Hubbard Decision Research

Applied Information Economics

A Powerful Method for Quantifying IT Value

White Paper 2026

Critical Reviews for Applied Information Economics

“The strengths of the AIE included a process that clarified the ambiguous benefits of increased security, techniques that quantified uncertain costs and even more uncertain benefits, and methods that determined the usefulness of each performance measure…It also estimated risk in a meaningful way, included it in the decision, and identified means to reduce it.”

The Federal CIO Council - in a report assessing the use of AIE in federal IT decisions.

“The AIE process was a real eye-opener. It not only provided us with tools to measure observable outcomes, it also provided a means to look more introspectively at how people make observations and calculations”

Greg Maciag, President, ACORD – the standards organization for the insurance industry

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"AIE's unique strengths are its processes for clarifying and quantifying 'unmeasurable' benefits, costs and risks and their presentation in a probabilistic model based on a range of estimates (versus single-point estimates).”

Research Note, The Gartner Group

“The theory of Applied Information Economics is right on target. People that don’t use these methods will be missing a lot of opportunities.”

Dr. Marshall Van Alstyne, MIT Sloan School of Business

“AIE’s strength lies in its ability to conduct a true risk/return analysis based on proven methods that have a known statistical validity.”

Research Note, Forrester Research, Inc.

“Ask about ROI numbers for an IT project and you often hear that the benefits are great, but too soft, too intangible to be measured. Doug Hubbard begs to differ…. Hubbard has made a career of finding ways to measure things that other folks thought were immeasurable.”

Editorial, ComputerWorld

Risks & Opportunities for IT Decision-Makers

What is the single most important decision any decision maker faces?
How to make decisions.

Decision analysis methods should show measurable improvements in decisions, as opposed to simply making management more confident in decisions. When the stakes are high, as they often are in IT, the need for real improvements in decision analysis is critical.

Making "economically rational" decisions about information technology (IT) investments is becoming both more important and more difficult. The difference between the "right" decision and the "wrong" decision can be as dramatic as it is uncertain. Many success stories exist, including organizations that gain strategic advantages by leveraging IT into new levels of customer service, enhanced quality control, and reduced administrative costs.

However, for every success story there is a story of runaway development costs, cancellations after a huge investment, practically unmanageable maintenance, or unrealized expectations. In the worst-case scenarios, a bad IT investment has net costs above the loss of the direct investment.[1] Dysfunctional IT systems have also interfered with business operations and caused the loss of customers and revenue. Most managers may not experience the high-profile failures of the ACA website, Hershey's ERP implementation, Amazon's cloud outage, or Target's security breach, but even less public failures can still cost organizations dearly.

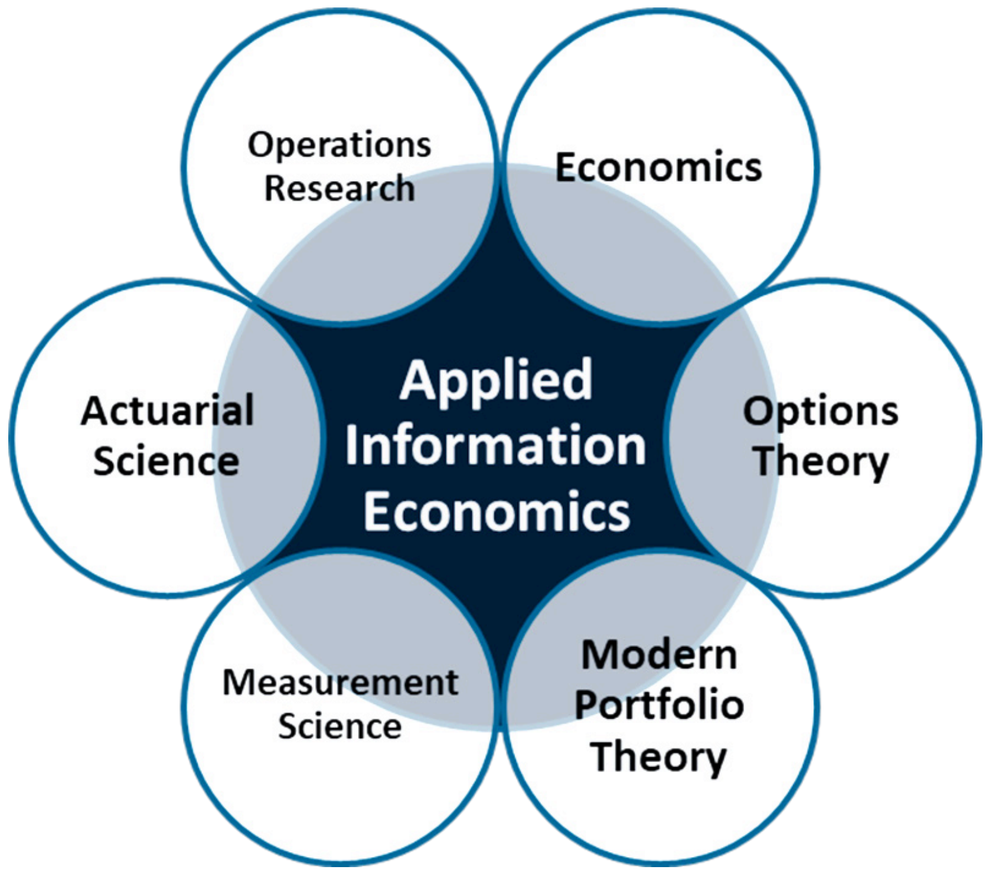
However, even with extreme differences in returns on IT investments, most decision makers find it difficult to determine which investments will be a phenomenal success and which will be a crippling failure. Some decision analysis methods may seem to help but actually produce a kind of "analysis placebo," where decision makers feel more confident in decisions without actually improving decisions.[2] The decision maker is confronted with many seemingly abstract and intractable questions:

- **How do I estimate the value of an information system (including "intangible" benefits)?**
- **How do I deal with extreme uncertainties in the estimates of IT costs and benefits?**
- **How do I know whether one IT investment is "better" than another (IT or otherwise)?**
- **How do I know when to stop analyzing, accept some risk, and make a decision?**
- **How do I know whether my decision analysis methods are working at all or are just feeding unjustified confidence?**

The Solution:

Applied Information Economics

Applied Information Economics (AIE) is the practical application of mathematical models and scientific measurements to optimize decisions in uncertain investment environments.



Hubbard Decision Research (HDR) specializes in Applied Information Economics (AIE), a quantitative decision-making methodology originally designed for the challenges of IT decisions, but now applied in a variety of other areas

AIE is a synthesis of techniques from a variety of scientific and mathematical fields. Economics, financial theory, and statistics are major contributors to AIE. In addition to these more familiar fields, AIE includes Decision Theory, the formulation of decisions into a mathematical framework, and Information Theory, the mathematical modeling of transmitting and receiving information.

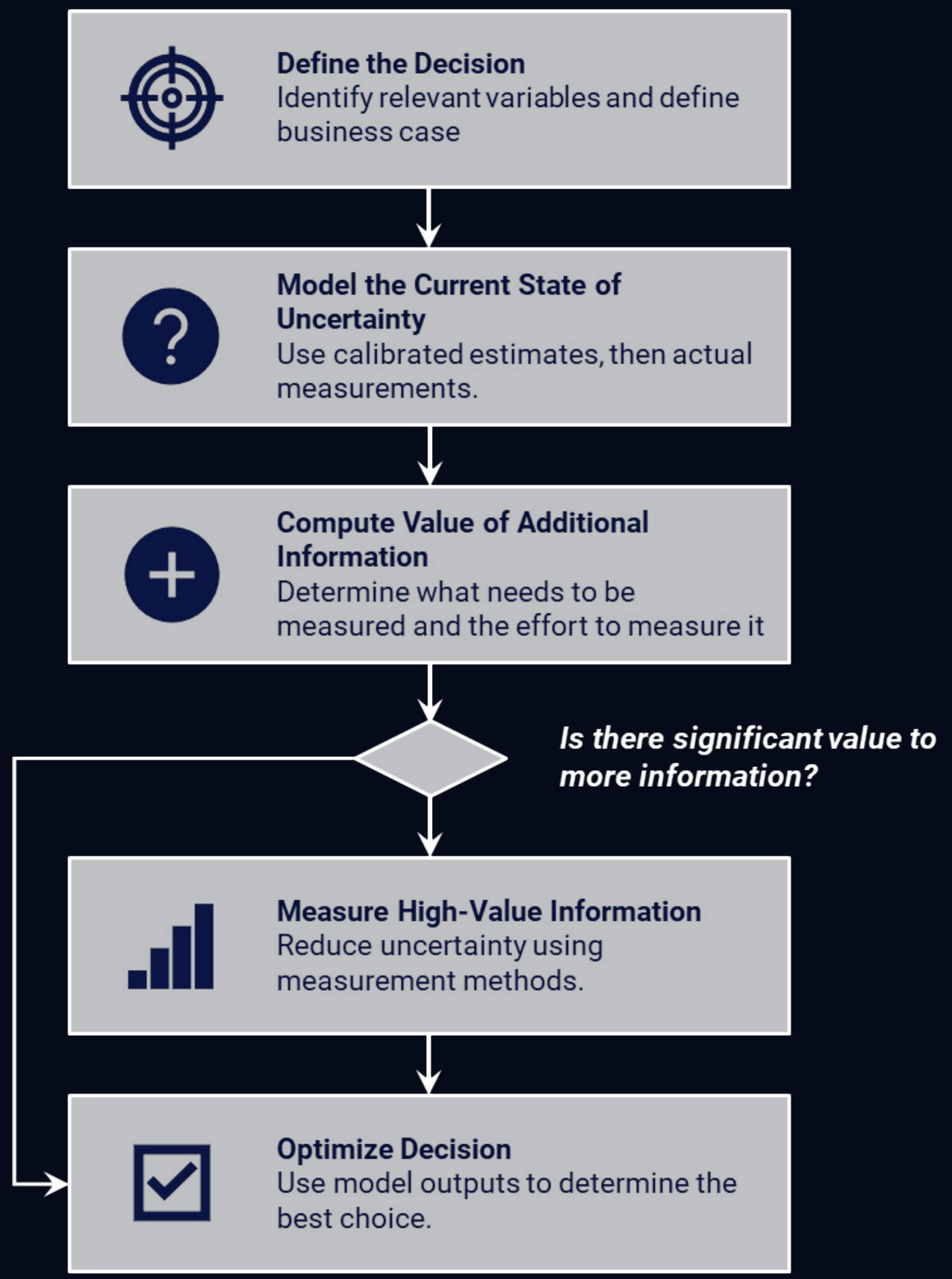
Importantly, although AIE is a theoretically well-founded set of techniques, AIE is also a practical approach that has been applied to over 80 major investment decisions in a variety of industries. Every proper application of AIE keeps the bottom line squarely in mind, and the output from the AIE project supports practical business objectives.

Some of the basic techniques that make AIE a powerful set of tools include methods for clarifying decisions and defining variables in a quantitative way, calculation methods for the value of information, methods for modeling uncertainty as estimates, measurement methods, and treating the IT investment as a type of investment portfolio. These methods are part of a fully documented formal procedure.

The Five-Step AIE Process

This powerful process helps clarify, measure, and provide optimal recommendations for a variety of situations. AIE can be applied across the enterprise to solve some of its most perplexing problems, including the following:

- Investment decisions at all levels of IT (using probabilistic analysis)
- Ensuring that the implementation of IT decisions is effective (with financially based quality assurance measurements)
- Developing a strategic plan for information systems based on identifying the best opportunities for economic contribution by information systems



Defining the Decision

Most IT investment arguments include some costs or benefits that are treated as “intangibles,” or factors that cannot be measured. Common examples include “Strategic Alignment,” “Customer Satisfaction,” and “Employee Empowerment.” In most cases, these factors seem immeasurable because they are ambiguously defined. AIE removes this type of ambiguity by focusing on definitions that can be expressed in units of measure.

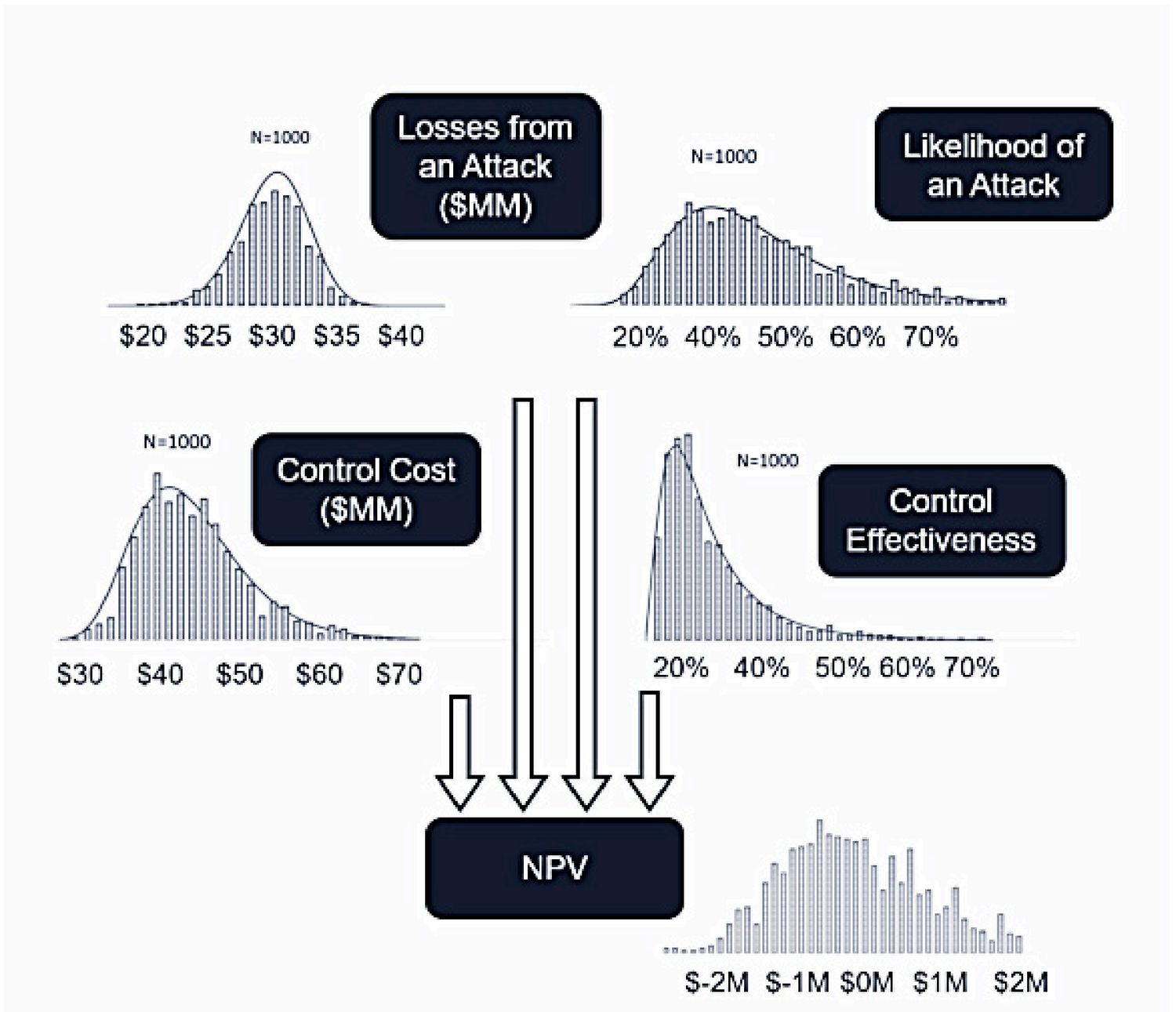
For example, an argument for a new Project Management System may claim that, among other things, it increases “employee empowerment.” Does this term mean that certain types of decisions can be made better and faster because information needed to make decisions becomes available to more people? If so, how frequently do situations arise that require such decisions, and what is the economic impact of a timely decision that is more likely to be correct? Does “employee empowerment” mean that management overhead per employee is reduced because less supervision is required? Does it mean that employee turnover is reduced, along with recruiting and training costs, or all of the above? By asking specific questions tied to observables, decision makers can turn “intangibles” into something known and measurable.

Analyzing Uncertainty Quantitatively

Rational investment decisions must always take both the risk and return of a given project into account. The ability to quantify the risk of a given IT investment, and to compare its risk/return with other non-IT investments, represents one of the key differences that sets AIE apart.

In reality, uncertainty affects nearly any estimate used in a cost/benefit analysis, and uncertainty often exists in the relationship between previously "intangible" factors and their now tangible terms. Instead of choosing an arbitrary number as a point estimate, AIE focuses on determining the range of possible values for a given variable and ascribing probabilities to those values. Decades of research show that managers and technology experts alike can be taught this skill in a way that is reliable and demonstrates measurable improvement.[2,3,4,5,6]

Monte Carlo: How to Model Uncertainty in Decisions



The ranges of values assigned to variables in a decision model can be used to determine a "probability distribution" of the net benefit of a particular IT investment. AIE uses the "Monte Carlo" method, the generation of thousands of random scenarios on a computer (also used in statistics, actuarial science, and game theory), to develop a profile of the likelihood of each possible outcome. Usually, this method shows that at least some risk of a negative outcome exists, and that risk can be measured.

Calculating the Economic Value of Information

Contrary to popular belief, the value of information can be calculated as a dollar value. Although the term "information" is often used ambiguously, the term can also be used as an unambiguous unit of measure with a well-defined value calculation. This mathematical procedure can be paraphrased as follows:

1. Information Reduces Uncertainty
2. Less Uncertainty Improves Decisions
3. Better Decisions Result In More Effective Actions
4. Effective Actions Improve Profit

These four steps can be stated in an equation that has been in use since the late 1940s. From this equation, the "elusive" value of information can be determined precisely. Although the equation has been in use for many decades, limited adoption can result in a focus on variables with low economic value. This observation has been so ubiquitous that it has been given a name: the "measurement inversion."[2]

Examples of Measurement Inversions

Some investments considered by HDR Clients	What they would have measured	What needed to be measured (methods designed by HDR)
Document Management Systems for Legal Discovery	Reduced printing and handling costs	Percent of relevant documents not introduced to a case
Infrastructure Upgrades	Downtime and IT labor costs	How work processes are affected by downtime
New Procurement System for Government	Detailed "time and motion" study of procurement process	Price savings from using reverse auctions
IT Security	People who attended training, external threats	Internal theft incidents

Measuring What Matters Most

Measures for ROI in IT business cases have historically focused on minor cost reductions such as printing, internal IT costs, attendance at training, and similar items. However, more valuable measures more often relate to behavior, and especially to behaviors outside of IT.

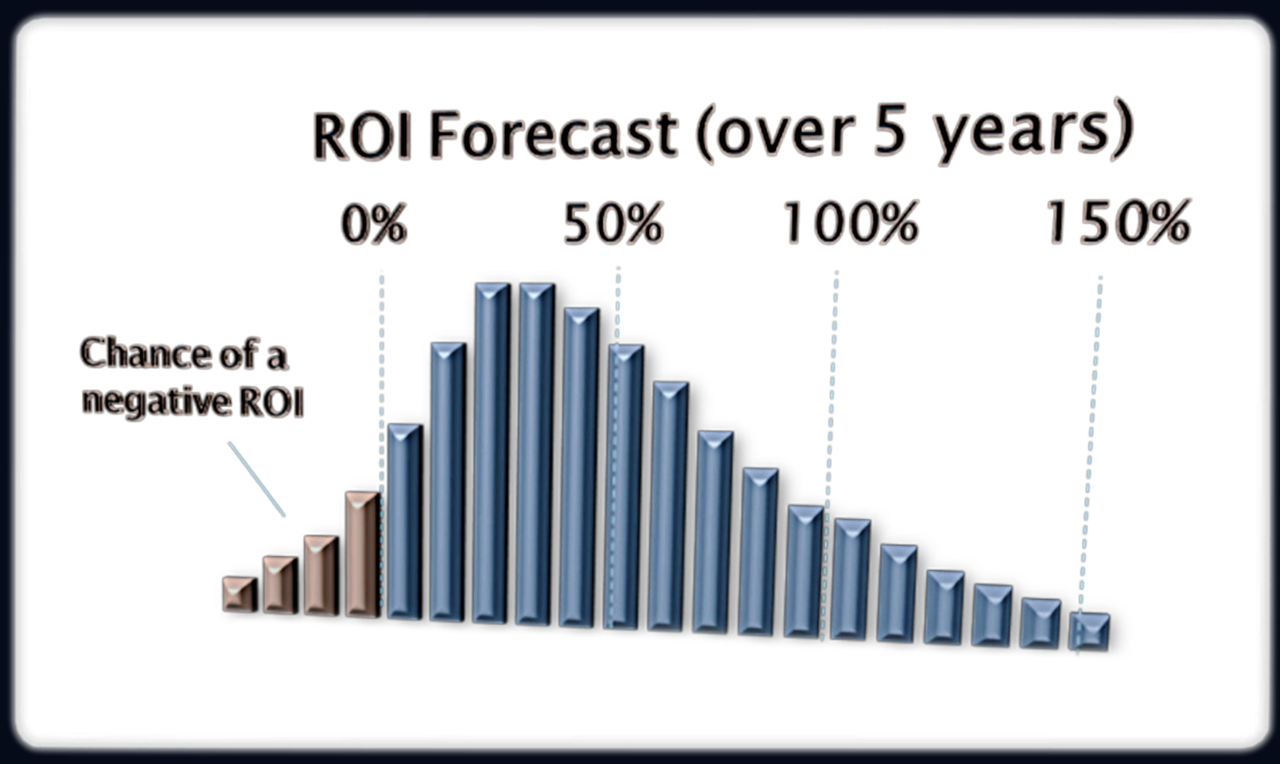
If something matters to a decision, detectable consequences must exist. Detectable consequences are observable in some amount and therefore measurable. However, decision makers often worry that sufficient data does not exist and that, even if enough data existed, statistical measurement methods would be impractical for some reason. These beliefs are myths.

The value of information points us toward measuring quantities with high uncertainty. High uncertainty represents exactly the situation in which gathering a small amount of data can produce surprising and positive results. In this situation, most people consistently underestimate the mathematical uncertainty reduction derived from even a small amount of data. HDR has demonstrated this effect by using statistical measurement methods of many kinds on a variety of practical decisions for two decades.

Making the Best Bet

The last step in applying AIE to IT uses a method from Modern Portfolio Theory. This step treats the set of IT investments in a firm as another type of investment portfolio. Each investment is analyzed on a risk/return basis for its contribution to the portfolio

By using techniques from Modern Portfolio Theory, decision makers can determine whether the uncertainties inherent in a given IT investment decision are acceptable given the "risk/return boundary" for the firm. Executives are guided through a process to determine their risk/return boundary if an internal definition does not already exist. One of the primary benefits of having an explicit risk/return boundary is improved consistency in investment decisions. By removing environmental biases, the risk tolerance of executives and the company can be applied consistently.



What is different about Applied Information Economics?

The methods and results of AIE improve upon predecessors and represent an opportunity, since AIE would still be new to almost any IT decision-making committee. Previous attempts to improve the ability of firms to invest in IT more effectively can be put into two categories: traditional CBA and Weighted Scoring Methods.

Traditional Cost Benefit Analysis

The methods and results of AIE improve upon predecessors and represent an opportunity, since AIE would still be new to almost any IT decision-making committee. Previous attempts to improve the ability of firms to invest in IT more effectively can be put into two categories: traditional CBA and Weighted Scoring Methods.

A key weakness of CBA is reliance on point estimates (exact numbers instead of ranges) for every relevant factor in the costs and benefits of an information system. These point estimates are not usually justified by measurement methods, but are instead based on the judgment of individuals. In some cases, the only attempt to differentiate between levels of uncertainty relies on an ambiguous "hard" versus "soft" distinction. Often, a benefit identified as "soft" is left out of the calculation altogether. This practice systematically ignores some of the largest benefits of information systems. Consequently, the result of most CBAs is a number that leaves out any risk of loss and cannot be meaningfully compared to alternative uses of the budget.

Weighted Scoring Methods

Many managers have resorted to a much simpler method that attempts to emulate quantitative analysis by assigning "scores" on some scale (for example, 1 to 5). These methods ask IT investment decision makers to rate a proposed project in categories such as "Strategic Alignment," "Organizational Risk," and so on. Scores in each category may then be multiplied by a weighting factor, intended to reflect the relative importance of each category.

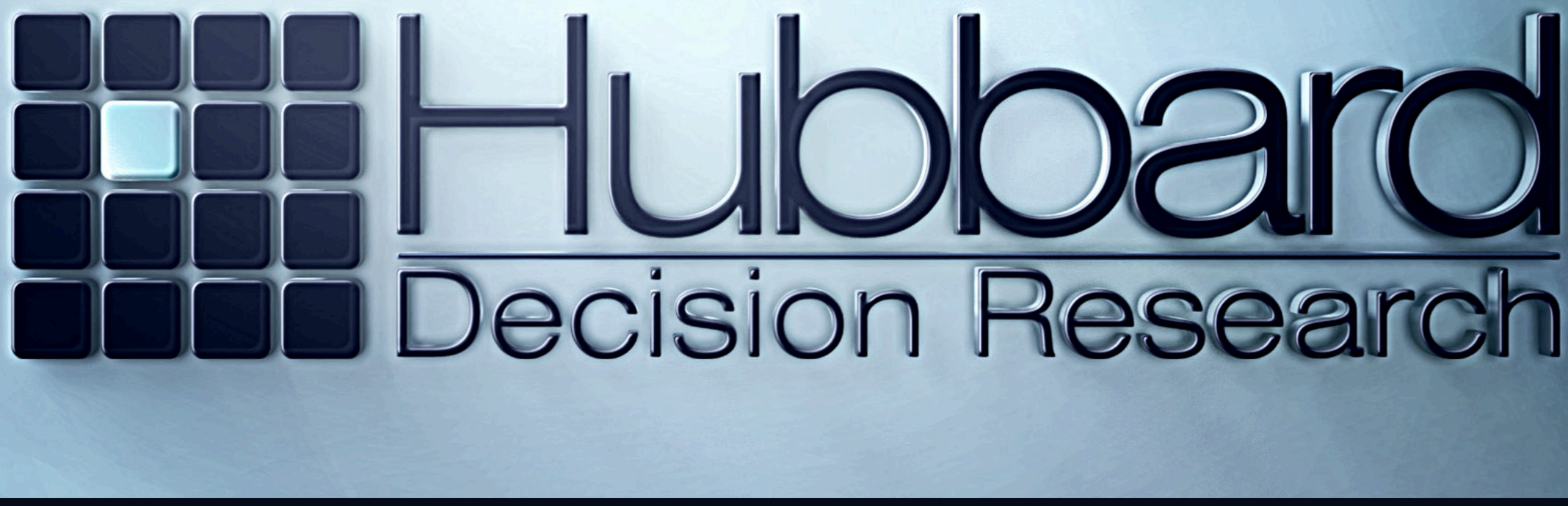
While this method may appear beneficial, little evidence shows measurable improvements in decisions. These methods are not based on any formal, accepted economic model, and cannot truly be called "economics." The total score generated for a proposed system maps poorly to financial reality. In fact, some research suggests that such methods can make decisions worse by adding ambiguity to the analysis.[1]

Summary Comparison of Methods

Evaluation Criteria	Weighted Scoring Methods (NO IMPROVEMENT)	Traditional Cost/ Benefit Analysis (BETTER)	Applied Information Economics (BEST)
Basic Financial Tools	Not included, or largely ignored; produces a "score" that is not financially meaningful	NPV, ROI, EVA (sound financial tools)	NPV, ROI, EVA (sound financial tools)
Analyzing "Intangibles"	Attempts evaluation without removing ambiguity; scoring can add ambiguity	Often ignored because only "hard" benefits receive numerical values	Removes ambiguity by defining intangibles in units of measure
Uncertainty and Risk in Estimates	No specific methods discussed; subjective scoring can add uncertainty	Uses point estimates; differences in uncertainty are often reduced to ambiguous "hard/soft" distinctions	Uses sound mathematical methods commonly applied in actuarial science, statistics, and financial management theory
Information Gathering Methods	Almost no focus on measurement techniques	Some systematic methods, but rarely; often depends on individual judgment	Empirical, scientific methods based on calculated information values
Overall Assessment	***Creates an illusion of objectivity and quantification; shows no demonstrated measurable improvement in decisions***	***Better than nothing; uses sound financial methods***	***Only method providing scientifically and economically valid recommendations***

The AIE Advantage

Applied Information Economics has distinct advantages over other methods for assessing the value of information systems investments. AIE is the only method with specific tools to address the uncertainty, intangibility, and ambiguity typical of IT investments in a financially meaningful way. Every component of AIE, from initial estimates and modeling uncertainty to computing information values and applying empirical measurement methods, is based on quantitative techniques that independent research has shown to measurably improve estimates. Applied Information Economics is, and will continue to be, at the forefront of methods that help keep businesses prosperous in the growing information economy.



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