

Practical Metrics and Models



for Return on Investment

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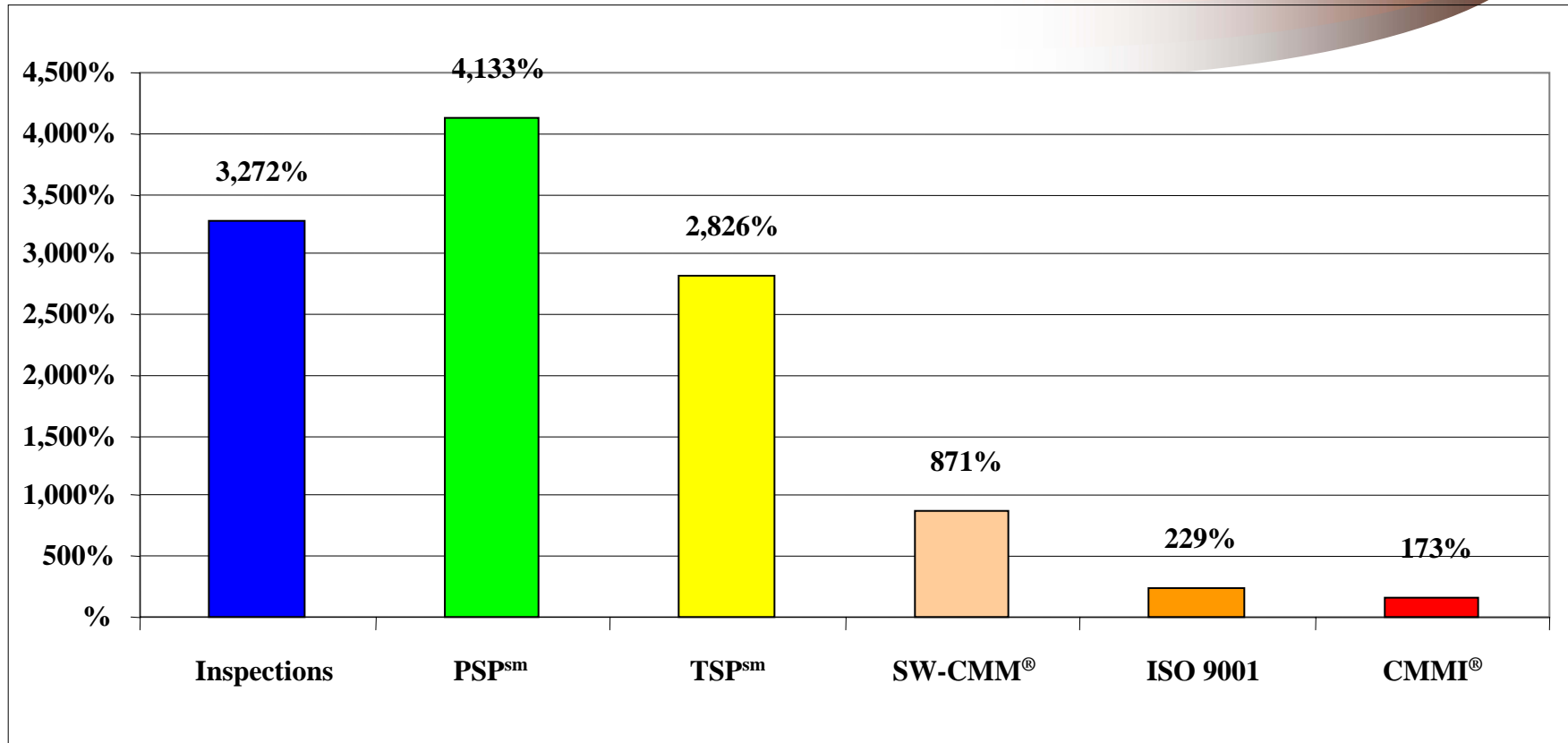
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Goals and Objectives



- ROI of SPI Methods
- ROI Metrics
- ROI Cost Models
- ROI Benefit Models
- ROI Costs and Benefits
- ROI Summary
- ROI Examples
- ROI Cost per Person
- ROI Recommendations

ROI of SPI Methods



ROI Metrics

Metric	Definition	Formula
Costs	Total amount of money spent on a new and improved software process	$\sum_{i=1}^n Cost_i$
Benefits	Total amount of money gained from a new and improved software process	$\sum_{i=1}^n Benefit_i$
B/CR	Ratio of benefits to costs	$\frac{Benefits}{Costs}$
ROI	Ratio of adjusted benefits to costs	$\frac{Benefits - Costs}{Costs} \times 100\%$
NPV	Discounted cash flows	$\sum_{i=1}^{Years} \frac{Benefit_i}{(1 + Discount\ Rate)^{Years}} - Costs_0$
BEP	Point when benefits meet or exceed cost	$\frac{Costs}{Old\ Costs / New\ Costs - 1}$

ROI Cost Models

Method	Cost Models and Worked Examples	Hours	Costs
Inspections (effort)	$LOC / (Review_Rate \times 2) \times (Team_Size \times 4 + 1)$	708	^a \$70,833
	$10,000 / (120 \times 2) \times (4 \times 4 + 1)$		
Inspections (training)	$Team_Size \times (Fee / Rate + Hours)$	112.4	^b \$11,240
	$4 \times (410 / 100 + 24)$		
PSP sm (training)	$Team_Size \times ((Fee + Expenses) / Rate + Hours)$	1,056	^c \$105,600
	$4 \times ((5,000 + 5,400) / 100 + 160)$		
TSP sm (training)	$Team_Size \times ((Fee + Expenses) / Rate + Hours) + PSP$	1,484	^d \$148,400
	$4 \times ((4,000 + 2,700) / 100 + 40) + 1,056$		
SW-CMM [®] (process)	$561 + 1,176 \times Number_of_Projects$	1,737	^e \$173,700
	$561 + 1,176 \times 1$		
ISO 9001 (process)	$546 + 560 \times Number_of_Projects$	1,106	^f \$110,600
	$546 + 560 \times 1$		
CMMI [®] (process)	$(10,826 + 8,008 \times Number_of_Projects) / 2$	9,417	^g \$941,700
	$(10,826 + 8,008 \times 1) / 2$		

ROI Benefit Models

Method	Benefit Models and Worked Examples	Hours	Costs
Old Costs	$LOC \times 10.51 - Test_Hours \times 9$	45,100	^h \$4,509,997
	$10,000 \times 10.51 - 6,666.67 \times 9$		
Inspections	$LOC \times 10.51 - Inspection_Hours \times 99 - Test_Hours \times 9$	17,425	ⁱ \$1,742,533
	$10,000 \times 10.51 - 708.33 \times 99 - 1,950 \times 9$		
PSP sm	$LOC / 25$	400	^j \$40,000
	$10,000 / 25$		
TSP sm	$LOC / 5.9347$	1,685	^k \$168,501
	$10,000 / 5.9347$		
SW-CMM [®]	$LOC \times 10.2544 - Inspection_Hours \times 99 - Test_Hours \times 9$	14,869	^l \$1,486,933
	$10,000 \times 10.2544 - 708.33 \times 99 - 1,950 \times 9$		
ISO 9001	$LOC \times 10.442656 - Test_Hours \times 9 - Rework_Savings$	39,402	^m \$3,940,156
	$10,000 \times 10.442656 - 6,670 \times 9 - 4,995$		
CMMI [®]	$LOC \times 10.2544 - Inspection_Hours \times 99 - Test_Hours \times 9$	14,869	ⁿ \$1,486,933
	$10,000 \times 10.2544 - 708.33 \times 99 - 1,950 \times 9$		

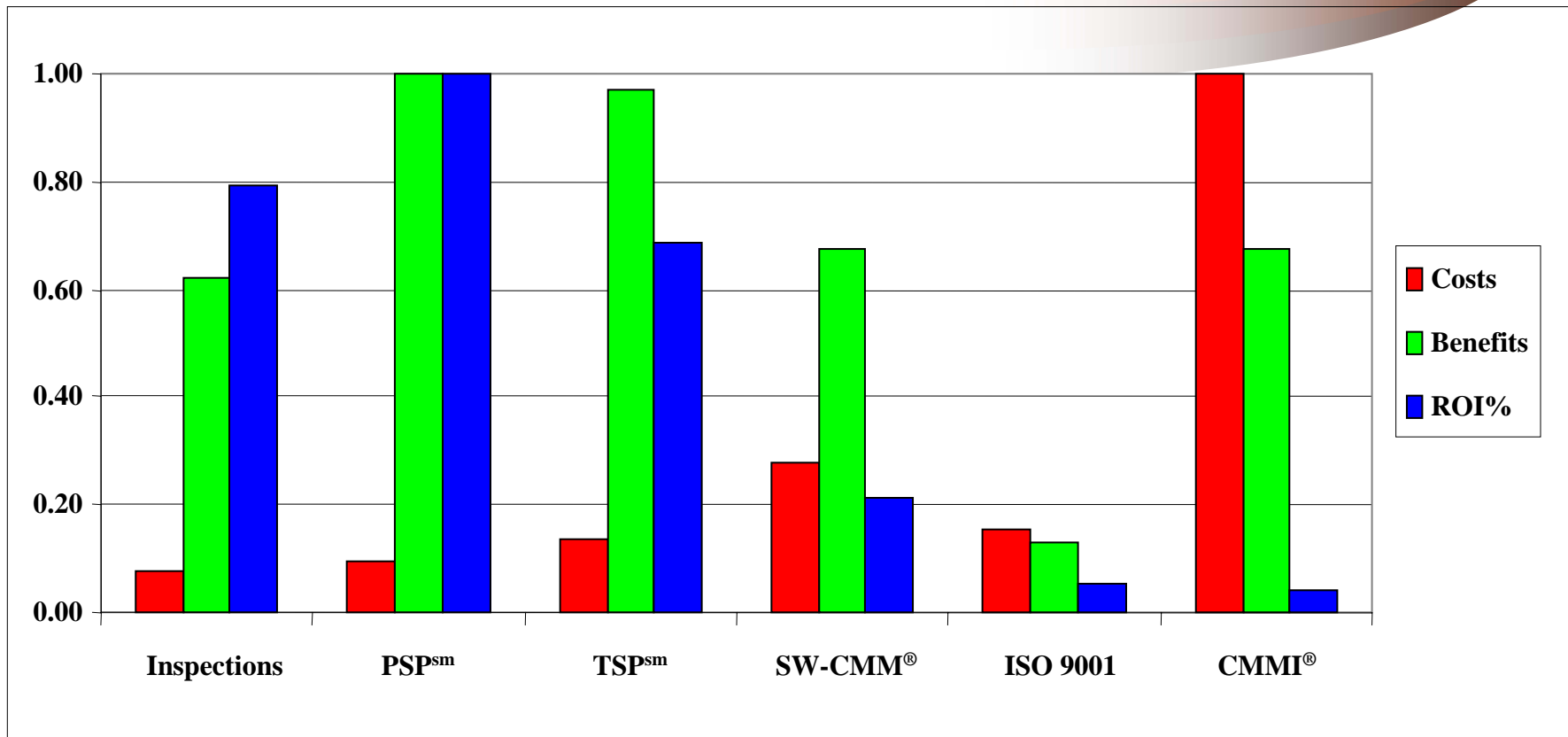
ROI Costs and Benefits

Factor	Inspections	PSP sm	TSP sm	SW-CMM®	ISO 9001	CMMI®
1. Inspections	^a \$70,833	n/a	n/a	^a \$70,833	n/a	^a \$70,833
2. Training	^b \$11,240	^c \$105,600	^d \$148,400	n/a	n/a	n/a
3. Process	n/a	n/a	n/a	^e \$173,700	^f \$110,600	^g \$941,700
4. Preparation	n/a	n/a	n/a	* \$36,800	* \$26,400	* \$48,000
5. Appraisal	n/a	n/a	n/a	* \$30,100	n/a	* \$47,700
6. Audit	n/a	n/a	n/a	n/a	* \$36,000	n/a
Costs	\$82,073	\$105,600	\$148,400	\$311,433	\$173,000	\$1,108,233
7. Old Costs	^h \$4,509,997	^h \$4,509,997	^h \$4,509,997	^h \$4,509,997	^h \$4,509,997	^h \$4,509,997
8. (New Costs)	ⁱ (\$1,742,533)	^j (\$40,000)	^k (\$168,501)	^l (\$1,486,933)	^m (\$3,940,156)	ⁿ (\$1,486,933)
Benefits	\$2,767,464	\$4,469,997	\$4,341,496	\$3,023,064	\$569,841	\$3,023,064
<i>(* Preparation, appraisal, and audit costs determined without the aid of a cost model.)</i>						

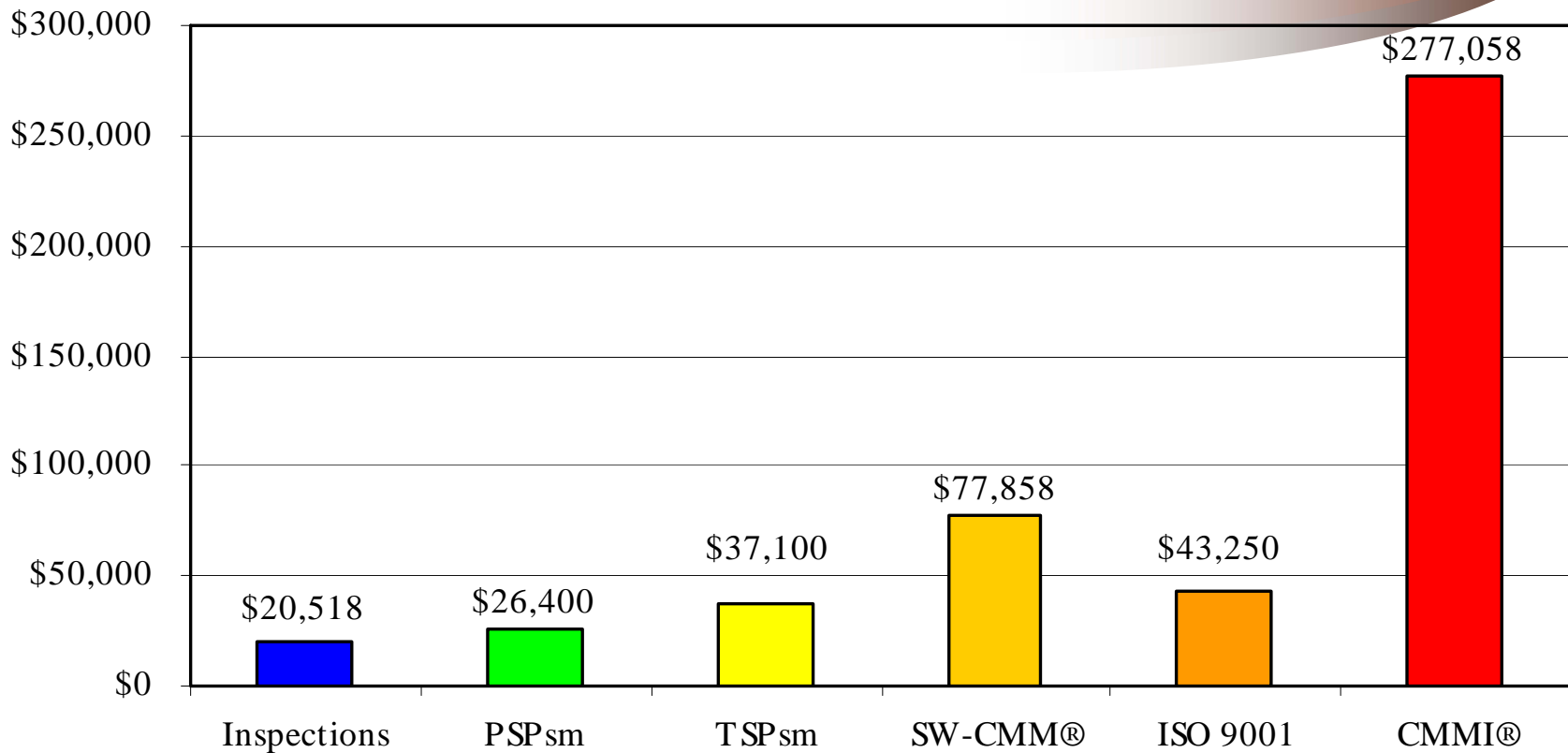
ROI Summary

Method	Costs	Benefits	B/CR	ROI%	NPV	BEP
Inspections	\$82,073	\$2,767,464	34:1	3,272%	\$2,314,261	\$51,677
PSP sm	\$105,600	\$4,469,997	42:1	4,133%	\$3,764,950	\$945
TSP sm	\$148,400	\$4,341,496	29:1	2,826%	\$3,610,882	\$5,760
SW-CMM [®]	\$311,433	\$3,023,064	10:1	871%	\$2,306,224	\$153,182
ISO 9001	\$173,000	\$569,841	3:1	229%	\$320,423	\$1,196,206
CMMI [®]	\$1,108,233	\$3,023,064	3:1	173%	\$1,509,424	\$545,099

ROI Examples



ROI Cost per Person



ROI Recommendations



- Choose a simple set of metrics and models for ROI
- Don't spend a lot of money to achieve a high ROI
- Don't go bankrupt using expensive SPI methods
- Seek low cost automated SPI methods with a high ROI
- Don't wait until you're SW-CMM®/ CMMI® Level 5
- Don't spend too much money measuring ROI
- Proactively plan for ROI, don't wish for ROI after-the-fact
- Use ROI to right size a SPI program for your organization
- Apply metrics and models for ROI before it's too late