Criteria for the determination of economic replacement of mining equipment

Bertus Johann Steyn

SHORT DISSERTATION

submitted in partial fulfilment of the requirements for the degree

MAGISTER COMMERCII

in

BUSINESS MANAGEMENT

in the

FACULTY OF ECONOMIC AND MANAGEMENT SCIENCES

at

RAND AFRIKAANS UNIVERSITY

Study Leader: J Bredenkamp

October 2003

Acknowledgements

The author wishes to thank his employer for the opportunity to study towards this degree. He is also thankful for the support he received from his wife. Finally, he also wishes to thank his supervisor, Mr Bredenkamp, for his time, assistance and encouragement to complete this study. The author also thanks his fellow employees at Barloworld Equipment Company who contributed their time and knowledge in assisting him with this study.

Bertus Steyn
October 2003
Pretoria

Abstract

This study investigates the criteria for determining the economic lifespan of mining equipment from the perspective of a supplier of maintenance and repair contracts. The Net Present Value method was selected as the method of choice in developing the model. The model was applied to three different mining equipment models where the life of the mining equipment where extended to 100,000 hours. The results indicate that the model can be used as a criterion for determining the economic life of mining equipment. It is calculated that all three mining equipment models have an economic life span of less than 100,000 hours.

Summary

This study answered one of the most pressing questions in the mining industry, namely when to replace a piece of equipment with new equipment, or otherwise formalised, what is the economic life span of a piece of equipment. This problem of determining the replacement time of the mining equipment has been present since the first mining equipment was used. Various models and methods were developed over the years. However, none could give a definite answer to the problem.

This study started off with a study of the available literature. The most important finding of the literature study is that the methods that exist to investigate the economic life span of mining equipment do this over short periods (up to 35,000 hours). In view of the results of the literature study, it was decided that this study will investigate the criteria for determining the economic live of mining equipment over longer periods (up to 100,000 hours).

After the literature study was concluded, several methods that were mentioned in the literature was evaluated as a criterion. From these methods, the Net Present Value method was selected as the most effective criterion for determining the economic life span of mining equipment and was used in the development of the model.

The model was tested against a selection of mining equipment. The selection of mining equipment consisted of five Off Highway Trucks (mining equipment on which the model is developed), two Wheel Loaders and two Front Shovels.

The results of the model indicated that the model can be used. It does, however, depend on certain aspects:

1) The accuracy of the budget
2) The application in which the mining equipment will operate

3) Conditions of use

The study answers the question: When will the mining equipment give a positive return on the investment? It will thus give a value for the economic life span of the mining equipment. This value will be the minimum time that the mining equipment must be on the contract to ensure a positive return on the investment. If the mining equipment is utilised for a shorter period than planned not all the money will be recovered and the mining equipment will give a negative return on the investment.

The results can now be used to determine what must be done to achieve a positive Net Present Value. For example lower the cost with 10% to see if the Net Present Value becomes positive. The biggest advantage of the model is that it is robust and can thus be applied to new mining equipment (test of it will be a profitable contract) and current equipment. For current equipment a forward projection can be done and it will highlight problematic mining equipment immediately, and a decision can be made on the future of this mining equipment.

Contents

List of figures

List of tables

1 Introduction

1.1 Background

Barloworld Equipment Company (BEC) is one of a number of companies in the Barloworld Group. BEC is the sole distributor of Caterpillar (CAT) earthmoving equipment in Southern Africa.

To keep a competitive edge, BEC has introduced many new ideas to do business. One of the new ideas is the Maintenance and Repairs Contracts (MARC). MARC is a contract where BEC does all the maintenance and repairs on the customer's Caterpillar mining equipment with the customer only paying an hourly rate (and not for the individual maintenance and repairs tasks).

BEC has always advised customers on the best way to maintain and operate their Caterpillar mining equipment, but the customer has invariable cut-back on maintenance and repairs to save on the operating costs. By doing the maintenance and repairs on the mining equipment, BEC uses the latest methods and techniques and can thus lower the operating cost of the mining equipment. This happens without cutting back on maintenance and repairs to lower the operating cost. The customer does not see the cost other than through an hourly Maintenance and Repair contract rate.

The advantage for BEC is that BEC is guaranteed 100% of the customer's business because BEC is doing all the work on the mining equipment. At present BEC manages 17 contracts with ±300 models of mining equipment.

BEC has calculated a life cycle cost (LCC), for each of the mining equipment models that predicts the cost of the mining equipment over the assumed life of that mining equipment. The LCC process will result in a rate table that will give a different rate for every 5,000 hours (for example) the mining equipment is in use. The life cycle cost comprises of all the interventions, maintenance and repairs that BEC foresees to occur on the mining equipment over the contract period. An intervention can be a replacement of an engine or a repair of a hydraulic hose on the mining equipment or a normal routine maintenance service.

Thus, the benefit to the customer is that all the maintenance and repair costs for mining equipment are fixed over the life of the mining equipment. The customer does not have to budget extra for unforeseen repairs on the mining equipment. BEC carries all the risk on the customer's mining equipment (for example BEC budgets for two engine repairs, but if for unforeseen reasons, there are three failures, one of the failures are for BEC own account). The customer pays only a monthly amount based on the monthly utilisation of the mining equipment.

The following table is an example of the LCC rate table:

Start hours	End hours	Rate per hour
1	5,000	R 10.37
5,001	10,000	R 82.76
10,001	15,000	R 268.88
15,001	20,000	R 178.69
20,001	25,000	R 218.58
25,001	30,000	R 133.06
30,001	35,000	R 10.37
35,001	40,000	R 384.57
40,001	45,000	R 82.76
45,001	50,000	R 31.54
Average		R 140.16

Table 1 LCC example

The problem that arises is that in the interval 35,001 - 40,000 (Table 1 (page 2)) the customer pays R384.57 per hour. In this interval, the piece of equipment will be overhauled and repaired to be as good as new. Thus, the customer will be spending R1,922,850 (R384.57 x 5000 hours) on the mining equipment, which is approximately a third of a new mining equipment's price (if the trade in value of the mining equipment as well as the difference in the rate is taken into account).

Some of the customers ponder on the idea to replace the mining equipment at this stage, as opposed to the full overhaul of the mining equipment. The benefit for customer, if the mining equipment is replaced, is that the new mining equipment will be the latest technology that will improve productivity. The customer is then back in the first interval and will only have to pay R10.37 per hour used for the first interval.

A further complication is that not all the components on a fleet, lasts the same amount of hours. For example, an engine on one truck can last for 26,000 hours but on the next truck, it only lasts 18,000 hours. This dramatically influences the profitability of the contract and rises uncertainty, and thus the risk.

What would the best time to replace the mining equipment? Or must the mining equipment be prepared and continued with the contract?

1.2 Problem statement

The challenge to determine the economic life span of mining equipment has been present from the first time mining equipment was ever used. Various models were developed but none could give a definite answer to the problem.

Ultimately, BEC carries the risk on the mining equipment and it would be in the interest of BEC to determine the correct replacement policy on the mining equipment under contract to minimise the cost, risk and maximise the profits.

Therefore, the questions that must be answered are the following.

- Must BEC sell a fixed term for the contract? In other words, should BEC sell the contract for 50,000 hours; or is it more economical to review the length of the contract quarterly, identifying problem mining equipment and terminating the contract on these mining equipment prematurely?
- How long must BEC continue with good mining equipment (terminate at 50,000 hours or is 60,000 a more economical number)?

Thus, this dissertation is an exploratory study to investigate criteria for determining the economic life span of mining equipment.

1.3 Research methodology

The following research methodology is followed in the study to investigate criteria for determining economic replacement of mining equipment.

1.3.1 Literature study

The study will be based on a literature study carried out on the available literature on the determination of the economic life span of mining equipment. The literature study will be used to gain a better understanding of the problem and the various methods available to provide criteria for determining the economic life span of mining equipment. The literature is discussed with regard to the applicability towards the goals of the study (as outlined in the problem statement).

1.3.2 Different methods

After conducting the literature study, this study will start off by investigating the different methods found in the literature study in determining the life span of mining equipment. The methods are evaluated in terms of their applicability. The selected method (the Net Present Value Method) will be used to build the model that will be applied in the study.

1.3.3 The development of the model

The model is developed using the Net Present Value method as a criterion for determining the economic life span of mining equipment. The main idea behind the Net Present Value method is to determine when the proposed investment or project will be worth more than the original capital outlay or when the investment/project will start to add value to the company.

If the value that is calculated from the Net Present Value method is a positive value, it will indicate that the investment/project has added value to the company. If the value calculated is negative no value is created for the company.

Because the study also assumes the mining equipment is the customers' property, all the owning cost (other expenses) will be for the customers account. Thus, only the maintenance and repair costs are taken into account and all the other costs such as tyres, fuel and operator's salaries are for the mining equipment owner's account (customer in this instance).

The operating cash flows are the difference between the sales (expected income) and the expenses. The expected income is the invoices that the customer will be charged for the use of the mining equipment. The expenses will be the expenses that are used to repair the mining equipment in case of a failure and the routine maintenance tasks.

1.3.4 The application of the model

The life span of the mining equipment is divided in fixed intervals (5,000 hours). For each of the this intervals the Net Present Value method is applied to determine whether the mining equipment has a positive Net Present Value up to that period. The result of the calculation is then displayed on a graph to determine the lowest boundary for the economic life span of the mining equipment.

The study assumes that the lowest boundary for the economic life span of the mining equipment is indicated by the point on the graph where the graph changes from negative to positive value. The mining equipment must be used up to this point before replacing the mining equipment to add value to BEC for selling the contract and taking over the risk of the mining equipment.

1.3.5 Sample selection and sample size

The model is tested on a selection of current mining equipment on a Maintenance and Repair contract at one specific site. Only one site was selected to rule out site differences such as travel cost, for example, that is included or not included on work order level (and thus influences the cash outflow) and cannot be identified separately in the assumptions. The selected mining equipment consist of five Off Highway Trucks (mining equipment on which the model is developed), two Wheel Loaders and two Front Shovels. The latter two models' selection was done to compensate for the in-accuracy of the budgets of the mining equipment (if in-accuracy exists), as this could influence the decision of the applicability of the model.

1.3.6 Constraints of the study

The biggest challenge is to find reliable data to test the model. Because the MARC is a relatively new concept, there are no completed contracts available and thus no data that can be used, exist.

This study overcomes this problem by using the actual data that is available (up to half of the mining equipment life) and then forecast the rest of the presumed life span of the mining equipment by using the original budget's component lives. Where the budget period is extended, the original budget is used for the extension.

1.3.7 Constraints of the model

The model was developed to handle any set of data (mining equipment data to determine the economic life of) that the model is applied on. The model was tested on various models without any difficulties.

1.4 Demarcation of the chapters

The study is divided into five chapters, which are structured as follows:

Chapter 1: Introduction
This chapter provides the introduction to the study with the problem statement and a discussion on the research methodology that will be followed in the study.

Chapter 2: Literature study
A literature study is carried out regarding the field of the economic life of mining equipment/projects. Various criteria in determining the economic life of mining equipment are identified and the applicability of the Net Present Value method is discussed and motivated.

Chapter 3: The Net Present Value method model
In this chapter, the theoretical background and the approach that was followed to develop the model by using the Net Present Value method to determine the

economic life span of mining equipment will be explained. All the assumptions made in the study will be listed and explained in detail.

Chapter 4: Results

In chapter four, the Net Present Value Method model developed in the previous chapter, is applied to different types of mining equipment to determine the economic life span of the mining equipment. The results of the model applied to different mining equipment are listed and discussed.

Chapter 5: Conclusions and recommendations

In the last chapter, a conclusion is reached regarding the use of the model to determine the economic life span of the mining equipment. Recommendations are made for the use of the model and further studies.

The following chapter therefore provides an overview of the relevant literature.

2 Literature study

2.1 Introduction and overview

The acquisition of mining equipment is an investment in "capital goods" that is either a good investment (making the company money or saving the company money) or a bad investment (the money cannot be recuperated from the investment) and can therefore constitute a financial risk. The mining equipment, over its lifetime, can be seen as a project. The project starts when the feasibility studies are done, and it ends when the mining equipment is terminated.

Thus, the literature study investigates the following aspects, to determine if the aspects can be used to determine the economic life of mining equipment. The aspects investigated are:

1) Methods to evaluate financial risk
2) Methods to evaluate project risk
3) Methods that use deductive methods in making replacement decisions
4) The results of studies attempting to identify criteria for determining the economic life span of the mining equipment on a financial basis
5) Capital budgeting methods.

The different criteria that could possibility be applied will be discussed and their applicability in the scope of this study will be evaluated.

2.2 Financial risk

In the first aspect of the literature study, the study investigates methods used in evaluating financial risks for the applicability in the determining the economic life span of mining equipment, as the impact of failure is normally measured in monetary values.

Gouws (1993:8) has done a study on risk exposure in foreign exchange. This has become even more applicable now with the fluctuating exchange rate and will definitely influence the decision to repair or replace. The replacement price of new mining equipment is more expensive than the repair of mining equipment. Thus, if a more favourable exchange rate is expected in the near future, the machine could be repaired (the cheaper option). This will extend the mining equipment's life span to the time that the favourable exchange rate will come into effect and then the mining equipment can be replaced.

Grandell (1991:9) presents discussions of selected aspects of the collective risk theory as part of insurance or actuarial mathematics. This method for determining the length of the insurance period of mining equipment cannot be used to determine economic life of the mining equipment.

Vose (1996:25) uses various techniques to model risk. The writer gives more attention to the mathematical presentation of risk than the management of the process. This study makes use of proven techniques and provides guidelines for modelling risk using the Monte Carlo model. The Monte Carlo simulation can be used to determine the part of the life span of the mining equipment that is not yet completed.

Deshotels & Zimmerman (1995:6) discuss risk management methods against the background of certain facilities. It is more applicable to the human side of risk management but the principles can still be used. One facility that is under scrutiny is a nuclear plant. In the scope of this study the principles can be used, because a nuclear plant is a very sensitive plant and can be easily be a victim of hear-say (the same can happen between BEC' customers: bad news travels fast). This study gives guidelines to the project manager on what to do if a project has a few bad failures and the mining equipment puts the relationship between the mine and BEC at risk.

Parker & Beaver (1995:18) discuss risk from a financial background. If mining equipment on contract causes a negative cash flow, the risk would be most apparent on the finances. The risk of the occurrence of a negative cash flow is quantified in financial terms.

From the above descriptions of the literature available on the evaluation of financial risk, it is concluded that the methods can be used to quantify risk, but cannot provide a method for determining the economic life span of the mining equipment. In all the above studies, the period for determining the financial risk was known and not unknown as in the case in this study.

2.3 Project risk

The study now considers the literature regarding project management to investigate if any theory exists that can be used to determine the length of a project based on increase risk exposure. This is done, because project management has received much focus over the last few years.

Gentle (2000:7) gives a good overview and guidelines on the process of mitigating project risk. He pays specific attention to the application of capital projects. This is helpful, because it also gives a means to mitigate the risk. Lastly, the study suggests ways to get go-ahead in a project with ways to show that the financial risk of the project has been taken care of. The study also provides guidelines in identifying the risks. This study is more a qualitative work than it is a quantitative work.

Raubenheimer (2000:20) has looked at the problem from an engineering perspective. This is a quantitative study, which uses an actual project to discuss the management process. The study concentrates on capital projects, which is comparable to MARC, but no calculations are done regarding the length of the project.

Riskdriver consortium (2001:21) discusses project risk management and discusses all the steps involved in generating the management principles necessary to set up the project. The information on the Internet site also describes the process of project risk management, how to implement risk management in an organisation, tools, as well as techniques and documents used by risk management.

Chong & Brown (2000:4) discuss project risk from a technical perspective. The authors go further by discussing the influences from outside factors such as operations.

Pretorius (2001:19) supplies information on a failed project and gives reasons for the failure. Pretorius (2001:19) then compares this information with a project that was a success and lists all the critical success factors. No mention is made on whether the variable length of a project would have an influence on the success of the project.

The basic ideas of project management are discussed by Wysocki, Beck & Crane (1995:27). Relevant from this study is the fact that the stress experience by project managers running the project also influences the success of the contracts. It does however, not mention what the effect on the length of the contract would be.

The material discussed, mostly looks at projects that are completed or are close to completion and makes comments regarding factors that have influenced the project's success or failure. None of the literature reviewed commented on how the length of the project will influence the risk of the project or the success of the project.

2.4 Deductive replacement decisions

Wimble (1975:26) describes the entire acquisition process that a specific company has experienced. As part of his description, he discusses the replacement of the mining equipment as well as the optimum replacement period. He comes to the conclusion that prior knowledge of the mining equipment application and information from the equipment manufacturer must be used to determine the optimum replacement time. He further says that each of the mining equipment needs to be evaluated on its own. If the mining equipment has a bad cost record, it must be replaced. As in the Caterpillar study (Caterpillar, 1969:13), he notes that if the mining equipment is kept for too long the obsolescence cost will get to high. An even more important point is that the calculations should not be seen as the final decision, as it can still be changed in economical difficult times.

Sang-Hoon & Srinivasan (2003:23) describe the profitability of the replacement decision from the perspective of electronic equipment. The approach that they follow makes use of the hazard function (the conditional likelihood of an event occurring at time t given that the event has not occurred by time t-1). Their approach then integrates this with an individual-level multi-attribute utility model. They conclude that costs and the possibility of a better product influence the replacement decision. The rationale of this study can be used to predict the human side in the decision-making process more accurately and to link engineering terms, such as the hazard rate, mean time between failures (MTBF) and mean time to repairs (MTTR) to the human side of decision making.

Lynch (2000:12) proposes a strategic process to evaluate a new purchase and then gives financial evaluation techniques to determine whether the purchase is viable. He lists a few cautions regarding the use of financial criteria/evaluation techniques:

- Not all future sales/expenses (cash flows) can be accurately determined (it occurs 10 years into the future).

- They can sometimes use a too long life cycle (product obsolescence can play a big role).
- They sometimes over-emphasise the cash generated/benefit and the evaluation concentrates too much on the financial benefits, ignoring the strategic benefits that are more difficult to quantify.

Lynch (2000:12) further notes that after all the calculations have been done, judgemental evaluation needs to be added, such as the risks involved, the financial exposure, the possibility of the project failing and the opportunity cost (funds to be used for alternative projects).

Hertz (1964:10) points out that there is risk involved in every decision, even if the decision is based on sound calculations. Every assumption made carries a certain portion of uncertainty and if many assumptions are made this uncertainty causes risk. Hertz (1964:10) then demonstrates a method to "compute" the risk. He describes a method where the uncertainty/assumptions have been taken into account and then postulates that the kind of uncertainty can be evaluated. Knowing the level of uncertainty, the results can be better evaluated.

Ayton (1998:3) discusses the memory based forecasting or experience. He says that any statistical forecasting method will not be perfect. People still use these methods because that they want something to base their decisions on. This could create a perfect model. However, people will still say that the answers could be different, as experience varies from person to person.

This section demonstrates that the replacement decision is influenced by many factors, such as deductive methods (methods based on experience or gut feel). None of the deductive methods gives a useable method to determine the economic life span of mining equipment. In the last section, the financial methods will be discussed.

2.5 *Financial decision methods*

Mclean (1976:15) has done a study on improving the methods in evaluating new capital investments. He compares three methods used in evaluating new capital investments and then concludes that the discounted cash flow method should be used in the process of evaluating new capital investments. Mclean also demonstrates that three different projects with the same investment and period, but with different repayment values, will not have the same merit in adopting the projects. This can only be determined by applying the discounted cash flow method to the projects.

Vorster (Date unknown: 24) describes the replacement policy from an engineering point of view. He also makes the comment that the cost patterns (new mining equipment) will be different to the cost patterns of current mining equipment. He discusses the replacement policy by comparing a defender (current mining equipment) with the challenger (new technology and advanced mining equipment). He starts of with the bathtub curve, then makes the comment that the average cost is not a sufficient vertical-axis, and then calculates the cumulative costs, which is then used on the vertical-axis. With the help of this new graph, he makes predictions regarding the best replacement time of the mining equipment. A shortcoming, in the author's opinion, is that renewing some of the components, which does not influence the cost curve that much, causes the graph to become flat again, and causes longer life span than expected. A very interesting conclusion is reached, which determines that the decision maker should make a decision based on experience. He ends the paper with a discussion on the calculation of availability and its importance (another source for decision-making) in the replacement decision.

McDonald, Kucera & Van der Merwe (1983:14) use the above study (Vorster, Date unknown: 24). However, to get a more accurate result, they suggest that regression analysis should be used to fit the best line to determine the cost behaviour of the mining equipment. Again, the author raises the concern that this is not the most accurate way to determine the line. They then developed a computer programme based on the method described by Vorster (Date unknown: 24) to determine best economic life span of mining equipment by using the regression analysis for the cost calculation.

The objective of Atkins's (1990:2) study was to determine if the mining equipment have an optimum replacement life span or whether the mining equipment should be used indefinitely. He uses the previous study as starting point, because his feeling is that the replacement time, calculated with McDonald *et al.* (1983:14), was to low. He was awarded the luxury that the replacement time of the previous method was used as a starting point, meaning the mine runs the mining equipment past the replacement times, to determine whether the calculated times of McDonald *et al.* (1983:14) are the optimum time. In this study, he took all the costs in consideration that will influence the calculations (operator labour, fuel, lubes, parts and engineering labour). The results of the study suggest that the best replacement time will be in a window of 22,000 – 30,000 hours. The study then summarised its findings stating that no financial benefit will be achieved to extend the life span after the third rebuild. The drawback of this study is that the interval is not extended beyond the assumed life span (the study assumes the life of a truck to be 40,000 hours and then the calculations is done on that period).

Caterpillar (1969:13) states that to determine the best equipment replacement time you have to consider five elements simultaneously. These elements are:

1) Replacement and depreciation cost (the biggest cost in the first few years)
2) Investment costs
3) Maintenance and repair costs
4) Downtime costs
5) Cost of obsolescence

The first two components usually suggest that the mining equipment be kept and never be replaced and the next two aspects suggest that the mining equipment be replaced as soon as possible. The last component suggests that the mining equipment be replaced when a new model is released. Caterpillar goes further to show how the influence of the above factors varies over time (see figure 1 (page 17)).

The study does not include other operating expenses, as these are assumed to be the same for old and new mining equipment. This study then concludes that detailed records should be kept because the costs of mining equipment vary over the life time of the mining equipment and that regular calculations must be done to determine when the best time to replace the mining equipment would be. A good time replacing one piece of equipment may not be the best time for the next piece of equipment.

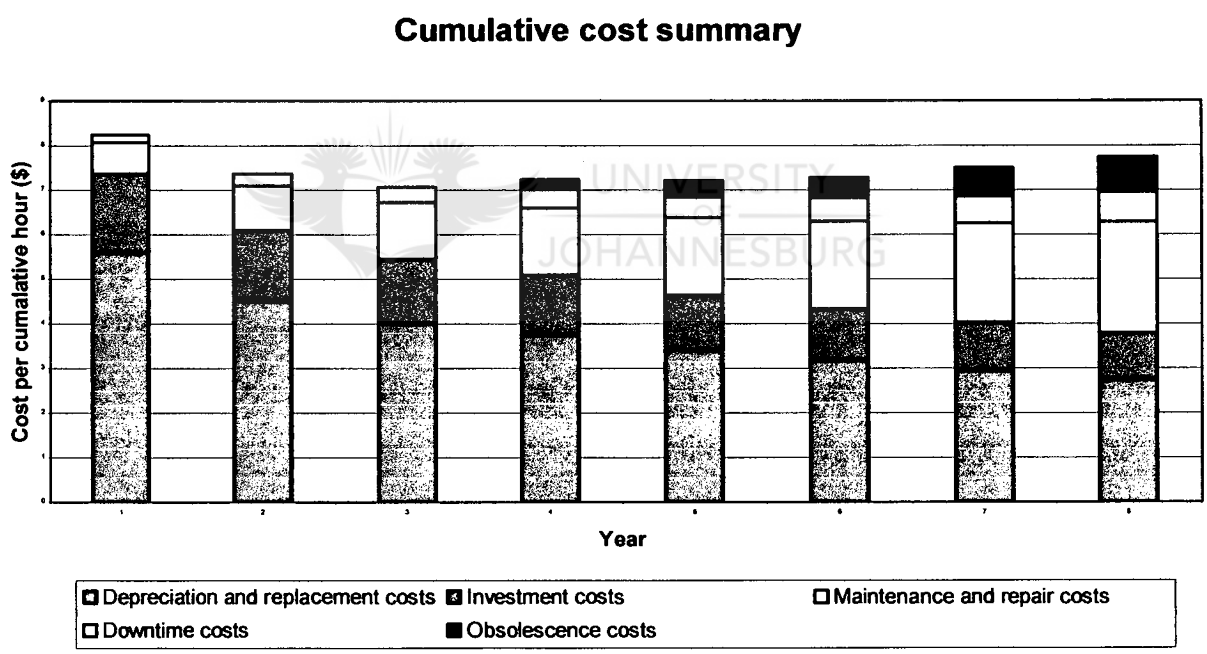


Figure 1 Costs that influence mining equipment over its life (Caterpillar (1969:13))

Mettelmann (Date unknown: 16) starts off by listing all the costs that influence the mining equipment over the lifetime of the mining equipment. The costs are:

- Loss in market value (high rates of decline in market value if used)
- Interest, insurance and taxes

- Maintenance and repair
- Associated downtime costs (if another piece of equipment is in for repair and the mining equipment under inspection, parks and cannot be used because the two pieces mining equipment depend on each other for production, i.e. a loader and an off highway truck).
- Fuel, lube oil and grease
- Operator cost

Mettelmann then postulates that a method to determine the best time to replace the mining equipment would to plot above costs on a graph and when the slope of the cumulative cost graph becomes positive the mining equipment must be replaced. No examples or values are given to demonstrate the application of this method. He only makes the comment that accurate records are essential. He then goes further to discuss the Net Present Value method to calculate when to replace the current mining equipment with newer mining equipment. He, however, never uses the Net Present Value method to determine mining equipment's economic life span.

The conclusion reached is that the above-mentioned financial methods do not supply a definite answer to the question as to when to replace mining equipment. All the methods discussed make an assumption (mostly the length of the period) that makes the answer incomplete in the context of suggesting an appropriate economic life span of the mining equipment.

2.6 *The methods used in capital budgeting*

This section of the literature study is undertaken to determine if the capital budgeting methods can be used as criteria to determine the economic life span of mining equipment.

Ross, Westerfield, Bradford & Firer (2001:22) give several financial definitions and discuss ways to determine the cost of projects and calculate the break-even point of a new project.

According to Ross *et al.* (2001:22), the major different methods used in capital budgeting are the following:

1) Net Present Value method
2) The payback rule (and the discounted payback rule)
3) The Internal rate of return (IRR)

The Net Present value method's theoretical background as well as the payback rule and the internal rate of return's theoretical background is found in this text. Ross *et al.* (2001:22) also discusses different applications for the Net Present Value method.

A general background and a discussion on the advantages and disadvantages of using the different methods will now be given.

2.6.1 The Net Present Value method

The Net Present Value calculation determines the difference between the market value and the cost of future cash flows. If the result of the calculation for the Net Present Value method is positive, the project/investment should be undertaken/made. If the result is negative, no investment should be made or the project should be discarded.

This method is also known as the Discounted Cash Flow method, where the cumulative cash flows are discounted back to today's value and then used in the calculation. The advantage of the method is that it is robust without any visible drawbacks (Ross *et al.*, 2001:22). It is also straightforward to apply.

2.6.2 The payback rule

The payback rule is the time it will take, to repay an investment. Thus, this method adds the cumulative cash flows. Should this value be greater than the original investment it is said that payback has been achieved.

This method has two big flaws, namely that the time value of money is ignored and secondly the cash flows after the investment is made are ignored. The advantage of payback rule is that it is very easy to apply and easy to understand and explain.

A variation of the payback rule is the discounted payback rule. This rule takes into account the time value of money. Thus, the investment is acceptable if the discounted payback is achieved in a certain amount of time. Ross *et al.* (2001:22) indicate that this method may reject positive Net Present Value calculations.

2.6.3 The internal rate of return

This method is closely related to the Net Present Value method. The internal rate of return is the required rate on an investment, calculated where the Net Present Value method results in a zero value. A project or investment should be accepted when the internal rate of return exceeds a certain return. The biggest disadvantage of the internal rate of return is that the method cannot accommodate non-conventional cash flows (Ross *et al.*, 2001:22).

2.7 Considerations when selecting a method

After reviewing the literature and investigating the different methods, the decision was made to use the capital budgeting methods. These are the only methods that give an indication of the economic life span of mining equipment.

Two of the capital budget methods considered namely, the payback method and the internal rate of return, were not selected because some of the drawbacks of the methods identified in the literature were deemed not to-be suitable for this study. These drawbacks will either lead to results that cannot be used, or that are not suitable for the purpose of determining the economic life span of mining equipment.

The payback method was not selected, as it is not geared for long projects (payback is not achieved early, because mining equipment can be seen as are specific projects with a longer duration). On the other hand, the internal rate of return method requires conventional cash flows. The problem of determining the economic life of mining equipment can also have non-conventional cash flows, which means that this method is un-reliant. These non-conventional cash flows can occur if, for example, major repairs are needed on the mining equipment early in the mining equipment's life, resulting in the expenditure being more than the income.

The Net Present Value method was selected as the preferred method, as there are no serious flaws reported with regard to the implementation of the method. It can also accommodate non-conventional cash flows and projects of a longer duration.

This study will thus only concentrates on the Net Present Value method due to the generality of the method and the ease of application.

2.8 Closure and preview

The findings of the literature study can be summarised as follows:

- Various methods exist to determine financial and project risk
- A limited number of studies have been done to determine the economic life span of mining equipment

- The small number of studies that exist usually compares current mining equipment to new mining equipment. This causes a problem because the improvements of the new mining equipment are not always known in advance.
- Other methods that exist that investigate the economic life of mining equipment do this over short periods (up to 35,000 hours).

In view of the above-mentioned facts, the conclusion can be drawn that it is highly relevant to investigate the criteria for determining the economic life span of mining equipment, but over longer periods. This study will investigate the applicability of the Net Present Value method in determining the life span of mining equipment over a longer period.

The replacement of mining equipment is a highly involved subject. Many factors/components influence the decision. From BEC's perspective, where the company maintains the mining equipment for the customers, some of the factors do not have that a big effect.

In the next chapter the theoretical background for the Net Present Value method will be discussed. The methodology followed when applying the Net Present Value method to determine the economic life span will be explained and the assumptions made will also be discussed.

3 The Net Present Value method model

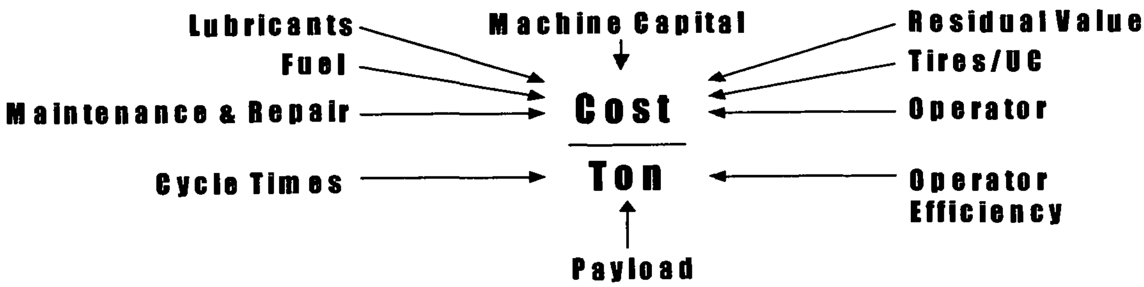
3.1 *Introduction and overview*

This chapter starts with a discussion of all the costs that influence the term cost per ton. This is done to identify all the costs that influence the operation of mining equipment. In the next paragraph the theoretical background of the Net Present Value method is given. The last section of the chapter deals with the model development and all the important assumptions are listed and discussed.

3.2 *Costs that influence production*

In the mining industry, the term cost per ton is very important, because it is used to determine the production costs of the mine. The objective of the mines is to lower the cost per ton as far as possible. This will increase the mine's profitability. The mining equipment generates "productivity" at a cost and this productivity produces material that has a monetary value and can be sold.

The following diagram demonstrates the concept of cost per ton.



From this diagram above it is clear that the following costs influence the calculation of cost per ton on the cost side (numerator):

1) Mining equipment capital (capital to buy mining equipment as well as interest on the borrowed amount)
2) Lubricants (this includes waste and disposal cost of the used lubricants)
3) Diesel fuel used to operate the mining equipment
4) Maintenance and repair cost (including initial tooling, salary costs of the maintenance and repairs staff and the planning/supervising costs)
5) Residual value (of the components) of the mining equipment
6) Tires/under carriage cost of the equipment
7) Operator cost (training and salary costs of the operators)

The following influences from the production side act as denominators in the equation:

1) Cycle times (how fast the mined "earth" can be delivered for production)
2) Payload (how much of the mined "earth" can be moved per cycle)
3) Operator efficiency (how efficient is the operator in using the mining equipment)

As can be seen from the above the replacement of the old mining equipment with new mining equipment will have a larger influence on the denominator, because it will decrease the cycle times with an increased payload. This will lead to and increase in tonnage and a decrease in the cost per ton, because the costs are kept constant. The reason for the costs staying constant is the closeness of the different product offerings of the different suppliers.

In the contracts between BEC and the customers, BEC undertakes to manage two components that influence the cost per ton calculation. These are the maintenance and repair costs and the residual value of the components. The maintenance and repair cost will have a bigger impact on the attractiveness of the contract as it makes up the biggest portion of the cost. Therefore, this study will concentrate on this aspect of the cost per ton calculation.

3.3 Net Present Value method

The Net Present Value method is a capital budgeting technique that uses discounted cash flows to compare the present value of an investment with the expected future cash inflows and outflows. The Net Present Value method determines the difference between the present values and the expected inflows and outflows of the future cash flows. Thus, the Net Present Value method compares the value of one rand today with the value of one rand in the future. The value changes because of the influence of inflation. The future value of the rand is discounted by a certain rate, which is usually the highest rate at which you can invest your money, minus the risk-adjusted rate or the lowest rate that you can borrow money at.

The basic formula that is used to calculate the present value is the following:

$$PV = {FV_t}/{(1+r)^t} \tag{3.1}$$

where

PV	Present value of future cash flows
FV_t	Future value cash flows
R	Interest rate per period

t Number of periods

The main idea behind the Net Present Value method is to determine when the proposed investment or project will be worth more than the original capital outlay than it costs or when the investment/project will start to add value to the company.

If the value, calculated from equation (3.1) is a positive value, it will indicate that the investment/project has added value to the company. If the value calculated for equation (3.1) is negative, no value is created for the company.

Ross *et al.* (2001:22) raises a few issues regarding the Net Present Value method, which should be taken into account when using this method.

1) Sunken costs – current or future company expenditure, regardless of whether the project will go ahead or not. This must not be included in the calculation for the Net Present Value.
2) Opportunity costs – past expenditure related to, for example, tooling equipment. The company will be using this tooling equipment in the project. This must be used in the calculation. The value used must be the current value and not the value when the tooling was acquired.
3) Side effects – for example, the company decides on one project, but to staff the project it uses labour that was hired for a completely different purpose or project. The income that the company should have generated from this other purpose must now also be covered by the project or taken into account as an additional cost (negative cash flow).
4) Networking capital – this will normally be the start-up capital to establish site offices, inventories and to pay for accounts receivable.
5) Financing costs – in evaluating the Net Present Value method the interest and dividends are ignored, as only the cash flow generated by the project is of interest for this study.

3.4 ***Developing the model***

A discussion will now follow on the aspects of the approach followed to calculate the economic life of the mining equipment by using the Net Present Value method.

3.4.1 Budgeting

Y. Marot (private discussions, 2001-2003) has contributed to the methodology of MARC management. Marot supplied most of the component lives and specifics regarding the lengths of the contracts that is used to compile the budget.

The budgets for the mining equipment are created for a period that is perceived to be the correct period. Sometimes the customer specifies in the bidding request document that they want to utilise the mining equipment for 10 years and 5,000 hours per year. Then the Life Cycle Cost (LCC) is drawn up for 50,000 hours. For the purpose of this study a budget for 50,000 hours is taken into account and then extended to 100,000 hours. In this extended budget, the intervals are kept the same as the original interval, i.e. 5,000 hours. The following rate table is used in the example in Table 3 on page 31 and is the result of extending Table 1 (page 2) to 100,000 hours.

Start hours	End hours	Rate per hour
1	5,000	R 10.37
5,001	10,000	R 82.76
10,001	15,000	R 268.88
15,001	20,000	R 178.69
20,001	25,000	R 218.58
25,001	30,000	R 133.06
30,001	35,000	R 10.37
35,001	40,000	R 384.57

40,001	45,000	R 82.76
45,001	50,000	R 31.54
50,001	55,000	R225.93
55,001	60,000	R159.79
60,001	65,000	R99.32
65,001	70,000	R6.19
70,001	75,000	R379.60
75,001	80,000	R6.19
80,001	85,000	R259.11
85,001	90,000	R226.00
90,001	95,000	R0.00
95,001	100,000	R259.11
Average		R151.41

Table 2 Rate table

3.4.2 Network capital

To operate mining equipment, start-up capital is needed for the expenses on the truck as well as to establish inventories of parts for the truck. In the application of the Net Present Value method, this capital is known as the Net Working capital (in the example of the method given in Table 3 (page 31), this is (a)). At the end of the project, this money must be available again.

The money set aside for the Net Working capital must be sufficient in value to cover expenses over any period of the contract. To determine the amount of money that must be put aside for the Net Working Capital the following procedure is used: the model compares all the operating cash flows over the life of the mining equipment and the maximum value is used for the networking capital's value. In Table 3 (page 31), for example the maximum "Total cash flow" occurs in the last period and is R767,325.

3.4.3 Tooling cost

For the tooling cost ((b) in Table 3 (page 31)), this study assumes that the tooling required will be ten percent of the cost of a new mining equipment divided by the number of the mining equipment (the mining equipment will use the same tooling and can thus share the cost). This tooling cost includes all the special tooling, such as lifting tools as well as the repair manuals. In the example given in Table 3 (page 31), the cost of a new mining equipment is R15,229,685. This value is then divided by the number of mining equipment of the same model on the contract (5), which give R3,045,937. Ten percent of this value is then R304,593.

3.4.4 Cash flow

The sales (expected income (c) in Table 3 (page 31)) is the invoices that the customer will be charged for the use of the mining equipment ($SMR_{Hours\ used}$ x Hourly rate). For period 1, for example, the mining equipment operates for 5000 hours and the rate per hour is R10.37 (see Table 2 (page 28-29) for the different rates). Thus, the income will be R51,850, which is made up by 5000 x R10.37 or R51,850.

The expenses ((d) in Table 3 (page 31)) will be the expenses that are used to repair the mining equipment in case of a failure. This will typically be the cumulative costs of all the work orders open over the 5,000-hour period.

The operating cash flows are the difference between the sales (expected income) and the expenses.

3.4.5 General

Because the study also assumes that the mining equipment is the property of the customer, all the owning costs (other expenses such as fuel, tyres and operator's salaries) will be for the customer's account. The depreciation of the customer's mining equipment is not included in the study. This study includes the depreciation of the tooling and the tax on the cash flow. Tax is calculated at a rate of 30% as prescribed in Ross *et al.* (2001:22). The depreciation of the tooling is written off over a five-year period (Ross *et al.*, 2001:22).

At the end of the contract, it is further assumed that some of the tooling can still be used or have a commercial value. The profit made on the sale of this tooling is taken care of in calculation (g) in Table 3 (page 31) in the example.

The following table (Table 3 (page 31)) gives an example of the calculation of the model developed.

For each of the intervals in Table 3 (page 31) the Net Present Value method is calculated to determine if the mining equipment has a positive Net Present Value up to that period. The period that returns a positive value, is then assumed as the lower boundary of the economic life of the mining equipment. The mining equipment must be used at least up to this interval before replacing the mining equipment to add value to the company.

CAPITAL PROJECT CASH FLOW EVALUATION

Machine Hours	5,000	10,000	15,000	20,000	25,000	30,000
Rate	R10.37	R82.76	R268.88	R178.69	R218.58	R133.06

Year		1	2	3	4	5	6
Cost of Acquisition							
Machine	-						
Net working Capital (a)	-767,325						
Tooling (additional) (b)	-304,594						
Sales (Expected income) (c)		51,850	413,800	1,344,400	893,450	1,092,900	665,300
Expenses (d)		-31,110	-248,280	-806,640	-536,070	-655,740	-399,180
Operating Cash Flow (e)		20,740	165,520	537,760	357,380	437,160	266,120
Tax Paid (f)		-	-31,380	-143,052	-88,938	-112,872	-79,836
Residual value of tooling (salvage value)							60,919
Tax on salvage value (tooling)							-18,276
Net working Capital (a)							767,325
Total Cash Flow	-1,071,919	20,740	134,140	394,708	268,442	324,288	996,252
Cumulative Cash Flow		-1,051,179	-917,039	-522,331	-253,890	70,398	1,066,650

Expenses (d)

Repair costs	31,110	248,280	806,640	536,070	655,740	399,180
Other Expenses	-	-	-	-	-	-
Total	31,110	248,280	806,640	536,070	655,740	399,180

Tax Paid (f)

Operating Cash Flow		20,740	165,520	537,760	357,380	437,160	266,120
Wear & Tear							
Machine (depreciation)		-	-	-	-	-	-
Tooling (depreciation @ 20%/year)		-60,919	-60,919	-60,919	-60,919	-60,919	-
Taxable Income		-40,179	104,601	476,841	296,461	376,241	266,120
Tax Payable		-	31,380	143,052	88,938	112,872	79,836
NPV for the periods	-	-1,051,179	-917,039	-522,331	-253,890	70,398	1,066,650

Table 3 Example of the calculation

The result of the calculation is then displayed in a graph (Figure 2 (page 32) to determine the lowest boundary for the economic life of the mining equipment. This study assumes that the lowest boundary for the economic life of the mining equipment is indicated by the point on the graph where it changes from a negative to a positive value.

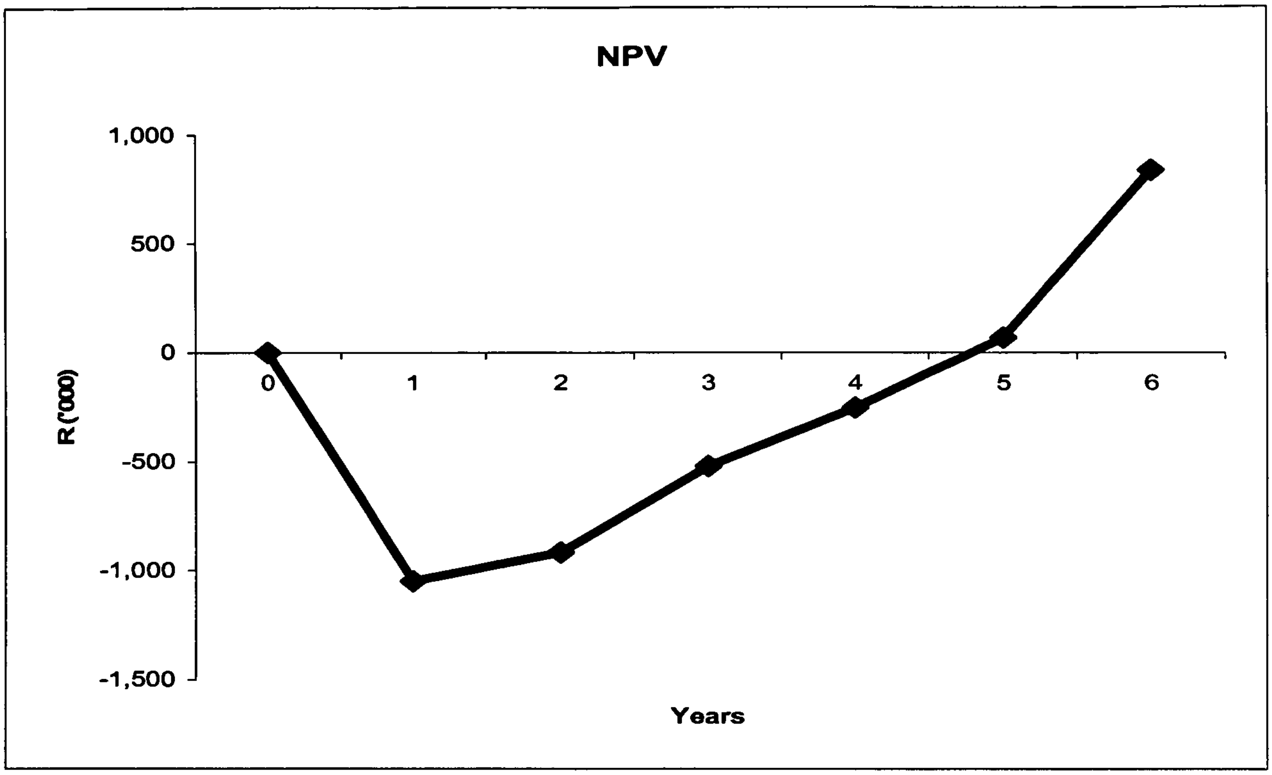


Figure 2 Example of the graph of the Net Present Value method

3.4.6 Assumptions made in this study

The following assumptions where made:

- In preparing the budget the cost of a repair of a component (for example an engine) is determine according to the following principle: 80% of the time the repair incident will occur before failure and 20% of the time, after failure. Thus, the following formula is used: Cost of repair = 0.8 x (before failure price) + 0.2 x (after failure price).
- On the major components, the assumption is made that the second life (amount of hours that the component will last) will be less then the first life (10%), but the second, third and the following lives will be the same.
- It is also assumed that the components to be replaced are replaced with new components. The effect of this would be that the life assumed in the previous point, will be achieved, because in this point a reduction is built into the life of the component.

- It is expected that all maintenance will be done and will be of excellent quality. The study assumes that the maintenance on the mining equipment will be performed as per the prescribed manufacturer schedule. No maintenance task on the mining equipment will be missed. Thus for purposes of the study, maintenance will not be taken into account. Money received will be equal to money spent to maintain the mining equipment. Thus, the maintenance will not influence the risk model.
- The same can be said about tyre expense. The cost will occur without any effect on the life span of the mining equipment.
- Production cost is ignored (cost of fuel and operator salaries) – the mine will carry the cost.
- This study assumes that no operator abuse occurs on the mining equipment. It also assumes that no accidents happen that will lower the life of the mining equipment that is involved in the accidents.
- Inflation is indirectly taken into account. The costs on both sides of the equation are escalated by an agreed percentage. On the supply side the parts are increased annually by the:
    - suppliers
    - the rate of exchange fluctuations

  These increases are passed on to the mine by increase in the rate table.
- All cash inflows and outflows are represented in this study when the costs occur and not when the transaction is recorded.
- The capital cost of acquiring of the mining equipment is for the customer's account.
- No penalties (for production or availability) are taken into account.
- The key performance indicators such as availability, MTTR (mean time to repair) and MTBS (mean time between stoppages) are not taken into account. An increase in MTTR and a decrease of MTBS usually indicate that mechanical components have reached the end of their life span.

3.5 Closure and overview

This chapter explored the theoretical background of the model. The proposed model was also given and all the influences discussed. All the assumptions were given and explained. In the next chapter, the method is applied to different mining equipment and the results of the method are discussed.

4 Results

4.1 Introduction and overview

The previous chapter, focussed on the model incorporating the Net Present Value method. This chapter explores the results that were acquired from the application of the model on three different mining equipment models to determine the economic life span of the mining equipment.

4.2 Results

The model is tested against a selection of current mining equipment on the maintenance and repair contract at one site. Only one site was selected to rule out site differences such as travel cost, which are included or not included on the work order level (and thus influence the outflow cash flow) and cannot be identified separately in the assumptions.

The selected mining equipment is five Off Highway Trucks (mining equipment on which the model is developed on), two Wheel Loaders and two Front Shovels. The latter two models' selection was done to compensate for the in-accuracy of the budgets of the mining equipment (if in-accuracy exists), as this could influence the decision with regards to the applicability of the model.

The following results were obtained from the study:

4.2.1 Off Highway Trucks

The results of the original Off Highway Trucks (OHT) budget and the five pieces of mining equipment on the contract are displayed in Table 4. The results and calculations are shown in Appendix B.

Mining equipment	Current hours	Life in hours for positive NPV
OHT Budget	50,000	40,000
OHT 1	25,912	27,361
OHT 2	25,999	42,469
OHT 3	24,592	42,998
OHT 4	21,997	23,455
OHT 5	23,032	24,479

Table 4 The Off Highway Truck results

As can be seen from the graphs, all the Off Highway Trucks achieve a positive Net Present Value. The "Off Highway Truck Budget" suggests a life span of 40,000 hours before the asset will add value to the shareholders money. Three of the test cases have a positive Net Present Value before 40,000 hours and two after that period. This illustrates the fact that not all mining equipment are the same (even if it is the same model) and must be looked at individually. BEC has assumed that 50,000 hours is a good estimate for the economic life span of the mining equipment and this assumption seem to be a good choice. The following graphs illustrate these results:

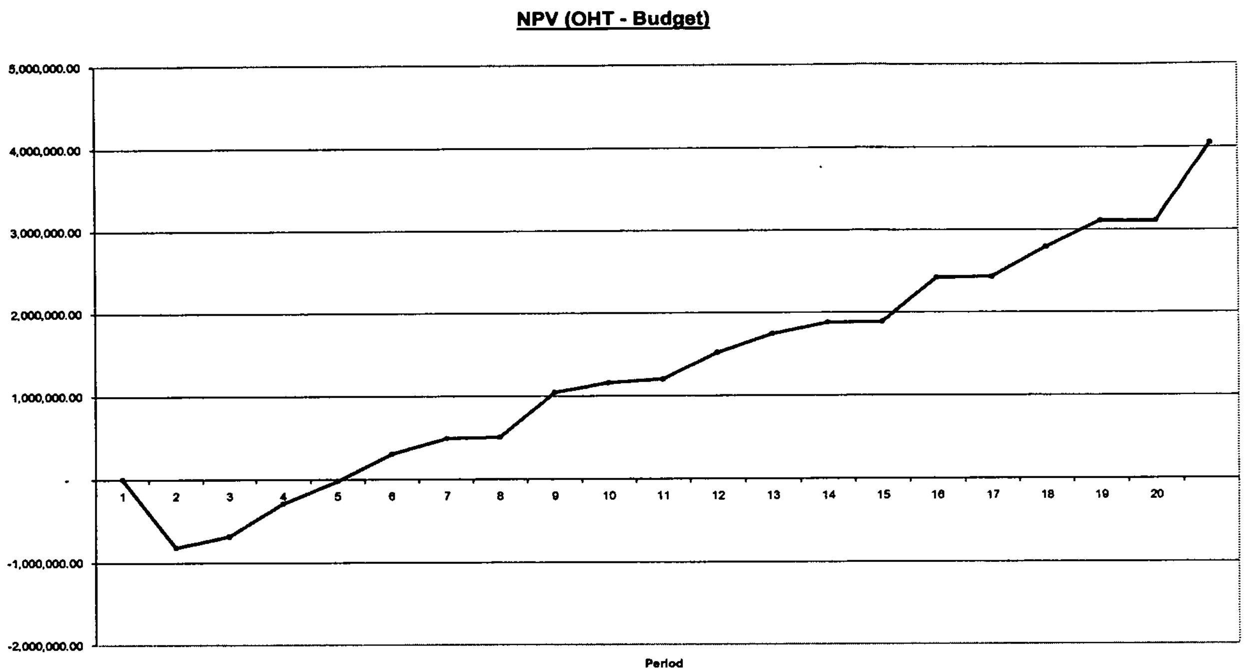


Figure 3 The Net Present Value method applied to the budget of the Off Highway Truck

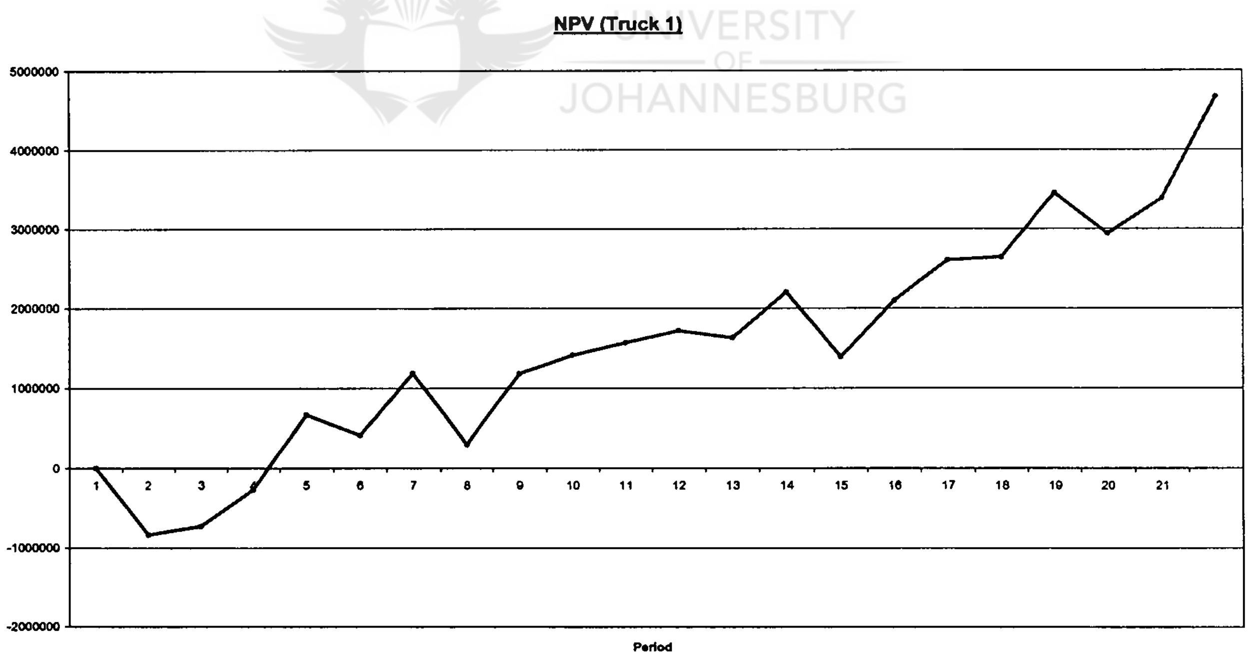


Figure 4 The Net Present Value method results for Off Highway Truck one

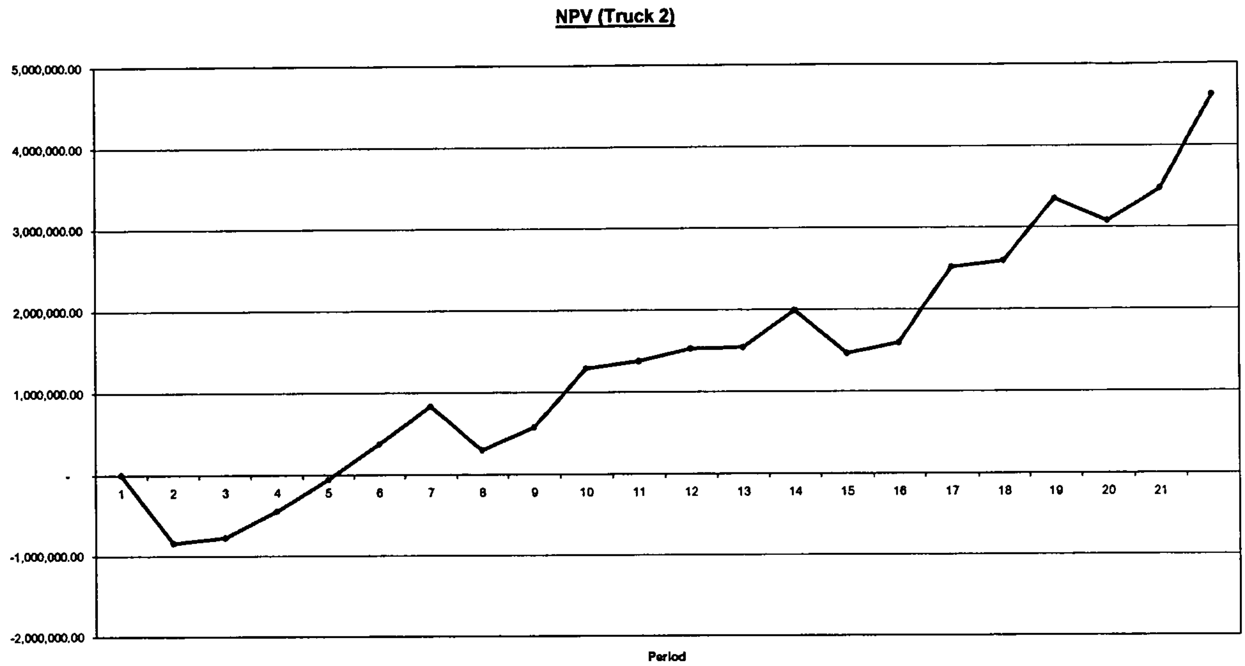


Figure 5 The Net Present Value method results for Off Highway Truck two

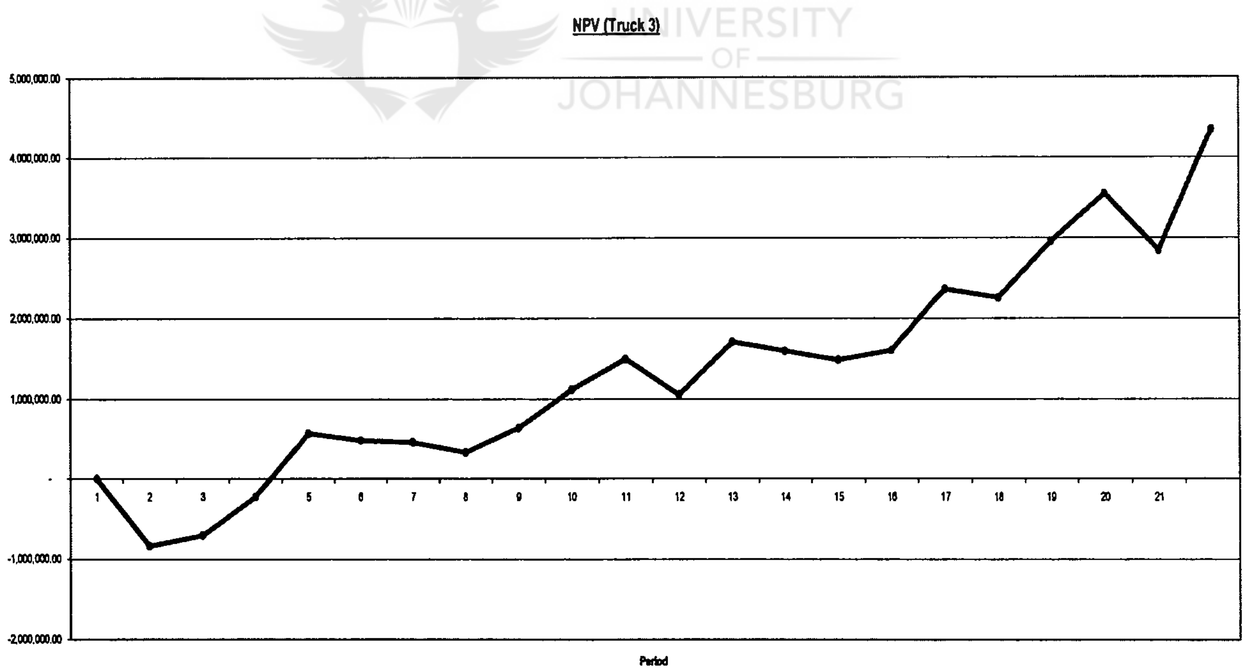


Figure 6 The Net Present Value method results for Off Highway Truck three

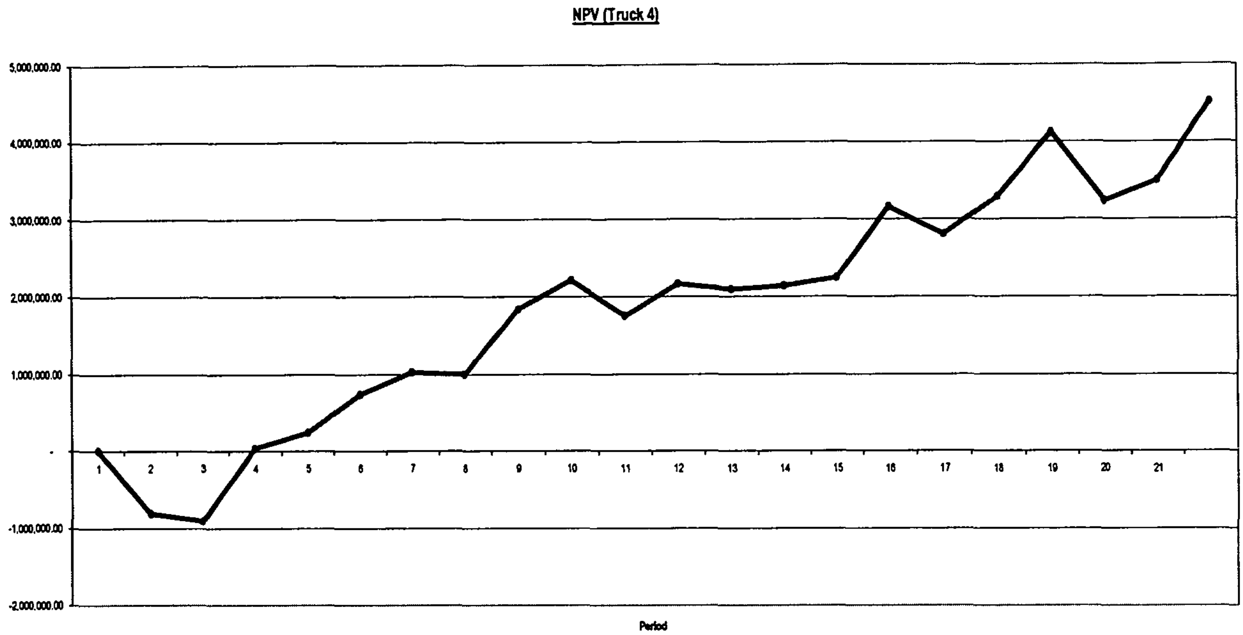


Figure 7 The Net Present Value method results for Off Highway Truck four

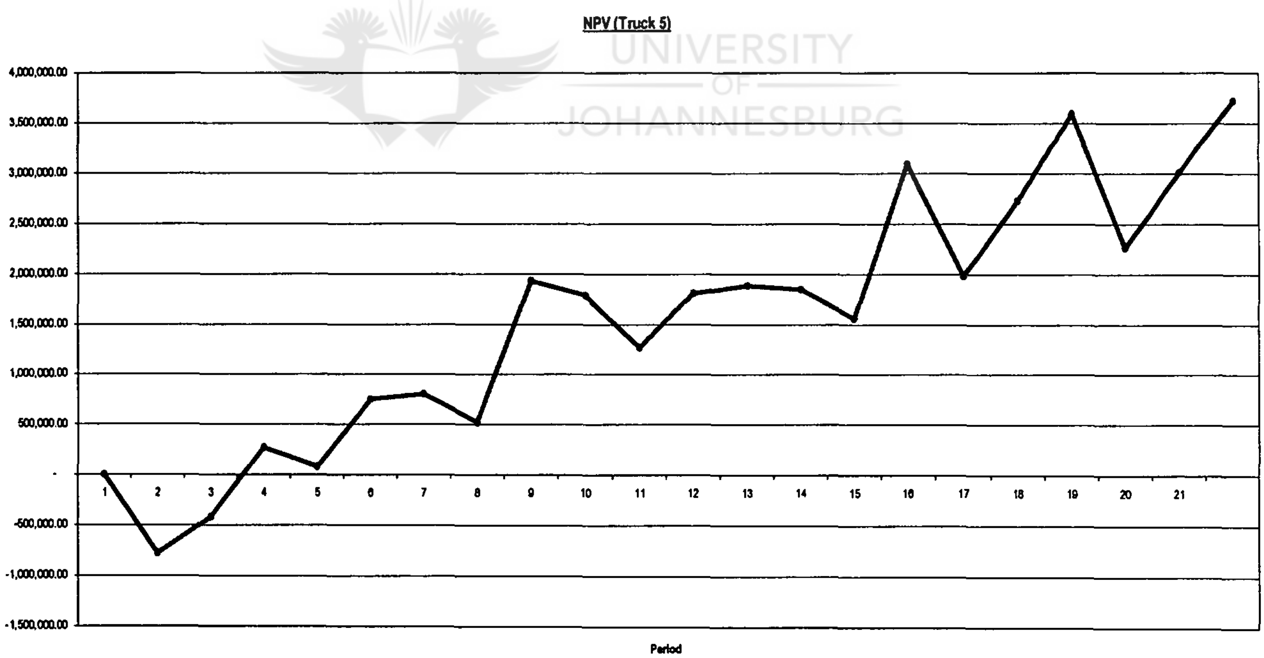


Figure 8 The Net Present Value method results for Off Highway Truck five

4.2.2 Wheel Loaders

The results of the Wheel Loaders (WL) budget and the two pieces of mining equipment on the contract are displayed in Table 5. The results and calculations are shown in Appendix C.

Mining equipment	Current hours	Life in hours for positive NPV
WL Budget	35,000	60,000
WL 1	27,256	59,158
WL 2	23,959	25,835

Table 5 The Wheel Loaders results

As can be seen from the graphs, all the Wheel Loaders achieve a positive Net Present Value calculation. The "Wheel Loader Budget" has the highest hours before the Net Present Value calculation becomes positive, namely 60,000. The two Wheel Loaders become positive at different times. This equipment arrived on the site at different times (approximately a year apart). This could influence the Net Present Value calculation dramatically because all the mistakes made when repairing the one piece of mining equipment could be avoided on the next piece of mining equipment. BEC assumed that the economic life span of the mining equipment is 35,000 hours and looking at the results this seems to be low. This value was definitely influenced by prior experience of the mining equipment. The study also suggests that the first piece of mining equipment (Wheel Loader 1) must be evaluated on a regular basis.

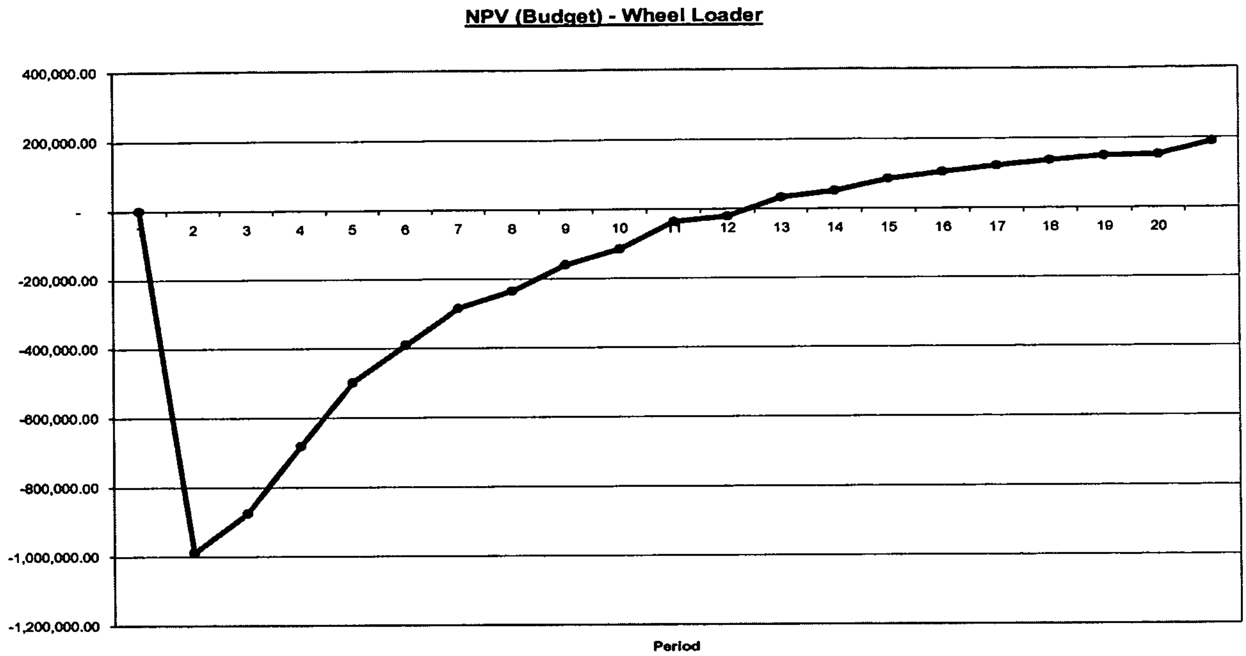


Figure 9 The Net Present Value method results for Wheel Loader budget

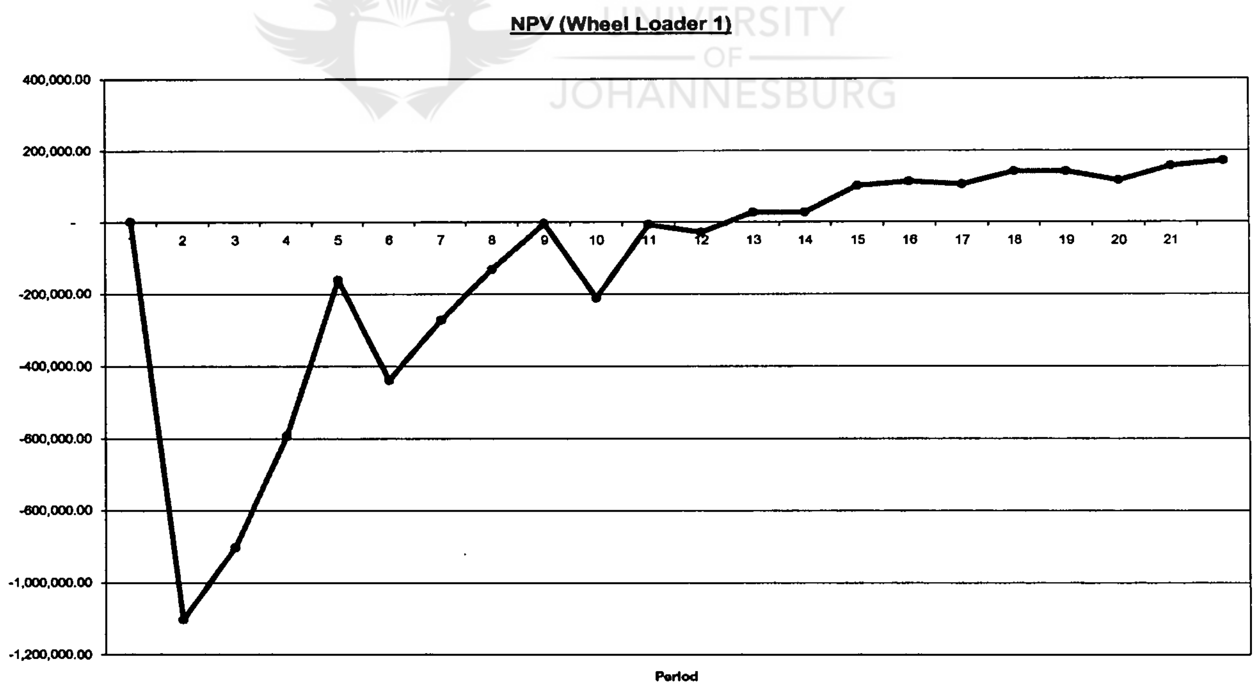


Figure 10 The Net Present Value method results for Wheel Loader one

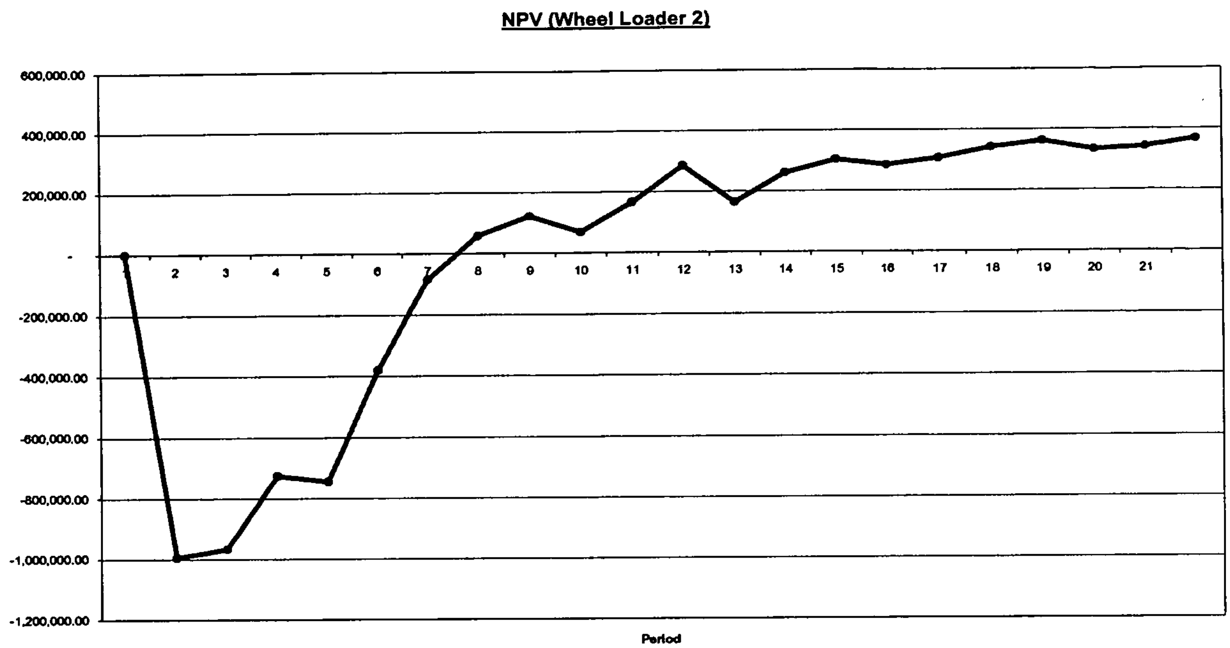


Figure 11 The Net Present Value method results for Wheel Loader two

4.2.3 <u>Front Shovels</u>

The results of the Front Shovels (FS) budget and the two pieces of mining equipment on the contract are displayed in Table 6. The results and calculations are shown in Appendix D.

Mining equipment	Current hours	Life in hours for positive NPV
FS Budget	30,000	50,000
FS 1	19,103	Not positive
FS 2	14,918	Not positive

Table 6 The Front Shovel results

As can be seen from the graphs, the Front Shovel budget achieved a positive Net Present Value, but the two mining equipment did not achieve a positive Net Present Value. Reasons for this could be that the budget was incorrect and the actual cost was higher than expected. The life span of the components in the budget are also less than expected (meaning that more repairs are needed than expected).

BEC has initiated an investigation into costs to determine whether all the costs are for the mining equipment account. In other words, some of the costs could have been warranty costs. This will definitely lower the expenses and will result in a positive Net Present Value.

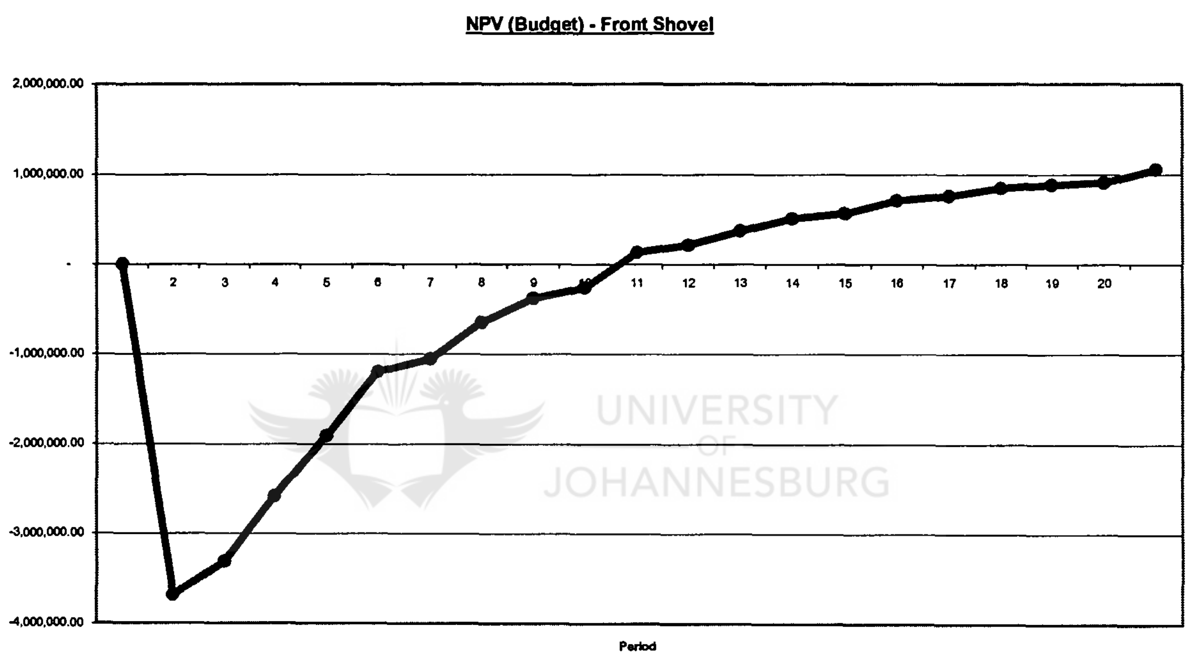


Figure 12 The Net Present Value method results for the Front Shovel Budget

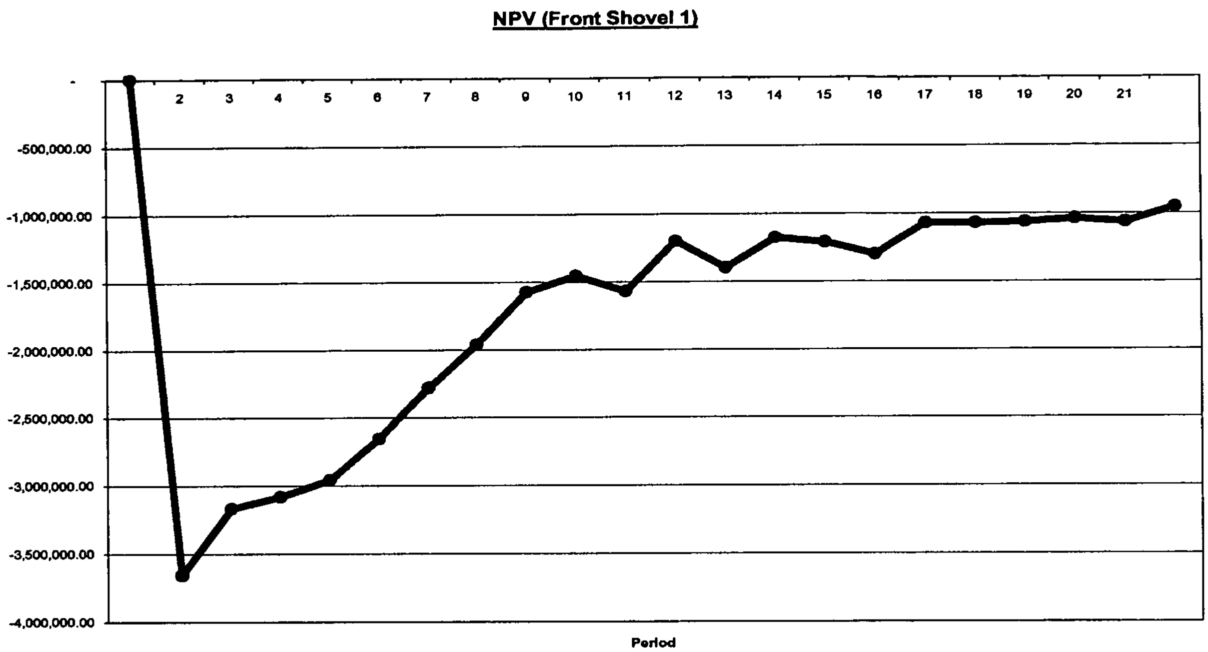


Figure 13 The Net Present Value method results for the Front Shovel one

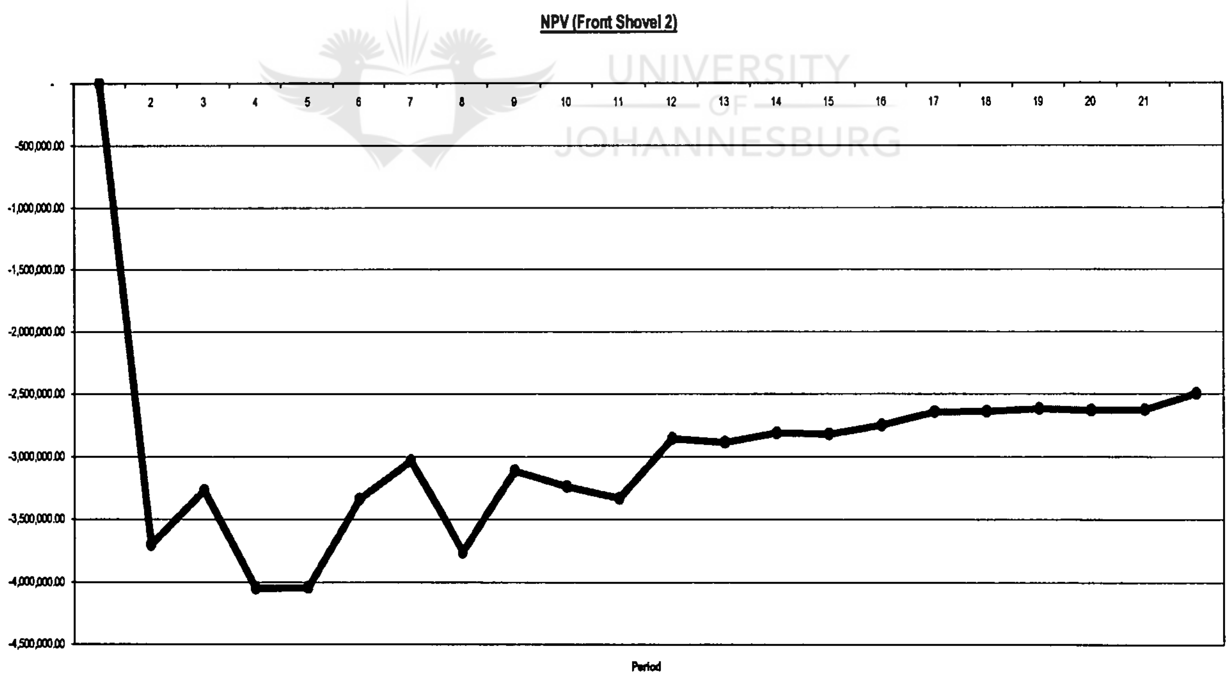


Figure 14 The Net Present Value method results for the Front Shovel two

4.3 Closure and preview

In this chapter, the results of applying the model on selected mining equipment were discussed. In the following chapter, a conclusion will be reached regarding the applicability of the method used when determining the economic life span of mining equipment. Recommendations are also made for the use of the model and further studies.

5 Conclusion and recommendations

5.1 Conclusion

The study has originated as a result of the need to investigate the criteria for determining the economic life span of mining equipment. The results indicate that the model that was developed in Chapter 4 can be used as criterion for determining the economic life of mining equipment.

The study supplies answers to the question of when the mining equipment will give a positive return on the investment. It will thus give a value for the economic life span of the mining equipment. This value, is the minimum time that the mining equipment can remain on the contract to ensure a positive return of the investment. If the mining equipment is utilised for a shorter period than planned, not all the money will be recovered and the mining equipment will give a negative return on the investment.

The results can now be used to determine ways to achieve a positive Net Present Value (for example lower the cost with 10% to see if the Net Present Value becomes positive). The biggest advantage of the model is that it is robust and can thus be applied to new mining equipment (test of it will be a profitable contract) and current equipment. For current equipment a forward projection can be done, which will immediately highlight problematic mining equipment. A decision can then be made on the future of this mining equipment.

5.2 Recommendations on the use of the model

To make use of the model certain points must be taken into consideration:

1) The accuracy of the budget (the budget is dependent on the experience of the person drawing up the budgets of the specific mining equipment)
2) Where the mining equipment will be applied (sometimes a budget is used for one mine to the next – a deeper pit will result in a slighter shorter lifetime of the components and thus higher costs)
3) Conditions of use (accidents can lower the life expectations and can cause unforeseen costs)

5.3 Recommendations for further studies

The following recommendations can be made for further studies:

1) Calculate the residual values of the components that make up the mining equipment for every period under investigation and relate this calculation to the current method.
2) Repeat the study from the objective of the customer (taking ownership cost and production into consideration).
3) Do a more accurate calculation of the network capital (start up capital) and equipment tooling cost to make sure all the costs, which could affect the study are taken into consideration.
4) Repeat the study when the mining equipment completes a project cycle and compare the data and results with the current study.
5) If a new generation of mining equipment is available, develop a method to take this into consideration (advantages of using the new mining equipment – better production, etc.) in the calculation of the economic life span of mining equipment.

Appendix A. Bibliography

1. Andrews, V.L. & Hunt, P. (1976). Financial Management: Cases and readings. Rev ed. Richard D. Irwin, Inc. 839p.
2. Atkins, N.G. (1990). Study of historical costs on diesel mining machines to determine the optimum machine replacement age. Middelburg Mine Services (PTY) Limited. 12p.
3. Ayton, P. (1998). How bad is human judgement? (In: Wright, G. & Goodwin, P. (editors) (1998). Forecasting with judgement. West Sussex: John Wiley & Sons LTD. 237-268p.)
4. Chong, Y.Y. & Brown, E.M. (2000). Managing project risk. Great Britain: Pearson Education Limited. 239p.
5. Caterpillar. (2003). Mining machine information. [Web:] http://catminer.cat.com [Date of access: 6 October 2003]
6. Deshotels, R.L. & Zimmerman R.D. (1995). Cost-Effective Risk Assessment for Process Design. New York: McGraw-Hill Inc. 252 p.
7. Gentle, F.E. (2000). The mitigation of financial risk associated with Capital projects. Johannesburg: RAU. (Dissertation – M.Com) 93 p.
8. Gouws, J.N. (1994). Managing foreign exchange exposure risk in an operating environment. Johannesburg: RAU. (Essay – M.Com) 74 p.
9. Grandell, J. (1991). Aspects of Risk Theory. New York: Springer-Verlag. 166 p.
10. Hertz, D.B. (1964), Risk analysis in Capital Investment. (In: Andrews, V.L. & Hunt, P. (1976). Financial management – cases and readings. Rev Ed. Richard D. Irwin, Inc. 839p.)
11. Investopedia. (2003). Dictionary. http://www.investopedia.com/default.asp [Date of access: 3 October 2003]
12. Lynch, R. (2000). Corporate strategy. Pearson education Limited. 1014p.

13. Marketing division, Caterpillar Tractor Company. (1969). Equipment Economics. Peoria. Illinois. 16p.
14. McDonald, K.L. & Kucera, Z. & Van der Merwe, J. (1983). Regression analysis for Budgeting purposes at Rietspruit. Rietspruit Opencast services (PTY) Ltd. 19p.
15. Mclean, J.G. (1958) How to evaluate new capital investments. (In: Andrews, V.L. & Hunt, P. (1976). Financial management – cases and readings. Rev Ed. Richard D. Irwin, Inc. 839p.)
16. Mettelmann, K. (Date unknown). Planned equipment replacement. Peoria. Illinois. 22p.
17. Musiela, M. & Rutkowski, M. (1997). Martingale Methods in Financial Modelling, Vol. 36. Berlin: Springer-Verlag. 512 p.
18. Parker, G. & Beaver, W. (1995). Risk Management Problems and Solutions. Singapore: McGraw-Hill Inc. 367 p.
19. Pretorius, Y. (2001). Aspects of Engineering Project Failure: A managerial approach. Johannesburg: RAU. (Dissertation – M.Eng). 78 p.
20. Raubenheimer, P.J. (2000). A case study in industrial risk management. Johannesburg: RAU. (Dissertation – M.Eng) 96 p.
21. Riskdriver consortium. (2001). Risk management for project management [Web:] http://www.riskdriver.com/ie/directory/direct.html [Date of access: 27 September 2001].
22. Ross, S., Westerfield, R.W., Bradford, D.J. & Firer, C. (2001). Fundamentals of corporate finance. Australia: McGraw-Hill. 763 p.
23. Sang-Hoon, K. & Srinivasan, V. (2003). A multiattribute model of the timing of buyers' upgrading to improved versions of high technology products. [Web:] http://gobi.stanford.edu/ResearchPapers/ [Date of access: 20 September 2003]. 36p.
24. Vorster, M.C. (Date unknown) Evaluation of replacement techniques and philosophies. Internal paper. Department of Civil Engineering. University of Cape Town.
25. Vose, D. (1996). Quantitative Risk Analysis: A Guide to Monte Carlo Simulation Modelling. West Sussex: John Wiley & Sons LTD. 317 p.

26. Wimble, K.M. (1975). Acquisition, Maintenance and replacement policies and problems with Mobile quarry equipment and transport fleets of the Hippo Quarries in South Africa. Paper presented at the Holderbank ready mix and stone conference. 28p.

27. Wysocki, R.K. & Beck, R. & Crane, D.B. (1995). Effective project management: how to plan, manage, and deliver projects on time and within budget. Canada: John Wiley & sons, Inc. 333p.

Appendix B. Off Highway Trucks

Appendix B includes the following:

1) Off Highway Truck background
2) The general information sheet
3) The budget Net Present Value calculation
4) The application on different mining equipment
5) The component lives for the components and the replacement intervals

Off Highway Truck Background

The 785 Mining Truck (OHT) has a payload of 150 ton (136 metric ton). The Off Highway Truck is mainly used for hauling the production from the mined area to the crusher or the plant. This truck was developed for high production mining and construction applications.

Off Highway Truck

Depreciation of machine

Year	Value
1	33%
2	33%
3	33%
4	0%
5	0%
6	0%
7	0%
8	0%
9	0%
10	0%
	100%

Business Paramaters

Cost of Capital (Rate of Return on Money Used) (%)	0.00%
Marginal Tax Rate (%)	30.00%
Inflation (Projected Yearly Increase in Prices) (%)	3.00%
Projected Years of Vehicle Operation (# of years)	10
Avg. Projected Gross Margin on Parts and labour (%)	80%

Project Costs

Total Machine Purchase Price (R)	R	15,229,685.89
Network Capital	R	2,691,990.00
Additional tooling	R	1,522,968.59

Depreciation of tooling

Year	Value
1	20%
2	20%
3	20%
4	20%
5	20%
6	0%
7	0%
8	0%
9	0%
10	0%
	100%

Residual Values

Percentage of life of Machine			0%
Residual Value of Machine After Useful Life (R)	Years	R	-
Percentage of life of Tooling			0%
Residual Value of Tooling After Useful Life (R)	Years	R	-

Number of machines on the contract 5

Table 7 Off Highway trucks general information

CAPITAL PROJECT CASH FLOW EVALUATION (Off Highway truck)

Machine Hours		5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000
Rate		R10.37	R82.76	R268.88	R176.69	R218.58	R133.06	R10.37	R384.57	R82.76	R31.54
						PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year		1	2	3	4	5	6	7	8	9	10
Cost of Acquisition											
Machine	-										
Networking Capital	(538,398)										
Tooling (additional)	(304,594)										
Sales (Expected income)		51,850	413,800	1,344,400	893,450	1,092,900	665,300	51,850	1,922,850	413,800	157,700
Expenses		(31,110)	(248,280)	(806,640)	(536,070)	(655,740)	(399,180)	(31,110)	(1,153,710)	(248,280)	(94,620)
Operating Cash Flow		20,740	165,520	537,760	357,380	437,160	266,120	20,740	769,140	165,520	63,080
Tax Paid		-	(31,380)	(143,052)	(88,938)	(112,872)	(79,836)	(6,222)	(230,742)	(49,656)	(18,924)
Residual value of machine (salvage value)											
Tax on salvage value (machine)											
Residual value of tooling (salvage value)											
Tax on salvage value (tooling)											
Networking Capital											
Total Cash Flow	(842,992)	20,740	134,140	394,708	268,442	324,288	186,284	14,518	538,398	115,864	44,156
Cumulative Cash Flow		(822,252)	(688,112)	(293,404)	(24,963)	299,325	485,609	500,127	1,038,525	1,154,389	1,198,545
Expenses											
Repair costs		31,110	248,280	806,640	536,070	655,740	399,180	31,110	1,153,710	248,280	94,620
Other Expenses		-	-	-	-	-	-	-	-	-	-
Total		31,110	248,280	806,640	536,070	655,740	399,180	31,110	1,153,710	248,280	94,620
Tax Paid											
Operating Cash Flow		20,740	165,520	537,760	357,380	437,160	266,120	20,740	769,140	165,520	63,080
Wear & Tear											
Machine		-	-	-	-	-	-	-	-	-	-
Tooling		(60,919)	(60,919)	(60,919)	(60,919)	(60,919)	-	-	-	-	-
Taxable Income		(40,179)	104,601	476,841	296,461	376,241	266,120	20,740	769,140	165,520	63,080
Tax Payable		-	31,380	143,052	88,938	112,872	79,836	6,222	230,742	49,656	18,924
NPV for the periods	-	(822,252)	(688,112)	(293,404)	(24,963)	299,325	485,609	500,127	1,038,525	1,154,389	1,198,545
									0		

Machine Hours	55,000	60,000	65,000	70,000	75,000	80,000	85,000	90,000	95,000	100,000
Rate	R225.93	R159.79	R99.32	R6.19	R379.60	R6.19	R259.11	R226.00	R0.01	R259.11
	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year	11	12	13	14	15	16	17	18	19	20
Cost of Acquisition										
Machine										
Networking Capital										
Tooling (additional)										
Sales (Expected income)	1,129,650	798,950	496,600	30,950	1,898,000	30,950	1,295,550	1,130,000	30	1,295,550
Expenses	(677,790)	(479,370)	(297,960)	(18,570)	(1,138,800)	(18,570)	(777,330)	(678,000)	(18)	(777,330)
Operating Cash Flow	451,860	319,580	198,640	12,380	759,200	12,380	518,220	452,000	12	518,220
Tax Paid	(135,558)	(95,874)	(59,592)	(3,714)	(227,760)	(3,714)	(155,466)	(135,600)	(4)	(155,466)
Residual value of machine (salvage value)										-
Tax on salvage value (machine)										-
Residual value of tooling (salvage value)										60,919
Tax on salvage value (tooling)										(18,276)
Networking Capital										538398
Total Cash Flow	316,302	223,706	139,048	8,666	531,440	8,666	362,754	316,400	8	943,795
Cumulative Cash Flow	1,514,847	1,738,553	1,877,601	1,886,267	2,417,707	2,426,373	2,789,127	3,105,527	3,105,535	4,049,330
Expenses										
Repair costs	677,790	479,370	297,960	18,570	1,138,800	18,570	777,330	676,000	18	777,330
Other Expenses	-	-	-	-	-	-	-	-	-	-
Total	677,790	479,370	297,960	18,570	1,138,800	18,570	777,330	678,000	18	777,330
Tax Paid										
Operating Cash Flow	451,860	319,560	198,640	12,380	759,200	12,380	518,220	452,000	12	518,220
Wear & Tear										
Machine	-	-	-	-	-	-	-	-	-	-
Tooling	-	-	-	-	-	-	-	-	-	-
Taxable Income	451,860	319,580	198,640	12,380	759,200	12,380	518,220	452,000	12	518,220
Tax Payable	135,558	95,874	59,592	3,714	227,760	3,714	155,466	135,600	4	155,466
NPV for the periods	1,514,847	1,738,553	1,877,601	1,886,267	2,417,707	2,426,373	2,789,127	3,105,527	3,105,535	4,049,330

Table 8 Off Highway Truck Net Present Value calculation

CAPITAL PROJECT CASH FLOW EVALUATION for truck 1

Machine Hours		190	6,826	11,694	17,958	22,386	27,361	32,361	37,375	42,375	47,375	52,375	57,389	62,389	67,389	72,389	77,403	82,403	87,403	92,403	97,416	100,000
					PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Cost of Acquisition																						
Machine	-																					
Networking Capital	(538,398)																					
Tooling (additional)	(304,594)																					
Sales (Expected income)		1,579	184,441	697,658	1,452,663	1,080,559	1,378,587	599,108	1,500,683	1,923,797	466,023	988,052	1,554,890	1,044,036	437,282	1,472,283	1,604,858	1,018,672	1,939,733	936,435	998,711	1,067,939
Expenses		-	(52,396)	(63,750)	(142,375)	(1,337,528)	(277,959)	(1,489,169)	(231,632)	(1,593,804)	(241,666)	(774,308)	(1,641,900)	(233,814)	(1,246,454)	(466,576)	(873,950)	(969,292)	(784,847)	(1,448,600)	(357,283)	(62,183)
Operating Cash Flow		1,579	132,045	633,908	1,310,288	(256,969)	1,100,628	(890,061)	1,269,051	329,993	224,357	213,743	(87,010)	810,222	(809,172)	1,005,708	730,909	49,380	1,154,886	(512,165)	641,428	1,005,756
Tax Paid		-	(21,338)	(171,897)	(374,811)	-	(330,188)	-	(380,715)	(98,998)	(67,307)	(64,123)	-	(243,067)	-	(301,712)	(219,273)	(14,814)	(346,466)	-	(192,428)	(301,727)
Residual value of machine (salvage value)																						-
Tax on salvage value (machine)																						-
Residual value of tooling (salvage value)																						60,919
Tax on salvage value (tooling)																						(18,276)
Networking Capital																						538,398
Total Cash Flow	(842,992)	1,579	110,707	462,011	935,477	(256,969)	770,439	(890,061)	888,336	230,995	157,050	149,620	(87,010)	567,155	(809,172)	703,995	511,636	34,566	808,420	(512,165)	448,999	1,285,070
Cumulative Cash Flow		(641,413)	(730,706)	(268,695)	666,782	409,813	1,180,252	290,191	1,178,527	1,409,522	1,566,572	1,716,192	1,629,182	2,196,337	1,387,166	2,091,161	2,602,797	2,637,364	3,445,783	2,933,618	3,382,618	4,667,688
Expenses																						
Repair costs		-	52,396	63,750	142,375	1,337,528	277,959	1,489,169	231,632	1,593,804	241,666	774,308	1,641,900	233,814	1,246,454	466,576	873,950	969,292	784,847	1,448,600	357,283	62,183
Other Expenses		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		0	52,396	63,750	142,375	1,337,528	277,959	1,489,169	231,632	1,593,804	241,666	774,308	1,641,900	233,814	1,246,454	466,576	873,950	969,292	784,847	1,448,600	357,283	62,183
Tax Paid																						
Operating Cash Flow		1,579	132,045	633,908	1,310,288	(256,969)	1,100,628	(890,061)	1,269,051	329,993	224,357	213,743	(87,010)	810,222	(809,172)	1,005,708	730,909	49,380	1,154,886	(512,165)	641,428	1,005,756
Wear & Tear																						
Machine		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tooling		(60,919)	(60,919)	(60,919)	(60,919)	(60,919)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Income		(59,340)	71,126	572,989	1,249,369	(317,888)	1,100,628	(890,061)	1,269,051	329,993	224,357	213,743	(87,010)	810,222	(809,172)	1,005,708	730,909	49,380	1,154,886	(512,165)	641,428	1,005,756
Tax Payable		-	21,338	171,897	374,811	-	330,188	-	380,715	98,998	67,307	64,123	-	243,067	-	301,712	219,273	14,814	346,466	-	192,428	301,727
NPV for the periods	0	(641,413)	(730,706)	(268,695)	666,782	409,813	1,180,252	290,191	1,178,527	1,409,522	1,566,572	1,716,192	1,629,162	2,196,337	1,387,166	2,091,161	2,602,797	2,637,364	3,445,783	2,933,618	3,382,618	4,667,688

Table 9 Off Highway Truck #1 Net Present Value calculation

CAPITAL PROJECT CASH FLOW EVALUATION for truck 2

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Machine Hours		158	6,669	11,998	18,210	23,137	27,456	32,455	37,469	42,469	47,469	52,469	57,482	62,482	67,482	72,482	77,496	82,496	87,496	92,496	97,510	100,000
						PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Cost of Acquisition																						
Machine	-																					
Networking Capital	(538,398)																					
Tooling (additional)	(304,594)																					
Sales (Expected income)		1,308	174,283	789,368	1,412,893	1,230,320	1,144,619	580,800	1,556,523	1,878,759	458,380	1,017,060	1,545,020	1,035,012	423,385	1,528,006	1,549,136	1,066,414	1,934,792	902,711	1,037,376	1,029,273
Expenses		-	(107,544)	(344,069)	(887,004)	(635,917)	(491,931)	(1,116,475)	(1,158,756)	(863,052)	(337,551)	(799,273)	(1,524,883)	(384,952)	(958,042)	(1,341,431)	(230,699)	(945,787)	(852,265)	(1,180,377)	(467,987)	(222,058)
Operating Cash Flow		1,308	66,740	445,299	525,889	594,403	652,688	(535,675)	397,767	1,015,707	120,828	217,786	20,137	650,060	(534,657)	186,575	1,318,437	110,627	1,082,526	(277,666)	569,389	807,214
Tax Paid		-	(1,746)	(115,314)	(139,491)	(160,045)	(195,807)	-	(119,330)	(304,712)	(36,248)	(65,336)	(6,041)	(195,018)	-	(55,973)	(395,531)	(33,188)	(324,758)	-	(170,817)	(242,164)
Residual value of machine (salvage value)																						-
Tax on salvage value (machine)																						-
Residual value of tooling (salvage value)																						60,919
Tax on salvage value (tooling)																						(18,276)
Networking Capital																						538,398
Total Cash Flow	(842,992)	1,308	64,993	329,985	386,398	434,358	456,882	(535,675)	278,437	710,995	84,580	152,451	14,096	455,042	(534,657)	130,603	922,906	77,439	757,768	(277,666)	398,572	1,146,091
Cumulative Cash Flow		(841,683)	(776,690)	(446,705)	(60,307)	374,051	830,933	295,258	573,695	1,284,689	1,369,269	1,521,719	1,536,816	1,990,858	1,456,200	1,586,803	2,509,709	2,587,148	3,344,917	3,067,251	3,465,823	4,611,914

Expenses																						
Repair costs	-	107,544	344,069	887,004	635,917	491,931	1,116,475	1,158,756	863,052	337,551	799,273	1,524,883	384,952	958,042	1,341,431	230,699	945,787	852,265	1,180,377	467,987	222,058	
Other Expenses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total	0	107,544	344,069	887,004	635,917	491,931	1,116,475	1,158,756	863,052	337,551	799,273	1,524,883	384,952	958,042	1,341,431	230,699	945,787	852,265	1,180,377	467,987	222,058	

Table 10 Off Highway Truck #2 Net Present Value calculation

CAPITAL PROJECT CASH FLOW EVALUATION (Off Highway truck)

Machine Hours		5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000	70,000	75,000	80,000	85,000	90,000	95,000	100,000
Rate		R10.37	R82.76	R268.88	R178.69	R218.58	R133.06	R10.37	R384.57	R82.76	R31.54	R225.93	R159.79	R99.32	R6.19	R379.60	R6.19	R259.11	R226.00	R0.01	R259.11
						PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cost of Acquisition																					
Machine	-																				
Networking Capital	(538,398)																				
Tooling (additional)	(304,594)																				
Sales (Expected income)		51,850	413,800	1,344,400	893,450	1,092,900	665,300	51,850	1,922,850	413,800	157,700	1,129,650	798,950	496,600	30,950	1,898,000	30,950	1,295,550	1,130,000	30	1,295,550
Expenses		(31,110)	(248,280)	(806,640)	(536,070)	(655,740)	(399,180)	(31,110)	(1,153,710)	(248,280)	(94,620)	(677,790)	(479,370)	(297,960)	(18,570)	(1,138,800)	(18,570)	(777,330)	(678,000)	(18)	(777,330)
Operating Cash Flow		20,740	165,520	537,760	357,380	437,160	266,120	20,740	769,140	165,520	63,080	451,860	319,580	198,640	12,380	759,200	12,380	518,220	452,000	12	518,220
Tax Paid		-	(31,380)	(143,052)	(88,938)	(112,872)	(79,836)	(6,222)	(230,742)	(49,656)	(18,924)	(135,558)	(95,874)	(59,592)	(3,714)	(227,760)	(3,714)	(155,466)	(135,600)	(4)	(155,466)
Residual value of machine (salvage value)																					-
Tax on salvage value (machine)																					-
Residual value of tooling (salvage value)																					60,919
Tax on salvage value (tooling)																					(18,276)
Networking Capital																					538398
Total Cash Flow	(842,992)	20,740	134,140	394,708	268,442	324,288	186,284	14,518	538,398	115,864	44,156	316,302	223,706	139,048	8,666	531,440	8,666	362,754	316,400	8	943,795
Cumulative Cash Flow		(822,252)	(688,112)	(293,404)	(24,963)	299,325	485,609	500,127	1,038,525	1,154,389	1,198,545	1,514,847	1,738,553	1,877,601	1,886,267	2,417,707	2,426,373	2,789,127	3,105,527	3,105,535	4,049,330
Expenses																					
Repair costs		31,110	248,280	806,640	536,070	655,740	399,180	31,110	1,153,710	248,280	94,620	677,790	479,370	297,960	18,570	1,138,800	18,570	777,330	678,000	18	777,330
Other Expenses		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		31,110	248,280	806,640	536,070	655,740	399,180	31,110	1,153,710	248,280	94,620	677,790	479,370	297,960	18,570	1,138,800	18,570	777,330	678,000	18	777,330
Tax Paid																					
Operating Cash Flow		20,740	165,520	537,760	357,380	437,160	266,120	20,740	769,140	165,520	63,080	451,860	319,580	198,640	12,380	759,200	12,380	518,220	452,000	12	518,220
Wear & Tear																					
Machine		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tooling		(60,919)	(60,919)	(60,919)	(60,919)	(60,919)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Income		(40,179)	104,601	476,841	296,461	376,241	266,120	20,740	769,140	165,520	63,080	451,860	319,580	198,640	12,380	759,200	12,380	518,220	452,000	12	518,220
Tax Payable		-	31,380	143,052	88,938	112,872	79,836	6,222	230,742	49,656	18,924	135,558	95,874	59,592	3,714	227,760	3,714	155,466	135,600	4	155,466
NPV for the periods	-	(822,252)	(688,112)	(293,404)	(24,963)	299,325	485,609	500,127	1,038,525	1,154,389	1,198,545	1,514,847	1,738,553	1,877,601	1,886,267	2,417,707	2,426,373	2,789,127	3,105,527	3,105,535	4,049,330

Table 11 Off Highway Truck #3 Net Present Value calculation

CAPITAL PROJECT CASH FLOW EVALUATION for truck 4

Machine Hours		5,258	10,125	16,273	20,682	23,455	28,455	33,469	38,469	43,469	48,469	53,482	58,482	63,482	68,482	73,496	78,496	83,496	88,496	93,510	98,510	100,000
				PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Cost of Acquisition																						
Machine	-																					
Networking Capital	(538,398)																					
Tooling (additional)	(304,594)																					
Sales (Expected income)		65,259	413,136	1,578,265	991,100	964,523	1,272,043	385,321	2,153,190	1,397,336	376,677	1,332,072	1,434,582	938,555	274,831	2,131,935	945,207	1,459,852	1,881,977	542,223	1,450,678	615,961
Expenses		(37,247)	(510,170)	(256,952)	(719,784)	(286,448)	(862,049)	(411,110)	(955,384)	(853,178)	(842,075)	(739,849)	(1,510,758)	(871,345)	(126,307)	(822,744)	(1,293,091)	(772,254)	(693,666)	(1,430,470)	(1,067,762)	-
Operating Cash Flow		28,012	(97,034)	1,321,314	271,316	678,076	409,993	(25,789)	1,197,807	544,157	(465,398)	592,223	(76,176)	67,211	148,524	1,309,190	(347,884)	687,598	1,188,311	(888,246)	382,917	615,961
Tax Paid		-	-	(378,119)	(63,119)	(185,147)	(122,998)	-	(359,342)	(163,247)	-	(177,667)	-	(20,163)	(44,557)	(392,757)	-	(206,279)	(356,493)	-	(114,875)	(184,788)
Residual value of machine (salvage value)																						-
Tax on salvage value (machine)																						-
Residual value of tooling (salvage value)																						60,919
Tax on salvage value (tooling)																						(18,276)
Networking Capital																						538,398
Total Cash Flow	(842,992)	28,012	(97,034)	943,195	208,197	492,929	286,995	(25,789)	838,465	380,910	(465,398)	414,556	(76,176)	47,047	103,967	916,433	(347,884)	481,319	831,818	(888,246)	268,042	1,012,214
Cumulative Cash Flow		(814,980)	(912,014)	31,181	239,378	732,307	1,019,302	993,513	1,831,977	2,212,887	1,747,490	2,162,046	2,085,870	2,132,917	2,236,884	3,153,318	2,805,434	3,286,752	4,118,570	3,230,324	3,498,365	4,510,579
Expenses																						
Repair costs		37,247	510,170	256,952	719,784	286,448	862,049	411,110	955,384	853,178	842,075	739,849	1,510,758	871,345	126,307	822,744	1,293,091	772,254	693,666	1,430,470	1,067,762	-
Other Expenses		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		37,247	510,170	256,952	719,784	286,448	862,049	411,110	955,384	853,178	842,075	739,849	1,510,758	871,345	126,307	822,744	1,293,091	772,254	693,666	1,430,470	1,067,762	-
Tax Paid																						
Operating Cash Flow		28,012	(97,034)	1,321,314	271,316	678,076	409,993	(25,789)	1,197,807	544,157	(465,398)	592,223	(76,176)	67,211	148,524	1,309,190	(347,884)	687,598	1,188,311	(888,246)	382,917	615,961
Wear & Tear																						
Machine		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tooling		(60,919)	(60,919)	(60,919)	(60,919)	(60,919)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Income		(32,907)	(157,953)	1,260,395	210,398	617,157	409,993	(25,789)	1,197,807	544,157	(465,398)	592,223	(76,176)	67,211	148,524	1,309,190	(347,884)	687,598	1,188,311	(888,246)	382,917	615,961
Tax Payable		-	-	378,119	63,119	185,147	122,998	-	359,342	163,247	-	177,667	-	20,163	44,557	392,757	-	206,279	356,493	-	114,875	184,788
NPV for the periods	-	(814,980)	(912,014)	31,181	239,378	732,307	1,019,302	993,513	1,831,977	2,212,887	1,747,490	2,162,046	2,085,870	2,132,917	2,236,884	3,153,318	2,805,434	3,286,752	4,118,570	3,230,324	3,498,365	4,510,579

Table 12 Off Highway Truck #4 Net Present Value calculation

CAPITAL PROJECT CASH FLOW EVALUATION for truck 5

Machine Hours		5,367	10,682	17,070	21,638	24,479	29,479	34,492	39,492	44,492	49,492	54,506	59,506	64,506	69,506	74,520	79,520	84,520	89,520	94,533	99,533	100,000
				PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Cost of Acquisition																						
Machine	-																					
Networking Capital	(538,398)																					
Tooling (additional)	(304,594)																					
Sales (Expected Income)		73,941	550,239	1,569,059	1,070,365	988,909	1,132,393	184,976	2,764,237	904,497	293,038	1,649,500	1,326,580	839,811	122,755	2,741,691	335,451	1,872,856	1,827,911	173,188	1,873,780	192,850
Expenses		(7,776)	(67,328)	(612,618)	(1,256,254)	(61,404)	(1,057,537)	(467,361)	(743,244)	(1,053,669)	(807,616)	(881,938)	(1,214,804)	(876,027)	(413,404)	(549,104)	(1,451,510)	(802,413)	(591,065)	(1,501,542)	(812,451)	-
Operating Cash Flow		66,166	482,912	956,441	(185,889)	927,505	74,856	(282,386)	2,020,993	(149,172)	(514,578)	767,561	111,775	(36,215)	(290,649)	2,192,587	(1,116,060)	1,070,442	1,236,845	(1,328,353)	1,061,328	192,850
Tax Paid		(1,574)	(126,598)	(268,657)	-	(259,976)	(22,457)	-	(606,298)	-	-	(230,268)	(33,533)	-	-	(657,776)	-	(321,133)	(371,054)	-	(318,399)	(57,855)
Residual value of machine (salvage value)																						-
Tax on salvage value (machine)																						-
Residual value of tooling (salvage value)																						60,919
Tax on salvage value (tooling)																						(18,276)
Networking Capital																						538,398
Total Cash Flow	(842,992)	64,592	356,314	687,784	(185,889)	667,529	52,399	(282,386)	1,414,695	(149,172)	(514,578)	537,293	78,243	(36,215)	(290,649)	1,534,811	(1,116,060)	749,310	865,792	(1,328,353)	742,930	716,036
Cumulative Cash Flow		(778,400)	(422,086)	265,698	79,809	747,338	799,737	517,351	1,932,047	1,782,875	1,268,297	1,805,589	1,883,832	1,847,617	1,556,967	3,091,778	1,975,718	2,725,028	3,590,820	2,262,466	3,005,396	3,721,432
Expenses																						
Repair costs		7,776	67,328	612,618	1,256,254	61,404	1,057,537	467,361	743,244	1,053,669	807,616	881,938	1,214,804	876,027	413,404	549,104	1,451,510	802,413	591,065	1,501,542	812,451	-
Other Expenses		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		7,776	67,328	612,618	1,256,254	61,404	1,057,537	467,361	743,244	1,053,669	807,616	881,938	1,214,804	876,027	413,404	549,104	1,451,510	802,413	591,065	1,501,542	812,451	-
Tax Paid																						
Operating Cash Flow		66,166	482,912	956,441	(185,889)	927,505	74,856	(282,386)	2,020,993	(149,172)	(514,578)	767,561	111,775	(36,215)	(290,649)	2,192,587	(1,116,060)	1,070,442	1,236,845	(1,328,353)	1,061,328	192,850
Wear & Tear																						
Machine		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tooling		(60,919)	(60,919)	(60,919)	(60,919)	(60,919)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Income		5,247	421,993	895,522	(246,808)	866,586	74,856	(282,386)	2,020,993	(149,172)	(514,578)	767,561	111,775	(36,215)	(290,649)	2,192,587	(1,116,060)	1,070,442	1,236,845	(1,328,353)	1,061,328	192,850
Tax Payable		1,574	126,598	268,657	-	259,976	22,457	-	606,298	-	-	230,268	33,533	-	-	657,776	-	321,133	371,054	-	318,399	57,855
NPV for the periods	-	(778,400)	(422,086)	265,698	79,809	747,338	799,737	517,351	1,932,047	1,782,875	1,268,297	1,805,589	1,883,832	1,847,617	1,556,967	3,091,778	1,975,718	2,725,028	3,590,820	2,262,466	3,005,396	3,721,432

Table 13 Off Highway Truck #5 Net Present Value calculation

Off Highway Truck

Period 0-100,000 hours

Description	Qty	First Change	Interval	Times Sched	Cost / Interval	Total Costs
Engine	1	18,000	18,000	5	526,821	2,634,106
Turbocharger	1	9,000	18,000	6	26,737	160,422
Muffler	1	18,000	18,000	5	70,278	351,390
Cylinder Head Assembly	1	9,000	18,000	6	11,517	69,105
Fuelsystem	1	9,000	18,000	6	37,514	225,084
Cooling System	1	18,000	18,000	5	70,233	351,164
Radiator	1	9,000	18,000	6	20,009	120,053
Thermostat/Water Temperature Regulator	1	9,000	18,000	6	1,336	8,015
Fan Drive	1	9,000	18,000	6	22,889	137,335
Water Pump	1	9,000	18,000	6	10,518	63,107
Electric System	1	6,000	6,000	16	23,511	376,183
Battery	1	9,000	9,000	11	1,239	13,629
Alternator	1	9,000	9,000	11	3,290	36,194
Refrigerant Compressor	1	9,000	9,000	11	4,745	52,192
Air Compressor	1	9,000	9,000	11	3,771	41,479
Torque Converter, Torque Divid	1	12,000	12,000	8	7,725	61,797
Torque Converter	1	12,000	12,000	8	66,517	532,137
Pump Drive	1	9,000	9,000	11	7,787	85,653
Torque Converter/Transmission pump	1	9,000	9,000	11	6,374	70,111
Power Shift Transmission	1	12,000	12,000	8	144,564	1,156,514
Drive Line/Drive Axle	1	12,000	12,000	8	24,492	195,936
Drive Shaft	1	12,000	12,000	8	19,915	159,317
Differential	1	12,000	12,000	8	68,758	550,060
Final Drive	2	12,000	12,000	8	189,416	1,515,320
Wheel Assembly	2	9,000	9,000	11	53,140	584,530
Wheel Hub Assembly	2	9,000	9,000	11	53,190	585,090
Braking System	1	9,000	9,000	11	119,324	1,312,564
Brake Accumulator	1	9,000	9,000	11	7,482	82,302
Steering System	1	9,000	9,000	11	40,568	446,248
Steering Cylinder	1	12,000	12,000	8	20,291	162,330
Steering Pump	1	9,000	9,000	11	6,731	74,041
Hydraulic System	1	12,000	12,000	8	27,928	223,424
Hydraulic Hoist Pump	1	9,000	9,000	11	13,319	146,509

Table 14 Component lives (Off Highway Trucks)

Appendix C. Wheel Loaders

Appendix C contains the following:

1) Wheel Loader background
2) The general information sheet
3) The budget Net Present Value calculation
4) The application on different mining equipment
5) The component lives for the components and the replacement intervals

Wheel Loader background

The Wheel Loader is used to load the Off Highway Trucks at the production area. The Wheel Loader has a bucket capacity of 11.5 to 12.3 m^3. The advantage of the Wheel Loader over the Front Shovel is the mobility it offered.

Wheel Loader

Depreciation of machine

Year	Value
1	33%
2	33%
3	33%
4	0%
5	0%
6	0%
7	0%
8	0%
9	0%
10	0%
	100%

Business Paramaters

Cost of Capital (Rate of Return on Money Used) (%)	18.00%
Marginal Tax Rate (%)	30.00%
Inflation (Projected Yearly Increase in Prices) (%)	3.00%
Projected Years of Vehicle Operation (# of years)	10
Avg. Projected Gross Margin on Parts and labour (%)	80%

Project Costs

Total Machine Purchase Price (R)	R	11,642,850.00
Network Capital	R	827,652.00
Additional tooling	R	1,164,285.00

Depreciation of tooling

Year	Value
1	20%
2	20%
3	20%
4	20%
5	20%
6	0%
7	0%
8	0%
9	0%
10	0%
	100%

Residual Values

Percentage of life of Machine			0%
Residual Value of Machine After Useful Life (I	10 Years	R	-
Percentage of life of Tooling			0%
Residual Value of Tooling After Useful Life (R	10 Years	R	-

Number of machines on the contract 2

Table 15 Wheel Loaders general information

CAPITAL PROJECT CASH FLOW EVALUATION (Wheel Loader)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Machine Hours		5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000	70,000	75,000	80,000	85,000	90,000	95,000	100,000
Rate		3.69	87.53	202.94	229.46	149.24	204.46	112.45	203.02	143.75	295.59	61.68	282.57	114.96	246.22	163.78	173.16	183.06	163.71	62.82	359.1416
						PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cost of Acquisition																					
Machine	-																				
Networking Capital	(413,826)																				
Tooling (additional)	(582,142)																				
Sales (Expected Income)		18,450	437,650	1,014,700	1,147,300	746,200	1,022,300	562,250	1,015,100	718,750	1,477,950	308,400	1,412,850	574,800	1,231,100	818,900	865,800	915,300	818,550	314,100	1,795,708
Expenses		(11,070)	(262,590)	(608,820)	(688,380)	(447,720)	(613,380)	(337,350)	(609,060)	(431,250)	(886,770)	(185,040)	(847,710)	(344,880)	(738,660)	(491,340)	(519,480)	(549,180)	(491,130)	(188,460)	(1,077,425)
Operating Cash Flow		7,380	175,060	405,880	458,920	298,480	408,920	224,900	406,040	287,500	591,180	123,360	565,140	229,920	492,440	327,560	346,320	366,120	327,420	125,640	718,283
Tax Paid		-	(17,589)	(86,835)	(102,747)	(54,615)	(122,676)	(67,470)	(121,812)	(86,250)	(177,354)	(37,008)	(169,542)	(68,976)	(147,732)	(98,268)	(103,896)	(109,836)	(98,226)	(37,692)	(215,485)
Residual value of machine (salvage value)																					-
Tax on salvage value (machine)																					-
Residual value of tooling (salvage value)																					116,428
Tax on salvage value (tooling)																					(34,929)
Networking Capital																					413,826
Total Cash Flow	(995,968)	7,380	157,471	319,045	356,173	243,865	286,244	157,430	284,228	201,250	413,826	86,352	395,598	160,944	344,708	229,292	242,424	256,284	229,194	87,948	998,124
Cumulative Cash Flow		(988,588)	(831,118)	(512,073)	(155,901)	87,964	374,208	531,638	815,866	1,017,116	1,430,942	1,517,294	1,912,892	2,073,836	2,418,544	2,647,836	2,890,260	3,146,544	3,375,738	3,463,686	4,461,810
Expenses																					
Repair costs		11,070	262,590	608,820	688,380	447,720	613,380	337,350	609,060	431,250	886,770	185,040	847,710	344,880	738,660	491,340	519,480	549,180	491,130	188,460	1,077,425
Other Expenses		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		11,070	262,590	608,820	688,380	447,720	613,380	337,350	609,060	431,250	886,770	185,040	847,710	344,880	738,660	491,340	519,480	549,180	491,130	188,460	1,077,425
Tax Paid																					
Operating Cash Flow		7,380	175,060	405,880	458,920	298,480	408,920	224,900	406,040	287,500	591,180	123,360	565,140	229,920	492,440	327,560	346,320	366,120	327,420	125,640	718,283
Wear & Tear																					
Machine		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tooling		(116,428)	(116,428)	(116,428)	(116,428)	(116,428)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Income		(109,048)	58,632	289,452	342,492	182,052	408,920	224,900	406,040	287,500	591,180	123,360	565,140	229,920	492,440	327,560	346,320	366,120	327,420	125,640	718,283
Tax Payable		0	17,589	86,835	102,747	54,615	122,676	67,470	121,812	86,250	177,354	37,008	169,542	68,976	147,732	98,268	103,896	109,836	98,226	37,692	215,485
NPV for the periods	-	(989,714)	(876,621)	(682,441)	(498,731)	(392,136)	(286,102)	(236,681)	(161,065)	(115,692)	(36,625)	(22,643)	31,641	50,357	84,327	103,477	120,635	136,007	147,657	151,445	187,883

Table 16 Wheel Loader (budget) Net Present Value calculation

CAPITAL PROJECT CASH FLOW EVALUATION for Wheel Loader 1

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Machine Hours		4,813	9,977	14,780	20,127	24,387	29,130	29,130	39,144	44,144	49,144	54,158	59,158	64,158	69,158	74,171	79,171	84,171	89,171	94,185	99,185	100,000
					PAYBACK ACHIEVED		PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Cost of Acquisition																						
Machine	-																					
Networking Capital	(413,826)																					
Tooling (additional)	(582,142)																					
Sales (Expected income)		15,311	416,942	991,071	1,485,983	982,758	1,381,950	1,381,950	1,342,597	1,101,926	1,930,287	729,621	1,756,739	1,025,326	1,604,600	1,275,345	1,228,706	1,298,973	1,195,139	570,762	2,225,622	419,178
Expenses		(142,591)	(70,184)	(312,127)	(339,278)	(1,619,202)	(740,493)	(740,493)	(652,290)	(2,023,809)	(403,626)	(859,972)	(1,188,381)	(1,027,974)	(521,381)	(1,087,225)	(1,334,980)	(428,776)	(1,185,239)	(1,167,483)	(635,942)	(468,841)
Operating Cash Flow		(127,280)	346,758	678,943	1,146,705	(636,444)	641,458	641,458	690,307	(921,883)	1,526,661	(130,351)	568,358	(2,648)	1,083,219	188,120	(106,275)	870,197	9,900	(596,721)	1,589,681	(49,663)
Tax Paid		-	(69,099)	(168,754)	(309,083)	-	(192,437)	(192,437)	(207,092)	-	(457,998)	-	(170,507)	-	(324,966)	(56,436)	-	(261,059)	(2,970)	-	(476,904)	-
Residual value of machine (salvage value)																						-
Tax on salvage value (machine)																						-
Residual value of tooling (salvage value)																						116,428
Tax on salvage value (tooling)																						(34,929)
Networking Capital																						413,826
Total Cash Flow	(995,968)	(127,280)	277,659	510,189	837,622	(636,444)	449,020	449,020	483,215	(921,883)	1,068,662	(130,351)	397,851	(2,648)	758,253	131,684	(106,275)	609,138	6,930	(596,721)	1,112,776	445,663
Cumulative Cash Flow		(1,123,248)	(845,589)	(335,400)	502,222	(134,222)	314,798	763,819	1,247,034	325,151	1,393,813	1,263,462	1,661,313	1,658,665	2,416,919	2,548,603	2,442,328	3,051,466	3,058,396	2,461,676	3,574,452	4,020,115
Expenses																						
Repair costs		142,591	70,184	312,127	339,278	1,619,202	740,493	740,493	652,290	2,023,809	403,626	859,972	1,188,381	1,027,974	521,381	1,087,225	1,334,980	428,776	1,185,239	1,167,483	635,942	468,841
Other Expenses		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Total		142,591	70,184	312,127	339,278	1,619,202	740,493	740,493	652,290	2,023,809	403,626	859,972	1,188,381	1,027,974	521,381	1,087,225	1,334,980	428,776	1,185,239	1,167,483	635,942	468,841
Tax Paid																						
Operating Cash Flow		(127,280)	346,758	678,943	1,146,705	(636,444)	641,458	641,458	690,307	(921,883)	1,526,661	(130,351)	568,358	(2,648)	1,083,219	188,120	(106,275)	870,197	9,900	(596,721)	1,589,681	(49,663)
Wear & Tear																						
Machine		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tooling		(116,428)	(116,428)	(116,428)	(116,428)	(116,428)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Income		(243,708)	230,329	562,515	1,030,277	(752,873)	641,458	641,458	690,307	(921,883)	1,526,661	(130,351)	568,358	(2,648)	1,083,219	188,120	(106,275)	870,197	9,900	(596,721)	1,589,681	(49,663)
Tax Payable		-	69,099	168,754	309,083	-	192,437	192,437	207,092	-	457,998	-	170,507	-	324,966	56,436	-	261,059	2,970	-	476,904	-
NPV for the periods	-	(1,103,833)	(904,422)	(593,906)	(161,869)	(440,065)	(273,734)	(132,775)	(4,221)	(212,065)	(7,882)	(28,988)	25,605	25,297	100,022	111,020	103,498	140,034	140,386	114,681	155,304	169,091

Table 17 Wheel Loader #1 Net Present Value calculation

CAPITAL PROJECT CASH FLOW EVALUATION for Wheel Loader 2

Machine Hours		314	5,580	10,776	15,627	20,428	20,428	25,835	35,849	40,849	45,849	50,862	55,862	60,862	65,862	70,876	75,876	80,876	85,876	90,890	95,890	100,000	100,000
						PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Cost of Acquisition																							
Machine	-																						
Networking Capital	(413,826)																						
Tooling (additional)	(582,142)																						
Sales (Expected income)		928	64,407	567,926	1,248,480	1,666,217	1,666,217	1,284,519	929,932	1,403,864	1,233,295	1,862,958	725,861	1,845,518	1,001,046	1,691,174	1,203,510	1,272,416	1,307,163	1,063,716	840,601	2,147,999	59,919,990
Expenses		(280)	(26,089)	(51,207)	(1,285,561)	(526,628)	(526,628)	(634,824)	(587,287)	(1,636,438)	(512,023)	(807,916)	(1,609,051)	(665,608)	(383,670)	(1,912,631)	(752,972)	(423,501)	(749,509)	(1,740,525)	(503,491)	(972,757)	(53,155,586)
Operating Cash Flow		648	38,318	516,720	(37,080)	1,139,589	1,139,589	649,695	342,645	(232,574)	721,272	1,055,042	(883,190)	1,179,910	617,376	(221,457)	450,538	848,915	557,654	(676,810)	337,110	1,175,242	6,764,405
Tax Paid		-	-	(120,087)	-	(306,948)	(341,877)	(194,908)	(102,794)	-	(216,382)	(316,513)	-	(353,973)	(185,213)	-	(135,162)	(254,674)	(167,296)	-	(101,133)	(352,572)	(2,029,321)
Residual value of machine (salvage value)																							-
Tax on salvage value (machine)																							-
Residual value of tooling (salvage value)																							116,428
Tax on salvage value (tooling)																							(34,929)
Networking Capital																							413,826
Total Cash Flow	(995,968)	648	38,318	396,632	(37,080)	832,641	797,712	454,786	239,852	(232,574)	504,891	738,529	(883,190)	825,937	432,163	(221,457)	315,377	594,240	390,358	(676,810)	235,977	822,669	5,230,409
Cumulative Cash Flow		(995,321)	(957,003)	(560,371)	(597,451)	235,190	1,032,902	1,487,688	1,727,540	1,494,966	1,999,856	2,738,386	1,855,196	2,681,133	3,113,297	2,891,839	3,207,216	3,801,457	4,191,814	3,515,004	3,750,981	4,573,650	9,804,060
Expenses																							
Repair costs		280	26,089	51,207	1,285,561	526,628	526,628	634,824	587,287	1,636,438	512,023	807,916	1,609,051	665,608	383,670	1,912,631	752,972	423,501	749,509	1,740,525	503,491	972,757	53,155,586
Other Expenses		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		280	26,089	51,207	1,285,561	526,628	526,628	634,824	587,287	1,636,438	512,023	807,916	1,609,051	665,608	383,670	1,912,631	752,972	423,501	749,509	1,740,525	503,491	972,757	53,155,586
Tax Paid																							
Operating Cash Flow		648	38,318	516,720	(37,080)	1,139,589	1,139,589	649,695	342,645	(232,574)	721,272	1,055,042	(883,190)	1,179,910	617,376	(221,457)	450,538	848,915	557,654	(676,810)	337,110	1,175,242	6,764,405
Wear & Tear																							
Machine		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tooling		(116,428)	(116,428)	(116,428)	(116,428)	(116,428)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Income		(115,781)	(78,111)	400,291	(153,509)	1,023,161	1,139,589	649,695	342,645	(232,574)	721,272	1,055,042	(883,190)	1,179,910	617,376	(221,457)	450,538	848,915	557,654	(676,810)	337,110	1,175,242	6,764,405
Tax Payable		-	-	120,087	-	306,948	341,877	194,908	102,794	-	216,382	316,513	-	353,973	185,213	-	135,162	254,674	167,296	-	101,133	352,572	2,029,321
NPV for the periods	-	(995,420)	(967,901)	(726,498)	(745,624)	(381,669)	(86,171)	56,598	120,408	67,973	164,439	284,021	162,830	258,877	301,466	282,971	305,292	340,934	360,776	331,622	340,236	365,687	502,817

Table 18 Wheel Loader #2 Net Present Value calculation

Wheel Loader

Period 0-100,000 hours

Description	Qty	First Change	Interval	Times Sched	Cost / Interval	Total Costs
Engine	1	16,000	16,000	6	391,020	2,346,120
Air Induction & Exhaust System	1	16,000	16,000	6	26,360	158,160
Turbocharger	2	8,000	8,000	12	17,620	211,440
Fuel Injection Valve/nozzle	1	8,000	8,000	12	35,560	426,720
Cooling System	1	16,000	16,000	6	19,290	115,740
V-Belt(S)	1	1,500	1,500	66	1,380	91,080
Water Pump	2	8,000	8,000	12	10,924	131,088
Battery	4	8,000	8,000	12	4,676	56,112
Alternator	1	8,000	8,000	12	5,390	64,680
Starting System	1	8,000	8,000	12	15,170	182,040
Refrigerant Compressor	1	8,000	8,000	12	4,390	52,680
Air Compressor	1	8,000	8,000	12	9,487	113,844
Torque Converter	1	12,000	12,000	8	43,710	349,680
Pump Drive	1	10,000	10,000	10	48,705	487,050
Power Shift Transmission	1	12,000	12,000	8	151,365	1,210,920
Universal Joint	4	12,000	12,000	8	32,340	258,720
Drive Shaft	2	18,000	17,820	5	32,060	160,300
Differential	2	14,000	14,000	7	134,040	938,280
Axle Housing Assembly	2	14,000	14,000	7	17,190	120,330
Final Drive	4	14,000	14,000	7	377,160	2,640,120
Braking System	1	24,000	24,000	4	20,495	81,980
Braking System.Front	1	14,000	14,000	7	51,020	357,140
Braking System.Rear	1	14,000	14,000	7	25,510	178,570
Steering System	1	23,000	23,000	4	14,070	56,280
Steering Cylinder	2	10,000	10,000	10	18,740	187,400
Hydraulic System	1	10,000	10,000	10	11,120	111,200
Hydraulic System	1	23,000	23,000	4	52,605	210,420
Hydraulic Pump, Vane-Type	2	10,000	10,000	10	100,290	1,002,900
Hydraulic Hosesilines	1	8,000	8,000	12	3,890	46,680
Hydraulic Pump, Gear-Type	1	10,000	10,000	10	12,975	129,750
Lift/Hoist Cylinder	2	10,000	10,000	10	48,120	481,200
Tilt Cylinder	1	10,000	10,000	10	45,120	451,200
Articulation Cylinder	2	10,000	10,000	10	17,340	173,400
Loading Implements	1	12,000	12,000	8	25,510	204,080
One-Piece Boom	1	18,000	18,000	5	249,387	1,246,935
Bucket Linkage	1	3,000	3,000	33	8,475	279,675
Machine	1	12,000	12,000	8	30,510	244,080
Frame	1	23,000	23,000	4	92,285	369,140
Articulated Pivot Pin	1	15,000	15,000	6	84,360	506,160
Air Conditioner	1	2,000	2,000	50	1,195	59,750
ROPS/FOPS Cab	1	23,000	23,000	4	136,700	546,800
Gauges & Indicators	1	12,500	12,500	8	12,560	100,480
Miscellaneous	1	1,500	1,500	66	1,149	75,834

Table 19 Component lives (Wheel Loaders)

Appendix D. Front shovels

Appendix D contains the following:

1) Front Shovel background
2) The general information sheet
3) The budget Net Present Value calculation
4) The application on different mining equipment
5) The component lives for the components and the replacement intervals

Front Shovel background

The Caterpillar 5230 Front shovel weighs approximately 327 000 kg. The front shovel buckets range from 15.5 m^3 to 17.0 m^3. The 5230-size class is ideally suited for loading the Off Highway Truck. The advantage of the Front Shovel over the Wheel Loader is the greater break-out force it offers.

Front Shovel

Depreciation of machine

Year	Value
1	33%
2	33%
3	33%
4	0%
5	0%
6	0%
7	0%
8	0%
9	0%
10	0%
	100%

Business Paramaters

Cost of Capital (Rate of Return on Money Used) (%)	18.00%
Marginal Tax Rate (%)	30.00%
Inflation (Projected Yearly Increase in Prices) (%)	3.00%
Projected Years of Vehicle Operation (# of years)	10
Avg. Projected Gross Margin on Parts and labour (%)	80%

Project Costs

Total Machine Purchase Price (R)	R 32,513,268.00
Network Capital	R 4,153,212.00
Additional tooling	R 3,251,326.80

Depreciation of tooling

Year	Value
1	20%
2	20%
3	20%
4	20%
5	20%
6	0%
7	0%
8	0%
9	0%
10	0%
	100%

Residual Values

Percentage of life of Machine			0%
Residual Value of Machine After Useful Life	10 Years	R	-
Percentage of life of Tooling			0%
Residual Value of Tooling After Useful Life (I	10 Years	R	-

Number of machines on the contract 2

Table 20 Front Shovel general information

CAPITAL PROJECT CASH FLOW EVALUATION (Front Shovel)

Machine Hours		5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000
Rate		13.56	298.91	779.24	859.6	1096.36	281.21	917.99	731.17	371.94	1483.29
						PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year		1	2	3	4	5	6	7	8	9	10
Cost of Acquisition											
Machine	-										
Networking Capital	(2,076,606)										
Tooling (additional)	(1,625,663)										
Sales (Expected income)		67,800	1,494,550	3,896,200	4,298,000	5,481,800	1,406,050	4,589,950	3,655,850	1,859,700	7,416,450
Expenses		(40,680)	(896,730)	(2,337,720)	(2,578,800)	(3,289,080)	(843,630)	(2,753,970)	(2,193,510)	(1,115,820)	(4,449,870)
Operating Cash Flow		27,120	597,820	1,558,480	1,719,200	2,192,720	562,420	1,835,980	1,462,340	743,880	2,966,580
Tax Paid		-	(81,806)	(370,004)	(418,220)	(560,276)	(168,726)	(550,794)	(438,702)	(223,164)	(889,974)
Residual value of machine (salvage value)											
Tax on salvage value (machine)											
Residual value of tooling (salvage value)											
Tax on salvage value (tooling)											
Networking Capital											
Total Cash Flow	(3,702,269)	27,120	516,014	1,188,476	1,300,980	1,632,444	393,694	1,285,186	1,023,638	520,716	2,076,606
Cumulative Cash Flow		(3,675,149)	(3,159,136)	(1,970,660)	(669,680)	962,764	1,356,458	2,641,644	3,665,282	4,185,998	6,262,604
Expenses											
Repair costs		40,680	896,730	2,337,720	2,578,800	3,289,080	843,630	2,753,970	2,193,510	1,115,820	4,449,870
Other Expenses		-	-	-	-	-	-	-	-	-	-
Total		40,680	896,730	2,337,720	2,578,800	3,289,080	843,630	2,753,970	2,193,510	1,115,820	4,449,870
Tax Paid											
Operating Cash Flow		27,120	597,820	1,558,480	1,719,200	2,192,720	562,420	1,835,980	1,462,340	743,880	2,966,580
Wear & Tear											
Machine		-	-	-	-	-	-	-	-	-	-
Tooling		(325,133)	(325,133)	(325,133)	(325,133)	(325,133)	-	-	-	-	-
Taxable Income		(298,013)	272,687	1,233,347	1,394,067	1,867,587	562,420	1,835,980	1,462,340	743,880	2,966,580
Tax Payable		-	81,806	370,004	418,220	560,276	168,726	550,794	438,702	223,164	889,974
NPV for the periods	-	(3,679,286)	(3,308,693)	(2,585,350)	(1,914,319)	(1,200,763)	(1,054,926)	(651,474)	(379,148)	(261,749)	135,017

Machine Hours	55,000	60,000	65,000	70,000	75,000	80,000	85,000	90,000	95,000	100,000
Rate	342.59	818.58	840.72	430.93	1216.96	538.94	1006.54	545.07	407.78	1196.1166
	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year	11	12	13	14	15	16	17	18	19	20
Cost of Acquisition										
Machine										
Networking Capital										
Tooling (additional)										
Sales (Expected income)	1,712,950	4,092,900	4,203,600	2,154,650	6,084,800	2,694,700	5,032,700	2,725,350	2,038,900	5,980,583
Expenses	(1,027,770)	(2,455,740)	(2,522,160)	(1,292,790)	(3,650,880)	(1,616,820)	(3,019,620)	(1,635,210)	(1,223,340)	(3,588,350)
Operating Cash Flow	685,180	1,637,160	1,681,440	861,860	2,433,920	1,077,880	2,013,080	1,090,140	815,560	2,392,233
Tax Paid	(205,554)	(491,148)	(504,432)	(258,558)	(730,176)	(323,364)	(603,924)	(327,042)	(244,668)	(717,670)
Residual value of machine (salvage value)										-
Tax on salvage value (machine)										-
Residual value of tooling (salvage value)										325,133
Tax on salvage value (tooling)										(97,540)
Networking Capital										2,076,606
Total Cash Flow	479,626	1,146,012	1,177,008	603,302	1,703,744	754,516	1,409,156	763,098	570,892	3,978,762
Cumulative Cash Flow	6,742,230	7,888,242	9,065,250	9,668,552	11,372,296	12,126,812	13,535,968	14,299,066	14,869,958	18,848,720
Expenses										
Repair costs	1,027,770	2,455,740	2,522,160	1,292,790	3,650,880	1,616,820	3,019,620	1,635,210	1,223,340	3,588,350
Other Expenses	-	-	-	-	-	-	-	-	-	-
Total	1,027,770	2,455,740	2,522,160	1,292,790	3,650,880	1,616,820	3,019,620	1,635,210	1,223,340	3,588,350
Tax Paid										
Operating Cash Flow	685,180	1,637,160	1,681,440	861,860	2,433,920	1,077,880	2,013,080	1,090,140	815,560	2,392,233
Wear & Tear										
Machine	-	-	-	-	-	-	-	-	-	-
Tooling	-	-	-	-	-	-	-	-	-	-
Taxable Income	685,180	1,637,160	1,681,440	861,860	2,433,920	1,077,880	2,013,080	1,090,140	815,560	2,392,233
Tax Payable	205,554	491,148	504,432	258,558	730,176	323,364	603,924	327,042	244,668	717,670
NPV for the periods	212,677	369,932	506,804	566,259	708,549	761,951	846,472	885,260	909,852	1,055,100

Table 21 Front Shovel (budget) Net Present Value calculation

CAPITAL PROJECT CASH FLOW EVALUATION for Front Shovel 1

Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Machine Hours		4,707	9,557	13,754	16,374	20,976	25,989	25,989	35,989	40,989	46,003	51,003	56,003	61,003	66,017	71,017	76,017	81,017	86,031	91,031	96,031	100,000
								PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Cost of Acquisition																						
Machine	-																					
Networking Capital	(2,076,606)																					
Tooling (additional)	(1,625,663)																					
Sales (Expected income)		51,066	1,165,816	3,117,415	2,822,784	5,139,240	5,596,522	5,596,522	5,256,265	3,938,119	3,555,399	7,484,064	2,613,690	4,910,244	4,532,359	3,524,702	6,437,853	3,782,737	5,454,122	3,083,127	3,402,271	5,665,319
Expenses		-	(328,791)	(2,977,867)	(2,580,272)	(4,301,687)	(4,149,027)	(4,149,027)	(3,169,105)	(3,175,679)	(4,172,145)	(4,220,143)	(4,062,318)	(2,166,343)	(4,861,166)	(4,622,778)	(1,736,725)	(3,801,344)	(5,271,071)	(2,216,149)	(4,109,933)	(3,889,772)
Operating Cash Flow		51,066	837,025	139,548	242,513	837,553	1,447,496	1,447,496	2,087,160	762,440	(616,745)	3,263,922	(1,448,628)	2,743,901	(328,807)	(1,098,076)	4,701,128	(18,607)	183,051	866,977	(707,662)	1,775,547
Tax Paid		-	(153,568)	-	-	(153,726)	(434,249)	(434,249)	(626,148)	(228,732)	-	(979,176)	-	(823,170)	-	-	(1,410,338)	-	(54,915)	(260,093)	-	(532,664)
Residual value of machine (salvage value)																						-
Tax on salvage value (machine)																						-
Residual value of tooling (salvage value)																						325,133
Tax on salvage value (tooling)																						(97,540)
Networking Capital																						2,076,606
Total Cash Flow	(3,702,269)	51,066	683,457	139,548	242,513	683,827	1,013,247	1,013,247	1,461,012	533,708	(616,745)	2,284,745	(1,448,628)	1,920,731	(328,807)	(1,098,076)	3,290,790	(18,607)	128,136	606,884	(707,662)	3,547,082
Cumulative Cash Flow		(3,651,204)	(2,967,747)	(2,828,199)	(2,585,686)	(1,901,859)	(888,612)	124,634	1,585,647	2,119,354	1,502,609	3,787,354	2,338,726	4,259,457	3,930,649	2,832,574	6,123,363	6,104,756	6,232,892	6,839,776	6,132,114	9,679,195
Expenses																						
Repair costs		-	328,791	2,977,867	2,580,272	4,301,687	4,149,027	4,149,027	3,169,105	3,175,679	4,172,145	4,220,143	4,062,318	2,166,343	4,861,166	4,622,778	1,736,725	3,801,344	5,271,071	2,216,149	4,109,933	3,889,772
Other Expenses		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		-	328,791	2,977,867	2,580,272	4,301,687	4,149,027	4,149,027	3,169,105	3,175,679	4,172,145	4,220,143	4,062,318	2,166,343	4,861,166	4,622,778	1,736,725	3,801,344	5,271,071	2,216,149	4,109,933	3,889,772
Tax Paid																						
Operating Cash Flow		51,066	837,025	139,548	242,513	837,553	1,447,496	1,447,496	2,087,160	762,440	(616,745)	3,263,922	(1,448,628)	2,743,901	(328,807)	(1,098,076)	4,701,128	(18,607)	183,051	866,977	(707,662)	1,775,547
Wear & Tear																						
Machine		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tooling		(325,133)	(325,133)	(325,133)	(325,133)	(325,133)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Income		(274,067)	511,892	(185,585)	(82,620)	512,420	1,447,496	1,447,496	2,087,160	762,440	(616,745)	3,263,922	(1,448,628)	2,743,901	(328,807)	(1,098,076)	4,701,128	(18,607)	183,051	866,977	(707,662)	1,775,547
Tax Payable		-	153,568	-	-	153,726	434,249	434,249	626,148	228,732	-	979,176	-	823,170	-	-	1,410,338	-	54,915	260,093	-	532,664
NPV for the periods	-	(3,658,993)	(3,168,145)	(3,083,212)	(2,958,127)	(2,659,220)	(2,283,881)	(1,965,798)	(1,577,113)	(1,456,785)	(1,574,623)	(1,204,679)	(1,403,459)	(1,180,102)	(1,212,506)	(1,304,212)	(1,071,303)	(1,072,419)	(1,065,905)	(1,039,763)	(1,065,597)	(955,861)

Table 22 Front Shovel #1 Net Present Value calculation

CAPITAL PROJECT CASH FLOW EVALUATION for Front Shovel 2

Machine Hours		5,285	9,352	12,643	16,771	21,784	26,784	31,784	36,784	41,798	46,798	51,798	56,798	61,812	66,812	71,812	76,812	81,826	86,826	91,826	96,826	100,000
												PAYBACK ACHIEVED		PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED	PAYBACK ACHIEVED
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Cost of Acquisition																						
Machine	-																					
Networking Capital	(2,076,606)																					
Tooling (additional)	(1,625,663)																					
Sales (Expected income)		138,655	1,227,152	2,925,222	4,113,461	5,646,654	4,805,321	3,033,619	5,079,041	3,603,420	4,603,587	6,401,955	3,065,232	4,944,989	4,129,875	4,270,359	5,794,658	4,242,772	4,999,902	2,952,888	4,150,116	4,530,639
Expenses		(139,243)	(513,315)	(4,201,492)	(4,106,493)	(3,493,461)	(3,607,701)	(5,358,824)	(1,598,237)	(4,163,785)	(5,086,120)	(2,185,721)	(3,297,155)	(4,050,471)	(4,210,169)	(3,047,038)	(3,671,750)	(4,118,001)	(4,317,299)	(3,235,195)	(4,137,575)	(1,702,242)
Operating Cash Flow		-587.73	713,837	(1,276,269)	6,968	2,153,192	1,197,620	(2,325,205)	3,480,804	(560,365)	(482,533)	4,216,234	(231,923)	894,518	(80,295)	1,223,321	2,122,909	124,771	682,603	(282,306)	12,540	2,828,397
Tax Paid		-	(116,611)	-	-	(548,418)	(359,286)	-	(1,044,241)	-	-	(1,264,870)	-	(268,356)	-	(366,996)	(636,873)	(37,431)	(204,781)	-	(3,762)	(848,519)
Residual value of machine (salvage value)																						-
Tax on salvage value (machine)																						-
Residual value of tooling (salvage value)																						325,133
Tax on salvage value (tooling)																						(97,540)
Networking Capital																						2,076,606
Total Cash Flow	(3,702,269)	(588)	597,226	(1,276,269)	6,968	1,604,774	838,334	(2,325,205)	2,436,563	(560,365)	(482,533)	2,951,364	(231,923)	626,163	(80,295)	856,325	1,486,036	87,340	477,822	(282,306)	8,778	4,284,077
Cumulative Cash Flow		(3,702,857)	(3,105,632)	(4,381,901)	(4,374,933)	(2,770,158)	(1,931,824)	(4,257,029)	(1,820,466)	(2,380,832)	(2,863,365)	87,999	(143,924)	482,238	401,944	1,258,269	2,744,305	2,831,644	3,309,467	3,027,160	3,035,939	7,320,016
Expenses																						
Repair costs		139,243	513,315	4,201,492	4,106,493	3,493,461	3,607,701	5,358,824	1,598,237	4,163,785	5,086,120	2,185,721	3,297,155	4,050,471	4,210,169	3,047,038	3,671,750	4,118,001	4,317,299	3,235,195	4,137,575	1,702,242
Other Expenses		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		139,243	513,315	4,201,492	4,106,493	3,493,461	3,607,701	5,358,824	1,598,237	4,163,785	5,086,120	2,185,721	3,297,155	4,050,471	4,210,169	3,047,038	3,671,750	4,118,001	4,317,299	3,235,195	4,137,575	1,702,242
Tax Paid																						
Operating Cash Flow		-587.73	713,837	(1,276,269)	6,968	2,153,192	1,197,620	(2,325,205)	3,480,804	(560,365)	(482,533)	4,216,234	(231,923)	894,518	(80,295)	1,223,321	2,122,909	124,771	682,603	(282,306)	12,540	2,828,397
Wear & Tear																						
Machine		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tooling		(325,133)	(325,133)	(325,133)	(325,133)	(325,133)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Income		(325,720)	388,704	(1,601,402)	(318,165)	1,828,060	1,197,620	(2,325,205)	3,480,804	(560,365)	(482,533)	4,216,234	(231,923)	894,518	(80,295)	1,223,321	2,122,909	124,771	682,603	(282,306)	12,540	2,828,397
Tax Payable		-	116,611	-	-	548,418	359,286	-	1,044,241	-	-	1,264,870	-	268,356	-	366,996	636,873	37,431	204,781	-	3,762	848,519
NPV for the periods	-	(3,702,767)	(3,273,849)	(4,050,626)	(4,047,032)	(3,345,570)	(3,035,025)	(3,764,965)	(3,116,746)	(3,243,084)	(3,335,279)	(2,857,397)	(2,889,222)	(2,816,406)	(2,824,319)	(2,752,803)	(2,647,626)	(2,642,388)	(2,618,100)	(2,630,261)	(2,629,940)	(2,497,404)

Table 23 Front Shovel #2 Net Present Value calculation

Front Shovel

Period 0-100,000 hours

Description	Qty	First Change	Interval	Times Sched	Cost / Interval	Total Costs
Engine	1	16,500	14,850	6	965,564	5,793,384
Turbocharger	4	7,000	7,000	14	54,064	756,896
Muffler	1	7,000	7,000	14	77,986	1,091,804
Cylinder Head Assembly	1	8,000	8,000	12	35,174	422,088
Fuelsystem	1	7,000	7,000	14	56,312	788,368
Cooling System	1	8,000	8,000	12	112,397	1,348,764
Radiator	1	15,000	15,000	6	36,355	218,130
Thermostat/Water Temperature Regulator	1	8,000	8,000	12	6,432	77,184
Water Pump	1	8,000	8,000	12	7,772	93,264
Hydraulic Fan Motor	1	8,000	8,000	12	16,687	200,244
Hydraulic Fan Pump	1	8,000	8,000	12	6,509	78,108
Electric System	1	16,000	16,000	6	81,986	491,916
Battery	1	6,000	6,000	16	4,020	64,320
Alternator	1	7,000	7,000	14	4,806	67,284
Prelub Starter	1	6,000	6,000	16	11,166	178,656
Refrigerant Compressor	1	8,000	8,000	12	4,493	53,916
Air Compressor	1	8,000	8,000	12	13,742	164,904
Pump Drive	1	16,000	14,720	6	86,255	517,530
Final Drive	2	16,000	14,720	6	1,178,128	7,068,768
Undercarriage	2	12,000	12,000	8	1,758,926	14,071,408
Track Roller Frame	2	24,000	24,000	4	962,820	3,851,280
Sprocket Segment	2	12,000	12,000	8	395,976	3,167,800
Parking Brake	1	10,000	9,200	10	23,245	232,450
Hydraulic Propel/Drive Motor	4	12,000	11,040	8	159,872	1,278,976
Hydraulic System	1	18,000	16,200	6	638,011	3,828,066
Hydraulic Motor, Piston-Type	1	12,000	11,040	8	85,578	684,624
Swivel	1	6,000	6,000	16	21,720	347,520
Hydraulic Pump, Gear-Type	1	9,000	8,550	11	475,134	5,226,474
Pilot Pump	1	9,000	8,550	11	5,640	62,040
Shovel Boom Cylinder	2	8,000	7,600	13	106,638	1,386,294
Bucket Cylinder	2	8,000	7,600	13	98,312	1,278,056
Stick Cylinder	2	8,000	7,600	13	73,684	957,892
Swing Drive	1	15,000	13,800	7	338,277	2,367,939
Swing Pump	1	12,000	11,040	8	64,838	518,704
Loading Implements	1	12,000	12,000	8	710,100	5,680,800
Bucket Control	1	9,000	9,000	11	181,084	1,991,924
Frame	1	22,000	22,000	4	96,084	384,336
Swing Gear/Bearing	1	21,000	21,000	4	380,835	1,523,340
Body	1	15,000	15,000	6	18,678	112,068
Air Conditioner	1	25,000	25,000	4	11,963	47,852
ROPS/FOPS Cab	1	25,000	25,000	4	45,329	181,316
Automatic Lubrication System	1	7,000	6,650	14	29,761	416,654
Electronic Control Data Manage	1	16,000	16,000	6	76,407	458,442
Miscellaneous	1	1,000	1,000	100	13,557	1,355,700

Table 24 Component lives (Front Shovel)