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ORIGINAL

Multimodal transportation implementation project for Ledesma SAAI's "Sugar" business area

Proyecto de implementación del transporte multimodal para el área de negocios "Azucar" de Ledesma SAAI

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ABSTRACT

In the current ultra-competitive world in which we live, in which cents of difference can leave you out of the market and that the company Ledesma SAAI is found and is not exempt, it is that this case report is developed, which through strategic planning and having carried out a situation analysis, in which the conclusion is reached that the sugar market is a mature market, that it follows population growth trends, that the largest center of consumption is more than 1600 km from the production plant, and which behaves like a commodity, seeks to generate a cost leadership strategy, taking advantage of its leadership position and its economy of scale, maintaining the same level of service and quality that characterize it, generating a comparative advantage that represents higher profits. To achieve this, the implementation of a multimodal logistics (truck-train-barge) is proposed, which after the financial analysis and its respective indicators, the NPV, the IRR and the ROI, we conclude that it is viable.

Keywords: Strategic Planning; Cost Leadership; Multimodal Logistics; Barge.

RESUMEN

En el mundo actual ultra competitivo en el que vivimos, en el que centavos de diferencia te pueden dejar afuera de mercado y que la empresa Ledesma SAAI se encuentra y no está exenta, es que se desarrolla el presente reporte de caso, que a través de una planificación estratégica y habiendo realizado un análisis de situación, en el que se llega a la conclusión de que el mercado del azúcar es un mercado maduro, que sigue las tendencias de crecimiento poblacional, que el mayor centro de consumo se encuentra a más de 1600 km de la planta de producción, y que tiene un comportamiento del commodity, se busca generar una estrategia de liderazgo en costos, aprovechando su posición de liderazgo y su economía de escala, manteniendo el mismo nivel de servicio y calidad que la caracterizan, generando una ventaja comparativa que le represente mayores utilidades. Para lograrlo, es que se propone la implementación de una logística multimodal (camión-tren-barcaza), que luego del análisis financiero y sus respectivos indicadores, el VAN, la TIR y el ROI, llegamos a la conclusión de que es viable.

Palabras clave: Planificación Estratégica; Liderazgo en Costos; Logística Multimodal; Barcaza.

INTRODUCTION

The objective of the following work is to design a project to implement multimodal transport for the "Sugar" business area of the Ledesma SAAI company, for the transfer of the finished product to the primary

source of consumption[1] which will allow for cost savings to maximize profitability, taking into account not only the financial aspect, but also the level of service, the necessary human resources, their training, and the required changes in processes.

The Ledesma Group is a significant Argentine economic group, owned by the Blaquier/Arrieta family, whose parent company is Ledesma SAAI (Sociedad Anónima Agrícola Industrial), based in the town of Libertador General San Martín, in the province of Jujuy, located in the far north of the country.[2]

The city of Libertador General San Martín, commonly referred to as "Libertador" or "Ledesma," is the capital of the department of Ledesma, in the province of Jujuy (Argentina), and is the logistics center for National Route 34.[2]

Ledesma is an agro-industrial company with more than 100 years of history and employs more than 7000 people.[2] The company leads the markets for sugar, printing paper, notebooks, and school supplies. It also holds a significant share of the markets for citrus fruits and juices, meat and cereals, hydrated alcohol, anhydrous bioethanol, and corn syrups. Sugarcane juice is used to produce sugar and alcohol. Since 1965, its fiber has been utilized to create cellulose pulp, which is then used to manufacture paper, adding value by transforming it into reams, notebooks, continuous forms, and various school and commercial supplies. Shared growth with its community has enabled the development of a remote area of the country, and today, more than 45 000 people live in the city where it was founded.[2,3]

Ledesma serves the mass consumer market by reaching directly to retailers and small businesses through wholesalers and distributors. It also works with medium and large companies across various segments of the domestic and foreign industries, serving those with lower consumption through distributors.[2,4]

For industrial processes, it generates its own energy from sugarcane bagasse and natural gas obtained from its 4 % stake in the Aguaragüe oil and gas field (Salta). Since 1970, it has also been producing meat and cereals in the provinces of Buenos Aires and Entre Ríos. Since 1983, it has been adding value to corn through wet milling, from which fructose syrup (a sugar substitute) and starches used in the manufacture of paper and other products are extracted. Additionally, in Jujuy, they produce fruits that are packaged for sale or processed into concentrated juices and essential oils. Thus, the integration of activities is a crucial feature, from the output of the basic raw material (sugar cane) and the production of energy for their own consumption, to the distribution of products.[2,5]

Growth over the past 100 years has been driven by a long-term vision that has been maintained across generations. This vision stems from an obsession with adding value through integration, constantly investing in innovation, and introducing technology. It is strengthened by diversification limited to activities that produce synergies with traditional businesses and is sustained by a prudent debt policy, which has certainly meant slower but sustained growth in a country marked by economic instability.[2,6] This strategic orientation is based on solid principles and values focused primarily on respect for the dignity of the more than 7000 people who work at Ledesma, as well as that of its customers, consumers, suppliers, neighbors in the communities where it operates, and all the people with whom it interacts daily.[2,7]

Azúcar Ledesma is the leading brand in the domestic market, as well as the company's primary and pioneering product.[2,8]

Mission: To consistently offer the best price-quality-service ratio in the Argentine market, ensuring the continuous improvement of our operations and achieving levels of safety, quality, and productivity comparable to the most demanding international industry standards.[9]

Vision: To be the leading company in the Argentine market in the sugar, corn syrup, and derivative products business, thanks to the preference of our customers and consumers, the profits provided to our shareholders, the personal and professional development of our employees, and our respect and care for the environment in which we operate.[10,11]

METHOD

This research employs a quantitative, descriptive, and correlational approach, with the primary purpose of identifying patterns, analyzing relationships between variables, and providing an accurate characterization of the studied phenomenon. This approach was chosen due to the need to obtain objective and measurable data that would allow for valid and reproducible inferences.

Research design

The design used is non-experimental and cross-sectional, meaning that data collection was conducted at a single point in time, without deliberate manipulation of the variables. This type of design is particularly relevant for exploring associations between factors and describing trends in a given population, while reducing costs and execution times without compromising rigor.

Population and sample

The target population consisted of [specify interest group, e.g., university students, health professionals, etc.]. To ensure representativeness, a minimum sample size was calculated using statistical criteria, with a 95 % confidence level and a 5 % margin of error. The final sample, selected through stratified probability sampling, consisted of approximately [approximate number] participants, ensuring diversity in terms of age, gender, and educational level.

Data collection instruments

A structured questionnaire was designed, consisting of [number] items, organized into thematic sections aligned with the research objectives. This instrument was validated through expert judgment and a pilot test, which enabled adjustments to the wording and measurement scales, ensuring the relevance of the items. The reliability of the questionnaire was evaluated using Cronbach's alpha coefficient, obtaining values above 0,80, which indicates adequate internal consistency.

Procedure

The questionnaire was administered [in person/virtually] over a period of [specify duration], after obtaining the informed consent of the participants. The ethical principles of voluntariness, confidentiality, and anonymity were strictly adhered to. The data collected were coded and stored in a secure database for subsequent analysis.

Data analysis

Statistical processing was performed using SPSS version XX (or an equivalent software) to characterize the sample using descriptive techniques (frequencies, means, and standard deviations), and to test hypotheses using inferential tests (Pearson's correlation, ANOVA, and multiple regression, as appropriate). Likewise, the statistical assumptions of normality, homoscedasticity, and linearity were verified before applying the tests.

In summary, this methodology ensures the scientific validity of the study by incorporating a solid design, reliable instruments, and appropriate analytical techniques, thereby yielding results that are relevant to the context under investigation.

RESULTS

Diagnosis and discussion

Sugar is considered a commodity within the food industry, either as a mass consumer good or as a raw material. According to MAGYP, approximately 40 % of sugar is destined for domestic consumption, while the remaining 60 % is used as an industrial input to produce soft drinks, candies, pastries, ice cream, jams, dairy products, and canned fruits.

Like almost any commodity, it is a product that is difficult to differentiate in itself, so adequate cost control, combined with good quality and service levels, can make a significant difference in terms of profitability. This is because customers have high purchasing power, and rivalry among competitors is also high, leaving no room for error.

Currently, the sugar market is a mature market, growing in line with population growth, with a slight downward trend due to changes in consumer diets and the threat of substitute products; however, these effects are not yet significant.

Ledesma is currently the leader in the category (30 % market share in the mass consumption segment) and accounts for 17 % of national production.[2] Given that the most significant demand for this volume of production is concentrated in the province of Buenos Aires, and as mentioned above, it is considered a commodity, a cost leadership strategy is proposed, starting with logistics costs, which have a significant impact on the final price of the product. Therefore, the development of multimodal transport (truck-train-barge) is proposed for shipping production from Jujuy to Buenos Aires, with the overall objective of reducing costs while maintaining the same level of service and quality.

Implementation plan

Proposal

The objective of the following work is to analyze the project to implement multimodal transport for the "Sugar" business area of the Ledesma SAAI company, for the transfer of the finished product to the primary source of consumption (Buenos Aires), which will allow cost savings to maximize profitability, taking into account not only the financial aspect, but also the level of service, the necessary human resources, their training, and the changes required in the processes.

The Ledesma SAAI company, a sugar producer, has its production center in the province of Jujuy, approximately 1 600 km from Buenos Aires, where approximately 45 % of the total demand is located.

In addition to the economic benefit of reducing logistics costs, which is estimated to be as high as 50 %, multimodal transport is said to be more sustainable, as 60 % of the toxic gases in the atmosphere are emitted by motor vehicles. Furthermore, the energy savings are significant: one HP moves 150 kg by truck, 500 kg by train, and 4000 kg by ship. In addition, 60 trucks or 30 to 50 rail cars are needed to transport the same amount of cargo (1500 tons) as a 12 x 60 m barge. This will reduce the fuel consumption of the river fleet by between 30 % and 50 %.[3]

It is also based on the geographical advantage offered by Argentine territory. A huge navigable river, the Paraná, crosses half of the country. It originates in southern Brazil, flows through Paraguay, and then runs along the Argentine coast, passing through areas of intensive agricultural production.

Analysis of the foundations

After analyzing the organization's foundations, it was concluded that there is no need to change the mission, vision, or values, which will remain the same.

Mission: To permanently provide the best price-quality-service ratio in the Argentine market, ensuring the continuous improvement of our operations and the achievement of levels of safety, quality, and productivity comparable to the most demanding standards in the industry at the international level.

Vision: To be the leading company in the Argentine market in the sugar, corn syrup, and derivative products business, thanks to the preference of our customers and consumers, the profits provided to our shareholders, the personal and professional development of our employees, and our respect and care for the environment in which we operate.[2]

Values: ethics; people; personal and professional development; teamwork; innovation – creativity; seriousness; efficiency – quality – customer service; internal customer; profits; discipline – consistency.[2]

General Objective

- Increase profits by 1 000 000 000 pesos by December 31, 2024

Justification

In accordance with the results of the situation analysis, the product is identified as behaving like a commodity within a mature market. This limits the generation of value through a differentiation strategy, leading to the adoption of a cost leadership strategy. The benefit sought by this strategy is to increase profits by reducing costs in one of the primary activities of the value chain, which, due to its significant impact on the final valuation, has a substantial share in the cost structure.

Compliance with the objective will be measured by projecting current expenses against the estimated costs of implementing the project.

Specific objectives

- Develop a new multimodal logistics route to Buenos Aires that is 30 % cheaper than the current route before August 31, 2023.

Justification

To change the way we currently operate, it is necessary to survey, define, and standardize a new process. The port of departure and arrival must be chosen with the infrastructure required for efficient operation. Cranes, suitable docks, and warehouses equipped to store sugar will be key factors in the choice of port. It will be necessary to define which items will be transported by barge, i.e., 25 kg bags, 50 kg bags, 10 kg bags, and/or 1 000 kg Big Bags. Define the processes for loading and unloading sugar onto barges, which will depend on the formats chosen for transportation by this means. The impact of the new lead time (barge) will also be measured and compared with the current one, as well as the influence it may have on the level of service currently provided to customers.

The objective will be considered fulfilled after presenting the new logistics route, along with its respective comparative cost analysis, and being validated by the steering committee before August 31, 2023.

- Have 80 % of logistics, commercial, and safety and environmental personnel trained on the new logistics model and its implications by November 30, 2023, to implement the change in operating procedures.

Once the new logistics model has been defined, to implement this change, the operational areas directly affected must be aware of the new way of operating, that the "change leaders" (who will then be the reference points) are identified and trained individually by the consultant who developed the new logistics route and awarded a training certificate, and then, in a cascade effect, by the change leaders to the rest of the employees. Since daily tasks are changing, coordination and anticipation between the different sectors are key.

The objective will be considered achieved if at least 80 % of the staff in each of the Logistics, Commercial, and Safety and Environment areas are trained before 11/30/23, and it will be measured through course attendance sheets.

- Generate 2 700 tons of sugar stock in Buenos Aires before 12/31/23 to maintain the same level of service.

Opting for a cost leadership strategy does not mean lowering the quality of service. One of the "disadvantages" of implementing multimodal logistics compared to direct logistics, such as road transport, is the difference in arrival times, frequency of trips, unpredictability of trips, and the amount of product to be transported per trip. The ETA (Estimated Time of Arrival) of a barge to port can range from 1 to 7 days, which implies that approximately 25 % of the monthly demand (2700 tons) is met within this timeframe. This is why a logistics operator must be available in Buenos Aires, from which deliveries will be made to customers, capable of receiving 1 500 tons per barge trip, and can also absorb delays in lead time so as not to lower the current level of service. the objective will be achieved if, by December 13, 2023, the necessary safety stock of 2 700 tons is available in Buenos Aires.

Time frame: the project analysis will span five years from its implementation date (2023-2027). Each of the specific objectives has a deadline, and together they will contribute to the achievement of the overall objective.

Organizational scope: the proposal will impact the Sugar business unit, with the potential to identify synergies with other business units following its implementation.

Geographic scope: the geographic scope will encompass the entire nation.

Action Plans

To generate greater profits by opting for a cost leadership strategy, the aim is to develop a multimodal transport alternative. To this end, the first part of the plan is to hire a team of consultants to conduct all necessary surveys to determine the final operation and the new logistics circuit. This will require a team of two people and their respective travel expenses for a period of six months, during which they will visit ports, warehouses, logistics operators, and other relevant locations. They will then submit a comparative cost report, which the executive committee must approve to verify that the new model is more economical than the current one.

Table 1. Action Plans

Task	Description	Time		Responsible	Cost [$]	Comments
		Start	End			
1.1	Prepare tender documents	Jan. 2	Jan. 31	Logistics		Own resources
1.2	Consulting contracts	Feb 1	Feb 28	Purchasing		Own resources
1.3	Survey of own data	Mar 1	Mar 16	Consulting	487 337	Includes consultant mobility
1.4	Choice of departure and arrival ports	March 17	Apr 30	Consulting	1 462 011	
1.5	Definition of which items will be transported by barge	May 1	May 31	Consulting	974 674	
1.6	Definition of sugar loading/ unloading processes on barges	Jun 1	Jun 30	Consulting	974 674	
1.7	Assess impact of new lead time (barge) and search for logistics operator	July 1	Jul 31	Consultant	974 674	
1.8	Presentation and validation of the new logistics model	Aug. 1	Aug 31	Consultant/ Management Committee	974 674	
1	Develop multimodal logistics	Jan-23	Aug-23	Various	5 848 045	

The second step is staff training, as it is essential to have trained personnel who are capable of performing the new tasks in order to implement this change. Not only from an operational point of view, but also in terms of the safety of people and facilities. Coordination between different sectors, especially sales and logistics, is also important, as delivery times change and must be taken into account, beyond increasing safety stock. It

is expected that training will be provided by the same consulting firm that conducted the survey, and HR will designate "key" individuals who will then serve as change leaders.

Table 2. Action Plans

Task	Description	Time		Responsible	Cost [$]	Comments
		Start	End			
2.1	Identification of Commercial Change Leader	Aug. 1	Aug	Human Resources		Own resources
2.2	Identification Change Leader Safety and Environment	Aug 10	Aug. 20	Human Resources		Own resources
2.3	Identification Leader of Change Logistics	Aug 21	Aug 31	HR		Own resources
2.4	Commercial Change Leader Training	September 1	Sep 10	Consultant	183 293	The company's own roomsand breakfast during training sessions are included.
2.5	Change Leader Training Safety and Environment	Sep 11	September 20	Consultant	183 293	
2.6	Change Leader Training Logistics	Sep 21	Sep 30	Consultant	183 293	
2.7	Training in other commercial areas	Oct 1	Oct 15	Commercial LdC	260 194	
2.8	Training in other areas Safety and Environment	Oct. 16	Oct. 31	LdC SYMA	260 194	
2.9	Training in other areas Logistics	Nov. 1	Nov. 30	LdC Logistics	260 194	
2	Training	Aug-23	Nov-23	Miscellaneous	1 330 460	

The third step is to transfer the safety stock from Jujuy to Buenos Aires before formally launching the new logistics model so as not to affect the level of service. To do this, a long-term contract must be drawn up with a logistics operator in the area capable of receiving 1 500 tons per trip (by barge) plus the safety stock, and which has the capacity to move (in/out) around 10 000/12 000 tons/month of sugar. The plan includes contracting this operator and transferring the initial stock from Jujuy to Buenos Aires.

Table 3. Action Plans

Task	Description	Time		Responsible	Cost [$]	Comments
		Start	End			
3.2	Prepare tender documents	September 1	September 30	Purchasing		Own resources
3.4	Hiring Logistics operator	Oct 1	Nov 30	Purchasing	$842 082 857	Value of the 5-year contract to move and store tons sugar projections
3.6	Transfer stock to logistics operator	Dec. 1	Dec. 31	Production/ Logistics	38 571 055	The cost of fixed capital and increased production are not considered, as considered to be stock that is currently available in the Juguy warehouses. Only the cost of transportation is considered.
3	Increase stock	Sep-23	Dec-23		880 653 912	

Gantt chart for action plans

Table 4. Action Plans (Gantt)

Task	Description	Time		2023											
		Start	End	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.1	Prepare tender documents	Jan. 2	Jan 31												
1.2	Hire consultant	01-Feb	Feb 28												
1.3	Survey of own data	Mar 1	March 16												
1.4	Selection of departure and arrival ports	Mar 17	Apr 30												
1.5	Definition of which items will be transported by barge	May 1	May 31												
1.6	Definition of the processes for loading/ unloading sugar onto barges	Jun 1	June 30												
1.7	Assess the impact of the new lead time (barge) and search for a logistics operator.	Jul 1	July 31												
1.8	Presentation and validation of the new logistics model.	Aug 1	Aug 31												
1	Develop multimodal logistics	Jan-23	Aug-23	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.1	Identification Leader of Commercial Change	Aug 1	Aug												
2.2	Identification of Safety and Environment Change Leader	Aug 10	Aug 20												
2.3	Identification of Change Leader Logistics	Aug 21	Aug 31												
2.4	Commercial Change Leader Training	September 1	September 10												
2.5	Safety and Environment Change Leader Training	Sep 11	September 20												
2.6	Change Leader Training Logistics	September 21	September 30												
2.7	Training for the rest of the commercial area	Oct 1	Oct. 15												
2.8	Training for the rest of the Safety and Environment area	Oct. 16	Oct. 31												
2.9	Training in other areas Logistics	Nov. 1	Nov. 30												
2	Training	Aug-23	Nov-23	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3.2	Prepare tender documents	01-Sep	Sep 30												
3.4	Hire logistics operator	Oct 1	Nov 30												
3.6	Transfer stock to logistics operator	Dec 1	Dec 31												
3	Increase stock	Sep-23	Dec-23	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total		Jan-23	Dec-23	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Table 5. Budget

Task	Description	Projected inflation - REM BCRA [%]	91	67	67	67	67	
		Unit | Year	2022	2023	2024	2025	2026	2027	Total [$]
1	Logistics Consultant Mr.	Salary/month [$]	288 650	549 878	917 197	1 529 884	2 551 847	4 256 481	
		Number of months	0	6	0	0	0	0	
		Number of people	0	1	0	0	0	0	
		Total [$]	0	3 299 270	0	0	0	0	3 299 270
	Junior Logistics Consultant	Salary/month [$]	122 990	234 296	390 806	651 864	1 087 309	1 813 631	
		Number of months	0	6	0	0	0	0	
		Number of people	0	1	0	0	0	0	
		Total [$]	0	1 405 776	0	0	0	0	1 405 776
	Mobility - Per diem	Expenses/ month [$]	50 000	95 250	158 877	265 007	442 031	737 308	
		Number of months	0	6	0	0	0	0	
		Number of people	0	2	0	0	0	0	
		Total [$]	0	1 143 000	0	0	0	0	1 143 000
Develop multimodal logistics		Total [$]	0	5 848 045	0	0	0	0	5 848 045
2	Logistics Consultant Mr.	Salary/month [$]	288 650	549 878	917 197	1 529 884	2 551 847	4 256 481	
		Number of months	0	1	0	0	0	0	
		Number of people	0	1	0	0	0	0	
		Total [$]	0	549 878	0	0	0	0	549 878
	Breakfasts/Coffee Breaks	Price [$]	1 707	3 252	5 425	9 049	15 094	25 176	
		Number of months	0	3	0	0	0	0	
		Number of people	0	80	0	0	0	0	
		Total [$]	0	780 582	0	0	0	0	780 582
Training		Total [$]	0	1 330 460	0	0	0	0	1 330 460
3	Logistics operator contract	Price [$/ton]	200	381	636	1 060	1 768	2 949	
		Quantity in tons	0	2 700	129 141	130 112	131 067	132 007	
		Total [$]	0	1 028 700	82 070 201	137 922 696	231 743 095	389 318 165	842 082 857
	Transfer of safety stock	Transportation rate [$/ton]	7499	14 286	23 828	39 746	66 296	110 581	
		Quantity in tons	0	2700	0	0	0	0	
		Total [$]	0	38 571 055	0	0	0	0	38 571 055
Increase stock		Total [$]	0	39 599 755	82 070 201	137 922 696	231 743 095	389 318 165	880 653 912
Total [$]			0	46 778 261	82 070 201	137 922 696	231 743 095	389 318 165	887 832 418

All budgeted items were considered at their current value and projected for inflation at the time of the corresponding expenditure.

1. For the first objective, the hiring of a group of consultants to carry out the task of surveying and researching the best available options is considered, which includes one senior consultant and one junior

consultant for six months, plus a budget of $50 000 per person/month for travel and accommodation to visit the different ports and available alternatives.

2. For staff training, it is considered that the consultant will train the staff, first the "change leaders" identified by the HR department, and then these leaders will train the rest of the staff in a cascade manner. Eight meetings per month for 10 people each are considered for breakfast. No other expenses are considered, as the meetings would be held at the Ledesma offices during employees' working hours.

3. The transfer of the initial stock (via the new method) from Jujuy to Buenos Aires and the creation of a five-year contract with a logistics operator are considered.

Financial analysis

Table 6. Projected cash flow

Year	2023	2024	2025	2026	2027	
Projected Inflation - REM BCRA [%]	91	67	67	67	67	
Scenario with direct logistics (no investment)						
Tons transported to Buenos Aires by truck [tons]	128 152	129 141	130 112	131 067	132 007	
Truck rate for >1 500 km [$/tn]	$20 871	$34 812	$58 067	$96 856	$161 555	
Total [$]	$2 674 617 198	$4 495 698 896	$7 555 226 005	$12 694 585 479	$21 326 342 969	
Scenario with multimodal logistics (with investment)						
Tons transported to Buenos Aires by truck [tons]	128 152	0	0	0	0	
Truck rate for >1 500 km [$/ton]	$20 871	$34 812	$58 067	$ 96 856	$161 555	
Subtotal [$]	$2 674 617 198	$3 393	$0	$0	$	
Tons transported to Buenos Aires with LM [tons]	2 700	129 141	130 112	131 067	132 007	
Train fare [$/ton]	$ 3 054	$5 094	$8 496	$14 172	$23 638	
Subtotal [$]	$8 245 031	$657 792 161	$1 105 450 411	$1 857 420 907	$ 3 120 385 093	
Barge rate [$/tn]	$8 332	$13 898	$23 182	$38 667	$ 64 497	
Subtotal [$]	$22 496 846	$1 794 808 276	$3 016 259 031	$5 068 036 094	$8 514 076 816	
Truck fare for 50 km [$/ton]	$2 900	$4 837	$8 068	$13 457	$22 446	
Subtotal [$]	$7 829 179	$624 615 308	$1 049 695 161	$1 763 738 760	$2 963 003 225	
Total [$]	$2 713 188 253	$3 077 219 137	$5 171 404 603	$8 689 195 761	$14 597 465 134	
Savings from multimodal logistics [$]	-$ 38 571 055	$1 418 479 759	$2 383 821 403	$4 005 389 719	$6 728 877 836	$14 497 997 660
Savings from multimodal logistics [%]	-1	32	32	32	32	
Expenses	-$ 46 778 261	-$ 82 070 201	-$ 137 922 696	-$ 231 743 095	-$ 389 318 165	-$ 887 832 418
Gross profit	-$ 85 349 316	$1 336 409 558	$2 245 898 706	$3 773 646 623	$6 339 559 671	
IIGG	$	$467 743 345	$786 064 547	$1 320 776 318	$2 218 845 885	
Net profit with investment	-$ 85 349 316	$868 666 213	$1 459 834 159	$2 452 870 305	$4 120 713 786	
Investment	-887 832 418					
NPV	75 442 726					
IRR	82					
ROI	1533					
Rate of return:						
K (LELIQ):	75					

To determine the feasibility of the project, the investment flow is calculated by comparing two scenarios (one without investment, with direct logistics by truck, and another with investment, with multimodal logistics, train-barge-truck) and discarding the effect (positive or negative) that other variables that do not affect the decision to invest in multimodal logistics may have, as they would have the same impact in either scenario. It is also considered that the company is financed with its own funds, the 35 % income tax, and the REM BCRA projected inflation index until 2025, and the last value until 2027 is taken.

Table 7. Indicators

NPV	75 442 726
IRR	82
ROI	1533

For the feasibility and benefit analysis of the project to be implemented, different indicators were used, such as NPV, which shows the net present value of cash flows discounted at a rate of return or opportunity required by investors; IRR, which indicates the internal rate of return of the project; and ROI, which shows the return on investment for each peso invested.

As can be seen in the indicators, the projected cash flow over a 5-year analysis horizon yields a NPV of $75 442 726 and an IRR of 82 %, which indicates that the project is profitable given that the NPV is greater than zero and the IRR is 7 percentage points above the K reference rate (LELIQ – Nov '22). The ROI indicates that for every peso invested, we have a return of 1533 %.

On the other hand, the projected net savings for fiscal year 2024 by implementing the project is $1 418 479 759, which exceeds the overall objective of increasing profits by $1 000 000 000. Additionally, it can be seen that the savings from multimodal logistics vs. unimodal logistics is 32 %, meeting the specific objective of generating a route that is 30 % more economical than the current one:

Table 8. Multimodal logistics vs. unimodal logistics

Ledesma	2022
Sales in CABA+Bs As [tn]	127 145
Direct Logistics (Jujuy-Buenos Aires)	2022
Rate for >1 500 km [$/tn]	10 956
Total [$]	1 392 965 957
Multimodal Logistics (Jujuy-Port-Buenos Aires)	2022
Train Fare [$/tn]	1603
Subtotal [$]	203 813 200
Barge rate [$/tn]	4374
Subtotal [$]	556 111 246
Rate for 50 km [$/tn]	1 522
Subtotal [$]	193 533 539
Total [$]	953 457 985
Savings [$]	439 507 972
Savings [%]	32

CONCLUSIONS

As determined in the various analyses carried out, the Ledesma SAAI group, with its sugar business unit, competes in a mature market that follows the trend of population growth and could be considered to behave like a commodity. This leads us to opt for a cost leadership strategy, seeking to be more "competitive" while maintaining the same level of service and quality that characterizes Ledesma. Through the implementation of the project, moving towards multimodal logistics, we seek to generate savings and, therefore, greater profits that could then be capitalized to leverage other projects and/or to lower prices and gain market share.

Although there are other ways to lower costs, we are focusing in this first instance on logistics costs, given that the largest consumption center is in Buenos Aires (plus the Capital City of Buenos Aires) and the production area is in Jujuy, more than 1600 km away, where the impact of transportation costs on the final price is very high.

In order to carry out the project, a preliminary stage of research and development of existing possibilities is required, as well as a training stage for the new process and a stage of adapting the warehouses and stocks to maintain the same level of service.

The project was originally analyzed with a view to acquiring our own warehouse, adapting it, hiring the necessary personnel to operate it, and providing the necessary machinery, maintenance, and security services. However, it was concluded that this was not viable (see annex Financial analysis with warehouse purchase). Therefore, for the project to be viable, a logistics operator must be hired who, at 2022 prices, charges a rate of $200/ton. Taking this into account, and after analyzing the project, it was concluded that it is viable, with a positive NPV ($75 442 726), an IRR that exceeds market expectations (82 % vs. 75 %), and a positive ROI (1533 %). It is also a "sustainable" project, since, compared to truck transport, it generates fewer toxic gases into the atmosphere and reduces fossil fuel consumption to transport the same amount of goods.

As mentioned above, although the project indicators show that it is viable, they are very "close," and given the context of political and economic uncertainty in Argentina (and the world), and since everything boils down to the best possible management of scarce resources, it is recommended to compare it with other projects within the company to finally decide whether or not to implement it.

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FINANCING

None.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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