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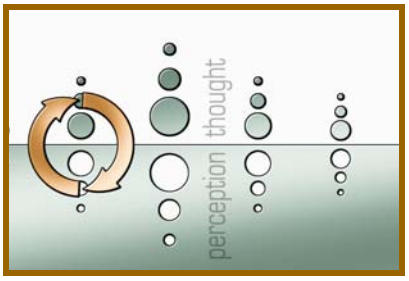
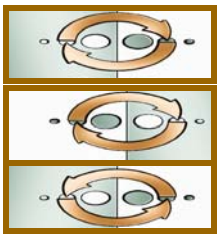
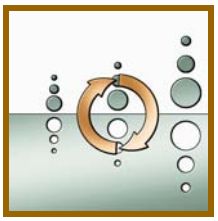


Engineers and Economists Think Differently



Accountants, Finance Specialists and Economists are not the same. pp155-156



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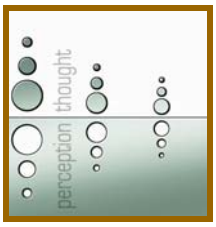

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A story: When she was 50 my father decided to teach my mother to drive – using my car! On her first time out she swerved to avoid another car and ran my car into a post. That was effectively the end of my car and her interest in driving. But later she confessed to me. "You know, dear, I reckon I would be alright at driving if it weren't for the other cars on the road!"

It is much the same with Asset Management. We can master our own specialty but the difficulty comes when we need to interact with others. And, of course, nothing is possible unless we do.

So in this issue, I tackle an essential element of successful asset management that you will not find in any of your asset management courses or manuals – getting on with other professionals.

On the premise that if you can understand what interests, drives or motivates someone, you have a better chance of productive interaction, I would like to share with you some thoughts on what is driving economists (and accountants and finance specialists) and how this differs from the way that engineers look at the world.

This is NOT a definitive treatise and individuals are individuals. But here are observations made from over 20 years of working with both.

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WHY COMMUNICATE?

Why is it important for Engineers and Economist to communicate with each other?

Key Idea

Understanding how other professionals think aids communication in the inter-disciplinary field of asset management

Three Reasons

1. To combine the joint understanding of both disciplines in the application of asset management. (two heads being better than one?)
2. To avoid getting in each other's way when the objectives are ones that both groups want
3. To reach an understanding when the groups are aiming at different objectives.

While Engineers are the dominant players in **discussion** of asset management, Economists have a lot of influence in what actually happens. For example

Economists staff the offices of the Regulator

- And can take a wider view of costs and benefits than may be taken by asset managers within a given organisation. Understanding how they see the world can help communication.

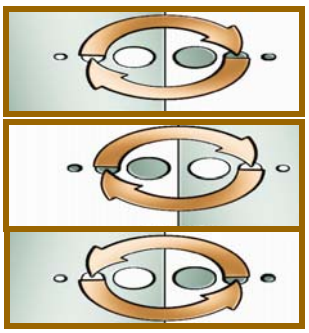
- And have a different idea of what is possible and desirable. For example, observing that you have improved your reliability by, say 0. 5 percentage points over the last review period, from 98.5 to 99.0; an economist could well ask that you now set your target at 99.5. Why don't they see that this could require millions in capital expenditure and yet provide only slight incremental customer benefits? (See Engineers and Economists Think Differently, Part 1)

Economists tend not to see differences between Infrastructure and Non-Infrastructure Assets

- And will happily suggest applying market price signals to both – (see Engineers and Economists Think Differently, Part 2.)

Economists determine our goals, targets and the environment in which we perform

- How they set these goals and targets depends on their world view. Understand it and you have the basis for discussion and the presentation of information that will influence them.



While they tend to get lumped together by those who are not in one of these professions, accountants, finance specialists and economists have very different interests and motivations.

(Role titles can be misleading; in my first job in the public service I, an economist, went by the title of 'policy analyst' whilst the position title of 'economist' was occupied by a person with a degree in accountancy! 'Chief Accountants' are quite often finance specialists. You are probably better off by observing interests and actions and not being too influenced by a role title. – And remember, these are general observations.

Key Ideas

Accountants
- **short term**
- **cash**
- **rules**
- **accountability**

Finance Specialists
- **longer term**
- **financial flows**
- **use models**
- **less accountability**

Economists
- **longer term**
- **all Costs & Benefits**
- **use models**
- **no accountability!**

Accountants

- Are required to produce annual budgets and balance sheets, and to be publicly accountable for the accuracy of the records that support both. Because of this they are inclined to want precision and to 'deal in facts'. This is what drove a lot of the support for historic cost accounting – receipts could prove the cost of something, whereas the 'value' was 'subjective'.
- They are audited on an annual basis, and budget estimates are constantly measured against actual expenditure. This drives a short-term focus.
- They are held accountable for the consistency of their practices with GAAP or 'Generally Accepted Accounting Practice'. This is why they are concerned first and foremost that they 'follow the rules'.

Accountants keep us 'on the straight and narrow'; they make sure that we manage the annual cash flow without which we do not survive into the longer term, thus accountants have an essential role to play.

Finance Specialists

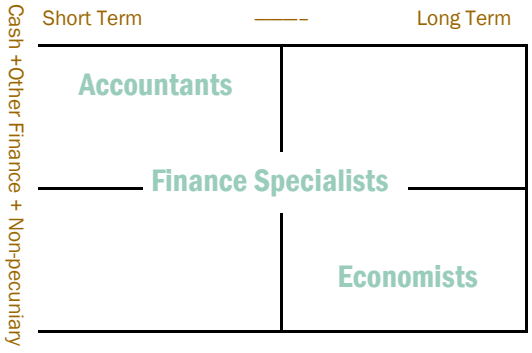
- Finance Specialists generally have a degree in accountancy or economics.
- Like accountants they have an interest in cash flows but they have a longer term focus – their job is to manage financial flows *over time*
- Finance Specialists are interested in investments, credit instruments, differential interest rates.
- Because they deal in longer-term futures, they use models (c.f. Accountants that like to deal in 'facts'). They often take a lot of pride in the complexity of these models. For a finance specialist, simplicity is generally not considered a virtue.
- Because of their longer-term interests, It is harder to hold finance specialists accountable and it is only when things go very wrong that they can be brought to book for misconduct (eg Enron, HIH)

In Asset Management, Finance Specialists are necessary to help manage a match between long-term asset consumption and the financing of that consumption.

Economists

- Have a wider remit than accountants and finance specialists – they are interested in cash AND *non-cash receipts and expenditures*
- They are interested in the full range of costs and benefits wherever they occur (ie not just to an organisation but also those costs and benefits that 'spill over' onto others – so-called 'externalities'.
- Like finance specialists they have a longer-term focus and make extensive use of models.
- When it comes to accountability, economists are in an even better position – *they can never be brought to book!* Their wider remit means that there are just too many variables to enable blame to be established. This is why economists 'projections' 'forecasts' and 'models' are invariably wrong, yet they continue in business!

On a typical 2 dimensional framing, we could say that:



In a similar way, one could probably make a useful distinction within the category of engineering and technicians.

Technicians generally have the shortest time focus (best expressed as 'get the job done and then move on') and are the most immediately accountable (either 'it works' or it doesn't!)

Asset centric engineers are those that put the needs of the asset first and foremost. They have a longer term focus than the technicians. They are measured not by whether the asset works or does not work, but rather in how effectively, and how long, it works – compared with some standard or norm and since the standard or norm is often, itself, in dispute, this reduces the possible overall accountability.

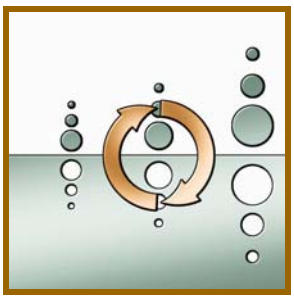
Those with the widest remit are the Outcome or Service focused engineers.

Where is the likely conflict or cooperation here?

Technicians and accountants probably have little interaction with each other except insofar as each may be required to provide data for the use of the other, which is perceived by both as a chore.

I suspect that most of the natural conflict between disciplines is between **asset centric engineers and the finance specialists**. These engineers need the support of the finance specialists to be allocated the budgets they require and the finance specialists feel a need to control the spending of the engineers to maintain their financial outcomes. Both commonly distrust the other.

However, It is not difficult for outcome focused engineers and economists to find common cause – they are both interested in the widest possible outcomes and are prepared to go back to first principles to come up with a solution.



An engineer, a chemist, and an economist are marooned on a desert island and starving. Up floats a can of baked beans and they consider how they can open the can. "I know!" declared the engineer, "by pelting the tin at sufficient velocity at that rock we should be able to knock off the top of the can." "Alternatively," suggested the chemist "by heating the top of the can to 450 degrees we could sufficiently weaken it to lever the top off." "But the problem is trivial!" exclaimed the economist "If we assume that we have a tin opener....".

Key Ideas

- **Engineers use assumptions *implicitly***

  Economists use assumptions *explicitly*

- **Engineers succeed when they *DO something***

  Economists succeed when they *stop something being done!*

- **Engineers look for *differences***

  Economists look for *similarities*

ASSUMPTIONS

An old joke, on which there are many variations. But it illustrates the first and crucial difference in the way that engineers and economists think. Engineers get their early training in practical solutions to real problems. They are 'grounded in reality' one might say. Economists, on the other hand, never deal with real problems, but rather with constructs or models that, well or badly, reflect 'the real world'. This requires attention to assumptions.

But do not be too quick to dismiss the Economists' use of assumptions. Engineers use them too! Whenever we have to deal with the longer-term future we are forced into using models or constructs and assumptions are critical to their development and to their relevance. The difference is that Economists are much more likely to use assumptions *explicitly*: that is to state them, write them down, question them, analyse them. Engineers use assumptions all the time but often do not recognize that they are doing it. They think of their assumptions as simply an expression of their understanding and professional expertise. So they are much less likely to write them down, question them or analyse them.

THE CAN-DO, CAN'T-DO DIVIDE

Me: Why are engineers always so cheerful?
Engineer: Well, at the end of the day we can see what we have achieved!

To an engineer success is achieving something. It doesn't have to mean 'building something' (although most of them, if honest, will say that this is best), it can also mean fixing something or changing something. I have always been impressed by engineers' ability to solve a problem. Ask them "Can you do this?" and seldom will they fail to come up with a solution that will achieve the stated objective. However, just as seldom are they likely to question whether the objective should be achieved at all!

Engineers are 'can-do' oriented.

As an economist, it was my task to analyse whether the objective was worth achieving – or rather worth achieving *in that way* or *at that cost*, since projects are seldom proposed that have no merit at all!

I would look at the costs and benefits (to the organisation and to society at large). If the project's projected benefits exceeded the likely costs, it would get the go-ahead. But as that is exactly what would have happened in the absence of my review, I can really only be said to have 'achieved anything' when I was able to show that the project was *not worth doing.*

So I guess you could say the difference here is between the Engineering 'can do' attitude and **the Economist 'can't do'.**

I moved from economics into asset management strategy because I tired of being continually negative. But it has to be recognized that the Economist's role here is very important if we are to achieve the best possible outcomes with limited resources.

SIMILARITIES-DIFFERENCES

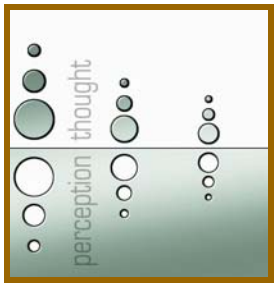
An article once appeared in the American Economic Review entitled "Can Economists do everything?" The article itself was applying economic principles to explain such diverse social phenomena as why people commit suicide or what influences your choice of marriage partner. What the author was instinctively doing is what economists do all the time – ***Economists look for similarities.***

Engineers – and this also applies to practical people of other disciplines – tend instead to look for differences. Consider, for example, the search for the cause of failure (eg root cause analysis or any of a number of engineering reliability maintenance techniques): the idea is to look for what is different for the piece of equipment that failed from those that didn't - ***Engineers look for differences.***

Both approaches are necessary. Solving problems requires attention to differences; modeling future beneficial outcomes benefits from taking a 'similarities approach'. Unless you are prepared to look for similarities, you end up with far too many variables to enable any practical future model. Consider this exchange between me, a neophyte to the water authority and he, a senior maintenance engineer.

Me: **How much does it cost to replace 1m. of water pipe?**
SME: **What size pipe?**
Me: **What have you got?** *(He showed me a list of 39 pipe diameters and the length of pipe the authority had in that dimension. Against each of them was the cost to purchase the pipe. There was a lot of difference in the cost between the larger and medium size pipes but little between the smaller diameter pipes.)*
Me (*noting the similarity of the smaller pipes and explicitly making an assumption that the differences were not material)* **: I would like the cost by that, that, that, and then** (*pointing to the group of about 36 smaller diameter pipes*) **these grouped all together.**
SME: **In the country or in the city?**
Neophyte me: **Does it matter?**
SME: '**Course it matters. In the city we have to dig up the road, reroute the traffic, deal with other buried utilities – in the country there is less, often the roads are not sealed, even.**
Me: **OK, I would like the costs separately by country and by city**
SME (with a grin): **Through rock or through sand?**
Me (returning the grin): **Before you get there do you know?**
SME: **Generally not, so we take an average.**
Me: **Right, then take an average!**

By focusing on similarities I was able to model the cost and timing of renewal of all of the assets of the water authority. Previously the great extent of the detailed differences had stopped this exercise dead in its tracks.



Key Ideas

- **Engineers deal with *discontinuity***

  Economists focus on *continuity*

- **Engineers see infrastructure assets as *intrinsically 'different '***

  Economists see them as *essentially 'the same'*

- **Engineers have a better handle on the *irreversibility of infrastructure decisions***

  Economists *struggle to include this in their models*

But Economists and Engineers share a common approach to problem solutions

Warning: These differences are more challenging!– proceed at your own risk!

DISCONTINUITY

Engineers deal with real things so that they are well aware of discontinuities: e.g. how an asset can gradually deteriorate over time but function perfectly ok and then eventually reach a point where it stops functioning altogether. There is not necessarily (in fact, probably hardly ever) a gradual decline in service outcome over the life of the asset. The skill of the engineering asset manager is to predict this discontinuity. Either to allow it to happen but to have processes in place that will quickly address the problem, or to monitor the condition so as to anticipate and prevent.

CONTINUITY

Economists deal with models and their major tool is the concept of the margin or increment, e.g. marginal (incremental) cost and marginal (incremental) benefit. As a result of this focus on marginal analysis, which is now, over many years, very well established, economists tend to think in terms of small, marginal, changes. But in asset management we often don't have this option. We are more likely to have to deal with step changes – small discontinuities. And we also frequently have to deal with large discontinuities and these are not easy to deal with in the economists' models.

The use of price signals

One of the effects of this emphasis on small, incremental, change is the belief in the effectiveness of price signals. In the economists' short-run marginal models, if demand goes up a little bit, it brings about an increase in price – and this in turn, brings about an increase in supply so that at the new price levels demand and supply are again equal.

But apply this analysis to water as a signal to increase dam capacity – as was seriously done by a number of university think tanks – and we end up with prices that reach astronomical levels as the capacity of the existing dam is reached – and then collapse once the new dam is built! Socially and politically the price fluctuations resulting from such price signals would be unacceptable – and the signaling itself would be very misleading for estimating returns from the new dam.

Non-incremental change

Marginal analysis is very useful for dealing with more or less use of a given quantity or portfolio of assets but it is less useful for deciding whether to acquire a new asset, dispose of an existing one, or make a radical change in the nature of an asset. All of these decisions are not questions of continuous but rather *discontinuous change*.

Where portfolios consist of many assets of a similar type – eg school buildings – marginal analysis can often be applied to portfolios. But where the portfolio consists of a few large assets, each quite unique – eg dams, then it doesn't work so well.

This is where engineers and economists need to get together to discuss the nature of the assets and the decisions being made. This discussion will be more fruitful if both sides realize the way that the other looks at the world – with the economist looking for similarities and the engineer looking for differences (see previous article).

INFRASTRUCTURE

Economists have come late to infrastructure. As with accountants and finance specialists they first developed the tools of their trades with private industry. In the 1980s there was much discussion about the nature of infrastructure and whether it should be treated the same as, or differently from, private sector assets.

Engineers generally argued for them being different. But economists, being more naturally inclined to see similarities rather than differences ended up with the position that 'an asset is an asset is an asset'. A lot of the problems that we now face could well be the result of infrastructure assets that are 'one-offs' being treated as if they were the same as industry assets where it does little damage to apply averaging principles based on the law of large numbers. And where infrastructure assets that have indefinite asset lives being forced, for purposes of depreciation, into the mould of assets with finite lives.

One of the major issues that I do not think we yet have a satisfactory resolution to is:

REVERSIBILITY

When you are dealing with abstract notions and concepts in a model, moving back and forward in time is equally easy. In marginal cost models for example, one can increase the supply (a little) and observe the price result. If it is not satisfactory then one can reduce the supply and put the system back as it was.

Life is not like that for infrastructure assets. One of the reasons that Infrastructure asset management is so challenging is that decisions are usually not reversible – or reversible only a great cost. Damming a river to create a dam, for example, destroys habitats for both man and beast and generally they cannot be put back again. This is a dramatic example. But changing the alignment of a road may have similar impacts on residents, local businesses, and the environment. Irreversibility is an important issue. I don't think that either economists OR engineers can have the final word on this.

ECONOMISTS AND ENGINEERS SHARE ONE VERY IMPORTANT WORLD VIEW

I once said to a very clever New Zealand Accountant (who had single handedly introduced accrual accounting to the country is about 18 months!) that I spent half my time talking with accountants and half with engineers and that I found it much easier to talk with engineers. "Why was that?" I wondered.

"That's easy!" he replied. "When you have a problem you go back to first principles, don't you?" " Of course!" I replied.
"So do engineers!" He then added wryly—
"But accountants ask 'what's the rule'"?

This ability to shape a model from first principles in order to achieve a desired solution is something that economist and engineers have in common. Economists and Engineers can build on this!