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## Prioritising Projects using Willingness to Pay

There is never enough funding to provide all the beneficial services that we can think of, so how do we choose between them? Assessing the benefits against the costs is a good way to start, but when we look at benefits we need to remember that it is the users perception of benefits that counts - not ours.

In this issue Anna Robak reports on an investigation she undertook in New Zealand in 2011 for her PhD to assist local councils there to determine which of the many water upgrading projects that they could consider were valued by their communities. With over 2000 usable responses, and carefully prepared survey questions, this project has much to say to all of us who seek to know what it is that our communities want - and are prepared to pay for.

The results may surprise you and cause you to look again at the nature of the services you intend to provide.

However, obtaining 2000 usable responses and having the services of a PhD quality researcher to analyse them may be beyond most of our capabilities. In past issues, we have looked at other ways of assessing willingness to pay and we review these different approaches here. You can access the original articles in the Archives - and then take the best ideas from all to assist in your decision-making.

Finally, for something different, how is asset management viewed in your organisation? Perhaps the ideas of Dominique Lorrain in "The Cucumber and the Cell Phone" might help?

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## Choosing between Investment Options

(with reference to water supply improvement projects, and using systems thinking and economic analysis)

by Anna Robak

**Ed:** *Some issues ago, I queried whether anyone could identify academic research in asset management that had had practical applications for them. A number of academic researchers told me how they had used their own research in later practical applications, but no-one identified academic research by someone else that had been of benefit. Well, here is a good example of academic research that could be of benefit to many practical asset managers trying to determine which projects to undertake in a constrained financial environment. The techniques are not limited to water projects.*

**Anna Robak**, an engineer working as a consultant to local government, recognised that there was a need to provide assistance to councils in New Zealand who faced many more proposals for improving water supply than they could ever fund. How were they to choose between them? Her PhD thesis set out to identify and apply a monetary value to the many different impacts of potable water supply infrastructure investments in New Zealand using stated and revealed preferences.

Chief among her discoveries were that

1. **“Willingness to pay” - doesn’t mean willingness to pay YOU!**
2. **‘Near enough’ is not always ‘good enough’**

Here is Anna’s story of what she did and what she discovered. These are techniques that can be used in your own community.

### What was done

I wanted to identify and apply monetary values to the many impacts of potable water supply system investments in order to help water suppliers set economic service levels and make investment decisions based on a robust, transparent and defensible process – and in particular, to base this process on sound economic principles.

To determine which impacts to monetise, I used a systems thinking approach – a cause-effect map that traces investments from their drivers through to their wider

economic impacts. This approach helps decision makers to identify cost-sharing and cost reducing opportunities and take a broader view of investment opportunities by (1) understanding the multiple ways of achieving the same impact, (2) identifying upstream issues driving investment requirements, and (3) identifying downstream issues caused by the investment.

I used stated preference (willingness to pay) and revealed preference (actual household-level behaviours and expenditures) techniques to monetise the impacts of potable water supply system investments and performance.

In addition to the interviews and surveys I conducted with water industry authorities and other stakeholders in 2011, I also conducted a New Zealand-wide survey covering a good cross-section of potable water supply consumers. This survey sought information about people's household expenditures and behaviours related to their water supply, their willingness to pay for improved levels of service (and willingness to accept compensation for reduced levels of service). These 'service levels' included social, environmental, cultural, and economic performance attributes (e.g., impact on freshwater quality for bathing and fishing, risk of illness, water rates).

### What the research showed

The research showed that ***for the most part, consumers are not willing to pay more in water rates for improved service levels.***

However, ***they are willing to pay for improved service levels by investing in household equipment such as filters or behaviours such as boiling water.***

Furthermore, ***consumers are willing to accept compensation for reduced service levels*** – presumably, they would then protect against these reduced service levels by undertaking household-level behaviours.

These findings show that care is required when consulting members of the public over preferred service levels. ***Although consumers may indicate a preference for a high level of service, they may prefer to manage some performance aspects within their households.***

Importantly, there is one exception to these findings:

***Consumers are willing to pay more in water rates to have potable water that is compliant with the New Zealand Drinking Water Standards.*** (But not for improvements to water quality that do not meet these standards!) These findings show that to best serve consumers, water suppliers' focus should remain on least cost service delivery, contingent on a good water quality.

However, that does not mean focusing solely on water treatment plant upgrades; international research has found statistically significant links between water pressure, pipe network maintenance, and risk of illness. This link between system failures and illness implies that, while consumers may not be willing to pay higher water rates for less frequent service interruptions or pressure management initiatives, they are willing to pay to protect against the resulting risk of illness. When considering these types of investments, it is therefore important to account for the resulting risk of illness.

Based on this research, some aspects of potable water performance, such as those relating to environmental resource consent compliance, cannot be reliably established based on choice experiment studies. Instead, these should be based on the downstream costs imposed on other water and land users – through the costs of higher levels of treatment, alternative (cleaner) water sources, and other averting behaviours or reduced profits. In the next few weeks, I will provide guidance on the types of monetisation methods that are most suitable to different types of service levels and investment types. This will help you to establish service level targets – and to make decisions on larger projects – based on robust, defensible and transparent economic principles.

This research was the first of its kind in New Zealand – the first choice experiment based on a large number of impacts (performance attributes) of potable water supply systems – and the first to estimate households' expenditures protecting against undesirable service levels. Nearly half (46%) of New Zealand households connected to town supply have equipment or undertake behaviour in their homes to improve their tap water, collectively spending an estimated \$173m nation-wide. The average household spends \$137 per year (amortised at 8% p.a.) on top of water rates (average amortised value of \$407), with the most important reasons (by dollar value) as follows:

- \$46 to improve the taste, smell and appearance of tap water,
- \$16 to protect against chemicals,
- \$13 to protect against waterborne microbes,
- \$13 to irrigate, and for garden and stock watering,
- \$5 to conserve water and/or electricity, and
- \$5 to reduce the impact of water restrictions.

Anna is a Senior Asset Manager at Opus International Consultants based in Auckland. Anna's asset management experience has included performance modelling, valuations, renewals programmes, and risk analysis across water and transportation assets. This mix of hands-on engineering experience and economic analytical ability has given Anna a unique perspective on investment drivers, stakeholder demands and opportunities for cost sharing. She advises local and central government on choosing metrics for public investment decisions. Anna is particularly interested in 'soft' solutions to delivering public services and accounting for the wider costs and benefits of proposed investments.

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A major investigation, such as that conducted by Anna in the preceding article, is critical when the issues are very large, expensive, or involve many organisations. But there are ways to approximate these results for smaller issues and Peter Buckland suggests one here. You can find more details in the original substantial article which was published in SAM 204, November 10 2006, and now available in the Archives.

## REVIEW

### HOW MUCH WOULD YOU PAY TO AVOID A SEWER SPILL **HERE?**

When it comes to managing risk, Peter Buckland argues that it is not only possible, but essential, to quantify ALL risks. What is more, he shows how, by choosing wisely from within your own organisation (i.e. NOT just the asset management team) , you can create a representative sample of the community and get a good view of community values.



*Here is Peter Buckland's suggestion for:*

### **Calculating 'Willingness to Pay' without extensive community consultation**

1. **Assemble a socially representative group.** This can easily be from within your own organisation but choose people according to the social, ethnic, interests mix of your society— .i.e. not only asset managers but accounting, catering, cleaning, managerial staff. A refinement may be to use community focus groups
2. **Present the group with clearly defined scenarios** so that they all relate fully to the situation they are paying to avoid. What assumptions should you make?
  - (a) costs should include financial loss to society, outrage, disruption, environmental damage
  - (b) if you assume it is a first time event then there is no cumulative outrage (on the other hand, if you are considering mitigating a sewer spill or water outage and there has already been a series of these in recent memory, you will need to deal with this.)

(c) in your scenarios assume typical events —with ‘most likely’ consequences rather than the most extreme conceivable consequences.

3. **First, estimate the \$ consequences in a broad order of magnitude** until the group is comfortable that this is within the right ballpark. Eg, sewage spill to the local swimming spot rendering it unusable for two days – between \$10,000 and \$100,000.

4. **Now, narrow down from the order of magnitude if possible.**

*Having done this you now have the information you need to complete Peter's risk cost templates - find them in SAM 204*

**REVIEW**

## **RISK, PRIORITISATION & PORTFOLIO PLANNING**

When using risk to prioritise projects, Ype Wijnia and Joost Warners remind us that it pays to take a portfolio approach, as the decisions you make on a ‘one-off’ basis can be very different to those that you would take for the whole portfolio. We published a series of articles by Ype and Joost back in 2006 (SAM Issues 182 - 184) on this issue of portfolio planning. The examples are drawn from the electricity industry.

### **‘One-off’ v. Portfolio Decision Making.**

‘Traditionally, decision making is essentially case by case. For this type of decision making policies are needed to evaluate the proposals as the influence of a single proposal on the network performance is very small. But if one looks at the effect of all proposals combined, the effect might be quite significant. For example, the loss of redundancy in a transmission circuit might increase the frequency of outages from virtually zero to once every 10 years, with a duration of 8 hours.

The effect of a single case on the network performance is negligible, but if all transmission circuits lost redundancy the average extra outage time per customer per year would be almost an hour! *No policy is needed to see that this is not very acceptable.*’

Making asset decisions based on portfolios is, of course, strategic asset management, and brings in the role of governance. Ype and Joost make a useful distinction between Risk Management and Risk Governance.

### **Risk Management and Risk Governance**

We asset managers like to think of policy making as problem solving. Somewhere in the network is a problem, we call a smart engineer, she designs the problem out of the system and this design is promoted to a policy to prevent the problem from reoccurring. However, in reality it does not work that way. Finally, sometimes we just

have a new design and are looking for a place in the network where it could work, or more directly, we are looking for a problem that fits the solution.

On one level, we have to determine how much we are willing to spend to solve a problem, or to determine if the problem solved is worth more or less than the new problems the solution creates. On a second level, we have to determine what the best solution is for a problem, given constraints as a budget , et cetera.

Those two levels of decision making are presented in the scheme below as interactions between systems. The bottom cycle represents the interaction between the technical system (the network) and the decision makers (asset managers) and is about valuing opportunities to improve the performance of the technical system. In our language this is risk management. The top cycle is the interaction between the institutional environment (for example, the stakeholders and regulators) and the decision makers. (we call it Risk Governance) is about valuing problems. In this cycle the business values are set and weighted, risk tolerance matrices are defined and the total budget is determined. As the risks of electricity networks typically do not only affect the company itself in this cycle the interest of other stakeholders are taken into account. To distinguish it from risk management we call this risk governance.

As you would expect, risk governance influences risk management by determining what should be seen as an opportunity. But risk management also influences risk governance. If for some intolerable risk no feasible solution exists, the risk will eventually be accepted. On the other hand, sometimes a risk becomes intolerable just because a feasible solution exists.

Those two levels of decision making are presented in the scheme below as interactions is interesting to look at this double-loop decision making system from a change perspective.



The system with the highest inertia is the technical system. We have seen the assets have a very long life cycle, but the technology (e.g. 50 Hz alternating current) has an even longer life cycle. In contrast, the institutional environment can change very fast, as we have witnessed in the case of liberalisation, or more recently, in the reactions to the threat of terrorism. Asset management is somewhere in between. It is easier to replace the asset management department than to replace the

network, but even with the most sophisticated knowledge management systems an asset manager takes some time to reach maturity.

*If you find this interesting, you can find the original series of articles in Issues 182- 184 in the Archives.*

These thoughts were penned by Dominique Lorrain, CNRS, Latts/Ecole des Ponts, France, a couple of years ago for a water advisory committee to which I belong, but they are also relevant to the management of assets generally, has only increased. Dominique has kindly allowed me to share his thoughts with you. As you read it, ask yourself, "What are we in asset management, cucumber or cell phone?"

## **THE CUCUMBER AND THE CELL PHONE (Some thoughts on some of the problems facing the water industry today)**

In May 2011, a deadly E.coli outbreak struck northern Germany. In search of an explanation, the German health authorities identified imported cucumbers as the likely cause of the outbreak. This was incorrect as it turned out, but the true causes were established only later. In the meantime, sales of cucumbers plummeted in Europe (falling by 70% on the Paris wholesale market, for example) and remained in decline for



several weeks. The factors behind the collapse: not the recommendations of an official agency but concerns about food safety on the part of individual consumers. Since the events occurred during the peak season for cucumbers, the consequences for producers - and Spanish cucumber growers in particular - were dramatic.

At the same time that the cucumber rumour began to circulate in Europe, a global public health agency published a damning report on the potential health consequences of the cell phone. The research had been conducted to provide answers to lingering questions about the potential risks from exposure to certain frequencies. The findings were clear. If a human being is heavily exposed to electromagnetic radiation of a certain frequency from their cell phone (frequencies vary according to handsets), there is a risk of damage to the brain's nerve cells which can potentially cause cancer. The report was quite balanced in its explanations, the gist of its recommendations being "be careful, in particular when it comes to young people". So how have the findings impacted cell phone sales? Not at all, it seems. No word from the telecom industry - a market that lays claim to five billion mobile phone users - to suggest that customers have responded to this possible threat by reducing their cell phone usage.



The cucumber versus cell phone story is an example of how people can be hypersensitive about some issues and utterly tolerant about others. This has profound consequences for the industries concerned. So what category does the water industry fall into: cucumber or telecom?

**Product and service life cycle and maturity** Vernon's product life cycle is a theory with which we are well familiar: birth, growth, maturity, decline and re-birth. Birth is characterised by invention, a boom in new technologies and a flurry of new solutions. Businesses are engaged in fierce competition, it is not yet possible to achieve economies of scale and the system is sub-optimal. Out of this Darwinian selection process and with the support of regulation by the state, standards emerge and some companies thrive. During the growth stage "everything is positive". New technologies settle in enabling mass production, and the growth in demand leads to a decrease in unit costs so that prices go down and operating profits go up. This process can last several decades but a time will come when the growth mechanism reaches its limits. The biggest challenge for an industry is to manage the transition period, i.e. from maturity to re-birth. This is the point in the cycle that the water industry has now reached.

Let us take a look at some of the characteristics of mature markets. Globally there are fewer innovations. And of those that have been developed, most are embedded in the production process and are not visible to the end user. Further, innovations can apply either to products or services. In the first case they are much more visible. In the water industry, a large proportion of the improvements made are related to the service. But there is a big difference between actual practices and how those practices are perceived. In a society where consumption is driven by a perpetual quest for new products, "stable" in respect of an industry equates with "boring" and lacking in innovation. This has practical consequences when it comes to consumer behaviour: no desire, no appetite and consequently an unwillingness to pay.

Because the changes are relatively small, the activity is seen as something that "anyone" can do. When something is new – witness electricity at the end of the nineteenth century or dot-com and the micro-computer in the nineteen eighties – people tend to accept it as being strictly the preserve of industry. No-one claims to be able to do the job in the place of the entrepreneur. Within a broad framework defining the roles of the different actors, the role of the state (or local authority) is to regulate the industry (if necessary), not to take its place. When an industry reaches maturity and is considered as a fairly straightforward activity, the number of potential actors grows.

**In a world driven by a new economy of speed and desire, there are continual pressures on politicians (as the decision makers) to deliver something new.** Such are the workings of democracy. For decades, public policy making was guided by the popular Keynesian doctrine that "government spending is good for the economy". Politicians have consistently campaigned on the promise of a better world, gain without pain and a better life for all. Put another way: everyone wants to be Santa Claus, no-one wants to risk being perceived as the Grinch. So what happens at the end of a cycle? Even if the money isn't there, most politicians continue to campaign in the same way; they have to show that they are capable of bringing change.

The City of Paris is a case in point. After a 2008 election campaign devoid of any real debate about the water question, the newly re-elected municipal council took the decision to "municipalize" the sector. Prior to that, water production had been handled by a semi-

public undertaking, while distribution had been contracted out to France's two major water companies. Between them the companies had improved the performance of the system (reduction of non-revenue water) as well as the service to users, while keeping prices low. From a purely business perspective, there was therefore little justification for the decision to put the sector back into wholly public hands. Had the operators behaved improperly? No. Would the new, integrated system be more efficient? Maybe. Would it be more efficient if run by a municipal company rather than by the incumbent private firms? None of the offerings would suggest so. Would the new arrangements result in lower water rates? No, since the price is largely determined by fixed costs. And if the answer were yes, the impact would be purely symbolic: a five percent reduction in the average household water bill of €300 would amount to €15 per year which is totally cosmetic in comparison to other parts of the household budget like housing and transportation. Is it a good decision in terms of industrial policy? No, since it has blurred the message sent out to the international market. So where are the gains to be had? Mostly in politics. The decision helped broker an agreement between the incumbent Socialist mayor and the Green movement, facilitating the mayor's reelection. And it is congruent with a basic principle which makes sense for part of the left-leaning electorate: public goods should be operated by public companies. In fact, there are many exceptions to this rule: public goods managed by private firms who respect the public service principle and, at the other end of the spectrum, nationalised companies which behave like private firms (as exemplified by the pricing policies adopted in the rail industry and the introduction of yield management).

In short, the water sector in Paris shifted to public hands for purely symbolic reasons and because water services are perceived as easy to deliver. At the same time, the city was facing a serious transportation problem. One option was to expand the use of the bicycle in the city and further down the road to organise carpooling. Both were an innovative departure from existing practices and their implementation required new products to be developed, new rules and pricing systems to be determined, and so on. Faced with these challenges, the municipal government in this case decided to pass the problem on to the private sector. In fact, the companies had no choice in the matter. The bike hire system (Vélib) was introduced as an off-shoot of a contract for control over city-owned advertising space that had come up for renegotiation. The incumbent company (a French company and one of the world leaders in the sector) was obliged to accept the deal, failing which they risked seeing their main rival, an American corporation, put its own flag on the Eiffel tower.

These two cases, which occurred in the same city at the same period of time, demonstrate that the same government can make totally polarised decisions regarding the private sector. In the one case they restrict, in the other they enter de facto into a partnership in order to develop a new market. These choices had nothing to do with either the performances or the behaviour of the companies in question. In the first case there was never any improper behaviour by the companies concerned, in the second case the company was just doing business as usual.

**In seeking an explanation**, our attention should be directed at three different forces:

**Emotions** (the cucumber and cell phone dichotomy),

**The maturity of the sector** (the perception of it being easy),

**Political need** to demonstrate that they are bringing something new.