

Myths and Realities in Energy Delivery Asset Management Tools and Information Systems

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Consultants to the Utility Industry

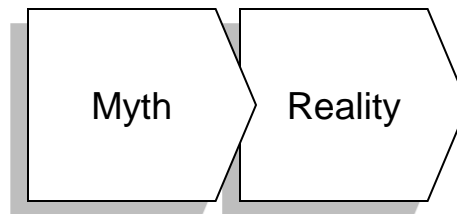
Agenda

- Why the myths must be critically examined
- The myths and the realities
 - Project Prioritization tools and 'drawing the line'
 - Asset Health indices and making decisions
 - Databases and making decisions
- The right way to make asset management decisions
- Observations and key questions

Myths can be helpful in establishing new paradigms...

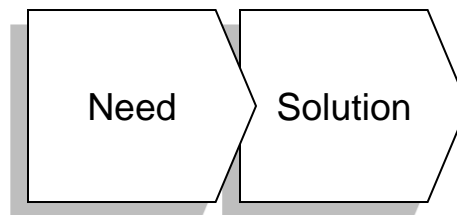
- Sometimes a myth serves to envision a possibility that is not yet a reality. How did these myths facilitate the reality:

- The dream of flying (a la Icarus) and ... Air travel?
- Jules Verne's 'Nautilus' and ... Submarines?
- Asimov's geosynchronous satellites and ... GPS?



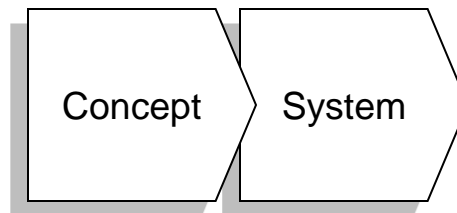
- In the utility world too, myths can be very powerful:

- Rural electrification gave rise to... public power
- Economists' dreams led to...electricity deregulation
- 'Oil independence' is driving...renewable energy



- And in information systems, we have seen concepts driven by needs give rise to real system solutions:

- One system for Order-to-Bill...T&D WMS
- Integrated systems...CES, SAP, UCA/CIM
- Smart Grid...AMI, DA, and DMS

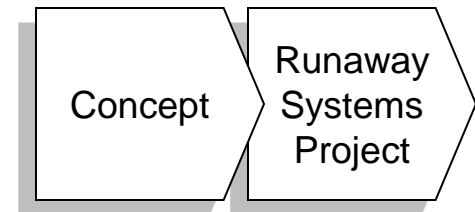
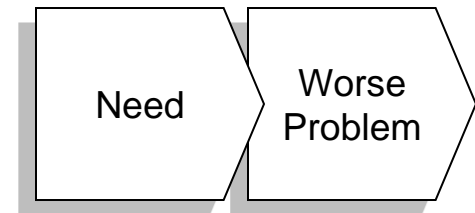
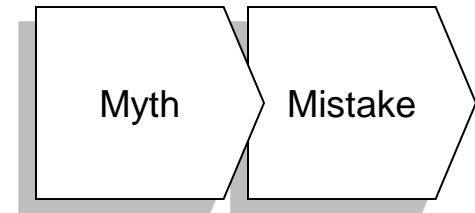


There is just no denying that myths have a powerful influence on the real world of the utility marketplace in which we live

...But myths can be counterproductive as well...

- Some myths have led people to do some stupid things over the years:
 - Throwing virgins into volcanoes
 - Throwing good money after bad
 - Throwing away a not-so-bad system for a new one that turns out to be a nightmare (at least at first)
- Some attempts to improve things only make them worse:
 - Electricity deregulation (Is the jury still out on that?)
 - The law of ‘unintended consequences’
 - Murphy’s Law (and Murphy was an optimist!)
- Or as Burt Lance famously said:

“If it ain’t broke, don’t fix it.”

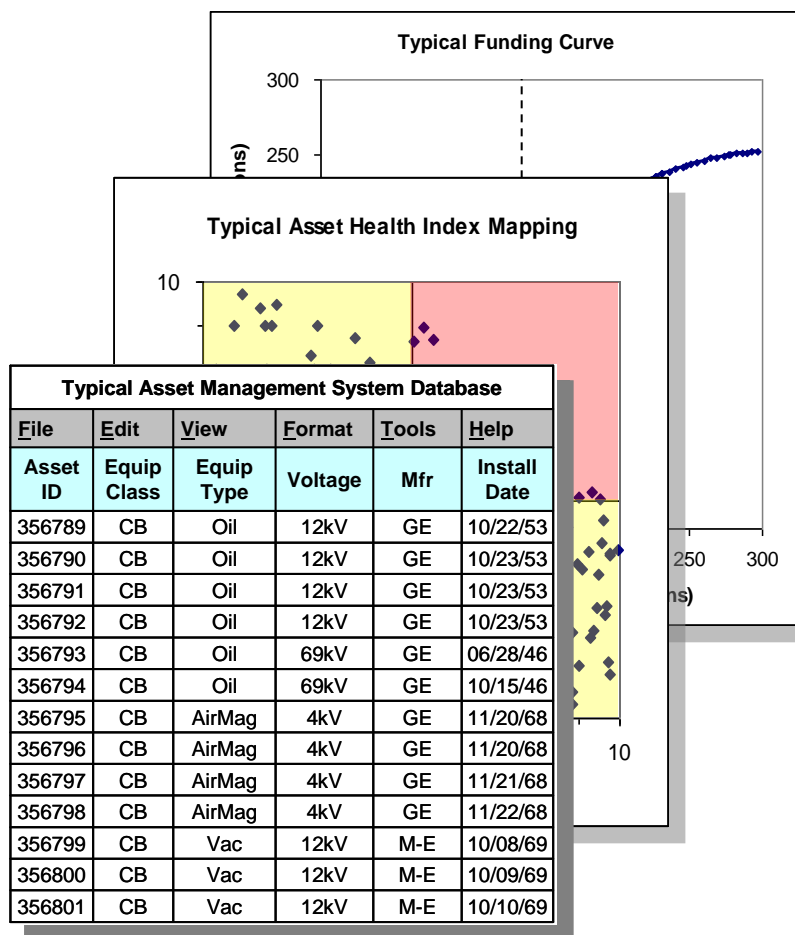


But myths can also be a destructive force, when they lead us to the wrong conclusion or down an unproductive path of effort

...So, we need to critically examine certain asset management myths

In this paper, we will examine three myths about T&D Asset Management Tools and Information Systems:

- Project Prioritization tools should be used to decide exactly where to 'draw the line' between projects, including, in fact, especially, that handful of projects on the margin of whether or not to be funded
- Asset Health Indices should be used to determine repair/replace decisions for specific assets
- Asset Databases can be populated with enough historical information in the right system, such that key asset decisions can be made by essentially 'pushing a button', i.e. executing a properly structured database query



***A myth that leads toward a counterproductive practice is not helpful.
Let's sort out the myths from the realities in T&D Asset Management***

Our experience comes from the companies we have served

Electric Companies

- Allegheny Power
- American Electric Power
- Commonwealth Edison
- FirstEnergy
- Georgia Power
- Hydro One
- Kansas City Power & Light
- London Electricity
- Long Island Power Authority
- Omaha Public Power District
- PacifiCorp
- Pepco
- PPL Electric Utilities
- Progress Energy
- Southern California Edison
- Tennessee Valley Authority
- TXU Electric
- Westar Energy

Gas Companies

- Lone Star Gas
- Peoples Energy
- Philadelphia Gas Works

Combined Companies

- Alliant Energy
- Avista
- Central Hudson Gas & Electric
- Con Edison
- Consumers Energy
- Dominion
- Entergy
- Exelon (Com Ed, PECO, and both)
- Northeast Utilities
- Northern Indiana Public Service
- NSTAR
- PHI (Pepco and ACE/Delmarva Power)
- Public Service Electric & Gas
- San Antonio City Public Service

See: www.oneillmanagementconsulting.com/experience.html

The conclusions we draw below are based on our direct experience consulting for many of the industry's major utility companies

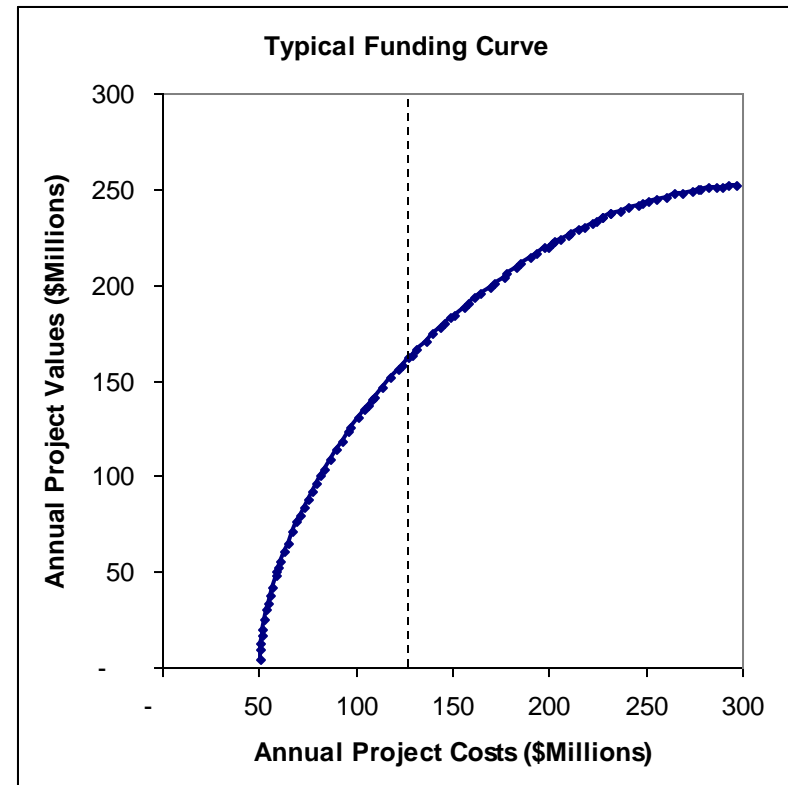
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Myth: Prioritization tools can 'draw the line' between similar projects

Illustrative

- The Funding Curve Myth is that prioritization tools should be used to decide exactly where to 'draw the line' between projects, including, in fact especially, that handful of projects on the margin of whether or not to be funded
- By being 'fact-based', i.e. driven by observable parameters, there should be no argument about whether a project is funded or not, and a project's funding success should not depend on who is making the case for it
- The benefit/cost ratio, if designed properly, will tell you how much money should be spent, i.e., where to draw the line
- 'Must do' projects are minimized, requiring projects to truly justify their funding in a zero-based way

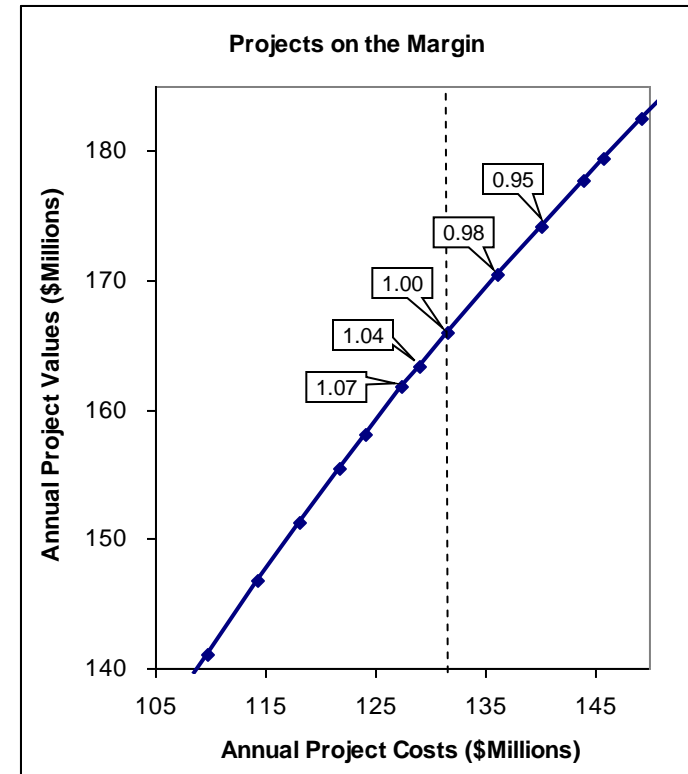


According to the myth, management just has to read a printout to see which projects should be funded, even for the 'close calls'

The reality: Prioritization tools separate the sheep from the goats

Illustrative

- In reality, the effort to ‘rack and stack’ all the projects, using either point scoring or a benefit/cost ratio, should leave many projects ‘on the margin’ with scores that are very close or essentially the same
- In fact, the difference between two projects with ratios of benefit-to-cost of 1.10 and 1.11 is probably a statistical artifact – not numerically significant, given the precision of the estimates used to score them
- Moreover, with scores so close, would it really make any difference to the corporation which was picked?
- In fact, if an important project does not make the cut, it probably means that it should be broken into tiers, or layers, at least one of which would make the cut
- Finally, what tells you where to draw the line in the first place? With point scoring – nothing, but even with benefit-cost ratios, the answer must be checked against what it implies for reliability goals, financial and resource constraints, and regulatory timing*



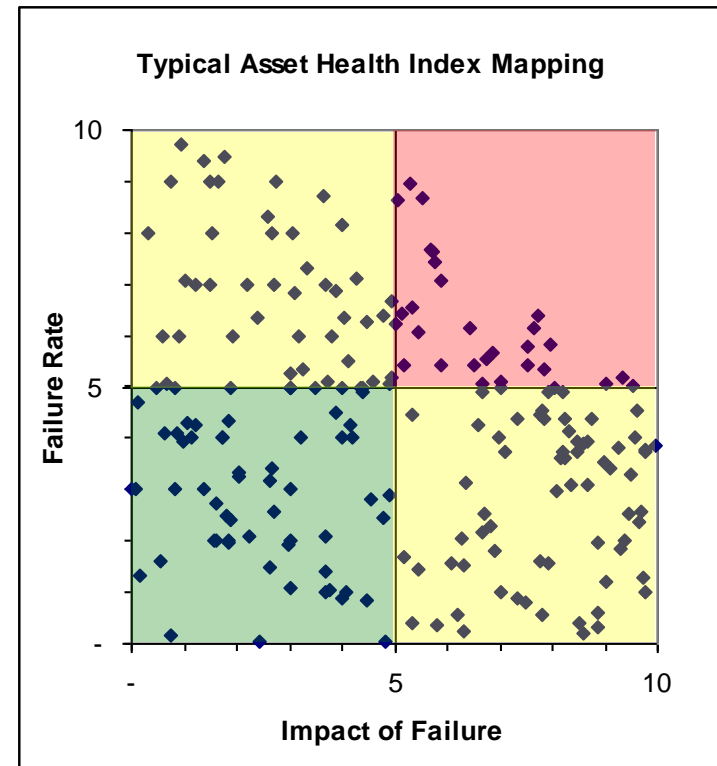
* See my article: "The Reliability Conundrum – What Is the Right and Prudent Level of Spending on Service?" PUF, March 2004

If the projects ‘at the margin’ or ‘on the line’ are not almost equally valuable, the tool is probably not being used appropriately

The myth: Health indices can make repair/replace decisions

Illustrative

- The Health Indices Myth is that asset health indices should be used to determine repair/replace decisions for specific assets
- Usually, the indices are multi-dimensional, but are likely reduced to two: probability and impact of possible failure to perform properly
- Assets in the upper right quadrant are obviously problematic, while those on the diagonals represent different kinds of risk
- The indices are weighted scores involving age, design-type, condition, redundancy, number and type of customers or load attached, etc.
- The idea is that while a funding curve might say how many assets of type 'A' to replace each year, the health indices tell you which ones to replace, based on current condition and cost

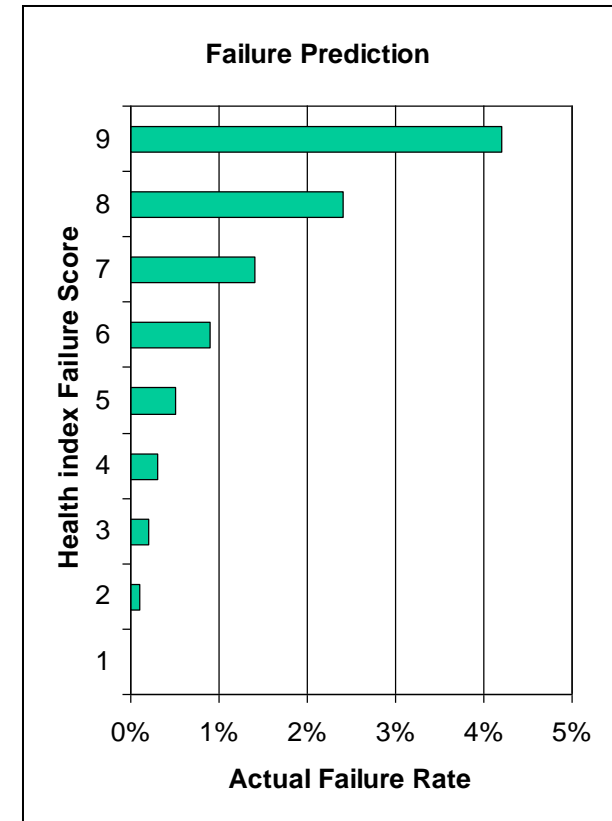


Again, the myth says that the payoff for the effort to score all the assets is that it allows someone sitting in a central office to make the decisions

The reality: Health indices are screening tools for exception reporting

Illustrative

- In reality, high scores (low asset 'health') do not always indicate replacement, for a number of reasons:
 - Failure prediction algorithm accuracy is not high, and can vary considerably by type of asset
 - Currently, and for the foreseeable future, some of the most predictive data is effectively unavailable
 - Many individual assets will have scores that are identical or insignificantly different, like differences of a few months of age, minor cost variations, etc.
 - High scores can be problematic to interpret, e.g., if an asset has high maintenance frequency/cost, does it indicate a tendency to failure or did the repairs reduce the chance of subsequent failure?
- But, high scores can be used well for exception reporting, facilitating review of all the data by a subject matter expert (SME), who can more easily see which components to ignore and which to pay attention to, including perhaps further testing and data analysis



The best use of asset health indices is as an automated way of identifying individual assets requiring SME and field evaluation

The myth: Databases can automate asset decision making

Illustrative

- The Asset Database Myth is that with enough historical information in the right system, key asset management decisions can be made with a properly structured database query
- All relevant data can be stored in a single database with proper cross-references to work orders, failures, outages, projects, inspections, conditions, purchasing, etc.
- Key insights can be extracted with English-language-like structured queries, e.g., “which brand of circuit breakers fail most frequently in the last five years”
- Predictive relationships and insightful analyses can be automatically developed
- Data quality can be assured by empowering a dedicated group of ‘data police’ to ensure reports and analyses will be correct

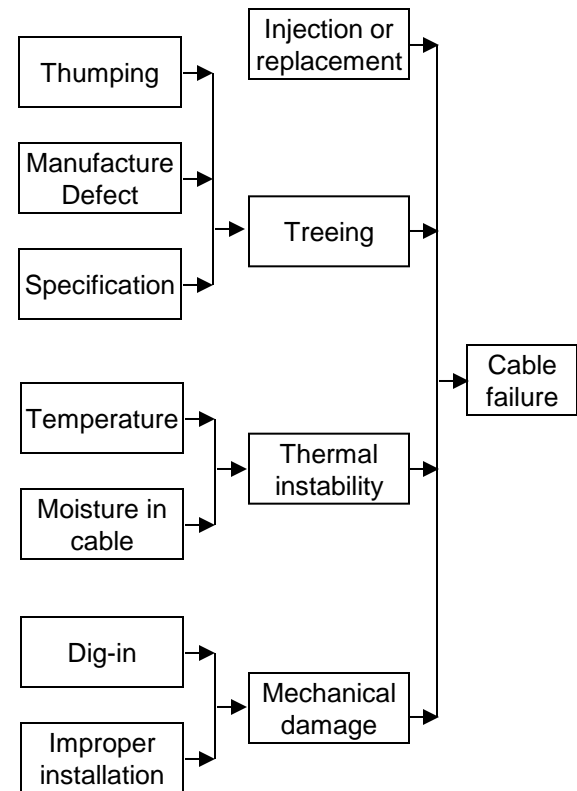
Typical Asset Management System Database					
File	Edit	View	Format	Tools	Help
Asset ID	Equip Class	Equip Type	Voltage	➤ Root Cause	
				➤ Weibull Curve	
356789	CB	Oil	12kV	➤ Optimal PM/CM	
356790	CB	Oil	12kV	➤ RCM	
356791	CB	Oil	12kV	➤ FMEA	
356792	CB	Oil	12kV	➤ Life-Cycle Cost	
356793	CB	Oil	69kV	GE	06/28/46
356794	CB	Oil	69kV	GE	10/15/46
356795	CB	AirMag	4kV	GE	11/20/68
356796	CB	AirMag	4kV	GE	11/20/68
356797	CB	AirMag	4kV	GE	11/21/68
356798	CB	AirMag	4kV	GE	11/22/68
356799	CB	Vac	12kV	M-E	10/08/69
356800	CB	Vac	12kV	M-E	10/09/69
356801	CB	Vac	12kV	M-E	10/10/69

Software vendors and utility managers have for years collaborated in envisioning the systems that could automate utility asset management

The reality: Databases cannot do magic in finding relationships

Simplified Root Cause Diagram

- Finding relationships in utility data is not automatic
 - Most utility causal relationships are complex, often non-linear or requiring interaction effects
 - The specification of the observations, i.e., the time period or cross-section, as well as each variable requires some thought and care
 - Once this is done, some good rules could be automated in a database, but even then, it should only be used to draw the attention of an SME
- Sometimes historical data is not enough, as in my favorite example:
 - For 30 years, you have maintained breakers scrupulously on a 36-month cycle, and have kept meticulous data on every overhaul and failure
 - Management wants to know what will happen if you extend the interval to 48 or 60 months. So, what query do you run on the historical database?



Answering the questions needed to make real decisions usually cannot be done with the push of a button or an automated query

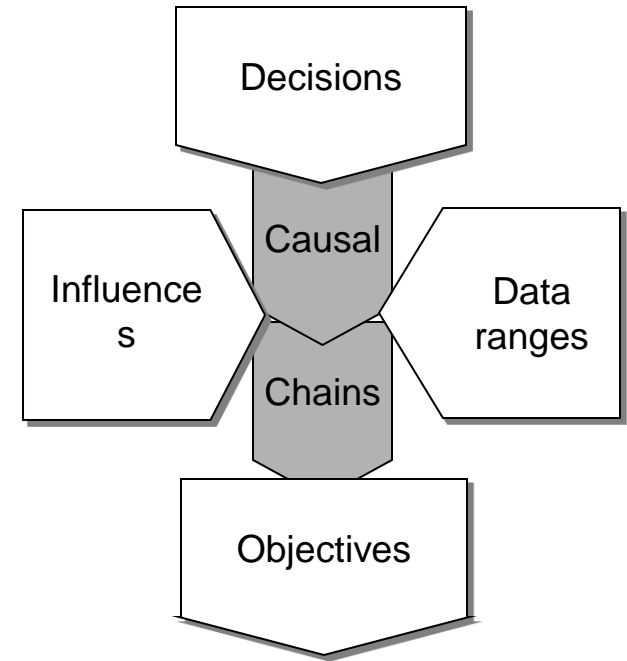
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A decision-analytic approach has many advantages

- The best way to gather and use data to make decisions is to use a decision-analytic approach
 - Not meaning use of decision calculus as such
 - But clearly defining the key components (see diagram at right)
- Once done, you may find:
 - Your actual possible decisions are limited, though the influences on them are many
 - The data you already have may be good enough to make the decisions
 - The objectives were not clearly defined, and multiple objectives must be weighted
 - Sometimes it pays to invest in more or better data, and sometimes it doesn't
 - You now have a framework upon which to build, so more data can be used effectively

Decision-Analytic Approach



The decision-analytic approach has been shown to be efficient in its use of information and data resources to manage utility assets

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Observations and Key Questions

Observations

- Asset management tools and information systems can be helpful, even essential, but are often ‘sold’ as ways to virtually automate asset decision making
- Their best use is when combined with subject matter expertise and placed within an explicitly decision-analytic framework
- Many companies are tempted to spend resources at first gathering data (and improving its ‘quality’), without the right decision framework for using the data efficiently and effectively

Key Questions

- Do you know precisely what questions you want to answer with your asset management systems?
- Have you done a value of information calculation to see how more information could be worth its cost?



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With the right framework, the quest for asset management tools and information systems can be made effective for utility management