Title: Cascade Containers Company: Capital Budgeting Project

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Abstract: Cascade Containers Company (CCC) manufactures on a job order basis drop boxes, containers, and self dumping hoppers. All of the work done is on a special contract basis and there is no finished goods' inventory. Its geographical market is very broad in North-West. Its target market stretches from Seattle, Washington to Eugene, Oregon. The population of this area is growing very rapidly and this drives the demand for its products. The company progressed very well in the last two years. It moved to a new site in Ridgefield, Washington from Vancouver. A new office, fully equipped with state-of-the-art computer network, and a shop building was recently constructed. In this paper, the feasibility of acquiring new machines for production and its impact on CCC's cash-flow is investigated.

Cascade Containers Company: Capital Budgeting Project

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ENGINEERING ECONOMICS

CAPITAL BUDGETING PROJECT

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INTRODUCTION

Cascade Containers Company (CCC) manufactures on a job order basis drop-boxes, containers, and self dumping hoppers. All of the work done is on a special contract basis and there is no finished goods' inventory. Its geographical market is very broad in North-West. Its target market stretches from Seattle, Washington to Eugene, Oregon. The population in this area is growing very rapidly and this drives the demand for its products.

The company progressed very well in the last two years. It moved to a new site in Ridgefield, Washington from Vancouver. A new office, fully equipped with state-of-the-art computer network, and a shop building was recently constructed. In this paper, the feasibility of acquiring new machines for production and its impact on CCC's cash-flow will be investigated.

CAPACITY INCREASE

Capital budgeting should be an integral part of long-range planning and it needs to be integrated into every firm's business plan. John J, Clark et all[1] state that:

> "Development of the business plan requires close examination of the company's position within the marketplace in terms of size and penetration of existing and future product lines. This leads to the examination of the physical plant in order to assess the capability of market objectives and securing the necessary inputs to production".

CCC recently started to implement a JIT manufacturing philosophy. Before this effort, it was basically a job shop. Now, it has started to group products and dedicates workstations to product lines. The figure below shows the production flow of CCC. In part's department there is one sheer machine and one break machine. These are expensive machines. Right now, sheer and break machines are constraining the production of CCC. Although they are working with full capacity CCC has a backlog of five weeks.

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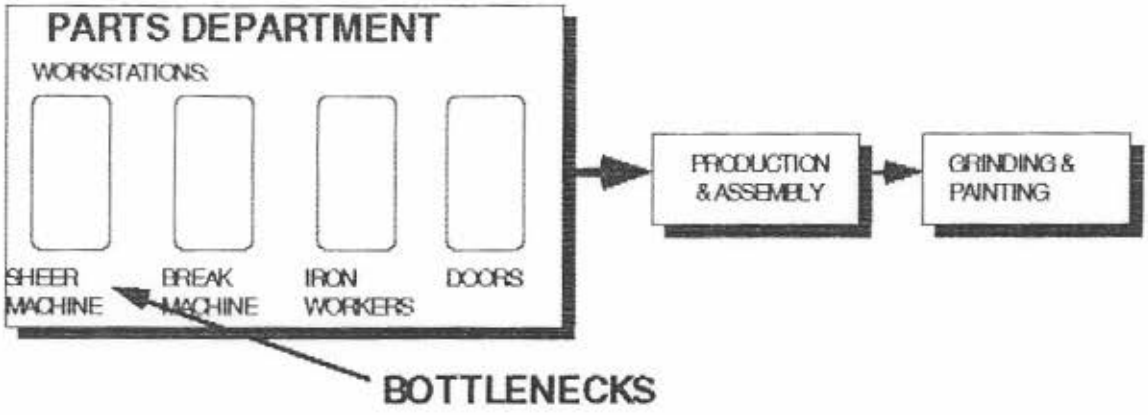
1. [1]Capital Budgeting, Planning and Control of Capital Expenditures, John J. Clark, Thomas J. [illegible] Robert U. Pritchard, Prentice-Hall pp. 7



These machines also obstruct the formation of dedicated product lines since CCC has only one of each machine. Right now, CCC is considering acquiring new machines

It is very difficult to determine the impact of new machines. If there were no other constraints in the production flow it might simply double the production of CCC. The management is considering hiring more workers for the assembly and production but still there are physical resource limitations in the painting department. It takes one day for the paint to dry and there is no enough space in the building while it is raining outside. This might also seem contradictory to JIT manufacturing philosophy that ideally requires work content to lead time ratios of two[2].

However, right now, all the factory is waiting for parts department and this increases the lead time for all the products. There is a backlog of five weeks. The customers are there and CCC cannot meet the demand.

By acquiring new machines batching of products will be much easier. Products which have common characteristics can be batched together on dedicated product lines. This might influence the cost structure of CCC very positively. Right now, CCC is designing a new information system for production that will give the necessary information for batching of orders. But, it still needs the new machines.

CCC has annual sales of $3,500,000. It manufactures around 4000-4500 units per year. So, the products have an average price of $800. The management of CCC estimates

[2]World Class Manufacturing Casebook, Richard J. Schonberger, pp. xxiii-xxiv

about an increase of 1200 units in capacity first year if the new machines are bought. It is expected to stay almost constant with a modest growth of 5% over the remaining years. These numbers are rough, intuitive estimates of the management. In order to have more accurate estimates, the production process of CCC needs to be modelled. The resource constraints can be quantified by using linear programming. The shadow prices of the resources and their range can be found. By doing so, the impact of buying additional machines can be accurately identified. However, there is always a trade-off between the necessary information and the cost of getting this information[3]. In this case, CCC wants immediate action and is not willing to spend money for additional information. Also, CCC has a high product diversity and this might add complexity to the analysis.

The new production setting is seems to have many benefits. Other than meeting the demand, CCC might have cost savings from batching of products and dedicating workstations to product lines in a pull system, At this stage, it is not possible to estimate the savings but the model will include the cost savings and its sensitivity to the key outputs of the model will be analysed.

INVESTMENT REQUIREMENT

Currently, the management of CCC is searching for sheer and break machines. They are not considering buying brand new machines. They would like to buy used machines. The costs of sheer and break machines are $40,000 and $35,000 respectively. The useful lives of these machines are 10-15 years but for tax purposes, they would like to depreciate them in 5 years. The salvage values of the machines are not quite predictable but the management expects $10,000. The pessimist estimate is $5000 and the optimist estimate is $12,000. Their installation cost is expected to be $2,000 per machine and first year maintenance expense is roughly estimated as $10,000. The new production setting will

[3]Managerial Decisions Under Uncertainty, Bruce F. Baird, John Wiley & Sons, Inc. pp. 263-265

need more space and the management is planning to add more floor space. CCC owns the land but it needs to invest $150,000 in building.

CCC expects a high increase in capacity and this would surely influence its net working capital requirement (NWC), The inventories and accounts receivable are expected to increase but at the same time accounts payable and accruals will also increase. Since the company is embarking JIT the impact of increase in inventory is not expected to be high. On the other hand, CCC's collection period is around 30 days, whereas it needs to pay its materials in 60 days. This gives CCC a fairly good timing advantage. Increasing the capacity do not necessarily require a big working capital investment. The management estimates $50,000 increase in working capital first year which is 1.4% of sales revenues.

OPERATING EXPENSES

The biggest item in CCC's income statement is its material costs. Almost 55% over sales are direct material costs. Direct labor accounts for about 20% over sales and total variable costs are around 75%.

The addition of new capacity will increase the manufacturing overhead, administrative expenses, as well as sales expenses. Right now, total fixed cost of CCC is 18% over sales which is $630,000. With the additional capacity and floor space, $200,000 increase in fixed costs is estimated. However, this estimate was frankly the most difficullt one for the management and needs great deal of attention in the sensitivity part.

INFLATION

It is not possible to exclude the inflation from the analysis. It will influence the unit price of the products, and also NWC. Although the elasticity of prices with respect to

the rate of inflation might not be the same as the elasticity of raw materials, in this analysis it has been assumed as the same.

DEPRECIATION

When an asset is bought, it is necessary to match the expenses with the revenues during the period in which it is used. The depreciation is defined as follows[4]:

> "Depreciation is a systematic recognition of such expenses in an historical framework in order to match the expense with revenues while the asset is being used. Depreciation recognizes the eventual wasting of the asset through wear, obsolescence, or the like".

For depreciating the assets there are specific methods. Accelerated Cost Recovery Method (ACRM) is the mostly used depreciation method although the owner might choose to use straight-line depreciation[4]. The management would like to use ACRM for this analysis (Exhibit 1).

Table 1:

Basis =	$310,000		
	ACRS	Depreciation	Ending Book
Year	Rate	Allowance	Value
1	0.20	$62,000	$248,000
2	0.32	99,200	148,800
3	0.19	58,900	89,900
4	0.12	37,200	52,700
5	0.11	34,100	18,600
6	0.06	18,600	0
	1.00	310,000	

For tax purposes, the useful lives of assets are published by Internal Revenue Service (IRS). Although the depreciation category has very little to do with an asset's useful life IRS permits the businesses to depreciate assets over shorter periods of time[4]. In this case, the useful life is taken as five years.

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[4]Capital Budgeting, Planning and Control of Capital Expenditures, John J. Clark, Thomas J. Hindelang, Robert E. Pritchard, Prentice-Hall pg. 134.

TAXES

All corporations bear federal income tax on ordinary income. The state income tax needs also be added to it. In this case the federal-plus-state corporate income tax rate was 34%.

METHODOLOGY

A spreadsheet, which contains all the factors mentioned till now has been build using Lotus 123. The net present value of the project over ten years, its internal rate of return and adjusted IRR have been calculated with a MARR of 10%. The model is presented in Exhibit I. The key outputs are as follows:

Table 2:

NPV	$332,283
IRR	33.38%
IRR*	24.49%
Payback	3.16
Disc PBK	3.91
PI	1.33

SENSITIVITY

All the analysis till now, depends on the accuracy of the forecasts of cash flows. It is now important to figure out which variables are critical to the success of the project. In this prospect, sensitivity analysis gains importance.

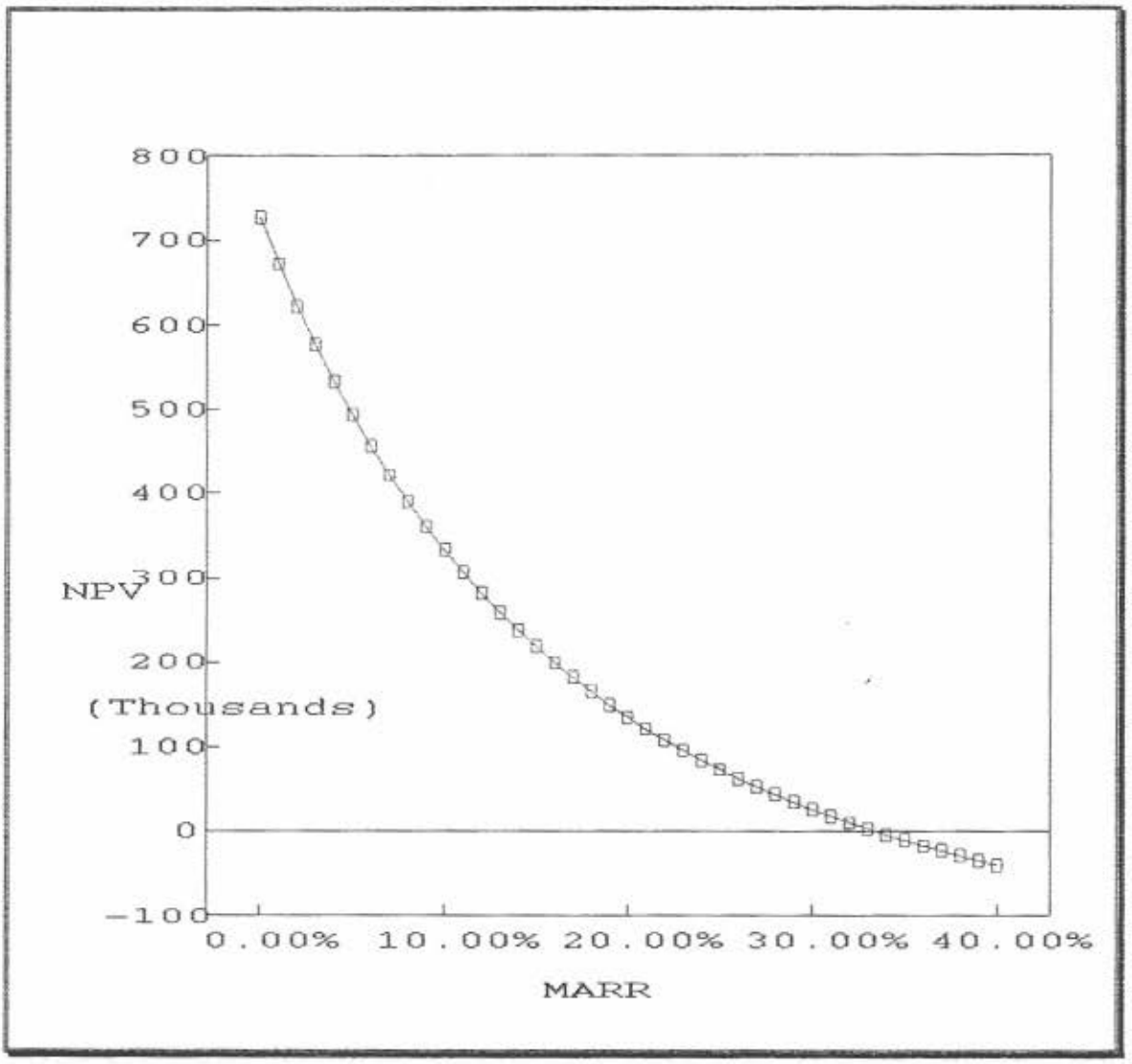
NPV PROFILE

Figure 1 gives the net present value profile of the project.

Exhibit I: Cascade Containers Company Capital Budgeting Analysis

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Unit sales		1,200	1,260	1,323	1,389	1,459	1,532	1,608	1,689	1,773	1,862
Unit Price		$800.00	$824.00	$848.72	$874.18	$900.41	$927.42	$955.24	$983.90	$1,013.42	$1,043.82
CAPITAL INVESTMENT REQUIREMENTS:											
Cost of new equipment	($225,000)										
Installation	(4,000)										
Change in NWC	(13,440)	(1,095)	(1,185)	(1,281)	(1,386)	(1,499)	(1,621)	(1,753)	(1,896)	0	0
Maintainance		($10,000)	($10,300)	($10,609)	($10,927)	($11,255)	($11,593)	($11,941)	($12,299)	($12,668)	
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
OPERATING FLOWS											
Sales revenues		960,000	1,038,240	1,122,857	1,214,369	1,313,340	1,420,378	1,536,139	1,661,334	1,796,732	
Operating costs:											
Variable		720,000	778,680	842,142	910,777	985,005	1,065,283	1,152,104	1,246,000	1,347,549	
Fixed		150,000	154,500	159,135	163,909	168,826	173,891	179,108	184,481	190,016	
Depreciation		45,800	73,280	43,510	27,480	25,190	13,740	0	0	0	0
Total		915,800	1,006,460	1,044,787	1,102,166	1,179,022	1,252,914	1,331,212	1,430,481	1,537,565	0
Net income BT		44,200	31,780	78,069	112,203	134,319	167,463	204,927	230,852	259,168	0
Taxes		15,470	11,123	27,324	39,271	47,012	58,612	71,724	80,798	90,709	0
Net income		28,730	20,657	50,745	72,932	87,307	108,851	133,202	150,054	168,459	0
Return of NWC (2002)											25,154
After-tax sal. val. (2002)											6,500
Net cash flow	(242,440)	63,435	82,452	82,365	88,099	99,744	109,378	119,509	135,860	155,791	32,181

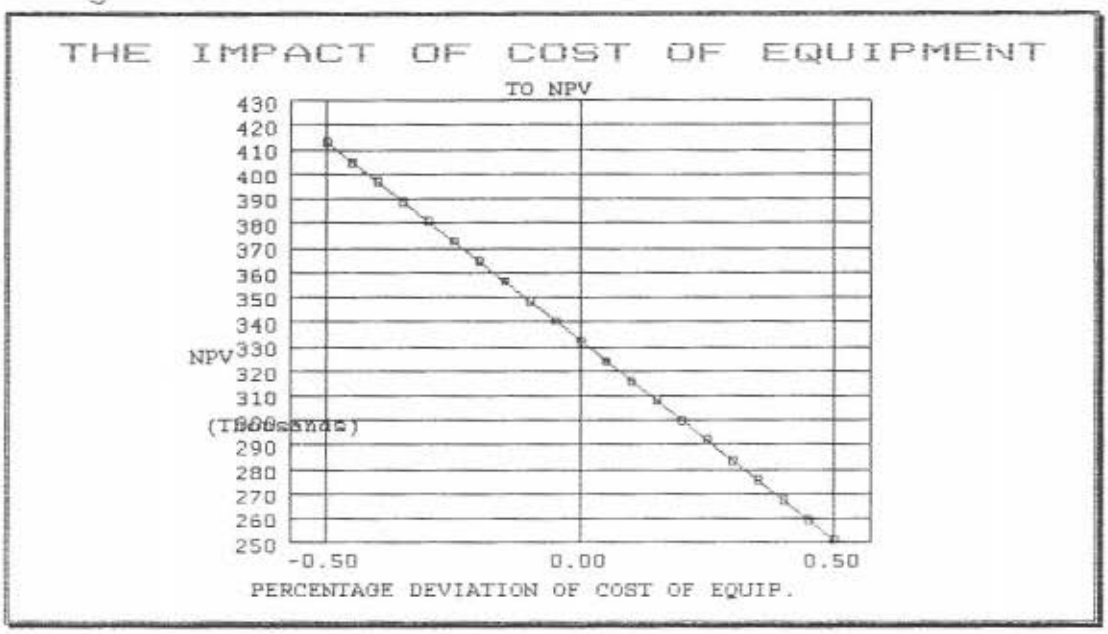
Figure 1:



CCC does not have formally a minimum attractive return. It will borrow a loan from its bank for this investment. The bank charges right now 9% interest to CCC. The present value of this project is positive till 33%. So, there is a lot of space for CCC till the project looses money. If all the estimates are correct this project seems like a star.

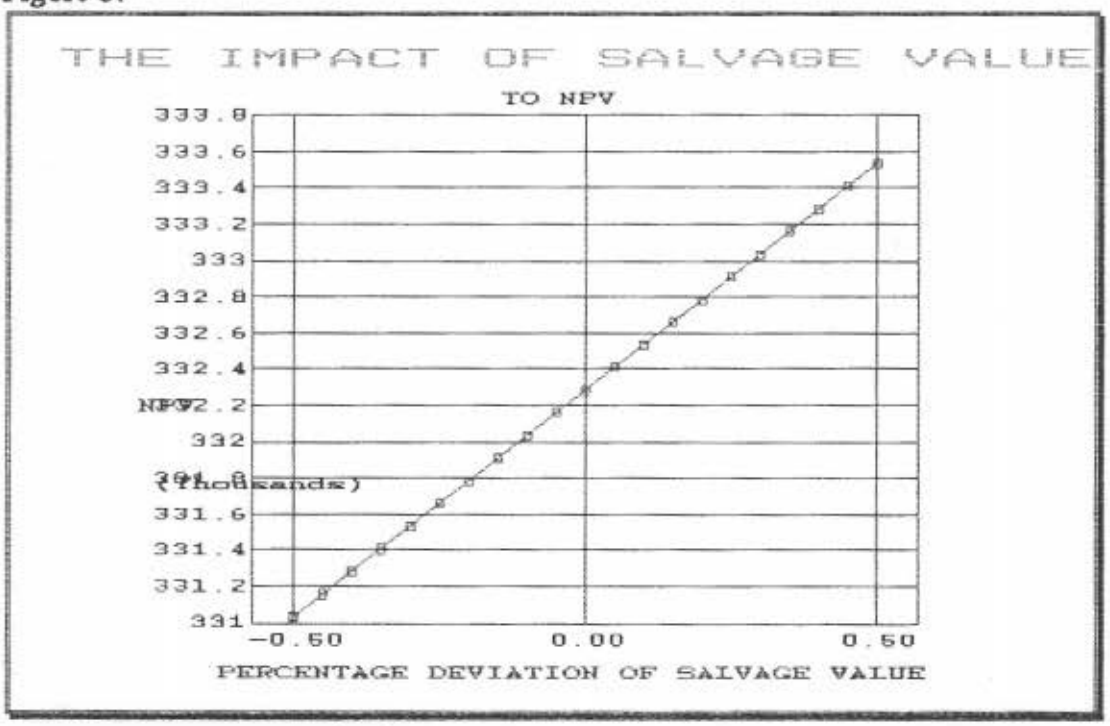
The investment in machines and floor space was estimated as $225,000. The Figure 2 shows the sensitivity of NPV to the amount invested.

Figure 2:



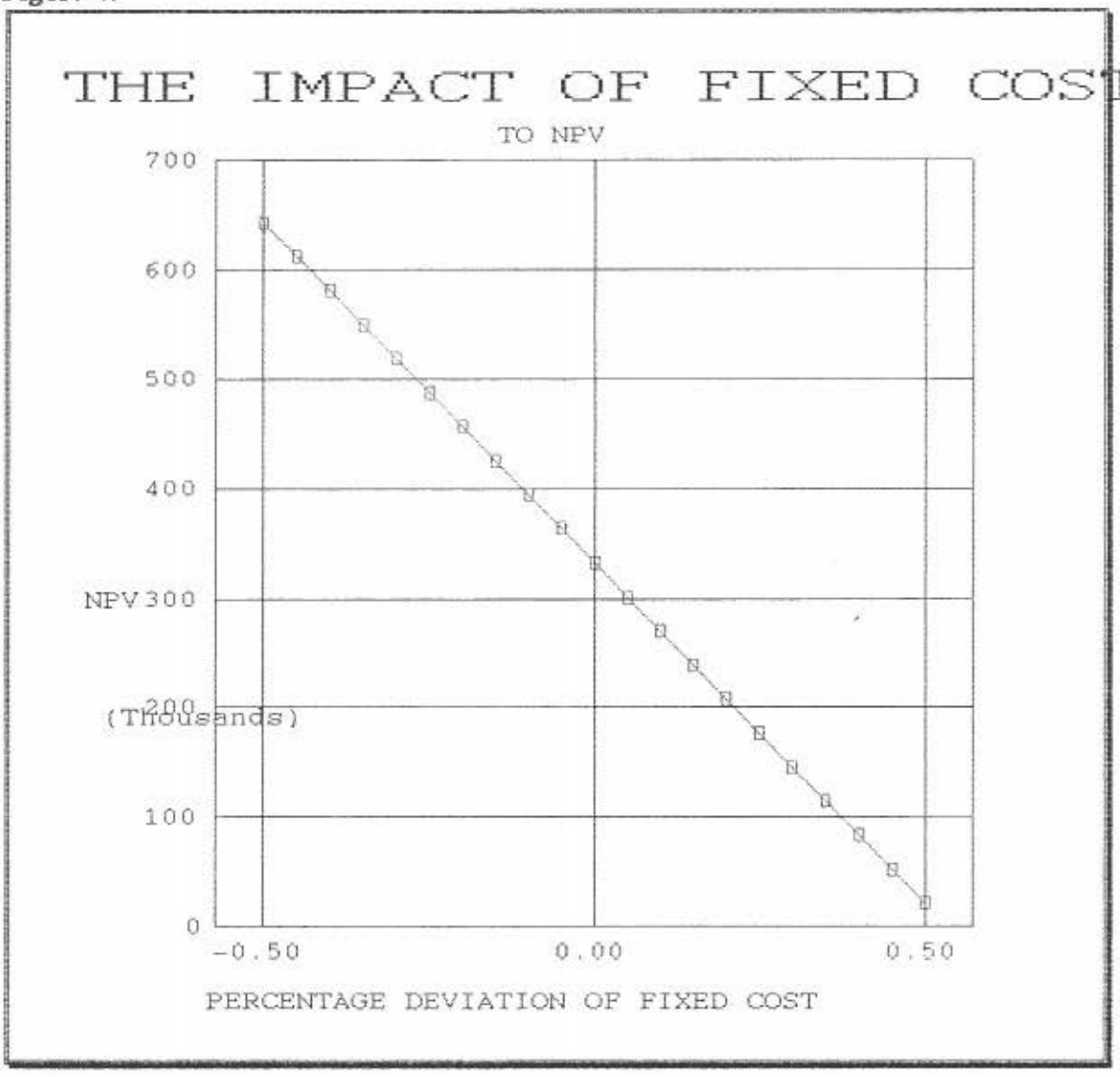
If the cost of equipment exceeds the estimate by 50%, the NPV drops to $250,000. The salvage value of the machines were not easily predictable. The Figure 3 shows its sensitivity:

Figure 3:



If the estimate is 50% off, the NPV drops only $1200. The present value is very insensitive to the salvage value. Another factor that was difficult to estimate was the initial fixed cost of the project. Figure 3 shows its sensitivity.

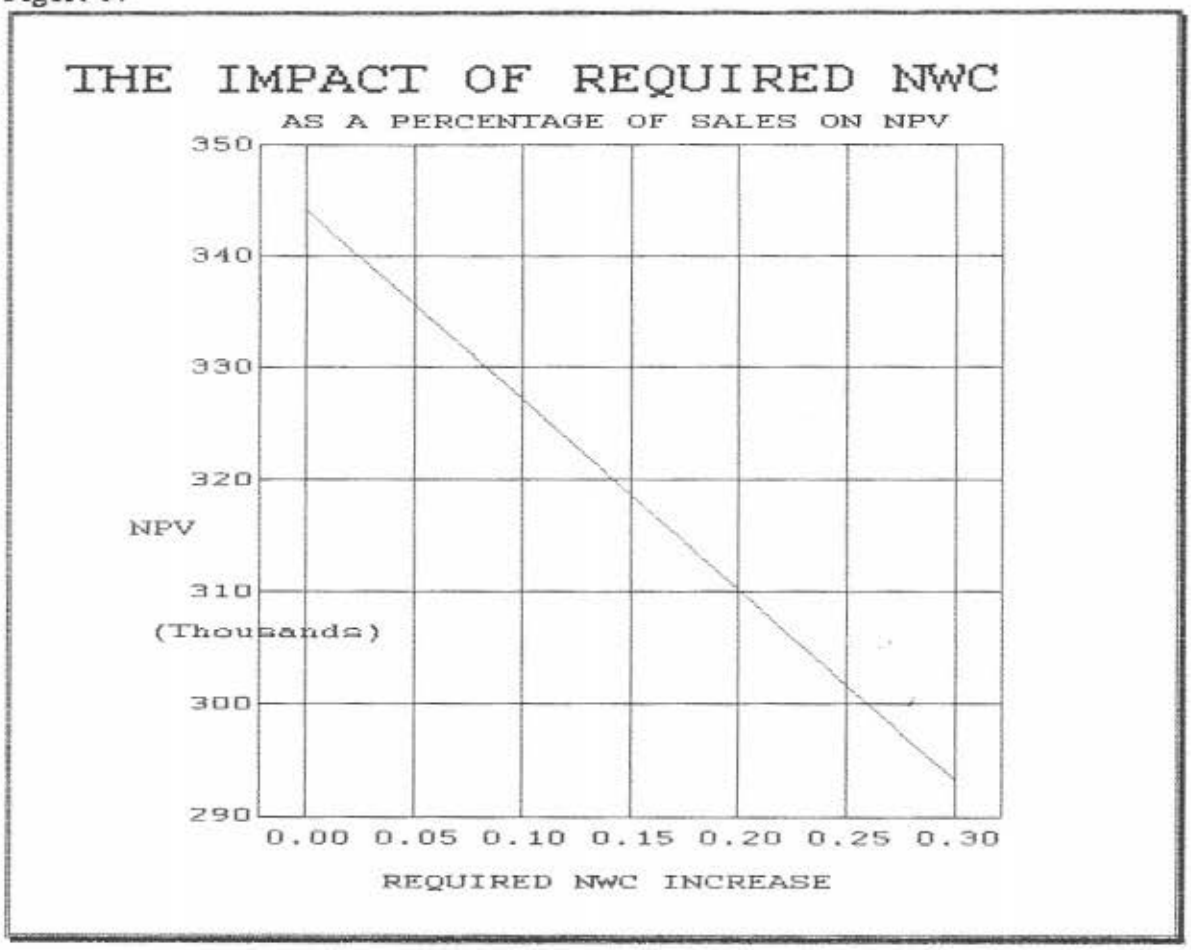
Figure 4:



The fixed cost without the depreciation is very critical. The estimate was $200,000. If the estimate is not accurate the project can easily loose its attractiveness. For every percent change in initial fixed cost, CCC looses $6,000. If the estimate is 50% wrong the NPV approaches zero.

The increase in net working capital was estimated as $50,000 first year. The Figure 5 shows its sensitivity to NPV.

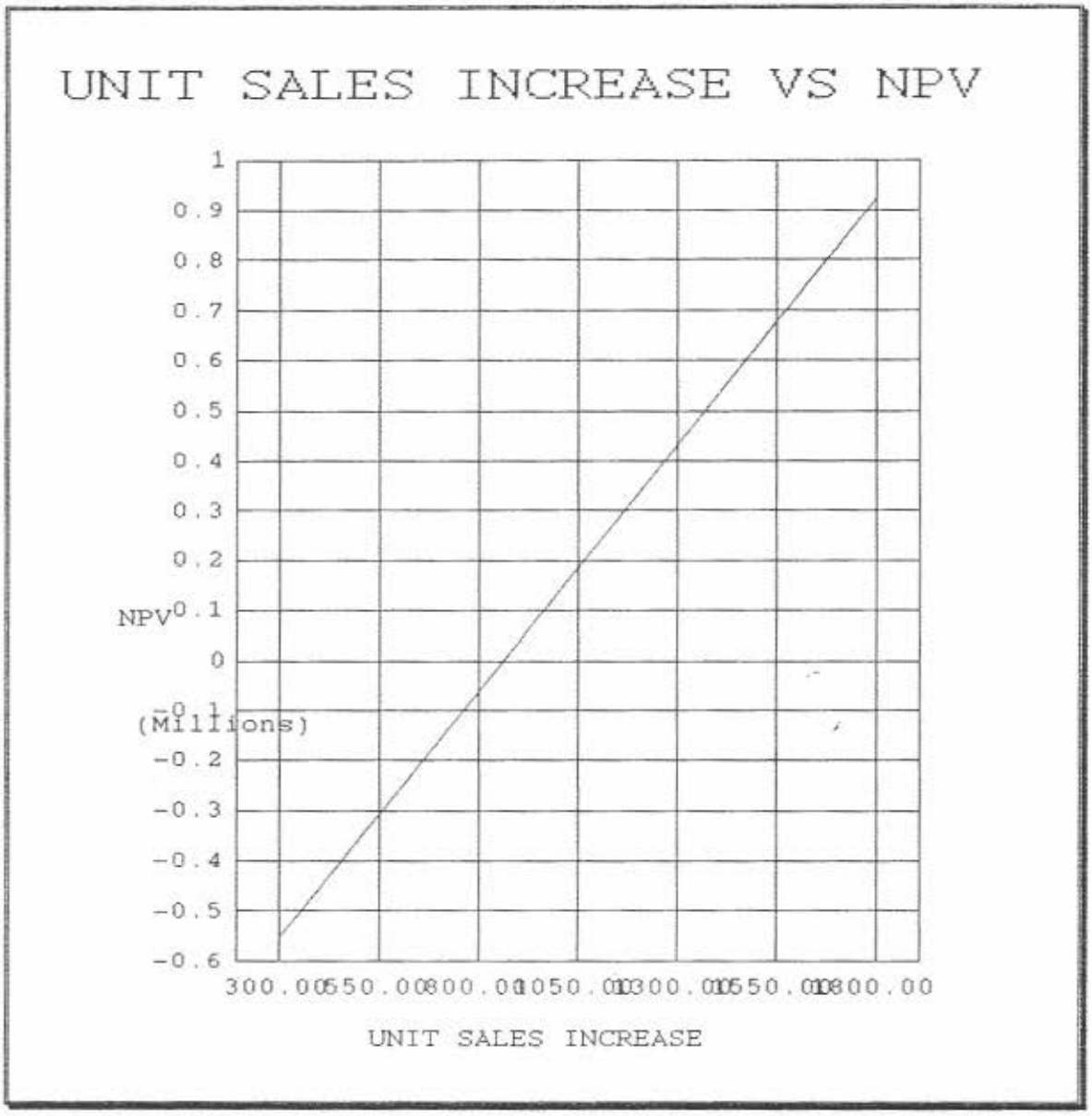
Figure 5:



The present value is not very sensitive to the increase in net working capital. Even the increase is 30% over sales the NPV is still $295,000. The management estimates a working capital increase of 1.4% and therefore this factor is not critical.

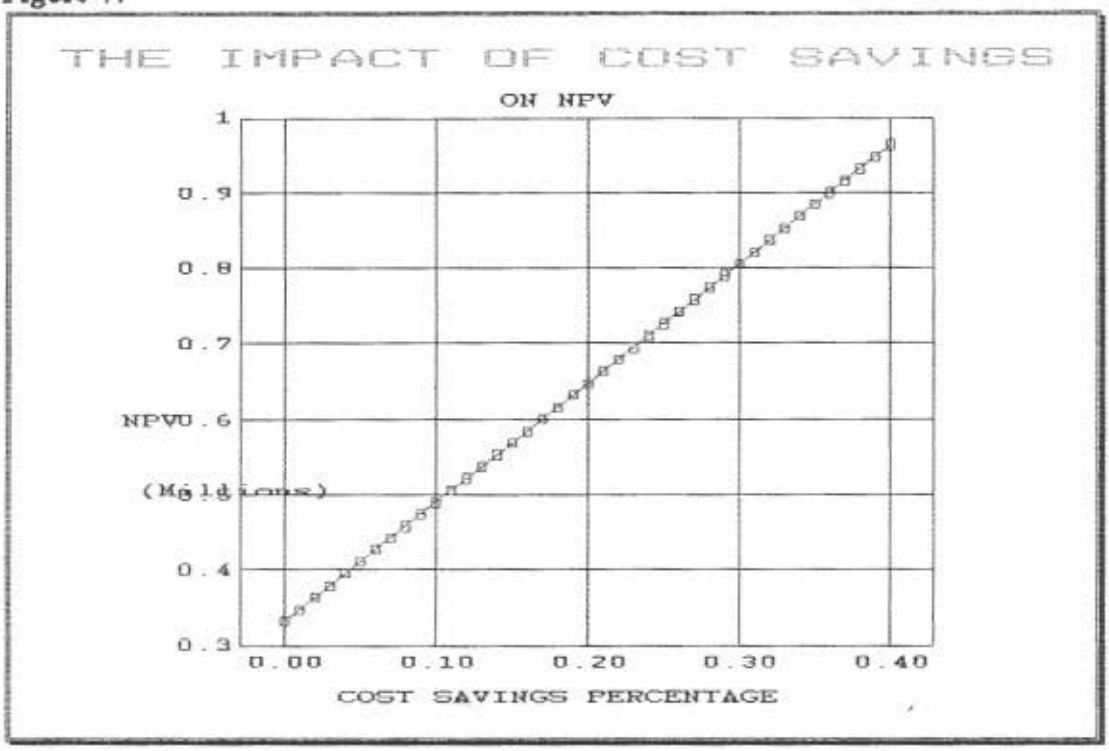
UNIT SALES vs. VARIABLE COST SAVINGS

The increase in unit sales was estimated as 1200. There are many factors that influence the sales of CCC. Right now, the sales are growing and there is a very big market for its product but the U.S. economy has not recovered from the past recession yet. The sales of CCC might be vulnerable in a slow recovery. The Figure 6 considers this factor and shows a break-even analysis.



The break-even point is at 875 units. CCC needs a good market analysis. Altough the demand is very high right now, if its estimates are off by 325 units, the project looses money. On the other hand by buying the new machines CCC is hoping to have cost savings and improve its lead time. Figure 7 shows NPV vs. cost savings.

Figure 7:

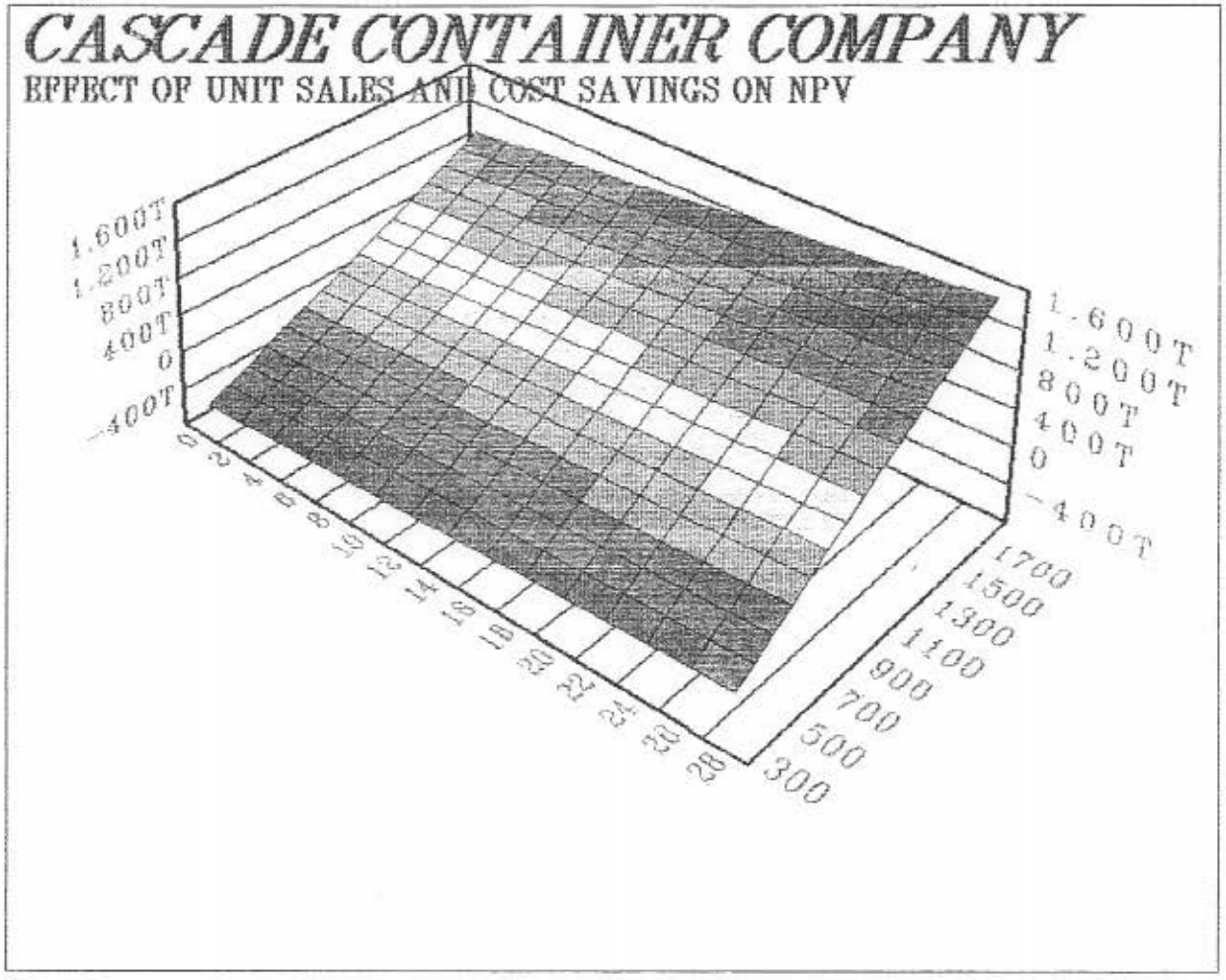


Per 10% cost saving the net present value increases $150,000. However, what if the demand is low while CCC has a lot of cost savings. Figure 8 shows a 3D picture of the NPV. The negative NPV's are showed in red color. If the unit sales increase is 300 at 28% cost saving the NPV is still negative (lower right corner). The NPV increases with unit sales and at 700 units the NPV becomes positive. This is a significant improvement since the break-even point was 875 units at no cost saving. The NPV seemed to be more sensitive to unit sales compared to cost savings from the new production setting. If everything is very optimistic (upper right hand corner), NPV can reach to $1,400,000 whereas it drops to $550,000 negative if everything is pessimistic (lower left corner).

SIMULATION

Most of the estimates seemed to be educated guesses of the management rather than solid forecasts. The researcher has been very frustrated using those numbers as hard facts. The simulation accounts the uncertainty of the guesses and gives more insight about the risk of the project.

@RISK simulation package has been used in this analysis to determine the risks of the project. The researcher asked three estimates from the management of CCC for each factor in order to come up with triangular distributions. The output of the simulation has been attached to Appendix I. The NPV and its distribution is depicted in Appendix II. The project has a mean of $335,412 and a standard deviation of $165,544. The


CASCADE CONTAINER COMPANY
EFFECT OF UNIT SALES AND COST SAVINGS ON NPV
1,600T
1,200T
800T
400T
0
-400T
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28
1,600T
1,200T
800T
400T
0
-400T
1700
1500
1300
1100
900
700
500
300

probability of a negative result is very low (1%). The NPV has a wide normal distribution. The coefficient of variation is around 2. The project is not unrisky but it promises a good return. The Appendix III shows the cash-flow over the years. The variation increases with time. The future is not certain and the uncertainy increases with time[5].

CONCLUSIONS:

It has been a very useful practise to perform this capital budgeting analysis. Altough some of the data was vague, the reason for analysis was insight rather than numbers. The objective was to determine the critical factors that determine the success of the project.

The initial fixed cost is very sensitive to the net present value of the project. The increase in capacity might cause a lot manufacturing overhead. If the demand declines this might be a problem. The break-even of the project is close to the current estimate and if the cost savings from the new production setting is not realized the company can easily loose money in a weak economy. On the other hand, the demand for CCC's products are growing and there is a backlog of five weeks. There are also risks of depending only on one sheer and one break machine. If one of the machines breaks the production might stops for days and CCC can loose a lot of money.

The net present value analysis suggests to take the project and increase the capacity. The interest rates are low right now and the capital is cheap. It might be a very good oppurtunity for CCC to expand the production. There are risks involved in the project but it is a very profitable investment.

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[5] "@RISK Manual", Addison Wesley, Benjamin Cummings, pg-103

APPENDIX I:

NPV (in Cell E2)
@RISK Risk Analysis 22-Feb-1992
==========
Expected/Mean Result = 335412.60
Maximum Result = 739602.30
Minimum Result = -58906.53
Range of Possible Results = 798508.90
Probability of Positive Result = 99.00
Probability of Negative Result = 1.00
Standard Deviation = 164544.50
Skewness = 0.06
Kurtosis = 2.62
Variance = 27074880000.00
ERRs Calculated = 0.00
Values Filtered = 0.00
Simulations Executed = 1.00
Iterations = 100.00

Percentile Probabilities:
(Chance of Result <= Shown Value)
==========
Chance of Result <-58906.53= 0%

Chance of Result < 55069.78= 5%

Chance of Result < 103838.5= 10%

Chance of Result < 166081.3= 15%

Chance of Result < 190782.2= 20%

Chance of Result < 218954 = 25%

Chance of Result < 243958.3= 30%

Chance of Result < 249678.5= 35%

Chance of Result < 296579.4= 40%

Chance of Result < 318691.5= 45%

Chance of Result < 322054.7= 50%

Chance of Result < 345835 = 55%

Chance of Result < 372016.3= 60%

Chance of Result < 392126.7= 65%

chance of Result < 411675.2= 70%

Chance of Result < 460293.9= 75%

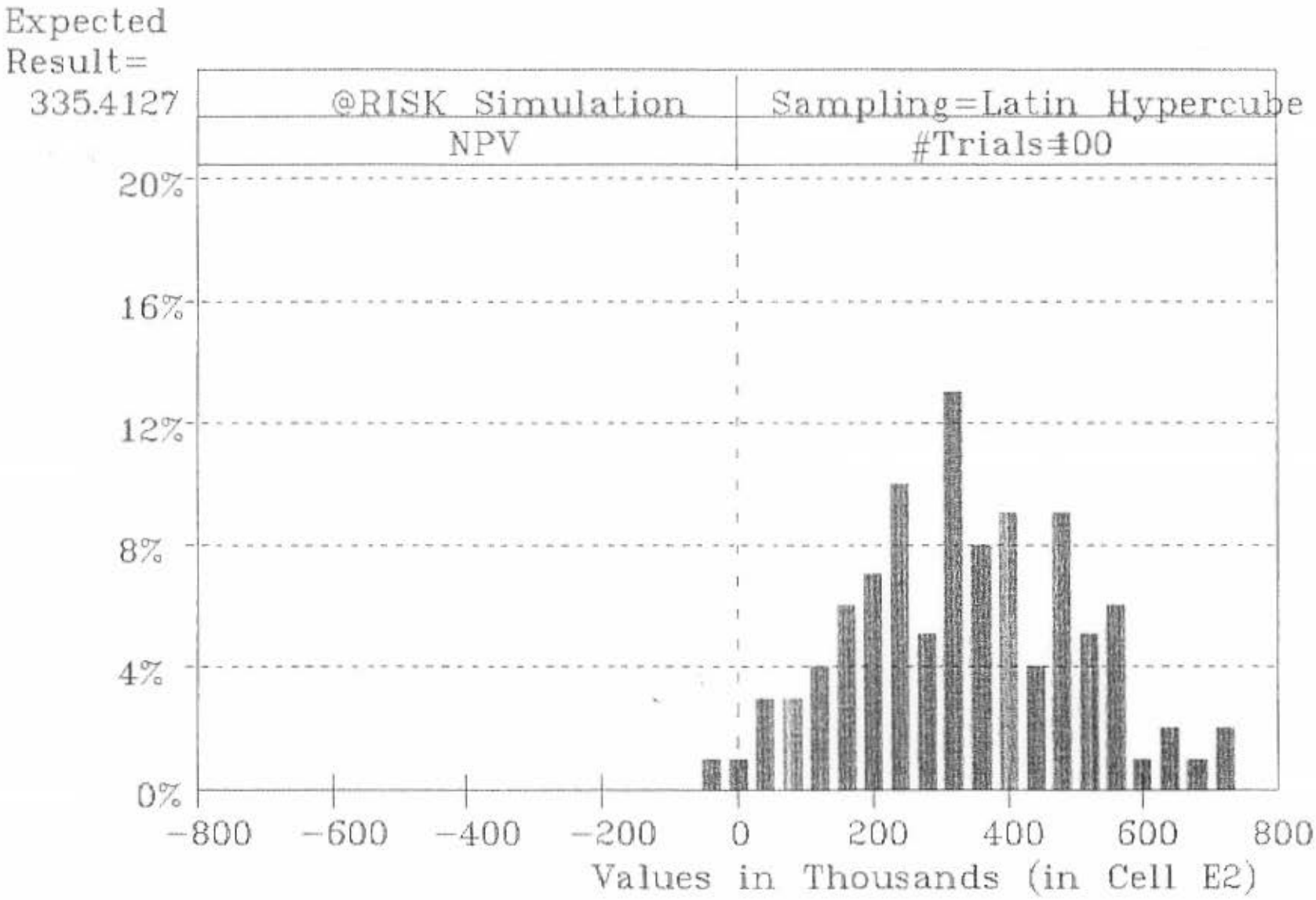
Chance of Result < 473840.4= 80%

Chance of Result < 514770.4= 85%

Chance of Result < 540766 = 90%

Chance of Result < 582978.2= 95%

Chance of Result < 739602.3= 100%


Expected
Result=
335.4127
@RISK Simulation
Sampling=Latin Hypercube
NPV
#Trials=400
20%
16%
12%
8%
4%
0%
-800
-600
-400
-200
0
200
400
600
800
Values in Thousands (in Cell E2)

Trend in Mean,
1 Std.Dev.,
5/95 Perc.