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Instituto Alberto Luiz Coimbra de
Pós-Graduação e Pesquisa de Engenharia

ELICITATION OF CRITERIA IMPORTANCE WEIGHTS THROUGH THE SIMOS METHOD – A CASE STUDY ON DECOMMISSIONING SUBSEA STRUCTURES

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AGENDA

- Introduction - Decommissioning
- Brazilian scenario
- Study criteria
- “Simos” method
- Results

DECOMMISSIONING – WHAT IS IT?



PROJECT

INTRODUCTION - DECOMMISSIONING

FIELD	FIELD DEACTIVATION	MAIN FACILITIES	BASIN
Bauna Sul	Total	Wells	Santos
Cação	Total	PCA-01, PCA-02, PCA-03	Espírito Santo
Camarão Norte	Total	Wells	Camamu
Carapiá	Total	Wells	Santos
Espadarte	Partial	FPSO Cidade do Rio de Janeiro; FPSO Espadarte	Campos
Guaiúba	Total	Wells	Potiguar
Guajá	Total	Wells	Potiguar
Linguado	Partial	P-12	Campos
Marlim Sul	Partial	FPSO Marlim Sul	Campos
Mexilhão	Partial	Wells	Santos
Piranema	Total	FPSO Piranema Spirit	Sergipe-Alagoas
Pirapitanga	Total	Wells	Santos
Roncador	Partial	FPSO Brasil	Campos
Salema Branca	Total	Wells	Potiguar
Tambuatá	Total	Wells	Santos
Tartaruga Verde	Partial	FPSO Cidade de Rio das Ostras	Campos

16 DECOMMISSIONING PROGRAMS **APPROVED!!!**

INTRODUCTION - DECOMMISSIONING



Instalation	Espadarte field FPSO Cidade do Rio de Janeiro Water dept: 1.365 m	
	Number / Extension (Km) / Weight (ton)	Approved Alternative
Abandoned wells	8	Leave in situ
Pipeline (Rigid)	9,4 Km	To be defined
Pipeline (Flexible)	92,7 Km	Removal
Umbilical and electric cable (Flexible)	52,0 Km	Removal
PLEM	1 un / 31 t	Removal
PLET	1 un / 15 t	To be defined
Manifold	-	-

Piranema field FPSO Piranema Spirit Water dept: 1.090 m	
Number / Extension (Km) / Weight (ton)	Approved Alternative
11	Leave in situ
-	-
75,0 Km	Removal
48,9 Km	Removal
-	-
-	-
-	-

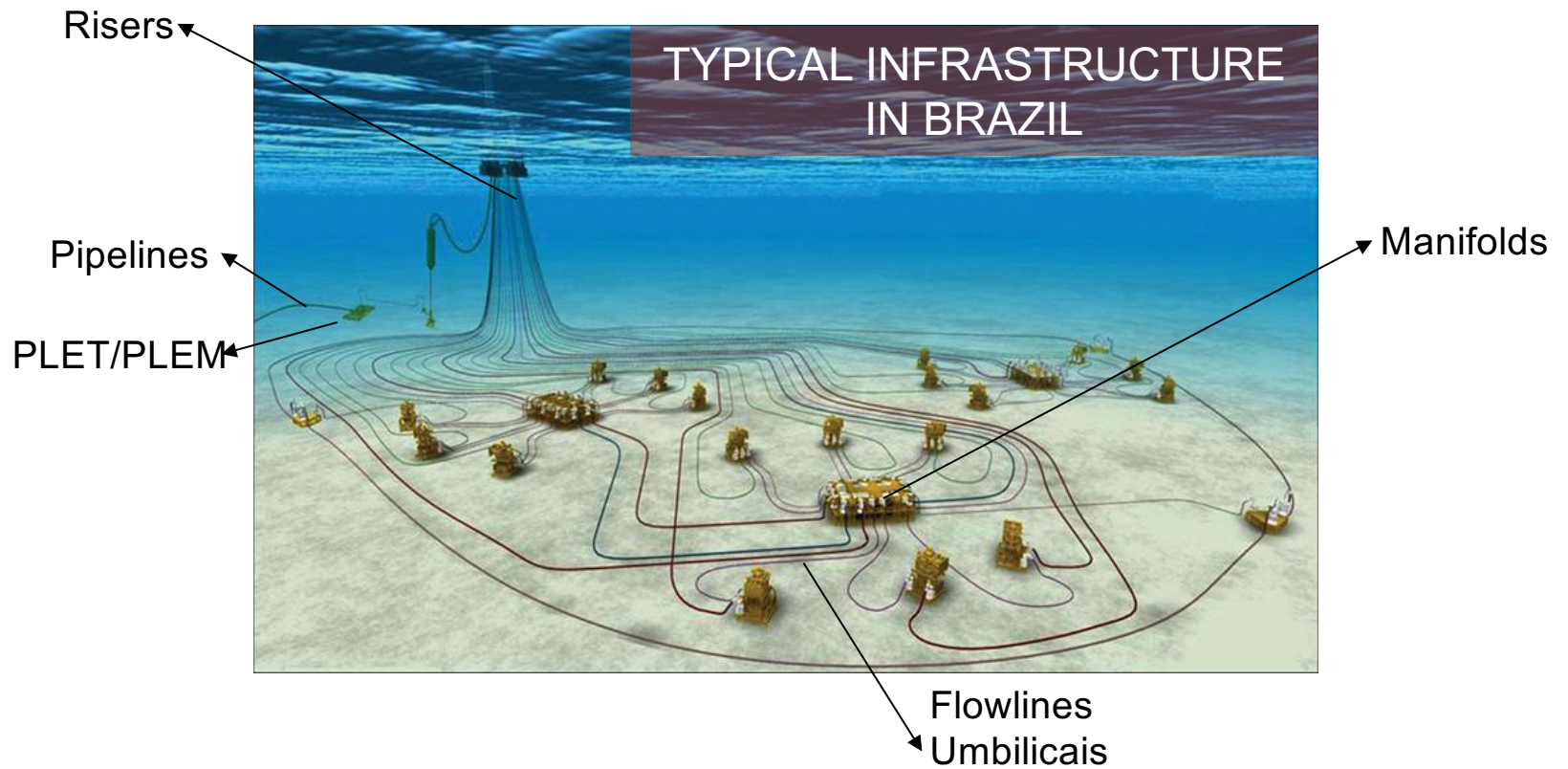
Roncador field FPSO Brasil Water dept: 1.290 m	
Number / Extension (Km) / Weight (ton)	Approved Alternative
4	To be defined
17,3 Km	To be defined
109,5 Km	To be defined
95,7 Km	To be defined
-	-
-	-
1	To be defined

INTRODUCTION - DECOMMISSIONING

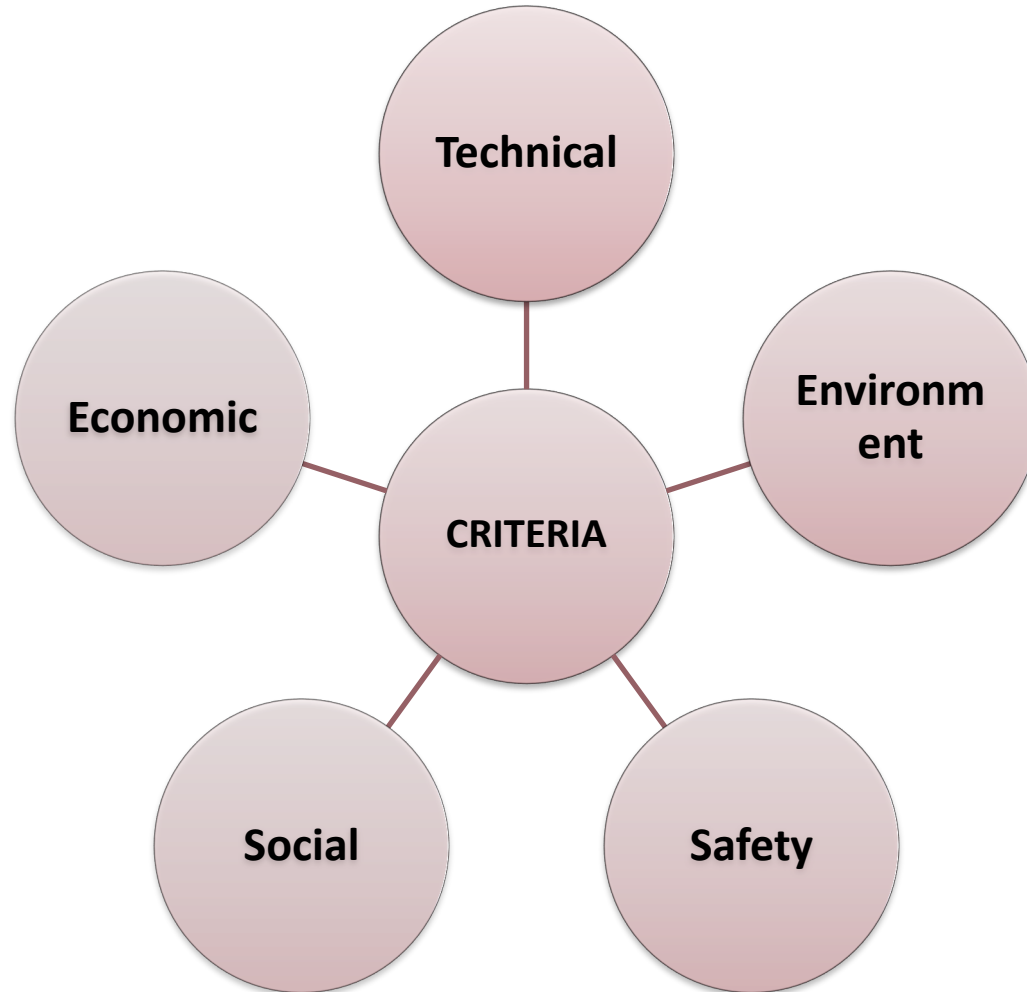


Instalation	Espadarte field FPSO Cidade do Rio de Janeiro Water dept: 1.365 m		Piranema field FPSO Piranema Spirit Water dept: 1.090 m		Roncador field FPSO Brasil Water dept: 1.290 m	
	Number / Extension (Km) / Weight (ton)	Approved Alternative	Number / Extension (Km) / Weight (ton)	Approved Alternative	Number / Extension (Km) / Weight (ton)	Approved Alternative
Abandoned wells	8	Leave in situ	11	Leave in situ	4	To be defined
Pipeline (Rigid)	9,4 Km	To be defined	-	-	17,3 Km	To be defined
Pipeline (Flexible)	92,7 Km	Removal	75,0 Km	Removal	109,5 Km	To be defined
Umbilical and electric cable (Flexible)	52,0 Km	Removal	48,9 Km	Removal	95,7 Km	To be defined
PLEM	1 un / 31 t	Removal	-	-	-	-
PLET	1 un / 15 t	To be defined	-	-	-	-
Manifold	-	-	-	-	1	To be defined

BRAZILIAN SCENARIO



DECISION MAKING PROCESS – 5 CRITERIA



DECISION MAKING PROCESS – SEVERAL OPTIONS

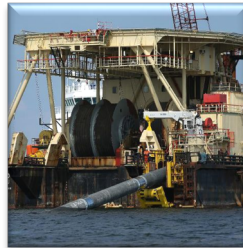


Reverse Reeling Recovery



Leave in situ without intervention

S-lay/J-Lay Recovery



Leave in situ with intervention



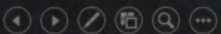
Cut and Lift



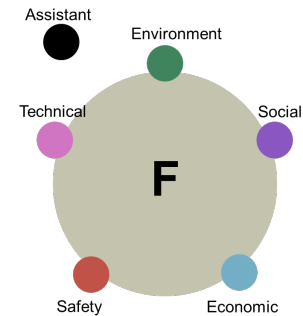
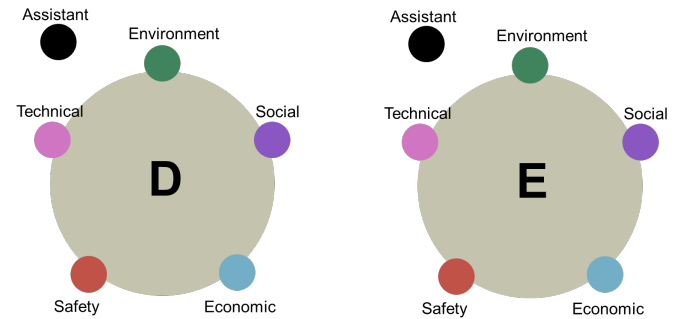
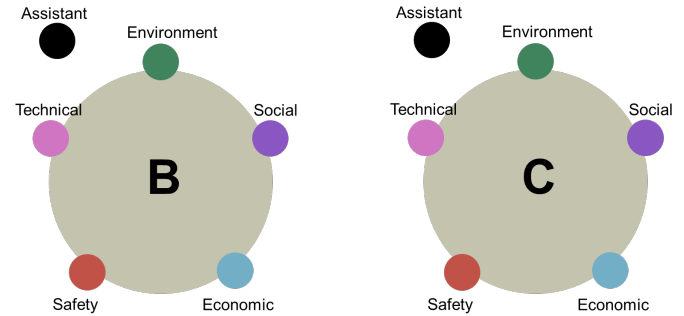
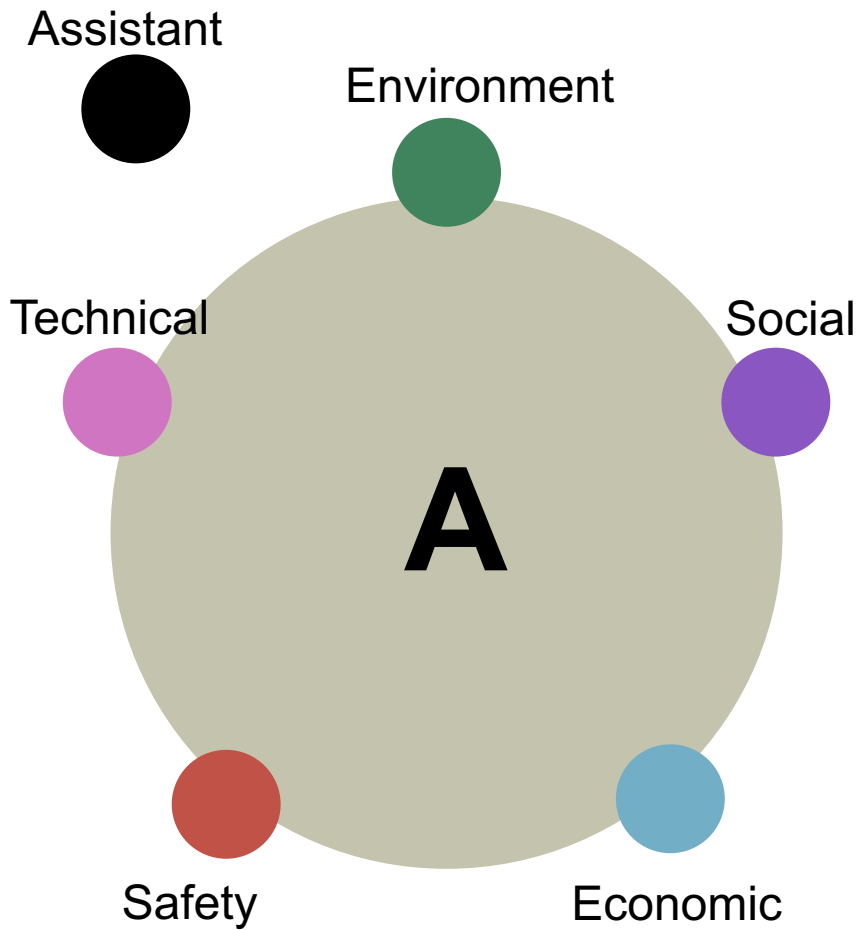
DECISION MAKING PROCESS – WEIGHT?



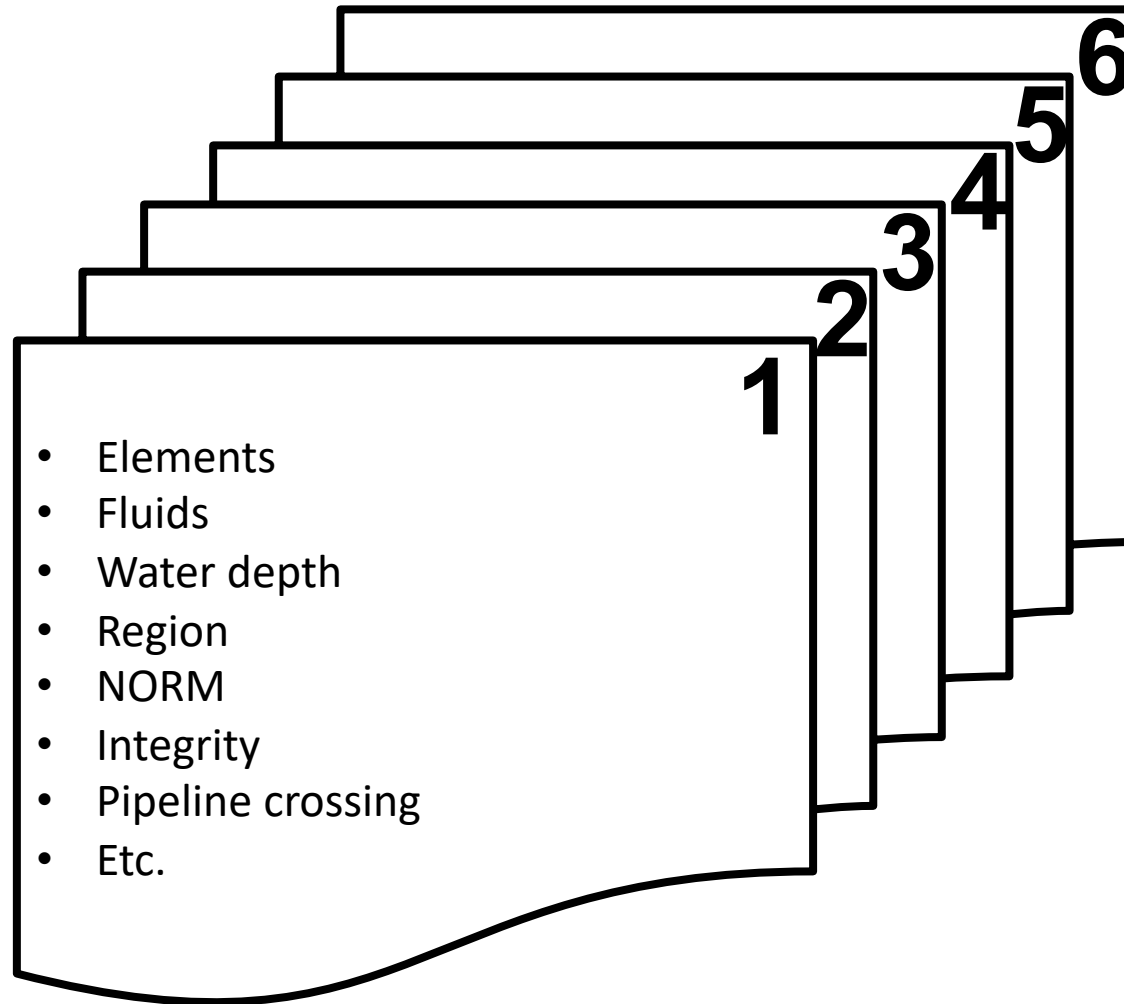
How to determine the
CRITERIA WEIGHTS ?



WORKSHOP ON SIMOS METHOD - TABLES



WORKSHOP ON SIMOS METHOD - SCENARIOS



WORKSHOP ON SIMOS METHOD - SCENARIOS

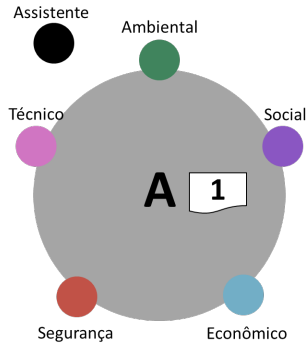
SCENARIO 1 - FLEXIBLE PIPELINE	SCENARIO 2 - FLEXIBLE PIPELINE
<ul style="list-style-type: none"> - Element: Flowline - Transported fluid: Oil - Depth: 1000 meters - Distance from coast: 40 km - Country Region: Southeast - NORM: Yes - Integrity: Integrate - Crossings: 3 intersections with lines in operation and 2 with lines disabled - Seabed: Muddy soil - Marine Life: Without coral - Fishing: Commercial and eventual - Diving: No 	<ul style="list-style-type: none"> - Element: Riser - Transported fluid: Water - Depth: 160 meters - Distance from coast: 25 km - Country Region: Southeast - NORM: No - Integrity: Committed - Crossings: No - Seabed: Sandy soil - Marine Life: Presence of Coral-Sun associated with the structure - Fishing: Artisanal and eventual - Diving: Yes
SCENARIO 3 – RIGID PIPELINE	SCENARIO 4 – RIGID PIPELINE
<ul style="list-style-type: none"> - Element: Export pipeline - Transported fluid: Gás - Depth: 19 meters - Distance from coast: 7 km - Country Region: Southeast - NORM: No - Integrity: Not defined - Crossings: No - Seabed: Sandy soil - Marine Life: Presence of limestone and coral - Fishing: Artisanal and frequent - Diving: Yes 	<ul style="list-style-type: none"> - Element: Export pipeline - Transported fluid: Óleo - Depth: 300 meters - Distance from coast: 85 km - Country Region: Southeast - NORM: No - Integrity: Integrate - Crossings: 10 intersections of various types - Seabed: Muddy soil - Marine Life: Presence of tubiform worms - Fishing: No - Diving: No
SCENARIO 5 - EQUIPMENT	SCENARIO 6 - EQUIPMENT
<ul style="list-style-type: none"> - Element: Manifold modular - Weight: 30 t - Fluid: Oil - Depth: 16 meters - Distance from coast: 13 km - Country Region: Northeast - NORM: Yes - Integrity: Committed - Seabed: Muddy soil - Marine Life: Whale Route - Fishing: Artisanal - Diving: Yes 	<ul style="list-style-type: none"> - Element: PLEM - Weight: 150 t - Fluid: Gas - Depth: 1100 meters - Distance from coast: 120 km - Country Region: Southeast - NORM: No - Integrity: Integrate - Seabed: Sandy soil - Marine Life: Squids and Sperm Whales - Fishing: No - Diving: No

Flexible pipeline

Rigid pipeline

Subsea equipment's

WORKSHOP ON SIMOS METHOD - CARDS



ENVIRONMENT

SOCIAL

SAFETY

ECONOMIC

TECHNICAL

1

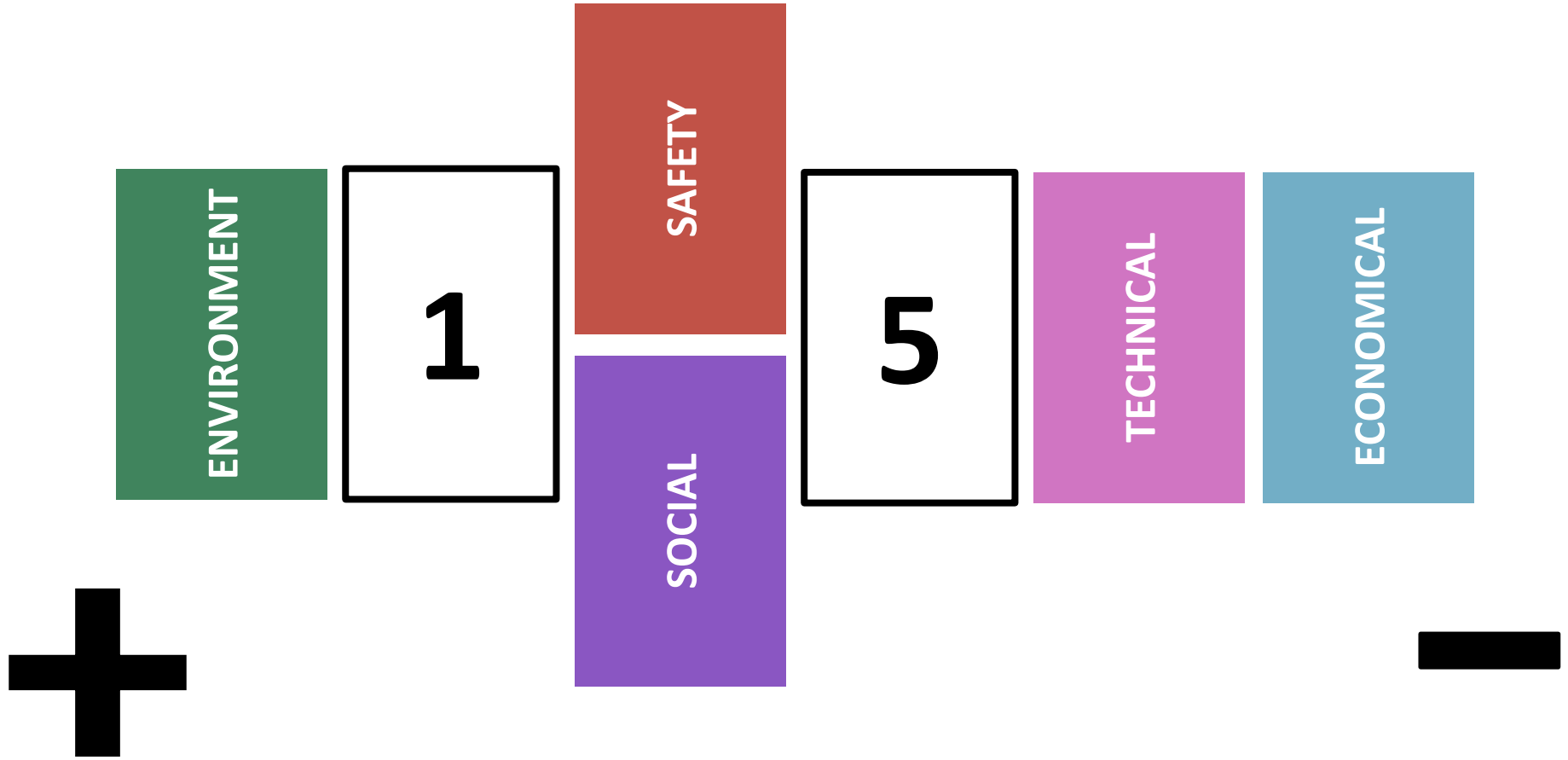
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5

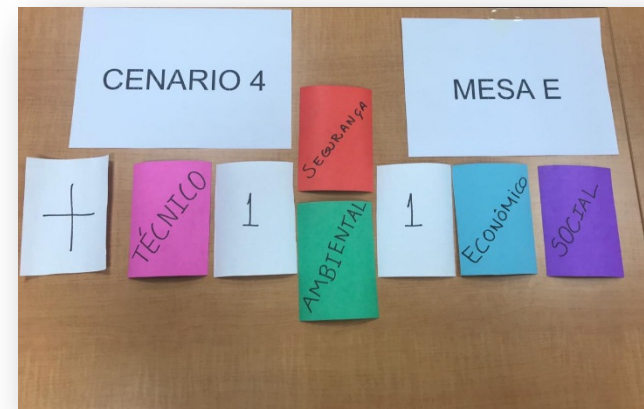
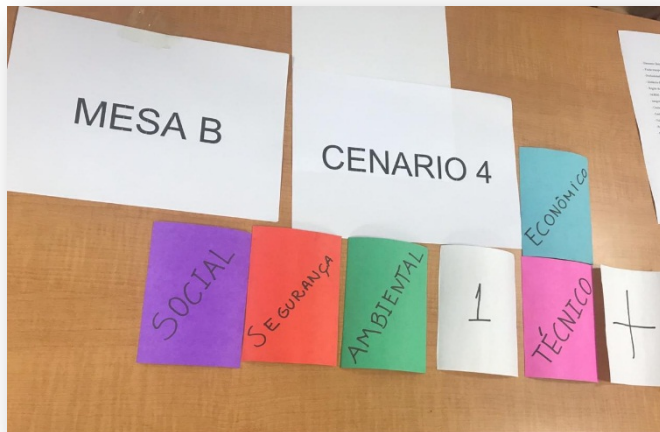
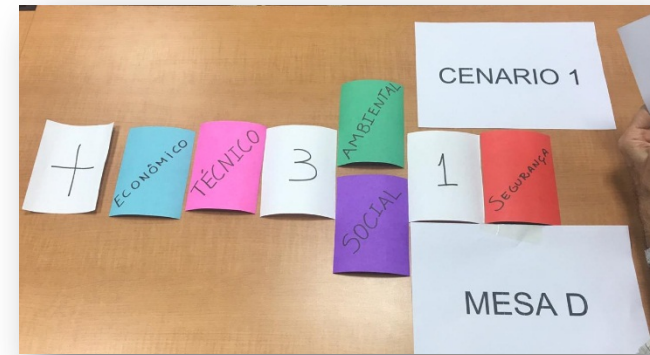
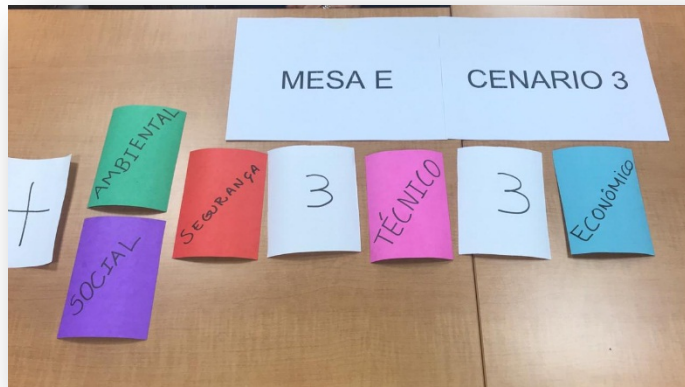
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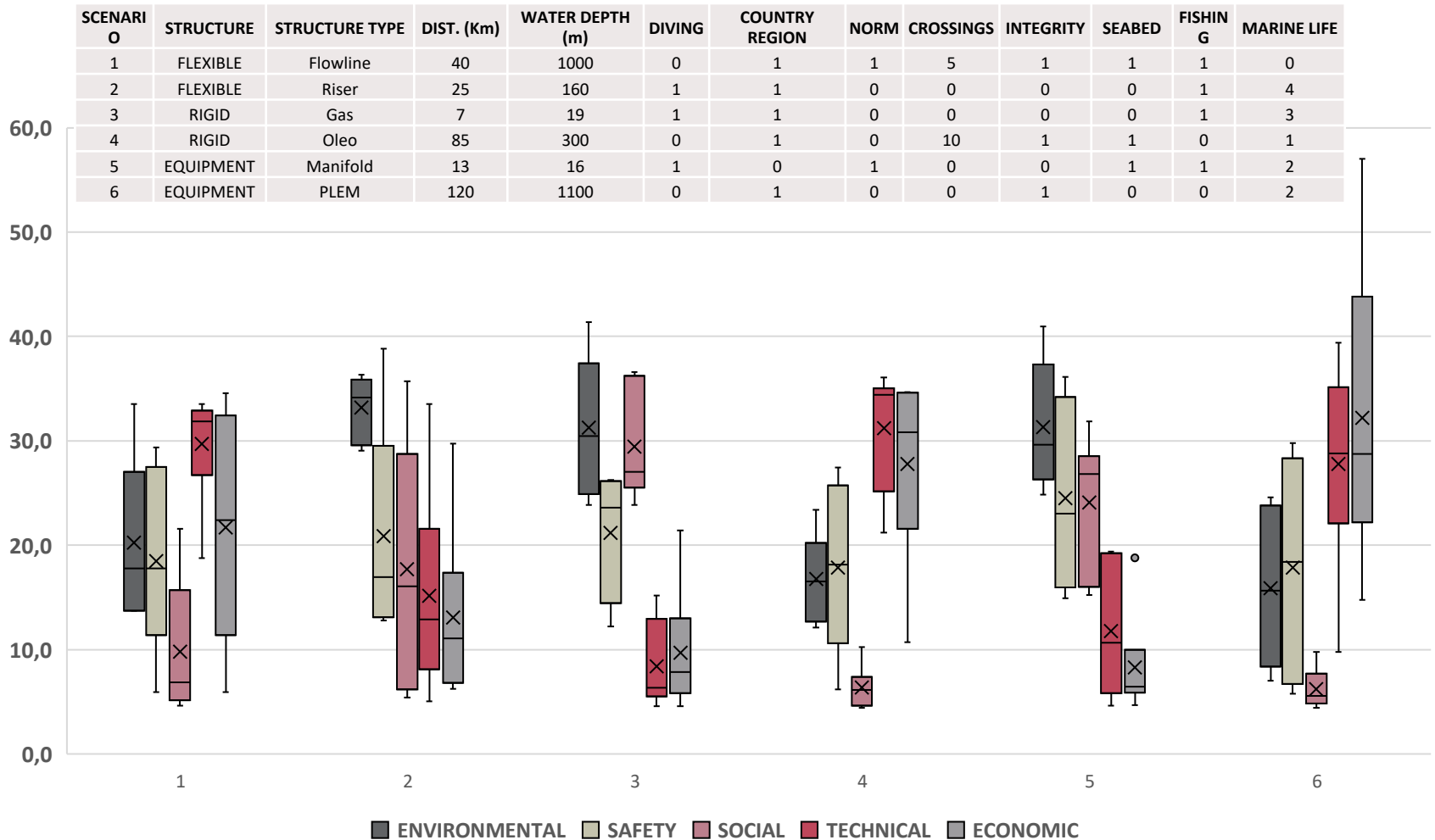
WORKSHOP ON SIMOS METHOD – THE GAME



WORKSHOP ON SIMOS METHOD - RESULTS

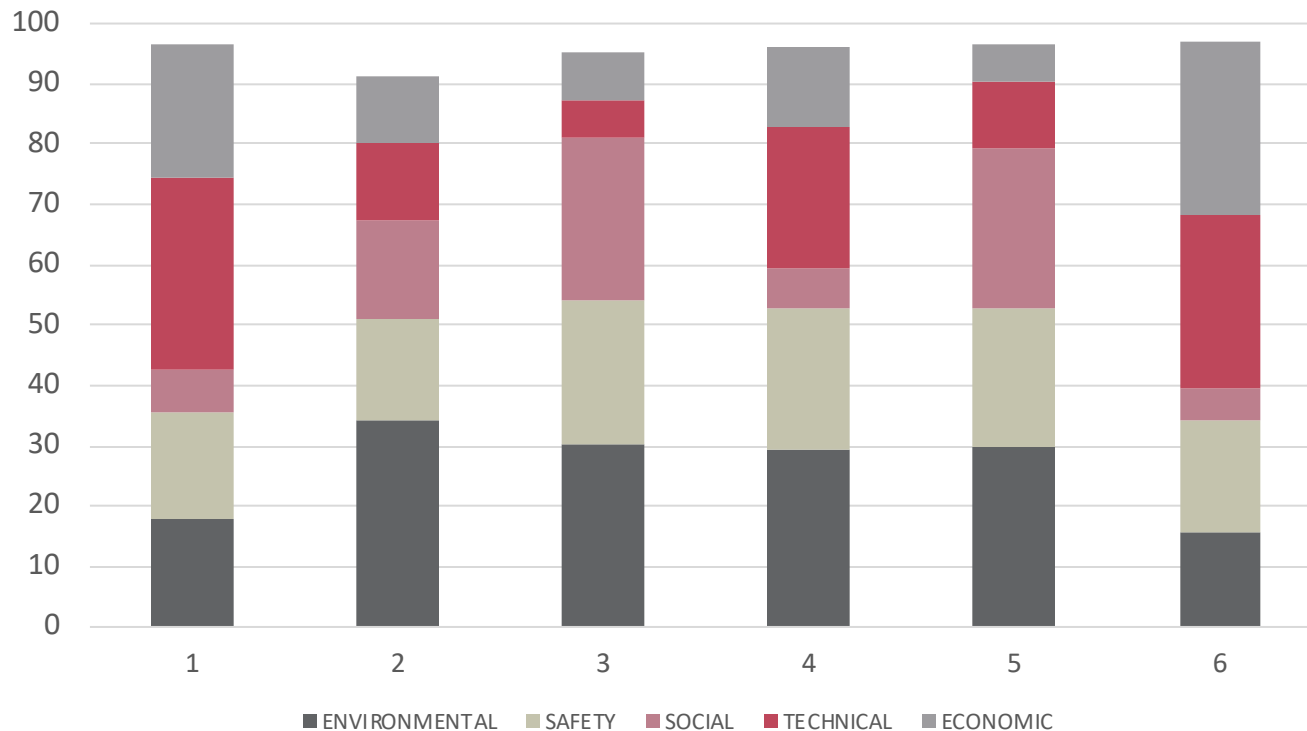


RESULTS



RESULTS

SCENARIO	SCENARIO ANALYSIS - MEDIAN				
	ENVIRONMENTAL	SAFETY	SOCIAL	TECHNICAL	ECONOMIC
1	17,8	17,8	6,9	31,9	22,4
2	34,2	16,9	16,1	12,9	11,1
3	30,5	23,6	27,0	6,4	7,9
4	29,4	23,2	6,9	23,5	13,1
5	29,7	23,0	26,8	10,7	6,5
6	15,7	18,4	5,6	28,8	28,7



RESULTS

CORRELATION

	DISTANCE (Km)	WATER DEPTH (m)	DIVING	COUNTRY REGION	NORM	CROSSINGS	INTEGRITY	SEABED	FISHING	MARINE LIFE
ENVIRONMENTAL	-0,6	-0,9	0,8	-0,2	-0,3	-0,1	-0,8	-0,1	0,4	0,6
SAFETY	-0,2	-0,6	0,2	-0,4	0,0	0,2	-0,2	0,3	-0,1	-0,1
SOCIAL	-0,8	-0,8	0,9	-0,6	0,2	-0,6	-0,9	-0,1	0,7	0,5
TECHNICAL	0,7	0,9	-0,9	0,4	0,2	0,5	0,9	0,3	-0,5	-0,7
ECONOMIC	0,8	1,0	-0,8	0,5	0,0	0,1	0,8	-0,1	-0,5	-0,5

CONCLUSION

- **Key Stakeholder Contribution**
- **Search for Consensus**
- **Problem Definition** in an explicit and transparent way
- **Visualization** of the critical points and conflict strength
- **Ranking** of alternatives

