

A Report focussing on:

Renting or Purchasing Site Machinery



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1. Executive Summary

The aim of this report is to understand and assess whether purchasing site machinery is more economic and cost effective than financing. Within this report I will show calculations of a specific site machinery analysing 'Time-Value of Money' 'Financing Cost' and 'Depreciation'. To conclude I will discuss and justify my solutions.

2. Terms of Reference

The principal focuses are:

- 2.1** To understand the purchasing and financing of site machinery.
- 2.2** To carry out mathematical exercises to analyse time-value of money, financing cost and depreciation.
- 2.3** To discuss and justify my solutions.

2.1.1 The report was constrained by the information given and researched with the need to complete by 13th February 2018.

3. Procedure

This section identifies the research sources used.

- 3.1** The research included secondary sources on the subjects of purchasing and renting site machinery from websites and text books set out in the references and bibliography.

4. Findings

In the construction industry there is more than one way of obtaining site machinery. Up-front Purchasing and Renting. There are different factors which will determine the route in which a construction company will proceed with. Some of these include;

- Financial status
- Use of the machine (Limited/Extensive)
- Whether it will be an Investment

Below are some of the advantages and disadvantages of renting site plant;

Advantages of Renting	Disadvantages of Renting
Hiring machinery allows a company to spread the cost. By hiring, it allows you to utilise the money that would've been spent upfront on other areas within the project.	If the vehicle is hired, the company will never own it.
Some projects require specialised plant. Therefore, short term renting allows you to use the vehicle for a short period of time, specifically for that project.	Long term rentals can be more expensive than purchasing.
If the machinery breaks (beyond repair), the rental company will source a replacement as part of the contract.	In the unfortunate event where the rental company comes into hard times, you may lose the vehicle through no fault of their own.
It allows you to understand and determine how much use you would get out of the vehicle before actually purchasing one.	

Anon. (2015).

On the other hand, below are some of the advantages and disadvantages of up-front purchasing site plant;

Advantages of Purchasing	Disadvantages of Purchasing
The vehicle is owned by the company – no agreements, negotiations or contracts to sign.	A large upfront cost is required.
Purchasing new equipment means fewer damages and as a result less time dedicated to repair, thus minimising delays on site.	The company is responsible for transporting, maintaining, repairing, storing and safely disposing of the vehicle at the end of its working life.
An online source suggests that having new machinery signals that the company takes pride in its work, and that they will accept nothing less than the best when it comes to providing clients and customers with the highest quality of services.	Money and time spent in training workers on new machinery.
Owning equipment can build equity within a company.	

Koutsogiannis, A. (2017).

Corresponding Works

With regard to my construction Gantt programme for the 'Commercial Building Block' submitted as part of the project planning assignment, I had calculated that the total duration to complete all works was 18 months. With reference to the executive summary set out on page 3 of this report I have decided that I am going to mathematically analyse the hydraulic excavator JCB JS200W. I am going to understand the cost implications of purchasing this vehicle.

Vehicle Details:**2003 JCB JS200W**

Purchase Price (P)	-	£75,000.00 <i>Wilkins, A. (2014).</i>
Salvage Value (F)	-	£19,995.00 <i>Wilkins, A. (2014).</i>
Useful Life (N)	-	15 Years
Insurance (Per Annum)	-	£3,000.00 (assumed)
Operation Factor	-	50% (assumed)
Working Hours	-	200 days/year, 8 hours/day
Maintenance/ Repair Costs	-	110% of annual depreciation (assumed)
Diesel Fuel Price	-	£5.55/Gallon <i>Fuel Protest. (2018).</i>
Fuel Consumption	-	0.04 gallon/hp/hr (assumed)
Lube Oil Cost	-	10% of Fuel (assumed)
Maximum Engine Power	-	129Kw (172hp) <i>JCB. (2018).</i>
Maximum Operating Weight	-	22490kg <i>JCB. (2018).</i>
Oil Life	-	5000 hour <i>JCB. (2018).</i>
Interest	-	12% (assumed)



Anon. (2018).

Time – Value of Money

It is known that money today is worth more than the same money to be received in the future, it can be invested. There are two different ways of analysing this. Single Payment and Uniform Series of Payments. The formulas have been set out below;

→ Single Payment

$$F = P \times (1 + i)^n$$

→ Uniform Series of Payment

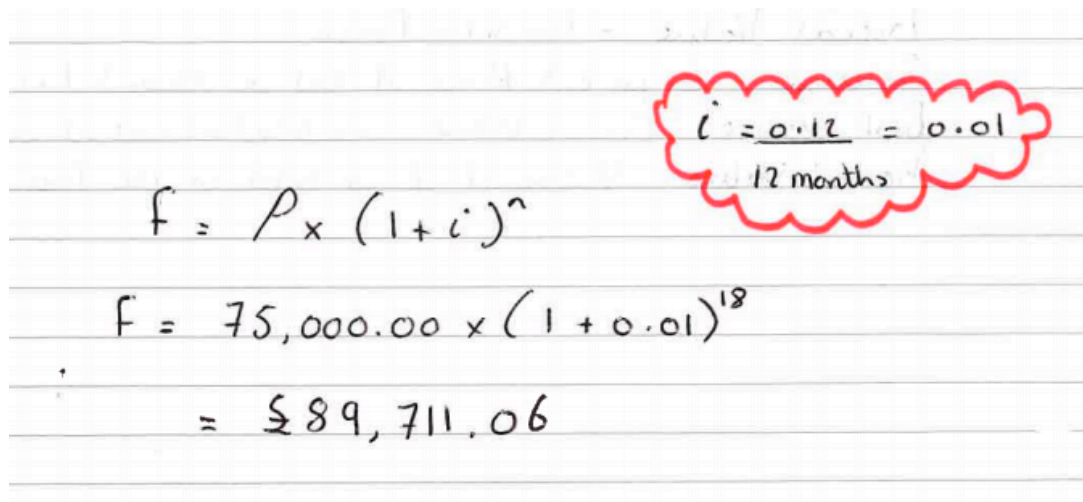
$$F = C \times \left[\frac{(1 + i)^n - 1}{i} \right]$$

$$\underline{P} = C \times \left[\frac{(1 + i)^n - 1}{i(1 + i)^n} \right]$$

F = Future Value
 P = Single Payment
 i = Interest
 n = no of years
 C = Uniform Annual payment
 $\underline{P}$ = Present value of a future amount of Money (F)

Single Payment Calculation

In order to understand a single payment analysis, for the JCB JS200 W, the following calculation was made;



Handwritten calculation on lined paper showing the formula for future value $F = P \times (1+i)^n$. A red cloud-shaped note indicates $i = \frac{0.12}{12 \text{ months}} = 0.01$. The calculation then substitutes $P = 75,000.00$ and $n = 18$ to find $F = £89,711.06$.

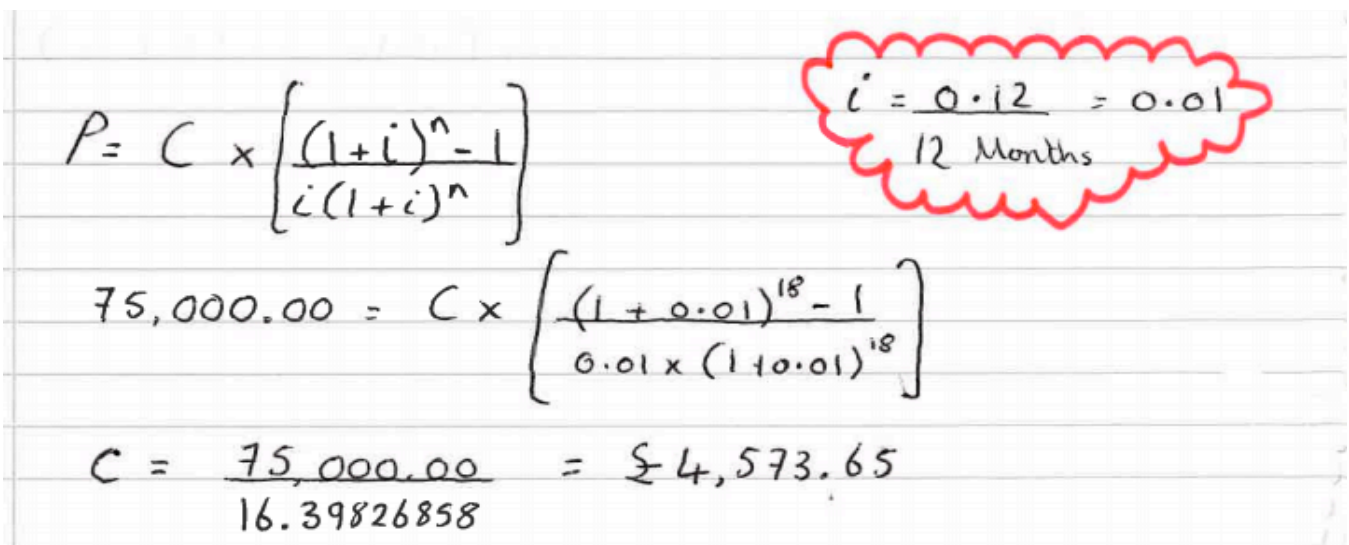
$$F = P \times (1+i)^n$$

$$F = 75,000.00 \times (1 + 0.01)^{18}$$

$$= £89,711.06$$

Uniform Series Payment Calculation

In order to determine how much it will cost to purchase the JCB on a monthly basis, I used the uniform series of payments formula. As you can see below, with the assumption of interest rate of 12%, I have calculated that the uniform monthly payment to be **£4,573.65**.



Handwritten calculation on lined paper showing the formula for present value $P = C \times \left[\frac{(1+i)^n - 1}{i(1+i)^n} \right]$. A red cloud-shaped note indicates $i = \frac{0.12}{12 \text{ Months}} = 0.01$. The calculation then substitutes $P = 75,000.00$ and $n = 18$ to solve for C , resulting in $C = £4,573.65$.

$$P = C \times \left[\frac{(1+i)^n - 1}{i(1+i)^n} \right]$$

$$75,000.00 = C \times \left[\frac{(1 + 0.01)^{18} - 1}{0.01 \times (1 + 0.01)^{18}} \right]$$

$$C = \frac{75,000.00}{16.39826858} = £4,573.65$$

With this information, I have developed the table below;

Month	Interest	Payment	Debt
0		0.00	75,000.00
1	750.00	3,823.65	71,176.35
2	711.76	3,861.89	67,314.46
3	673.14	3,900.51	63,413.96
4	634.14	3,939.51	59,474.45
5	594.74	3,978.91	55,495.54
6	554.96	4,018.69	51,476.85
7	514.77	4,058.88	47,417.97
8	474.18	4,099.47	43,318.50
9	433.18	4,140.47	39,178.03
10	391.78	4,181.87	34,996.16
11	349.96	4,223.69	30,772.47
12	307.72	4,265.93	26,506.55
13	265.07	4,308.58	22,197.96
14	221.98	4,351.67	17,846.29
15	178.46	4,395.19	13,451.11
16	134.51	4,439.14	9,011.97
17	90.12	4,483.53	4,528.37
18	45.28	4,528.37	0.00

Financing Cost

Financing cost involves the charge of an interest rate for the borrowed money. The formula below is used to calculate annual cost of finance. A calculation for the JCB JS200 W will be made later on in this report.

Financing Cost

$$\text{Annual Cost of Finance} = \left[P \left(\frac{i(1+i)^n}{(1+i)^n - 1} \right) - \frac{P}{n} \right] - \left[F \left(\frac{i}{(1+i)^n - 1} \right) - \frac{F}{n} \right]$$

Annual payment
Annual Av payback
Salvage

Depreciation of the Vehicle

Depreciation is the term used to describe the cost of using an asset over a period of time. Smith, T. (2016).

When calculating depreciation, the following terms are used;

- **Initial Value** – Purchase price
- **Salvage** – Expected price at the end of useful life
- **Book Value** – Current value calculated at the end of each year. (Initial value – depreciation costs)
- **Market Value** – Value if it's sold in the free market

There are three different methods to calculate depreciation;

1. Straight-Line Method
2. Sum-of-Years Digits Method
3. Sinking Fund Method

In order to determine the depreciation value of the JCB JS200W, I have decided to use the 'Straight-Line Method' as shown below;

Straight-Line Method

- A constant depreciation charge is made

$$D_n = \frac{P - F}{N}$$

D_n = Annual depreciation charge
 P = Initial Value
 F = Salvage Value
 N = Useful life in years

Vehicle = JCB JS200W 2003 model

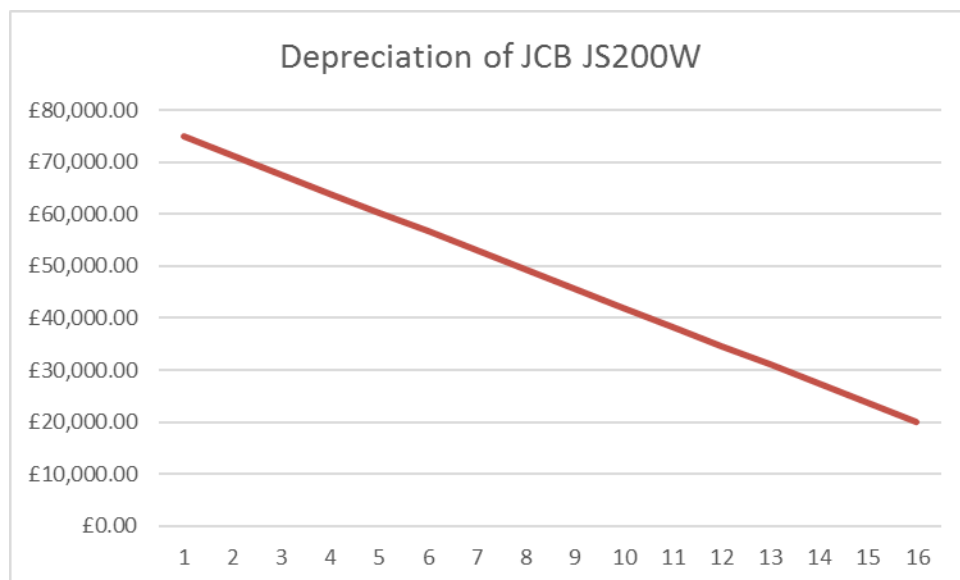
- Purchase price in 2003 was £75,000.00
(Reference Andrew Wilkins - 07702332109)
- Salvage Value after 15 years is £19,995.00
(Reference Andrew Wilkins Plant Ltd or Autotrader ref)
- 15 years of depreciation

$$D_n = \frac{75,000.00 - 19,995.00}{15 \text{ years}} = \underline{\underline{£3,667.00}}$$

As you can see the annual depreciation has been calculated. With this information I can now calculate the book value of the excavator for each year. This has been illustrated in the table below;

Year	Depreciation	Book Value
0	0	£75,000.00
1	£3,667	£71,333.00
2	£3,667	£67,666.00
3	£3,667	£63,999.00
4	£3,667	£60,332.00
5	£3,667	£56,665.00
6	£3,667	£52,998.00
7	£3,667	£49,331.00
8	£3,667	£45,664.00
9	£3,667	£41,997.00
10	£3,667	£38,330.00
11	£3,667	£34,663.00
12	£3,667	£30,996.00
13	£3,667	£27,329.00
14	£3,667	£23,662.00
15	£3,667	£19,995.00

With the above information I was able to produce a line graph as shown below;



This clearly shows a gradual depreciation of the excavator over a duration of 15 years.

Equipment Costs and Operating Costs

When purchasing a vehicle, the ownership and operating costs must be understood. These include;

- Initial Costs

- Financing Cost
- Depreciation
- Taxes and Insurance Costs
- Maintenance and Repair Cost
- Other Costs such as Fuel, Lubricating, Oil, tires etc.

In order to calculate the ownership and operating costs per hour of the JCB JS200W, the data set out on page 6 has been used below;

Depreciation (Assume straight-line)

$$D_n = \frac{75,000.00 - 19,995.00}{15} = £3,667 / \text{year}$$

Annual Investment Cost

$$\left[75,000.00 \times \left(\frac{0.12(1.12)^{15}}{(1.12)^{15} - 1} \right) - \frac{75,000.00}{15} \right] - \left[19,995.00 \left(\frac{0.12}{(1.12)^{15} - 1} \right) - \frac{19,995}{15} \right]$$

$$(11011.82 - 5000) - (536.35 - 1333) = 11308.47$$

$$£11308.47 / \text{year}$$

Total Ownership Cost

$$£3,667 + £11,308.47 + £3,000 = £17,975.47$$

$$\text{Total Working hours per year} = 200 \times \frac{8 \text{ hr}}{\text{day}} = 1,600 \text{ hr/year}$$

$$\text{Ownership cost} = \frac{17,975.47}{1,600} = £11.23/\text{hour}$$

Maintenance and Repair cost

$$\text{Total} = 1.1 \times 3,667 = £4,033.7/\text{year}$$

$$\frac{4,033.7}{1,600} = £2.52/\text{hour}$$

Fuel and Lube Oil costs

$$\text{Fuel consumption} = 172 \times 0.04 \times 0.5 = 3.44 \text{ gallon}$$

$$\text{Fuel Cost} = 3.44 \times 5.55 = £19.09/\text{hour}$$

$$\text{Lube Oil cost} = £19.09 \times 0.1 = £1.9/\text{hour}$$

Therefore, the total operating costs for the JCB JS200 W is $£2.52 + £19.09 + £1.9 = £23.51/\text{hour}$

Conclusion

There are clearly many advantages when it comes to purchasing new machinery. However, it is crucial to understand that the impact of these advantages can vary greatly from different companies, and in some cases, negative aspects related to purchasing new machinery may outweigh the positives. For example, even when renting, a brand new product can still be an economic burden. There might be a cheaper, used product that will still fulfil the required works just as well as the new machinery.

Additionally, some site plant may only be required for a short period of time, in which case investing in a new machine proves un-economic for a long-term perspective, especially when you take into consideration maintenance/repair, storage and transportation.

5. References

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