

Capital Investments Analysis in Manufacturing

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Abstract— The objective of this paper is to analyze six capital investments projects at Apex Corporation using time value of money (TVM) techniques. The projects are Product 18-4 Development, Department 14 Equipment Upgrade, Computer Department Request, Apex Corp Expansion Request, Plant Engineering and Assembly Request. A suggested course of action was developed using the often-incomplete information provided for each project. Key methods of analysis compared annual cost along with return on investment (ROI) of the selected projects. The analysis shows that Apex should invest in the Copmuter Department Request as it will yield a 226.58% return on investment.

Index Terms— Apex Corporation, Capital Investments, Time Value of Money, Return on Investment, Incremental Analysis.

1 INTRODUCTION

The objective of this paper is to analyze six capital investments projects at Apex Corporation using time value of money (TVM) techniques. The projects are Product 18-4 Development, Department 14 Equipment Upgrade, Computer Department Request, Apex Corp Expansion Request, Plant Engineering and Assembly Request.

2 ANALYSIS OF PROJECTS

Using TVM techniques, the following table was developed:

Table 1: Calculation Summary

	Product 18-4 Development	Dept.14 Equip. Upgrade	Computer Department	Apex Corp Expansion	Plant Engineering	Assembly	
						Lease	Buy
ROI (Based on Profit)	-9.2% For the year	-14% For the year	226.85% For the year	14% For the year	-13.5% For the year	-	-
Annual Cost	\$117,010	\$37,830	\$35,000	-	-	\$30,000	\$60,725
Initial Cost	\$400,000	\$100,000	-	\$400,000	\$250,000	-	\$250,000
Revenue	\$79,921.6/yr	\$36,433.5/yr.	114,400/yr	-	-	-	-
Net Profit	-\$37,088.4/yr	-\$1396.5/yr	\$79,400/yr	-\$200,000/yr	-\$33,800/yr	-	-
Suggestion	Don't Invest	Might Invest	Invest	Might Invest	Might Invest	lease	Don't Buy

Green = invest, Orange = Might invest, Red= don't invest
Total Investment= \$35000+\$400000+\$250000+\$30000= \$715,000
Net Profit = \$313,200, ROI = 43%.

3 SELECTION OF PROJECTS

The selection of projects can be implemented using several methods namely:

- IRR, incremental analysis
- Initial cost of the project
- Risk of the project

The selection of projects is being analyzed by understanding the risk of every single project. The life of each and every project varies and is not the same and hence the present worth method cannot be applied to determine project selection.

Hence, by knowing the probability of risk and impact of the project, one can easily decide on which project the investment is to be made.

Risk of the project:

The chart below displays the values for the probability and impact. The probability of risk is determined by dividing the net revenue by the initial investment, which gives the risk of the project.

Table 2: Probability and Impact Chart Data

Probability	Very High	High	Medium	Low	Very Low
	0.045	0.035	0.025	0.015	0.005
Impact	Very Low	Low	Medium	High	Very High
	0.05	0.1	0.2	0.4	0.8

3.1 Computer Department Request

The IRR of this project is determined to be 226.85%. The revenue generated by this department is \$114,400/year and the annual cost is \$35,000/year. The net profit produced is \$79,400/year, by bringing all the related cost and the lease to (t0) =374,428.1(P/A, n=3, i=15%)=\$854,894.23

Dividing the net revenue by the above value gives us a probability of 0.21. By looking at table 2 and finding out the risk and impact of the project it shows that the probability of risk is very low and the impact is high. Hence it is worth investing on this project. The expected outcome of this project = [Risk probability value] * [Risk Impact value] = [0.10] * [0.1] = 0.01

If the expected value of outcome < 0.05, then the result is that the investment can be made. Here 0.04 < 0.05, which shows that the investment is suitable for this project.

3.2 Apex Corporation

The IRR of this project is determined to be 50%. The net revenue generated by this department is \$200,000 and by dividing the net revenue by the initial investment we get a value of 0.5. Table 2 indicates the probability of risk of the project to be low and the same for the impact of the project is low. It is worth investing on this project. The expected outcome of this project = [Risk probability value] * [Risk Impact value] = [0.3] * [0.1] =

0.03. If the expected value of outcome < 0.05 , then the result is that the investment can be made. Here $0.03 < 0.05$, which shows that the investment is suitable for this project.

3.3 Plant Engineering

The IRR of this project is determined to be 16%. The net profit obtained is 40,000/year and dividing this by the initial investment we get a value of 0.16. The probability of risk will be VERY LOW and the impact is HIGH. There is a possibility of investing in this project. The expected outcome of this project = [Risk probability value] * [Risk Impact value] = $[0.1] * [0.2] = 0.02$

If the expected value of outcome < 0.05 , then the result is that the investment can be made. Here $0.04 < 0.05$, which shows that the investment can be made on this project.

3.4 Product 18-4 development:

The IRR of this project is determined to be -9.2%. Since the IRR $<$ Desired ROI, it is not suggested to invest in this project. The net revenue generated per year -\$37,088.4/yr. Since the net revenue is a negative value, the probability of the risk is considered to be VERY HIGH and the impact is VERY HIGH. The expected outcome of this project = [Risk probability value] * [Risk Impact value] = $[0.9] * [0.8] = 0.72$

If the expected value of outcome < 0.05 , then the result is that the investment can be made. Here $0.72 > 0.05$, indicating that it's not worth investing on this project.

3.5 Dept 14 Equipment Upgrade

The IRR of this project is determined to be -14%. Since the IRR $<$ Desired ROI, it is not suggested to invest in this project. Moreover, the net profit obtained in this project is a negative value and dividing this value by the initial cost will make the probability to be negative (which is not supposed to be a negative value). The probability of risk in this project is high and the impact is very high. The expected outcome of this project = [Risk probability value] * [Risk Impact value] = $[0.7] * [0.8] = 0.56$

If the expected value of outcome < 0.05 , then the result is that the investment can be made. Here $0.56 > 0.05$, indicating that it's not worth investing on this project.

3.6 Assembly Request

We have a multiple investment projects areas **within** this project, the investments are lease and buy. The lease alternative for this project is considered for investment, because by calculating the buy-lease for both these alternatives it was found that the i(Buy-Lease) = -1.71%. Since $-1.71\% < 15\%$, we will be able to consider only the lease alternative and neglect the higher initial cost for the project. The probability of risk in this project is considered to be high due to the fact that there is no net revenue produced by this project and hence this project might contain some risk.

In figure 1, the x-axis is as indicated: [1- very low, 2- low, 3-medium, 3-high & 4-very high]. The values for the above plot are obtained from the table 1. The graph IRR vs. Risk indicates that the IRR of the computer department request project which is 226.85% has a very low risk of probability of 0.01, and has better net revenue and hence yields a better expected outcome. Likewise, for the IRR's of Apex corporation and the Plant Engineering.

Table 3: Selection of project through Risk Analysis

Projects	Probability of Risk	Annual Cost	Initial Cost	IRR
Computer Dept. Request	Very low	35,000	-	226.85%
Apex Corporation	Low	-	\$400,000	50%
Plant Engineering	Very low	-	\$250,000	16%
Assembly lease	High	\$30,000	-	-1.71%
Product 18-4 development	Very high	\$117,010	\$400,000	-9.2%
Dept.14 Equipment Upgrade	High	\$37830	\$100,000	-14%

Table 4: Expected Outcome indicating better investment

Projects	Probability of Risk	Impact of Project	Expected outcome	Indicators
Computer Dept. Request	Very low	Low	0.01	🎯
Apex Corporation	Low	Low	0.03	🎯
Plant Engineering	Very low	Medium	0.02	🎯
Assembly lease	Very high	High	0.36	🎯
Product 18-4 development	Very high	Very high	0.72	🎯
Dept. 14 Equipment Upgrade	High	Very high	0.56	🎯

Green: indicates that the following project can be invested
Red: indicates that the following project is not safe for investment

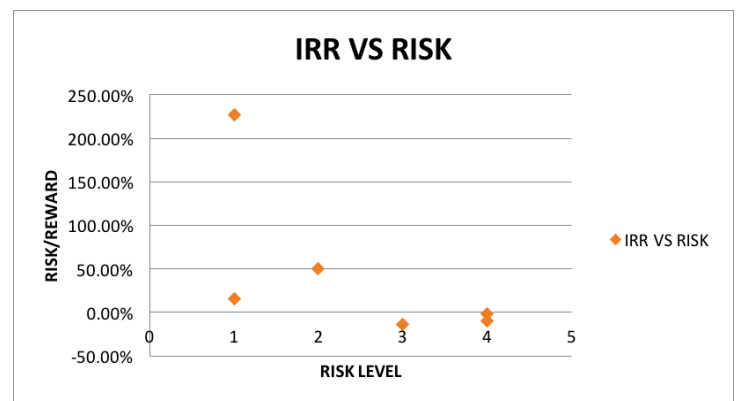


Figure 1: Plot of IRR vs. Risk

In figure 2, the x-axis is as indicated: [1- very low, 2- low, 2.5-medium, 3-high & 4-very high]. The impact is calculated from the annual cost and revenue and the net revenue gives an estimate of the impact of the project. The impact is calculated with the values obtained from table 1.

In conclusion, the method of Risk and Impact analysis is used in the selection of the projects. From various calculations of the risk of each and every project by knowing the total annual cost and the revenue it was easy to determine the project risk level and Impact. It was then concluded that investment can be

made only on three projects namely Computer department request, Apex Corporation and Plant Engineering. Funding can be made on these projects which will yield in a good outcome in the future.

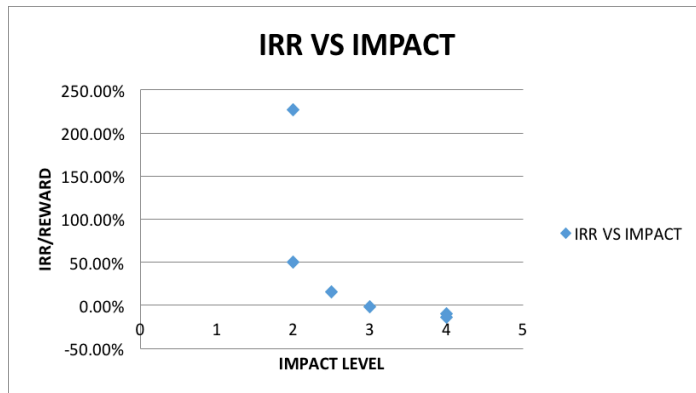


Figure 2: Plot of IRR vs. Impact

4 MANAGEMENT OF FUNDS

Due to the information provide, there are several limitations to the provided suggestions. That being said, it is recommended that funds first be allocated towards the computer department request. That project provides the largest percentage of return with a relatively small initial investment. Money should also go towards leasing instead of purchasing new assembly equipment. The Apex corporation investment has a low economic return on the surface but may be a worthwhile investment. If Apex's future growth is expected to follow their 4% ROI increase from last year, then the \$400,000 investment will pay dividends in the future.

Table 5: Apex Corp. Potential Growth Projection

	2013	2014	2015	2016
Asset Base	\$1,000,000	\$1,400,000	\$1,800,000	\$2,200,000
Earnings	\$100,000	\$200,000	\$300,000	\$400,000
ROI	\$0.10	\$0.14	\$0.17	\$0.18

The Apex Corporation investment may be a hard sell to investors and the board but can be extremely beneficial to the company if it pans out. Table 6 below shows the initial cost of each investment along with remaining funds. The initial cost will be the immediate visible cost of each investment. The Net Present Value (PV) in the chart uses the TVM technique to show how much the cost would be in today's dollars if the money was instead put towards other investments with a 15% ROI. As you can see, this is much higher although the future savings in the computer department more than compensate for this cost. If it is a mandatory cost, the leasing option from the assembly request is still cheaper than purchasing new equipment. The optional Apex Corporation expansion can easily be afforded with current funds but if it doesn't make estimated returns can result in a significant loss of future revenue. A suggested course of action for remaining funds is to invest in money market account for future investment use.

Table 6: initial cost of each investment along with remaining funds

	Initial Cost	Net PV
Total New Funds	\$550,000.00	\$-
Computer Department	\$(35,000.00)	\$(117,320.00)
Assembly Lease	\$(30,000.00)	\$(100,516.00)
Remaining Revenue	\$485,000.00	\$332,164.00
(Optional) Apex	\$(400,000.00)	\$(400,000.00)
New Remaining Revenue	\$85,000.00	\$(67,836.00)

4.1 Management Limitations

The decision on how to manage funds needs to be taken knowing the limitations of this analysis. For Project 18-4, more information is needed about the economic life of the new equipment since its taxable life is shorter than the given product life.

4.2 Dept. 14 Equipment Upgrade

It was assumed that a "standard single shift" resulted in a 40-hour work week for the calculations. If the workers work longer than this or if overtime payment is involved, then purchasing machinery could be a potentially good investment. Additional information about the production rate of the workers compared to the new equipment along with its influence on annual profit will also have a significant impact on the investment decision.

4.3 Computer Department Request

This investment seems like the soundest choice of the available options. Other considerations include removal costs of the old equipment along with networking and installation costs of the new. Because it is a high-speed printer, it was assumed that these costs were negligible for the analysis. A critical value missing from the analysis was the expected life of the new printer. A five-year life was assumed for some of the calculations and is annotated in the appendix.

4.4 Apex Corporation

This seems like one of the worst investment on the surface by providing a net income of -\$200,000 but is potentially a profitable venture. If previous data shows consistent growth equal to their ROI last year and projected ROI this year than it might be worth giving them funds to maintain momentum. Other considerations include looking at their product to see if their market share appears to be growing or decreasing. In order to provide more accurate calculations using the time value of money technique, information will be needed about the expected life of the new equipment being purchased and improvements that they are making. Salvage value along with asset value increase or depreciation would also help make a more accurate analysis. I suggest looking at the previous five years' sales data while also getting a five to ten year sales projection from this investment before deciding whether or not to continue with the investment

4.5 Plant Engineering

For the plant engineering analysis, more equipment is needed about the current equipment salvage value, expected life, and production output. It is assumed that this was taken into ac-

count in the estimated \$40,000 of savings but information on the current equipment will help make a more accurate comparative analysis.

4.6 Assembly Requests

As with the previous request, information on the existing equipment should be included in the comparison. Information needed is the current estimated life, salvage value, annual maintenance costs, operating costs, and current market value.

5 CONCLUSION

5.1 Product 18-4 Development

We don't recommend investing in product 18-4 because it will reflect an ROI of -9.2% which won't make the investors satisfied since it didn't achieve the 15% target ROI

5.2 Dept.14 Equip. Upgrade

We also don't recommend investing in Dept.14 Equipment Upgrade because it will result in an ROI of -14% and a net profit of -1396yr. On the other hand, one can argue that replacing the workers with machines will increase the productivity in the long run but investors don't trust assumptions they trust numbers.

5.3 Computer Department

Investing in the computer department will result in ROI of 226.85% which exceeds the 15% target ROI. Therefore, we recommend investing in the computer department.

5.4 Apex Corp Expansion

Apex shows improvement and growth compared their performance last year. They expect 50% ROI this year therefore, investing in Apex is recommended.

5.5 Plant Engineering

Since the available funds are between \$500,000 and \$600,000, we recommend investing in the plant if there were a fund available. The plant investment is not a high priority since it will result in only 16% ROI and 40,000/yr.

5.6 Assembly

In order to make a decision on leasing or buying, we need the expected salvage value. Comparing both options in terms of annual cost will result in choosing the lease option since it is less expensive than the buy option.

The company is moving in the direction of using TVM for allocating capital budget since Projects that are budgeted through a firm-internal allocation process are typically infrastructural assets, such as machinery, equipment or plants.

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