

MAE - 548

ENGINEERING ECONOMICS & TECHNOLOGY VALUATION

FINAL PROJECT REPORT

Instructor: Prof. Dr. Jackie Anderson

Submitted By:

Name: Rishi Siddanth Yaga.

SU ID: 627161225.

Email ID: riyaga@syr.edu

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Proposal: Economic Analysis of a new Warehouse for an Automobile Company.

Introduction:

The Automobile industry is constantly evolving, with new technologies and emerging to improve their services and outcomes. To accommodate the parts and equipment, we need a new modern warehouse. However, introducing new modern warehouse requires significant financial investment and can have a substantial impact on company's budget. The purpose of this project is to conduct an economic analysis of introducing a new modern warehouse to determine its financial feasibility.

Project Description:

A five-hundred-thousand square-foot Warehouse Facility is to be constructed by an Automobile Company in New York State. The owner has a twenty-five-acre Land for the project. Ten of the twenty-five acres is dedicated for truck circulation and parking. Four project scenarios have been given. For these four scenarios, multiple economic analysis methods are used to calculate and determine which of the four is more economical. The more economical and logical scenario shall be chosen for the project. All the scenarios have several expenses including site work, construction, civil engineering, landscape and building maintenance, snow removal, pavement rehabilitation, and utilities.

Goals:

1. Determine the feasibility of constructing a new warehouse for the automobile company.
2. Evaluate the potential economic benefits of the new warehouse to the company.
3. Identify the potential risks and costs associated with the new warehouse construction.
4. Determine the most cost-effective way to construct the new warehouse and evaluate various financing options.

Objectives:

1. Estimate the total costs of constructing the new warehouse, including land acquisition, construction costs, and equipment and inventory expenses.
2. Evaluate the potential benefits of the new warehouse, including increased production efficiency, reduced transportation costs, and improved inventory management.
3. Estimate the return on investment (ROI) for the new warehouse and conduct sensitivity analysis to identify potential risks and uncertainties.

4. Identify potential financing options for the new warehouse, including bank loans, equity financing, and public-private partnerships, and evaluate the costs and benefits of each option.
5. Evaluate the potential locations for the new warehouse based on factors such as transportation costs, labor availability, and proximity to suppliers and customers.

Project Alternatives:

- Construction of warehouse in 6 months using multiple resources.
- Construction of warehouse in a year using less resources.
- Renting a land for construction of warehouse in certain period.
- Constructing the warehouse in a certain period and using half of the warehouse immediately after construction, the other half is to be leased five years beginning one year after construction.
- Do nothing!

Literature Review:

The construction of new warehouses is often associated with the growth of the economy, as it reflects increased demand for goods and services, and the need for increased storage capacity. This literature review aims to provide an overview of the existing literature on the economic analysis of new warehouse construction. Several studies have also examined the impact of warehouse construction on local and regional economies. These studies have examined the direct and indirect effects of warehouse construction on employment, income, and tax revenue, as well as the potential negative externalities, such as traffic congestion and environmental degradation.

One of the key issues in the economic analysis of new warehouse construction is the identification of the costs and benefits associated with the project. Several studies have focused on identifying the direct and indirect costs associated with warehouse construction, such as land acquisition, building design, construction materials, labor costs, and financing costs. These studies have also examined the economic benefits associated with warehouse construction, such as increased employment opportunities, improved supply chain efficiency, and increased tax revenue.

Overall, the literature suggests that the economic analysis of new warehouse construction is a complex and multifaceted issue that requires careful consideration of the costs and benefits associated with the project, as well as its impact on the local and regional economy and the environment. Further research is needed to better understand the factors that contribute to the financial viability and economic impact of warehouse construction projects. These studies have examined the impact of zoning regulations, tax incentives, and subsidies on warehouse construction, as well as the impact of environmental regulations on the construction and operation of warehouses.

Economic Methodologies:

Net Present Value (NPV):

NPV stands for Net Present Value, and it is a financial metric used to evaluate the profitability of an investment or a project. The basic idea behind NPV is to determine the present value of all expected future cash flows generated by an investment or a project, subtracting the initial cost of the investment. If the resulting value is positive, then the investment is considered profitable, while if it is negative, then the investment is considered unprofitable.

To calculate NPV, we must first estimate the cash flows that the investment is expected to generate over a certain period, usually several years. Then, each expected cash flow is discounted to its present value using a discount rate that reflects the time value of money and the risk associated with the investment. Finally, the present value of all cash flows is added together, and the initial cost of the investment is subtracted.

In general, the higher the NPV, the more attractive the investment is, since it indicates that the investment generates more cash flows than the initial cost. On the other hand, a negative NPV means that the investment generates less cash flows than the initial cost, making it unprofitable. NPV is a useful tool for decision-making because it allows you to compare the profitability of different projects or investments that have different initial costs and cash flow patterns. In conclusion, NPV is a powerful financial tool that can help investors and managers make informed decisions about projects and investments by considering the time value of money.

Internal Rate of Return (IRR):

IRR (Internal Rate of Return) is a financial metric used to evaluate the profitability of an investment or a project, by calculating the rate at which the net present value (NPV) of all expected future cash flows equals zero. In other words, it is the discount rate that makes the NPV of an investment or project equal to zero.

The IRR is a useful tool for comparing different investments or projects, as it represents the rate of return that each investment or project would generate, assuming that all cash flows are reinvested at the same rate as the IRR.

To calculate the IRR, we must first estimate the expected cash flows that the investment or project is expected to generate over a certain period. Then, the NPV of these cash flows is calculated at different discount rates until a rate is found that makes the NPV equal to zero.

If the calculated IRR is greater than the required rate of return, the investment or project is considered profitable and should be accepted. If the calculated IRR is less than the required rate of return, the investment or project is considered unprofitable and should be rejected. A higher IRR represents a more attractive investment or project. In summary, IRR is a powerful financial metric used to evaluate the potential profitability of an investment or project. It represents the discount rate that makes the NPV of future cash flows equal to zero and is a useful tool for decision-making in finance.

Economic Analysis:

Alternative 1:

In this alternative, we have considered to build a 30000 SQ. FT warehouse in 1 Acre of land. The various costs of the project include, Civil Engineering Fee, Site Work, Design Fee, Construction & Resources, Labor which sums to a total cost of \$350,000. This project brings an Annual Benefit of \$100,000. The Operating & Maintenance costs comes to a total of \$50,000 for first 3 year and increases by \$2000 every year after 3 years.

We have assumed an interest rate of 12%.

After performing the Economic Analysis using NPV and IRR Analysis techniques, we found out that NPV of the project has a value of -\$80858.88 and the IRR of the project is 4.88 %.

The below picture shows the economic analysis done for this project:

The screenshot shows an Excel spreadsheet titled "EETV project". The summary table is as follows:

	A	B	C	D	E	F	G
1	30,000 squarefoot						
2	Land	1 acre land					
3	Warehouse construction						
4	Civil Engineering Fee	\$30,000					
5	Site Work	\$10,000					
6	Design fee	\$10,000		12%			
7	Construction and Resources	\$200,000					
8	Maintenance and Operating cost	\$50,000	will increase by 5000 every year after 3 years				
9							
10	Labor cost	\$100,000				amount we are saving	
11							
12	Total cost	\$350,000					
13							
14	Annual benefit	\$100,000	cost that is being saved after constructing a warehouse			2005 per 600 sq feet	
15							
16	Alternative 1						
17	Year	Operating and Maintenance	Annual Benefit	Cashflow			
18	0	\$350,000		\$350,000			
19	1	\$50,000	\$100,000	\$50,000			
20	2	\$50,000	\$100,000	\$50,000			
21	3	\$50,000	\$100,000	\$50,000			
22	4	\$52,000	\$100,000	\$48,000			
23	5	\$54,000	\$100,000	\$46,000			
24	6	\$56,000	\$100,000	\$44,000			
25	7	\$58,000	\$100,000	\$42,000			
26	8	\$60,000	\$100,000	\$40,000			
27	9	\$62,000	\$100,000	\$38,000			
28	10	\$64,000	\$100,000	\$36,000			
29			NPV	(\$80,858.88)			
30			IRR	4.88%			
31							
32							
33							
34							
35	design fee		https://www.buildingsguide.com/costs/what-does-it-cost-to-build-a-warehouse/#~:text=How%20much%20does%20it%20cost,center%20costing%20over%20%241M.				
36	maintenance and operating cost		https://www.prologis.com/what-we-do/resources/best-ways-to-reduce-warehouse-costs/#~:text=Administrative%20and%20management%20expenses%20for,square%20foot%20of%20storage%20space.				
37							
38							
39							

The spreadsheet also shows a taskbar at the bottom with various application icons and a system clock indicating Sun Apr 30 9:31 PM.

Alternative 2:

In this alternative, we have considered to build a 30000 SQ. FT warehouse in 1 Acre of land. The various costs of the project include, Civil Engineering Fee, Site Work, Design Fee, Construction & Resources, Labor which sums to a total cost of \$325,000. This project brings an Annual Benefit of \$100,000. The Operating & Maintenance costs comes to a total of \$50,000 for first 3 year and increases by \$2000 every year after 3 years.

We have assumed an interest rate of 12%.

After performing the Economic Analysis using NPV and IRR Analysis techniques, we found out that NPV of the project has a value of -\$58,537.46 and the IRR of the project is 6.53 %.

The below picture shows the economic analysis done for this project:

The screenshot shows an Excel spreadsheet titled "EETV project" with the following data:

	A	B	C	D	E	F	G	H
1	30,000 squarefoot							
2	Land	1 acre land						
3	Warehouse construction							
4	Civil Engineering Fee	\$30,000						
5	Site Work	\$10,000						
6	Design fee	\$10,000		12%				
7	Construction and Resources	\$200,000						
8	Maintenance and Operating cost	\$50,000	will increase by 5000 every year after 3 years					
9								
10	Labor cost	\$75,000						
11								
12	Total cost	\$325,000						
13								
14	Annual Benefit	\$100,000	cost that is being saved after constructing a warehouse					
15								
16	Alternative 2							
17	Year	Operating and Maintenance	Annual Benefit	Cashflow				
18	0	\$325,000		\$325,000				
19	1	\$50,000	\$100,000	\$50,000				
20	2	\$50,000	\$100,000	\$50,000				
21	3	\$50,000	\$100,000	\$50,000				
22	4	\$52,000	\$100,000	\$48,000				
23	5	\$54,000	\$100,000	\$46,000				
24	6	\$56,000	\$100,000	\$44,000				
25	7	\$58,000	\$100,000	\$42,000				
26	8	\$60,000	\$100,000	\$40,000				
27	9	\$62,000	\$100,000	\$38,000				
28	10	\$64,000	\$100,000	\$36,000				
29			NPV	(\$58,537.46)				
30			IRR	6.53%				
31								
32								
33								
34								

The spreadsheet also shows a taskbar at the bottom with various application icons and a system clock indicating Sun Apr 30 9:32 PM.

Alternative 3:

In this alternative, we have considered to build a 30000 SQ. FT warehouse in 1 Acre of land. The various costs of the project include, Civil Engineering Fee, Site Work, Design Fee, Construction & Resources, Labor which sums to a total cost of \$325,000. This project brings an Annual Benefit of \$220,000. The Operating & Maintenance costs comes to a total of \$50,000 for first 3 year and increases by \$2000 every year after 3 years.

We have assumed an interest rate of 12%. In this Alternative we are gaining annual benefit on Renting the whole warehouse, through which we gain \$220,000.

After performing the Economic Analysis using NPV and IRR Analysis techniques, we found out that NPV of the project has a value of \$42,359.38 and the IRR of the project is 15.62 %.

The below picture shows the economic analysis done for this project:

The screenshot shows an Excel spreadsheet titled "EETV project" with the following data:

	A	B	C	D	E	F	G	H	I	J
1	30,000	squarefoot								
2	Land	1 acre land								
3	Warehouse construction									
4	Civil Engineering Fee		\$30,000							
5	Site work		\$10,000							
6	Design fee		\$10,000		12%					
7	Construction and Resources		\$200,000							
8	Maintenance and Operating cost		\$50,000	will increase by 5000 every year after 3 years						
9										
10	Labor cost		\$75,000							
11										
12	Total cost		\$325,000							
13										
14	Annual Benefit		\$220,000	cost that is being saved after constructing a warehouse						
15										
16	Alternative 3									
17	Year	Operating and Maintenance	Annual Benefit	Cashflow						
18	0	\$325,000		\$325,000						
19	1	\$150,000	\$220,000	\$70,000						
20	2	\$150,000	\$220,000	\$70,000						
21	3	\$150,000	\$220,000	\$70,000						
22	4	\$152,000	\$220,000	\$68,000						
23	5	\$154,000	\$220,000	\$66,000						
24	6	\$156,000	\$220,000	\$64,000						
25	7	\$158,000	\$220,000	\$62,000						
26	8	\$160,000	\$220,000	\$60,000						
27	9	\$162,000	\$220,000	\$58,000						
28	10	\$164,000	\$220,000	\$56,000						
29			NPV	\$42,359.38						
30			IRR	15.62%						
31										
32										
33										
34										
35										

Additional notes from the spreadsheet:

- actual benefit of renting a warehouse is 220,000 because we need a space to place our inventory which we are going to use from the external storage places will cost 90,000
- renting \$100,000

Alternative 4:

In this alternative, we have considered to build a 30000 SQ. FT warehouse in 1 Acre of land. The various costs of the project include, Civil Engineering Fee, Site Work, Design Fee, Construction & Resources, Labor which sums to a total cost of \$325,000. This project brings an Annual Benefit of \$160,000. The Operating & Maintenance costs comes to a total of \$50,000 for first 3 year and increases by \$2000 every year after 3 years.

We have assumed an interest rate of 12%. In this Alternative we are gaining annual benefit on Renting half of the warehouse and using the other half for self-utilization, through which we gain \$160,000.

After performing the Economic Analysis using NPV and IRR Analysis techniques, we found out that NPV of the project has a value of \$244,153.06 and the IRR of the project is 30.85 %.

The below picture shows the economic analysis done for this project:

Excel File Edit View Insert Format Tools Data Window Help

AutoSave OFF

EETV project

Home Insert Draw Page Layout Formulas Data Review View Automate Tell me

Comments Share

Draw Eraser Lasso Select Add Pen Draw with Trackpad

F21

	A	B	C	D	E	F	G	H	I
1	30,000	squarefoot							
2	land	1 acre land							
3	Warehouse construction								
4	Civil Engineering Fee	\$30,000							
5	Site work	\$10,000							
6	Design fee	\$10,000		12%					
7	Construction and Resources	\$200,000							
8	Maintenance and Operating cost	\$50,000	will increase by 5000 every year after 3 years						
9									
10	Labor cost	\$75,000							
11					renting	\$220,000			
12	Total cost	\$325,000				\$110,000			
13						\$50,000			
14	Annual Benefit	\$160,000	cost that is being saved after constructing a warehouse			\$160,000			
15									
16	Alternative 4								
17	Year	Operating and Maintenance	Annual Benefit	Cashflow					
18	0	\$325,000		\$325,000					
19	1	\$50,000	\$160,000	\$110,000					
20	2	\$50,000	\$160,000	\$110,000					
21	3	\$50,000	\$160,000	\$110,000					
22	4	\$52,000	\$160,000	\$108,000					
23	5	\$54,000	\$160,000	\$106,000					
24	6	\$56,000	\$160,000	\$104,000					
25	7	\$58,000	\$160,000	\$102,000					
26	8	\$60,000	\$160,000	\$100,000					
27	9	\$62,000	\$160,000	\$98,000					
28	10	\$64,000	\$160,000	\$96,000					
29			NPV	\$244,153.06					
30			IRR	30.85%					
31									
32									
33									
34									

ALT 1 ALT 2 ALT 3 ALT 4 +

Ready Accessibility: Investigate

120%

Results:

The results of economic analysis of the construction of a new warehouse are typically evaluated using financial metrics such as net present value (NPV), internal rate of return (IRR), and payback period. The economic analysis assesses whether the construction project is financially viable and whether it will generate sufficient returns to justify the investment.

The following Results are obtained by doing an economic analysis of the project:

- Alternative 4 will be selected after the economic analysis using NPV & IRR analysis techniques.
- As the NPV is positive, it indicates that the investment is expected to generate more cash than it costs, and therefore may be a profitable opportunity.
- The IRR of approximately 31% indicates that the expected rate of return on an investment is 31% per year.

Outcomes:

The following outcomes are obtained by doing this project:

- Increased storage capacity: A new warehouse provides additional storage capacity for goods and materials, which can increase efficiency and reduce inventory costs.
- Improved supply chain management: A new warehouse can improve supply chain management by reducing lead times, improving delivery times, and increasing the flexibility of the supply chain.
- Increased employment opportunities: The construction and operation of a new warehouse can create new jobs in the construction, logistics, and distribution sectors.
- Increased tax revenue: A new warehouse can generate additional tax revenue for the local government through property taxes, sales taxes, and income taxes.
- Economic development: A new warehouse can attract new businesses and industries to the area, which can lead to further economic development and growth.
- Increased competition: A new warehouse can increase competition in the local market, which can lead to lower prices and improved quality of goods and services.

Recommendations:

Based on the economic analysis and potential impacts of a new warehouse construction project, some recommendations that could be considered include:

Engage with stakeholders: It is important to engage with local businesses, residents, and government officials to address any concerns or questions they may have about the project. This can help to build trust and support for the project and can also help to identify potential issues that may need to be addressed.

Consider the location and design of the warehouse: The location and design of the warehouse can have a significant impact on its economic viability and potential impact on the local community and environment. Consideration should be given to factors such as accessibility, proximity to transportation infrastructure, and environmental impact.

Evaluate potential revenue streams: In addition to considering the costs of construction and operation, it is important to evaluate potential revenue streams associated with the project. This may include rental income, revenue from storage or logistics services, or potential tax incentives.

Monitor and mitigate potential negative impacts: It is important to monitor the project's impact on the local community and environment and take steps to mitigate any negative impacts that may arise. This may include measures such as noise abatement, traffic management, or environmental mitigation strategies.

By following these recommendations, a new warehouse construction project can be optimized to maximize its economic benefits while minimizing any potential negative impacts on the local community and environment.

Conclusion:

The conclusion of a new warehouse construction project depends on the results of the economic analysis and the specific circumstances of the project. If the economic analysis indicates that the project is financially viable and will generate sufficient returns to justify the investment, then the project may proceed.

- Overall, the economic analysis suggests that the renting half of the warehouse and utilizing the remaining warehouse for transport and storage is a viable investment opportunity with a positive net present value, a favorable internal rate of return.
- Thus, it can be concluded that the warehouse construction project is a financially feasible investment opportunity that is likely to provide attractive returns for investors.

Reference List:

- <https://www.buildingsguide.com/costs/what-does-it-cost-to-build-a-warehouse/#:~:text=How%20much%20does%20it%20cost,center%20costing%20over%20%241M.>
- <https://www.prologis.com/what-we-do/resources/best-ways-to-reduce-warehouse-costs#:~:text=Administrative%20and%20management%20expenses%20for,square%20foot%20of%20storage%20space.>
- <https://proest.com/construction/cost-estimates/warehouses/>
- <https://www.cadcrowd.com/blog/civil-engineering-services-rates-budget-breakdown-and-project-costs/>
- <https://www.loopnet.com/search/warehouses/syracuse-ny/for-sale/?sk=32f4711e2f3ff9af264519facf7858a3&e=u>