



The Advisory Council

THE NEXT GENERATION OF IT RESEARCH & ADVISORY SERVICES

# How to Measure Anything

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Expert

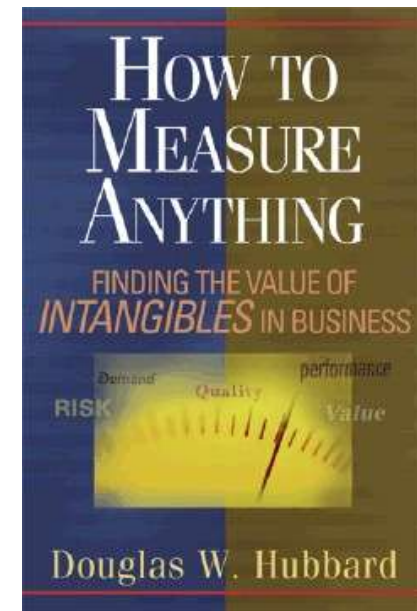
The Advisory Council

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# How to Measure Anything

- I conducted 55 major risk/return analysis projects so far that included a variety of “impossible” measurements
- I found such a high need for measuring difficult things that I decided I had to write a book
- The book will be released in July 2007 with the publisher John Wiley & Sons
- This is a “sneak preview” of many of the methods in the book





## A Few Examples

Org.	Problem	Findings	Benefit
<b>EPA</b>	Assess value of "Safe Drinking Water Information System" SDWIS	Identified and measured previously unnoticed risks & benefits	<u>\$15 million</u> improved NPV from reprioritizing functions
<b>US Marine Corp</b>	Forecast fuel use for the battle field	Found factors that better correlated to actual fuel use	<u>\$50 million savings per year</u> by reducing unnecessary battlefield inventory
<b>American Express</b>	Analyze ROI of a dedicated test network for new applications	Determined key metric to prioritize replacements was downtime reduction	<u>\$2 million improved net benefit</u> reprioritizing rollout

Source: Hubbard Decision Research



## A Few More Examples

- Risk of IT
- The risk of obsolescence
- The value of a human life
- The value of saving an endangered species
- The value of public health
- The value of IQ points lost by children exposed to methyl-mercury
- The value of better security
- The future demand for space tourism
- The value of better information
- The value of information availability
- Productivity and performance



## Three “Measurement Muses”

- Eratosthenes – measured the Earth’s circumference to within 1% accuracy
- Enrico Fermi – the physicist who used “Fermi Questions” to break down any uncertain quantity (and was the first to estimate the yield of the first atom bomb)
- Emily Rosa – the 11 yr old who was published in JAMA (youngest author ever) for her experiment that debunked “therapeutic touch”



## Three Illusions of Intangibles (The “.com” approach)

- The perceived impossibility of measurement is an illusion caused by not understanding:
  - the *Concept* of measurement
  - the *Object* of measurement
  - the *Methods* of measurement
- See my “[Everything Is Measurable](#)” article in *CIO* magazine



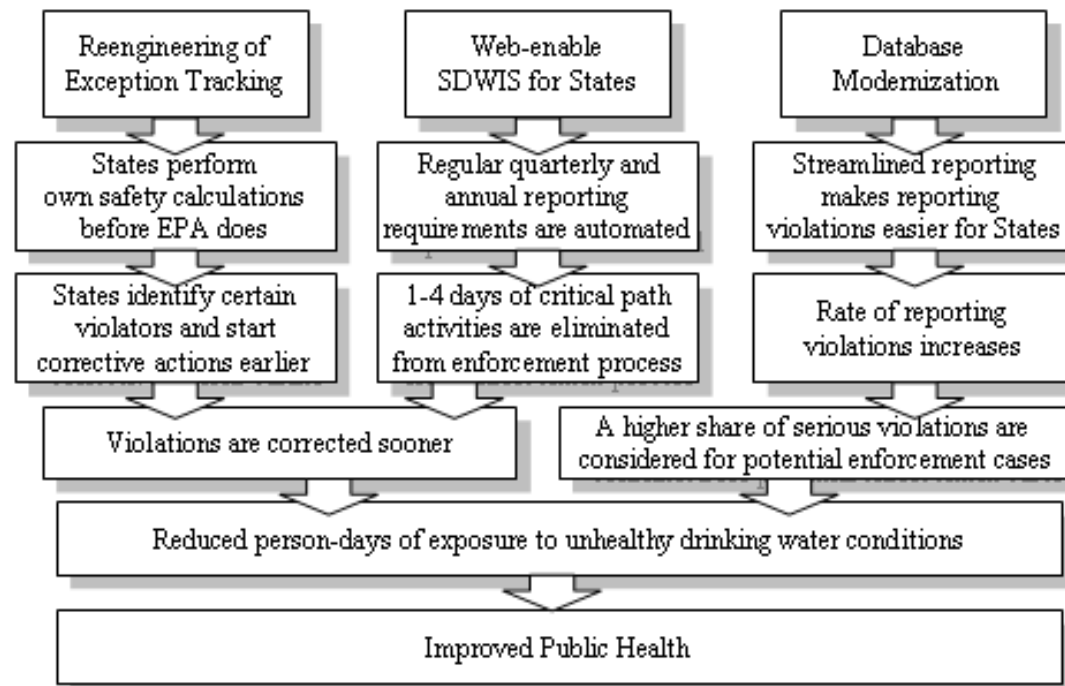
## Before We Measure We Ask:

- Why do you want to know?
- How much do you know now?
- What is the value to additional information?



# Why Do You Want To Know?

- The EPA needed to compute the ROI of the Safe Drinking Water Information System (SDWIS)
- Why?: To prioritize three specific upgrades
- We built a spreadsheet model that connected the expected effects of the system to relevant impacts

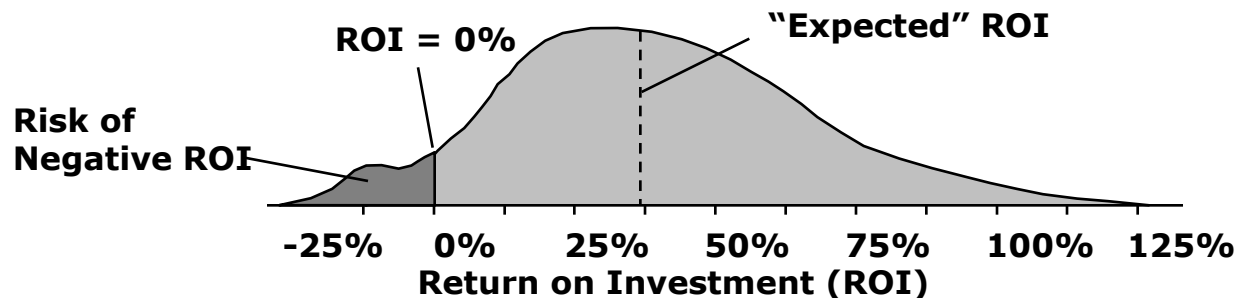


Source: Hubbard Decision Research



# Uncertainty, Risk & Measurement

- Measuring Uncertainty, Risk and the Value of Information are closely related concepts, important measurements themselves, and precursors to most other measurements
- The "Measurement Theory" definition of measurement: ***"A measurement is an observation that results in information (reduction of uncertainty) about a quantity."***
- We model uncertainty statistically





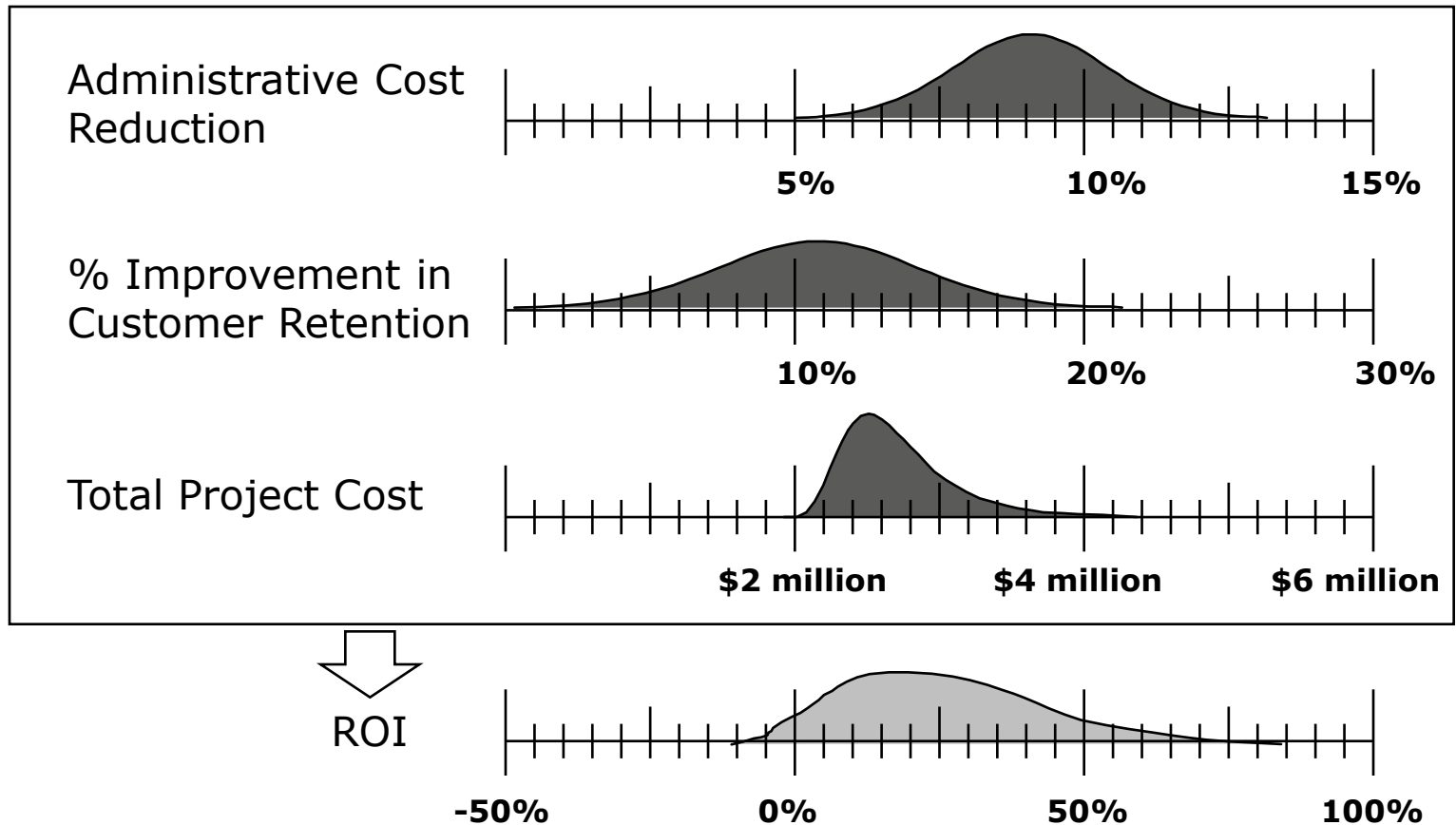
## How Much Do You Know Now?

- Most people can be taught how to subjectively assess their current state of uncertainty
- A small amount of training (three hours) can significantly improve calibration of estimates
- Comparisons of actual measures to original calibrated estimates show calibration works



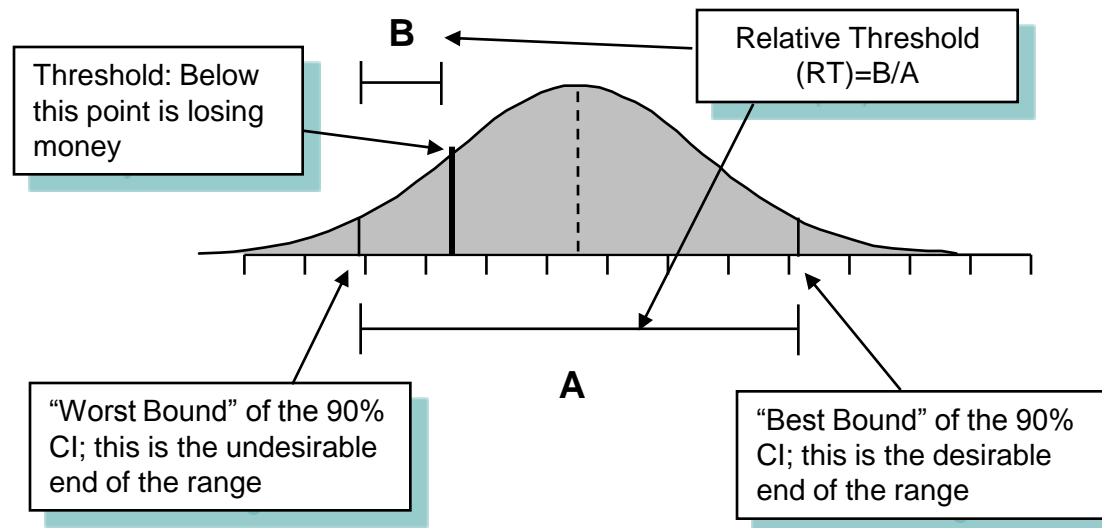
# Risk/ROI w/ "Monte Carlo"

## Inputs



# What Is The Value of Measurement?

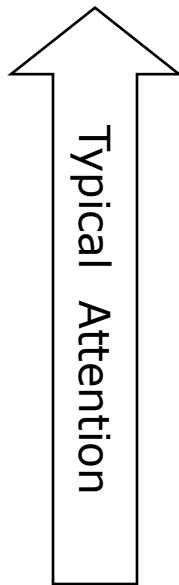
- As a rule of thumb, the value of information is simply the *cost of being wrong times the chance of being wrong*
- The value of information on a range often just comes down to where the “threshold” is within the range.



Source: [How to Measure Anything: Finding the Value of 'Intangibles' in Business](#)

# The IT(?) Measurement Inversion

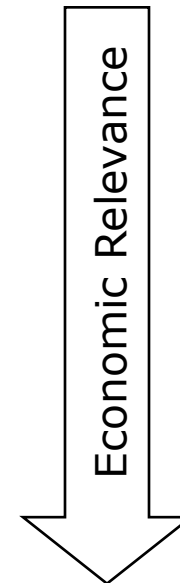
Receives Most Attention



Receives Least Attention

- Costs
  - Initial Development Costs
  - Ongoing Maintenance/Training Costs
- Benefits
  - A specific benefit (productivity, sales, etc.)
  - Utilization (when usage starts and how quickly usage grows)
- Chance of Cancellation

Least Relevant to Approval Decisions



Most Relevant to Approval Decisions

See my article "[The IT Measurement Inversion](#)" in *CIO* magazine



## Next Step: Observations

- Now that we know what to measure and what it's worth to measure, we can think of observations that would reduce uncertainty
- The value of the information limits what methods we should use, but we have a variety of methods available
- Take the "Nike Method": Just Do It – don't let imagined difficulties get in the way of starting observations



## The Power of Sampling Methods

- Several clever sampling methods exist that can measure more with less data than you might think
- Examples: estimating the population of fish in the ocean, estimating the number of tanks created by the Germans in WW II, extremely small samples, etc.

Month of Production	Intelligence estimate	Statistical estimate	Actual (Based on captured documents after the war)
June 1940	1000	169	122
June 1941	1550	244	271
August 1942	1550	327	342

Source: [\*How to Measure Anything: Finding the Value of 'Intangibles' in Business\*](#)



# The “Math-less” Statistics Table

Sample size	nth largest & smallest sample value	Actual confidence
5	1 <sup>st</sup>	93.8%
8	2 <sup>nd</sup>	93.0%
11	3 <sup>rd</sup>	93.5%
13	4 <sup>th</sup>	90.8%
16	5 <sup>th</sup>	92.3%
18	6 <sup>th</sup>	90.4%
21	7 <sup>th</sup>	92.2%
23	8 <sup>th</sup>	90.7%

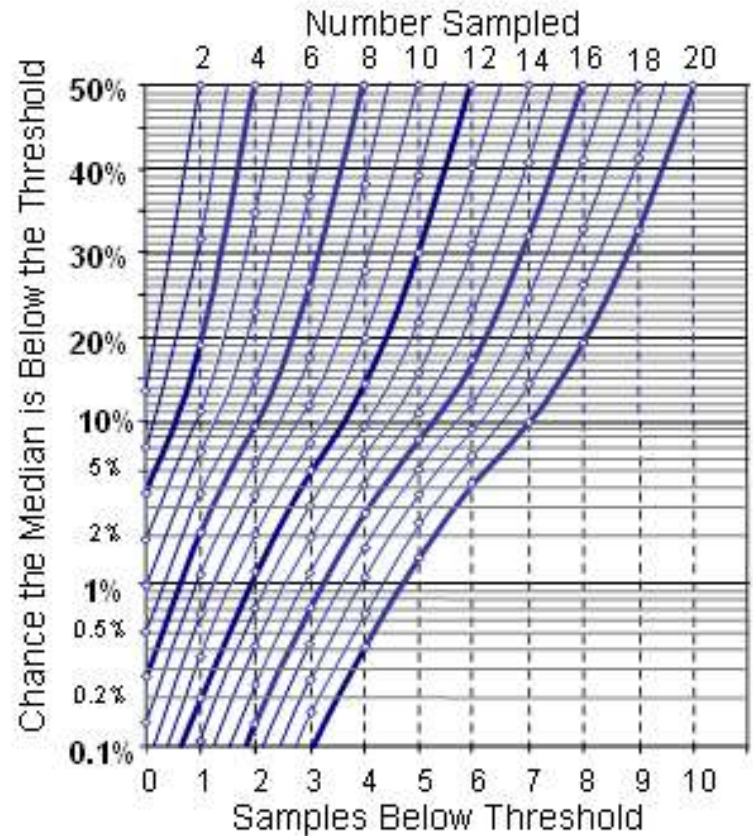
- Measurement is based on observation and most observations are just samples
- Reducing your uncertainty with random samples is not made intuitive in most statistics texts
- This table makes computing a 90% confidence interval easy

Source: [\*How to Measure Anything: Finding the Value of 'Intangibles' in Business\*](#)



# Measuring to the Threshold

- Measurements have value usually because there is some point where the quantity makes a difference
- Its often much harder to ask "How much is X" than "Is X enough"



Source: [How to Measure Anything: Finding the Value of 'Intangibles' in Business](#)



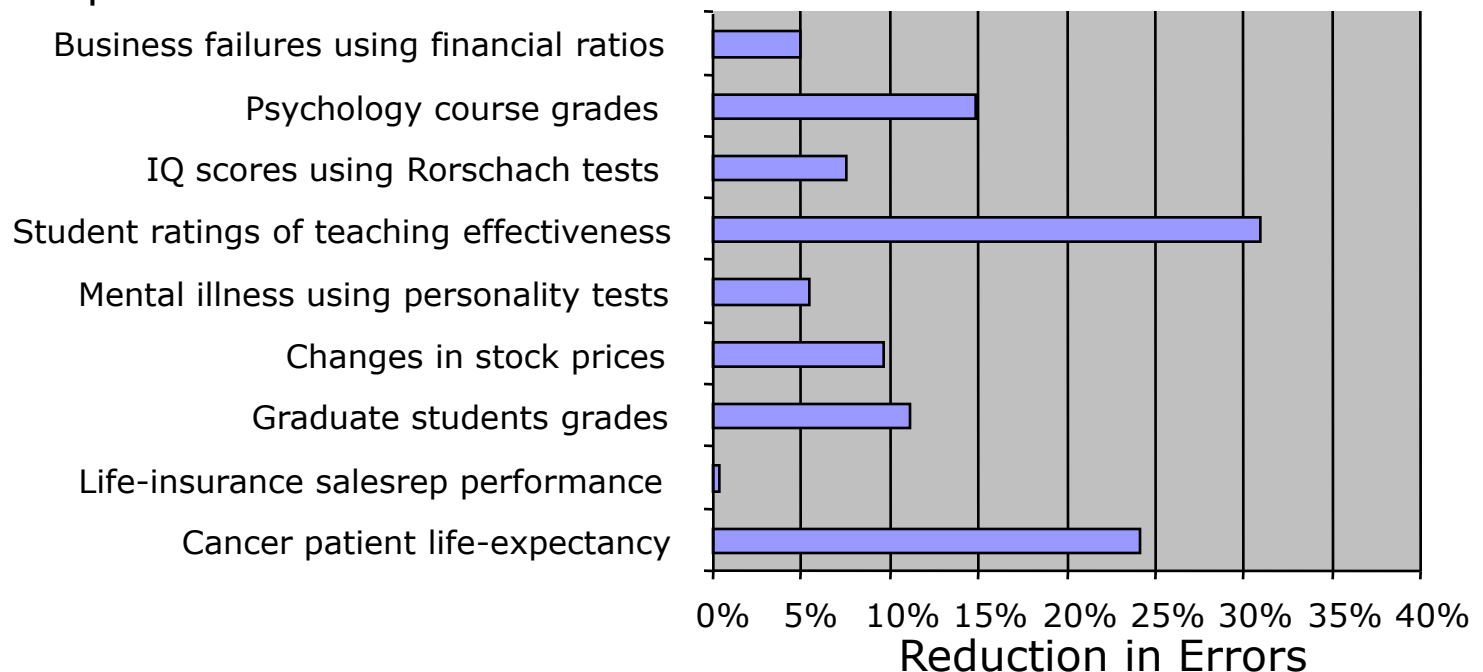
## The Simplest Method

- “Bayesian” methods in statistics use new information to update prior knowledge
- Bayesian methods can be even more elaborate than other statistical methods BUT...
- It turns out that calibrated people are already mostly “subjectively Bayesian”



# Improving on Human Judgment

- The “Lens Model” is one method used to improve on expert intuition
- The chart shows the reduction in error from this method on intuitive estimates
- In every case, this method equaled or bettered the judgment of experts

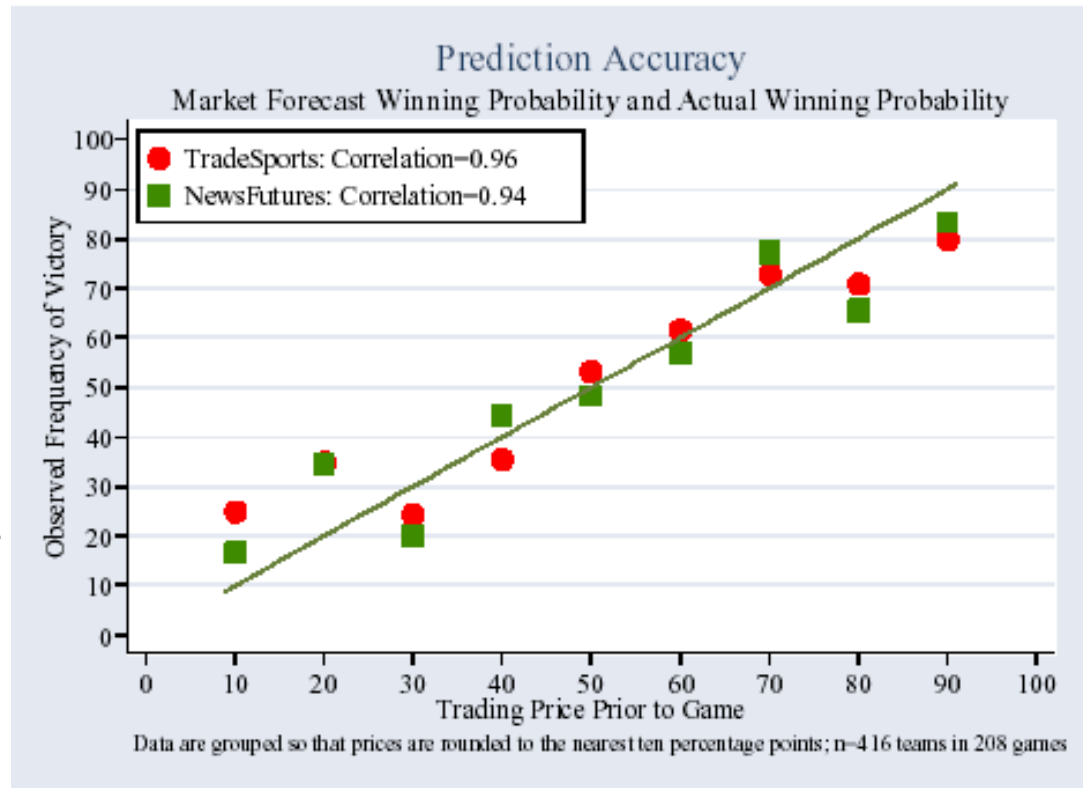


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# Prediction Markets

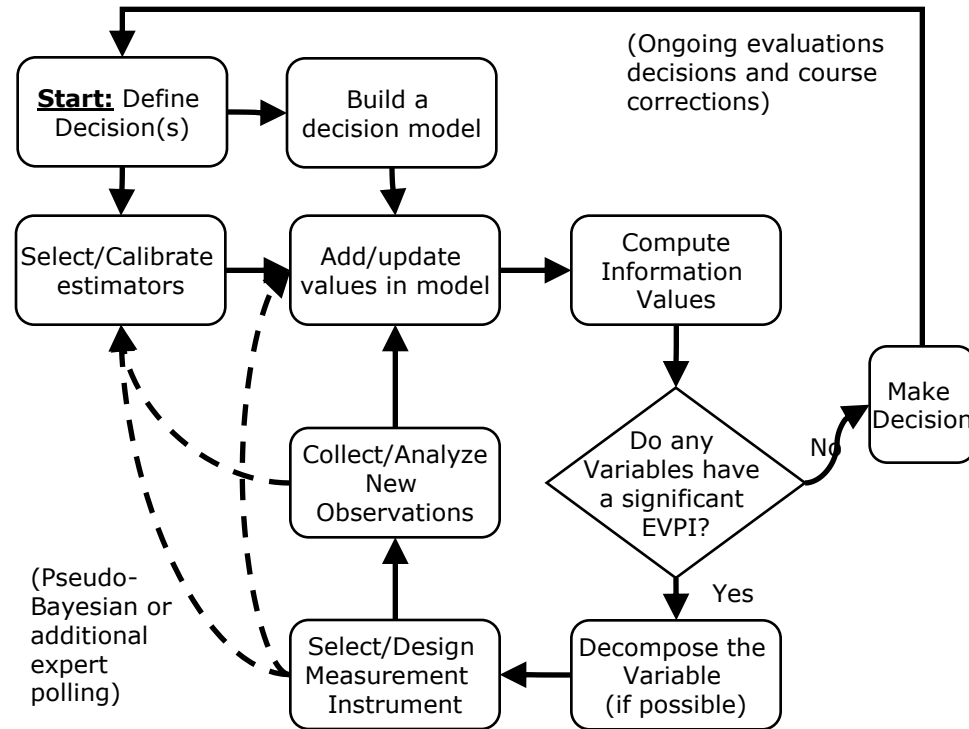
- Simulated trading markets are a proven method of generating probabilities for uncertain events
- Research shows that it works even without purely monetary reward systems



Source: Servan-Schreiber, et. al. *Electronic Markets*, v 14-3, September 2004

# Applied Information Economics

- The basic AIE model was used in several of these examples where “intangibles” dominated the decision
- Even though it has been used on problems as different as...
  - IT portfolio prioritization
  - Forecasting fuel for the battlefield
- ...the same basic process applies



Source: [How to Measure Anything: Finding the Value of 'Intangibles' in Business](#)



## Final Tips

- Learn how to think about uncertainty, risk and information value in a quantitative way
- Assume its been measured before
- You have more data than you think and you need less data than you think
- Methods that reduce your uncertainty are more economical than many managers assume
- Don't let "exception anxiety" cause you to avoid any observations at all
- Just do it



## More Information:

- Several of my articles in *CIO* magazine, *InformationWeek* and other periodicals discuss measurement - especially the risk and value of IT. All of them are linked on [www.hubbardresearch.com](http://www.hubbardresearch.com).
- The book will have its own web site at [www.howtomeasureanything.com](http://www.howtomeasureanything.com). The site will be online before the book is released in July. It will include detailed examples and spreadsheets mentioned in the book as well as discussion groups for readers.
- Contribute to “The Measurement Challenge” by sending us your examples of difficult measurements.