

Combining new technologies with new ways of working to create continuous asset management improvements.

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Abstract

Many directors & city analysts think "Asset Management" is all about corporate mergers & acquisitions, Return on Capital Employed and 'asset stripping'. Others have high-jacked the phrase simply to mean 'more professional maintenance', or 'equipment tagging & tracking', or 'asset information & work management software'. The new British Standard, PAS-55, clears the air and defines what a physical asset management system needs to include - but how are UK companies stacking up against this model? How are the tools and technology being used, and what about the overall clarity of direction, corporate governance and value attributes? All need to be joined-up to ensure sustainable, optimised asset performance. This paper looks at the best practices, the practical challenges and some of the key enablers required to put the whole jigsaw together.

Competing interpretations and definitions

Even a fairly superficial survey of uses for the term "Asset Management" reveals some fundamental differences in interpretation and usage. Here are 6 distinct yet common current uses of the term:

1. The **financial services** sector has long used the phrase to describe the management of a stock or investment portfolio – trying to find the best mix of capital security/growth and interest rates/yield.
2. Main board (usually **financial**) **directors** and some city analysts use the term in relation to mergers and acquisitions– buying and selling companies, re-organising them, divesting low value elements and trying to raise capital value and/or yields.
3. **Equipment maintainers** have also adopted the name in an attempt to gain greater credibility and 'voice' for their activities. As 'maintenance' has for so long been treated as a necessary evil and low on the budgeting priority list, perhaps calling it 'Asset Management' instead will raise awareness on the corporate agenda? 'Asset Management' becomes, therefore, a more sellable way of saying 'better and more business-focussed maintenance'. *This is the dominant use of the term in the USA at present.*
4. In line with the maintainers seeking greater corporate clout, the large number of **software vendors** selling 'computerised maintenance management systems' (i.e. asset registers, work management, history gathering, materials & cost databases) - over 300 at the last survey - have relabelled their products as "Enterprise Asset Management Systems".

5. If we dig deeper into the **information systems** world, we even find “Asset Management” interpreted as just the bar-code labelling of computers and peripherals, and the tracking of their location/status.
6. Increasingly, however, **physical infrastructure** or **plant owners and operators** have adopted ‘Asset Management’ to describe their core role in life – both caring for, and making best sustained use of, physical plant, infrastructure and its associated facilities. *This is the interpretation that the new British Standard, PAS-55 is focussed-upon, and is the subject of this paper’s discussion.*

“Optimisation”

Item 6 above is the most desirable modern interpretation, because it represents a significant performance improvement opportunity for almost every company in every industrial sector. If we broaden the scope to describe not just physical assets, but *any* core, owned elements of significant value to the company (such as good reputation, licenses, workforce capabilities, experience and knowledge, data, intellectual property etc), then *optimised, integrated* Asset Management represents the sustained best mix of:

- Asset *care* (i.e. maintenance and risk management)
- and
- Asset *exploitation* (i.e. *use* of the asset to meet some corporate objective and/or achieve some performance benefit)

Perhaps not surprisingly, this is what the financial services sector already uses the term to describe – finding the right combination of asset *value retention* (capital value/security) and *exploitation* (yield) over the required horizon. Like different bank accounts or investment options, physical infrastructure can also be protected and well cared-for, with high capital security (condition) but lower immediate returns (lower profit, or higher unit costs of performance), or it can be ‘sweated’ for better short term gains, but at the risk & condition cost of future usefulness/value. Asset Management involves trying to juggle the conflicting objectives – milking the cow today but also caring for it so that it can be milked and/or sold well in the future.

“Optimisation” is the word for the resolution of such trade-off’s and compromise requirements, but few really understand what it means in practice. “Balanced Scorecards”, for example, are nearly always mis-named – there is no ‘balancing’ mechanism in sight! In fact, ‘balance’ is not what we are looking for anyway: balance involves *equality* of impact, pressure or achievement. Optimisation, on the other hand, involves trying to find the most attractive *combination* (sum) of conflicting elements (which may involve lots of cost and very little risk, or *vice versa*, or any other combination - just so long as the net total impact is the best that can be achieved).

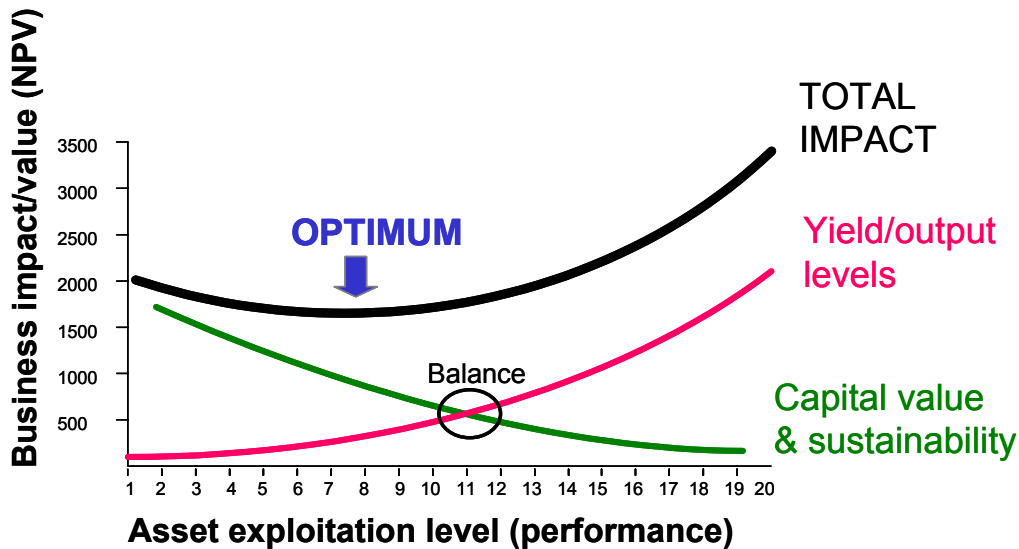


Figure 1. Getting the concepts right first: what is “optimal”?

Of course there are significant challenges in putting numbers to figure 1. The uncertainties about asset behaviour, future requirements, performance values, costs and risks all contribute to make the lines ‘fuzzy’. Furthermore, we tend to organise ourselves into groups of functional specialism so that we do not see the whole picture anyway. Departments are set up to design/build the assets (“engineering”), exploit them (“operations” or “production”), or to care for them (“maintenance”). Only the managing director has the self-interest in optimising the combination – unless “Asset-based Management” has been adopted properly. Organising ourselves by ‘activity type’ may be administratively convenient and offer ‘tribal’ comforts, but it loses sight of the whole and misses some spectacular opportunities for collaborative gain.

The origins of “integrated, optimised Asset Management”

The term Asset Management would not normally be expected to set many on fire with enthusiastic zeal. It sounds too much like housekeeping and a boring, disciplined ‘ticking of all the boxes’. However, the surge in corporate and regulatory interest for better *optimised, integrated* Asset Management has gathered considerable momentum over the last 15 years. There is certainly a big contrast between merely ‘managing the assets’ (which many companies would feel they have been doing for decades), and the integrated, optimised whole-life management of physical, human, intellectual, reputational, financial and other assets.

The oil & gas sector has had longest to prove what is possible, starting with the wake-up calls of the late 1980’s (Piper Alpha disaster, oil price crash, Cullen recommendations on risk/safety management, market globalisation etc). These forced a fundamental reappraisal of the business models – and the recognition that big companies, while holding a number of strategic advantages and economies of scale, were losing the ‘joined-up thinking’ and operational efficiency that smaller organisations naturally enjoy (or need, to survive). So the asset-centred organisation and profit units emerged. The ‘Asset’ definition differed between interpretations –

some set the boundary as the oil/gas reservoir, then included all associated infrastructure to extract it; others chose the physical infrastructure (platforms) in the first place as the units of mini-business management. The common and vital feature, however, was the recognition that

- Performance *accountability*
- and
- Investment/expenditure *responsibility*

needed to be much more closely linked (i.e. lie in one pair of hands: the ‘Asset Manager’). So the person that had to deliver the output also had full relevant budget decision-making (what is worth spending, when) to achieve/improve/sustain the performance. Any services or resources *shared* between multiple assets were funded entirely by their asset/client budget-holders, and had to compete with the open market in value-for-money terms. My colleague, Tom Brown, former senior Asset Manager with Shell, recognised this breakthrough when the Director of Human Resources approached him to ask ‘what can HR do to help you?’ rather than the traditional instruction style of applied controls and overhead costs. The HR department now only gets paid via the Asset Manager’s budget and has to demonstrate added value.

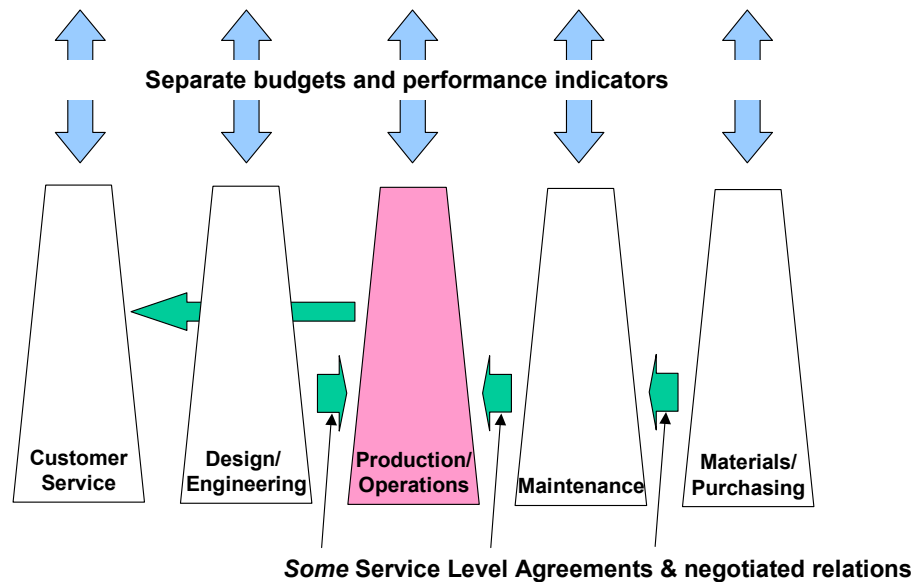


Figure 2. Traditional functional and activity-centred organisation

Asset-centred organisation

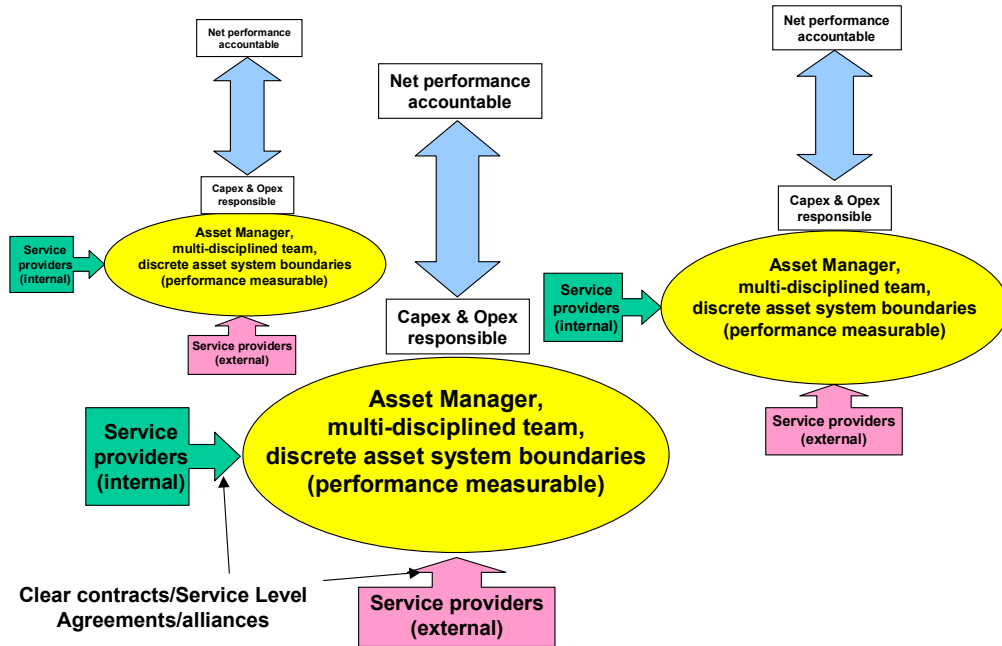


Figure 3. Asset performance-centred organisation

The *consequences* of such a transformation are now a matter of record: BP, for example, was producing oil at around \$15/barrel in the 1980's – now it does so, in more extreme conditions, at greater safety and environmental standards, for just \$2/barrel. Tom Brown, managing a couple of Shell's asset units, generated a 17% increase in total production rates within 4 years at the same time as a 50% total reduction in operating expenditures. Again, this was achieved while significantly increasing asset integrity *and* his team won a national training award during the same period.

Emergence in other industry sectors

Over the last 10 years, the Asset Management language has increasingly been adopted in electrical, water and transport sectors, both in the UK and in Australia & New Zealand. In these cases, as in the original oil and gas circumstances, it has emerged in answer to increased corporate governance pressures and scrutiny (privatisation, changed regulatory environment, major safety incidents, severe weather events etc). In these areas, however, it is still an emerging recognition of the need, rather than a stabilising, iterative improvement process. The Institute of Asset Management (www.iam-uk.org) is acting as a catalyst for sharing practical experience, understanding and the development of new opportunities. However there is a long way still to go, and there are massive performance gains still available for the taking.

The PAS 55 definition

Initiated by the IAM, the new British Standard, PAS 55, endorses the need for primary, performance-accountable asset/business units, with secondary 'horizontal' coordination and efficiency aids through asset type specialisms, common service

providers and standards. However, not many infrastructure managers can really claim to have such a structure in place yet!

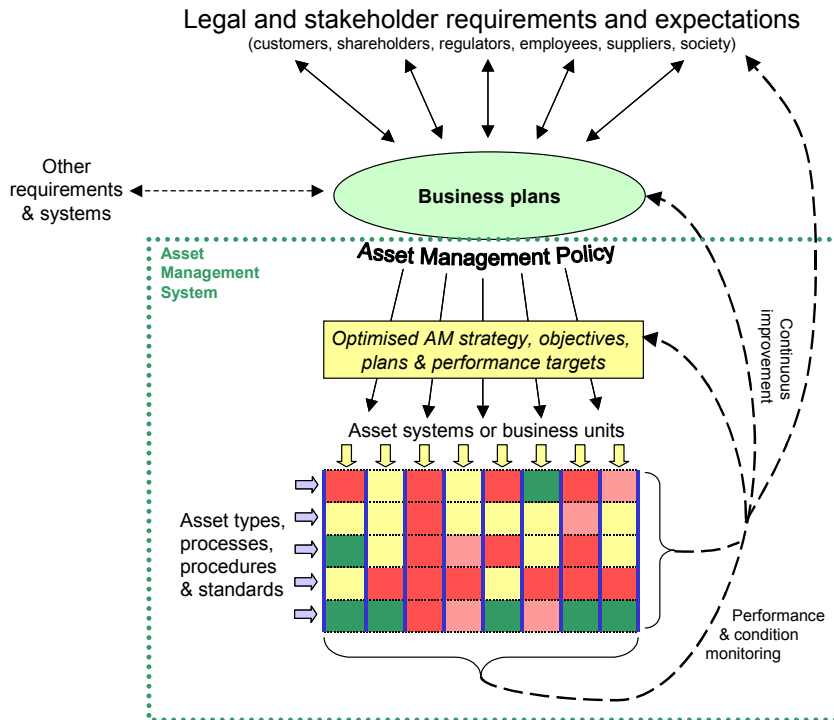


Figure 4. PAS 55 Asset Management System illustration

In the wider view, PAS 55 defines Asset Management as

“Systematic & coordinated activities and practices through which an organization optimally manages its physical assets and their associated performance, risks and expenditures over their lifecycles for the purpose of achieving its organizational strategic plan.”

This sets the goal, but how does a company get there? How do we know, and demonstrate, what is ‘optimal’? How do we coordinate component activities to this goal? How can such a joined-up, whole-life performance responsibility be established? How do we develop the skills, tools and processes to establish and sustain such an environment in the first place?

The human factor

Even a quick comparison between the skills needed to deliver the above, and the typical training or education background of most staff will reveal a major misalignment. How many engineers have sufficient business, financial and communication awareness? Why do we continue to see/treat operators & technicians as (skilled) hands, rather than also having brains and very sophisticated sensors? Ask any BP Asset Manager where most of their improvements have come from and a very clear answer comes back – from the workforce! We hear that “people are our greatest asset”, but often see evidence of the opposite. The disillusionment and scepticism resulting from past, temporary initiatives, ‘spin’ and oscillating management fashions means that there is much credibility to be rebuilt. Just another re-badging exercise is not going to be enough.

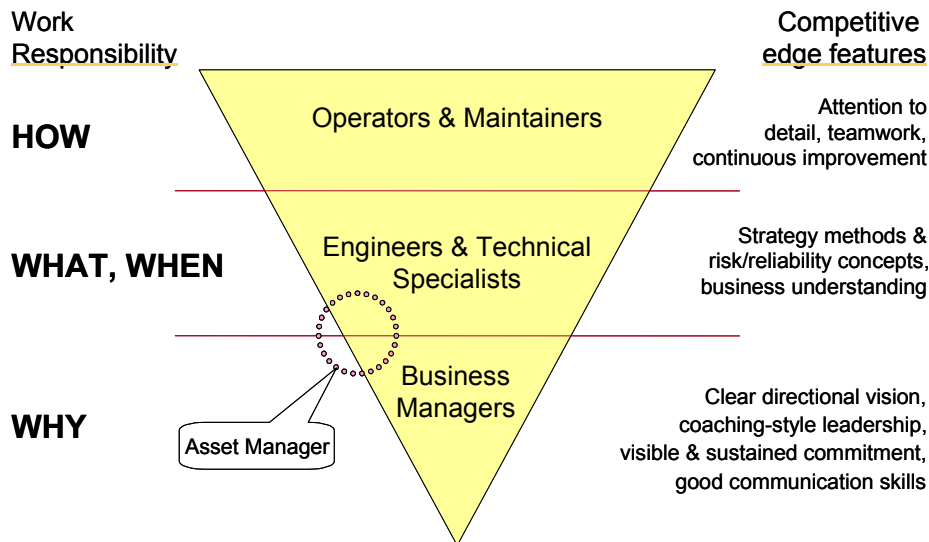


Figure 5. Inverting the pyramid

The gap between current practices and capabilities, and those required to harness everybody's best efforts, is wide. On the education front alone, simple things like 'awareness of the cost of downtime' and 'how the information being collected is going to be used' can transform the motivation, performance and creativity of the operators/technicians. The syllabus of most engineering-related degrees has only a 10-15% relevance to the jobs that most graduate engineers find themselves in. Senior managers are still too easily 'sold' on the latest 3-letter acronyms, IT 'solutions' and consultancy 'panaceas', without really understanding what they can, *or cannot*, do or deliver. And many still find it difficult to resist operational hands-on involvement ('playing with the train set'), instead of adopting new behaviours in giving directional clarity, protective empowerment, communication and coaching.

Putting hard numbers to the requirements, risks and intangibles

In addition to winning some hearts and minds, modern Asset Management needs a range of quantitative tools and optimisation processes. As the saying goes, "if you cannot measure it, you cannot manage it". The problem is, many of the key assumptions needed to determine what is worth doing and when, are speculative, risk-based and uncertain. The idea that better data will help is a shaky premise – in many cases, more data equals more confusion and, unless the need/usage is understood, we often end up gathering information that is not Better evidence is indeed valuable for identifying where the problems are, and how big they are (e.g. Mean Time Between Failures, system availabilities, condition survey results, asset performance data). Determining what to do about the problems, or how much inspection/maintenance is worthwhile, or when to replace/upgrade an asset, will not *and cannot* be based solely on collected hard data – for example, such decisions need to consider 'what would happen if we did not do the proposed task'. So such decision-support methods need to draw on the hard evidence that is collectable, plus the tacit knowledge and structured assumptions about the future. This is where the European MACRO project¹, rated as one of the most successful DTI-backed collaboration programmes in

¹ See www.twpl.co.uk or www.aptools.co.uk

the last 20 years, has achieved such a breakthrough. For the first time, whole life cost/risk/ performance trade-off evaluations and optimal task timing can be transparently quantified in financial terms, based on range-estimated knowledge (and sensitivity tested to discover which assumptions are critical). This is the ‘bottom-up’ determination of what is actually worth doing, when – in contrast to the historical top-down guesstimates, based on projected total budget estimates, broken down into component activity allocations.

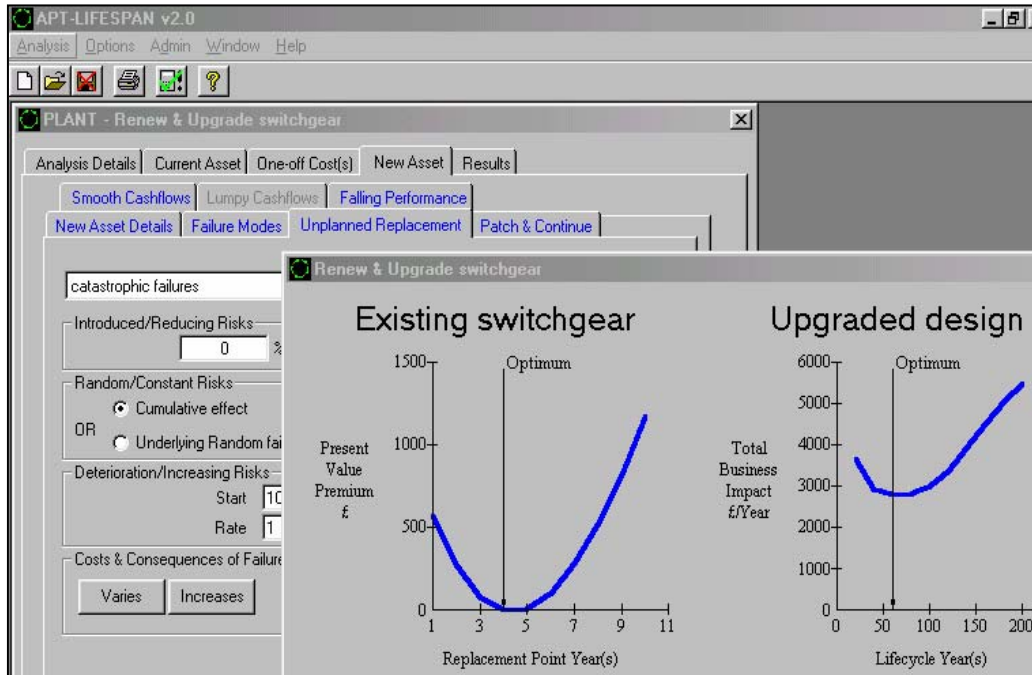


Figure 6. Optimised upgrade & replacement timing (APT-LIFESPAN)

As the leading players have demonstrated, both a top-down *clarity/alignment*, and a bottom-up *integrated delivery* are needed for truly optimised asset management. But it is in the joining up of the middle where many of the missed opportunities, conflicting energies and duplication/waste are usually felt.

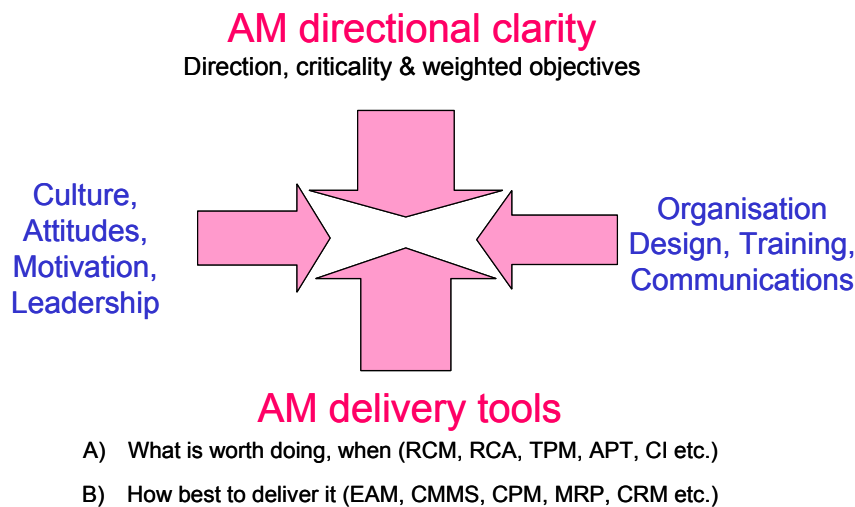


Figure 7. Top-down, bottom-up & middle-lubricated.

Top-down clarity & calibration of objectives

To sort out the picture, greater understanding of the Asset Management business model is certainly needed at board level and in regulatory circles. Separation into ‘Asset Owner’, ‘Asset Manager’ and ‘Service Provider’ roles is not enough – a good start, but not enough. On its own, this is just another set of functional silos. Greater risk awareness and better targeting of capital investment are also not enough. A top-down clarity of the conflicting business drivers, their relative and absolute significance or criticality, and optimisation or trade-off mechanisms are needed. The Balanced Scorecard must be appropriately calibrated - with real money values placed on the various conflicting performance pressures (that’s why money was invented in the first place - to ascribe appropriate value to dissimilar commodities so that they could be traded). Until there is a calibration mechanism, it is impossible to demonstrate that, for example, sacrificing 20% of the innovation ‘score’ (such as reduced R&D activity) might be worthwhile to prop up this year’s financial results (or *vice versa*). This goes for all the conflicting business drivers (safety, environment performance, profit, regulatory compliance, social responsibility etc).

Bottom-up delivery: what is worth doing, when & how

There is real excitement and evidence of change in the hands-on levels of Asset Management, *if* given a chance by the senior managers (i.e. not dictating that any single initiative shall dominate, but enthusiastically supporting a composite, iterative and cumulative approach). The weapons, understanding, methodologies and clarity of purpose are all evolving fast. RCM, TPM, Root Cause Analysis, Condition Based Maintenance, CMMS/EAM information and work management systems are all part of the basic toolkit now. In particular there is an awakening to the need for business accountability in place of technical or operational jargon, and cost/risk/performance justification of individual activities and their optimal timing. The MACRO project deliverables, for example, have yielded spectacular results in trade-off decision-making. One manufacturing company has just reduced their annual downtime by 50%, another (international valve stockist) has reduced inventory by 60% (with *improved* service levels) and the *average* reductions in maintenance costs have been 25-45%, usually accompanied by 5-20% increases in system performance/availability. One multinational company, that now mandates that *every* asset management/investment decision must go through the MACRO discipline/process, is quoting a doubling of shutdown intervals, a rise from 89% to 97% in system availability, and *sustainable* annual maintenance costs of just 0.6% of capital value (approx. 45% reduction). Last year they did 100 studies on one site alone, yielding \$50million/yr net improvements (and 80% of conclusions are already implemented).

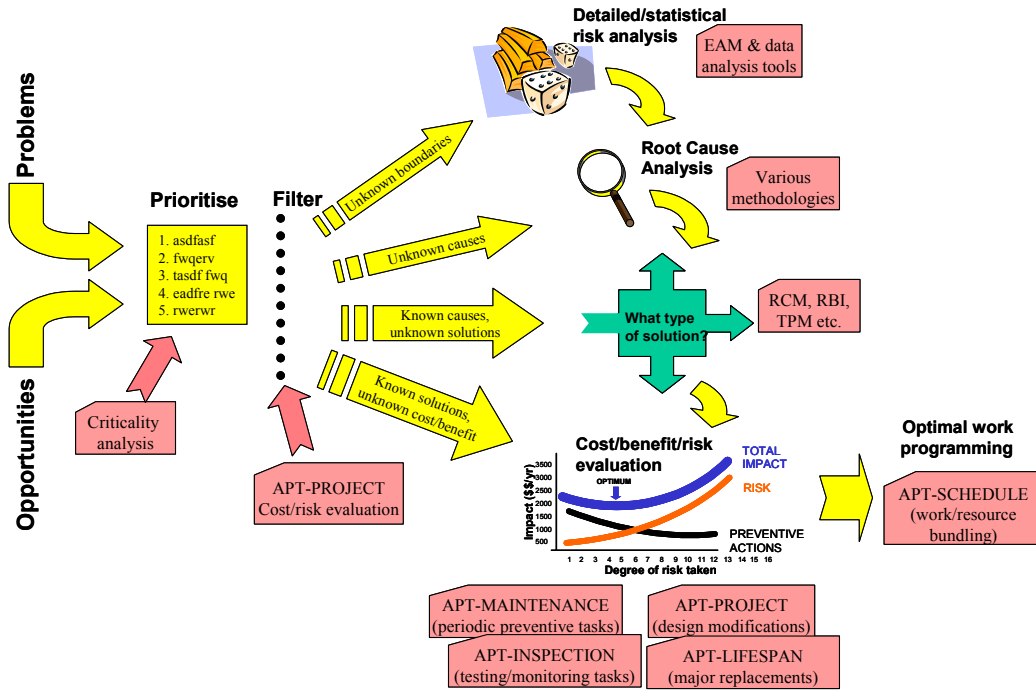


Figure 8. Continuous improvement toolkit

Methodology	ANALISES			TOTAL IMPACT (\$K/year)	
	PLANNED FOR 2002	COMPLETED (1st 6 months)	IN PROGRESS at July 2002	VISUALISED 2002	ACHIEVED AT JULY 2002
CRITICALITY ANALYSIS	6	1	9	-	-
LOST OPPORTUNITY ANALYSIS	3	-	3	-	-
CROSS-FUNCTIONAL TEAMS BUILD	1	1	3	4865	350
ROOT CAUSE ANALYSIS	16	1	9	13890	1100
STATISTICAL DISTRIBUTION ANALYSIS		1	-	-	-
RELIABILITY CENTRED MAINTENANCE	14	1	12	888	5269
RISK BASED INSPECTION	7	1	2	600	-
COST/RISK OPTIMISATION (APT)	10	8	9	950	15140
OPERATIONAL IMPROVEMENTS	13	1	10	780	1500
NEW TECHNOLOGY APPLICATIONS	11	1	9	1480	176
SYSTEMS RELIABILITY ENGINEERING	4	1	5	1500	457
	85	17	71	24,953	19,221

Figure 9. Sample of the range & impact of 'bottom-up' activities in an Asset Management environment (process industry; after c.1400 persons trained, 3-9 days each, over 3 year period)

Lubricating the middle

The real test of integrated, optimised Asset Management is when the top-down managerial expectations, budget-setting and performance targets, and the bottom-up capabilities, opportunities and prioritisation are lined up and transparently linked. This is where the lubrication and human issues become so important (*every* company that has really established a successful asset-centred performance leap says that this turned out to be the critical bit). The tools and techniques, reorganisations and better performance measures all help to make things possible, but ultimately it is people that

make them happen. So it is in the hearts, minds and collaborations that merely competent ‘management of assets’ turns into *integrated, optimised Asset Management*, and the performance and sustainability benefits are spectacular, so don’t stint on **education, communication and cross-functional teamworking!**

A preliminary AM checklist

Getting the whole jigsaw puzzle sorted out is clearly a major challenge. We certainly cannot solve all the problems simultaneously. However there are some valuable pointers to the establishment of the right environment, and foundation stones that help to build a robust total structure. The following is a set of observations gained over the last 20 years of working with successful Asset Managers and seeing what seems to be the minimum underlying set of enablers:

- A clear choice of ‘granularity’ for defining an asset (not ‘the whole company’ and not ‘the individual pump/motor/transformer’): a level of composite system whose measurable performance boundary is clear, big enough to justify a dedicated, full time Asset Manager and his/her multi-disciplined team (covering relevant, adequate asset exploitation and asset care skills).
- ALL other functions and occasional resource requirements organised as service providers, funded by their client ‘assets’ and competing with external alternatives.
- The ‘umbrella’ image and language (e.g. Asset Management) prominent and consistent in Company, Departmental & Personal objectives, house literature, training plans, stakeholder relationships etc.
- Lost Opportunity/downtime events are monitored *and costed* – this is where most of the big improvements will come from (rather than further opex cost cutting). Unless and until a price is put on asset *non*-performance, it is impossible to justify or optimise what is worth spending to improve it.
- Sustained communication on the *objectives*; *why* they are important and *what has/is being achieved so far* (people lose sight of how much improvement has already occurred). Problem/opportunity identification, investigation & solving processes all linked together and part of normal, daily life – *closing the loop and realising the benefits!*
- Natural *cross-functional team-based working style* (including geographic co-location where possible) e.g. engineering, operations & maintenance.
- Full-time *facilitator(s)* to make the ideas happen – this requires multiskilled communicators and enthusiasts to help corporate ‘dinosaurs’ to evolve, and to work around the ‘saboteurs’ (whose power base is being changed/removed).
- *Education*: urgently addressing the big gaps and backlog at management, technical and workforce levels.
- *Directional tools & disciplines* for renewals, changes, maintenance, inspection, spares and other risk-based decisions: decision-support is *not* just the better/greater provision of data & information about the assets. Cost/risk/performance optimisation methods are highly practical, can be used with or without good data, and provide clear audit trails for what is worth doing, when, and the consequences of delay, or the premium paid for intangibles etc.

- *Administration tools* for collecting/storing asset data, work control, resource control, project and financial management: avoid the “tail wagging the dog” either in overly prescriptive and expensive control systems, or in capture of data that is not really needed and will not be used.
- *Twin track corporate planning*: this year’s “quick wins” are visibly used to pay for sustained commitment to the larger goal - typically 3-5 years away, to benefit from behavioural changes. This is a self-adaptive, cumulative improvement path, and contrasts greatly with strategies based on typical benchmarking, audits and ‘blue skies visioneering’ (which tend to generate an intimidating wish-list without the business-case prioritisation, linkages and flexibilities).

Road maps, integration and prioritisation

Creating a logical, linked roadmap for the implementation of the above is also not easy. That is why TWPL spent a lot of time a couple of years ago to develop an Asset Management planning & development method – taking the comprehensive structures of the Business Excellence models (EFQM, Malcolm Baldrige award, Deming Prize etc) and a) converting them to Asset Management language, processes etc and b) extending them into the measurement of ‘scope for improvement, at what rate?’ in each of the areas covered. This yields both the baseline position and, more importantly, the structured organisation of improvement opportunities into two primary groups:

- i) those urgent and valuable first actions that either offer quick win benefits or represent vital groundwork for subsequent exploitation, and
- ii) the longer term (usually 3-5 years horizon) goals that involve behaviour change but offer significant performance benefits.

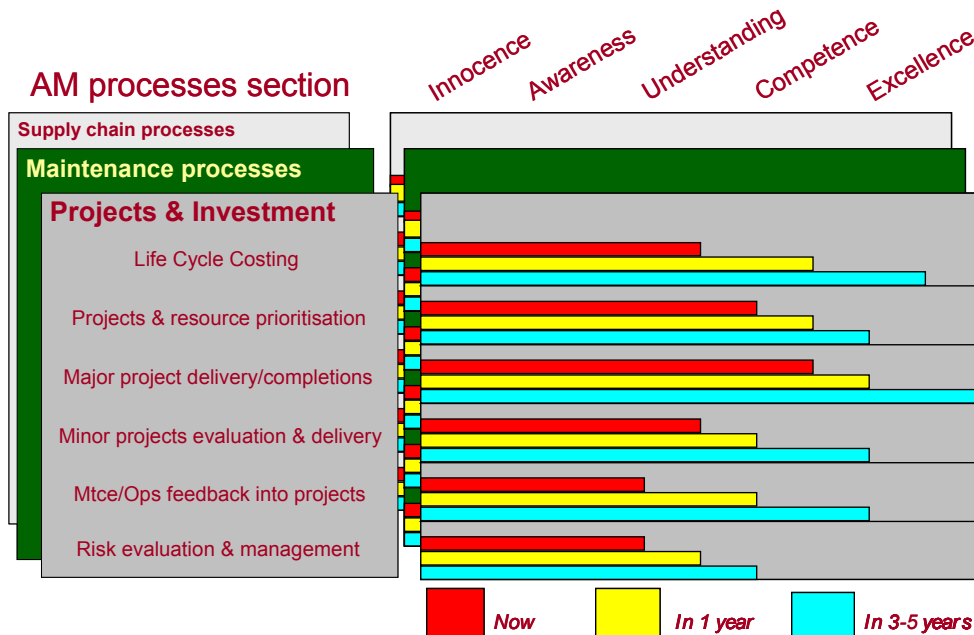


Figure 10. Example results from Asset Management improvement scope review

This roadmapping process puts a £-value on the various areas of attention, allowing organisations to prioritise and coordinate the component initiatives into a sustainable, cumulative improvement programme. Just like the BP experiences (\$15/barrel to \$2/barrel), this is what yields the massive benefits of integrated, optimised Asset Management.....

There are many shoulders to scale on the mountain!

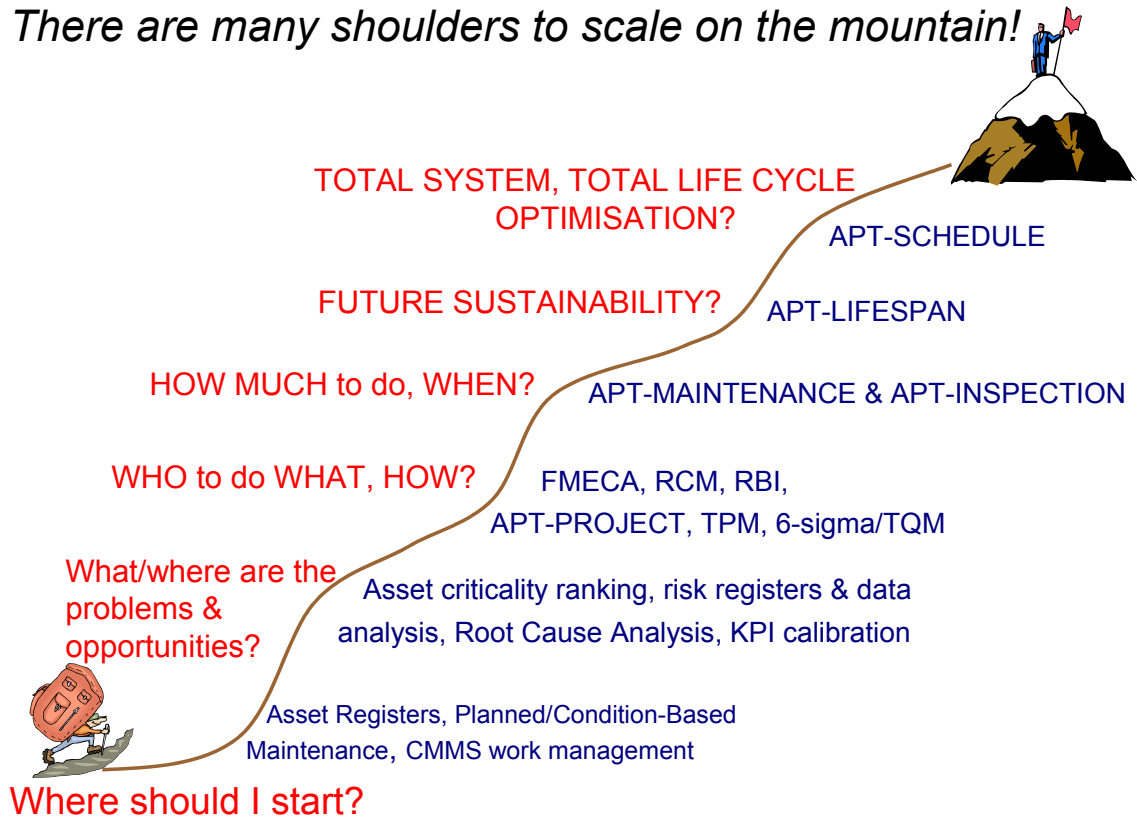


Figure 11. Planning the mountain climb.