files/CE21/CE21WebTerrazas/index\\_files/Page316.htm](http://www.justthefactstv.com/cis235/files/CE21/CE21WebTerrazas/index_files/Page316.htm)

- Intangible Benefits: Subjective benefits that cannot be measured in monetary terms.

Subjective: Based on (or related to) attitudes, beliefs, or opinions, instead of on verifiable evidence or phenomenon.

Source: BusinessDictionary.com

# Intangible Benefits - Examples

- “Better information” – Information systems are intended to provide relevant information for decision-making contributing to better decisions and therefore enhancing the return on investment.
  - More timely information.
  - Accurate and faster access to data for timely decisions.
  - Uniform reporting according to corporate standards.
- Improved effectiveness of decision-making processes facilitating:
  - Strategic planning and operations.
  - Resource control and asset utilization.
  - Organizational planning.
  - Organizational flexibility and transparency.
- Increased productivity and time savings.
- Increased intellectual capital.
- Enhanced employee goodwill.
- Increased job satisfaction.
- Higher customer satisfaction.
- Better corporate image.

# Reasons to Include Intangibles

- General observation that the value of the information systems goes way beyond the “tangible” benefits.
- According to economists more than 25% of the value of the enterprise is contributed by the intangible assets (brand name, intellectual property). So intangibles should be accounted for at any level of evaluation.
  - Need to make a footnote that formally this value is taken into account only during an acquisition process.
- An argument: “responsible ROI analysis demands that all factors be quantified in money terms. Whether recognized or not, the decision maker is placing a quantified monetary value on the intangible benefits... Thus for example, putting a dollar value on relieving pain and suffering may seem impossible and even inappropriate; but every day, health care providers make thousands of such determinations when allocating limited resources among competing demands.” [http://www.softwareceo.com/files/white\\_papers/ProveIT\\_WP\\_10\\_ROI\\_pitfalls\\_709.pdf](http://www.softwareceo.com/files/white_papers/ProveIT_WP_10_ROI_pitfalls_709.pdf)
- Another reason (not frequently admitted) is that in many/most cases ROI of information systems based on hard dollars (“tangible” benefits) is not high enough to justify investment decisions.

# Embedding Intangibles: Process

$$ROI[V] = \Psi \{ ROI[E], \text{\$B} \}$$

Seems to be good!  
There is a value...



Identify  
Quantify  
Convert into dollars

*Subjective judgment is  
involved on each step.*

**\\$B** - *Perceived value transformed  
into money terms*

# Intangibles vs Tangibles:

- A fuzzy border.
- The same type: “labour cost savings” may represent two absolutely different entities:
  1. Tangible. We had in Traditional ROI example “labour cost savings” due to the reduction of three FTE positions – resulting in real hard/tangible \$210,000 dollars.
  2. Intangible. “Labour cost savings” of 6 min per day for 200 people. Numerically it is the same savings of 111.75 hours per week with \$210,000 “saved” annually. However, realization of this amount is more than questionable.



# A Sample Case with Intangible Benefits

- Microsoft Corporation commissioned Forrester Consulting to evaluate potential return on investment (ROI) that enterprises may realize by deploying Microsoft Unified Communications (UC) products and services (UC products). Forrester conducted in-depth interviews with 15 Microsoft customers and compiled their results into a composite case study of a 4,000-person digital marketing services company. 2007.
- Microsoft's UC products include:
  - Microsoft Office Communications Server 2007.
  - Microsoft Exchange Server 2007.
  - Microsoft Exchange Hosted Services.
  - Microsoft Office Live Meeting 2007.
  - Microsoft Office Communicator 2007.
  - Microsoft Office Outlook 2007.
  - Microsoft RoundTable.
- Evaluation time frame 3 years. Calculations adjusted for time value of money and risk.

# A Sample Case with Intangible Benefits (continued)

Benefits by Type	Calculation	Intang/ Tang.	Present Value (Million )
1) Increased productivity by communicating more efficiently and faster.	Multiply: Number of workers; Hourly rate per worker; Adoption rate; <b>Number of hours (saved) - 40 to 100 per year based on the user group</b> ; Percent captured.	Intangible	<b>\$13.4</b>
2) Reduced time to complete projects.	Multiply: Net revenue of project; Gross margin %; Project per year; <b>Percent of project time reduced due to improved collaboration - 10%</b> ; Percent of time saved that could be applied to other projects; Adoption rate.	Intangible	<b>\$10.3</b>
3) Shortened sales cycle.	Multiply several parameters, including: <b>Percent of time saved through more effective internal communication, reducing delays in the proposal process - 20%</b> .	Intangible	<b>\$3.4</b>
4) Travel cost reductions.		Tangible	<b>\$11.1</b>
5) Reduced costs of dialing pay-per-minute telephone conferencing.		Tangible	<b>\$0.5</b>
6) Reduced long-distance telephone charges.		Tangible	<b>\$0.8</b>
<b>Subtotal Intangible</b>			<b>\$27.1</b>
<b>Subtotal Tangible</b>			<b>\$12.4</b>
<b>Total</b>			<b>\$39.5</b>

- Costs \$6 M
- **ROI 563%**
- **ROI 108% (with tangible benefits only)**

# A Sample of ROI Claims

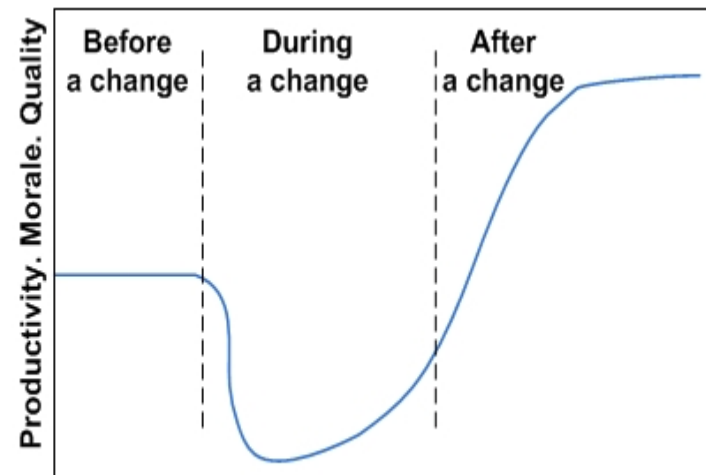
- The Gantry Group, found that the MarkView suite generated an average three-year **ROI of 332 percent**, or \$1.9 million, with an average payback of 7.4 months.
  - The MarkView Financial Suite automates financial processes to ensure consistent, efficient, cost-effective, and timely processing of all transactions.

Source: <http://www.kofax.com/markview/internal-controls.asp>

- Thanks to Force.com, our customers have built 185,000 apps 85% faster, **with an ROI of 721%** and a 54% lower TCO (Source: IDC research).  
SalesForce.com - Invitation for a Webinar Jan. 21, 2011.
- **The level of ROI numbers testifies that this measure has little, if anything, in common with a traditional ROI – important financial metric.**

# Intangible Costs

- Intangible costs are costs it is difficult/impossible to predict and quantify.
  - Upsetting customers from system change.
  - Cost of failure due to inappropriate system or faulty implementation.
  - Incompatibility with other systems.
  - Unexpected costs of software amendments, tailoring and maintenance.
  - Lack of experience in using new system (IT dept, Users)
  - Loss of staff morale.
  - [http://wiki.answers.com/Q/What are some intangible costs for information systems](http://wiki.answers.com/Q/What_are_some_intangible_costs_for_information_systems)
  - Cost of losing a competitive edge
  - Declining company image
  - Loss of investment in prior systems.
- A known J-curve of temporary drop in productivity associated with a change (implementation of a new IS and business processes).



Adapted from Westbrook Stevens Model  
(<http://www.westbrookstevens.com>)

# A Vicious Circle of a Hypothetical Organization



# ROI Virtualizations Wrap-Up

- The use of intangibles is not an “internal” ROI issue.
- Intangibles is a separate area of research. Nothing against attempts to quantify anything ... as a research exercise ... This area is far from being completed and the results being ready for use in regular business (accounting).
  - Evidence: Intangibles are not included in the accounting records, with some exceptional cases.
- Until financial people recognize and use intangibles for the accounting purposes, any ROI calculations and results should explicitly provide not only overall ROI but ROI for “hard” dollars and anything else.
- Currently, ROI virtualizations are intended to leave an impression of objective mathematically sound result, while in reality it is mostly based on subjective perceptions, prone to inaccuracies and falsifications.
- The inclusion of the intangible benefits makes a false promise/impression that ROI as a measure has a broad nature which provides an overarching description of the performance of the information system and business as a whole, while in reality it still characterizes only a certain aspect of a financial area.

# ROI Imitations

# ROI Imitations

- ROI Imitations can be classified into two subcategories:
  - Subcategory 1. Use the ROI term for the measures which have little or nothing to do with ROI. The purpose is to cash in on the seemingly positive credibility of the ROI term.
    - Typical for these group of measures is understanding of the ROI as “any benefit”.
    - Imitations are taking the ROI even further from the traditional financial understanding of it than the Virtualizations.

**`When I use a word,' Humpty Dumpty said...**

**it means just what I choose it to mean**

**-- neither more nor less.'**

*“Through the Looking Glass” by Lewis Carroll*

- Subcategory 2. Paradoxically enough, this group attempts NOT to use the ROI term (at least in the titles). They actually use ROI method (or very similar) under different names claiming that they’ve overcome the ROI deficiencies/limitations (e.g. their measures are multi-dimensional).



# ROI Perceptions

A quick comparison between ROI of personal investing and information systems

ROI of Personal Investing	ROI of Information Systems
It is about real money – both what I put in the bank and what I get back as a return.	Only for Traditional ROI – dollars are real. Often – ROI is not about dollars, it's about “nanoutopians”
Practically unbounded range of investments. It can \$1 or \$10 Million.	Level of investments is determined by the IS type. E.g. the highest ROI is demonstrated by a website (html page). It's impossible to invest \$10 Million in it. By the same token, if you have only \$10 you cannot invest in the ERP system.
It is after the fact calculations...	Mostly includes predictions...
Single criteria – rate of profit (profitability). Nothing else matters... (about nothing...).	Cannot be evaluated based on a single criteria (with few exception).

# ROI Terminology

- Use of the term “Benefits” instead of the “Financial Return”
  - Psychologically the motivation is clear – there’s not much if any “financial return”
  - The term is not helpful – smoke screen
- “Project ROI” – the term should be used carefully, if at all,
  - Seems to be in line with “project costs”, etc.
  - Especially in the context of the information systems.
  - By definition “project” will end up with a roll out of the system into production.
  - Next phase will be “business change management” – embracing the system by the operating units (in business processes). For IS (as ERP, CRM) that will be the first period of gaining returns. Not always these activities are included in the “project” (although they should be included).
  - Regular operations - may be for the duration of the system life cycle.

# Approach to the ROI Implementation

- Agree on the ROI concept.
- Develop a process of data collection.
- Develop and maintain a database of organization's historical costs and returns.
- Develop and implement a process of systematic application of the ROI metric.
- Agree on the place of the ROI metric in the overall framework of performance measurement and evaluation of information systems.
  
- Calculating ROI is not free.
- The cost of setting up such a system in the organization equals to 3 – 5% of the projects cost.

# Foundational Concepts and Methodologies

- Measure Theory
  - Estimating Theory
  - Cost Estimating
  - Forecasting
  - Data Quality
  - Quantification
  - Value Theory
  - Decision Making
  - Intangible Benefits (Intellectual Capital)
- 
- Validity and usefulness of the ROI calculations depends on:
    - The ROI team awareness and skillfulness in these areas.
    - The state-of-the-art in these areas.

# The World of “Return on Investment” (ROI)

## ROI Taxonomy

	Traditional ROI	ROI Extensions	ROI Virtualizations	ROI Imitations
What is it?	$ROI[T] = \frac{\sum_i FinRet(i) - \sum_j Cost(j)}{\sum_j Cost(j)} \times 100\%$ <p><i>FinRet</i> – Financial Return</p>	$ROI[E] = \mathfrak{S}\left(ROI[T]_{est}, t, Risk\right)$	$ROI[V] = \Psi\left(ROI[E], \$B\right)$	<p>Subcategory 1. Use the ROI term for the measures which have little or nothing to do with ROI. The purpose is to cash in on the seemingly positive credibility of the ROI term. Typical for this group of measures is understanding of the ROI as “any benefit”.</p> <p>Subcategory 2. Paradoxically enough, this group attempts NOT to use the ROI term (at least in the titles). They actually use ROI method (or very similar) under different names claiming that they’ve overcome the ROI deficiencies/limitations (e.g. their measures are multi-dimensional).</p> <p>Can be based on ANY Return / Benefit / Impact.</p> <p>Retrospective and Predictive.</p>
How it is measured?	Profitability based on “hard” dollars.	Profitability based on dollar estimates.	Profitability based on a mix of “hard” dollars, dollar estimates and “dollarized” assessments of intangibles.	
What is the time frame?	Retrospective.	Retrospective and Predictive.	Retrospective and Predictive.	
What is the level of accuracy?	As precise as accounting records are.	Uncertainty increases due to estimation errors.	Indeterminate. Open to subjective perceptions and interpretations.	
Accountability and transparency?	Accounting records (official financial documents or accounting systems) are used as sources of cost and return data. Full transparency and accountability.	Certain level of accountability may be preserved, if cost and return estimates are included in the planning financial documents and periodically reviewed. Limited transparency due to the subjectivity of predictions.	Data used in calculations (especially Returns) is not recorded in the official accounting systems. Prone to uncontrolled subjectivity.	

None of the above measures tells you anything about how good is the system at what it is supposed to do... They are all financial measures...

## ROI – A One-dimensional Measure (fine print from the previous slide)

- **None of the above measures tells you anything about how good is the system at what it is supposed to do...**
- **They are all financial measures...**

# ROI in the Real World

# Putting ROI in a Perspective

- Many other measures of performance and evaluation methods.
- Not a purpose of this presentation is to describe other metrics or compare them to ROI.
  - Just a brief mentioning of some them and providing references to the sources with information.
- Financial.
- Non-financial.
- Complex --- may include financial, operational etc.
- Many of them use ROI as a component.



# Economic Value Added

- Economic Value Added (EVA) - A measure of a company's financial performance based on the residual wealth calculated by deducting cost of capital from its operating profit (adjusted for taxes on a cash basis).
- The measure was devised by Stern Stewart & Co. EVA attempts to capture the true economic profit of a company.

Source: Investopedia <http://www.investopedia.com/terms/e/eva.asp>

- As with many metrics, it's hard to link precise EVA returns to a specific technology investment. EVA is ideally suited to publicly traded companies, not private companies, because it deals with the cost of equity for shareholders, as opposed to debt capital.

# Total Economic Impact

- Total Economic Impact (TEI) developed by Forrester Research Inc. (GIGA)
- Forrester claims TEI systematically looks at the potential effects of technology investments across four dimensions:
  - Cost — impact on IT.
  - Benefits — impact on business.
  - Flexibility — future options created by the investment.
  - Risk — uncertainty.
- Analysis of the Forrester case studies shows that TEI-approach essentially boils down to determining ROI (risk-adjusted, intangible benefits included in financial terms). Flexibility component either was not estimated or not included in the overall cost/benefit numbers.
- More info:
  - Forrester Research Inc. website <http://www.forrester.com/TEI>
  - Jeffrey North “The Total Economic Impact™ of Microsoft Unified Communications Products and Services” Forrester, 2007  
[http://download.microsoft.com/documents/australia/business/uc/TotalEconomicImpact\\_%20of\\_Microsoft\\_UC.pdf](http://download.microsoft.com/documents/australia/business/uc/TotalEconomicImpact_%20of_Microsoft_UC.pdf).
  - Chip Gliedman “The Total Economic Impact™ Methodology: A Foundation For Sound Technology Investments” *Forester, 2008*

# Business Value of Information Technology

- Business Value of IT (ITBV) Program was developed by Intel Corporation in 2002.
- The program uses a set of financial measurements of business value, that re called Business Value Dials (Indicators).  
Multidimensional – includes business component
- Relatively easy to implement.
- More info:
  - Martin G. Curley “Managing Information Technology for Business Value: Practical Strategies for IT and Business Managers (IT Best Practices series)” *Intel Press*, 2004. ISBN-13: 978-0971786172
  - Matthew M. Carty and Richard Lansford “Using an IT Business Value Program to Measure Benefits to the Enterprise” *Intel White Paper*, 2009.  
[http://www.intel.com/it/it-management/#business\\_value](http://www.intel.com/it/it-management/#business_value)
  - David S. Sward “Measuring the Business Value of Information Technology: Practical Strategies for IT and Business Managers” *Intel Press*, 2006  
[http://www.intel.com/intelpress/sum\\_bvm.htm](http://www.intel.com/intelpress/sum_bvm.htm)

# Val IT

- Val IT is a framework for the governance of IT investments developed by The IT Governance Institute (ITGI), the originator of the COBIT (Control Objectives for Information and related Technology).
- Val IT is aligned with COBIT Version 4 and provides:
  - a set of guiding principles, and
  - a number of processes conforming to those principles that are further defined as a set of key management practices (Wikipedia).
- Val IT includes several dozen practices in the three domains:
  - Value Governance
  - Portfolio Management
  - Investment Management
- More info:
  - Val IT Framework for Business Technology Management <http://www.isaca.org/Knowledge-Center/Val-IT-IT-Value-Delivery-/Pages/Val-IT1.aspx>

# Applied Information Economics

- Applied Information Economics (AIE) is a decision analysis method developed by Hubbard Decision Research.
- AIE claims to be “the first truly scientific and theoretically sound method” that builds on several methods from decision theory and risk analysis including the use of Monte Carlo methods.
- AIE is not used often because of its complexity.
- More info:
  - Hubbard Decision Research website <http://www.hubbardresearch.com/aie.html>
  - D. Hubbard, *How to Measure Anything: Finding the Value of Intangibles in Business*, 2nd ed., John Wiley & Sons, 2010.

# “Return on Investment” (ROI) – in the Real World

## Financial Measures

- Present Value (PV)
- Net Present Value (NPV)
- Internal Rate of Return (IRR)



- Total Cost of Ownership (TCO)
  - Total Value of Opportunity (TVO)
  - Real Cost of Ownership by META Group
  - Total Value of Opportunity by Gartner Group
  - Total Economic Impact (TEI) by Forrester

## Effectiveness Measures

## Efficiency Measures

## Complex Measures

- Business Value Indexes/Dials - Intel
- Val IT - ITGI (COBIT-related)
- Applied Information Economics (AIE) - Habbard

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- "What are Tangible and Intangible Costs and Benefits?"  
[http://www.justthefactstv.com/cis235/files/CE21/CE21WebTerrazas/index\\_files/Page316.htm](http://www.justthefactstv.com/cis235/files/CE21/CE21WebTerrazas/index_files/Page316.htm)

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[http://www.intel.com/intelpress/sum\\_bvm.htm](http://www.intel.com/intelpress/sum_bvm.htm)
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## **The Use of Return on Investment (ROI) in the Performance Measurement and Evaluation of Information Systems**

*The views, opinions and conclusions expressed in this document are those of the authors alone, and do not necessarily represent the views of the Ontario Ministry of Health and Long-Term Care or any of its individual departments.*

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