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Master Thesis

Towards a decision tool for decommissioning of subsea assets of oil-gas platforms in Brazil

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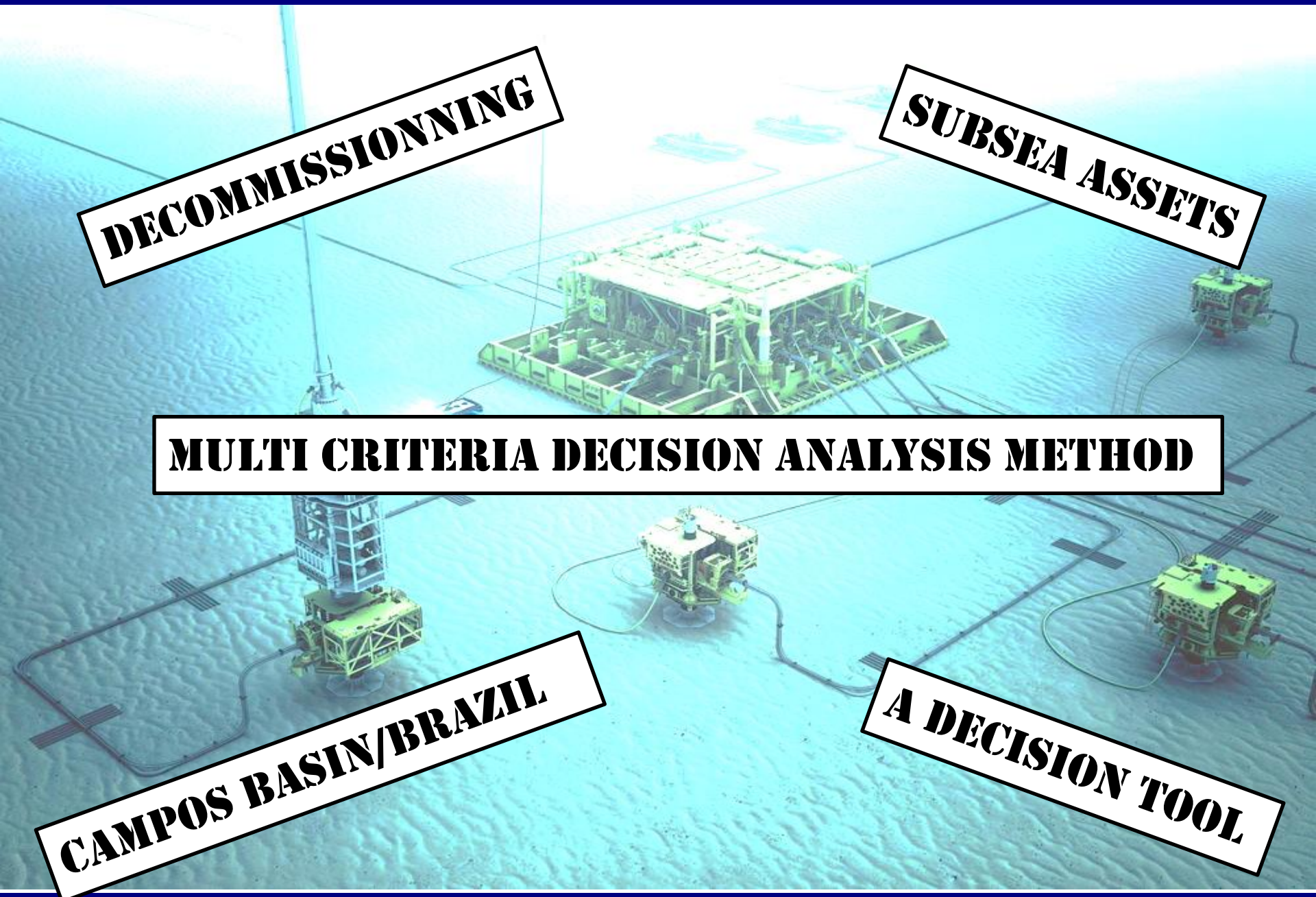
THE FEDERAL UNIVERSITY OF RIO DE JANEIRO

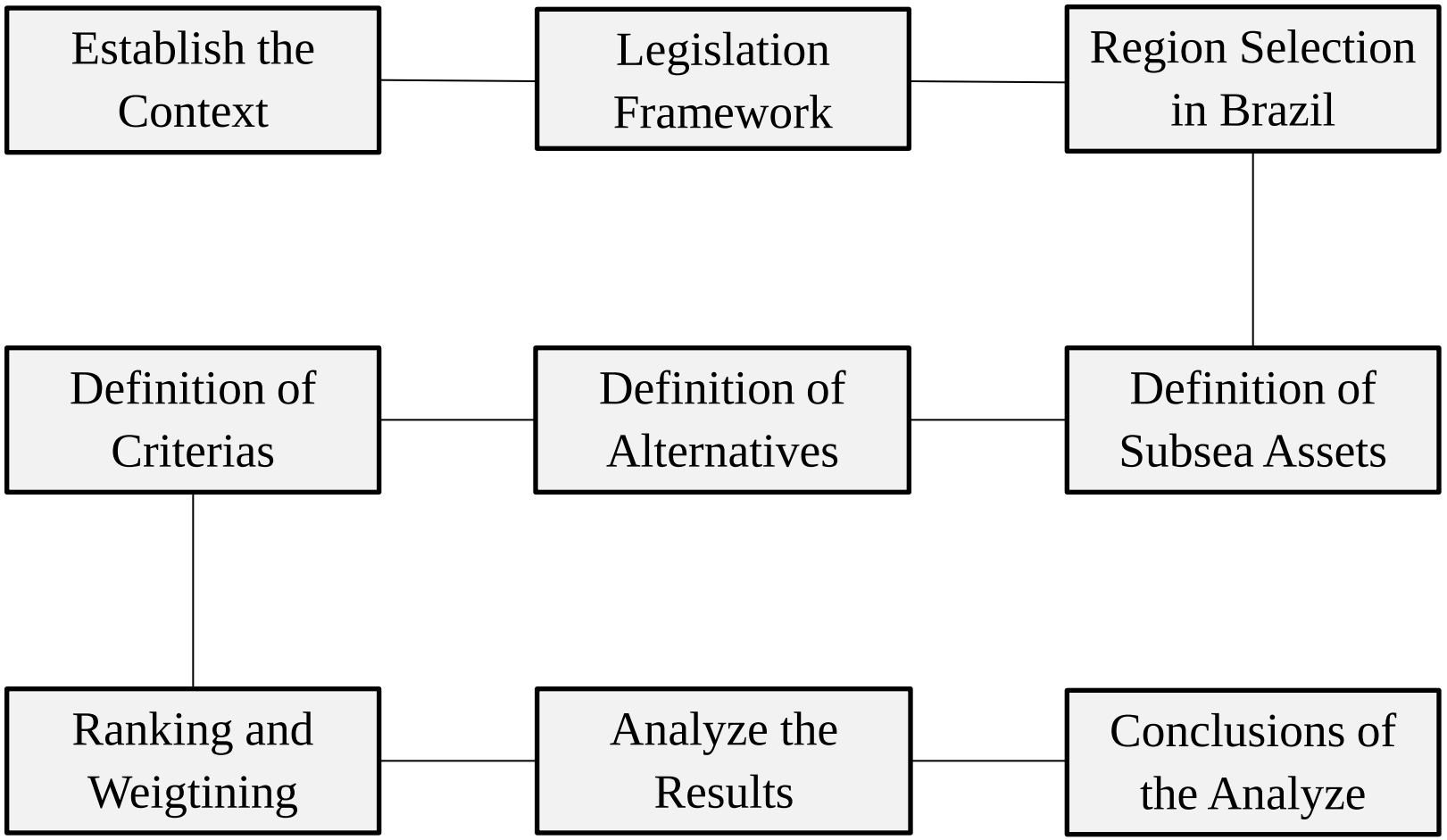

DECOMMISSIONNING
SUBSEA ASSETS
MULTI CRITERIA DECISION ANALYSIS METHOD
CAMPOS BASIN/BRAZIL
A DECISION TOOL

3. PROBLEMS

- Changed and Stricted International Regulations,
- High Expenses,
- Long Times,
- Complex Decision Mechanisms,
- Decision Mistakes Due to Number of Different Alternatives and Variable Factors.

4. GOAL OF THE RESEARCH

- Create a Decision Tool Using Multi Criteri Decision Analysis Method →
- Simpliyf the Decision Mechanism,
- Reach to Successful Results More Faster,
- Minimize the Decision Mistakes,
- Obtain the Successful Decisions.

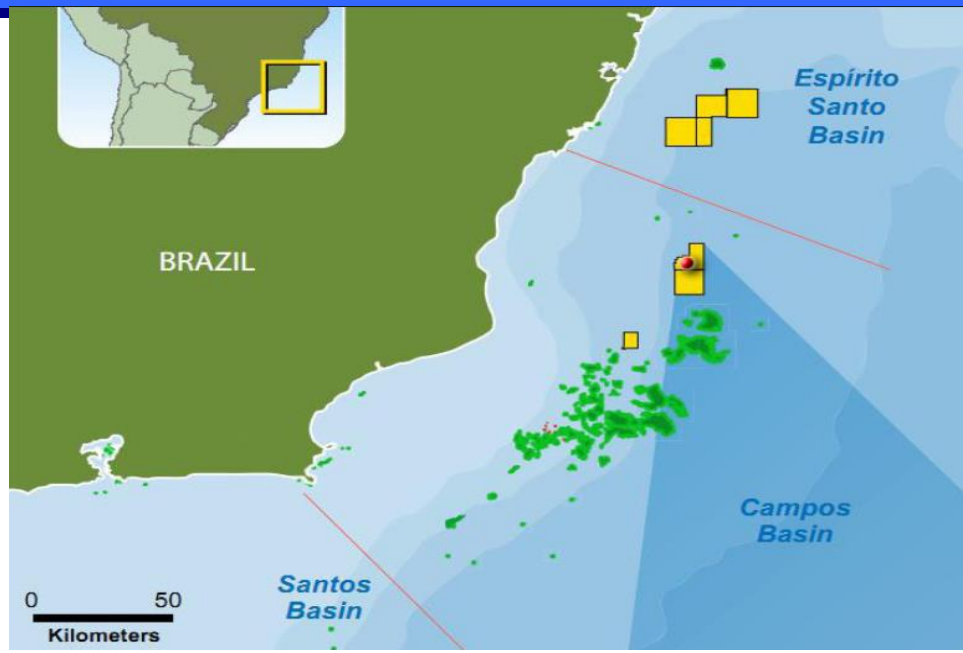

Establish the Context
Legislation Framework
Region Selection in Brazil
Definition of Criterias
Definition of Alternatives
Definition of Subsea Assets
Ranking and Weigtining
Analyze the Results
Conclusions of the Analyze

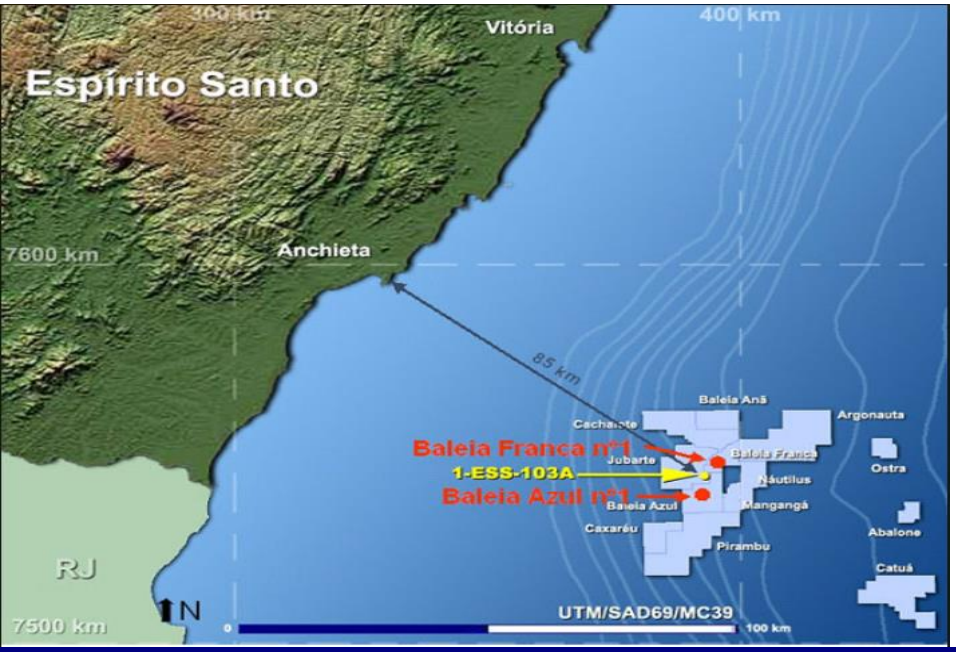
- The context of this process determined as Decommissionning Subsea Assests of Fixed Oil-Gas Offshore Platforms in Brazil.

- Within this context a tool will be created using Multi Criteria Decision Analysis Method to achieve the best options of decommissionning approach.

7. LEGISLATION FRAMEWORK

8. REGION SELECTION in BRAZIL





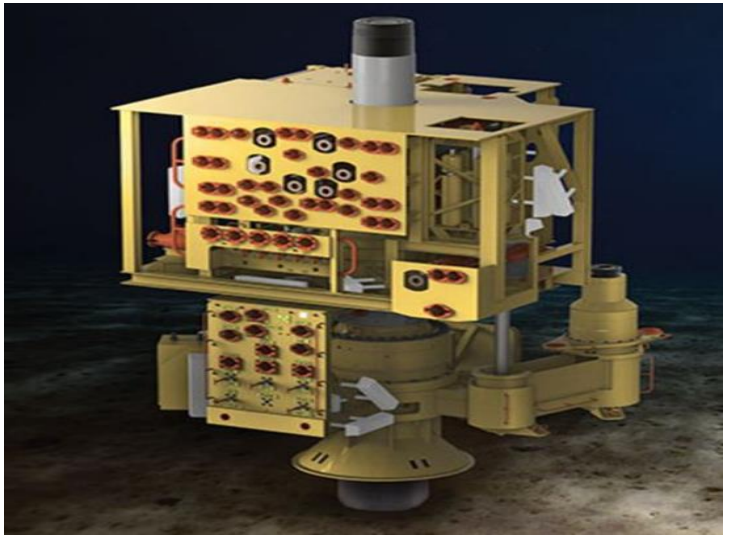
Subsea Manifold

Jumper

Riser

Subsea Pipelines

Subsea Tree

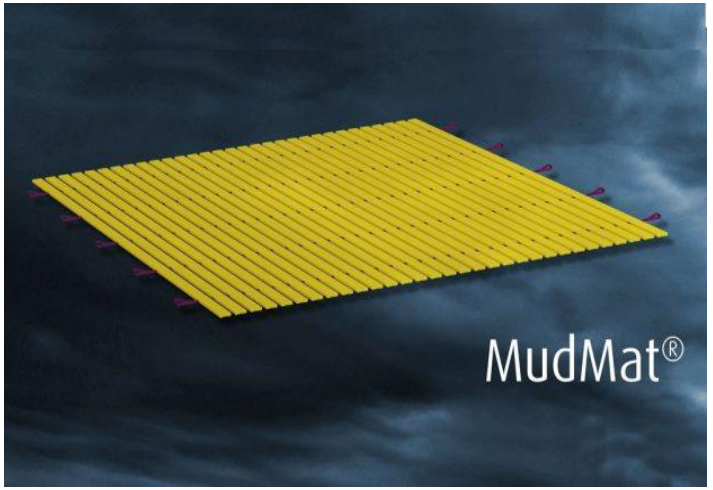


Seperation System

Pressure Boaster

Template

Mudmat



DECOMMISSIONNING ALTERNATIVES	
REMOVAL ALTERNATIVES	**LEAVE ON SEABED**
Reverse Reeling	Leave in Situ
Reverse S-Lay	Landfill- Rock Dumping
Cut and Lift	Burial or Trenching
Total Removal	
Partial Removal	

10. DEFINITION of ALTERNATIVES

			REMOVAL ALTERNATIVES					LEAVE ON SEABED		
			LINE REMOVAL OPTIONS			LOCAL EQ. REMOVAL				
	ALTERNATIVES / SUBSEA COMPONENTS	Pipeline or Local Eq.	Reverse Reeling	Reverse S-Lay	Cut and Lift	Total Removal	Partial Removal	Leave In Situ	Landfill-Rock Dumping	Burial or Trenching
PRODUCTION EQUIPMENTS	Subsea Manifolds	Local				✓		✓		
	Subsea Trees	Local				✓	✓	✓		
TRANSPORTATION AND CONNECTION EQUIPMENTS	Jumper (flexible)	Local				✓	✓	✓		
	Spool (rigid)	Local				✓	✓	✓		
	Pipelines (export lines) /Trunklines	Line		✓	✓	✓	✓	✓	✓	✓
	Rigid Flowlines	Line	✓		✓	✓	✓	✓		✓
	Flexible Flowlines	Line	✓		✓	✓	✓	✓		✓
	Umbilical Systems	Line	✓		✓	✓	✓	✓		✓
	Power Cables	Line	✓		✓	✓	✓	✓		✓
	Rigid Risers	Line				✓	✓	✓	✓	
PROCESSING EQUIPMETS	Subsea Pressure Booster Pump	Local				✓	✓	✓		
	Separation Systems	Local				✓	✓	✓		
SUPPORTER STRUCTURAL EQUIPMENTS	Template	Local				✓	✓	✓		
	Mudmat	Local				✓	✓	✓		

11. DEFINITION of CRITERIAS

Main Criteria	Sub Criteria
ENVIRONMENT	Operational Environmental Impacts
	Legacy Environmental Impacts
	Energy Use
	Gaseous Emmissions
SAFETY	Safety Risk to Offshore Project Personnel
	Safety Risk to Other Users of the Sea
	Safety Risk to Onshore Project Personnel
TECHNICAL	Technical Feasibility
ECONOMIC	Cost
SOCIETAL	Effects on Commercial Fisheries
	Employment
	Communuties

Rankings	Description
1	Very Low
2	Low
3	Medium
4	High
5	Very High

Scenario	Description of Weightinings
1	Weighted Equivalent (%20 for each main criteria)
2	Weighted to Environment (%40 for environment and %15 for others)
3	Weighted to Safety (%40 for safety and %15 for others)
4	Weighted to Technical (%40 for technical and %15 for others)
5	Weighted to Economic (%40 for economic and %15 for others)
6	Weighted to Societal (%40 for societal and %15 for others)

Description of Subsea Assets: MANIFOLD

Weightining Scenario: 1Weighted Equivalent (%20 for each main criteria)

		Option 1: Total Removal					Option 2: Leave In Situ				
Main Criteria	**Sub Criteria**	**Likelihood**	**Impact**	**Risk**	**Weigtining**	**Score**	**Likelihood**	**Impact**	**Risk**	**Weigtining**	**Score**
ENVIRONMENTAL %20	Operational Environmental Impacts	4	4	16	5,0%	0,80	1	1	1	5,0%	0,05
	Legacy Environmental Impacts	1	1	1	5,0%	0,05	5	5	25	5,0%	1,25
	Energy Use	3	3	9	5,0%	0,45	4	4	16	5,0%	0,80
	Gaseous Emissions	3	3	9	5,0%	0,45	4	4	16	5,0%	0,80
Total Environment=						1,75					2,90
SAFETY %15	Safety Risk to Offshore Project Personnel	4	4	16	6,7%	1,07	1	2	2	6,7%	0,13
	Safety Risk to Other Users of the Sea	1	1	1	6,7%	0,07	4	4	16	6,7%	1,07
	Safety Risk to Onshore Project Personnel	3	3	9	6,7%	0,60	1	1	1	6,7%	0,07
Total Safety=						1,73					1,27
TECHNICAL %15	Technical Feasibility	5	5	25	20,0%	5,00	1	1	1	20,0%	0,20
Total Technical=						5,00					0,20
SOCIETAL %15	Effects on Commercial Fisheries	1	1	1	6,7%	0,07	4	5	20	6,7%	1,33
	Employment	3	3	9	6,7%	0,60	2	1	2	6,7%	0,13
	Communities	1	2	2	6,7%	0,13	4	4	16	6,7%	1,07
Total Societal=						0,80					2,53
ECONOMIC %15	Cost	5	5	25	20,0%	5,00	1	1	1	20,0%	0,20
Total Economic=						5,00					0,20
Total Score =total environment+total safety+total technical+total societal+total economic						**14,283**					**7,100**

Description of Subsea Assets: MANIFOLD

Weightining Scenario:4 Weighted to Technical (%40 for technical and %15 for others)

		Option 1: Total Removal					Option 2: Leave In Situ				
Main Criteria	**Sub Criteria**	**Likelihood**	**Impact**	**Risk**	**Weigtining**	**Score**	**Likelihood**	**Impact**	**Risk**	**Weigtining**	**Score**
ENVIRONMENTAL %15	Operational Environmental Impacts	4	4	16	3,75%	0,60	1	1	1	3,75%	0,04
	Legacy Environmental Impacts	1	1	1	3,75%	0,04	5	5	25	3,75%	0,94
	Energy Use	3	3	9	3,75%	0,34	4	4	16	3,75%	0,60
	Gaseous Emissions	3	3	9	3,75%	0,34	4	4	16	3,75%	0,60
Total Environment=						1,31					2,18
SAFETY %15	Safety Risk to Offshore Project Personnel	4	4	16	5,00%	0,80	1	2	2	5,00%	0,10
	Safety Risk to Other Users of the Sea	1	1	1	5,00%	0,05	4	4	16	5,00%	0,80
	Safety Risk to Onshore Project Personnel	3	3	9	5,00%	0,45	1	1	1	5,00%	0,05
Total Safety=						1,30					0,95
TECHNICAL %40	Technical Feasibility	5	5	25	40%	10,00	1	1	1	40%	0,40
Total Technical=						10,00					0,40
SOCIETAL %15	Effects on Commercial Fisheries	1	1	1	5,0%	0,05	4	5	20	5,0%	1,00
	Employment	3	3	9	5,0%	0,45	2	1	2	5,0%	0,10
	Communities	1	2	2	5,0%	0,10	4	4	16	5,0%	0,80
Total Societal=						0,60					1,90
ECONOMIC %15	Cost	5	5	25	15,0%	3,75	1	1	1	15,0%	0,15
Total Economic=						3,75					0,15
Total Score =total environment+total safety+total technical+total societal+total economic						**16,963**					**5,575**

11. CONCLUSIONS

- Generally, the decommissioning option "leave in situ" has minimum scores according to analyzed results
- In today's world environmental politics have accelerated positively and under this circumstance, abandon of the equipment should not be handled, unless it has to be leave on sea bed due to significant reasons. Additionally according to Brazil national legislations, for the abandoned option, the companies have to prepare valid and very strong arguments, also submit these proofs within 180 days to competent authorities.
- On the other hand, MCDA method is so useful to analyze and display the ambiguous situations.
- Laws on the decommissioning area have a lot of loopholes. If the company owners want to take advantage of these legal gaps, they may destroy the sea habitant and these negative effects start the butterfly effect.
- Other options that are at least close to the ideal option can be considered as an alternative to decommissioning operations. As mentioned before, to create specific molds for this decommissioning and apply them to all platforms will be inadequate.

10. RECOMMENDATIONS

- At the beginning of this study, we asserted a claim and we mentioned that using MCDA method we can obtain the best decision which helps select the most available decommissioning alternative for the subsea assets. But according to analyze, the obtained results cannot be the final decisions. On the other hand it is still a consistent approach. With this approach, we may have taken a step towards comprehensive results.

- Use these results as starter point for stakeholder engagement.

- Results are changeble for every region please check the results for different platforms and different regions.

- Results has been analyzed in the view of regulations therefore please every time check the regulations against the any changing.

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