Strategic Asset Management

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Vision and Technology

Risk, Probability and all that

Peter Bernstein tells the story, in "Against the Gods", of how in 1654 'the Chevalier de Mere, a French nobleman with a taste for both gambling and mathematics, challenged the famed French mathematician Blaise Pascal to solve a puzzle. The question was how to divide the stakes of an unfinished game of chance between two players when one of them is ahead. The puzzle had confounded mathematicians since it was posed some 200 years earlier… Pascal turned for help to Pierre de Fermat … and the outcome of their collaboration ..was the discovery of the theory of probability, the mathematical heart of the concept of risk'. (p.3) This made possible risk management, future planning, the stock market, capitalism, in fact the world as we know it today.

Why was it, Bernstein wondered, that the discovery of probability had to wait until 1654. After all, he mused, 'Probability theory seems a subject made to order for the Greeks, given their zest for gambling, their skill as mathematicians, their mastery of logic, and their obsession with proof.' Moreover, 'the Greeks had the only recorded civilisation up to that point untrammelled by a dominating priesthood that claimed a monopoly on the lines of communication with the powers of mystery.' (p.16)

But the Greeks didn't venture into the mathematics of managing the future. For two reasons, both of which are instructive for us today in Asset Management.

One, they didn't see their future as manageable. ('Order' resided in the heavens, life on earth was chaotic and at the whim of the gods.)

Two, they didn't have the zero! The Hindu numbering system and the concept of zero was yet to be discovered.

One could say that they failed to apply their mathematical ability to managing the future because (1) they did not envision a manageable future and (2) they lacked the tools to do the job. In other words, *they lacked the Vision and they lacked the Technology*.

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Emerging Technologies

Both are necessary, Vision *and* Technology. The Arabs had the concept of zero, but they did not use it to manage their future, again *because they did not know they could*. They had the technology but they lacked the Vision.

This is true of Asset Management as well. We now have the vision, the concepts, the guidelines—but is technology keeping up? (Do we have the equivalent of the zero?) On this page and the next we look at 'emerging technologies' and areas where technology seems to be lagging behind.

> **Technology:** 'systematic treatment', 'the scientific study of the practical or industrial arts'. *The Shorter Oxford English Dictionary.*

Making a concept 'operational'

For our purposes it is useful to look at technologies as those tools and techniques that allow us to take a theoretical concept and 'make it work on the ground'. A steam engine is an example of a technology. It is the application of the scientific concept of steam to practical use. The vision is the concept. The technology is the tool allowing its *practical* application.

Development within a Discipline

Technologies in the past have tended to be developed *'within'* a discipline *'for'* that discipline. So we have technologies such as reliability centered maintenance, developed by and for engineers; practical rules of valuation, developed by and for valuers; and practical rules of depreciation developed by and for accountants.

Leading Edge is now Multi-disciplinary

The new, emerging, technologies are *MULTI-DISCIPLINARY*. This is the new challenge for asset managers.

Concept	Existing Technologies	Emerging Technologies
Asset Consumption: The rate at which an asset's service potential is 'used up' is a function of asset type, age, maintenance, use, and changing demand and technology	**Degradation rates** (*engineering*) – a function of asset type, age, maintenance and use, *a management tool* **Depreciation rates** (*accounting*) – a function of asset type, expected obsolescence, *a recording tool*	**Condition Based Depreciation** (*combination of engineering, accounting and management*) – changing service potential measured as a function of asset type, age, maintenance, use, *and actual* obsolescence. *A planning and a recording tool*
Life Cycle Costing: The idea that decision making should aim to ensure the lowest average total costs of an asset over its lifetime (including maintenance, operations, repair/renewal) and NOT the initial purchase cost only.	**Terotechnology** (*engineering*) – integrates finance and engineering aspects. Mostly applied to plant and equipment. **Net Present Value and related discounting technology.** (*Economics/ Finance)* Mostly applied to choice of new asset.	**Life Cycle Analysis within Asset Management Plans**—the integration of financial and technical aspects, through risk management to both new and existing assets. Renewal seen as an alternative to replacement. LCA tools are specific to individual industries and maybe to firms within industries.
Fitness for Purpose The notion that an asset, eg a building, can be physically sound but not appropriate for a particular use because of such things as asset type, size, location, etc. By extension, the notion that an asset, not currently in sound condition, may not be made 'fit for purpose' merely by repair and renewal.	**Condition Analysis** *(technical)* - analysis of asset from perspective of works needed to restore original function. **Compliance Testing** *(technical)* – analysis of asset from perspective of its compliance with regulations (eg OH&S, EPA)	**Serviceability** – A measure of how well the asset meets the service needs required of it; it combines measures of service *demand* and service capability; goes beyond mere compliance testing; goes beyond restoring original function. Looks at future rather than past service requirements. *See AMQ International, Vol 2 no 7 1998*

Concepts in Need of Technologies.

We now take for granted the concept of infrastructure as an asset which has to be managed. They may be long living assets, but *infrastructure asset management* is still a very *new* practical science. We now realise that an asset can be *managed* (not simply measured) and that they have a cost that is reflected in the real cost of service.

With this new realisation, concepts of asset costing and management have grown rapidly. So rapidly, in fact, that they have, in some instances, outstripped the ability of technology to deliver on the ideas of the conceptual visionaries.

The following are some of the concepts (visions of what can be achieved) that are being enthusiastically promoted – but currently lack good enabling technologies. The community would benefit from their development.

To develop a new technology requires:

(a) recognising that there is a need (the visionaries, in their enthusiasm, often assume the technology exists when it does not, or –worse– that an existing technology will do the job when it will not.

(b) imagination, application, persistence and endurance!

The following are examples of concepts that currently lack good enabling technologies.

If you know of a technology that is up to the job, we will print it—the future of asset management will rest, not with new concepts, but rather with ideas for making existing conceptual ideas operational.

Your advice on other areas where technologies are needed is also welcome.

The Vision/Concept	Technology needed
Capital Charging—the notion that capital is not "free" and that requiring managers who receive assets through a central budgeting process to pay the 'cost' of these assets through an annual charge on their budget, will make them take capital costs into account in their decision making and result in better decisions.	**Needed:** A way to make the capital charges *transparently separate* from the ordinary budgeting procedures so that there is an incentive for managers to dedicate resources to freeing up or redeploying surplus assets.
Accrual Budgeting—an extension of accrual accounting (where costs are assigned to the period in which the service or output is produced or used) to budgeting. In particular it means regarding depreciation as a cost to be included in the budget.	**Needed:** A way of managing the recording and spending of depreciation funds (when most agencies can't even manage to allocate maintenance funds efficiently with ease.)
Outcome Budgeting—basically the notion of "paying by results", moving away from paying for inputs (salaries, wages, etc) to paying for services rendered.	**Needed:** A way of measuring service outcomes independently of inputs when there is no ready market to set the price.
Knowledge Management—the notion that knowledge itself is an asset that needs management	**Needed:** A way of valuing knowledge—and an understanding of the rates of degradation, costs and benefits of maintenance, etc.
Holistic Asset Management—integrating natural resources, human resources, and physical and knowledge assets for social and environmental benefit both in the present and in the future. Takes a wide view of community and stakeholders.	**Needed:** A means of transparently and logically trading off one benefit against another, when different groups benefit, either within or through time.

Service Level Agreements by Sara Cullen

Q&A: Reward and Penalty Measures

Question: "I have noticed a tendency for companies to ask contractors to suggest their own reward and penalty measures - largely, I suspect because they have tried to derive them themselves and have failed. For organisations thinking of pursuing this approach, are there any useful tips?"

Answer: While I always recommend that the Client put forward their measures in the tender and let the market respond, there are a few rules irrespective of who prepares the measures:

1. penalty and reward structures are to direct contractor behaviour and equalise the value for money equation, not to give windfall profits or to send anyone broke.
2. penalties and rewards, in effect, represent the same bucket of money. It is the manner and timing of distribution that is the difference, however it can radically change the nature of the relationship.

Guidance Needed

If you have the contractor develop the system, you must give them guidance as to which KPIs (key performance indicators) are most important and your preferences for penalties and/or rewards, the timing, manner of distribution and the "at risk" amount.

Industry Standards

It is imperative that you get across industry standards so that you know if what they are proposing is reasonable. Ask for the "at risk" amount relative to profit margins. It is common for the entire margin to be at risk regarding penalties and a reasonable ROI for rewards.

Ease of Administration

Consider how easy it will be to administrate. There are many extremely detailed methods out there that require a full time person purely to validate the amount of the penalty/reward each month. This is not an ideal situation. Your goal should be to get the services you contracted for, not to get every cent of a penalty rebate. Accordingly the system should be simple, transparent and enable resolution of service problems before dispute/ termination or drive exceptional performance.

Here are the basic methods:

Approach	Description
Fixed Amount	The contractor is penalised/rewarded a fixed dollar amount for each service level failure. In this scenario, different service levels may have different fixed dollar amounts; each weighted in accordance with the impact on the business of that service level failure.
Percentage	The contractor is penalised/rewarded a percentage of the 'at-risk' amount. In this scenario different service levels may have different percentage amounts, weighted against the commensurate business impact.
Points	The contractor is given a points score for performance against service levels. Each service level is has a level of points commensurate with the importance of that service. Outstanding service receives a positive score, and poor service receives a negative score. In this scenario different service levels may have different point amounts, weighted against the commensurate business impact. At balance day (say every month, quarterly or whatever is agreed), the points are tallied and either of the above methods is used to apply amounts. This approach is useful if the client also has a set of its own KPIs to represent its workflow obligations to the contractor. Both parties' KPI achievement are used as offsets to determine the net payment.

Asset Valuation or Business Valuation?

I really appreciate the number of kind people who ring up with, or email me, questions. The following set of questions from Chris Adam is good fun. There are many interlocking aspects to these questions and I certainly don't think that I have addressed them all. Chris and I welcome other points of view.

Chris writes:
"Suppose I am a small regional Council. To meet the requirements of AAS27, I carry out a valuation of my assets (lets say I use deprival valuation although the technique doesn't really matter). This valuation gives me the Non Current Asset Value of my portfolio. Lets say that I have $1bn in total assets.

Asset Value and Commercial Value
However, this doesn't reflect the true commercial value of the assets. The commercial value of the assets is the present value of the annuity stream which is generated by the enterprise, discounted by a and appropriate (risk weighted) rate.

Lets say the annual rates revenue is $175 million. Assuming a (real) discount rate of 7% (calculated using the Capital Asset Pricing Model and consistent with the overseas (UK) experience), and an average age of assets within the portfolio of 25 years, then the COMMERCIAL value of my business is $2.038bn.

A large developer approaches the Council and says: I will buy your assets for $1.5 billion (and the rates will not increase). The mayor thinks this is a good deal - he is getting 50% more than the book value of his assets but less than the commercial value of the business.

Should a Council's Assets be Valued the Same Way as a Business' Assets?
Whilst I understand and support the need for valuation of individual assets to meet a range of business functions, why shouldn't the value of the Councils business be valued in its entirety in the same manner that a publicly traded firm would be? It would be quite possible to determine the COMMERCIAL value of large chunks of the infrastructure (i.e. total value of a sewer/water/road catchment area) or even construct a model which went down to the individual asset basis. Then we could calculate the ROI of the expenditure on Ops and Maint or capital replacement from a commercial perspective.

Spending on O&M should match Depreciation?
Mainstream ideology appears to favor the concept that spending on O & M should match the depreciation schedule when the choice of depreciation model (i.e. straight line/sum of years etc.) will almost invariably differ from the degradation of the asset, thereby making the comparison erroneous. In addition, such an indicator does not attempt to relate the O & M Expense to the commercial value of the asset to the firm. You could also argue that we should use a "risk cost" to reflect the criticality of key assets but this is probably an issue for another discussion.

Response:
Chris, There seem to be 3 parts to your question.

1. The basis for valuing council assets
2. Separation of commercial and non-commercial council assets
3. Spending on O&M matching the depreciation schedule

1. The commercial value of business is the present value of the NET annuity stream (ie what is left over after accounting for recurrent expenditure (salaries, wages, contract costs, etc). Suppose these amount to $100m. This then reduces to an annual NET revenue stream of $75m that can be attributed to the business itself and, following your discounting procedure, would yield a value of $873.4 m.

Goodwill/Rents/CSOs

The discounted net value of the business could be equal to, greater than, or less than, the written down replacement cost of the assets themselves. If it were greater than the WDRC the differential would represent an intangible asset ("goodwill" if a competitive business; possibly "monopoly rent" if a council). If the business value were less than the replacement cost of the assets then the differential represents a subsidy (possibly "community service obligations", but equally possibly, simply losses through inefficiencies, poor choice of assets, or changes in demand).

Unexploited Potential

A large developer could offer more than the PV of the NET annuity stream if it saw possibilities for growth and development not yet exploited by the council. In this case the council would share in the assets 'potential'. The community would be well off if the council accepted the offer (given the rates freeze) and distributed the money back to ratepayers. (Although it might take the 'Wisdom of Solomon' to determine the basis of the distribution.)

Where there is undeveloped potential giving rise to greater value, it would be more appropriate to attribute the value differential to the business, rather than to the fixed assets component of the business.

2. Businesses and Non-Businesses

Some elements of council service provision, such as the provision of water services or electricity services, can be hived off into special business units. Australia did this many years ago with respect to both water and electricity and New Zealand are now in the process of developing LATEs (Local Authority Trading Enterprises) to run the 'business' part of council activities. At least one of these LATEs has now been sold and more are also likely to go this way. This is simply doing at the local government level what has been happening at the State and Federal levels of government. For these council businesses your comments on ROI apply.

Public goods/services

However many of the services provided by councils are "public good" type services where it is not possible to identify and isolate individual users and prevent them from receiving service if they do not pay. Provision of roads is a major example. Other services could, theoretically, be charged for but produce far lower community benefits if they are. Libraries and museums are major examples.

Some services may be provided on a 'user pays' basis, eg caravan parks. The new competitive neutrality laws are now causing councils to reassess the charges they levy and in the process 'implicit' subsidies are becoming explicit. If councils cannot subsidise activities then why not let the market provide them? This is increasingly the way that councils are turning.

As a result, we should be seeing, at all levels of government, a falling back to the provision of only public good type services. Services that can be managed commercially are increasingly being commercialised. Commercial rules are not applicable to the public good type services that remain.

3. Mainstream ideology needs a major shake up!

You are completely right in saying that the straight-line depreciation model has no relevance to the way that infrastructure assets depreciate in practice. The concept that O&M should match the depreciation schedule is a result of (a) councils not having good techniques for managing funding for the future (b) a not-so-irrational fear of "hollow logs" – given that past practice has often seen prudent reserves being used for quite imprudent purposes and (c) a less-than-clear – and communicable - idea of what reserves are needed in the future. At least the latter problem can be overcome by good quality asset planning and the use of condition based depreciation.

We still, however, face the problem that most councils find it difficult to provide for the future – and face even greater difficulties in keeping sticky fingers off any depreciation or replacement reserves.

Automated Hydraulic Modelling Reduces Time and Cost by 95%

Yarra Valley Water has won the Colliers Jardine Award for Innovation in Asset Management.

The judges were impressed by

- The pre-project investigations
- The value of the automated hydraulic modelling process to both the company and the industry
- The clarity of exposition and selective use of illustration

The entry was submitted by Matthew Hudson.
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What is Hydraulic Modelling?

Yarra Valley Water, as with most water utility companies, utilise hydraulic modelling for

- Accurate determination of the size of the pipes, tanks and pump stations that are necessary to ensure that there is sufficient hydraulic capacity for the customer;
- Detailed analysis of system hydraulic deficiencies to develop capital renewal/ augmentation programs;
- Identification of redundant assets to reduce maintenance costs; and
- Optimise the performance of hydraulic infrastructure such as pump stations to minimise power consumption and routine maintenance costs.

COLLIERS JARDINE

Award for **Innovation** in Asset Management

The Challenge

The traditional hydraulic model building process is both time and cost intensive and typically most utility companies focus on building models for growth areas where major capital works are required to service new developments or to assess system performance issues such as poor pressure and flows.

In recent years many applications of hydraulic modelling have been implemented as a result of improvements to hydraulic modelling software and demands on utilities to utilise smarter Asset Management practices to reduce operating costs and provide superior customer service.

Such applications include:

- Real time on-line system monitoring
- Pressure and flow enquiries
- Demand analysis
- Reticulation mains replacement
- Design of flushing flows for mains cleaning
- Unaccounted for water/leakage studies
- Risk Management/ operational shutoff impact studies
- Chlorine residual monitoring
- Age of water analysis

To undertake these functions the hydraulic models need to be detailed and include all attributes of the system but this is extremely time consuming and so less detailed planning models containing only the major distribution infrastructure, are frequently used.

In recent years many utilities have been developing 'middleware' systems to partially automate the model building process to reduce building time and cost. Most of these systems can successfully extract GIS data or generate customer demand data, however none were found to have full automation capability.

Solution: Automation of the Hydraulic Modelling Process

Yarra Valley Water's approach to automation is the Hydraulic Modelling Interface (HMI) design, an advanced application that extracts and compiles the data required for all components of the model building process. Managed through a simple front end web browser, building a model is as simple as a click of a mouse button.

HMI integrates with 4 main business systems, GIS, Customer Information, Asset Management and Telemetry, to create a hydraulic model, complete in every detail, containing all size pipes, system installations such as pumps and tanks, valves and customer demand allocations.

HMI was modularly designed to output hydraulic models in formats to suit two of the leading hydraulic modelling packages. The system is also capable of generating customer supply block plans to overlay on the company's GIS system to enable engineering planners to evaluate enquiries for new development proposals.

The HMI has two major benefits:

1. It has improved the quality compared with manual building methods. Common data input errors have been eliminated and the models are now detailed enough to enable them to be utilised for asset management functions such as assessment of reticulation mains renewal, leakage studies and pressure and flow enquiries.

2. It can build models in a fraction of the time previously taken. Models for critical growth zone areas (which previously required almost as much time to update as to build) can also be regularly updated with the press of a button. The time taken to construct a complete model compared with manual processes has been reduced from 5 weeks (to build the model to reticulation level) down to 4 hours. A saving of 95% in time and resource costs.

Alternatives Considered

Yarra Valley Water considered alternatives such as digitising GIS data, which would have slightly reduced model building time and cost but would still be a manual process and could not address one of the major components of the building phase, customer demand allocation.

It also considered outsourcing its model building. Competitive tendering was trailed with limited success. Some cost saving was achieved, however the consultant market was limited due to software costs and a limited market for model building in the Melbourne Metropolitan area. Tender prices for building detailed models were also too high and updating of growth zone models would still be a cost and time intensive process.

End result.

The company looked to see whether other water companies overseas had solved the automation problem. All UK companies spoken to agreed that automation was essential to their business and that they were currently working towards it but none had so far achieved a fully automated system.

With their HMI system, Yarra Valley has continued their innovative approach to technology that won them First Prize in 1996 and a total of seven Awards to date in the International Asset Management Competitions.

On the Move

I will be visiting the following cities in November. If you would like to have a chat about the asset management issues that are of importance to you and what others are doing about them, send me an email and we will see what can be arranged. **amqi@amqi.com**

- **Perth** November 10,11,12
- **Brisbane** November 15, 22
- **Sydney** November 23 24
- **Melbourne** November 25 26
- **Hobart** November 29, 30, December 1-3