ASSET MANAGEMENT IS MORE THEN JUST ASSET CARE (MAINTENANCE): EDUCATION, CULTURE CHANGE AND COLLABORATION IN ASSET LIFE CYCLE MANAGEMENT

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SUMMARY
This paper summarizes the experiences of many organizations in migrating from an asset care (maintenance) culture to a whole life cycle asset management approach, and the benefits obtained from this transformation. It will explain the evolution of the modern discipline, and the practical steps that can be taken to break down the barriers between departments, take a long-term strategic view (instead of short-term, cost-only view) and make better risk-based decisions to justify what is worth doing, and when.

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1. INTRODUCTION

The accelerating growth of international interest, debate and activity in the subject of asset management is very encouraging. It is also good news that, at last, there is a converging consensus about what is needed to deliver results, but there is also an increasing variety of interpretations, flavours and misconceptions. For example, some organisations, geographical regions and industry sectors are still using "asset management" to mean just "asset maintenance".

Others have recognised the bigger picture - the *combination* of asset **design/selection/creation** with the optimal blend of asset **utilisation** and asset **care** (maintenance), over the *whole life cycle*. We still have some challenges and education ahead, therefore, as any regular visitor to conferences, or readers of internet discussion forums, or participants in the recent ISO 55000 development[1] will recognise!

The different levels of capability and maturity in asset management show some consistent patterns. There are, for example, basic issues [1] that need to be acknowledged, and solutions found, before a joined-up, optimised and whole life cycle approach is viable and sustainable. These include:

1. Understanding **what** are the organisation's assets, and which assets have what importance **(criticality), condition** and **capability**;
2. **Planning and (risk-based) decision-making** processes that convert organisational objectives into '**who** should do **what, where, when** &**why**'.
3. **Cross-disciplinary teamwork** and de-siloing of departmental motivations and selfish behaviours, to deliver best value-for-money over the whole life cycle.
4. The role, elements and integration of a **management system** for asset management (not to be confused with an enterprise asset information management (EAM) *software* tool)

2. WHAT ARE THE ASSETS, IN WHAT CONDITION AND HOW IMPORTANTARETHEY?

Depressingly, a large number of organisations still do not even have a reasonably complete asset register. They do not know what they own. A large European rail operation discovered, a

[1] ISO PC251 project that developed the first international standards for Asset Management, using BSI PAS 55:2008 as the basis. For more information see www.iso55000.info

few years ago, a regional storage depot with over $200k of materials inside, that did not appear on any records at all, despite a recent 3 year data/IT initiative to update the network asset register. This is not a unique experience, even among apparently 'mature' asset management organisations. With the rate of change in technology, information systems and staff turnover, there is a constant battle to keep up to date with the basics. How up-to-date are your own 'as built' drawings, for example?

Naturally there are different levels of 'granularity' in identifying and holding technical information about discrete assets (e.g. individual components, assemblies, whole equipment units, operating systems, mine s or ore bodies) but an ear1y priority must be to have a good under-standing of the primary business-enabling ("value chain") infrastructure, operational systems and supportive equipment associated with any core organisational purpose (e.g. to produce ore) or responsibility (e.g. to ensure safety). Furthermore, it is a basic expectation to have reasonable knowledge of the condition, criticality and capabilities of these assets. Yet, despite the blossoming of interest and investment in condition and performance monitoring over the last 10 years, there have been many examples of technology over-optimism and poor basic discipline, allowing data collection to be patchy and un-sustained. In many cases this is also due to lack of understanding and visibility in data usage - those collecting it do not get to see *why* is needed, and *how it should he used*.

Clear understanding of the *functions* of the assets, and the interdependencies between them, provides a good test of asset management insight and maturity. Asset 'criticalities' are recognised to be important aids to prioritising attention and asset care, but there is still great inconsistency determination of what to use for this purpose. Some regard the consequences of failure (with safety, environmental, financial and operational impacts) as the primary concern, while others incorporate event probability or frequency to influence priorities based on levels of true risk. The leading players have even gone one stage further - since degradation and risks that change with time have such a profound impact on the appropriate timing and justification for planned intervention, it is also the *rate of change* in risks that needs to be identified and tracked in many cases.

3. WHO MANAGES THE ASSETS?

A good asset management organisation actively works, in a coordinated way, to realise and maximise value-for-money over sustained timescales, in direct alignment with the organisation's goals. Easy to say, but this can be difficult to put into practice in a large organisation, often geographically dispersed and segmented into departmental roles and specialisms.

The joined-up asset management vision requires a "total life cycle" and "total value" viewpoint: the sum of all costs, risks and benefits from initial investments (creating or acquiring assets), exploitation (usage), care (maintenance) and ultimate renewal or disposal. This presents challenges at different levels of assets integration (see figure 1). The life cyc1e management of individual equipment items is juggling act of buying the right ones, using them right, maintaining them correctly and modifying/ renewing/upgrading then appropriately. At this level of granularity there is plenty of inter-departmental tension: procurement pressure to "buy cheap" production to "sweat the assets" and maintenance concerns about risk, reliability and sustainability.

At higher levels in the 'assets pyramid', system integrations 'smooth' the picture of individual activities into *programmes* of investment, system performance and operational activities. The business impacts are more visible and quantifiable at this level, but individual issues and 'missed opportunities' can easily be hidden in the distracting noise of budgets, conflicting departmental priorities (KPIs), politics and tribalism. More mature asset management organisations have cross-functional decision-making mechanisms that outweigh local self-interests and budget protectionism.

Near the top of the pyramid, asset management attention takes the form of managing stakeholder expectations and juggling an asset portfolio to meet the conflicting demands of short- term performance and longer term security and sustained confidence. This involves a translation role, converting organisational objectives into asset management implications (and *vice versa,* using asset facts and realities to help manage stakeholder expectations). Unfortunately, many senior managers still use one set of wards for articulating vision, mission and goals, and then make apparent1y unrelated 'translations' into who should have what resources to do what activities in managing assets.

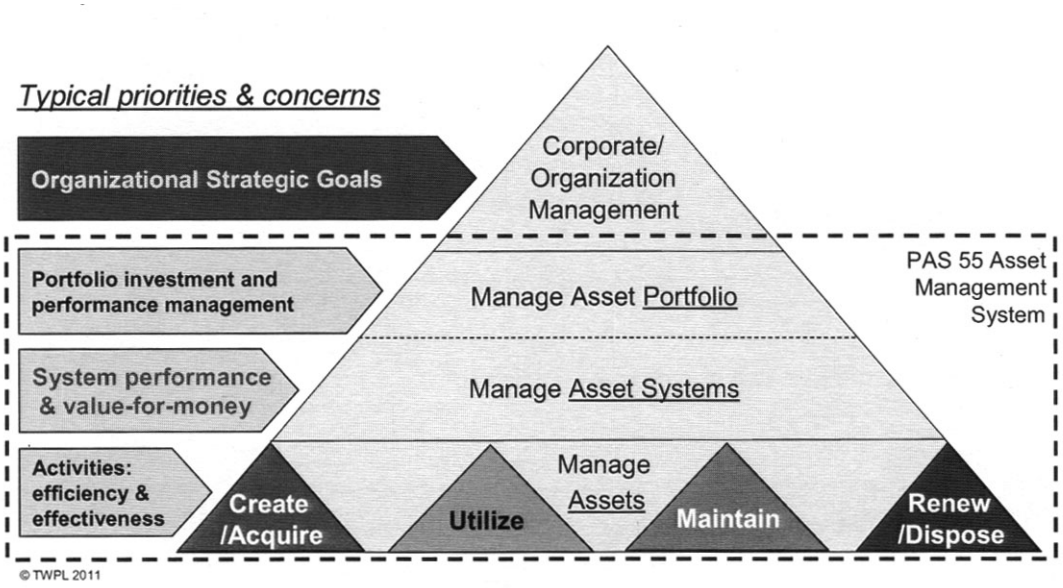

Figure 1. *Managing assets at different levels in a management system [2]*

4. TEAMWORK IN MANAGING ASSETS

Organisation structures range from largely autonomous (multi-disciplined) 'business units', to centralised, functionally specialised activities or, increasingly, a matrix combination of both. There is also a wide spectrum of approaches to what elements can or should be outsourced. Any of the extremes of independent mini-businesses or pure departmental/ functional silos, with fully in-house resources or extensively outsourced to service providers, can create difficulties for joined-up, optimised asset management (see Figure 2).

Physical asset-intensive organisations, such as mining operations, are often structured by departmental specialism to a very high level, assigning separate functional responsibilities, budgets and resources to activities such as planning, engineering, procurement, operations and maintenance - and then measuring the different contributions individually and locally. These structures easily become silos, particularly if the performance measures encourage conflicting priorities. For example, capital projects/engineering functions are often targeted strongly by "on time, on budget" *irrespective of operability or maintainability consequences.* Similarly, asset users/operational staff seek maximum asset performance and customer service, but often at the expense of sustainable asset condition (creating the need for maintenance, yet not wanting any downtime for it).

Semi-autonomous, multi-disciplinary business units, on the other hand, easily turn in to proud, localised 'empires' that re-invent wheels, duplicate capabilities and increasingly diverge from parent organisation priorities. While the individual asset systems or business units might be more value-optimised in this model, the overall *portfolio* opportunities (such as adoption of common practices and sharing of 'enabler' functions or resources) can be missed.

Of the two extremes, however, the establishment of a good asset management performance is most difficult within a strongly department-silo'ed organisation. The challenges lie in breaking down barriers and protectionism, reducing divisiveness in key performance indicators and even the jargon and tribalism that evolves when people only mix with others doing the same job.

It is possible, however, to create an effective asset management system, *even in a primarily function-based organisation,* provided that cross-functional communications, decision-making and, ultimately, the measures of success have the power to outrank individual department priorities or localised performance goals. The total value-for-money card must always trump the cards of individual egos and departmental agendas. Back in the 1980's origins of modern asset management (North Sea oil & gas sector), this was achieved by creating the "culture of a small company with the leverage and resources of a large company" [4].

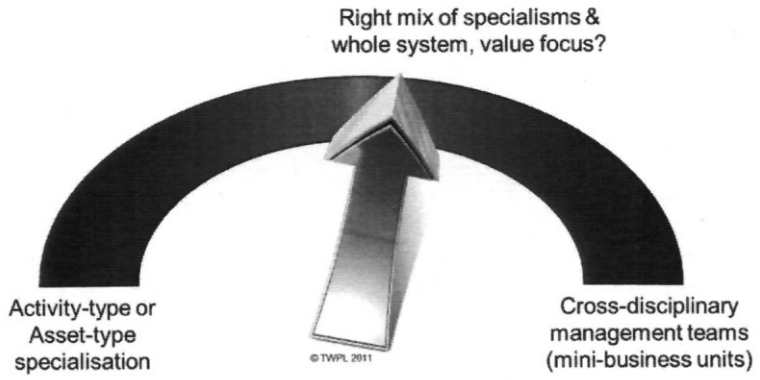

Figure 2. *Actively managing the mix of functional specialisms and asset system responsibility (whole life cycle value-for-money)*

5. DECISION-MAKING

At the heart of good asset management, it is often said, lies good decision-making. Yet the determination of what to do, what to spend, where and when, remains one of the commonest weaknesses in asset management. Partly this is due to lack of **education** (e.g. correct methods to select the best value-for-money option), partly due to lack of **information** (data uncertainty is inevitable) and partly due to the **conflicting interests** of short-term pressures versus long- term consequences, localised performance goals or resource bottlenecks. Yet research in this area [5] has shown how much is rapidly achievable, even with existing knowledge and information quality, through a little training, business discipline and "what if?" analytical tools. For example, there are 13 factors that must be considered when deciding which critical spares to hold, and in what numbers; yet the average decision-maker will usually only consider 4-5 of them. The SALVO Process [6] ensures that a more disciplined, cost/risk optimised decision is made, also creating an audit trail for **why** the decision is correct.

Characteristics of good asset management decision-making, recognisable in leading asset management organisations, include:

- fact-based (uses known-quality hard data wherever possible and transparent, sensitivity-tested assumptions if it is not),
- risk-based (incorporate risks and uncertainties),
- considers long term as well as short term impacts (e.g. whole asset life cycle optimization, total cost of ownership, total business impact)
- handles trade-offs between competing objectives (optimum = the best value compromise)
- uses total value-for-money as the decision criterion (not cheapest, quickest, 'technically best').

6. DATA ANALYTICS, RELIABILITY ENGINEERING & BUSINESS SKILLS

A very common mistake along the path to better decisions is an over-enthusiasm for data capture and data analytics. While fact-based decision-making is highly desirable, the reality of many asset management decisions is that they:

a) are always multi-disciplinary (affecting multiple parties),
b) have to be made in the face of great *uncertainties* and
c) must combine (asset) technical knowledge and business context (financial and risk) information.

For example, an asset replacement decision is not just dependent upon knowledge of the current asset's past and current behaviour/condition, but also upon what is expected in future. This relates not just to the current asset's possible degradation and risks, but also the assumed characteristics of the proposed replacement (e.g. life expectancy, reliability and performance), on-going demand/criticality for the asset function, the 'cost of money' and a range of other assumptions.

The maturity path in this area seems to go through 3 stages:

1. Little or no data, subjective/'engineering' judgement, often driven by fire-fighting and budget allocations, little consistency & auditability,
2. Intense efforts on data collection and analytics (reporting, trending, root cause analysis etc.) in the belief that more data = better decisions (however, the reality is that more data often simply generates more confusion!).
3. Shift of focus towards business process, competencies and cross-disciplinary cost/risk evaluation methods to determine net value-for-money [6].

7. MANAGEMENT SYSTEMS FOR ASSET MANAGEMENT

A "management system" is the label for whatever we put in place to ensure that *what is important* is identified and understood, and is converted into what gets done. It involves planning, coordination and control systems, and a continual improvement habit at multiple levels of learning and refinement (see Figure 3).

This is where there is greatest current variation in the maturity of asset management. The levels of integration and coordination range from "chaos management" environments of fire-fighting, ingenious problem-solving, short-termism and resource/budget battles, to the extremes of "command and control", where the top-down instructional and compliance culture often suppresses creativity, motivation and innovation. The optimal mix appears to be a *framework* of control, with a clear 'line of sight' between organisational objectives and the asset-specific management needs, in tum leading to the individual functional contributions. The controls comprise a set of common *policies* and agreement to adopt a common basis for risk, value definition (criticality) and prioritisation methods. Thereafter the management system is primarily focused on ensuring the vital 'enablers' of competency, data/information support and business process clarity.

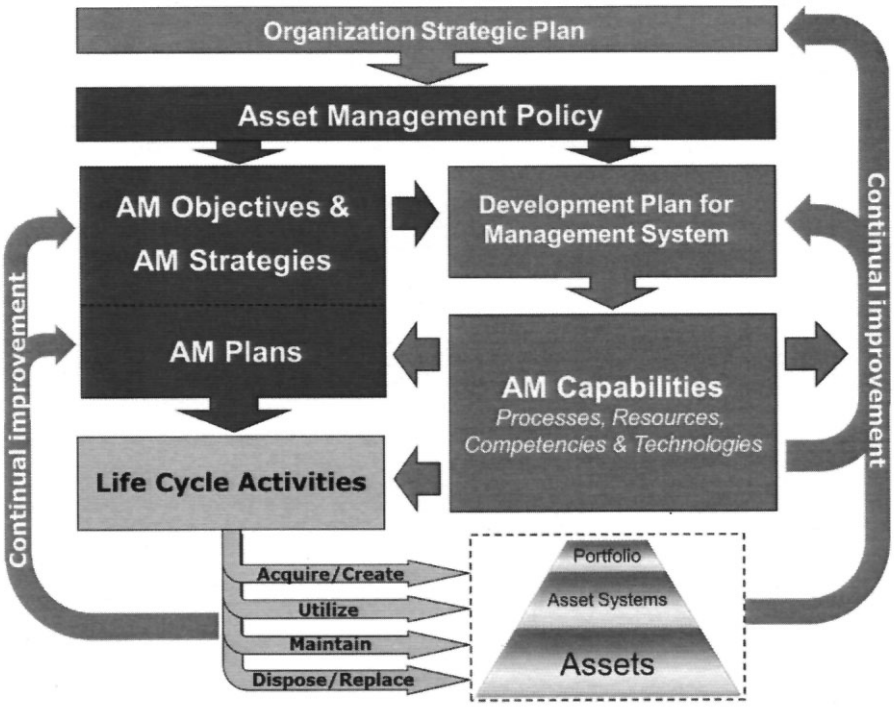

Figure 3. *Overwiev of an asset management system*

8. RESULTS

The outcomes of concerted efforts to better asset management, taking all these challenges into account, have been remarkable. The 'message' has spread from industry sector to sector, from the early origins in North Sea oil & gas and in the Australian public sector to power and water utilities, road, rail and air transport, petrochemical, pharmaceutical and process industries to heavy engineering, manufacturing and mining. The hard evidence of results is also emerging, and the scale of impact is greater than many would have believed possible:

- CLP Hong Kong: **90% reduction in system downtime**/losses ("customer minutes lost") while **reducing charged tariffs by 40%** and increasing the total networklassets by 20%.
- **30% reduction** in 'total cost of ownership' (Nuon electricity network)
- **30% reduction** in maintenance costs with 3-10% increased availability

(mine crushing plant, Chile)

- **17% increased output at 50% lower operating cost** (Shell N.Sea oil platforms)
- **28% reduction** in planned system downtime (UK National Grid)
- **A$l1M/year** budget savings (New South Wales government)
- **29% increased output** at no extra cost (Baltimore power generation).

9. CONCLUSIONS

The prizes are clearly large, and the lessons share-able (the same issues, challenges and opportunities lie in most industry sectors). There are many blind alleys, however, and it is easy to slip backwards if, for example, senior managers change, or people believe that a technology-led 'solution' will solve all the problems.

In each of the areas discussed, a spectrum of innocence to excellence can be identified and, in organisations that have sustained their efforts towards better asset management, a sequential path of emerging awareness, understanding, integration and optimisation found (see Figure 4).

On the international stage, there is growing consensus about what comprises 'good' asset management. BSI PAS 55:2008 standard was widely accepted as a valuable catalyst to achieving such competence. Now it has moved forward to become a full ISO standard (see www.iso55000.info) with 31 countries developing and publishing the set of 3 standards in February 2014. Casting further ahead, therefore, it is not unreasonable to expect that joined-up, cost/risk optimised, whole life cycle asset management will become a required, normal feature of all competent organisations, in the same way as safety and quality management are already.

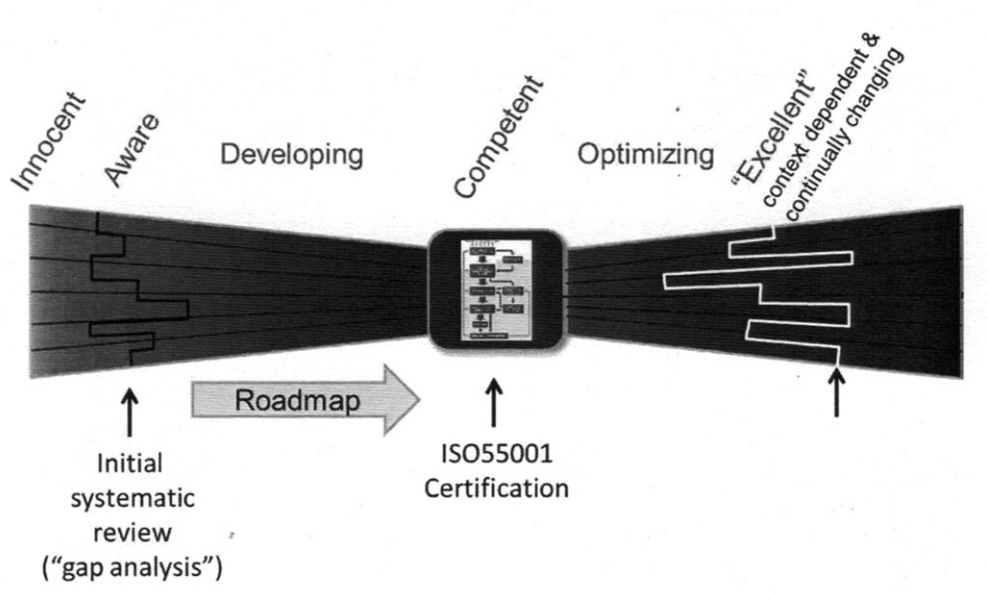

Figure 4. *IAM maturity scale for asset management*

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