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LAYOUT ASSESSMENT WITH STRUCTURING AND MATHEMATICAL MODELING BY THE AHP METHOD

Lucas Ramon dos Hermogenes[1], Miguel Ângelo Lellis Moreira[1], Lorena Berzins[2] , and Marcos dos Santos[1]

[1]Instituto Militar de Engenharia (IME)
[2]Fundação Getúlio Vargas (FGV)

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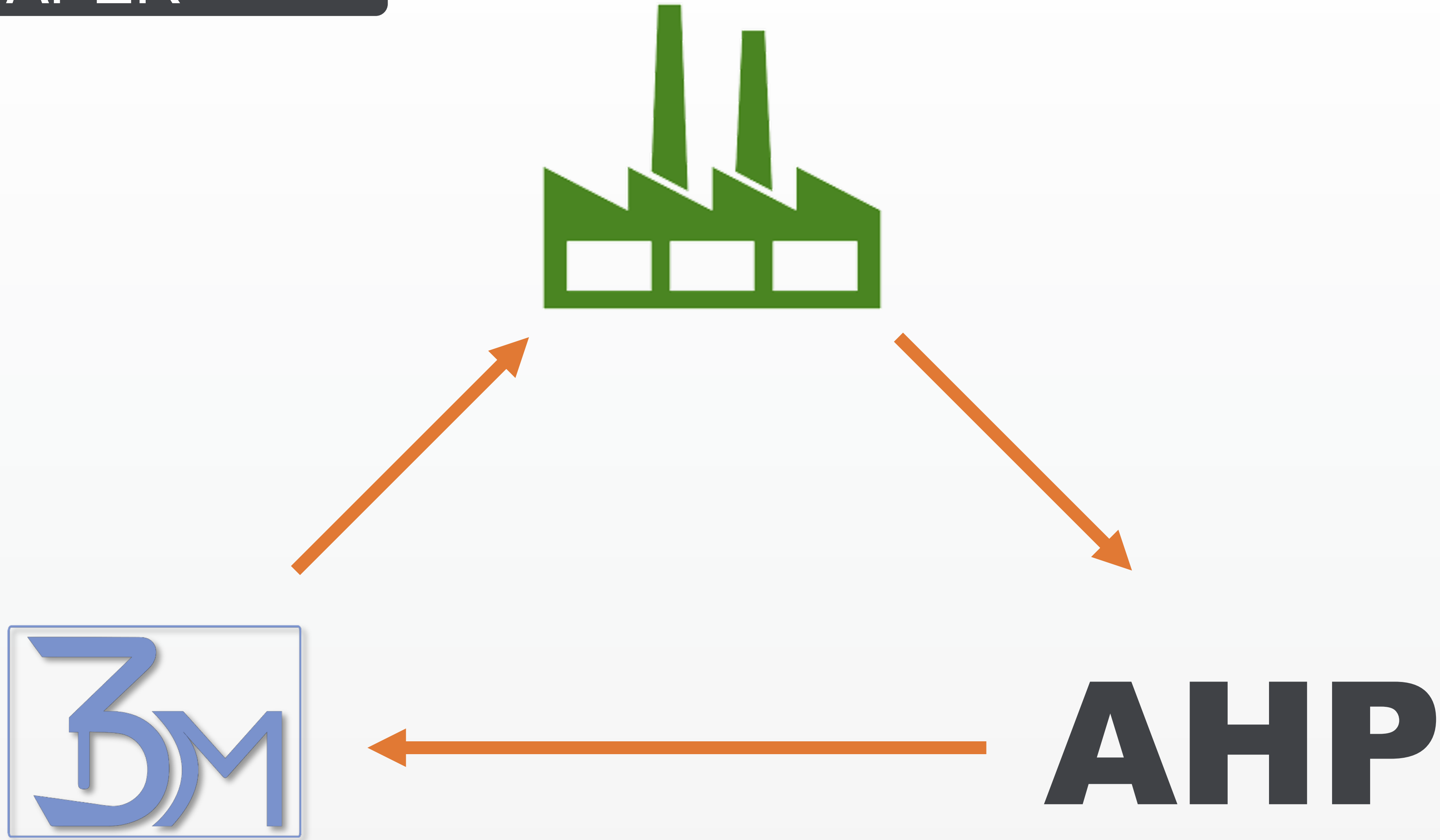
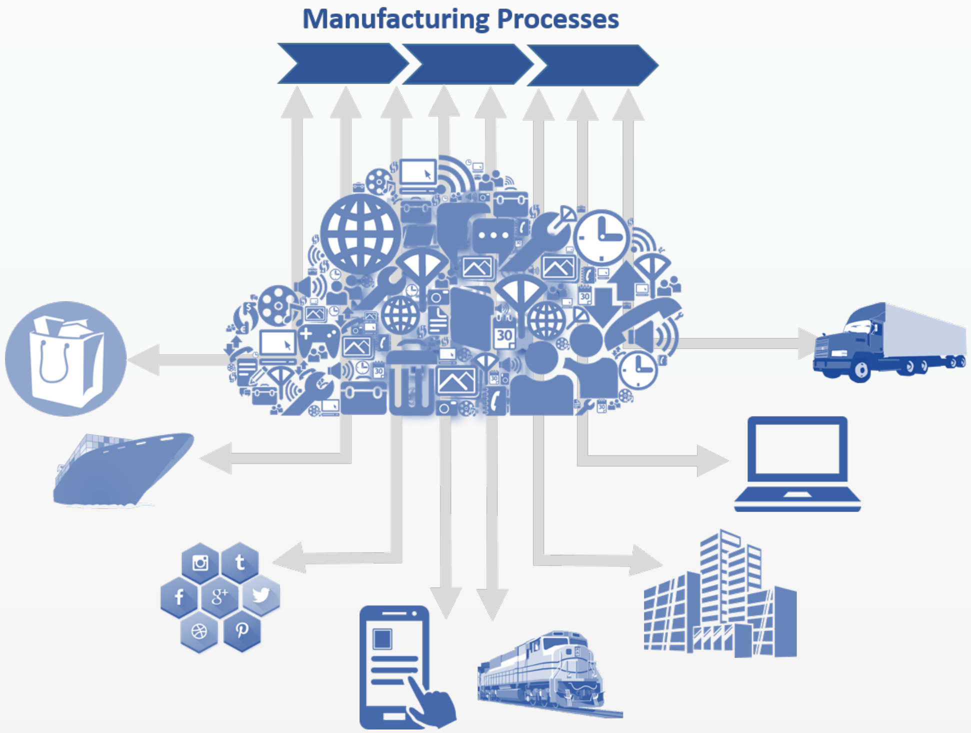
THE PAPER



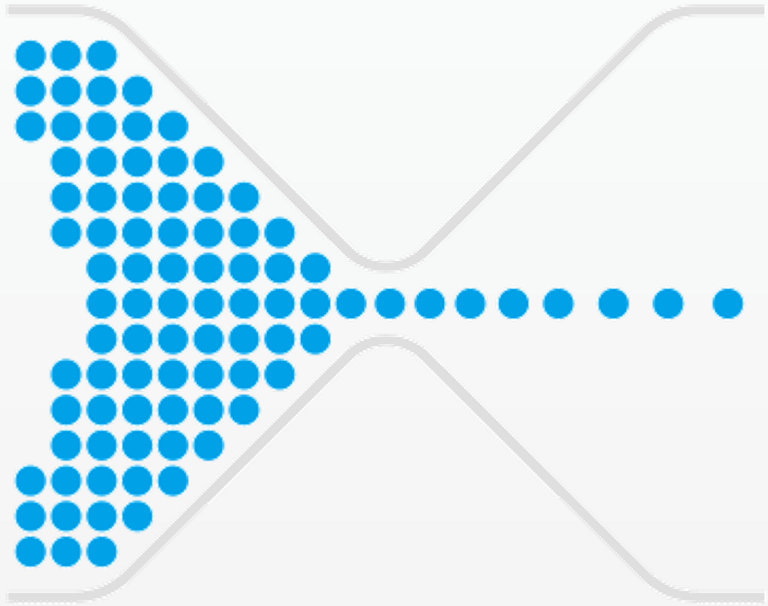
INTRODUCTION

Considering the technological advances obtained in the last decades and the need for man to achieve the personal and social interests, he was motivated to the development of devices and manufacturing processes in search to achieve his goals in a simple way.



INTRODUCTION

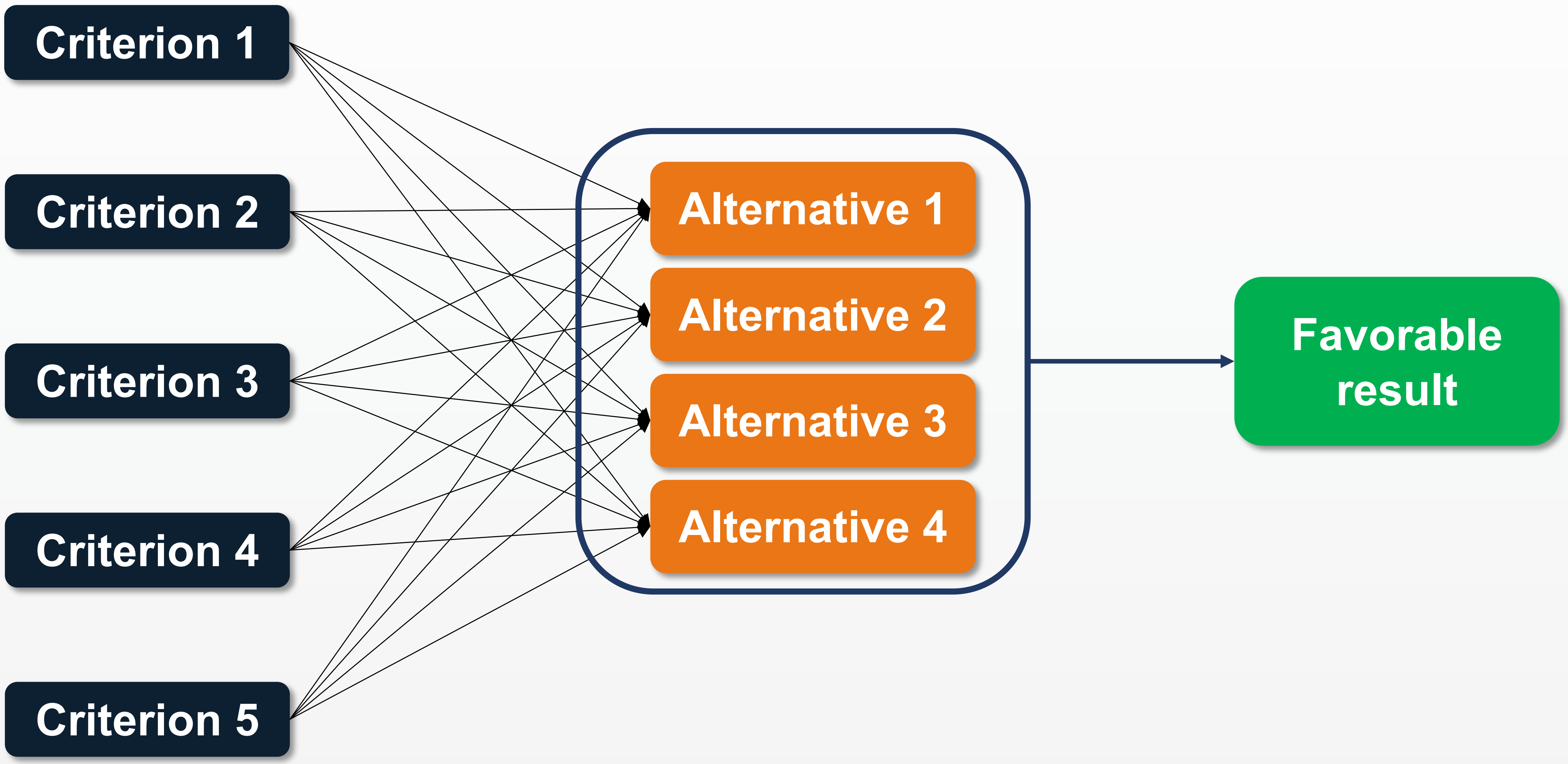
The company STEEL S/A operates manufacturing galvanized steel ducts. Considering the need to meet the market demand, regarding the process of galvanized ducts, it was observed a bottleneck in one of these manufacturing lines, relative to the production of fixatives used in the painting process of ducts.



INTRODUCTION

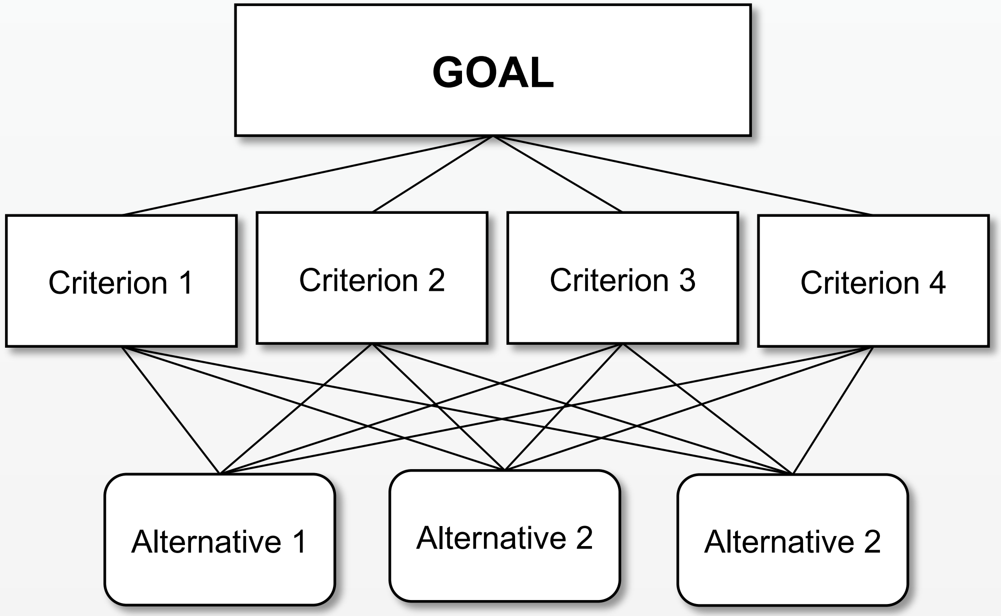
The analysis of production layouts and manufacturing lines can be understood as a key point for a company to remain competitive in the market. Considering this factor, the paper addresses a case study based on the analysis of two types of layouts for implementation at STEEL S/A, in search to identify the most favorable solution regarding make possible the reduction of bottlenecks, achieve the market demand, and due to some possibilities, reduce the costs.

LITERATURE REVIEW



LITERATURE REVIEW

The AHP method works supporting the decision-making process where they are not structured (SANTOS; GOMES; OLIVEIRA, 2016), allowing a value judgment based on the use of a specific scale, for standardization and the inherent subjectivity of the use of qualitative variables, based on a verbal dig of value, also known as the fundamental Saaty scale (SAATY, 2008).



Intensity of importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
2	Weak or Slight	
3	Moderate Importance	Experience and judgment slightly favor one activity over another
4	Moderate Plus	
5	Strong Importance	Experience and judgment strongly favor one activity over another
6	Strong Plus	
7	Very Strong	An activity is favored very strongly over another
8	Very, very Strong	
9	Extreme Importance	The evidence favoring one activity over another is of the highest

HYPOTHESES/OBJECTIVES

The analysis delimits the evaluation of the manufacturing line of fixatives for application to the production of metal ducts. Currently, the production line operates with only 54% of its predetermined daily capacity (8000 units produced out of 13714 projected), resulting in non-fulfillment of demands and delays in deliveries.

HYPOTHESES/OBJECTIVES

The company STEEL S/A adopted as a hypothesis the updating of its manufacturing line layout relative to fixatives production considered a bottleneck in the respective manufacturing process. Considering two types of layouts to be implemented both of them will be evaluated under a set of five criteria in search to achieve the company’s objectives.

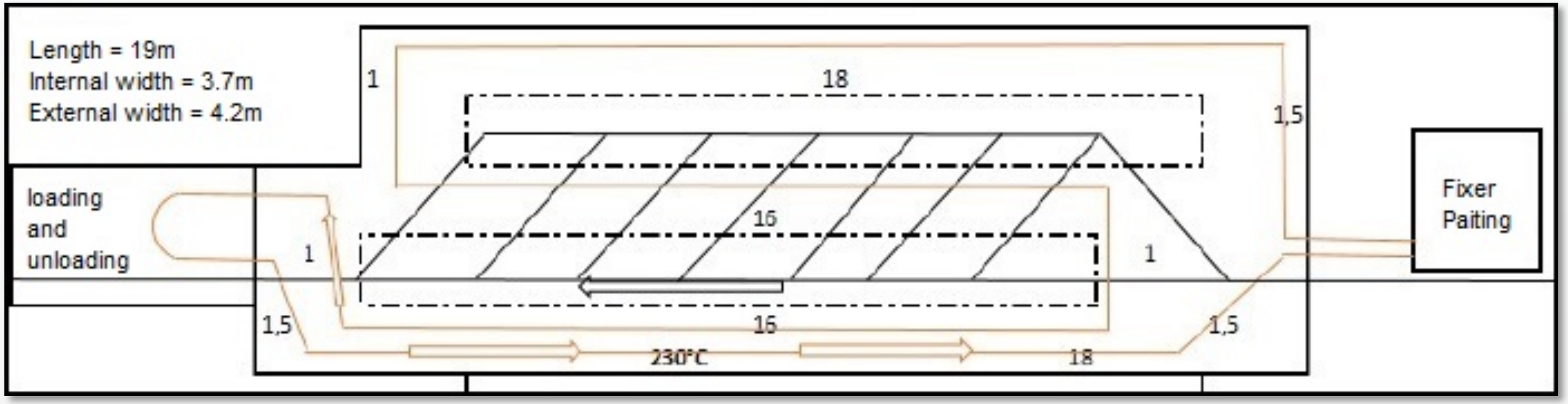
LAYOUT A

LAYOUT B

CASE STUDY

LAYOUT A

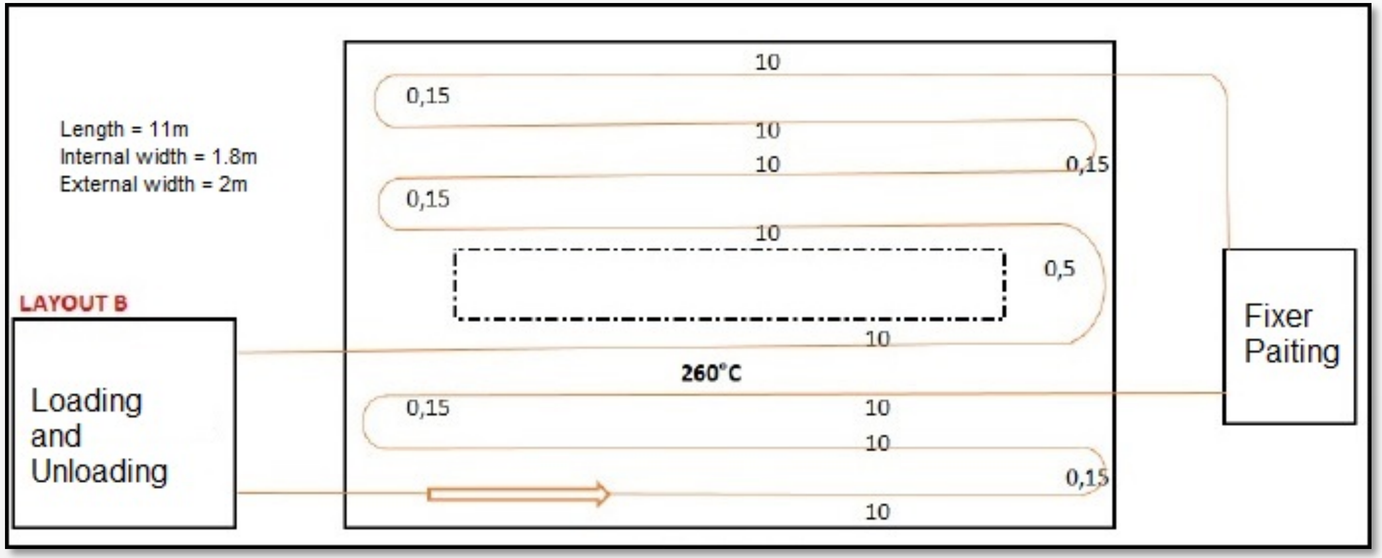
The fixator line heating 230°C along a 21m course before paint, after the painting, the fixer enters the oven again for the curing process, realizing the drying and homogenization of the epoxy powder, heating 230ºC and traveling 54.5m. Layout A features a production of 17389 units per day, a line speed of 4.8 m/min, an estimated investment of R$ 200,000.00, and a prospective cost reduction of R $ 420,000.00 in one year.



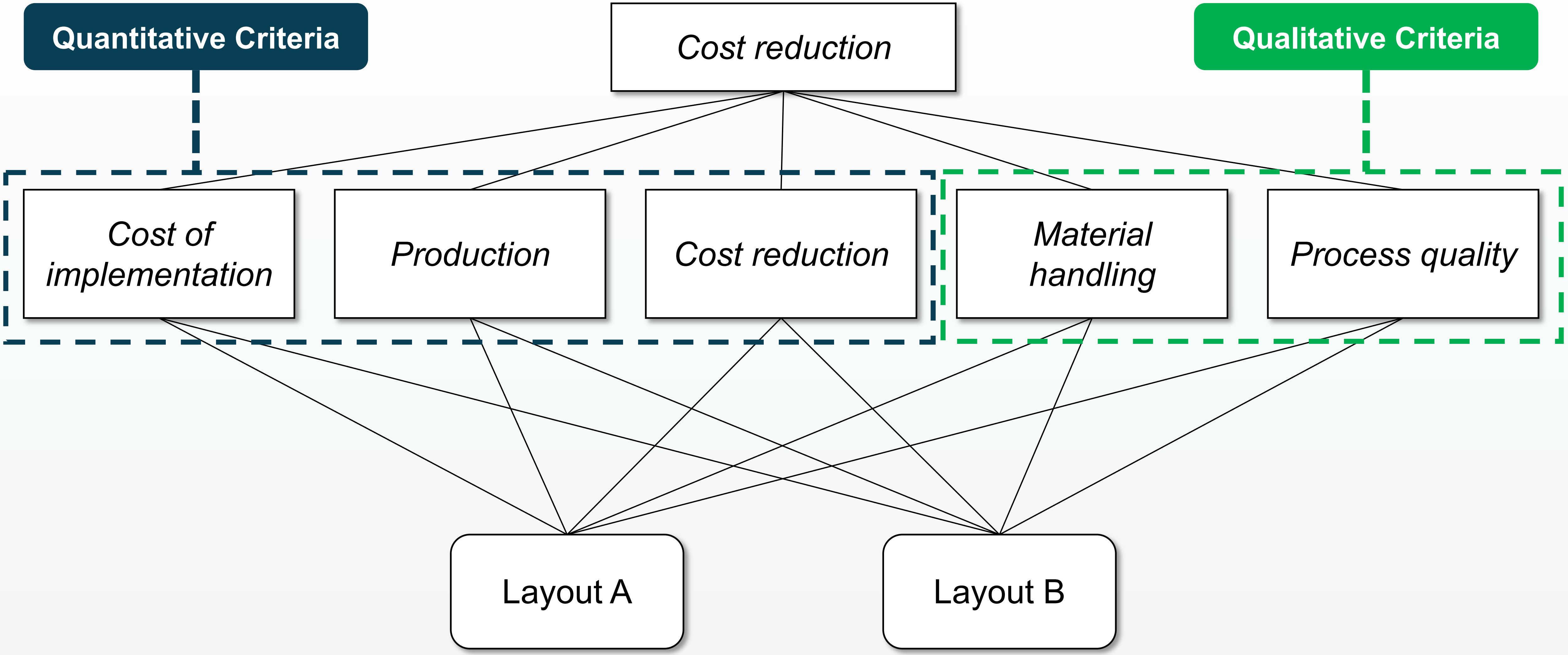
CASE STUDY

LAYOUT B

The fixator line heating 260 ° C, the screw or nut would travel a total path of 94.1m, being 30.3m before painting and 50.8m after painting, providing correct curing and maintaining the quality standard. Layout B has a production of 28257 units per day, a line speed of 7.8 m / min, polymerization time of 6.5 min, an estimated investment of R $ 300,000.00, and a prospective cost reduction of R $ 360,000.00 in one year.



CASE STUDY


Quantitative Criteria
Cost reduction
Qualitative Criteria
Cost of implementation
Production
Cost reduction
Material handling
Process quality
Layout A
Layout B

CASE STUDY

MATRIX EVALUATION

	Layout A	Layout B
Cost of implementation	R$ 200 000,00	R$ 300 000,00
Production	17 389 units	28 257 units
Cost reduction	R$ 420.000,00 / year	R$ 360.000,00 / year
Material handling	low need for movement	high need for movement
Process quality	Average	High

CASE STUDY

QUANTITATIVE PROCEDURE

	Values		Funclion
	Layout A	Layout B	
Cost of implementation	200 000	300 000	Min
Production	17 389	28 257	Max
Cost reduction	420 000	360 000	Max

∴

Normalized Values	
Layout A	Layout B
0.6	0.4
0.381	0.619
0.539	0.461

CASE STUDY

QUALITATIVE PROCEDURE

Material Handling	Layout A	Layout B
Layout A	1	5
Layout B	1/5	1

∴

Layout A	Layout B
0.833	0.833
0.167	0.167

∴

Normalized Punctuation
0.833
0.167

Process Quality	Layout A	Layout B
Layout A	1	3
Layout B	1/3	1

∴

Layout A	Layout B
0.25	0.25
0.75	0.75

∴

Normalized Punctuation
0.25
0.75

CASE STUDY

AGGREGATION PROCESS

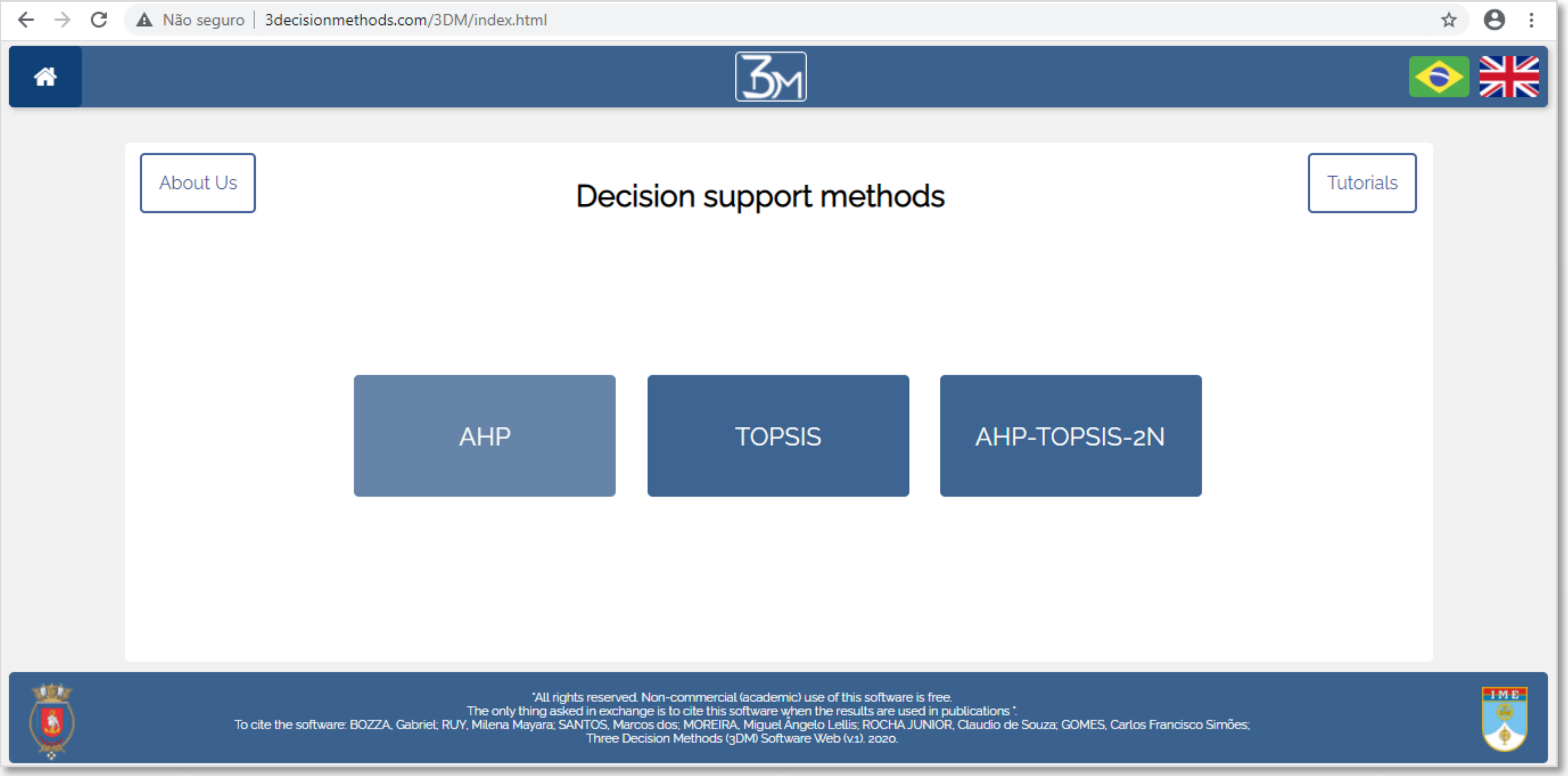
	Weights	Layout A	Layout B
Cost of implementation	0.0860	0.600	0.400
Production	0.3690	0.381	0.619
Cost reduction	0.1610	0.539	0.461
Material handling	0.0685	0.833	0.167
Process quality	0.3155	0.250	0.750

∴

	Layout A	Layout B
	0.0516	0.0344
	0.1406	0.2284
	0.0867	0.0743
	0.0571	0.0114
	0.0789	0.2367
Final Punctuation	0,4148	0,5852

Layout B

CASE STUDY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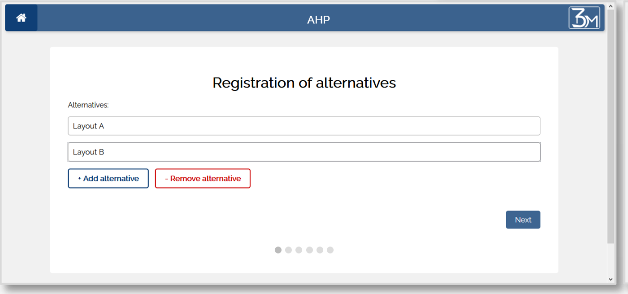
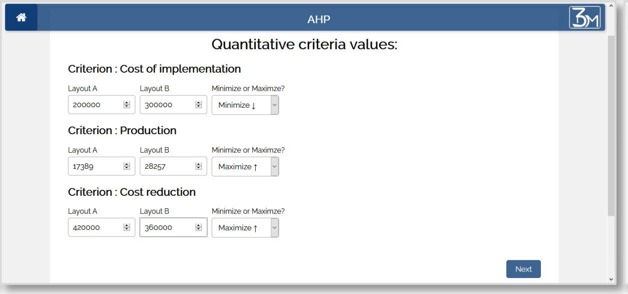
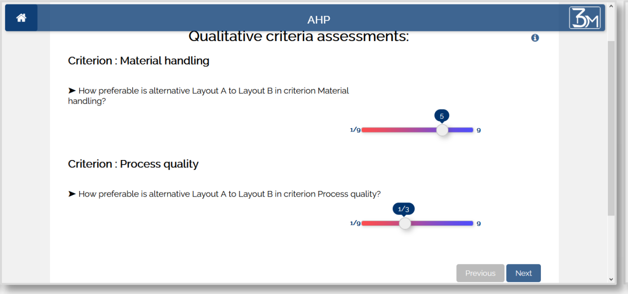
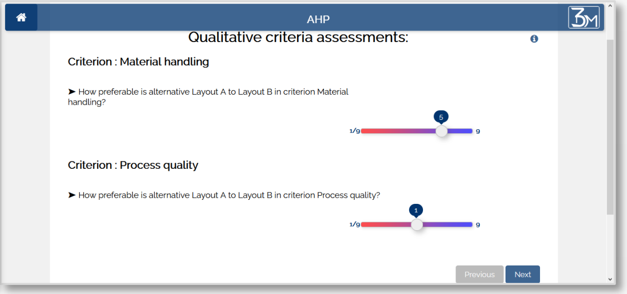

AHP
Registration of alternatives
Alternatives:
Layout A
Layout B
+ Add alternative
- Remove alternative
Next

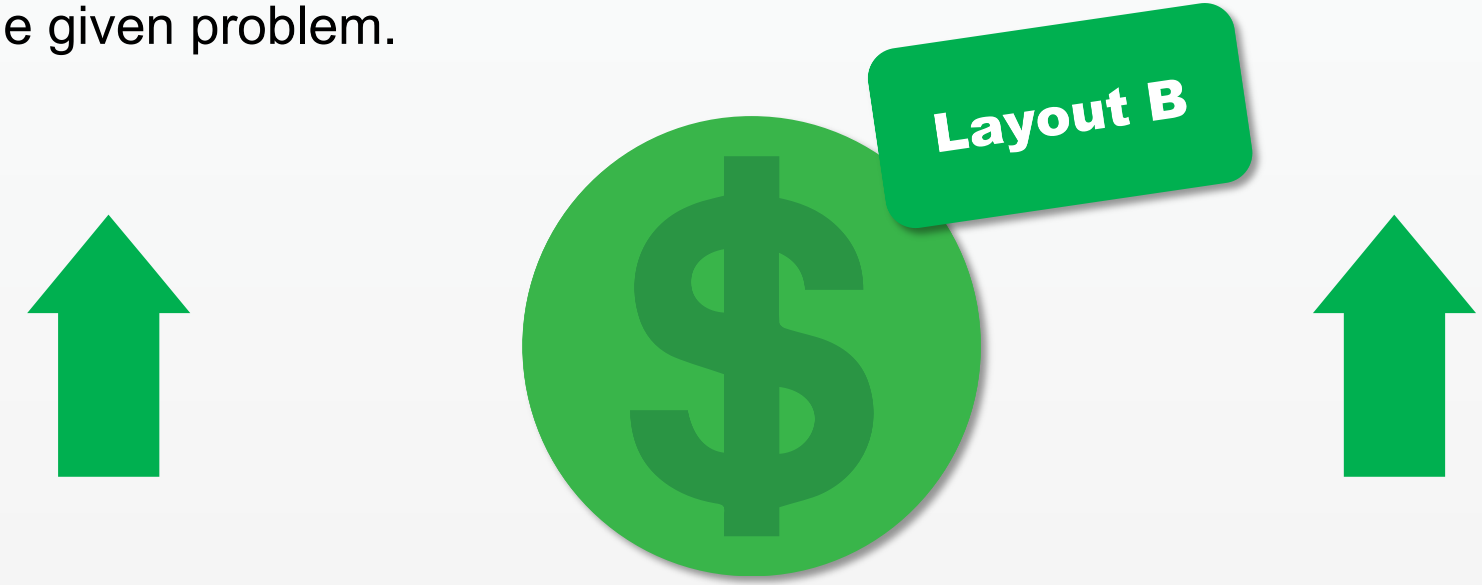

AHP
Quantitative criteria values:
Criterion : Cost of implementation
Layout A
Layout B
Minimize or Maximize?
200000
300000
Minimize
Criterion : Production
17389
28257
Maximize
Criterion : Cost reduction
420000
360000
Maximize
Next


AHP
Qualitative criteria assessments:
Criterion : Material handling
How preferable is alternative Layout A to Layout B in criterion Material handling?
Criterion : Process quality
How preferable is alternative Layout A to Layout B in criterion Process quality?
Previous
Next


AHP
Qualitative criteria assessments:
Criterion : Material handling
How preferable is alternative Layout A to Layout B in criterion Material handling?
Criterion : Process quality
How preferable is alternative Layout A to Layout B in criterion Process quality?
Previous
Next

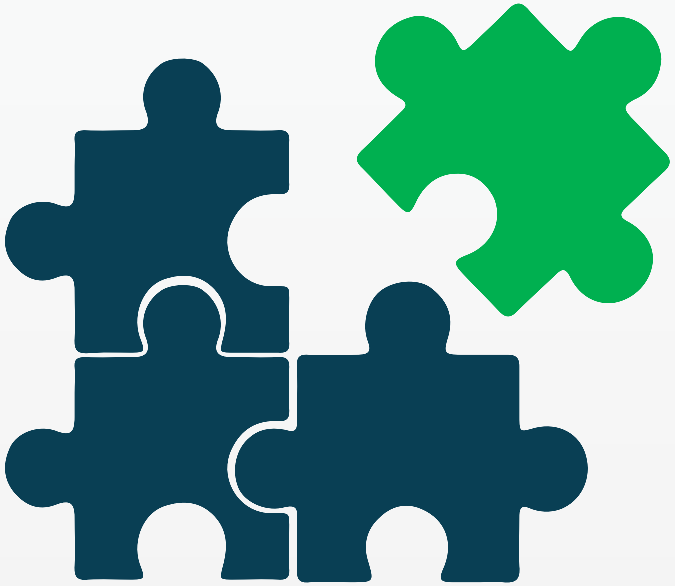
CONCLUSIONS

In a substantiated way, the implementation of the method made possible an extended analysis of the problem in context. After observing the problematic, collecting data, proposing improvement, and implementing the mathematical model as a solution tool, it was possible to indicate the most favorable alternative as a way of solution regarding the preferences and requirements stipulated by the company for the given problem.



CONCLUSIONS

The axiomatic model used logically demonstrates the most favorable alternative to implement, indicating the most appropriate investment for the return provided by cost reduction and increased productivity and quality in manufacturing processes. This application proves that decision support methodologies help small, medium, and large companies to better define their day-to-day strategies, in a logical and reasoned way, because Operational Research is for everyone.



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