Economic Viability of Using Artificial Wetlands in Rural Areas of Mexico

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Abstracts

This study analyzed the economic viability of implementing artificial wetlands in rural areas, utilizing a cost-benefit analysis methodology based on secondary sources and previous studies. The break-even point identified in this study indicates that a minimum of 0.52% of sales is necessary to cover total costs without generating profits or losses. This percentage represents the minimum requirement for a wetland to function at full capacity. Despite the high construction cost, the investment recovered in approximately six years. The evaluation demonstrates that the project is profitable, with a positive Net Present Value (NPV) of $388,875.62 (Mexican Pesos), suggesting that in addition to recovering investment, additional profits will be obtained at the end of the fifth year. The Internal Rate of Return (IRR) was 18.36%, exceeding the evaluation rate of 10%, which confirms the project's viability. The Benefit-Cost ratio is greater than 1, indicating that for every peso invested, a surplus of 0.11 pesos will be generated.

Keywords: Ornamental Plants, Wastewater, artificial wetlands.

1. Introduction

Contamination of aquifers in vulnerable communities and insufficient investment in wastewater treatment in developing countries pose an increasing threat to human health and ecosystems owing to anthropogenic activities. This phenomenon is attributed to the release of pollutants and the substantial volume of untreated wastewater discharged directly into water bodies (Villalobos & Díaz, 2018; Zhindón et al., 2018). Consequently, it is imperative to explore economically viable options that can benefit communities with limited financial resources. This analysis pertains to marginalized communities in Pastorías that experience high levels of social vulnerability, the causes of which extend beyond individual or familial remediation (Almejo et al., 2013).

For this project, the community contributed by donating land for the artificial wetland (HC) and received training in the cultivation of local ornamental plants, enabling them to generate income through sales, while simultaneously utilizing these plants for pollutant removal. The primary objective of this study was to conduct an economic analysis to determine the viability of these projects, considering their potential for implementation in other nearby communities or those

with similar characteristics, with the aim of managing wastewater and creating economic opportunities that promote social well-being.

2. Materials and Methods

2.1 Description of the study area

This study was conducted in a rural town in Veracruz, Mexico, situated 260 m above sea level at coordinates -96° 570556' W, 19° 564444' N. The town's population comprises 620 inhabitants, according to INEGI data from 2015. The Topiltepeka River (a tributary of the Actopan River) constitutes a significant component of the hydrology of the area. The study area exhibits a humid regular climate characterized by three distinct periods: precipitation from July to October, cold fronts accompanied by winds and intense rainfall from November to February, and drought conditions from March to June. The annual precipitation ranges from 1,200 to 1,650 mm, with an average annual temperature of 24.3°C (Marín-Muñiz, 2016). In this region, the soil is classified as pheozem and is characterized by an appropriate quantity of organic matter and nutrients, which are primarily utilized for livestock and agricultural purposes (INAFED, 2010). Consequently, marginalized communities such as Pastorías experience conditions of high social vulnerability that cannot be mitigated by individuals or families (Almejo et al., 2013).

2.2. Environmental problems in the study area

The primary issue in Pastorías is contamination of the Topiltepec River due to inadequate wastewater treatment, despite the implementation of a sewer system in 2013. The 15 m3 receiving tank was insufficient and overflowed, resulting in ecosystem damage when the effluent reached the river. Moreover, the community utilizes the water body for recreational purposes and for fishing native species such as "barrigones," which serve as a food source for local families, according to Marín-Muñiz (2016). Consequently, the discharge of contaminated water into rivers represents a potential source of disease for the population and alterations in the aquatic environment, among other adverse effects.

Contamination of the Topiltepec River in Pastorías constitutes a significant problem because of the absence of an adequate wastewater treatment system in the community, despite the presence of a sewer system since 2013. The 15 m3 receiving tank was insufficient for the volume of wastewater generated, resulting in overflows into the river and subsequent ecosystem damage due to the topography of the area. Additionally, the community utilizes the water body for recreational activities and for fishing native species such as "barrigones," which serve as a food source for local families (Marín-Muñiz, 2016). Consequently, the introduction of contaminated water into rivers may pose a potential risk to the local population and cause detrimental effects on the aquatic environment.

2.3. Design of constructed wetland system

The design of the horizontal flow constructed wetland system comprises 12 cells, each measuring 4 m in length, 0.85 m in width, and 0.65 m in depth, with an effective treatment area of 40 m2.

A total of 408 ornamental plants (Canna hybrids, Iris germanica, Anthurium sp., Spathiphyllum wallisii, Zingiber spectabile, and Alpinia purpurata) were planted in rows spaced 30 cm apart in both directions and were collected from their natural environment in proximity to the study area. The system utilized 36 tons of recycled PET bottles collected from cafeterias and schools in Actopan, Veracruz, Mexico. The wastewater treatment plant was constructed and monitored with community participation, while the maintenance of the wetland and the cultivation of ornamental plants were conducted by a group of women organized by the municipal agency of Pastorías, Actopan, and Veracruz. Between January and October 2018, HC was maintained, and ornamental plants and commercial flowers were cultivated to generate economic income in conjunction with eco-technology. This constructed wetland area processes 6,240 liters of water per day, equivalent to treating 187,200 liters in one month. This volume could potentially irrigate 1,883 ha of agricultural land in Actopan, Veracruz.

2.4. Economic analysis

In this study, the cost-benefit method was selected to evaluate the viability and feasibility of the project. Unlike a public value assessment, which aims to measure the total economic value of infrastructure solutions (Talberth et al. 2013), this approach specifically assesses the viability of a constructed wetland as a business model, focusing exclusively on its wastewater treatment capacity.

The cost-benefit approach can be utilized to calculate the value of a good or service as well as to assess the value of infrastructure (Bateman et al., 2018; Bateman et al., 2014).

Consequently, the subsequent stage of the research involved conducting a cost-benefit analysis in accordance with the European Guidelines for this type of analysis. According to Litardo et al. (2022), cost-benefit analysis is a method of analyzing data using financial reports of a completed project to competitively and strategically evaluate its viability and relevance, with the following objectives:

• Demonstrate the reliability and stability of the project for potential third-party financing.

• Establish an opportunity to execute a project of this nature.

• Identify individuals and entities interested in implementing similar new projects or expanding existing ones.

• Seek resources from state or private entities.

The following elements must be available prior to conducting a financial evaluation.

• Project concept.

• Analysis of the environment (Economic, Socioeconomic, Technological, Environmental factors).

• Current market situation (analysis of industry, Clients, Competition).

• Business lines, products, services, clients, and distribution.

• Production (Resources).

• Financial statements or financial projections.

The introduction of new technology inherently carries the risk of effectiveness, which is typically mitigated by conducting pilot studies (Dimuro et al., 2014). The costs of this study were incorporated into the financial results.

3. Results and discussions

3.1. Initial investment

As elucidated by Gutiérrez et al. (2021), the financial resources required to initiate project operations must encompass all essential assets, both tangible and intangible, that are necessary for project commencement.

3.2. Working capital

Santana (2015) defines working capital as a critical economic resource for initiating a business venture, distinct from the initial investment. This functions to finance the company's preliminary production activities. Working capital was quantified by comparing expenses with income over a specified time interval. This interval may be weekly, biweekly, monthly, yearly, or of an appropriate duration.

Table 1. Initial investment

CONCEPTS	UNIT	AMOUNT	UNIT COST	AMOUNTS	PROGRAM	CITIZEN PARTICIPATION	TOTAL
Fixed Assets							
Cost of Materials	Freight	1	$ 489,295.3	$ 489,295.35	$ 0.00	$ 489,295.35	$ 489.295.3
Hydrosanitary Installations	Batch	1	$ 8,997.3	$ 8,997.30	$ 8,997.30		$ 8,997.3
Sedimentator Construction Materials	Batch	1	$ 33,826.0	$ 33,826.05	$ 33,826.05		$ 33,826.0
Cell Construction Materials	Batch	1	$ 98,169.3	$ 98,169.30	$ 98,169.30		$ 98,169.3
TOTAL					$ 140,992.65	$ 489,295.35	$ 630,288.0
Deferred Assets							
Labour	Budget	1	$ 26,325.00	$ 26,325.00		$ 26,325.00	$ 26,325.00
TOTAL							$ 26,325.00
Working Capital							
Waste Water	Batch	1	$2,250.00		$0.00	$2,250.00	$2,250.00
Ornamental Plants	Batch	1	$518.40	$518.40	$518.40	$0.00	$518.40
TOTAL					$141,511.05	$517,870.35	$659,381
GRAND TOTAL				$657,131.40	$282,503.70	$1,007,165.70	$1,315,994

3.3. Income, Costs and Expenses

This item encompasses production income (units sold and sale price), production costs (labor, materials, machinery, etc.), and total expenses (sales, administrative, and financial). Given the social and community-oriented nature of this project, total expenses incorporated the amount of payment for all expenditures, including those contributed by the community.

The installation of electricity for water pumping was not necessary in the constructed wetland, as water was supplied by gravitational force. The acquisition of land eliminated rental costs and there were no salaries associated with the wetland. The only costs incurred were for inputs and plant materials.

Table 2. Economic income

CONCEPT (MERCHANDISE)	PRESENTATION	COST OF INPUTS	WEEKLY SALE	WEEKLY COST	MONTHLY COST	SALE PRICE	WEEKLY INCOME	MONTHLY INCOME	ANNUAL INCOME
Canna Hybrids	Unit	$10.80	2	$21.60	$86.4	$108	$216	$864	$10,368
Iris Germanica	Unit	$10.80	2	$21.60	$86.4	$97.2	$194.4	$777.6	$9,331.2
Anthurium Sp	Unit	$10.80	2	$21.60	$86.4	$129.6	$259.2	$1,036.8	$12,441.6
Spathiphyllum Wallisii	Unit	$10.80	2	$21.60	$86.4	$86.4	$172.8	$691.2	$8,294.4
Zingiber Spectabile	Unit	$10.80	2	$21.60	$86.4	$86.4	$172.8	$691.2	$8,294.4
Alpinia Purpurata	Unit	$10.80	2	$21.60	$86.4	$97.2	$194.4	$777.6	$9,331.2
Treated Water	Liters	$0.045	37,800	$1,701.00	$6,804	$0.25	$9,525.6	$38,102.0	$457,228.8
TOTAL					$7,322.4	$605.0	$10,735.2	$42,940.4	$515,289.6

Table 3. Cost of raw material

CONCEPT (MERCHANDISE)	PRESENTATION	COST OF INPUTS	AMOUNT	TOTAL
Canna Hybrids	Unit	$ 10.08	8	$80.64
Iris Germanica	Unit	$ 10.08	8	$80.64
Anthurium Sp	Unit	$ 10.08	8	$80.64
Spathiphyllum Wallisii	Unit	$ 10.08	8	$80.64
Zingiber Spectabile	Unit	$ 10.08	8	$80.64
Alpinia Purpurata	Unit	$ 10.08	8	$80.64
Waste Water	Liters	$ 0.045	50000	$2,250.00
TOTAL				$2,733.84

Table 4. Cost of inputs

CONCEPT	PRESENTATION	COST	AMOUNT	TOTAL
Freight	Unit	$ 225.00	0.030	$6.75
Tool	Unit	$ 90.00	0.023	$2.07
Auxiliary Labor (2)	Wage	$ 180.00	0.010	$1.80
Pet Packaging	Unit	$ 0.18	1.000	$0.18
TOTAL				$10.80

Table 5. Labor cost

CONCEPT	PRESENTATION	COST	AMOUNT	TOTAL
Tool	Unit	$ 90.00	75.000	$6,750.00
Master Labor	Wage	$ 405.00	15.000	$6,075.00
Auxiliary Labor (2)	Wage	$ 450.00	30.000	$13,500.00
TOTAL				$26,325.00

Table 6. Fixed costs

CONCEPT	MONTHLY AMOUNT	2 MONTHS AWAY	1 YEAR
Rent of Premises	$0.00	$0.00	$0.00
Light Service	$0.00	$0.00	$0.00
Salaries (Pruning, Flower Harvesting and Maintenance)	$180.00	$360.00	$2,160.00
TOTAL	$180.00	$360.00	$2,160.00

3.4. Depreciation and amortization

Depreciation entails a systematic reduction in the value of an asset, whether tangible or intangible, over time, whereas amortization represents the allocated value for each period. Consequently, the following elements were incorporated.

• Original value: The cost of the concept in the specified period.

• Percentage of rate that will increase.

• Duration for which the concept remains in the project.

• Annual charge derived from total value.

• Residual value: the total amount corresponding to each period, accounting for depreciation.

Table 7. Depreciation costs of assets

FIXED ASSETS	ORIGINAL VALUE	RATE	YEARS	ANNUAL DEPREC.	RESCUE VALUE
Cost of Materials	$489,295.35	5%	10.00	$24,464.77	$244,647.65
Hydrosanitary Installations	$8,997.30	5%	10.00	$449.87	$4,498.60
Construction Materials Sedimentation	$33,826.05	5%	10.00	$1,691.30	$16,913.05
Cell Construction Materials	$98,169.30	5%	10.00	$4,908.47	$49,084.60
TOTAL	$930,288.00			$31,514.41	$315,143.90

3.5. Straight-line depreciation method

This technique involves allocating a fixed depreciation amount each year for the asset in question (Santana, 2015).

Annual depreciation is considered to be constant throughout the entire useful life; thus, equivalent amounts are allocated each year to establish a reserve fund that, in conjunction with the salvage value, at the conclusion of the said period is sufficient to replace the asset. The value of the annual allocation or depreciation charge can be calculated as follows:

$$\text{Depreciation charge (DC)} = \frac{\text{Initial cost– Salvage Value}}{\text{Year number of useful life}} \quad (1)$$

3.6. Variable Costs and Fixed Costs

Variable costs are expenses that fluctuate in proportion to a company's level of activity. These costs are occasionally referred to as unit costs because of their variation based on the quantity of units produced, with their value adjusted according to the company's activity level. They are sometimes termed unit costs because they vary depending on the number of units produced (Santana, 2015).

Table 8. Variable costs

VARIABLE COSTS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
RAW MATERIALS BATCH	$ 87,868.80	$ 92,262.24	$ 96,875.35	$ 101,719.12	$ 106,805.08
TOTAL	$ 87,868.80	$ 92,262.24	$ 96,875.35	$ 101,719.12	$ 106,805.08

Fixed costs are defined as expenses incurred by an organization regardless of its operational level, meaning they are payable whether production occurs. These costs may encompass labor, maintenance, and other expenditures.

Table 9. Fixed costs

FIXED COSTS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
RENT OF PREMISES	$0.00	$0.00	$0.00	$0.00	$0.00
WAGES (PRUNING, FLOWER PICKING AND MAINTENANCE)	$2,160.00	$2,268.00	$2,381.40	$2,500.47	$2,625.50
TOTAL	$2,160.00	$2,268.00	$2,381.4	$2,500.47	$2,625.50

3.7. Break-even point

The breakeven point represents the minimum quantity of products or services that must be sold to ensure that a company does not incur losses, specifically when its revenue equals its costs. This can be expressed in terms of physical units or monetary value (Santana, 2015). To determine the break-even point, it is essential to define the contribution margin, which is calculated as the difference between the sales price of the product or service and its associated costs. Contribution margin per unit produced = sales price - variable cost per unit.

The breakeven point is calculated by solving:

$$\text{Break-even point for the period} = \frac{\text{Total fixed costs for the period}}{\text{Unitary contribution margin}} \quad (2)$$

$$\text{Break Even Point Units} = \frac{\text{Fixed Costs X Units Produced}}{\text{Total Sales} - \text{Variable Costs}} \quad (3)$$

$$\text{Monetary Break-Even Point} = \frac{\text{Variable costs}}{1 - (\text{Fixed costs} / \text{Total sales})} \quad (4)$$

Table 10. Break even point

CONCEPTS / YEAR	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
SALES	$515,289.60	$543,463.20	$573,045.48	$604,106.87	$636,721.74
FIXED COSTS	$2,160.00	$2,268.00	$2,381.40	$2,500.47	$2,625.50
VARIABLE COSTS	$87,868.80	$92,262.24	$96,875.35	$101,719.12	$106,805.08
TOTAL COSTS	$90,058.80	$94,530.24	$99,256.75	$104,219.59	$109,430.58
BREAK-EVEN POINT $	$2,612.70	$2,743.34	$2,880.50	$3,024.52	$3,175.75
BREAK-EVEN POINT %	0.52%	0.52%	0.52%	0.52%	0.52%

3.8. Income statement

A financial report reflects the profits or losses for a specific period, namely the profitability of the company in terms of its operations. The 5-year projection of the artificial wetland necessitates the preparation of budgets, generation of cash flow, and formulation of the financial statement at a specified future date. Detailed budgetary information is required to accomplish this objective (Santana 2015).

Table 11. Income statement

CONCEPTS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
(+) SALES	$515,289.60	$543,463.20	$573,045.48	$604,106.87	$636,721.74
FIXED COSTS	$2,160.00	$2,268.00	$2,381.40	$2,500.47	$2,625.50
VARIABLE COSTS	$87,868.80	$92,262.24	$96,875.35	$101,719.12	$106,805.08

(-) TOTAL COSTS	$90,058.80	$94,530.24	$99,256.75	$104,219.59	$109,430.58
(=) GROSS PROFIT	$425,230.80	$448,932.96	$473,788.73	$499,887.28	$527,291.16
(-) DEPRECIATION	$31,514.41	$33,265.21	$35,103.55	$37,033.81	$39,060.58
(=) NET INCOME BEFORE TAXES	$393,716.39	$415,667.75	$438,685.18	$462,853.47	$488,230.58
(-) TAXES	$61,693.07	$64,777.71	$68,016.59	$71,417.42	$74,988.30
(=) USEFULNESS OF THE EXERCISE	$332,023.32	$350,890.04	$370,668.59	$391,436.05	$413,242.28

3.9. Cash flow

Cash flow reflects both the present and future income and expenses of a specific project.

Cash flow must consider the following three factors:

• Income: Total quantity sold multiplied by unit sales price.

• Expenses: Sum of manufacturing, administrative, and marketing costs.

• Financing: Amortization of interest and capital.

The cash flow calculation is conducted considering year 0, which encompasses the acquisition of fixed assets, deferred assets, and working capital, as delineated in the investment table. Upon the commencement of project activities, operating expenses are also initiated; the cash flow of the first year incorporates the sales of ornamental plants and treated water, in addition to the salvage value. The sum of expenses, comprising fixed and variable costs, was subsequently subtracted.

Table 12. Cash flow

CONCEPTS / YEAR	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
(+) SALES	$0.00	$515,289.60	$543,463.20	$573,045.48	$604,106.87	$636,721.74
(+) RESCUE VALUE	$0.00	$315,143.90	$315,143.90	$315,143.90	$315,143.90	$315,143.90
(=) TOTAL INCOME	$0.00	$830,433.50	$888,607.10	$918,189.38	$943,250.77	$981,865.64
FIXED COSTS	$0.00	$2,160.00	$2,268.00	$2,381.40	$2,500.47	$2,625.50
VARIABLE COSTS	$0.00	$87,868.80	$92,262.24	$96,875.35	$101,719.12	$106,805.08
(=) TOTAL COSTS	$0.00	$90,058.80	$94,530.24	$99,256.75	$104,219.59	$109,430.58
PURCHASE FIXED ASSETS	$630,288.00	$0.00	$0.00	$0.00	$0.00	$0.00
PURCHASE DEFERRED ASSETS	$26,325.00	$0.00	$0.00	$0.00	$0.00	$0.00
PURCHASE WORKING CAPITAL	$659,381.40	$0.00	$0.00	$0.00	$0.00	$0.00
(=) FINAL BALANCE	-$1,315,994.40	$740,374.70	$794,076.86	$818,932.63	$839,031.18	$873,435.02

3.10. Internal Rate of Return, Net Present Value and Discounted Payback Period

Internal Rate of Return (IRR) of an investment is defined as the interest rate at which the Net Present Value (NPV) is equal to zero. Profitability = Profit / Investment Cost x 100

Indexes to determine the profitability of the project plan:

• The Benefit Cost Ratio: which must be greater than 1.

• The Internal Rate of Return: must be greater than the long-term market interest rate.

• The Net Present Value: which must be positive.

• The discounted payback period determines the moment in which the money from an investment is recovered, considering the effects of the passage of time on the money.

The NPV is a procedure that allows calculating the present value of a certain number of future cash flows, originated by an investment. Adjustments are made to the projected cash flow to obtain the cash flow, then a discount rate is applied to calculate the Net Present Value (NPV) and estimate the value of the project at present (Santana, 2015). Net Present Value = Present Value of Revenues (Including the residual value of the project) - Present Value of Revenues (Including the initial investment).

Santana (2015) explains that the easiest way to calculate the Discounted Payback Period (DRP) is through a spreadsheet. This is the formula to calculate it:

$$PRD = a + \frac{I_0 - b}{Ft} \quad (5)$$

Where:

a: Denotes the number of the period immediately preceding the recovery of the initial disbursement

I_0: Represents the initial investment of the project

b: Signifies the sum of the flows until the conclusion of period "a"

Ft indicates the value of cash flow in the year of investment recovery.

Subsequently, the results are analyzed to propose a decentralized wastewater management model for rural communities in Mexico.

Table 12. Cash flow

YEAR	INCOME	COSTS	CASH FLOW	RATE (1+t)-n	UPDATED INCOME	UPDATED EXPENDITURES	ACCUMULATED CASH FLOW
0	$0.00	$1,315,994.40	-$1,315,994.40	$1.00	$0.00	$1,315,994.40	-$1,315,994.40
1	$515,289.60	$90,058.80	$425,230.80	$0.91	$461,022.54	$81,844.36	-$925,223.40
2	$543,463.20	$94,530.24	$448,932.96	$0.83	$440,066.98	$78,124.17	-$830,693.16
3	$573,045.48	$99,256.75	$473,788.73	$0.75	$420,063.93	$74,573.06	-$731,436.41
4	$604,106.87	$104,219.59	$499,887.28	$0.68	$400,970.12	$71,183.39	-$627,217.82
5	$636,721.74	$109,430.58	$527,291.16	$0.62	$382,744.20	$67,947.78	-$517,786.25
TOTAL	$3,113,538.49	$2,044,205.95	$1,069,332.55		$2,104,867.76	$1,689,667.16	
VAN	$ 388,875.62						
TIR	18.36%						
B/C	$ 1.11						
PRD	5.42						

Based on the evaluation, the project demonstrates feasibility as evidenced by a positive Net Present Value, indicating that, in addition to investment recovery, surplus profit will be generated at the conclusion of the 5-year period. The Internal Rate of Return (IRR) exceeds the discount rate, further supporting the project's feasibility. Moreover, the Benefit-Cost ratio surpasses 1, signifying that for each monetary unit invested, an additional 0.11 monetary units will be recovered. According to the Payback Period (PRD), the total investment of the project is recouped in 5.42 periods.

4. Conclusions

The use of constructed wetlands for wastewater processing incurs various costs. These expenses encompass the initial capital investment, operational expenditures, raw material procurement, and additional associated costs. However, evaluation methodologies that assess willingness to pay for enhanced water quality or clean water consumption have been utilized to quantify the benefits of these systems. Valuing the benefits of wastewater treatment presents challenges owing to the lack of consensus among beneficiaries regarding the economic value of a unit volume of treated water.

To develop a viable business proposition for wetlands, the concept of generating revenue through the sale of ornamental plants indigenous to the area was proposed. These plants require approximately four months for maturation and can be harvested three times annually within a fiscal cycle. The wetland yielded an average of 102 plants per quarter and maintained a total inventory of approximately 421 ornamental plants. The acquisition of native plant species and associated pruning and maintenance tasks were incorporated into operational expenses. Given its community-based nature, no additional expenditure is incurred within the proposed economic model.

The breakeven analysis indicates that 0.52% of sales must be realized to cover total costs without generating profits, representing the minimum threshold necessary to avoid financial losses in terms of both percentage and monetary value. Despite low sales projections, a minimum period of 6 years is required to recoup the initial investment in wetland construction. The project is deemed financially viable, as evidenced by a positive Net Present Value (NPV) of $388,875.6, indicating additional profits at the conclusion of the 5-year period, in addition to the recovery of the initial investment. The Internal Rate of Return (IRR) exceeds the assessment rate (10%) by 8.36%, further supporting the project's viability. Finally, the Benefit-Cost ratio exceeds 1, signifying that each monetary unit invested will be recovered with an additional surplus of 0.11 units.

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