ETM 535 Project

Analysis of Profitability of Out-of-State Projects for a Small Construction Company in Michigan

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Abstract

As a result of Michigan's high unemployment rate (the largest in the nation) many small companies are going out of business or struggling to survive. One industry that has been hit particularly hard is the construction industry, and many small construction companies in Michigan have been looking into ways to expand their business and remain profitable. One possible solution to this problem is to pursue construction jobs outside of the state of Michigan, but the profitability of this business model is questionable. The goal of our study is to analyze the profitability of pursuing out-of-state construction projects for a small Michigan based construction company. After identifying the top 5 growing metropolitan areas within 800 miles of Detroit Michigan, we used information from the company regarding project costs that vary by location, and analyzed the profitability for projects in each location, using the company's MARR of 16%. Based on our NPV model and sensitivity analysis, we have demonstrated that out-of-state projects can be profitable for this company, and were able to recommend one metropolitan area with the highest PW for the company to pursue. In addition, based on the results of our sensitivity analysis, we were able to make recommendations for further cost savings for out-of-state projects and suggestions for future work in this area.

Introduction

As of September 2009, the State of Michigan's unemployment rate was the nation's highest, at 15.3% - an increase of 6.4 over the previous year. [1] As a result of the state's economic struggles, many Michigan based companies have either gone out of business, or are struggling to stay alive. One industry that has been hit particularly hard is the construction industry – for both commercial and residential construction in the state. Although large construction companies may have additional locations outside of Michigan, small construction companies do not have that luxury. However, it may be possible for small construction companies in Michigan to remain profitable during the state's economic decline by pursuing job opportunities in other mid-western or east coast states.

Problem Statement & Project Goals

A small Michigan based construction company is having trouble remaining profitable with their current business model of only taking jobs within the state. As a result, this company is considering changing their business model to pursue construction jobs in other nearby states within the mid-west and east coast region of the United States.

The goal of our project is to create a model in which project costs and profitability of an average construction job for this company can be compared for multiple states. For the

purposes of our project we will be focusing our analysis on the top 5 growing metropolitan areas (based on population increase) [2] within 800 miles of the Detroit Metropolitan area:

- Aurora and Juliet, Illinois,
- New York City, New York
- Fort Wayne, Indiana
- Columbus, Ohio
- Raleigh, Charlotte and Durham, North Carolina

Using the economic model we develop, we will calculate the different project costs and profitability for each metropolitan area identified above, including the state of Michigan to be used as a baseline. The metropolitan area that results in the greatest profit at or above the company's MARR of 16% and highest NPV for which increment of investment capital is justified will be recommended to the Michigan based construction company as an area to pursue for future project opportunities.

Model Creation

Model Assumptions

The creation of our model requires a number of key assumptions, as well as information from the company under analysis.

The first key assumption made for our analysis is that pursuing jobs in any of the five metropolitan areas are considered to be mutually exclusion alternatives. Thus, although the company may pursue projects in any of the cities recommended by our results at some point in the future, we are making the assumption that the company only has the necessary resources to pursue any one out of state alternative at a time.

Another key assumption made by our model is that equivalent construction project opportunities are available in each of these metropolitan areas – thus, the cost structure for a given project will be the same in each city. We expect only the costs that may differ by location to be variable among the project alternatives. Any costs that are NOT variable based on project location are not included as part of the model since they will not change the results.

Based on data received from the company being analyzed, their typical Michigan projects yield ~25% profit margins. Thus, our model will assume project revenue equal to the sum of costs for a Michigan project + 25%. This assumed project revenue will be held constant for all metropolitan areas under comparison. Effectively, this will result in metropolitan areas with lower costs being more profitable than those with higher costs, which is what we would expect for this type of analysis. It is important to note that although Michigan projects average a profit margin of 25%, the company's MARR is

only 16%, so projects with a lower profit margin than can be gained in Michigan are still considered acceptable. This is because the number of projects available in Michigan is not high enough to use all the company's resources – so restricting all projects to Michigan may not be ideal. (Unless other metropolitan areas are unable to provide a MARR greater than or equal to 16%).

Variable Costs by State

As mentioned above, only costs that are variable among the different locations are considered as part of the model. Based on interviews with company representatives, these variable costs include:

- **Project Overhead**: This includes everything not directly tied to a given project, including human resources, electricity and heat for the main office, maintenance for vehicles and equipment, etc. Overhead is typically charged as 15% of the overall project costs.
- **Taxes:** This includes local sales taxes for any materials or equipment purchased out of state.
- **Supplies/Materials:** This includes two different areas – 1. Supplies that are purchased locally such as paint and wood and are thus subject to local costs. 2. Supplies and equipment that are driven down from the company's headquarters in Detroit to the job site and thus subject to variable costs based on distance to the job site.
- **Scrap Costs:** This includes the costs for dumpster rental and waste removal on site.
- **Porta-Potties & Equipment Rental:** This includes the costs for porta-potties on site, as well as scaffolding, fencing, and lifts. United Rental is used everywhere for equipment rental, but actual rental costs may vary by location.
- **Permits:** This includes the costs for permits that must be obtained from the building department of the city the project is being done in – including permits for demolition, electric, and plumbing.
- **Travel:** This includes the costs of travel and living expenses for all employees working on the construction job.

Construction Project Assumptions

To create the model certain assumptions were made about the cost structure of the project to ensure consistency in our comparison across different metropolitan areas. Although construction projects may not always follow this cost structure, the assumptions identified to develop the model were based on the cost structure for an average construction project undertaken by the company under analysis. The high level assumptions are described below, but for a full list of all project assumptions used in the model, please see Appendix 1.

It is assumed that 5 Michigan based employees are at the job site at any given time. The employees are rotated through their assignments, each spending 10 days at the job location followed by a week back home. These 5 employees are paid the same wages as they would be paid in Michigan, although they have additional taxes taken out of their income for the state in which they are working. Although this affects the individual employee's income, it does not affect the project profitability from the respect of the company. No local labor is used, and the subcontractors used for the job handle their own travel to and from the job site at no additional cost to the company under analysis. The average job duration is two years, after which one lump sum of payment is paid to the construction company under study.

There are 3 trucks used by the company to carry equipment and materials to the job site and transport the employees on site. These 3 trucks get ~15 mpg, and travel about 100 miles per week while on the job. The trucks stay at the job site throughout the duration of the project and then they are driven back to Michigan.

Any job site over 600 miles from Detroit, Michigan requires air travel for the employees working on the job site. This does not include the 3 employees needed to drive down the trucks at the start of the project and then back at the end of the project. For those trips the 600 mile rule is waived. Any project site less than 600 miles away requires all employees to drive, and they are reimbursed at 20 cents per mile for their mileage.

While out of state all employees stay in the least expensive hotel near the job site and sleep two people to a room. They are also provided with $25/day for food expenses while they are at the job site. This is not the case for jobs taken in Michigan.

The equipment rentals used for each project are fencing, scaffolding, porta-potties and lifts. The necessary materials that must be purchased locally are wood and paint. The company reuses all leftover material. However, there is a need to remove some scrap material at a local waste management site once a year. Demolition, electrical and plumbing permits will also be required for purchase in each state that will differ by location as to the cost of these permits. For the purposes of permit cost calculations the average project was assumed to be two years and only one $100,000 commercial unit is assumed to be built. Figure 1, shows these basic assumptions that were used in the model.

Figure 1: Assumptions

Assumptions		
Project	2	years average project duration
	1	Commerical Unit Built
	$ 377,616.65	Revenue End of Year 2
	$ 100,000.00	Construction Costs/ Unit
	16.00%	Company's MARR

Additionally, since the project is assumed to be two years, the Consumers Price Index (CPI) was used for the annual inflation rates in Mid-west, North East and South regions of the U.S. Figure 2, shows in yellow all the above described inputs used in model.

Figure 2: Model Inputs

Inputs

People	5	people per week on site
	10	days on site
	5	days backhome
	0	local labor used
	336	days per year for work days
Company Owned Trucks	3	travel to site location
	15	miles/gal for each truck
	100	miles/week at site location
	1	round trip from start to end of project
Emp. Travel	600	miles, max. driving range 1-way before an employee must travel by air to site
	$ 0.20	per mile reimbursement for employee to drive to site location
	$ 25.00	per day for food expenses at job site
	$ 30.00	Miles/gallon Avg. employee

Figure 2: Model Inputs (Continued)

Costs that Vary by State							
State and Local Tax Burdens	Illinois	New York	Indiana	Ohio	North Carolina	Michigan	Notes
Year 0	9.3%	11.7%	9.4%	10.4%	9.8%	9.4%	See Reference [4]
Year 1	9.3%	10.4%	11.7%	9.4%	9.8%	9.4%	See Reference [4]
Year 2	9.2%	9.9%	12.5%	9.0%	9.7%	9.3%	See Reference [4]
Gas/gallon	$ 2.60	$ 2.56	$ 2.59	$ 2.51	$ 2.49	$ 2.70	See Reference [5]
Miles to Site (1-Way)	207	617	194	219	698	$ 50.00	See Reference [6]
Lodging per Night	$ 51.00	$ 82.00	$ 32.00	$ 34.00	$ 39.00	$ -	
Airfare if Mile>600		$ 430.00			$ 310.00		See Reference [7-8]
Equipment Rental Purchased Locally (cost per year)							Notes
Fence	$ 100.00	$ 100.00	$ 150.00	$ 150.00	$ 150.00	$ 150.00	See Reference [9]
Scaffolding	$ 585.00	$ 585.00	$ 585.00	$ 585.00	$ 585.00	$ 585.00	See Reference [10]
Porta-Potties	$ 225.00	$ 225.00	$ 200.00	$ 225.00	$ 225.00	$ 225.00	See Reference [11]
Lifts	$ 500.00	$ 500.00	$ 500.00	$ 500.00	$ 500.00	$ 500.00	See Reference [12]
Material Purchased Locally (only state taxes apply for model)							Notes
Wood per Project per year	$ 15,500.00	$ 15,500.00	$ 15,500.00	$ 15,500.00	$ 15,500.00	$ 15,500.00	See Reference [13], Assume Avg. in EOY 1 & 2
Paint Per Project per year	$ 1,000.00	$ 1,000.00	$ 1,000.00	$ 1,000.00	$ 1,000.00	$ 1,000.00	See Reference [14], Assume Avg. in EOY 1 & 2
lbs/ton Scrap Material per year	$ 235.00	$ 235.00	$ 235.00	$ 235.00	$ 235.00	$ 235.00	See Reference [15], Assume Avg. in EOY 1 & 2
Permit for Non-residential Purchased Locally							Notes
Demolition Permit	$ 125.00	$ 30.00	$ 125.00	$ 125.00	$ 150.00	$ 111	See Reference [16-21] Assume in EOY 0
Electrical Permit	$ 2,875.00	$ 262.00	$ 1,800.00	$ 1,800.00	$ 675.00	$ 1,482	See Reference [22-26] Assume in EOY 0
Plumbing Permit	$ 100.00	$ 70.00	$ 150.00	$ 150.00	$ 75.00	$ 109	See Reference [27-31] Assume in EOY 0

Annual Inflation Rate (CPI)		Notes
Mid West	3.66%	See
North East	3.99%	Reference
South	4.15%	[32]

Discussion & Analysis

As described above, the goal of this project is to determine whether or not an out of state project is a profitable venture for the company under study, considering economic factors that differ among site locations. We will use an After Tax Cash Flow (ATCF) Net Present Value (NPV, or Present Worth PW) calculation for each mutually exclusive out-of-state project and a Sensitivity Analysis to make this determination.

NPV Background

Net Present Value (NPV), also known as Present Worth (PW), is one of the four measures of worth to evaluate and select a single project. [3] The goal of calculating the NPV is to bring back the value of the project costs, project revenue, and relevant taxes to year 0 to make a comparison between projects. All acceptable projects that have a present worth greater than zero at the MARR @ 16% will be a potential candidate, at which point we will use an incremental analysis to choose the single best option.

Sensitivity Analysis Background

The next step of our analysis will be to look at the costs and benefits and determine their sensitivity via a Sensitivity Analysis (SA). The goal of the Sensitivity Analysis is to demonstrate factors that are dynamic and uncertain. Sensitivity analysis has the ability to analyze the data based on different assumptions. [3] By implementing sensitivity analysis one can determine which parameters are not really critical and could be put in the lower priority [3]. Therefore, sensitivity analysis will show which parameters are the most important. When making a final decision more attention can then be placed on the variability of those parameters, and additional cost reductions can be recommended.

The NPV Economic Model

Based on our assumptions regarding the construction project described above, we created an economic model in Excel to calculate the NPV of the project for each of the 5 metropolitan areas selected and the state of Michigan (used as a baseline). Screen shots of the model for each state are shown in Figures 3-5.

Figure 3: NPV for Illinois and New York

	Illinois			New York		
Categories of Project	Expenses Per Year			Expenses Per Year		
Cost for Cash Flow	0	1	2	0	1	2
Revenue			$ 377,617			$ 377,617
Project Overhead		$ (29,499.75)	$ (30,578.43)		$ (29,499.75)	$ (30,578.43)
Supplies/Materials		$ (8,250.00)	$ (8,552.27)		$ (8,250.00)	$ (8,579.01)
Scrap Costs		$ (235.00)	$ (243.61)		$ (235.00)	$ (244.37)
Porta-Potties & Equipment Rental		$ (1,410.00)	$ (1,461.66)		$ (1,410.00)	$ (1,466.23)
Permits	$ (3,100.00)			$ (362.00)		
Travel		$ (130,740.33)	$ (135,530.51)		$ (170,390.84)	$ (177,186.01)
Before-Tax Cash Flow (BTCF)	$ (3,100)	$ (170,135)	$ 201,250	$ (362)	$ (209,786)	$ 159,563
Depreciation						
Taxable Income (TI)	$ (3,100.00)	$ (170,135.08)	$ 201,250.17	$ (362.00)	$ (209,785.59)	$ 159,562.59
Cash Flow for Income Taxes	$ -	$ -	$ -	$ -	$ -	$ -
After Tax Cash Flow (ATCF)	$ (3,100.00)	$ (170,135.08)	$ 201,250.17	$ (362.00)	$ (209,785.59)	$ 159,562.59
	$ (3,100.00)	$ (197,357)	$ 270,802	$ (362.00)	$ (243,351)	$ 214,707
PW(16%)	**$**		**70,345.54**	**$**		**(29,005.86)**

Figure 4: NPV India and Ohio

	Indiana			Ohio		
Categories of Project	Expenses Per Year			Expenses Per Year		
Cost for Cash Flow	0	1	2	0	1	2
Revenue			$ 377,617			$ 377,617
Project Overhead		$ (29,499.75)	$ (30,578.43)		$ (29,499.75)	$ (30,578.43)
Supplies/Materials		$ (8,250.00)	$ (8,552.27)		$ (8,250.00)	$ (8,552.27)
Scrap Costs		$ (235.00)	$ (235.00)		$ (235.00)	$ (235.00)
Porta-Potties & Equipment Rental		$ (1,435.00)	$ (1,487.58)		$ (1,460.00)	$ (1,513.49)
Permits	$ (2,075.00)			$ (2,075.00)		
Travel		$ (98,624.02)	$ (102,237.49)		$ (102,253.23)	$ (105,999.67)
Before-Tax Cash Flow (BTCF)	$ (2,075)	$ (138,044)	$ 234,526	$ (2,075)	$ (141,698)	$ 230,738
Depreciation						
Taxable Income (TI)	$ (2,075.00)	$ (138,043.77)	$ 234,525.88	$ (2,075.00)	$ (141,697.98)	$ 230,737.78
Cash Flow for Income Taxes	$ -	$ -	$ -	$ -	$ -	$ -
After Tax Cash Flow (ATCF)	$ (2,075.00)	$ (138,043.77)	$ 234,525.88	$ (2,075.00)	$ (141,697.98)	$ 230,737.78
	$ (2,075.00)	$ (160,131)	$ 315,578	$ (2,075.00)	$ (164,370)	$ 310,481
PW(16%)	**$**		**153,372.25**	**$**		**144,036.10**

Figure 5: NPV Michigan (Baseline)

	Michigan		
Categories of Project	Expenses Per Year		
Cost for Cash Flow	0	1	2
Revenue			$ 377,617
Project Overhead		$ (29,499.75)	$ (30,578.43)
Supplies/Materials		$ (8,250.00)	$ (8,552.27)
Scrap Costs		$ (235.00)	$ (235.00)
Porta-Potties & Equipment Rental		$ (1,460.00)	$ (1,513.49)
Permits	$ (1,702.40)		
Travel		$ (108,054.00)	$ (112,012.97)
Before-Tax Cash Flow (BTCF)	$ (1,702)	$ (147,499)	$ 224,724
Depreciation			
Taxable Income (TI)	$ (1,702.40)	$ (147,498.75)	$ 224,724.48
Cash Flow for Income Taxes	$ -	$ -	$ -
After Tax Cash Flow (ATCF)	$ (1,702.40)	$ (147,498.75)	$ 224,724.48
	-1702.4	$ (171,099)	$ 302,389
PW(16%)	**$**		**129,588.31**

Since the projects are assumed to span a 2 year period, both taxes and inflation were taken into account in the NPV calculations. Note there was no equipment purchased so there was no need to calculate depreciation. To do our project comparisons we used an incremental comparison of the NPV of the 5 out-of-state projects. Two of the out-of-state projects had a negative NPV and were thus not included in the incremental analysis. The three locations with a positive NPV were Illinois, Ohio and Indiana. Ultimately, Indiana was proven to have the greatest value, since it had a smaller investment and the incremental benefit gained by the larger investment in the other out-of-state projects was not justified.

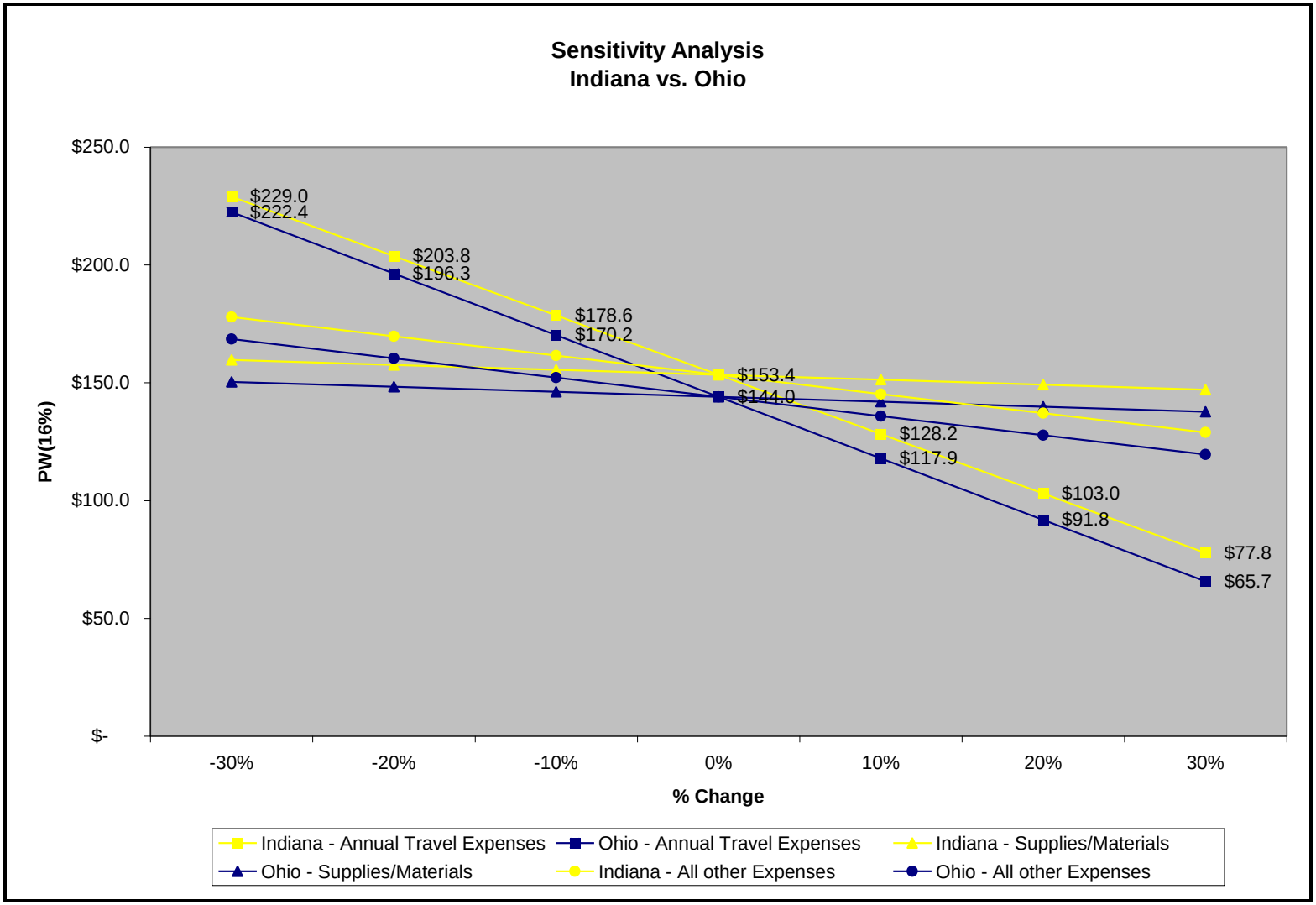
This finding is not surprising – given that Indiana is the closest project location to Michigan, and the cost of living in Indiana is much lower than the other 4 states under consideration. Based on the NPV model it appeared as though travel costs had the most effect on the overall NPV of the project. To verify this, and determine what other factors had big impacts on project profitability, we completed a sensitivity analysis using a What-if Analysis.

The Sensitivity Analysis

For our sensitivity analysis we chose to use a What-if Analysis instead of a more detailed Monte Carlo simulation. We had two reasons for this – first of all, as students, we do not have the necessary licenses to use Monte Carlo simulation software such as Crystal Ball, and secondly, we are not sure if the company under study has access to Monte Carlo simulation software either. Thus, since the ultimate goal of this analysis is to make a recommendation to the company under study and provide them with a useable model to do further analysis, providing them a model they don't have a license to use would defeat the purpose. A What-if Analysis, although simplistic, is easy to reproduce and modify in Excel. What-if analysis is the process of changing the values in cells to see how those changes will affect the outcome of formulas on the worksheet. For our purposes we changed values in increments of 10% from -30% to 30% to see how the NPV would change.

Some of the variable costs in our model have almost no weighting in the overall project costs. In fact, travel costs and overhead alone make up 80% of the total project costs for all 5 states studied. Thus, we chose to focus our sensitivity analysis on travel costs, supplies/material costs, and all remaining costs combined. For this analysis we only considered the states of Ohio and Indiana, since those were the two states that resulted in the highest PW based on our NPV analysis. See Figure 6 for the results of this sensitivity analysis.

Figure 6: What-If Sensitivity Analysis for Ohio and Indiana



Not surprisingly, the results of the sensitivity analysis indicate that travel costs have the most bearing on the ultimate PW of the project. The slope of travel is much steeper thus is more sensitive to change and will have the greatest impact on NPV. This aligns with our results, since Indiana, the closest out-of-state project to Michigan, had the largest PW in our NPV model. Ohio, the second closest, had the next highest PW. Most other project costs had little bearing on the overall project costs. Thus, we can assume that any possible reductions in overall travel costs will have the largest impact on the PW for out-of-state projects. It would be worth taking more time gathering accurate costs for travel to minimize errors in NPV calculations.

Recommendations & Future Work

Based on our financial analysis of the profitability of out-of-state projects for the small Michigan based construction company under study, there are a few key recommendations we can make. First of all, based on our NPV model, pursuing projects in the state of Indiana (specifically the Fort Wayne area) will prove to be the most profitable. The area of Columbus Ohio is a close second, and also has a positive PW for the company's MARR of 16%. The PW worth of Illinois was so low that although it is a viable option, we do not strongly recommend pursuing projects in that location.

Our second recommendation is to make every effort to reduce the travel costs associated with out-of-state projects, since the PW of the projects in both Ohio and Indiana were the most sensitive to travel costs. Since Indiana and Ohio are so close to Michigan, it is possible that costs can be reduced by not requiring employees to stay in hotels close to the job site, and instead allow them to commute from home. This option would have to be examined however, since the increased costs from reimbursing employees for personal car usage may result in negligible savings. Other options include investing in more fuel-efficient company trucks, and looking for corporate rates and discounts for hotels. Future work could be done to explore the potential cost savings from reducing various travel costs.

Due to Monte Carlo software not being available to the company under study, we have limited our sensitivity analysis to What-If Analysis. As this type of analysis can not model distribution and generate hundreds of thousands of scenarios for the likelihood of an outcome, another future recommendation is for the company to buy Crystal Ball or another Monte Carlo license which would provide a better understanding of these behaviors in the model for better decision making.

Conclusion

In conclusion, our analysis demonstrates that pursuing construction projects outside of the state of Michigan is a feasible business model for the company under study. However, since travel costs have such a large affect on the overall profitability of the project, construction jobs closest to the state of Michigan are preferred.

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Appendix

Appendix 1: List of Construction Project Assumptions

- Total project revenue = Michigan Project Costs * 1.25 (Estimated 25% profit margin for Michigan projects)
- Average project duration is 2 years
- Project payment made as one lump sum at project completion
- MARR is 16%
- Permit costs assume a single unit cost on a new or existing building with 50 electrical connections and 10 plumbing features
- Only necessary scrap costs are dumpster rentals, which are emptied once per year
- Any project >= 600 miles from Detroit, MI require air travel (except for employees driving the trucks). Any project site less than 600 miles away requires employees to drive, and they are reimbursed at 20 cents per mile.
- 5 Michigan based employees at the site at a given time. Employees spend 10 days on site and 7 days back at home.
- Michigan based employees are paid Michigan wages, but must pay local state income taxes for work completed in that state.
- No local labor is used.
- Subcontractors cost the same as they would in Michigan, and handle all their own travel.
- Michigan based employees stay in the cheapest chain hotel in the city and sleep two to a room. They are provided 25$ per day for food.
- There are 3 trucks used by the company on site. They get ~15 mpg and travel 100 miles per week while on the job. The trucks are each driven down to the site by one employee at the start of the job, and driven back by one employee at the end.
- The equipment rentals used for an average project include fencing, scaffolding, porta-potties and lifts. The necessary materials to purchase locally are wood and paint – both of which are subject to local sales tax.
- The only travel costs in the state of Michigan are the costs to drive the company trucks to and from the jobsite every day. This has been estimated at about 300 miles per week – and a cost of 20 cents per mile.
- Since all capital equipment is rented, the projects do not include a depreciation cost for any equipment.