

An Executive Overview

Prejudice and Bias Technology: An Information Economics Perspective

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Hatred is something peculiar. You will always find it strongest and most violent where there is the lowest degree of culture.- Goethe

Critical Reviews For Applied Information Economics:

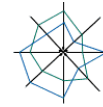
The Gartner Group “Applied Information Economics (AIE) represents a rigorous, quantitative approach to improving IT investment decision making.....this investment will return multiples by enabling much better decision making. Giga recommends that IT executives learn more about AIE and begin to adopt its tools and methodologies, especially for large IT projects.”

Forrester Research, Inc. “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

Drucker “If [the economy] is still ‘capitalist,’ it is now dominated by ‘information capitalism.’” Peter Drucker (Ref. 7)

Doug Hubbard " Information Technology investments and the power of computing has not been matched by a growth in successful techniques for finding the right combination."

__“Anything can measured in a way which is superior to not measuring it at all” Gilb’s Law (Ref. 19)



Synopsis

The sole determination of sustained business success and the singular cause of business failure is information based. Business optimization has proven to be possible only from a basis of Information Economics. Richard Bellman, a noted Operations Research pioneer, described the superior policy as one which causes the critical choices to be made consistent with maximizing goal gains. The policy - "An optimal policy has the property that whatever the initial state and initial choices are, the remaining (future) choices must constitute an optimal policy with respect to the state resulting from the first choices." The good news in this statement is the attribute that actual achievement of goal is open to all starting points or current states. The bad news is the absolute requirement to correctly measure the actual current "state" of the success ingredients. The success ingredients are information differentials. Information creates measurable bias,

I. Favorites Imply Bias

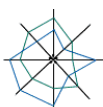
Each of us develop personal favorites. That such a condition exists is sufficient evidence of prejudice. When queried about our favorite color we often respond with our bias. Choices by their very nature rule some thing "in" and in so doing exclude others not in the chosen set. Strongly held belief systems cause passionate choices. Passion arises when strongly held beliefs are threatened or rewarded.

The recent ethnic cleansing in Kosovo is a case in point. Not long ago the American Indians were the subject of eradication. This policy was judged politically and socially "correct" at the time. The policy was actually practiced with passion and rigor. There is no ducking the choices made.

Hateful prejudice is counteracted with an opposite force of love. Many have died in protecting their love of country. More have died fighting for their favorite religion. Color bias is classic.

The vision of the anointed is one where such ills as poverty, irresponsible sex, and crime derive primarily from "society" rather than from individual choices. A belief in personal responsibility would void their role of "rescuing" people who have been unfairly treated by society. Some think that government exists to rescue people from themselves.

Merit and performance in business are treated as if all economic systems guarantee a result of unfair rewards. If, for example, eight producers introduce a similar function product then it is possible that none actually know the exact consumer wants or needs. Yet, if one of these products more closely fits consumers' desires than the others, its producer may become wealthy as sales skyrocket, while the less fortunate competitors tempt bankruptcy. The unseen beneficiary of the lucky producer serves the larger purpose of allowing consumers to receive the product nearest their desires. In addition the same unseen force stops waste on the

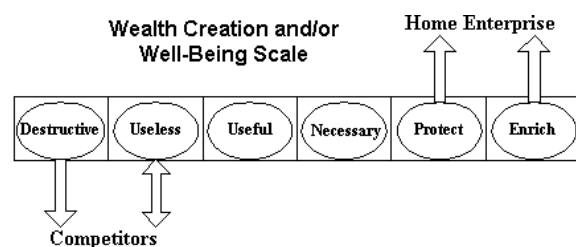


production of less satisfactory versions. Such is the power of the free choice marketplace. Had government made the choice a different product may have been selected. Completely invisible to most is the fact that luck cannot be sustained. The company that "lucked" into the close fit is dreadfully stuck into a position of inability to alter anything in the product for fear of voiding the very ingredient that is critical to success. Thus, the original instance of the product may have been due to a dose of luck but it is unrealistic to think that the longer time growth period continued to be luck driven. The competitors have ample time to adapt and improve their offering. Information is the thing that looks like luck but is measurable, manageable and trainable. Information changes the odds of success. It is the only thing in the universe that does such a thing.

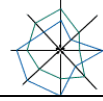
A Non-trivial Measurement System

A huge problem existed regarding information systems value measurement. A proper method did not exist to measure the value of information objects and/or information systems until my teams devised a rigorous technique. Simply put, one cannot manage what one cannot measure. The lack of measurement caused investment choices to be random (luck based). Millions of system dollars were devoted to waste.

The issue is much deeper than the technology-based computer assisted systems. Organizational learning, core competencies and applied knowledge are all



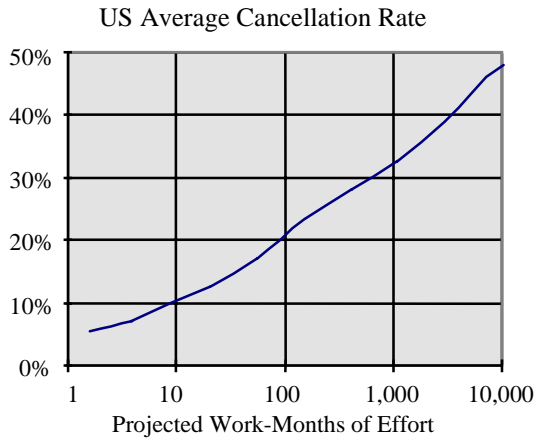
information based. These must also be measured. The scale above is offered as a starting point. Place "love" at one end and "hate" at the opposite end.



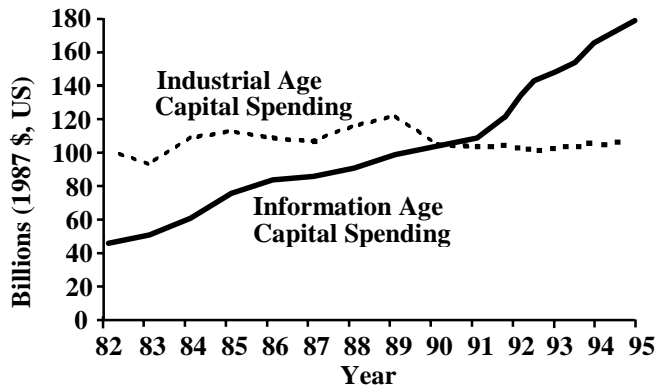
A scale at the bottom ranges from zero to one hundred. Choose any topic (including information) and classify the bias. Be fair and unbiased.

The Nature of the Problem

The following is an excerpt from information researcher Doug Hubbard. " IT investments and the power of computing has not been matched by a growth in successful techniques for finding the right



combination of IT investments. This is a real predicament because the difference between the "right" decision and the "wrong" decision is dramatic.



There are cases of companies realizing fantastic returns on investment of 50% or more from IT investments. (Ref. 6) Companies that have received these kinds of returns have turned information systems into 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. For example, the risk of project cancellation (usually resulting in the loss of most of the



investment up to cancellation) is often over 5% but sometimes over 40%.

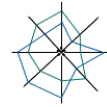
Other Risks:
Cost Overruns
Unrealized Benefits
Liabilities

It has been reported that in the worst-case scenarios a bad IT investment does more damage than just the loss of the direct investment. There are cases where dysfunctional IT systems have interfered with the business operations and cause the loss of customers and revenue. The Denver Airport construction is a well-known example of this. (Ref. 8)

Given the extremes of the risks and benefits of IT investments, it is easy to see how critical it is to tell the difference between the "right" investment decision and the "wrong" one. A rational and systematic analysis of the expected costs and benefits is essential. 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. The decision-maker is confronted with many seemingly abstract and intractable questions.

- ◆ How do I estimate the value of information or an information system (including "intangible" benefits)?
- ◆ How do I deal with the apparently extreme uncertainties in the estimates of IT costs and benefits?
- ◆ How do I know whether one IT investment is "better" than another investment (IT or otherwise)?
- ◆ How do I know when to stop analyzing, accept some risk, and make a decision?"

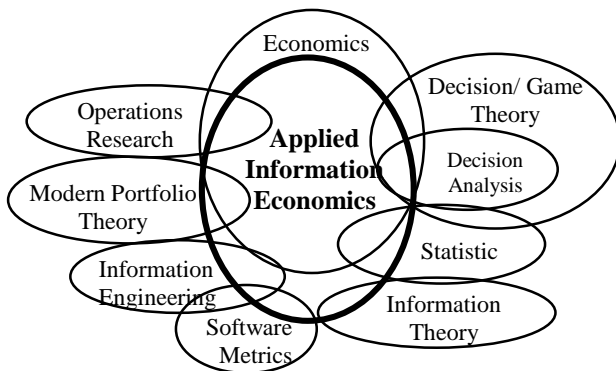
A clear business issue becomes evident. What business measures accurately show the current value if the information systems and which systems are able to be created and/or improved that will accelerate the success of the business. What is the process for allocating scarce resource to the highest goal gain activity?



II. The Solution: ITOP Information Economics

Definition: ITOP is an acronym that represents "Information Technique for Optimum Performance." ITOP is reversed to POTI, which is the origin of words like power and potent. Volume or weight does not properly measure valuable information. Rather, wealth-creating information is measured by its **potency**. Potent information is that which compels goal gain actions. Goal gain activity is the connection to the operation research discipline and to value economics.

ITOP is a unique methodology to rigorously apply a specialized economic theory to the problems confronting corporate executives in charge of the "human resources, IT portfolio, process engineering, value determination, learning and competencies of groups. Group



theory is akin to organizational studies. Later in this paper a corporate metrics scorecard is shown depicting all these aspects.

Other models for information measurement are a synthesis of various techniques including *mathematics, economics, financial theory, perception, psychology and statistics*. ITOP is not a synthetic model. ITOP utilizes physical science formulation exclusively. The reasoning deals with the issue of "proper measurement." All of the studies listed above are themselves none other than types of information systems. Self-measurement is not proper. Self-measurement is susceptible to BIAS. It is not proper for one biased system to be measuring another. In fact what needs to be measured IS BIAS ITSELF. Something stronger and more fundamental must be employed. The items above

are some of the information SUBJECTS to be measured and as



such cannot be a part of the measurement.

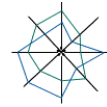
How ITOP Works

The basis is a powerful algorithm from science that calculates the amount of certainty or uncertainty attributed to an object such as a process or system. The "unit of measure" of information is the degree of uncertainty. Economic worth is determined by the value of differing degrees of uncertainty (knowledge). Risk and failure are directly linked to uncertainty. So are goal gain errors. Process control, or lack of it, is a direct function of information potency. All of these business elements clarify when the units of uncertainty become known. Intellectual capital of the enterprise combined with the IT investment can be portfolio managed as never before possible. The methods are fully documented formal procedures.

"Standard Unit of Measure"

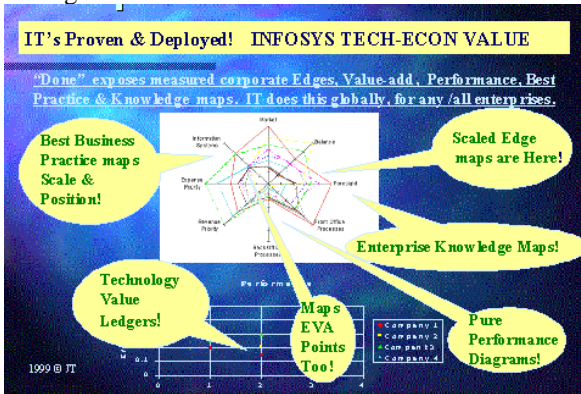
Confusion arises because of the expectation that by this time in history an accepted "standard" metric (weight and measure) exists for everything. There is no such *standard* scale for information content potency and will not be anytime soon **even though a proper scale exists**. The fact that there is not a *standard* is only a roadblock to those searching for such a crutch. Every standard scale was once "pending." After thousands of years there is barely a standard temperature measurement. Instead we have Fahrenheit and centigrade and Kelvin. Note the standard process but different units. In distance measure we have yards and meters. There is no standard language. What exists instead is a set of choices and individual or group bias toward one or another. The bias is toward what works well and is most familiar. The information we grew up with and learned from trusted teachers caused a bias that we now use to advantage.

Non-standard must not be considered wrong or incorrect in the absence of an established standard. Anything really new and different will undergo a long period of evaluation, teaching and training prior to becoming a "standard". During this period people are challenged to think for themselves about the consequences of acting on the new or ignoring the evidence. Consequences follow choices.

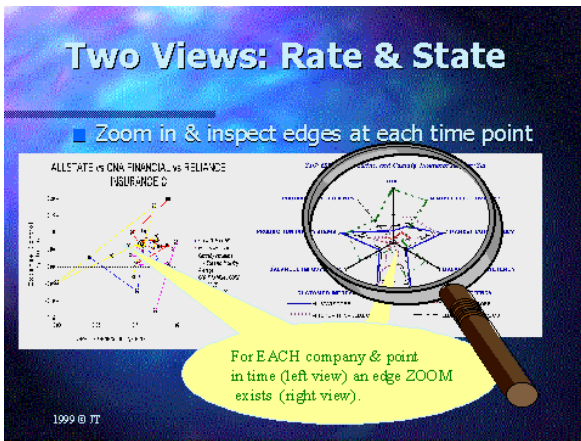


Business Metrics Scorecard

The proper application of Information Economics permits the creation of a value-oriented edge diagram for any or all enterprises. The example shown below was presented at a measurement forum sponsored by the American Management Association.



The position of the value creating edges, practices, processes and systems are shown. Extensions include reengineering, organizational learning and innovation measures for actual business organizations.



The value delivery state (state of value delivery) and rate of goal progress is able to be depicted for competing organizations. The complete set of graphics is available elsewhere and need not be repeated here.



Critical Disciplines?

Accomplishing that shown here can be accomplished from various starting points. Recall the earlier comment from Richard Bellman that optimal paths are available independent of the actual position of the current state. Some paths are individually more convenient because previous learning has provided a foundation of worthwhile principles. It is not a good practice to void all learning and start over. The penalty cost of engaging completely new doctrine is high. A few suitable (and familiar) starting points are briefly mentioned.

Process engineering as related to control systems is a good path. The difference is introducing the notion of information processes. What exactly is the composition and operational aspects of information processes?

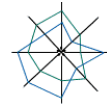
Communication engineering is a surprisingly strong path. An underpinning technology is exposed in message synthesis that is hidden or missing in other studies. The emphasis here is on content rather than conduit. It will turn out that communication is the dominant technology and therefore is worthy of serious investigation.

Complexity and chaos theory include useful ingredients but lack maturity because of the newness. Completeness is missing.

Cycle time management and engineering is a durable starting point. The difficulty here is the lack of consistent data from which to test global application. The cost of data collection often exceeds the gain. Information economics must be economical else it is hypocritical.

Knowledge management is an emerging field that holds promise. It also holds traps and dead ends. Not all knowledge is necessarily good knowledge when conditioned by the cost of learning and the reality that the time spent in one topic takes away from the learning of another potentially more valuable. Learning for learning sake may be destructive.

Value engineering is an absolute prerequisite because it represents the largest void in the academic teachings. The gains will be small unless a strong foundation is achieved here. Study value delivery effectiveness as contrasted with efficiency.



“Intangibles” Studies are Weak

A movement of considerable magnitude has begun with the purpose of measuring the business "intangibles." The otherwise prestigious Stern School of Business at New York University is one source. While it is true that any starting point can seek out the proper path choices to optimize the corporation (Bellman), the measuring of intangibles is least likely to yield a Eureka. I hold a negative view of such activity.

The measurement and understanding gained from intensely investigating sources of bias show the difference in action caused by seeking the positive as opposed to avoiding the negative. Accelerating the positive and eliminating the negative would seem to yield the same conclusion. Positive thinking focuses on the high worth "to do" list while the opposite (derogatory) focus derives the "don't do" list. Unfortunately, knowing all the avoidance actions does not lead to the value creating actions.

The movement toward measuring intangibles is fostered by the notion that Accounting and/or Finance measure all the major **high worth** objects. Thus, "intangibles" are all that remains to reach a state of completeness. Such is the false premise. Consider the following thought.

Economic value is represented as worth beyond cost. By rule, all items in the accounting journals are exactly represented by their cost. Therefore, value content is illegal in an expense accounting system by design. If any item is entered at other than cost, the journals become dreadfully out of balance. Professionals that are sanctioned to police cost accounting purity make certain to eliminate all evidence of value content from their systems. The years of constant focus on expense information create a bias. It is typical for an extreme focus on one thing to cause blindness in another. The very thought that a different kind of system could be designed to measure value becomes unthinkable. Accounting is yet to recognize or measure any of the really significant value creating assets. It is hypocritical to be worrying about "intangibles."

There is a path out of the "intangible wilderness." The solution resides in diligently seeking (and finding) the perfect (zero value) commodity. Such a commodity must be real and in constant use in every enterprise. Knowing the perfect commodity



permits comparison of it with any object to the purpose of exposing all the value components of the subject object. That is how ITOP works. *The bias in the perfect commodity is invariant.*

Analyzing Uncertainty Systematically

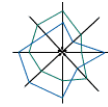
A question arises as to why the study of uncertainty, risk and information is so terribly important. Recall the eight companies that were mentioned at the outset.

Consider the core basis of competition. COMPETITION arises at EVERY instance where two or more parties target the same open goal (to win something contended). "Open" means that the future outcome (the winner) is not preordained. Who exactly, what team, what company, what product, and what technology will be the winner is uncertain. Only choice possibilities and probabilities are guaranteed. Uncertain choices come with fearful risk. Inaction, error and failure are constant undesired companions of risk and uncertainty. Competition and free choice guarantees that there are no absolute guarantees. Yet, among all the choices reside those that are truly best. Information economics operates in these situations.

Information Economics deals with the "winning" tactics in uncertain situations. The ONLY enemy of risk and uncertainty in the universe is information in some form. Exceptional information is the ONLY thing in the universe that holds the power to alter the winning odds positively or negatively_(Ref 26). Consistent winning requires continuous favorable odds, and the single source is information. Thus, all aspects of business performance and productivity are information based. Every competitive advantage in business is directly an information advantage and only that.

All investments have a measurable amount of uncertainty or risk. In fact, rational investment decisions under conditions of uncertainty must always consider both the risk and consequence. The ability to reliably select the highest value return investment, is paramount That means that the system to properly classify (with certainty) the highest value investments is the most critical missing system.

Because all winning tactics (edges) in competitive situations are information edges, it



follows that the high value investments will always fall into the class of information improvement. It does **not** follow that these are the type of information systems that one commonly thinks about. The information improvement may be product information systems, manufacturing method systems, supply chain systems, advertising systems, management systems, human resource systems, organizational learning systems, or innovation systems.

A Portfolio Approach

ITOP uses the methods of Modern Portfolio Theory and treats the entire set of IT investments as another type of investment portfolio. Each investment is analyzed on the basis of the value it adds now to the enterprise and the actual incremental value improvement potential. It does this by also analyzing all the competitors (and customers) on the identical basis. Such a process guarantees reality by showing the size of edges of each competitor head-to-head and dollar for dollar.

Recall the eight-company example at the outset. Here is a real example. The real economic value of a few of the more subtle edges is shown for companies that are competing in the petroleum refining industry.

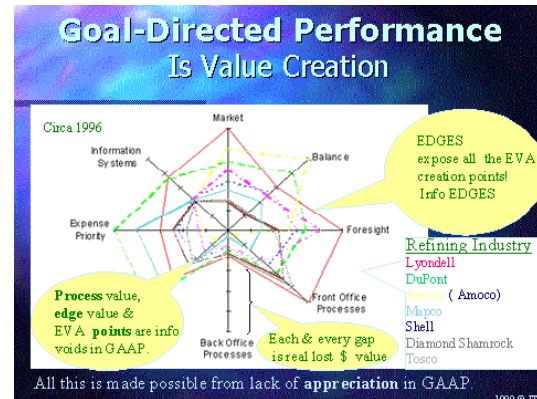
Enterprise System Topic	Enterprise Value Magnitude (Worth units in \$millions beyond cost)				
---	Lyondell	DuPont	Mapco	Amoco	Shell
Customer Information Systems	\$134	\$1382	\$35	\$853	\$106
Supply & Production Systems	-53	236	4	214	0
Asset Allocation Inf. systems	81	1618	39	1067	106
Can do any/all Systems \$ value	Etc...				
Total Information Systems	\$349	\$4382	\$11	rank of "best's"	
Reengineering Systems Rel-to Best	1	7	11	19	23
Organizational Learning Rel-to Best	1	3	6	2	8

The Calculation Of The Economic Value Of Information

Contrary to popular belief, the power of information can be calculated as can the dollar value of systems. The term "information" often seems to defy definition and is used in an ambiguous manner. Defining information in terms of the bias created by the presence or absence of it yields consistent linguistic and analytical method. This procedure can be paraphrased as follows:

1. Information causes Bias of Directional Action
2. Positive bias Reduces Uncertainty
3. Less Uncertainty Improves Decisions
4. Better Decisions Result In More Effective Actions
5. Effective Choices cause Improved Results

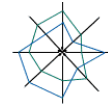
These steps can be stated in unambiguous mathematical terms. The mathematical model for this has been around since the mid 1800's. From this archetype the "elusive" value of information can be determined precisely.



Suddenly, the investment portfolio and improvement tactics are clarified. The largest gain available to the enterprise will be located in the largest gap. It is as simple as that. Investments for goal gains will need to be priority allocated in proportion to that necessary to close the weakness or extend the strength.

The profile will approximate organizational structure and functional responsibility. Sales, production, marketing, human resources, reengineering, and so on are performance "mapped" in comparison with competitors. A value delivery audit has been accomplished.





III. What Is Different About Applied Information Economics? Weighted Scoring Methods

There are several recent attempts to improve IT investment decisions by using various forms of weighted scoring methods. (Ref. 13, 14, 15, 16) These methods ask IT investment decision-makers to rate a proposed project in categories such as “strategic Alignment,” “Organizational Risk,” etc.

Sometimes these methods are misleadingly referred to as information economics methods and are represented as objective, structured or formal. It is important to note that these methods are not based on any kind of formal, accepted economic model and that they cannot truly be called economics at all. The total score that is generated for a proposed system has no meaning in financial terms. The definitions of the different scores in a category and the weight of a category are not tied to any scientific approach either theoretical or empirical. It is actually nothing more than another entirely subjective evaluation process. Many users of these methods claim they see a benefit but there is no demonstrated measurable value to this process. (Ref. 12, 17)

A report by Barbara McNurlin demonstrates this point. (Ref. 17) Ms. McNurlin analyzed 25 different benefit estimation techniques including various weighted scoring methods. She characterizes those methods, none of which she classified as based in theory, as “useless.”

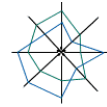
Summary Comparison of Methods

	Traditional Cost/ Benefit Analysis	Weighted Scoring Methods	Applied Information Economics
Basic Financial Tools	NPV, ROI, EVA (sound financial tools)	Not specifically included or altogether ignored; produces a “score”; not comparable to financial data	NPV, ROI, EVA (sound financial tools)
Analyzing “Intangibles”	Usually ignored because only “hard” benefits are given numbers	Attempts to evaluate without removing ambiguity, adds further ambiguity with subjective scoring	Focuses on removing the ambiguity of the identified intangible with “unit of measure” definitions
Uncertainty In The Estimates	Uses point estimates, ignores differences in level of uncertainty except for ambiguous “hard/soft” distinctions	As in Information Engineering, no specific methods are discussed. Subjective scoring methods actually may add uncertainty	Employs sound mathematical methods already used in actuarial science, statistics and financial management theory
Information Gathering Methods	Systematic methods employed - but rarely; usually depends on individual judgment	Almost no focus on real measurement techniques of any kind	Scientific information gathering. Also calculates the EIQ, to gather information just sufficient for a given decision
Overall Assessment	Better than nothing; has sound financial methods	Creates an illusion of objectivity and quantifying benefits; has demonstrated no measurable improvement in decisions	The only method which provides scientifically and economically valid recommendations

Paul Gray, a book reviewer for the Journal of Information Systems Management, may have summed it up best. He reviewed a book titled, “Information Economics: Linking Business Performance to Information Technology,” one of the definitive books of a popular type of weighted scoring method. (Ref. 16) He wrote: “Don’t be put off by the word ‘economics’ in the title: the only textbook economics discussed is in an appendix on cost curves.” (Ref. 18) Gray sums up the key weakness of the approach: there are no economics in this version of information economics.

None of the methods above are sufficiently strong to address the consistent and tough issues of complete value determination. Were they able to do so, the sticky problem of information system value management would have been long ago solved!

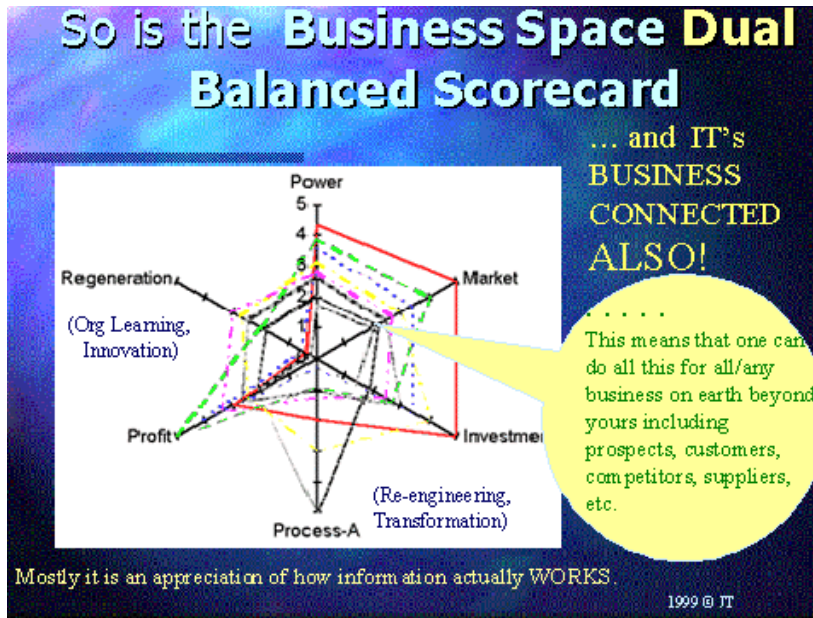




ITOP Methodology Information Economics Differences

The ITOP method is sufficiently robust to integrate all of the methods listed above through use of the fundamental information archetype of science - entropy.

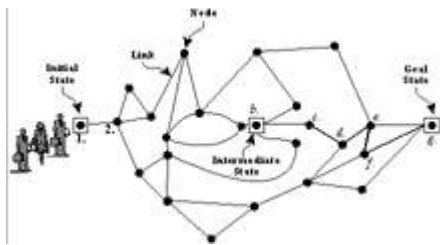
The results connect the information value measures directly to the corporation. The results are auditable at any level because they balance to the corporate financials.



The ITOP technique is proven in science. Reference papers develop a complete and comprehensive calculus of value delivery, knowledge metrics, and describe the Super-Ordinate Optimization algorithm.

Conclusion

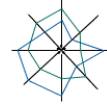
Information causes BIAS. That is exactly what it does. Bias is measurable. Most often bias is considered a "bad" thing. However, a **prejudice for excellence** is a good thing. A bias for the correct answer is what **knowledge** is all about. Until my teams developed the zero bias tool (ITOP) for measurement, ALL other methods included the unfortunate design property of including the subjective bias of the evaluation personnel that were participating in the measurement.



Application of the method optimizes choices as described by Bellman and all other Operations Research and Management Science practices and processes.

Applied Information Economics has distinct advantages over other methods for assessing the value of information systems investments. It is the only method that has specific tools to deal with the uncertainty, intangibility, and ambiguity typical of IT investments in a way which is financially meaningful. As the power of information systems increase, as the influence of information technology on economic prosperity grows, it will be even more critical that we develop and utilize rational business methods in the analysis on IT investments. **Applied Information Economics is and will continue to be at the forefront of methods to keep business prosperous in the growing information economy.**





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