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Risk Management Return on Investment

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ABSTRACT

How effective is your risk management process? Risk management return on investment is the ratio of savings to cost that indicates the value of performing risk management. This paper presents a standard definition for measuring risk management return on investment: $ROI_{(RM)}$. Application of this measure on two case studies provides examples of large programs with excellent risk management results. Both case studies report $ROI_{(RM)}$ at over 20 to 1, which is risk management nirvana. To achieve these results, the people worked hard—risk management does not make difficult work go away. © 1999 John Wiley & Sons, Inc. Syst Eng 3: 1770–180, 1999

1. INTRODUCTION

The business case for risk management is based on cost-benefit analysis. Cost of risk management is the total investment in resources for risk assessment and risk control. Resources include time spent in risk management meetings, the cost of reporting risk information, and the staff to develop a risk action plan. Quantifying the costs of risk management is a simple task using a cost history database.

If the cost to develop a risk management process is spread over ten programs, then benefits from process reuse can be estimated by the amount of time saved. Savings are measured in resources of time, money, and staff *not* expended on nine of ten programs. Cost is measured by the number of person-hours expended to develop the process. Return on investment (ROI) is the ratio of savings to cost that indicates the value provided. In this example, the business case to develop a standard risk management process is justified at 10 to 1 ROI.

Without ROI data, senior managers must rely on testimonials of program managers and staff to judge the perceived benefits of risk management. Reliance on testimonials is built on trust and perception. Trust will erode over time unless perceptions are validated by ROI data. Section 2 presents a definition for measuring effectiveness of the risk management process: $ROI_{(RM)}$. Several uses of $ROI_{(RM)}$ are described in Section 3, $ROI_{(RM)}$ Metric Utility. Section 4 reports results of two case studies that used the standard ROI measure. Section 5 recaps the value of a standard measure for risk management effectiveness in maximizing opportunities within an organization.

2. MEASURE OF SUCCESS

Cost of risk management is the total investment in resources—time spent in risk management meetings, the cost of reporting risk information, and the staff to develop a risk action plan—for risk assessment and risk control. The return for each managed risk is the savings. Risk management ROI is the savings for all managed risks divided by the total cost of risk management activities, which is expressed in the following equation:

$$\mathrm{ROI}_{(\mathrm{RM})} = \frac{\sum \text{Savings}}{\text{Cost}}$$

Risk management benefits come from two types of savings: cost avoidance and cost reduction [Hall, 1998, p. 143].

Cost avoidance is a technique for savings that decreases the anticipated cost growth. It is the difference between possible cost without risk resolution and the actual cost with risk resolution. An example of cost avoidance is any resolution strategy that successfully contains cost growth to maintain the budget. The key to understanding how to quantify cost avoidance is the insight that the calculation depends on four possible risk outcomes, as shown in Figure 1. These outcomes are presented in more detail in Table I, which describes the associated calculation for cost avoidance and rationale. Cost avoidance is calculated after risk resolution or when the risk occurs. The maximum risk exposure over time, Max(RE_t), denotes cost avoidance for risk that did not occur because of successful risk resolution. The risk exposure is a most likely estimate, because consequence is moderated by multiplication with probability [Boehm, 1991, p. 33]. When no cost is avoided (e.g., no risk management efforts were initiated or risk resolution strategies were ineffective), savings are zero. Negative returns are not used because they promote use of worst-case estimates.

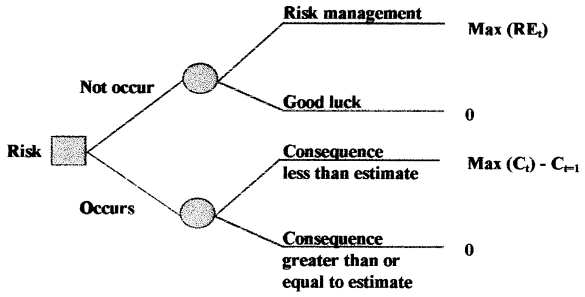

Figure 1 Four possible risk outcomes.

Cost reduction is a technique for savings that decreases the estimated planned cost. It is the difference between planned and actual costs. Through cost reduction, it is possible to underrun the budget. Risk management practices can lead to opportunities for a program to do better than their baseline plan. Unless an alternate course of action is taken, planned resources will be used. When the alternate course of action was the result of risk management activities, savings are captured as a reduction in cost. Use of new technology to increase productivity may be an opportunity for cost reduction. Because savings are cumulative, time in the develop-

Table I. Cost Avoidance Calculation[a]

Outcome	Cost Avoidance	Rationale
Risk did not occur because of successful risk resolution	Max (RE_t)	Cost avoidance is based on the maximum estimate of risk exposure. Using the Max function promotes periodic updates of the risk action plan to reflect more accurate estimates of probability and consequence
Risk did not occur because of good fortune	0	Cost avoidance is zero if no risk management efforts were initiated
Risk occurred; the consequence is less than the initial estimate	Max (C_t) − $C_{t=1}$	Cost avoidance is the difference between how bad it could have been and how bad it was when the consequence was realized
Risk occurred; the consequence is equal to (or greater than) the initial estimate	0	Risk resolution strategies were ineffective. Investment in risk management has a zero return. No cost was avoided. (Negative returns are not used because they promote use of worst-case estimates.)

[a]RE_t = the interim expectation of risk exposure, C_t = the interim expectation of risk consequence, $C_{t=0}$ = the initial expectation of risk consequence, and $C_{t=1}$ = the measured actual risk consequence.

ment cycle smoothes out potential estimation errors. For example, an estimated increase in productivity of 10% could be adjusted when found to be 20%.

3. $ROI_{(RM)}$ METRIC UTILITY

As shown in Figure 2, the $ROI_{(RM)}$ metric grows as program risks are resolved. Early variation of the $ROI_{(RM)}$ indicator will occur based on the diversity of opportunities for risk resolution. The indicator will eventually settle into an average $ROI_{(RM)}$ for the program that will be similar to historical program results. The $ROI_{(RM)}$ metric has a number of uses:

- Planning benchmark for risk leverage. When planning a risk resolution strategy, $ROI_{(RM)}$ is useful as a benchmark for expected risk leverage. When the expected risk leverage is well below $ROI_{(RM)}$, you may want to spend extra time planning a more effective strategy. When the expected risk leverage is far above $ROI_{(RM)}$, you may want to perform a reality check on your numbers.
- Planning benchmark for management reserve. An understanding of a typical $ROI_{(RM)}$ can be coupled with good estimates of total program risk exposure to set realistic program reserve levels.
- Program indicator of risk management effectiveness. For a specific program, $ROI_{(RM)}$ is an indicator of risk management effectiveness. When the $ROI_{(RM)}$ varies significantly from the organization metric, practices should be investigated for either improvement or lessons learned.
- Organizational measure of risk management utility. At the organizational level, $ROI_{(RM)}$ is a measure of the value of the risk management practice.

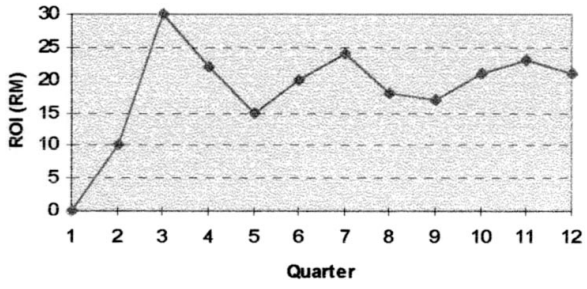

Figure 2 $ROI_{(RM)}$ trend data.

4. RISK MANAGEMENT BENCHMARK

Over time, the cost and savings from risk management yield an $ROI_{(RM)}$ metric that can be used as a performance standard. The following two case studies of large software systems development programs show that the benchmark for $ROI_{(RM)}$ is over 20 to 1.

4.1. Case Study 1

The program management team identified a necessary replan based on refined development model parameter inputs, which predicted the completed program in terms of cost, schedule, and staff. The return on investment for the schedule risk was calculated as cost avoidance relative to the cost of the required risk management activity. The cost avoidance was calculated as 2 months down the wrong path for each of the engineers. The risk management cost included the routine risk management activities and the research to investigate the effects of multiple small variances in program indicators. The replan costs were not included, as they were assumed to be inevitable at a later date.

The calculations show that the $ROI_{(\text{schedule risk})}$ was 23 to 1:

Savings: 25,600 labor hours cost avoidance (2 months 80 engineers 160 h/month).
Cost: 1120 labor hours:
480 h meetings (10 engineers 1 h/week 48 weeks),
320 h assessment (40 h 8 engineers on average),
320 h model research (1 engineer 320 h).
$ROI_{(\text{schedule risk})}$ = 25,600 labor h/1120 labor h.
$ROI_{(\text{schedule risk})}$ = 23 to 1.

4.2. Case Study 2

Each month, management reviewed the engineering team's cost savings in terms of cost avoidance and cost reduction. The team had to quantify either negative or positive cost and schedule impacts, as well as the solution cost. They had an objective of increasing productivity by 10–20%. One way the team improved productivity was a midcourse correction of coding standards. They quantified the inefficiency of a coding standard in the following manner: If it is aggravation for 20 people and it slows them down by 10 min/day, that is 200 min/day or 867 h/year. (This calculation is based on a nominal 40-h work week. The coding phase on the program lasted 1 year.) At a labor rate of $100/h, that adds up to about $87,000. The cost of changing a few lines in the coding standards was zero. Somebody volunteered to do it, and because the coding standards were online, it was easily done. The team saved roughly $87,000 by changing a few coding standards.

The engineering team cumulated their cost savings as well as their cost of performing risk management activities. The process required the estimates for risk probability and consequence to be most likely (not worst-case) estimates. These estimates were updated whenever significant changes occurred in the estimates or when a change in resolution strategy occurred. The task leader reported the return on investment as an indicator of the team's risk management effectiveness.

The calculations show the $ROI_{(RM)}$ was 22 to 1:

Savings: \$8 million (\$6 million cost avoidance and \$2 million cost reduction).

Cost: \$370,000:

\$150,000 programwide risk management,

\$100,000 software risk management,

\$120,000 risk resolution cost.

$ROI_{(RM)}$ = \$8 million/\$370,000.

$ROI_{(RM)}$ = 22 to 1.

5. CONCLUSIONS

The business case for risk management is based on cost-benefit analysis. Cumulating the cost of risk management is a simple task. However, quantifying the benefit can be difficult due to uncertainty inherent in risk. The standard definition for measuring risk management return on investment, $ROI_{(RM),}$, is a solution to the problem of how to calculate the benefits of risk management. Results of using $ROI_{(RM)}$ in two case studies shows the utility of this metric. In the first case study, return on investment of 23 to 1 for a significant schedule risk provided assurance that a costly replan was worthwhile. In the second case study, the final risk management spreadsheet showed \$6 million in cost avoidance and \$2 million in cost reduction. Quantitative, cumulative, and positive results propagate cost savings to make that program a success. With respect to large-scale software systems development, a best-in-class standard for $ROI_{(RM)}$ is over 20 to 1. Working to achieve this benchmark will maximize opportunities within this type of organization.

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Elaine Hall is founder of Level 6 Software and chair of the INCOSE Risk Management Working Group. She is author of *Managing Risk: Methods for Software Systems Development*, ©1998 Addison Wesley Longman, Inc. Hall has the first doctoral dissertation focused in software risk management: *Proactive Risk Management Methods for Software Engineering Excellence.* She received her M.S. (1983) and Ph.D. (1995) degrees in Computer Science from the Florida Institute of Technology, Melbourne, Florida. She is listed in *International Who's Who of Professionals*, *Who's Who in American Colleges and Universities*, the *Minority & Women Doctoral Directory*, and is a full member of Sigma Xi, a scientific research society.