

# Humans make decisions – and need help!

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## Abstract

Decision-making is not just a technical process, modelling and data issue. This paper discusses the human factors that are so essential to make asset management decisions credible and effective.

## 1 INTRODUCTION

As good asset management becomes an expected core competency of organisations, so too is the need to make good decisions about what is worth doing, when and why - and to be seen to make such decisions correctly. Indeed ISO55001 explicitly requires us to define, document and to consistently apply decision-making criteria, and PAS55 includes guidance on the suitable criteria for delivery of optimal whole life cycle value.

Unfortunately, however, while the human species is astoundingly good at pattern-recognition, making rapid judgements and innovating, we are generally poor and inconsistent in certain types of asset management decision-making. There are a number of good reasons for this, and things we can do about them. This paper discusses the problems and shares some of the findings of the SALVO project in providing decision-support for human beings.

## 2 NATURE OF DECISION-MAKING

Decisions vary in *criticality* from the trivial (“Shall I have a cup of tea or coffee?”) to the scary (“The high pressure warning light is on but we are tight on delivery deadlines, the boss is not here; what should I do?”). However there are also different levels of *complexity* in navigating the options and determining the right choice.

The simpler cases are represented by ‘digital’ choices: when faced with discrete options such as yes/no, A or B, left or right, in which we generally make a



comparative judgement against a particular merit or ‘decision criterion’ relating to some underlying objective. Clearly the success and confidence of our choice is closely related to the quality of information available, but the comparison between the options is a simple ‘either/or’. And, strangely enough, the more difficult it is to judge which way to go, the less it often matters (the difficulty of choice can mean that the merits, costs and risks cannot be too far apart!).

Even if there are multiple options available, provided they can all be converted into a common scale of merit, then the best option can be selected. However, as the number of choices increases, it becomes more and more difficult to assess them consistently. The benefits will take different forms, the information quality will be more varied, and there will be more stakeholders involved with competing interests. A single decision-maker is unlikely to have the breadth and depth of knowledge to consider each option with the same rigour and confidence. Subjective bias and distorted weightings creep in.

The situation becomes a lot worse when the decision involves a continuous spectrum of options. For example, the interval for planned maintenance, the level of inventory to hold, or the timing of an asset replacement. In such cases, the decision involves finding an *optimal compromise* between competing factors. Again we need decision criteria (what we mean by ‘optimal’), but the process of selecting the right point is much harder. And in these circumstances, the human brain is particularly vulnerable to distorted interpretation of the factors involved and how they change in relation to each other.

It is hard enough estimating the level of risk associated with a particular option, but when the risk *is changing with time*, we are very bad at correctly inferring the significance of delay or compound effects. Studies have shown <sup>1</sup> that, based solely on ‘engineering judgement’, only about 20% of inspection intervals and even fewer asset replacement timings are even close to their true optimum. This is serious and it is also a hidden vulnerability in most organisations, since the

<sup>1</sup> European MACRO project EU1488

costs, risks and performance impacts usually fall to different budgets and departmental responsibilities.

There are a number of reasons for these



decision difficulties, some of which are human factors, and others more technical. Fortunately however, there are also some sensible ways to reduce the errors, and these yield very significant cost, risk, asset performance and sustainability benefits to any business.

### 3 NATURE OF HUMANS

Asset managers need to understand not just the physical assets for which they are responsible, but also the human assets with whom they must work. Indeed, the more experience we get in *physical* asset management, the more we generally realise that *managing people right* is the key to getting the right things done, for the right reason, in the right way. So, despite our poor history of educating technical people into such people-dependent roles, a bit of insight into human behaviour is extremely valuable, especially when it comes to asset management decision-making.

#### 3.1 LEAPING TO CONCLUSIONS

The first observation is that the human brain is particularly evolved for pattern-recognition & inference from partial knowledge. As a species, humans are outstanding at deriving rules or implications from experience, and applying these to new situations with a reasonable chance of making the right choices, even if the specific circumstances have never been encountered before. In this way we recognise potential dangers, sense the body language of others, and drive a car with increasing confidence. Harnessing this ability in asset management is invaluable, as personal (and collective organisational) experience is a key resource for coping with the volatile world of surprises and continual improvement. In the specific cases of decision-making, however, there is good news and bad news associated with this ability:

a) If we understand how to capture and use it correctly, the ‘tacit knowledge’ that builds with experience, can contribute very successfully to the evaluation of new situations or options.

b) However this can also build into problems of *over-familiarity* and seeing patterns even when none exist. This is an effect caused by the presumption that our own personal experience is comprehensive enough to make all such judgements, and that the solution we chose last time must be the right one again (because at least it is a known entity). This has a distorting effect upon our ‘knowledge’, creating a bias in favour of previous experiences and conclusions. As we grow older, this tendency towards preconceived answers (and unwillingness to accept alternative viewpoints) increases, alongside the increased volume of experience upon which it is based. So, to ensure that we can draw upon the very valuable insight and experience without the associated ‘leaping to conclusions’, asset management decision-making needs to split the process of *acquiring the facts* (what is happening) from the processes of *identifying and evaluating potential solutions* (what to do about it, and when). Humans are good at the former, but unreliable and inconsistent at the latter.

#### 3.2 SOCIAL ANIMALS

The next human feature that we need to acknowledge is our social nature. With some rare exceptions, most people want to be liked by those around them, and this drives a lot of behaviours and decision-making. Fear of conflict at one extreme, and actively seeking approval at the other – the effect on decision-making is that there can be strong peer pressures to conform, sometimes suppressing the innovation and diversity advantages of cross-disciplinary teamwork. It takes an insightful leader to deliberately encourage (constructive) challenge, in which lies much of the scope for radical improvement. And in asset management decision-making, it is often the naturally quiet members of the team who are most worth listening to.

As most, if not all, asset management decisions are multi-disciplinary, these factors are critical both to getting the best outcome, and to achieving consensus or acceptance of the conclusion. There have been, of course, many psychometric and organisational psychology studies<sup>2</sup> over the years looking at effective team behaviours, and the role of personalities, communication and leadership. Yet few organisations really exploit this knowledge when developing asset management teams, or specific task-force groups to develop strategies or plans.

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<sup>2</sup> Belbin, Myers-Briggs and others

### 3.3 LEFT-BRAIN OR RIGHT-BRAIN

The next human factor on the menu is the difference between analytical/technical enthusiasts and artistic/creative communicator types. Many professionals in industrial management roles come up through a fairly technical career path. They reach professional leadership roles or managerial levels of responsibility and have more significant decisions to make. They love facts and hard data, models and problem-solving. And this is good, sound ‘left-brain’ stuff, upon which decisions can be made *if such data is available*. Unfortunately, most decisions require at least some assumptions and include uncertainties, conflicting personal opinions and the need to obtain tacit knowledge from subject matter experts. The decisions are also useless if the conclusions cannot be effectively communicated (‘sold’) to various parties. And this needs to achieve emotional as well as intellectual acceptance, understanding and belief before it has much of a chance of being converted into the necessary commitment and actions. This is ‘right-brain’ work, so technical people can find such ‘people issues’ difficult to handle.

### 3.4 THE BOSS KNOWS BEST

This is not always true, of course, yet it is a common excuse for avoiding personal responsibilities in decision-making. It comes either from a genuine lack of self-confidence (e.g. limited experience) or from fear (of being held accountable for the decision outcomes or, perhaps, fear of the boss). Either way, the idea that a more senior person will have greater insight into the problem and be able to make a better decision is a vulnerable one. Whereas the boss might have greater *context* awareness, particularly about the organisation’s priorities or the implications of different options, he or she is likely to be more distanced from the specific issue and nature of the problem to be solved.



The boss (if also older and more experienced) is also more vulnerable to the ‘pattern’ behaviours described earlier, which can cause presumptive conclusions without really listening to the unique or new aspects of the situation being addressed.

### 3.5 HARD CASH VERSUS RISKS AND INTANGIBLES

Decision-making authority within organisations tends to be very inconsistent and illogical. Operational decisions that have multi-million ££ and big risk implications can be made by shift operators, yet minor expenses such as a taxi journey, might need a senior director’s approval. Costs that involve cash outlay are treated quite differently to the notionally equivalent values of risk, performance opportunities or other indirect business impact.

So a proposal that makes a £1000 hard cash saving gets easier support than one which will make a 10% reduction in likelihood of £10,000 event. And this distinction persists even if we take the probabilistic or uncertain nature of the risk reduction into account. Our budgeting systems, accounts systems and regulatory frameworks further reinforce this distorted view, focussing disproportionately on the easiest-to-measure short-term evidence of cash flows compared to the £-for-£ equivalence of risk exposures, long term sustainability or ‘lost opportunity’ costs. This therefore also represents a systemic credibility problem in making good asset management decisions, since they often involve trade-offs between planned expenditures and such indirect, probabilistic or downstream/future impacts.

### 3.6 CENTRALISED VERSUS LOCAL DECISION-MAKING

A similar irrationality occurs in organisational initiatives to centralise or de-centralise decision-making. There is a cyclic nature of such behaviours (various studies have shown 4-year, 11-year and other cycles, in the same way as outsourcing/insourcing initiatives), and organisations tend to ‘overshoot’ in one direction, then move back in the other and overshoot again. This constantly churns and disrupts the clarity of who is in the best position, and who is responsible for, making what decision. For example, within many utilities and transport networks the advent of PAS 55 has triggered, or been coincident with, the realisation that long term strategies need to be developed and, to do this properly, a total network view and cross-disciplinary approach is needed. So Asset Management Directorates have been established for this purpose (risking, incidentally, the incorrect implication that other bits of the organisation are therefore *not* part of asset management!). Strategy-setting & planning has become much more centralised in such organisations, achieving standardisation and efficiency, but often at the expense of worthwhile regional variations, local decision agility, workforce ‘ownership’ and commitment. Very few organisations

manage to find the right mix of delegated local decision-making freedoms with corporate consistencies, economies of scale and central leadership.

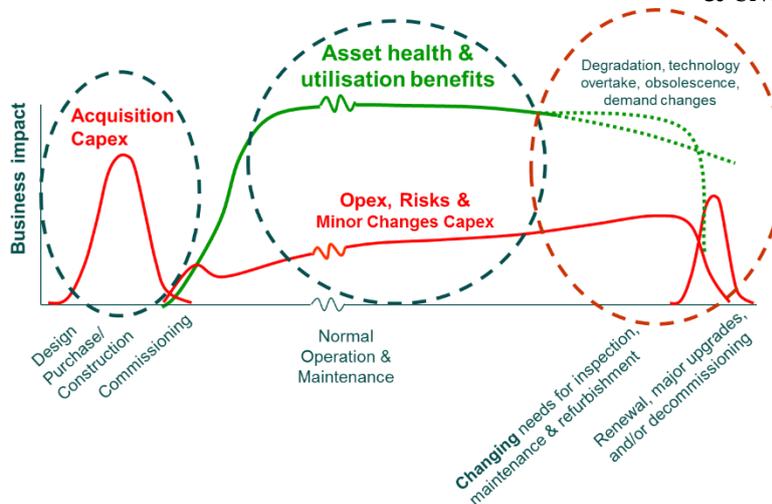
### 3.7 DECISION AVOIDANCE

Lastly we should recognise the human ability to avoid or delay making a decision. In some circumstances this can reach the point where almost anything is considered preferable to committing to a decision and being held accountable for it. The underlying psychology in such cases is usually a mix of low self-confidence, fear of error and/or wishful thinking that, if a decision is delayed long enough, the problem might simply go away. A variety of decision avoidance strategies are also used: the “head-in-the-sand” approach simply ignores evidence of a problem in the first place, the “I’m busy” strategy works through continual displacement by ‘more important’ issues, and the “consensus building” method hides behind collective responsibilities, endless discussion meetings and a strangulating bureaucracy that requires signatures of all possible stakeholders.

Unfortunately, in the case of asset management decisions, issues rarely go away of their own accord. Indeed, if the decisions relate to asset interventions, the risks and costs will usually be getting worse while a decision is not being made. Asset management performance would be significantly improved if the consequences of procrastination were a) quantified and b) visible as the price of decision deferment.

## 4 MAKING DECISIONS ABOUT ASSETS

If we now look at what sorts of decisions need to be made in asset management, the tricky ones are generally about *what* should be done, and *when*. The



by *who* and *how* aspects are generally less of a problem, albeit with some notable exceptions in competency, quality and contractor management.

And asset intervention decisions vary during the asset’s life cycle: decisions in the design phase are whole life cycle-critical, often made with a strong focus on short term (capital investment) costs, and with particularly vulnerable/uncertain assumptions about future demand and asset behaviours. Decisions *during* asset life have at least some asset performance knowledge to work with, but tend to focus on the tension between operations (asset exploitation) and maintenance (asset care) to yield, simultaneously, high performance, low risk, low cost and ongoing sustainability. And aging assets represent a third context, in which steady-state optimization is no longer viable, so Capex options (refurbishment, renewal, decommissioning) need to be considered once more.

These have been explored, and individually mapped into clear ‘storyboards’ but the international, cross-industry SALVO Project<sup>3</sup>. This collaboration has, over the last 3 years, addressed the combination of structured thinking (including the ‘people factors’) with the technical (data & modelling) challenges associated with resolving over 40 different asset management decisions, ranging from “*how often should I inspect?*” to “*what is the optimal time to replace?*” and “*how should competing activities be optimally bundled into constrained downtime opportunities or limited budgets?*”. The results are an interesting mix of process disciplines, data requirements checklists, advanced ‘what if?’ calculator tools and human psychology. Some key findings of the SALVO project include:

### 4.1 QUANTIFICATION: DATA, KNOWLEDGE & UNCERTAINTY

Many people think that more and better data = more and better decision making. Indeed the ‘Big Data’ message is strong, and vast sums are being spent on data collection, asset information systems and analytics. But how much of it is actually being used effectively? How do we avoid data swamping? What is the confidence that a) we are collecting the *right* information and b) understand how to use it correctly? And how much of the necessary information could have been obtained just by asking the right person the

<sup>3</sup> See [www.SALVOproject.org](http://www.SALVOproject.org)

right question? Hard data also only relates to the past and the present; is a shaky basis for extrapolating into the future. Relying solely on observable experiences is like trying to drive down the motorway looking only at the rear view mirror and dashboard instruments.

When gathering the necessary information for an asset management decision, The SALVO Process has identified particular rules and skills that are needed to safely draw out the ‘tacit knowledge’ from the appropriate subject matter experts. In summary these are:

1. **Ask the right questions** - preferably using a checklist or template to ensure that nothing gets missed.
2. **Of the right people** - both to get the best possible information and to be seen to consult the relevant range of stakeholders.
3. **In the right way** - how the question is asked can have a profound effect (see below).
4. **And show them the usage, implications & significance of their contributions** - when someone has contributed to a decision, there is far higher chance of accepting the conclusions and committing to their implementation.

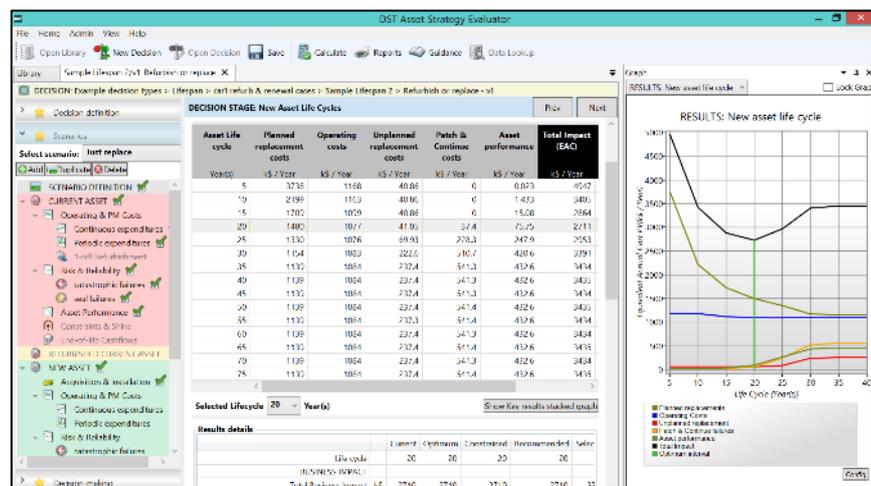
Perhaps the most interesting of these is rule 3. SALVO has extended work that was done in the prior MACRO project, in applying a ‘*Sherlock Holmes*’ method of ‘eliminating the impossible’ as a way of quantifying the min. and max. limits of credibility, within which the truth must lie. As a method of capturing tacit knowledge or uncertain assumptions, it is very effective, overcoming the common blockages of ‘I don’t know’ responses.

## 4.2 TRADE-OFF, COMPROMISE AND ‘OPTIMIZATION’

The much mis-used and over-used term ‘optimization’ is unavoidable in asset management decisions. It is the optimum we seek, between conflicting objectives such as cost reduction, asset performance and reliability, safety, environmental and regulatory compliance and the intangibles of reputation, morale etc. Unfortunately, not only are the component factors difficult to quantify, but their inter-relationships are complex. Renewal theory, reliability engineering and

financial mathematics are complex and intimidating. And the correct handling of trade-offs to find the optimal mix varies for different decision types. SALVO has grouped the methods into 6 generic ‘modules’, to support over 40 specific decision types, their ‘storyboards’, information requirements and optimization calculations.

- Project/Change Evaluator (step-changes)
- Inspection Evaluator (inspection & testing)
- Maintenance Evaluator (planned maintenance)
- Lifespan Evaluator (refurbs & renewals)
- Schedule Optimizer (optimal bundling)
- STAMP (Strategic Asset Management Planner)



## 4.3 SELLING THE CONCLUSIONS

Of course, just identifying the right thing to do, or the optimal time to do it, is no guarantee of acceptance and action. A common mistake of technical staff is to think that, once a report is written and presented, and no objection heard, then their job is done. However human psychology is even more important at this point, and some simple communication skills can make a big difference to decision-making, acceptance and implementation success. It could even be said that this is a core competency requirement for an effective asset manager – translating technical issues onto business language in one direction, and business needs and priorities into technical implications in the other.

There are many tips and techniques to learn here: from the appetite-whetting and management of expectations ahead of a key presentation/decision, to the ‘closing’ statements and consolidation of acceptance into firm commitment. The most important point, however, is that decisions affect people differently, so any proposals will be seen through different tinted glasses. These can and need to be anticipated for each specific case, and the explanation and ‘selling’ of the results need to be pre-digested for these different audiences.

Two sub-species of audience much be considered in particular. These are the “Dinosaurs” and the “Saboteurs”. In this context a dinosaur is one who struggles to understand the rationale for the proposal and is instinctively resistant to change. Care is needed to avoid ignoring or threatening such a person’s preconceptions or self-esteem, since the response will almost certainly be greater resistance. On the other hand, if the dinosaurs *can* be helped to understand (evolve), then their often substantial influence can have a powerful impact towards wider acceptance across the organisation.

The saboteurs are a bigger danger – they are individuals who have a vested interest in the *status quo*, or who will be negatively affected by the decision outcomes. The danger comes from their superficial acceptance of the proposals, but then (usually out of your sight) subtly and actively undermining their basis or credibility. This is a potential show-stopper for turning good decisions into actions. To pre-empt this, therefore, the contrary motives of the saboteur must be understood and addressed: perhaps the loss of influence, credibility or independence will be the concern. Whatever the reason, a positive self-interest (in supporting the new proposal) must be established to compensate for the perceived negative aspects. And a successfully convinced and converted saboteur is often the most effective subsequent champion for implementing the changes!

## 5 CONCLUSIONS

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In summary, good decision-making in asset management is not just a matter of gathering good data, performing lots of analytics and following a procedure. It involves people - their motivations, capabilities, limitations, prejudices and emotions. Understanding human psychology and communications is just as important as introducing ‘decision support’ tools and technologies.

Harnessing the best brains in the business, in the right way, has never been more important. We are facing an unprecedented mix of aging assets, rising demand and expectations, financial constraints and knowledge attrition (workforce age profile). The findings and guidance of the SALVO project are therefore particularly intriguing and significant, since they bring together the discipline of good decision processes, with the human factors and the appropriate role of supportive technologies. They hold the potential for a ‘next generation’ of maturity in decision-making competency across the organisation; giving technical staff the methods to talk in value-for-money language, and the navigational guidance to ensure that options are

evaluated objectively, including correct handling of risks, uncertainties, intangibles and future consequences.

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### Further reading

[www.SALVOproject.org](http://www.SALVOproject.org)

[www.belbin.com/rte.asp?id=8](http://www.belbin.com/rte.asp?id=8)

[www.myersbriggs.org/my-mbti-personality-type/mbti-basics/](http://www.myersbriggs.org/my-mbti-personality-type/mbti-basics/)

[www.assetmanagementacademy.com](http://www.assetmanagementacademy.com)