How to present a winning financially justification for new and replacement equipment.

"How to win the 'bean counters' over and get them to buy what you want, even if its not budgeted."

ABSTRACT
How to present a winning financially justification for new and replacement equipment. From time to time it becomes clear that an item of equipment is expensive to maintain and it would be cheaper to replace it. To get moneys for the change it is necessary to justify the expenditure and prove that replacement is a better decision than keeping the existing item. In this guide you will be taken through the necessary steps to fully compare and justify the alternatives. You will be directed how to make simple but convincing presentations to the financial people and departmental managers. The appropriate formulas and spreadsheet layouts will be developed simply and explained fully. By following the procedure and methods covered in this guide you will make such a strong case for replacement that people will give you the necessary money to do it. Keywords: net present value, hurdle rate, investment proposal, return on investment,

1. The HURDLE RATE

When investing your own money you look for the greatest interest rate at a level of risk that you can accept. Businesses are the same. To insure they get an acceptable return on their money they set a minimum rate of interest that their money must return. This 'hurdle rate' is used to make a cut between projects. Those above the rate are worth looking at and those below are left alone.

When you approach people to get money from them to buy new equipment they are looking to see how strong a case you have to support your request. A business uses its money where it will return greatest value. So your proposal will need to prove to people that their money is best spent on your recommendation and not on some other requirement.

The hurdle rate reflects where the money comes from in the first place. If the money is a loan from the bank then any investments must return higher than the bank interest plus a bit to make it worthwhile putting effort into the project. If the money is from shareholders then the investment must return a sufficiently greater return than another project or investment of equal risk that they could have put their money into. If the money is from moneylenders then it must return a higher interest rate than the moneylender's loan rate plus a bit more to pay for the effort. At times funding can come from all three sources and the hurdle rate reflects the proportionate mix of each source.

2. HARD EVIDENCE

When going to ask for money for replacement equipment or for an improvement project you need solid proof that a current problem exists and that it is wasting the business' money. In the case of replacement equipment it is necessary to compile real costs of remaining with the current equipment. These typically are cost of parts, cost of labour, cost of power, cost of fuel, cost of subcontractors, cost of management, engineering and supervisory time and cost of production losses that could have been sales revenue.

The strongest case is made when the real costs are faithfully quantified and recorded. There is nothing like an invoice from an expensive contractor, an invoice for parts that should not have been necessary to buy or wages time sheets for unplanned maintenance work, to clearly prove the true cost of remaining with the current item of plant. If necessary start collecting this 'hard evidence' by hand and through the accounting system. If you have a fully integrated computerised maintenance management system (CMMS) then the collection of real historic costs is extracted from the CMMS.

This hard evidence is the foundation of your case and because it is true it cannot be disputed. So it is very worthwhile to track it down and to analyse it and present it clearly and truthfully. Do not make figures up – if they cannot be found, but you believe that there is a cost involved, then estimate the cost and provide the basis for your estimation.

7. MODELING REPLACEMENT EVALUATIONS

There are three commonly used ways to present the comparison of old verses new. Each method will show up the better option provided it is used consistently with each of the replacement options.

7.1 Payback Period

This is the length of time it takes to recoup the cost of the replacement from the savings it provides.

$$\text{Payback Period} = \frac{\text{Cost to buy the replacement}}{\text{Average annual savings from replacement.}}$$

The average annual savings are the sum of the annual savings for the life of the equipment divided by the years of equipment life. For example, the payback period for a machine that cost $3,000 and has net average cash saving of $1,000 per year is 3 years.

7.2 Simple Rate of Return

This is the estimated saving as a percentage of the cost of the replacement. These are popular and widely used since they express a replacement's average annual earnings as a percentage of the initial investment or average investment.

$$\text{Simple Rate of Return} = \frac{\text{Average annual savings from replacement}}{\text{Cost to buy the replacement}} \times 100\%$$

$$\text{Simple Rate of Return} = \frac{\text{Average annual savings from replacement}}{\text{Average annual cost of replacement}} \times 100\%$$

This method is based on the values in the accounts, which depend on the method of depreciation, and so it is not based on precise cash flows. In addition it does not take into account the time dependency of the value of money, i.e. inflation.

7.3 Net Present Value

This is the cash flow saving each year discounted for the effect of interest and inflation and deducted from the original cost. This is the most accurate method and the one most widely used but also the most complicated. A discounted value is one that shows what a sum of money is worth today. For example $1,000 invested at 10% per year will be worth $1,100 in a year's time. That is, at a discount rate of 10% the $1,100 next year is worth $1,000 today.

When using Net Present Value (NPV) calculations you work out what the future savings will be in today's dollars and deduct them from the original expense. If the result is a negative value it means that the purchase will not be profitable. Whereas if the NPV is positive it means the proposal will make money for the business. This method accounts for all effects on the flow of cash. It requires the use of a spreadsheet but can be done by longhand on paper for simple equipment replacement options.

The effect of inflation is a compounding effect. That means that it acts every year on the previous year's value. Take $1,000 today with the inflation rate at 2%. In a years time you will need $1,020 ($1,000 x 1.02) for it to be worth the same amount as $1,000 today. The year after that you will need $1,040.40 ($1,020 x 1.02) for it to be worth $1,000 today, and so on in compound fashion.

The same approach is used when determining the NPV of replacement options. Each year the current costs are inflated. The net savings for each year are then calculated and converted back into the equivalent value today if the investment in the replacement had to meet the hurdle rate. Table No. 1 shows it done for our replacement truck.

Some Quality Paradigms are Expensive.

ABSTRACT
Some quality paradigms are expensive. Quality is a mindset! When a wise man is given the chance to buy quality items he does so because quality pays for itself. A quality item lasts longer, runs better and looks good when others fade. To change the way you think about quality takes a lot of experience with using poorer options. When you are sitting down with your head in your hands wondering what can be done to get costs down, to get production up and how you are going to hit the key performance indicators, remember the importance of quality equipment, quality systems, quality training and your quality mindset!
Keywords: quality control,

It is the way of people in many cultures to look at the purchase cost of a thing and not its life cycle cost. They have been taught short-term thinking at the expense of long-term benefits. It is an expensive paradigm by which to live your life.

When you go to buy a suit do you buy the least expensive suit that will fit you? That is what I used to do. In my ignorance I thought I was making a smart purchase. I did not understand why it was cheap.

It was cheap because it was not a thick, well woven fabric, it was not double stitched, the thread holding the buttons were not ended properly, the person sewing the suit would have been paid a meagre wage and it would have been made on piece work. Such a suit, by the nature of its manufacture, could not be a quality product. I needed to buy two such suits and leave one in the wardrobe awaiting the failure of the first. I took this philosophy with me into my engineering career. I did not know better at the time.

For 50% more I could have got a quality, world-class suit that would have lasted twice as long as the two cheaper suits. And for no extra cost it would have been altered for free to look good on me. Such a fine suit would have told the world that here is a person of quality with high standards and high expectations from life.

But I had been brought up with the wrong paradigm. Rather, … the effect of my choices had never been explained to me. So in my ignorance I thought buying cheap was buying smart.

It has taken me a long time to realise my great error. Even today, knowing full well the consequences of buying cheaply, the first thought that comes into my mind is how little do I have to spend to get the job done. I will have to fight against that way of thinking till the day I die. It is the wrong paradigm to use to make equipment purchase choices, terribly wrong!

If such an approach to doing business is ingrain in an organisation it will lead to loss of potential long-term profits. It must, because that which is cheap must be replaced often. Just like buying a cheap suit.

Suppose that instead the paradigm was turned around!

As an example, take an equipment design engineer or project design engineer given the task to make a thing do a job. But it must last 25 years without a single failure.

It now becomes critical to consider every possible failure cause and design adequate protection for 25 years fault-free service. That is a totally different perspective to what we are used to today.

Now cost is not the decision driver. Instead quality, creativity, craftsmanship, degrees of perfection and fault-free longevity of service become the decision drivers. That would be something wouldn't it! What great pride that would bring the persons that built with perfection as the aim and not the least cost to get through the warranty period. And what great benefits such a piece of equipment would bring its user. For a few dollars more they would get quality production , problem-free for 25 years.

If you think that such a requirement would cause the equipment to be too expensive to sell or buy? Well, …. let me tell you what I learnt long ago about buying suits…!

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Benchmarking using Replacement Asset Value

ABSTRACT

Benchmarking using Replacement Asset Value. A benchmark is the end distance point from the start. In the world of maintenance it is the name for the targets that an organisation sets for itself in an improvement program. Benchmarking is often against world-best practice and it is used to provide direction and focus in an organisation's efforts to improve. When RAV is chosen as the benchmark it means that the annual cost of maintaining the plant will be measured against the value of the plant. RAV is a percentage of the cost to replace the plant. The lower the RAV the more effective the maintenance effort. Keywords: metric, maintenance cost, percentage replacement value

The percentage of annual maintenance costs, as a proportion of replacement asset value (RAV) is becoming the universal way of benchmarking companies across a particular industry. It involves collecting the total annual maintenance costs and then dividing the RAV into it and multiplying by 100 to give a percentage.

The RAV is, strictly speaking, the current cost to rebuild your plant today exactly as it is today. It is the current cost to construct the plant to its present design. This approach takes in the effect of inflation on both the project costs and the spare parts and maintenance costs. The difficult part is how can you cost the rebuild of your plant today.

The most accurate way is to give all your design and construction drawings of the plant and facility as-it-is-today to a contractor and ask for a current price to build it. But that is a huge job and most people don't keep that sort of detail on their plant. You can go to your insurer and ask them to let you use their replacement cost data for the equipment in your plant and then, asset number by asset number, give it a current cost. But few insurers would have all the data you need. The last option is the one most used and that is to get the as-constructed asset value from the company accountants for each asset and then increase the as-constructed cost for inflation over the intervening years since construction.

The last option is not to hard to do if you use an average annual inflation increase on all the as-constructed values. Some complications arise if the assets have been revalued. When assets are revalued the revaluation is the monetary worth of the asset at that point in time, it is what people will pay for it and not actually what it costs. In that case take the as-constructed figure and multiply it by the average annual inflation rate. Complication also arises if a lot of capital work was done on maintenance and expensed. In that case the asset values in the asset register are undervalued. This is not usually a major issue.

Unfortunately using as-constructed costs does not take into effect the savings made from the introduction of new technology into the plant. Using new and better technology means the plant can now be made for less cost. But the accountant's books only register actual historical costs and would show a higher value than it would really need to be. This also is not usually a problem unless your plant has had a major technological change introduced into it since construction. Talk to the accountants in that case and come up with new asset values that they are happy with.

If you cannot get as-constructed values (the asset register should have them) then a rough way to estimate RAV is to get the total asset value for the entire plant as it is today from the accountants. The current value allows for depreciation. Then factor back in the average depreciation and the average inflation rates by asset number. The accountants will have both those rates.

The other side of the benchmarking equation is the annual maintenance costs. How true are your maintenance costs? If you include plant improvements, safety improvements, environmental improvements, site security improvements, small capital works and equipment modifications in the maintenance cost then you have an unreal, higher figure than the true maintenance cost for maintaining your plant. Your benchmark result will be higher than it should be.

Maintenance planning and scheduling

ABSTRACT
Maintenance planning and scheduling. The book "MAINTENANCE PLANNING AND SCHEDULING HANDBOOK" by Doc Palmer and published by McGraw Hill presents the recommended way to plan for a maintenance crew. Keywords: maintenance planning, scheduling, planner, performance, productivity, planner.

The book begins with the sentence - "The Maintenance Planning and Scheduling Handbook shows how to improve dramatically the productivity of maintenance." But what else would you expect the author to say? However the book soon starts quoting verifiable productivity improvements of 50% above the results achieved when not using planning.

Doc Palmer separates planning and scheduling. For each he gives 6 principles to work by. He sees planning as an entirely distinct step to scheduling. The planner is located separate to the maintenance department so he cannot be diverted from the job of planning by sudden problems.

The planner is not the scheduler. The maintenance supervisor schedules. The planner provides a complete work package – purchased materials, tool list, procedures, drawings, past equipment history, job times, manning requirements and external resource requirements such as cranes – and then walks away to prepare the next work order.

Breakdown jobs cannot be planned and Doc advises that breakdowns go directly to the maintenance supervisor to run with. The planner does not become involved in breakdowns or in any job once started. The planner is there to get ahead of the day-to-day work so that fresh work is always prepared for the crew before they finish their current jobs.

If the crew find a problem once a planned job is started the crew solves the problem themselves without involving the planner. The planner is advised of the problem in the report when the work order is returned. He makes a note in the plant records so he can plan and prepare for it next time.

Productivity is maximised because all the planning, parts and information is provided and the tradesmen can be immediately put onto the tools to do the job.

Doc also indicates that a good planner has particular attributes that are critical for success and provides a useful list of them in the appendix to his book.

This book is well worth reading if you are interested in maximising the productivity and performance of your maintenance crews.

Reviewed by Mike Sondalini

Understanding the Weibull shape parameters provides the owners, users and maintainers of equipment with a tool to predict the behaviour of engineering components and select effective maintenance strategies.

β<1 implies infant mortality. Electronic and mechanical components often have high failure rates initially. Some components are 'burnt in' prior to use, others require careful commissioning after installation.

β=1 implies random failures. These failures are independent of time where an old part is as good as a new part. Maintenance overhauls are not appropriate. Condition monitoring and inspection are strategies used to detect the onset of failure, and reduce the consequences of failure.

1<β<4 implies early wear out. Failures of this type are not normally expected within the design life. Failure mechanisms such as corrosion, erosion, low cycle fatigue and bearing failures fall in this range. Maintenance often involves a periodic rework or life extension task.

β>4 these are wear out or end of life failures. They should not appear within the design life. Appropriate maintenance is often renewal. An ideal profile for equipment is to have a negligible failure probability throughout its design life followed by a steep b where the replacement age can be predicted. Age related failures include stress corrosion cracking, creep, high cycle fatigue, and erosion.

Today Weibull analysis is commonly being used to predict safe intervals for operation in applications such as warranty periods, shutdown intervals and increasingly in setting maintenance and inspection intervals. With more sophisticated CMMS in use, the collection of failure mode data is more reliable and data analysis can be handled electronically.

Many organisations have been keeping records of failures manually or in computer systems, but not using the data in any useful way. Failure data is the best source of reliability information available. It has relevance and is easy for site people to relate their own experience to. By transforming it into useful information from which failure forecasts can be made it can then be used to model the benefits of alternative strategies or to analyse the reliability of current systems and the capacity to meet operating needs.

Life cycle Simulation

Having determined the Weibull parameters that best represent failure mode behaviour, they can be used to simulate performance over extended periods of time. Modern simulation packages involve a simulation engine that generates random numbers in accordance with the Weibull parameters over a specified system lifetime. Used in conjunction with Reliability Centered Maintenance (RCM) principles, the process of selecting maintenance and inspection intervals becomes a process of playing "what if" by comparing different reliability strategies.

Michael Drew – Director, Arms Reliability Engineers (This section has been edited)

ARMS Reliability Engineers provide training in the use of these methods and can assist companies with introduction of the methodologies into their organisations. For improving maintenance decisions and optimising plant up-time see www.reliability.com.au for more information.

How To Complete The 5 Whys

1. Write down the specific problem. Writing the issue helps you formalize the problem and describe it completely. It also helps a team focus on the same problem.

2. Ask Why the problem happens and write the answer down below the problem.

3. If the answer you just provided doesn't identify the root cause of the problem that you wrote down in step 1, ask Why again and write that answer down.

4. Loop back to step 3 until the team is in agreement that the problem's root cause is identified. Again, this may take fewer or more times than five Whys.

Problem Statement: You are on your way home from work and your car stops in the middle of the road.

1. Why did your car stop?
- Because it ran out of gas.
2. Why did it run out of gas?
- Because I didn't buy any gas on my way to work.
3. Why didn't you buy any gas this morning?
- Because I didn't have any money.
4. Why didn't you have any money?
- Because I lost it all last night in a poker game.
5. Why did you lose your money in last night's poker game?
- Because I'm not very good at "bluffing" when I don't have a good hand.

As you can see, in both examples the final Why leads the team to a statement (root cause) that the team can take action upon. It is much quicker to come up with a system that keeps the sales director updated on recent sales or teach a person to "bluff" a hand than it is to try to directly solve the stated problems above without further investigation.