

MACHINE REPAIR OR REPLACEMENT DECISION

Michael Duggan
Researcher
LIRA

A major decision to any logging contractor is that of equipment replacement. With modern logging equipment requiring a substantial level of investment, the replacement decision may have a very significant effect on the cashflow, the bank account, the owners equity situation and future tax payable. Since it may have a variety of far reaching effects, the evaluation of the best replacement strategy can become quite complex.

Working out the right time to repair or replace equipment requires consideration of the following :

- Are major repairs needed?
- Is the machine going to be suitable for future areas?
- How long does the contract have to run?

Theoretical equipment replacement models

Equipment replacement decisions are based on experience. For most in the

logging industry this experience is not described as hard recorded detail, but is instead more a combination of intuition and rules of thumb. Thus, depending on your location, a skidder's useful life might be, say 6000 hours and a tractors 10 000 hours. Other criteria for machine replacement can include - when repair and maintenance seem "too much" compared to what you are experienced to date or when you have had 2000 hours on a rebuilt motor.

There are available various analytical models for determining the optimum machine replacement time. Significantly all rely on keeping good records of costs actually incurred with the present machine ie. a thorough recording of the "experience". Once again we return to the importance of record keeping.

The underlying feature of the theoretical models is that they recognise the cumulative average total cost per hour of machine ownership. In general this measure behaves the following way :

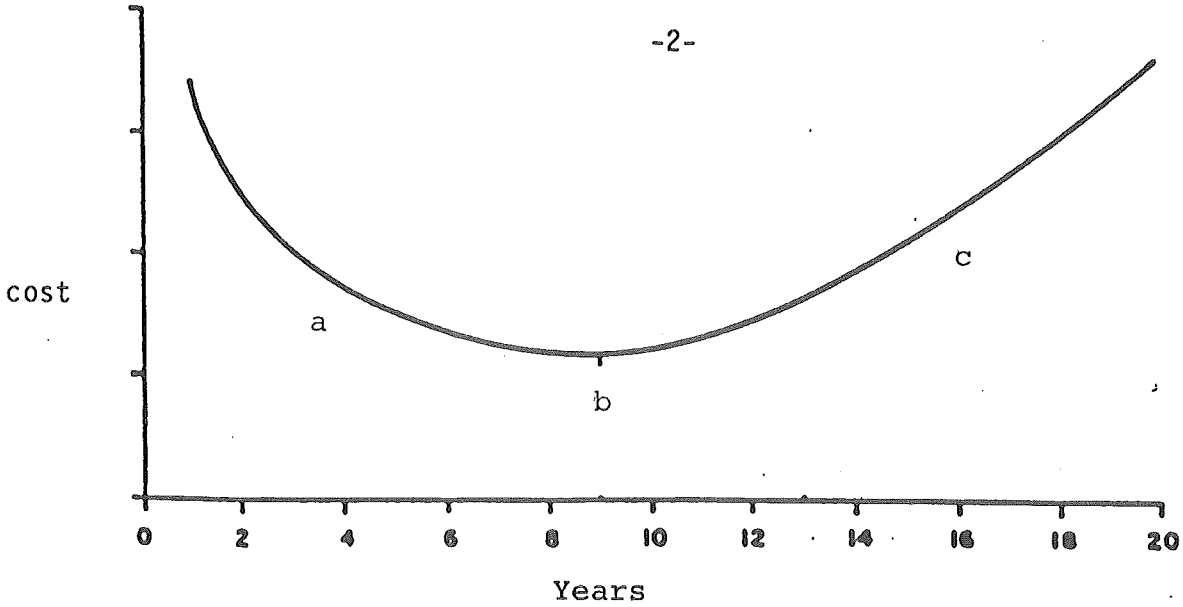


Figure 1

- a - cumulative average costs decrease as they become spread over more hours
- b - cumulative average costs at a minimum. The optimum age for machine replacement.
- c - Cumulative average cost increases as repair and maintenance costs increase.

Various degrees of complexity can be introduced into the analysis, especially if taxation and accounting for the time value of money are included. To what extent the refinements improve the analysis are arguable and this is examined in a recent Canadian report. Feric Report, TR68, "Two Replacement models for BC Coastal Logging Equipment" compares a simple replacement model (before tax and non discounted cash flow) with a more complex model (after tax, discounted cash flow).

Interestingly, for the equipment tested in the report, both methods gave similar replacement ages and therefore the simpler model is recommended.

The shape of cumulative cost curve varies with machine type.

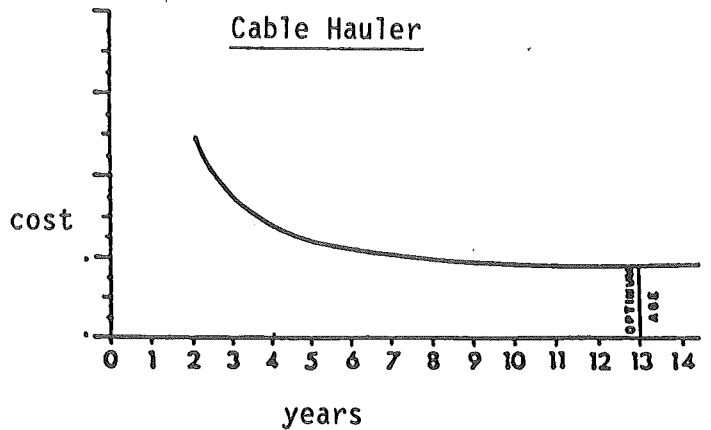


Figure 2 : Cumulative average total cost for a Cable Hauler

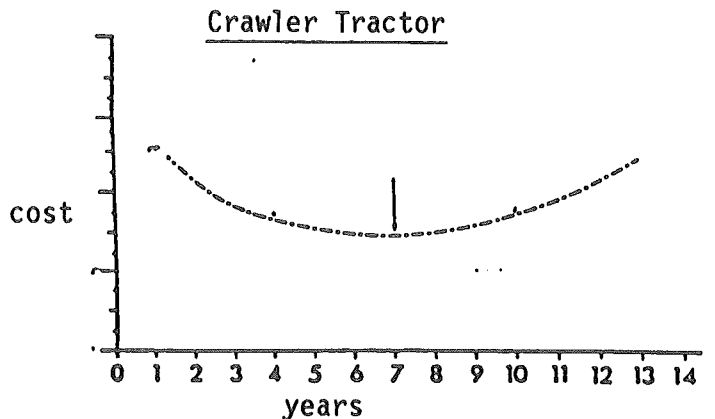


Figure 3 : Cumulative average total cost for a Crawler Tractor

Those with rapidly increasing repair and maintenance cost histories (Figure 2) are more sensitive to timely replacement and should be replaced on time, while those with less rapid repair and maintenance costs (Figure 3) can be retained without incurring the same level of cost penalty.

Other applications for equipment replacement models

Because of the very high cost of owning and operating equipment, managers may need to carry out detailed financial analyses of a number of possible alternatives. In the logging industry, for example, a logging manager may want to know what type of equipment to purchase for both operational and financial reasons or he may want to carry out a systems analysis involving a number of items of equipment in various configurations. Alternatively, he may want simply to investigate the costs and profitability implications of either carrying out a major overhaul on an item of equipment that is already operated 10 000 hours or trading the old machine in on a new one.

Additionally, sensitivity studies can be conducted to ascertain the effect of various inputs including method of financing, provision for taxation requirements, depreciation, loss of equipment efficiency over-time, changes in repair costs, changes in labour costs, quota variations and variations in production rates for example.

Using these programs a very wide range of analyses can be carried out quickly and inexpensively, according to a company's individual requirements.

This economic replacement theory is a guide and not a rule and is only one part of the overall replacement analysis.

In our examples so far we have looked at the effect of the operating costs - R & M, fuel etc, and the owning costs - depreciation, insurance. Other equally important factors however, influencing your machine replacement decision must also be considered.

Contract Tenure

The contract term is selected as a means of

- achieving financial repayment
- generate some equity in the business
- approximate the point where the contractor must face the repair or replace decision

There are many contractors outside the Bay of Plenty region, not supplying a pulp or chip mill whose contract are based on the rapidly diminishing domestic sawmill and on the stop/go log export trade.

To these contractors, contract tenure is only a concept with planning horizons ending when the ship leaves or when the sawmill shuts down.

At the other end of the scale, where the market exists an equally unhealthy situation can arise through the adoption of the "open slather" tendering system as a means of short term cost saving.

The cost of downtime

The planning for repairs and maintenance has been simplified initially by the warranties offered by some machinery suppliers. Some of these warranties are optional, the others are built into the purchase price so either way, with or without warranties the machine purchaser pays for R & M. The period of cover usually extends up to 3 year periods when the major repair and maintenance cost begin to be incurred.

None of the warranties take into account the effect of downtime on lost productivity.

With the more expensive repairs occurring after year 3 of machine life, the machine spends an increasing proportion of time parked up on the skid, generating a reduced income and becomes less able to cover repair costs.

Obsolescence

Technical obsolescence. A machine may lose value very quickly once it becomes outdated technology. The resale value of a "B" series skidder may drop substantially when the "C" series is announced, and an "A" series machine suffers even more, regardless of how low its total hours.

Functional obsolescence. Is the machine suited to present on future operations?

- Is it suited to the piece-size?
- Are the landings better suited to a hydraulic boom loader or a front-end loader?
- Will a newer model increase productivity and reduce costs?

Taxation and financial advantages

Assuming that your machine is able to perform all the functions required of it in the future and future work is assured, the tax advantages associated with the decision to repair or replace a piece of machinery becomes major consideration.

The cost of most repairs to logging machinery are treated as tax deductible in the same year they occur, while the expenditure in purchasing a new piece of equipment must be capitalised and depreciated over time.

When more than one piece of machinery makes up a gang the repair or

replacement of an individual machine cannot be considered in isolation. Rather the cashflow of the contractor usually dictates a staggered machinery replacement policy, which balances income and expenditure.

Having decided that the machine has come to the end of its economic life, it is important to consider whether to replace with a new machine or to rebuild your existing machine. With high interest rates and a limited second hand market for used log skidders, rebuilding can be one way of reducing debt loading.

By taking advantage of new component designs it is possible, for a contractor who chooses to rebuild, to bring a machine up to essentially better than new condition.

Conversely however - the judgment by those involved in the rebuild on the expected life of each component, is critical.

In general, rebuilding is more economic with types of equipment that have not undergone significant technological changes. Rebuilding should be considered if the rebuilt machine will do the same work as a new one and if a new machine does not offer significant technological advantages.

A general rule of thumb, used by the British Columbia Logging Industry, is that rebuilding should be considered when the cost of rebuilding is up to half the cost of a new machine.

In the Bay of Plenty a complete rebuild including new tyres costs approximately 40 to 50% of the price of a new machine.

Conclusion

- Most logging machinery works continuously and after its economic life, is of little value to either the contractor or the machinery dealers.

- Logging machinery is purpose-built and used logging machinery is not readily marketable outside the logging industry.

Meynink R Equipment Replacement, Investment and Cost analysis program (ERICA) Paper presented to AFDI conference Albury, 1987

- Logging machinery suppliers generally are not interested in accumulating hard to sell second hand logging equipment.

Meynink R Forfront Pty Ltd, Canberra, Pers. Com

- In contract logging a high degree of reliability is required of the prime mover. This reliability cannot be guaranteed from a machine which has exceeded its economic life.

Bulter D A
et al Scheduling replacement of logging equipment some quantitative guidelines, Forest Research Lab. Research Bulletin 32 1980

In some cases, rebuilding can be considered to be a viable alternative to machine replacement, however each case must be judged on its merits. The provision of a short term hire machine, during the rebuild, is essential to ensure a continuity of income.

Vodak N C
et al Business Management book for Eastern Timber Harvesting USFS 1983

- We are moving away from trying to extract 20 000 hours from a machine that was designed for 10 000 hours and moving toward the situation where the difference in price between the resale value and salvage or scrap value of a machine is rapidly diminishing.

The depreciation of a the new machine is the replacement fund for the next machine. This fund is substantially diminished by the operation of a used machine, and while the owning and operating costs for the machine may be able to be covered, assuming R & M costs can be maintained at a serviceable level, there will not be enough put aside to purchase new equipment when the used equipment finally turns up its toes, or is deemed obsolete by the company.

References

Sinclair A W Two replacement models for B C Coastal logging equipment. Feric Technical release 68,1986

Liley W B Depreciation and the Logging Business LIRA Brief report Vol 12 No 8, 1987

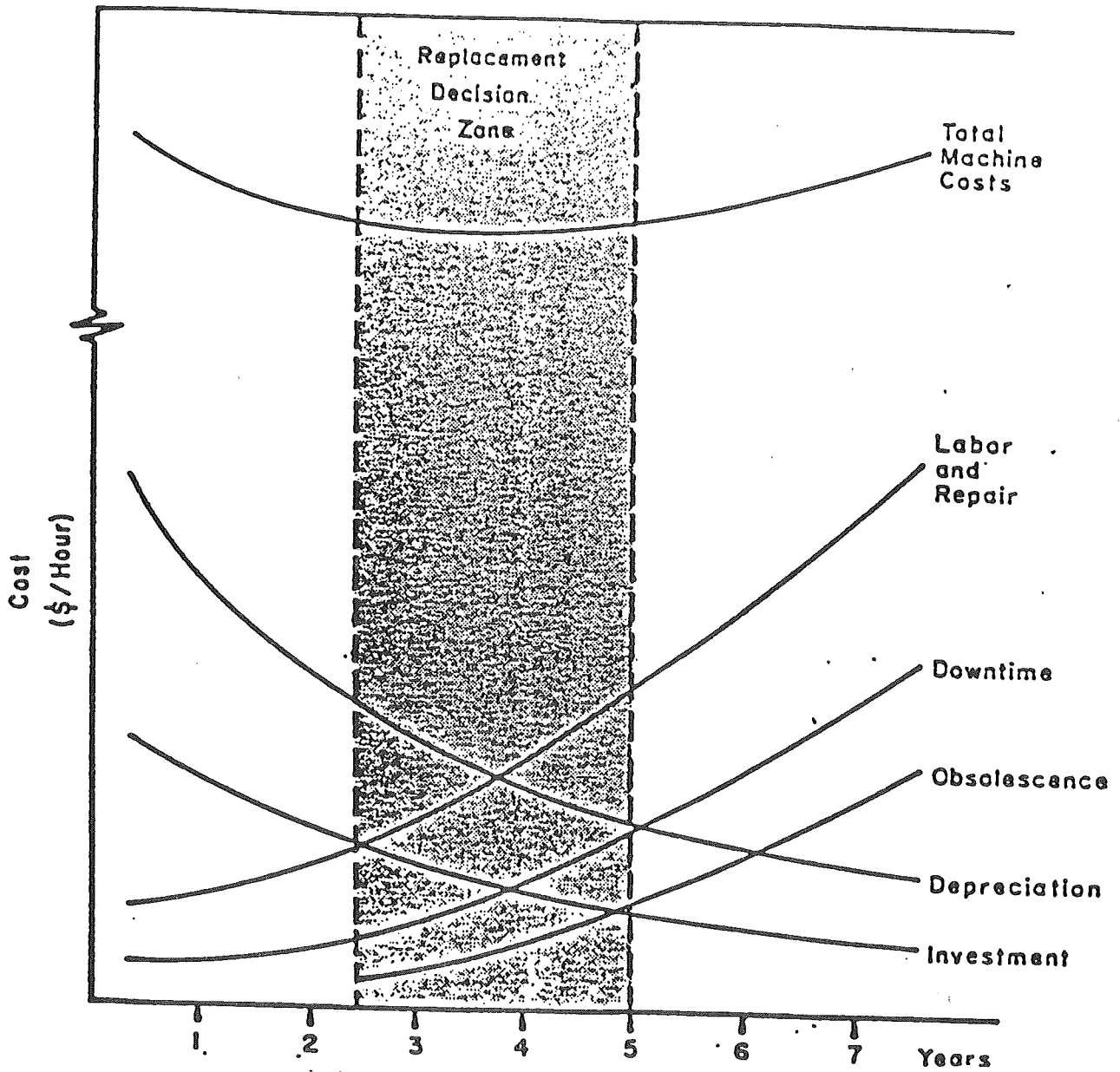


Figure 4 : Graph of Equipment Replacement Zone Using the Cumulative Cost Method