Asset Management – *the changing role of Maintenance Management*

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1 *Introduction:*

This paper is designed to share some of the experiences in the 21st century of the development of Asset Management in Europe, and the UK in particular. Initially, Asset Management was seen by many as another name for Maintenance Management. This initial shortsighted view lost many organizations their competitive edge. Asset Management was also confused with pension funding and equity investment etc, which was equally misleading. However, the term here refers to 'physical' or 'engineering' Asset Management. The scope of the subject is broad and deep but some of the topics or highlights will be discussed in this paper.

With international industrial competition increasing with globalisation, business survival is becoming more under threat as time goes by. In order to ensure survival in the short-, medium- to long-term, profitability from assets needs to be maximised. This implies ensuring productivity and profitability improvement, while including the improvement of safety, product quality and production efficiency too, in addition to reducing maintenance costs.

This paper focuses on decision-making and continuous improvement as distinct from work control, in other words, it concentrates on 'working smarter rather that harder', and not the control of work with CMMS (Computerised Maintenance Management Systems). It is decision-making that tends to enable Key Performance Indicators to be continuously improved upon, whereas work control tends to enable budgeted targets to be met but not improved upon.

In order to maximise the productivity of assets, decision-making needs to involve all relevant disciplines and functions involved in specific decisions. If organizations are structured into functions, for example maintenance, operations, and engineering etc, with functional heads of departments, 'silo thinking' can result. The result is that budgets are planned and controlled with little consideration for the performance of the whole organization. Politics too can result in 'silo thinking'. The Maintenance Manager needs to work in cross-functional teams to take decisions in the best interest of the organization, yet to maintain the maintenance work control program to meet budgeted performance. It is the former activity that normally needs development as it requires a paradigm shift from the past.

2 *Origins of Asset Management:*

The origins of Asset Management were accelerated in the 1980s and early 1990s in the North Sea oil exploration and production industry. Production costs were running at $15 per barrel. Due to the glut of crude on the market at that time, the price of crude dropped, and in order for companies to ensure survival, they had to take drastic action. One of the actions that was taken was to make the person responsible for each production unit responsible for the profitability too. The results were that production costs were reduced to $6 to $7 per barrel and in some cases $2 per barrel - this enabled survival.

Asset Management has now spread to many utility organizations and large and small companies are adopting similar programs.

3 The changing role of Maintenance Management in Asset Management:

To illustrate how maintenance managers can contribute to an Asset Management improvement program, the table below lists some common issues facing management in the first column, and thoughts on how these issues might be addressed in the second column. Each of these issues will then be addressed in more detail hereafter.

1. Our competitor's assets are more efficient, we need to do more PM!	*But is it not time to renew the asset with new more efficient assets?*
2. Our Engineering projects and modifications are often given lower priority than those of other departments!	*But in the economic interests of the company, priority needs to be given to investments with the best payback!*
3. This motor has been in stock for 3 years - get rid of it!	*But it often pays to keep an insurance spare even if it never moves!*
4. We can't take decisions because we don't have enough data - we need a bigger computer to store more data!	*But many good decisions can be taken with weak data – one needs to develop skills on how to work with the best data available!*
5. Asset Management is another name for Maintenance Management!	*But optimal asset efficiency requires other decision inputs: finance, process, safety, quality and production engineering etc as well as maintenance*

Table 1: Examples of common issues facing management when starting an Asset Management continuous improvement program.

3.1 Improve maintenance strategy or renew the asset?

Should one continue improving maintenance strategy or renew the asset? Which of these two choices is the most cost effective? We don't want to spend money on improving maintenance strategy when efficiency and safety could be improved by renewing the asset – but then on the other hand, is it not more cost effective to improve the maintenance strategy to improve the reliability and availability of the present asset? The choice between these two alternatives needs to be addressed jointly by Maintenance, Operations, Safety, Quality and Finance, to ensure a common vision, strategy and cost effective investment.

Examples of terminologies to address these types of issue are '*Whole Life Costing'* and *'Life Cycle Costing'*. They both necessitate that consideration be given to the whole life cycle of an asset and how it changes over the life of the asset:

Maintenance costs – both planned and unplanned
Downtime for maintenance – both planned and unplanned
Efficiency of the asset – productivity and output
Operating costs – energy etc
Quality of operation or service – product and service rejects etc
Safety to staff and the public

The only way to take a sensible decision with regard to continuing with the existing asset or changing for a new one, and then choosing which new one, is to turn each of these aspects and considerations into $ values.

'*Whole Life Costing'* and *'Life Cycle Costing'* enable assets to be compared in order to choose the most cost effective long term investment. However, they do not address the ***'Optimal total life cycle costing',*** which is illustrated below. We will first compare 2 assets (A & B) from different manufacturers to see which is more cost effective in the long term:

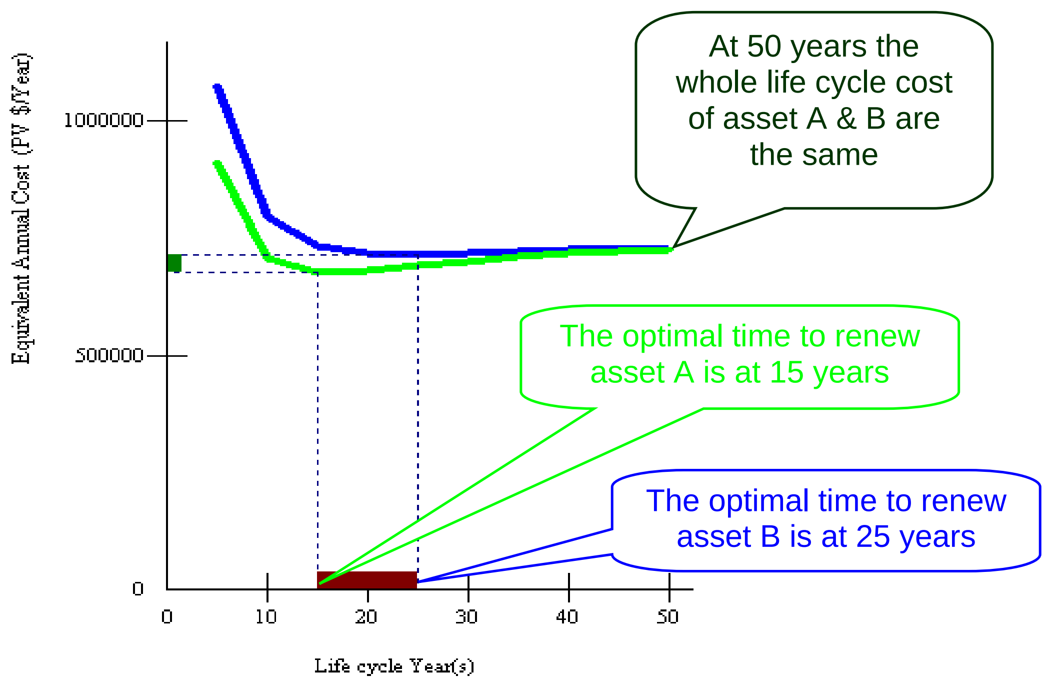

Figure 1: This graph illustrates that asset A, when renewed at 15 years, is the most cost effective investment.

If it was decided that the asset was to function for 40 to 50 years before renewing it, there would be no real difference between asset A and B. Asset B is more durable, costs more and has better availability and reliability over its possible life cycle. Asset B's optimal life cycle is 25 years. However, asset A in the long term is the more cost effective choice if it is renewed on a 15 years cycle!

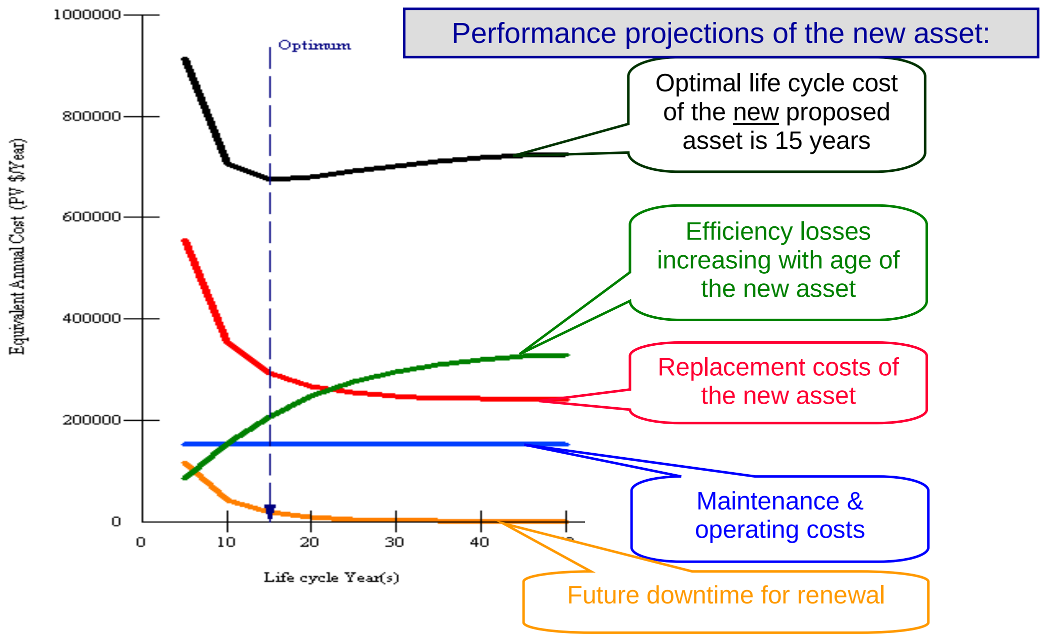

Figure 2: Asset A analysis in more detail: The optimal replacement time of the new asset is projected to be at 15 years.

If management decided on a new asset as illustrated above, the optimal time to replace it in the future according to the estimated projections of the Asset Management team of the organization, would be around 15 years' time. However, without this type of modeling, they could well decide to keep the asset past its optimal replacement date, such as deciding to replace it between 30 to 50 years. The asset would outwardly appear to be functioning perfectly well, but if their competitors had chosen asset A and decided to replace their assets on a 15 years cycle, they could well be 5% to 10% more cost effective! This is often enough to make the difference between being and market leader and going out of business!

However, that is not the end of the story. The scenario above needs to consider where one is with the present 'old' asset. Is it time to change from the existing asset to the new one of your choice? An example of a model to identify the optimal time to change from the existing asset to the new choice of asset is illustrated below:

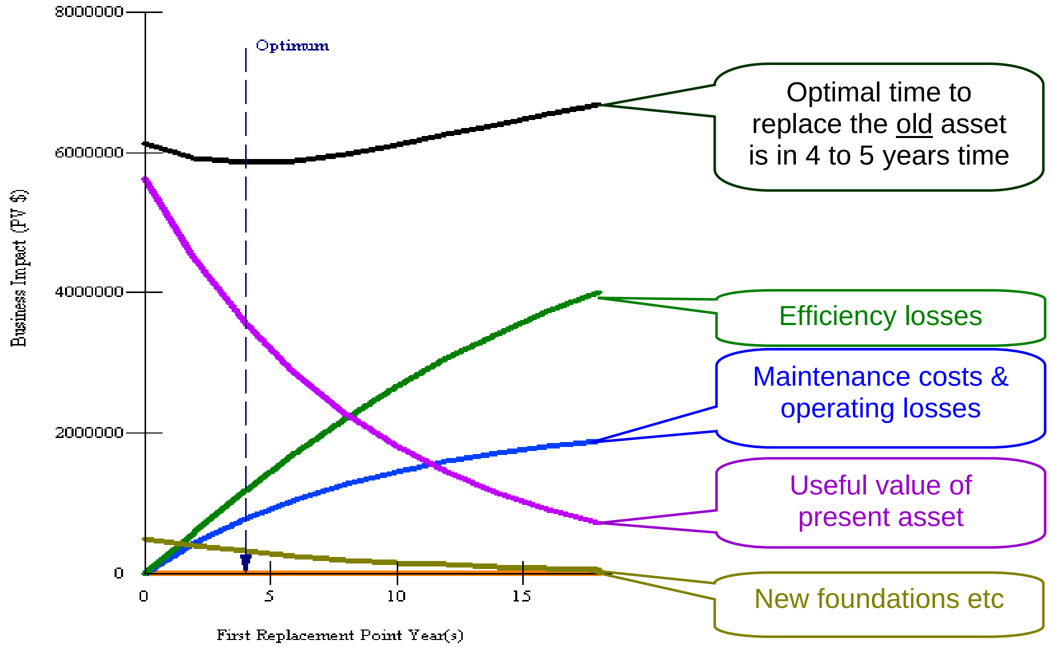

Figure 3: The optimal replacement time of the old existing asset for the new asset A is between 4 to 5 years.

As illustrated in figure 2, asset A is the best long term choice of asset. However, it is still cost effective to continue with the present old asset until 4 to 5 years' time, see figure 3 above, before replacing it for asset A. That could well be time enough to improve maintenance and operating strategy on the present asset to gain short term benefits. The decision to purchase and install asset A could be reviewed in 2 to 3 years' time, as costs might have changed which might change the course of strategy.

3.2 Engineering projects, are they given a fair priority?:

The Maintenance Manager normally has a number of projects that he wishes to motivate with the organization on an annual basis. They are modifications to plant and process, design changes, abnormal maintenance, major maintenance work etc. However, some of these projects may be paid for within the constraints of the maintenance budget, while others need to be motivated for additional expenditure. The latter projects need to join projects motivated by other departments such as Operations, Safety and Quality etc. The chart below illustrates how all projects can be compared and prioritized to give the best payback or profitability to the organization. This can be used as a guide, as Top Management has the authority to invest in certain projects that are not particularly good investments. However, clear identification of highly ranked and profitable projects does make a good case for attracting attention and investment, particularly when allocation of funds for projects is restricted!

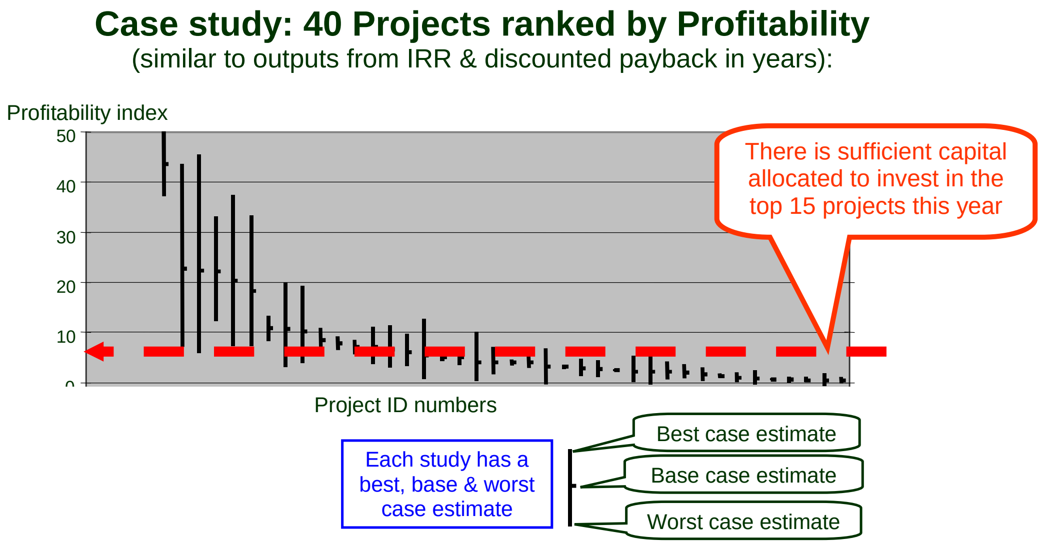

Figure 4: Five of the top fifteen projects come from the Maintenance Department. The rest can be motivated again the next year.

NB.: This case study illustrates one of the most important skills in Asset Management; how to work with poor or non-existent data.
Each project has 3 estimates, worst, base and best case. As can be seen above, some of the projects could have a broad variation in inputs but when ranked against some of the less cost effective projects, they are more profitable even in the worst cases. One of the reasons often given for not quantifying inputs to decisions is the lack of time to do so. However, before getting bogged down in analysis paralysis, get the best information currently available and using engineering judgment, estimate the best and worst cases. This range estimating will quickly enable a manager to evaluate whether there is a worthwhile case or not.

3.3 Critical insurance slow moving spares:

Have you heard: 'This motor has been in stock for 3 years and has not moved – get rid of it!' There are some items that might never move, but should still be kept in stock. This section illustrates how all the cost issues can be entered into a decision and communicated to motivate whether it is cost effective to keep a spare, or not. This is a case study of a 3kV electric motor that the finance department considered should not be kept in stock because it had not moved in the last 3 years. However, the Maintenance Manager and Operations Manager together calculated the answer to illustrate that the potential lost time cost would be catastrophic to the organization if the motor were not in available from stock if it were to fail.

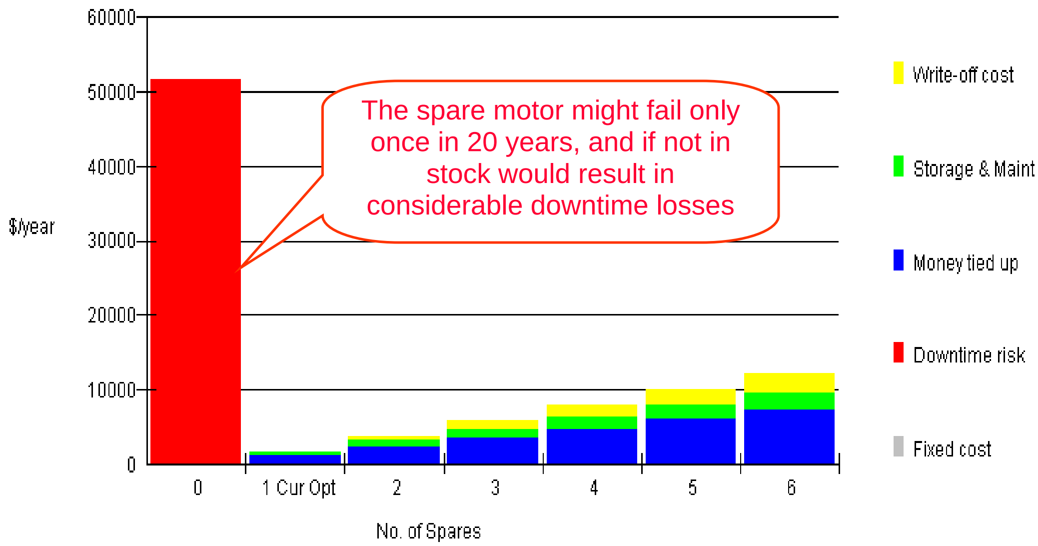

Figure 5: A case study: This chart illustrates that the current policy of holding one spare motor being considered, is the correct policy.

4 *The Macro project:*

The decision models in this paper were calculate and graphed using Asset Performance Tools, which were developed during the MACRO Project. The MACRO Project was initiated in 1995. It started with a budget of $M3 and lasted until the year 2000. A number of European organizations joined together to identify what decisions industrial organization take and need to take in managing their assets cost effectively. The Woodhouse Partnership Limited was the project manager and APT (Asset Performance Tools) designed the software tools resulting from the MACRO Project.

Figure 6: The Macro Project:

Objectives of the MACRO Project: research, collate and develop best practice in Asset Management decision-making, particularly where hard data is not available or adequate.

Scope: 42 areas of asset management decisions, of which examples include:

- *"When is the optimal time to replace this equipment?"*
- *"What is the optimal inspection or maintenance interval?"*
- *"Is it worth holding a strategic spare, and if so, how many?"*
- *"Which asset is best to purchase* **-** *the high cost option with better performance and longer potential life, or the cheaper but lower performance/more uncertain option?"*
- *"What is the optimal implementation sequence for a list of very dissimilar tasks or projects?"*
- *"What shutdowns are worthwhile, when?"*

Sponsors & participants:
DTI, Yorkshire Electricity, National Grid, Norske Shell, **Halliburton Brown & Root, The Woodhouse Partnership**, PSVSA Intevep, Det Norske Veritas, Anglesey Aluminium, Network Rail (Railtrack).

Deliverables:
7 suites of decision-support methods, training modules and software tools (Asset Performance Tools or APT) that an order of magnitude more advanced than any other methods for identifying and quantifying the cost/risk optimal solution.

Each decision type needed to lead to continuous improvement of ***'physical assets',*** and had to incorporate all responsibilities, as illustrated in the diagram below:

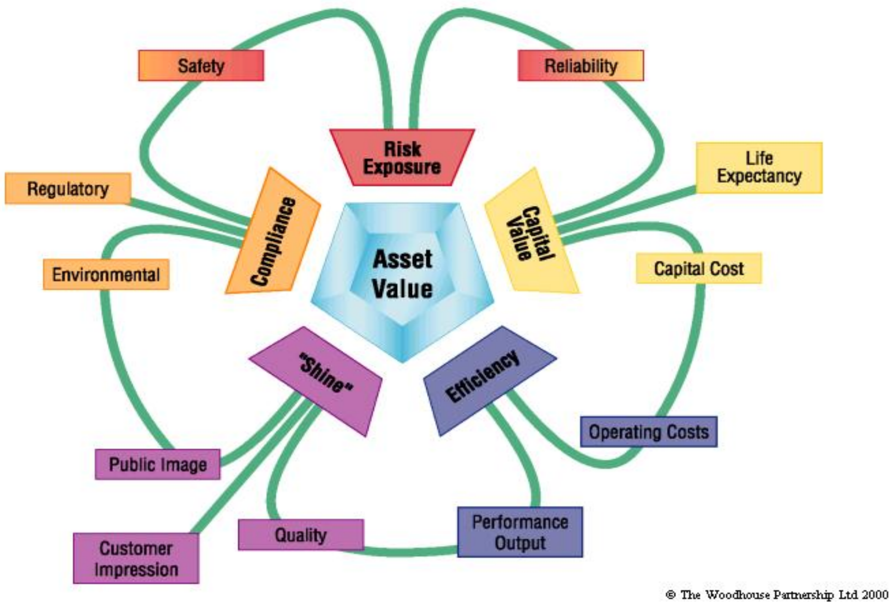

Figure 7. Recognising conflicting drivers and evaluating Total Impact/Value
(the green lines are just examples of close inter-relatedness)

The examples and case studies in this paper are illustrations from a few of the experiences of applying advanced Asset Management decision making modeling developed by the MACRO Project and applied in practice over the last 5 to 10 years with considerable success.

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