Knowledge Return on Investment

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Introduction to ROI

ROI (pronounced "are-oh-eye," and typically written without periods) is an acronym for *return on investment*. Herein we define ROI as a metric of the *net payouts from a financial outlay over time*. While discussing other ROI measures, we focus on *discounted cash flow* (DCF), also known as *internal rate of return* (IRR) and *net present value* (NPV). This technique is taught in most MBA programs, and is a standard way of projecting and measuring the results of capital projects in the modern enterprise.

The goals of this chapter are to explain these terms and, in so doing, give you some ways to think about the value of knowledge.

The word investment herein typically includes both capitalized and expense items.[1] All kinds of organizational projects—including Information Technology and Knowledge Management projects—are typically subjected to ROI analysis.

The ROI measurement usually has three uses: selecting among projects being considered; comparing alternative potential solutions; and evaluating projects already undertaken.

1. **Selecting among projects.** Any enterprise (whether business, government, or not-for-profit) has capital constraints, and therefore, project proposals must "compete" with each other for their share of expenditure. ROI analysis is used to allocate capital

resources among competing projects by providing a common framework for their evaluation.

In this usage, ROI is essentially a pro forma estimate of what is deemed most likely to occur in the future. Because it is a forecast, it is subject to a good deal of uncertainty. Consequently, the supporting estimates often must be arrived at by negotiation and consensus, rather than by scientific proof.

2. **Comparing potential solutions.** Once a particular kind of project is decided on (e.g., "Let's install an expertise profiling system"), then it remains to select among solutions offered by competing vendors. In those rare cases where vendors offer exactly the same feature sets ("apples-to-apples"), the benefits can be presumed to be the same and costs become the key feature of differentiation. In most complex projects, however, the solution sets offered by various vendors differ somewhat, or even substantially. ROI analysis offers a way to compensate for these differences.

   Just as when selecting among projects, comparing solutions suffers from the future estimation problems mentioned above. Moreover, these ROI estimates often are supplied by the respective vendors themselves and therefore may contain biases of various kinds.

3. **Evaluating projects after the fact.** After a project has been running, it is typical to compare the actual results with the estimates prepared, as above. This can be useful in determining whether to continue to fund the investment and in evaluating similar future investment opportunities. Here, the challenge is to measure what already has happened, rather than estimating what probably will happen.

   Alas, however, the effort often is no less problematic. The key measurement problem is *attribution*—that is, how can we tell whether a certain positive benefit resulted from our project, or was the result of some other factors (e.g., general business conditions)? In fact, in any complex system—of which the modern enterprise is a textbook example—one can

only rarely truthfully isolate the effects of various "causative" forces. As a result, in practice, post facto measurements of the results of a project, as do forecasts, become subject to negotiation and consensus building.

Though few ROI analyses are precisely scientific, the *process* of developing such an analysis has inherent benefits. The discipline of thinking through the specific costs and benefits expected to result from a project typically results in both greater cost control and greater expansion of potential applications than would otherwise have been the case.

The Value of Knowledge Management

The value of better KM is intuitively obvious to some (especially those on the knowledge supply side) but often less obvious to others (including those who control the purse strings of the organization). Several studies on the perceived benefits of better KM point to areas of benefits that could be exploited in a KM initiative. A study conducted by Ernst and Young (*Information Week*, 1997) among 431 U.S. and European companies found the following reported benefits from having organized KM programs:

- Increased innovativeness
- Enhanced efficiency
- Better decision-making
- Faster responsiveness
- Enhanced flexibility
- Improved quality
- Reduced duplication of effort
- Greater employee empowerment

A similar study conducted by KPMG (*PC Week*, 1999) among 43 companies found similar results—and included the numbers of companies reporting such benefits as

- Better decision making, 86 percent
- Reduced costs, 70 percent
- Improved productivity, 68 percent
- Faster response time to key issues, 68 percent
- Shared best practices, 60 percent
- Created new/additional business activity, 58 percent
- Increased profit, 53 percent
- Better staff attraction/retention, 42 percent
- Increased market share, 42 percent
- Increased share price, 23 percent

What is interesting is the trend in the 1999 study toward drawing direct correlations between KM initiatives and enterprise value in the form of reduced costs; new business activity; and increases in profit, market share, and share price. The movement toward more rigorous financial justification for KM projects was already under way.[2]

KM ROI

In a large organization, ROI analysis typically is used to determine whether a complex project lives or dies. At this writing (Summer 2002), most KM projects are competing for IT budgets that are growing much more slowly than previously, or even shrinking. Projects related to data security now appear to claim the top spot on organizational IT wish lists, and more strategic projects such as KM seem to be undertaken more reluctantly than previously.

Knowledge management projects are especially vulnerable to "death by ROI" because KM is an overhead function; it is viewed as expendable; and its benefits are often subtle.

1. **Knowledge management is overhead.** Alone, KM rarely generates revenues nor is that typically its primary mission. It is an overhead, or staff, function the benefits of which are necessarily indirect. Therefore its benefits, even its financial ones, are subject to estimation and biases as describe above.

2. **Knowledge management is expendable.** Knowledge management is a leading-edge practice and is not assumed to be necessary by all enterprises. This is not only because it is an overhead function. A typical enterprise does not subject other overhead functions (e.g., Human Resources) to continual ROI analyses, because HR is assumed to be a necessary and valuable function. In contrast, KM is relatively unproved and is not assumed to "work" in all enterprises. (In fact, it has not "worked" in many instances, though the reasons for this are beyond the scope of this chapter.)

3. **Knowledge management benefits are both far-reaching and hard to measure.** The benefits of KM are much more uncertain and subject to volatility than are other enterprise initiatives. We will discuss this further in looking at the details of a KM ROI model.

A confounding issue is that KM as a discipline is evolving so rapidly that even its name has become relatively meaningless at this writing. It is more accurate to think of KM as a *portfolio* of specific projects and larger initiatives.

Seen from this perspective, KM projects typically fall into one of the following categories:

- **Document management.** Systems that index, catalog, locate, and make available documents across the enterprise
- **Expertise profiling.** Systems that index, catalog, and locate human expertise across the enterprise

- **Best-practices repositories.** Databases that contain optimized procedures and solutions to common problems
- **Data warehousing and data mining ("business intelligence").** Software that analyzes large transactions databases for patterns and trends
- **Intellectual property management.** Cataloging and subsequent licensing of trademarks, copyrights, patents, and trade secrets
- **Collaboration.** Software that facilitates project-oriented work groups, typically across organizational and geographic boundaries

Each project type is quite different in several respects, including the costs and benefits profiles. The generalized model described subsequently will fit all of these types of projects. In the specific example that follows, we choose one of these categories to illustrate the application of this generalized model.

Generalized ROI Model

The general ROI model[3] can be diagrammed as shown in Figure 1. Neither project costs nor benefits are likely to be one-shot events; they are likely to be recurring. That is, there are costs associated with the initial investment ($Cost_0$) and both costs and benefits associated with each time period for which the investment is to be evaluated. Capital investments are typically evaluated by year, though more or less frequent units of measurement are also possible. Calculations are usually made on constant currency terms, such that no adjustments for inflation need be made.

	INITIAL	PERIOD 1	PERIOD 2	PERIOD 3	PERIOD N
BENEFITS (cash out)		$Benefit_1$	$Benefit_2$	$Benefit_3$	$Benefit_N$
COSTS (cash in)	$Cost_0$	$Cost_1$	$Cost_2$	$Cost_3$	$Cost_N$
NET CASH FLOW	Net_0	Net_1	Net_2	Net_3	Net_N

Figure 1. Generalized return on investment (ROI) model.

The ROI model uses cash flow as its unit of measurement. Cash flow is literally the amount of cash that comes in or goes out—without any accounting adjustments. Cash flow is quite different from earnings as defined by generally accepted accounting principles (GAAP), which all U. S. corporations currently must use for reporting. For example, for financial reporting purposes the cost of a piece of capital equipment is charged in stages over a period of, say, three to five years as depreciation. In an ROI analysis, the entire outlay is treated as a single initial cash outflow.

Cash flow is the standard measurement for all capital budgeting decisions, where the relevant decision involves a choice between two alternatives: investing in the project, or not investing (Van Horne, 1977).

Note that this general model would fit comfortably into an electronic spreadsheet, and you are encouraged to create a template as shown in Excel or any other spreadsheet software. This will greatly facilitate revising and running the model. The formula for each column is

$$Benefit_N - Cost_N = Net_N$$

Costs

Costs for a KM-related project typically include hardware, software, labor, and other related outlays. Some costs are obvious (such as software licenses), because they appear on invoices from vendors. Others are hidden costs, for example, the time of people to learn, use, and maintain an application.

- **Hardware** includes servers, storage, routers and wiring, and telecommunications equipment. Costs include purchase or lease costs and maintenance costs.

- **Software** includes the software for KM applications operating systems, network management, and so on. Software is typically licensed, rather than purchased. There may be an initial fee and a periodic license fee. License fees for many applications are charged on a "per seat" basis, that is, how many people are using the application at any given time. License fees often cover technical support and applications maintenance and upgrades; however, to the extent they do not, these costs must be factored in separately.

- **Labor** includes, for example, user time for training in the KM application, the costs of internal support staff, and the costs of data input to the system. The cost of staff salaries is a "sunk cost"; nevertheless, it should be included in a rigorous project analysis.

- **Other** can include related contracted costs, such as consulting support and internal marketing support for the application.

Costs are typically easier to estimate than are benefits because, by definition, costs usually are financial and often are contractually specified (where an outside vendor is involved).

Benefits

Benefits consist of the incremental (in the sense that they would not have occurred without the project) cash flows generated by the investment. These can be financial; nonfinancial but measurable; and qualitative, or nonmeasurable.

- **Financial metrics** can be top line or bottom line. Top-line financial benefits include revenue enhancements, which typically are incremental sales that would not have occurred without the project. Bottom-line improvements include cost reductions, which are outlays that can be reduced or eliminated by the project. The ROI measurement only takes financial metrics into consideration.

- **Nonfinancial metrics** are the subject of various kinds of business scorecards now in place in many enterprises. Examples include
  - Percentage of revenues from new products
  - Employee turnover
  - Market share
  - Average number of times the phone rings before being answered
  - Percentage of a sample of customers saying they are satisfied with the product
  - Number of new patents filed

  Though nonfinancial metrics are worth noting, they cannot be directly incorporated into an ROI analysis. Sometimes, however, it is possible to arrive at a financial equivalent for a nonfinancial metric.

- **Qualitative benefits** are assumed to exist, yet in practice typically are not measured because either they cannot be measured reliably (e.g., better decision making) or because economically it is not worth the cost of doing so (e.g., percentage of all satisfied customers).

Benefits are relatively difficult to estimate, and may be highly uncertain, especially in "out years" farther away from the date of implementation.

Note that, strictly speaking, benefits should be *outcome measures*; that is, they should reflect measurable bottom-line results. Too often, KM proponents present *output measures* (e.g., page hits on an intranet site) as benefits. Outputs are interim goals or metrics and should not be confused with outcome measures.

Net

The net cash flow for each period N is simply the incremental cash outflows ($Benefit_N$) less the incremental cash inflows ($Cost_N$) for that period (Figure 2). The initial outlay (often called Period 0) is not offset by a benefit, so that its cost and net are equal.

BENEFITS (cash outflows)	**TOTAL BENEFITS**	**$**
	Revenue enhancements	$
	Cost reductions	$
	(Nonfinancial)	
	(Qualitative)	
COSTS (cash inflows)	**TOTAL COSTS**	**$**
	Hardware	$
	Software	$
	Labor	$
	Other	$
NET CASH FLOW		$

Figure 2. Period benefits and costs.

Each "column" of our model, then, looks like those in Figure 2. Cash flows should be estimated for all future periods for some reasonable planning horizon. Five to seven years is a typical horizon for estimating project costs and benefits.

Cash flows for each period should be estimated independently; however, in many cases, they are based on the same value formulas. For example, benefits may "ramp up" over several periods before maturing to their full potential. Certain costs (e.g., vendor charges) tend to increase over time, whereas others (e.g., training) may actually decrease based on an experience curve that makes things more efficient.

Cash flows, both positive and negative, should be estimated as conservatively as possible. Wildly optimist assumptions will usually be detected in the reviews of the project proposal, and the chance to go back with a revised model may be limited. It is better to run the model conservatively (estimating costs on the high side and benefits on the low side). If the model "works," then it is robust and can be expected to provide a margin for error.

Estimates of future benefits and costs are most credible when expressed as ranges of values. Often it is useful to run three versions or your model: one optimistic (costs low, benefits high), one most likely (midpoints of the ranges), and one conservative (as above).

Where an ROI calculation is being used to evaluate an existing project, it is possible to measure the actual financial impact of the project. In the real world, however, such measurement is time-consuming, expensive, and often not "worth it" in terms of its own value (the ROI of ROI analysis).

Time Value of Money

Once the cash flows are estimated for each period, we must account for the *time value of money*. Put simply, a dollar (or any other unit of currency) to be received in the future is worth less

today than that same amount received today. The difference is the amount of income that could be earned in the interim if the sum were invested. (The uncertainty of future returns is also greater but, ideally, is already factored into the rate of return. Therefore we need not consider it separately.)

Each of our future cash flows must then be "discounted" by the *discount rate*, that is, the amount that the alternatives to this potential investment could be assumed to earn in that time. The discount rate for any given organization depends on a variety of factors, and is usually available from the office of the chief financial officer. If you cannot find this number, we suggest you run your model using 10 percent and make adjustments from there.

There are two related types of DCF calculations: IRR and NPV. These are different ways of expressing the same basic idea.[4] The IRR is the compounded percentage return the project is expected to yield over the planning time frame. Mathematically, it represents the discount rate at which the total cash inflows and outflows of the project are exactly equal. The project IRR is compared to a *hurdle rate*, that is, the rate defined as the cutoff for capital projects. If the project IRR is greater than the hurdle rate, the project should be a "go." The NPV is the present-value financial equivalent of a stream of future cash flows. The NPV formula builds in the hurdle rate, such that any project with a positive NPV should be accepted.

Formulas for calculating both NPV and IRR from a series of net cash flows are available in most PC spreadsheets' formula libraries**,** in moderately priced financial hand-held calculators, and in financial software for hand-held personal digital assistants.

We have said that, ideally, any project proposal with an IRR above the enterprise hurdle rate or a positive NPV should be accepted. In the real world, however, such proposals are typically further evaluated along with other "NPV-positive" proposals in order to arrive at final budget

allocations. In this capital-constrained world, these methods usually just get you to the discussion table; they do not guarantee you the funding you are seeking.

Populating the Model

So far, we have the structural outline of the model. Now we need to determine the value of each cell in Figure 2 by defining and calculating one (or more) *value formulas* for each cell. We will use as an example an ROI model for an *expertise profiling* system, one aspect of KM. (The entire model is shown in the Appendix to this chapter.)

For example, one of the labor costs associated with such a system is the training involved. Training might involve the cost to engage an outside trainer, as well as the training *opportunity cost* (the time spent by employees who could have been doing other things). The model also may need to account for employee turnover in that a new group of employees would need to be trained periodically.

The labor cost cells of our model might look something like this:

- Trainer cost = $25,000 first year; half that each succeeding year.
- Employee turnover = 15 percent per year.
- Employee costs = 10,000 employees x 60 minutes of online training each x $33/hour = average wage rate of $330,000 first year; $49,500 each succeeding year (or 15 percent of the annual total).

Of course, you will need to get actual figures or "best guesstimates" from your own organization.

Here is another example, this time from the benefits side. To stay with our example of expertise profiling, cost reductions could result from reducing the outside purchase of expertise, reducing hiring costs by reducing turnover, or reducing downtime by solving problems faster. Therefore, our cells might look like this:

- **Purchase of outside expertise.** This often involves the hiring of outside consultants. One company installed an expertise profiling system and as a result cut their substantial consulting expenditures by 50 percent in a short time. To estimate conservatively, our model might say something like this: current outside consultant budget $5 million/year, reduce this by 20 percent to $4 million/year. Our incremental cost reduction, therefore, is (eventually) $1 million/year.

- **Hiring costs.** Expertise profiling should reduce turnover. A certain number of people made redundant could be reassigned elsewhere in the organization based on their skill sets, rather than being let go and having new people hired. Reducing turnover by 10 percent (from 15 percent to 13.5 percent per year) would mean 150 fewer separations per year x fees of 1/3 annual compensation for the average search x average annual compensation of $68,640 = $3,432,000/year.

- **Reducing downtime.** Indexing expertise in a complex organization can result in problems being solved faster. Sometimes such problems have a debilitating impact on revenue-generating capability. Industries vary in the value of downtime caused by maintenance, accidents, and other problems. These costs tend to be relatively higher where expensive capital equipment is involved (e.g., drilling for oil). Because the value of this factor can vary substantially by industry, we recommend that an enterprise-specific value formula be developed here.

Finally, we should not assume that these "run rate" benefits would appear immediately in the first year of the project operations. Rather, they will scale up over time, say, during a three-to-five-year period.[5]

We have used a similar approach to develop each of the cells in the model shown in the Appendix.[6] As you can see, in this analysis the NPV was forecast at over $14 million, and the

IRR was nearly 69 percent. These numbers would be sufficient to earn such a project serious consideration in most organizations.

Note that although "reduced time in seeking information" (or similar) is often cited as a benefit of KM, we have not included it here. The reason is that empirical studies have shown that "time seeking information" is a relatively constant 20 percent to 25 percent of time for most knowledge workers, regardless of the kinds of knowledge support processes or systems at their disposal. This surprising finding is apparently due to the need to *satisfice* and move on with the task at hand, regardless of whether the best information has been located (Koenig, 2002).

Benefits and Limitations of ROI Analysis

The benefits of ROI analysis include the following:

- **Rationality.** Decisions should not be based on what vendors represent and not (necessarily) on what the competition is doing. The criterion should be "what creates value for stakeholders," such as customers, shareholders, and employees.[7]
- **Comparability.** Competing capital projects of differing types can be evaluated on an equivalent basis.

We have referred throughout to some of the limits of ROI analysis. To review, they include the following:

- **Uncertainty.** Cash flows may be difficult to estimate, especially in the far future. Moreover, they may be subject to substantial variability.
- **Nonmetric nature of some benefits.** Some benefits cannot be measured, and for others it is not worth the effort it would take to measure them.
- **Attribution.** Model organizations are truly complex, and it is difficult (if not foolish) to attribute certain benefits to specific management initiatives.

Nevertheless, we work in an economic environment in which ROI analysis of KM- and IT-related projects is regularly a requirement. It is imperative to know these techniques in order to discuss capital projects of any kind intelligently and persuasively.

Other Ways of Looking at Knowledge Value

In the appendix to his seminal book entitled *Intellectual Capital*, Thomas Stewart (1997) describes several "tools for measuring and managing intellectual capital." He characterizes these as follows: measures of the whole; human capital measures; structural capital measures; and customer capital measures.

- **Measures of the whole.** These are measures of the overall enterprise, including market-to-book ratios, Tobin's *q* (a similar measure that considers the replacement cost of assets), and calculated intangible value (a way of measuring the relative value of intangible assets at the enterprise level).
- **Human capital measures.** These include measures of innovation; employee attitudes, experience, and turnover; and the overall value of the accumulated "bank" of knowledge.
- **Structural capital measures.** These include intellectual property portfolio valuations, working capital turnover, measures of the amount of "bureaucratic drag," and measures of back-office productivity.
- **Customer capital measures.** These include customer satisfaction, the value of relationships and alliances, and the value of a customer over time.

Stewart provides a fascinating and well-informed discussion of each technique, including examples of how and where it has been applied. However, it is likely that the knowledge professional "competing for capital" will find these useful mostly by way of background, rather than in the executive summary of a KM project proposal. These metrics apply mostly at the enterprise or business unit level, rather than at the project level.

However, it is possible that some of the metrics described by Stewart will be useful as inputs to the kind of DCF capital projects analysis we have discussed herein. They may be among the value formulas that determine each cell of the model.

Much of Stewart's work derives from a comprehensive intellectual capital scorecard developed by Skandia, the Swedish insurance company (Edvinsson and Malone, 1997).This includes dozens of intangibles measures that are ultimately used to provide a single financial index for the efficiency of knowledge capital. Again, while this approach may provide useful ideas for some metrics, it is very "macro" in its outlook and scope.

Conclusion

All capital projects must be cost-justified in advance. No matter how great its promise, KM is no exception. In fact, the failure of some early KM initiatives to create value speaks to the need to manage such initiatives aggressively—before, during, and after implementation. KM is still evolving rapidly, with new success stories, technologies, and management approaches always on the horizon.

The use of rigorous business thinking and analytical tools, such as those presented herein, will ensure that KM remains at the forefront of enterprise competitiveness—and does not end in the dustbin of management fads whose time has passed.

Endnotes

1. Capitalized items are those that must be depreciated for financial reporting purposes, such as a new plant. Expense items flow directly to the current income statement, such as salaries and other operating expenses.

2. These studies share two significant flaws: (1) they do not strictly control for what constitutes a KM initiative in each implementing organization; and (2) they were produced by vendors offering services in the KM "space," and therefore, may dwell more on upside potential than on potential pitfalls.

3. This model is actually the discounted cash flow ROI model, the most common form of ROI analysis used in the modern enterprise.

4. Non–discounted cash flow kinds of capital projects analysis also are available, including the payback method and the profitability method. In order to be most effective, you will need to find out what kind of analysis is favored in the organization whose resources this project will consume.

5. For a more complete discussion of the model as applied here, see Herzberg, R., and Virzi, A. M. (2002). "Turning knowledge intro a collective asset." *Baseline*. April:99.

6. These data were based on a composite model company with the following characteristics: sales, $10 billion/year; 10,000 employees; employee turnover, 15 percent per year; net margin, 8 percent; hurdle rate, 10 percent; other assumptions as listed. Cost estimates were developed with input from Cadenza, Inc., an expertise-profiling firm in New York City. They are intended to be illustrative only and are not quotations for services.

7. For an extended discussion of the relationship between knowledge and value, see Powell, T. (2001). "The Knowledge Value Chain: How to fix it when it breaks." In: *Proceedings of the 22nd National Online Meeting*, Williams, M. E., ed.

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Appendix: A Return on Investment Model

for Expertise Profiling

KNOWLEDGE MANAGEMENT - RETURN ON INVESTMENT MODEL

	KM PROJECT CATEGORY			
	Expertise Profiling	**Value Formula**	**Value**	
			One-time	***Annual (Year 5)***
COST CATEGORIES				
HARDWARE	Client-server architecture	Dedicated server with backup	$210,000	$0
SOFTWARE	System license	Pricing of one system for 10,000 users (25% of employee base)	$1,500,000	$300,000
LABOR	Training	10,000 employees x 60 minutes online training; trainer @25K first year; half time in later years; 15% new employees/year	$355,000	$62,000
	Management consulting/customization		$500,000	$100,000
	Data population (create and maintain profiles)	10,000 employees x 30 minutes to complete initial profile x average cost of $33/hour; 2 updates/year @ 15 min. each; 15% new employees/year	$165,000	$177,375
	IT Support	Two FTE people first year; one in later years	$130,000	$65,000
OTHER				
	Internal Marketing		$500,000	$150,000
TOTAL COSTS			***$3,360,000***	***$854,375***

BENEFITS CATEGORIES				
FINANCIAL - Enhanced Revenues	Increase responsiveness to customer needs	Net margin (8%) on incremental sales (+1.5%, base $10 billion)		$12,000,000
FINANCIAL - Displaced Costs	Reduce costs of purchased expertise	Displace 20% of outside consulting budget ($5 million)		$1,000,000
	Reduce downtime by solving problems faster	Situation-specific		
	Reduce search/separation/hiring costs by reducing turnover by 10% (from 15% to 13.5%)	150 fewer separations/year x $68,640 annual salary x 1/3 year's salary search fees		$3,432,000
NON-FINANCIAL METRIC	Make decisions faster			
QUALITATIVE	Make better decisions (reduced risk)			
	Increase collaboration			

TOTAL QUANTIFIABLE BENEFITS	***$0***	***$16,432,000***

CASH FLOW ANALYSIS

	INITIAL	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Cost	3,360,000	854,375	854,375	854,375	854,375	854,375
Benefit	0	500,000	2,500,000	5,000,000	9,000,000	16,432,000
Net Gain/Loss	-3,360,000	-354,375	1,645,625	4,145,625	8,145,625	15,577,625

DISCOUNT RATE	**10%**
NET PRESENT VALUE	**$14,571,438**
INTERNAL RATE OF RETURN	**68.9%**