Sustainable business models for sustainable decision making: an application to reusing offshore gas platforms in the Adriatic Sea

Fabio Zagonari
Dipartimento di Scienze per la Qualità della Vita, Università di Bologna
C.so d'Augusto 237, 47921 Rimini (Italy), Phone: 0039 0541 434135, Fax: 0039 0541 434120
Email: fabio.zagonari@unibo.it, ORCID: 0000-0002-9872-8731

Sami Ouechtati
Research Fellow, Dipartimento di Scienze per la Qualità della Vita, Università di Bologna

February 2021

Abstract

This paper suggests an empirical methodology to use theoretical Sustainable Business Models (SBMs) in making sustainable (i.e., participatory decisions involving economic, social and environmental features) and rational (i.e., informed and consistent) decisions with respect to what, who, where, when, and how to do. The case study, focused on alternative reuses of offshore gas platforms (i.e., a complicated case due to the absence of previous stakeholders' experiences at local and national level), identified *when* (i.e., the end as opposed to the beginning of extraction activities) and *where* (i.e., the economic, social and environmental contexts of the Adriatic Sea in Abruzzo region, Italy). A questionnaire, submitted to stakeholders, produced the relative weights required by the tested SBM (i.e., a comprehensive model recently proposed by Lüdeke-Freund et al., 2018); it reached a conclusion about *how* (i.e., in favour of majority decisions as opposed to representative decisions); and it highlighted a sample size issue (i.e., solved with a 50% increase of stakeholders involved). In summary, the methodology suggested in this paper applied to a comprehensive SBM for a complicated case study produced an empirical sustainable decision which is *consistent* with relative weights expressed by stakeholders. However, this decision is theoretically *wrong*, since eco-design (empirically correlated with the proper institutional approach for *who*) should have been preferred to circular economy (empirically correlated with the proper cooperative approach for *who*). In other words, information gaps about *what* (mainly due to an overemphasis put on social features) must be solved with additional meetings between experts and stakeholders.

Keywords

Sustainable business model, offshore gas and oil platforms, sustainable decision making

DOI

http://doi.org/10.6092/unibo/amsacta/6618

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1.Introduction

Sustainable decision making requires the consideration of at least three dimensions (i.e., economic, social, and environmental features) (e.g., Grimmel et al., 2019) in a rational decision making methodology (i.e., substantive rationality, which focuses on the ethics of an action, or instrumental rationality, which focuses on whether the means can achieve the desired end, irrespective of the ethics of that means) (e.g., Bolis et al., 2017; Assuad, 2020) with a participatory approach (i.e., group decision making) (e.g., Ardebili and Padoano, 2020). Note that we disregard circular economy approaches, since they are still not defined and measured to be applied in sustainable decision making (Corona et al., 2019).

In traditional business models, firms create, deliver, and capture mere economic value, although business models have *then* suggested where value creation is outside the firm, with partners, suppliers, stakeholders and customers (Teece, 2010). Sustainable Business Models (SBM) have been *theoretically* defined as "business models that incorporate pro-active multi-stakeholder management, the creation of monetary and non-monetary value for a broad range of stakeholders, with a long-term perspective" (Geissdoerfer et al., 2018). Lüdeke-Freund et al. (2018) refer to the theory of patterns and *practically* define a SBM pattern as follows: "A SBM pattern describes an ecological, social, and/or economic problem that arises when an organisation aims to create value, and it describes the core of a solution to this problem that can be repeatedly applied in a multitude of ways, situations, contexts, and domains, by describing the design principles, value-creating activities, and their arrangements that are required to provide a useful problem–solution combination". Note that considering value creation implies the focus on SBMs for weak sustainability (see Brozovic (2019) on SBMs for strong sustainability).

The the *purpose* of this paper is to suggest a methodology to make SBMs a theoretical framework to practically recommend *what*, *who*, *when*, *where* and *how* to do within sustainable decision making. In particular, we will refer to the SBM by Lüdeke-Freund et al. (2018) as a very comprehensive framework for a synthesis of the SBM literature, with a stronger orientation towards sustainability issues; and to decisions on alternative reuses of offshore gas platforms at the end of the extraction period, by using a case study in the Adriatic Sea, since this decision involves economic, social, and environmental aspects (Abhinav et al., 2020).

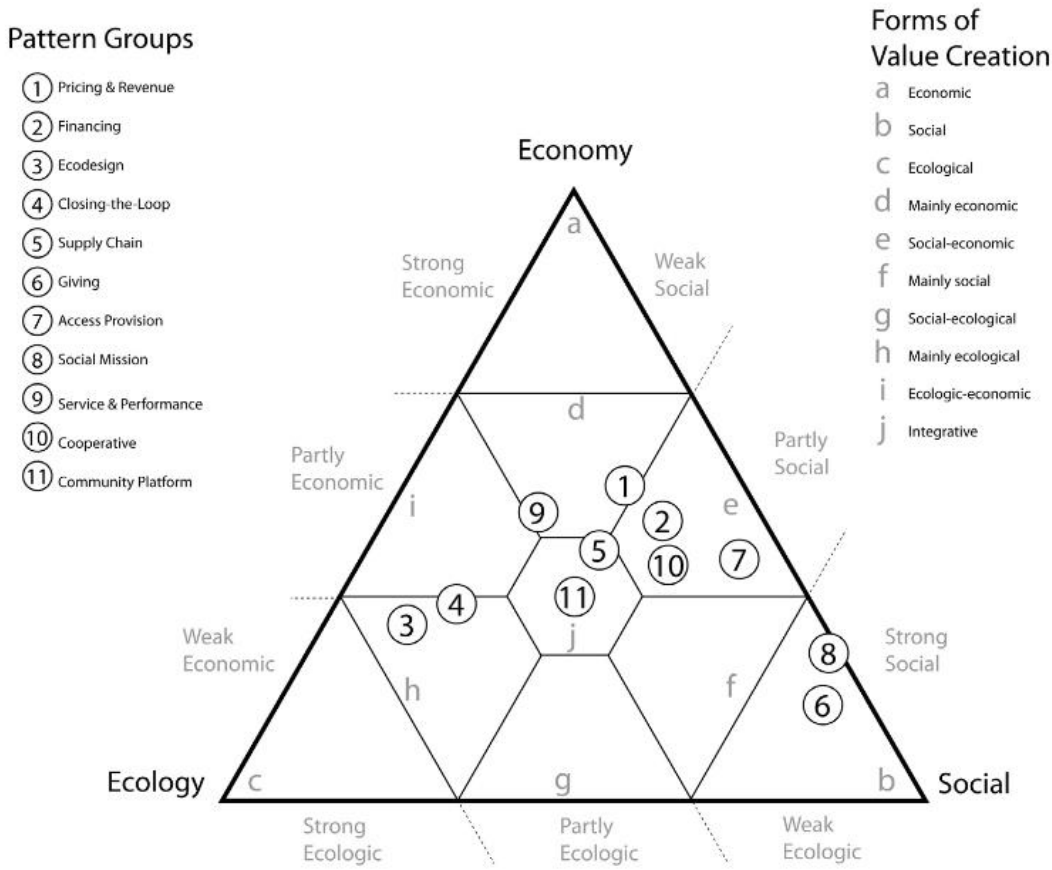
Note that we will disregard the Business Model Canvas for sustainability, since they are empirically similar to the SBM by Lüdeke-Freund et al. (2018), although in multi-dimensional frameworks (e.g., Cardeal et al., 2020; Joyce and Paquin, 2016); we will neglect SBM innovation, since reuse is a new business (Shakeel at al., 2020; Velter et al., 2020); and we will disregard circular Business Models, since the decision on alternative reuses is taken after the extraction period (Geissdoerfer et al., 2020; Lewandowski, 2016). Moreover, *why* to do is required by national and international laws and regulations (Fam et al., 2018) in many countries where a huge number of end-of-life gas and oil offshore platforms must be either decommissioned or reused. Finally, alternative decisions could have been analysed (e.g., decommissioning in Burdon et al. (2018) and Na et al. (2017); decommissioning vs. reuse in Bernstein (2015) and Kolian et al. (2019); or partial vs. complete decommissioning in Bressler and Bernstein (2015) and Sedlar et al. (2019)), but the decision on reuse vs. partial or complete decommissioning is an ethical rather than a business decision (Zagonari, 2021).

2. The theoretical framework

Lüdeke-Freund et al. (2018) identify 45 SBM patterns, arranged into 11 groups (i.e., Pricing & Revenue Patterns, Financing Patterns, Eco-design Patterns, Closing-the-Loop Patterns, Supply Chain Patterns, Giving Patterns, Access Provision Patterns, Social Mission Patterns, Service & Performance Patterns, Cooperative Patterns, Community Platform Patterns) and put into relation to 10 different forms of value creations (i.e., from a to j) (Figure 1). These 11 groups are related to a particular form of value creation, as long as the authors used a sustainability triangle to categorise

sustainability problem–solution combinations. The sustainability triangle is divided into ten areas that address ten different forms of value creation to which the pattern groups can be associated with.

Figure 1. The sustainable business model pattern taxonomy at the group level. Lüdeke-Freund et al. (2018).



In particular, we will apply the SBM by Lüdeke-Freund et al. (2018) with the following specifications:

- Closing the loop will be assumed to refer to a circular economy as opposed to a linear economy
- The sustainability triangle will be considered a 3-dimension simplex to represent the relative weights attached to economic (w_{eco}) , social (w_{soc}) and environmental (w_{env}) features (i.e., $w_{eco} + w_{soc} + w_{env} = 1$)
- Community platform will be assumed to refer to the involvement of public institutions as opposed to cooperative, where most actors are private

A methodological remark is needed here: some options (i.e., 1 and 2, 3 and 4, 6 and 8) are very close in the 3-dimension simplex.

3. The case study

This section will describe the variables that define the benefits and costs for a specific context: a case study of an offshore gas platform in the Adriatic Sea at ca. 18.5 km from Pineto d'Abruzzo in Teramo Province, in the Abruzzo region of Italy. Thus, in meetings with stakeholders, we will refer to Abruzzo as the relevant region. Note that the large distance from the coast suggests that impacts on the coastline can be disregarded. However, the offshore platform is close to a marine protected area, Torre del Cerrano, which has been classified as a natural site of EU interest. Consequently, in meetings with stakeholders, we will refer to economic and social data from the Abruzzo region and ecological data from the Torre del Cerrano marine protected area to discuss positive and negative impacts as well as benefits and costs of reuse vs. decommissioning.

The following issues are relevant for *reuse* (i.e., a partial decommissioning with carbonate coating of the original structure for tourism activities combined with additional structures for wave energy and mariculture activities):

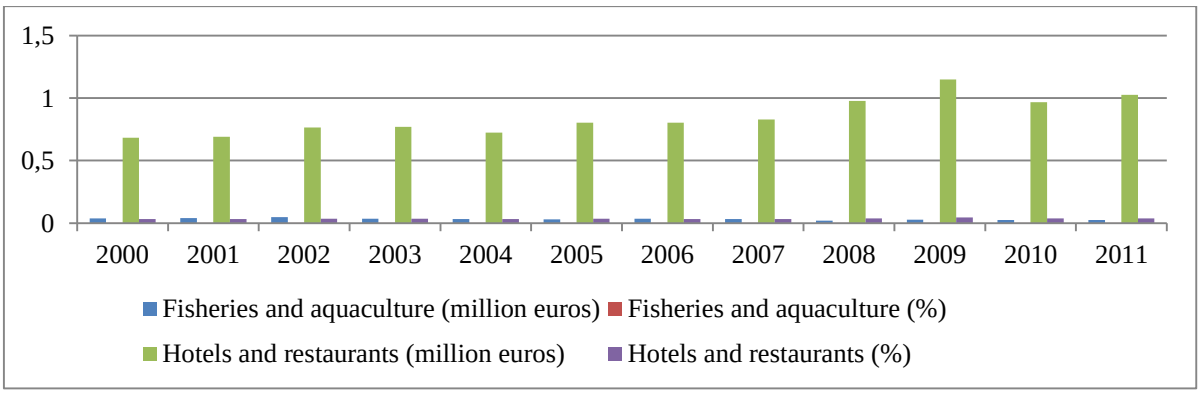
- the economic investment for carbonate coating to protect offshore platforms from corrosion (i.e., a technology that uses low voltage electrolysis of seawater for mineral accretion around artificial structures), and for mariculture and wave energy structures (Bull & Love, 2019)
- the economic operating and maintenance cost for wave energy, mariculture and tourism activities
- the economic revenues from mariculture and tourism activities (Kruse et al. 2015)
- the social costs due to aesthetic worsening of seascape (Cantle & Bernstein, 2015) and interference with navigation
- the social benefits from employment in partial decommissioning as well as in mariculture and tourism activities together with ecological monitoring (Wang et al., 2018)
- the environmental costs due to air and water pollution caused by partial decommissioning and tourism activities, impacts on the sea bed (Spagnolo et al., 2014), diffusion of jellyfish (Vodopivec et al., 2017), and noise impacts on avian and mammal species (Mangano and Sarà, 2017)
- the environmental benefits due to reduction of illegal fisheries and the increased biodiversity (Sommer et al., 2019)

Note that risk reduction from carbonate coating of offshore platforms is not a social benefit, since it is essential for tourism activities. Moreover, in meetings with stakeholders, we provided a picture of the offshore gas platform as it is now (at the end of the gas extraction process) and a layout of the offshore gas platform as it would be in the future (if reuse is implemented). Finally, the reduction of CO_2 emission permitted by the generation of wave energy is not an environmental benefit, since waves are the most feasible energy source for mariculture.

The *questionnaire* submitted to stakeholders (see Appendix) depicts the decision on decommissioning vs. reuse of an offshore platforms at the end of the gas extraction process (i.e., we neglect a life-cycle assessment which systematically analyses the full range of effects associated with all stage - from creation to disposal - of a product's life), by referring to positive and negative impacts (i.e., we neglect a cost-benefit analysis which applies a systematic set of rules for comparing economic benefits and costs - expressed in monetary terms - of alternative potential interventions to maximize social welfare).

Figure 2, presented to stakeholders during the first meeting as related to questions 8 and 28, depicts GDP data from official statistics for Abruzzo from 2000 to 2011 in the sectors that would potentially be involved in reuse. Note that fisheries and aquaculture represent a small proportion of regional GDP, although tourism achieves GDP levels of around 1×10^6 euros.

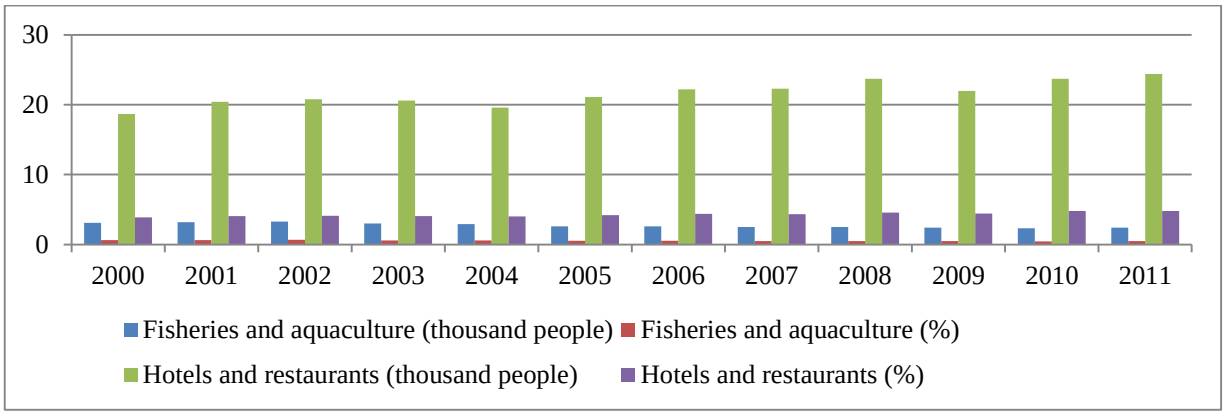
Figure 2. Sectoral GDP ($\times10^6$ € = million euros and percentages of regional values). Source: ISTAT.



Moreover, Figure 3, presented to stakeholders during the first meeting as related to question 12, shows employment for Abruzzo from 2000 to 2011 in the sectors potentially involved in reuse.

Note that fisheries and aquaculture represent a small proportion of regional employment, whereas tourism achieves employment levels of around 20 000.

Figure 3. Sectoral employment (×10^3 = thousands people and percentages of regional values). Source: ISTAT



Finally, Table 1, presented to stakeholders during the first meeting as related to questions 17 and 20, depicts the main ecological data for the marine protected area of Torre del Cerrano. Note that *Sabellaria halcocki* has a high value for biodiversity, since it is a rare species along the Italian coast and is unique to the Adriatic Sea.

Table 1. Species identified in article 4 of Directive 2009/147/EC and described in Annexes II and IV of Directive 92/43/EEC. Species groups: B = birds, I = invertebrates, M = mammals, R = reptiles. Population periods: r = during reproduction, w = in winter, p = permanent. Population categories: V = very rare, P = present. Motivation categories: C = International Conventions; O = other reasons. Source: Torre del Cerrano.

Species		Population		Motivation	
Group	Scientific Name	Period	Category	Annex	Other reasons
B	*Charadrius alexandrinus*	r		II	
B	*Charadrius alexandrinus*	w		II	
B	*Charadrius alexandrinus*	p	P	II	
I	*Ampelisca rubella*		P		O
I	*Balanus* sp.		P		O
I	*Ericthonius punctatus*		P		O
I	*Eriphia spiniformis*		P		O
I	*Gammarus credula*		P		O
I	*Hymedesmia peachii*		P		O
I	*Ischyorocerus inexpectatus*		P		O
I	*Liljeborgia dellavallei*		P		O
I	*Maera grossimana*		P		O
I	*Metaphoxus simplex*		P		O
I	*Nassarius incrassatus*		P		O
I	*Pachigrapsus marmoratus*		P		O
I	*Prosuberites epiphitum*		P		O
I	*Stenothoe cavimana*		P		O
I	*Sycon* sp.		P		O
M	*Tursiops truncatus*	p	V	II	
M	*Balaenoptera physalus*		P	IV	
M	*Delphinus delphis*		P	IV	
M	*Stenella coeruleoalba*		P	IV	
R	*Caretta caretta*	r	V	II	
R	*Chelonia mydas*		P		C

The *questionnaire* applied well established procedures (Zagonari, 2016) to estimate the relative concerns for economic, social and environmental features.

The main characteristics of the 22 stakeholders involved in the first (real) *meeting* in Pescara (Italy) on 24th January 2020 can be summarised as follows: 18 male and 4 female; 1 below 26 years old, 2

between 26 and 35 years old, 5 between 36 and 50 years old, 12 between 51 and 60 years old, and 2 above 61 years old; 6 with an higher education degree, 9 with a bachelor degree, 4 with a master degree, and 3 with a doctoral degree; 8 employed in public services, 8 employed in private firms, 2 employed in environmental organisations, and 4 in other jobs. Note that the sample of stakeholders is deliberately chosen so small to check for the effectiveness of the suggested methodology in saving time and money required to involve large numbers of stakeholders.
The case study suggests to disregard as irrelevant the options 5 to 8 of the SBM by Lüdeke-Freund et al. (2018). In particular, the estimated relative weights (i.e., 30, 28, 42 for economic, social and environmental features, respectively) suggest that the *theoretical* choice should be 3 over 4 about *what* options, and 11 over 10 about *who* options. Indeed, Zagonari (2021) showed that reusing should be preferred to decommissioning within a linear economic rather than a circular economy (i.e., 3 is better than 4) and that reusing vs. decommissioning is an inter-generational equity issues which requires laws and regulations (i.e., 11 is better than 10).

4. The empirical results

In order to identify the sustainable and rational decision practically suggested by the 22 involved stakeholders, we linked each answer to each point in the questionnaire to options from 1 to 4 and option 9 about the *what* options, and options 10 and 11 about *who* options (see Appendix). In particular, we will adopt two main perspectives about *how*: the stakeholder representative perspective, where we calculate the average of responses, under the assumption that the characterisation of stakeholders is unimodal and symmetric; the majority stakeholder perspective, where we calculate the votes that each option would obtain, under that assumption that each stakeholder votes his/her most preferred option. In other words, we refer to group decisions on which use should be chosen (see Herghiligiu et al. (2019) on SBM for management choices). The comparison of the theoretical and empirical choices highlights possible information gaps. Table 2 presents the empirical choices.

Table 2. The empirical choices by the 22 stakeholders (percentages).

	What 1	What 2	What 3	What 4	What 9	Who 10	Who 11
Representative stakeholder	51	38	44	50	40	44	33
Stakeholders' votes	25	0	20	36	18	59	41

Thus, the ranking of options in terms of the representative stakeholder is 1 ~ 4 > 3 > 9 > 2 for *what* options and 10 > 11 for *who* options, whereas the ranking of options in terms of the stakeholders' votes is 4 > 1 > 3 ~ 9 > 2 for *what* options and 10 > 11 for *who* options. Therefore, the SBM should be applied by using stakeholders' votes.
Figures 4 and 5 represent the distribution of scores among the 22 stakeholders for the *what* and *who* options, respectively, whereas Figures 6 and 7 represent the distribution of votes among the 22 stakeholders for the *what* and *who* options, respectively.
Note that the variance of scores for option *what* 3 is smaller than for option *what* 4 (i.e., 0.08 < 0.11). Next, in terms of scores, option *what* 4 is correlated with option *who* 11 to a greater extent than with option *who* 10 (i.e., 0.42 > 0.13) (Table 3).
However, in terms of votes, option *what* 3 is correlated with option *who* 11 to a greater extent than option *what* 4 (i.e., 0.17 > 0.05) (Table 4). Next, there is no uncertainty about the *who* options, while there is uncertainty about the *what* option (i.e., the same score for options *what* 3 and 4 by stakeholders 6 and 10; the same score for option *what* 1 and 3 for stakeholder 9).
Therefore, the following three issues are identified:

1. option *what* 1 is preferred to option *what* 3
2. option *who* 10 is preferred to option *who* 11
3. there is no correlation between *what* option 4 and *who* option 10.

We enlarged the sample by involving 11 additional stakeholders (i.e., an increase by 50% from 22 to 33 stakeholders) to check if these issues are due to the sample size.

Figure 4. Distribution of scores among the 22 stakeholders on the *what* options.

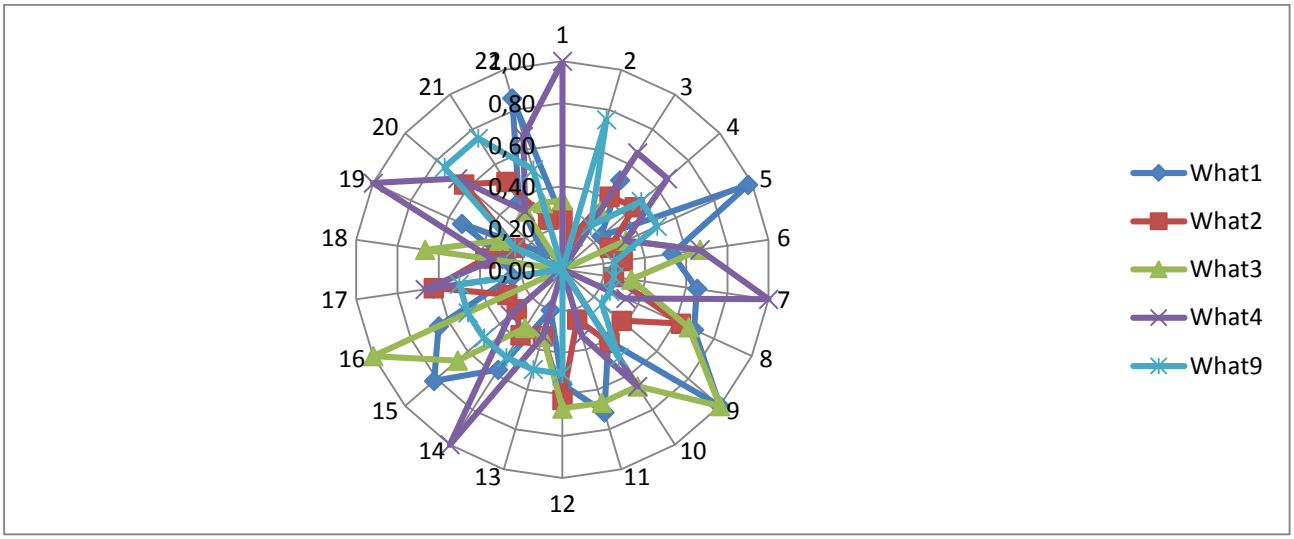


Figure 5. Distribution of scores among the 22 stakeholders on the *who* options.

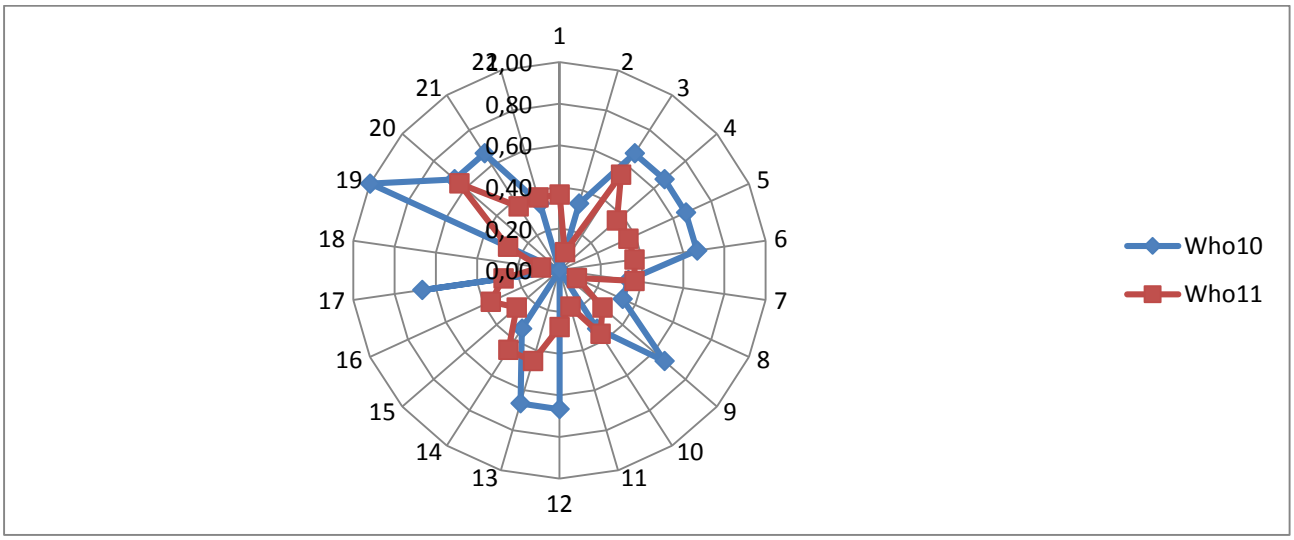


Figure 6. Distribution of votes among the 22 stakeholders on the *what* options.

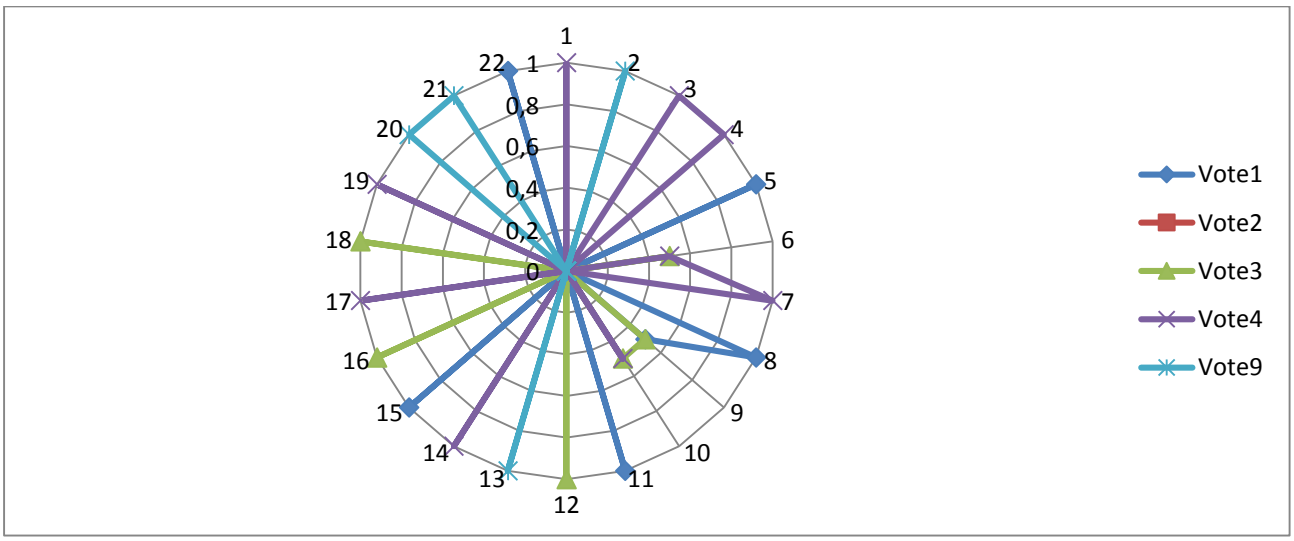


Figure 7. Distribution of votes among the 22 stakeholders on the *who* options.

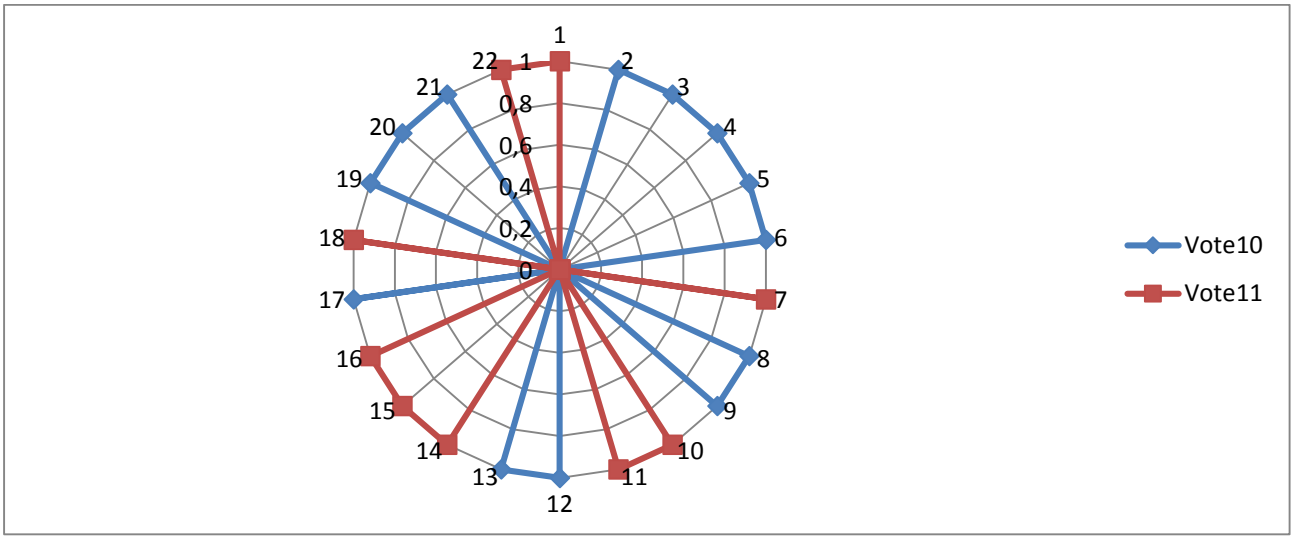


Table 3. Correlations of scores by the 22 stakeholders. Underlined = uncertainty between alternative *what* options; italics = inconsistency between *what* and *who* options; bold = consistency between *what* and *who* options.

	What2	What3	What4	What9	Who10	Who11
What1	-0.23	0.60	-0.16	-0.24	-0.08	-0.10
What2	1	-0.11	-0.09	0.26	*0.33*	0.14
What3		1	-0.45	-0.42	-0.37	-0.29
What4			1	-0.23	**0.13**	*0.42*
What9				1	*0.34*	**0.33**
Who10					1	0.35

Table 4. Correlations of votes by the 22 stakeholders. Italics = inconsistency between *what* and *who* options; bold = consistency between *what* and *who* options.

	What2	What3	What4	What9	Who10	Who11
What1	na	-0.26	-0.47	-0.28	-0.17	0.17
What2	na	na	na	na	na	na
What3		1	-0.32	-0.27	-0.17	**0.17**
What4			1	-0.38	-0.05	0.05
What9				1	*0.39*	-0.39
Who10					1	**-1**

The relative weights for 33 stakeholders are similar (i.e., 31, 24, 44 for economic, social and environmental features, respectively) and consequently the theoretical choice is the same (i.e., 3 > 4 and 11 > 10). Table 5 presents the empirical choices.

Table 5. The empirical choices by the 33 stakeholders (percentages).

	What 1	What 2	What 3	What 4	What 9	Who 10	Who 11
Representative stakeholder	44	36	43	51	43	42	36
Stakeholders' votes	20	3	24	38	15	55	45

Thus, the ranking of options in terms of the representative stakeholder is 4 > 1 ~ 3 = 9 > 2 for *what* options and 10 > 11 for *who* options, whereas the ranking of options in terms of the stakeholders' votes is 4 > 3 > 1 > 9 > 2 for *what* options and 10 > 11 for *who* options. Therefore, the first issue highlighted above (i.e., option *what* 1 being preferred to option *what* 3) has been solved by referring to a larger sample.

Figures 8 and 9 represent the distribution of scores among the 33 stakeholders for the *what* and *who* options, respectively, whereas Figures 10 and 11 represent the distribution of votes among the 33 stakeholders for the *what* and *who* options, respectively.
Note that the variance of scores for option *what* 3 is still smaller than for option *what* 4 (i.e., 0.07 < 0.10). Next, in terms of scores, option *what* 4 is correlated with option *who* 11 to a greater extent than with option *who* 10 (i.e., 0.37 > 0.24) (Table 6).
However, in terms of votes, option *what* 3 is correlated with option *who* 11 and option *what* 4 is correlated with option *who* 10 (Table 7). Next, there is no uncertainty about the *who* options, while there is uncertainty about the *what* option (i.e., the same score for options *what* 3 and 4 by stakeholders 6, 10 and 25; the same score for option *what* 1 and 3 for stakeholder 9).
Therefore, the third issue highlighted above (i.e., there is no correlation between *what* option 4 and *who* option 10) has been solved by referring to a larger sample.
However, an information gap is still relevant, since 4 is preferred to 3 and 10 is preferred to 11 (i.e., the social features are over weighted): an additional meeting between stakeholders and experts seem to be needed to discuss some specific issues.

Figure 8. Distribution of scores among the 33 stakeholders on the *what* options.

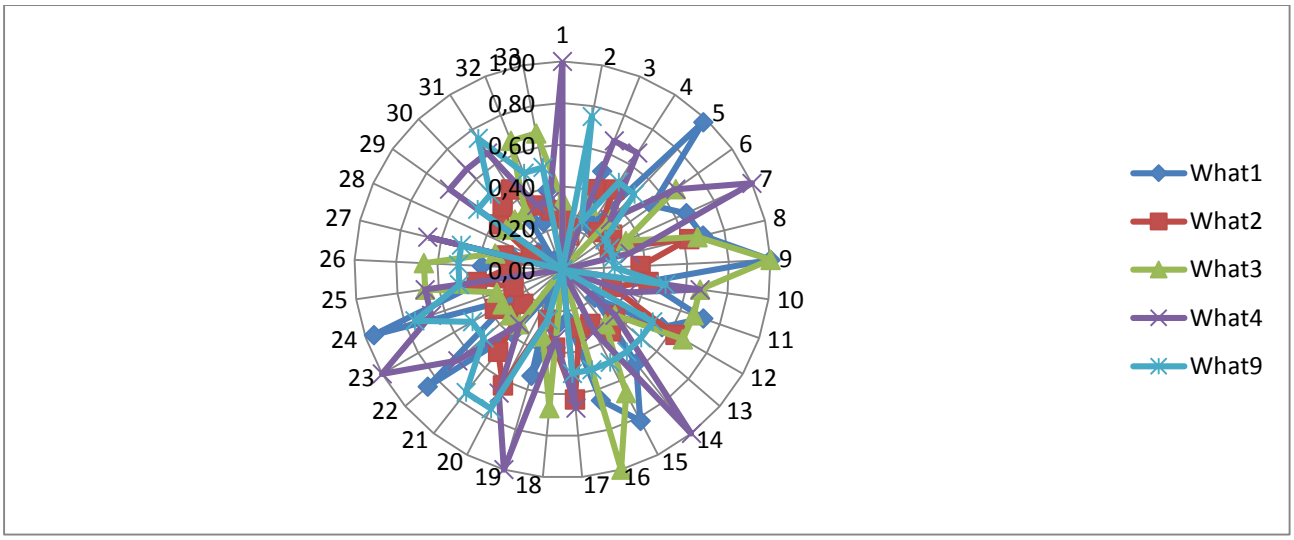


Figure 9. Distribution of scores among the 33 stakeholders on the *who* options.

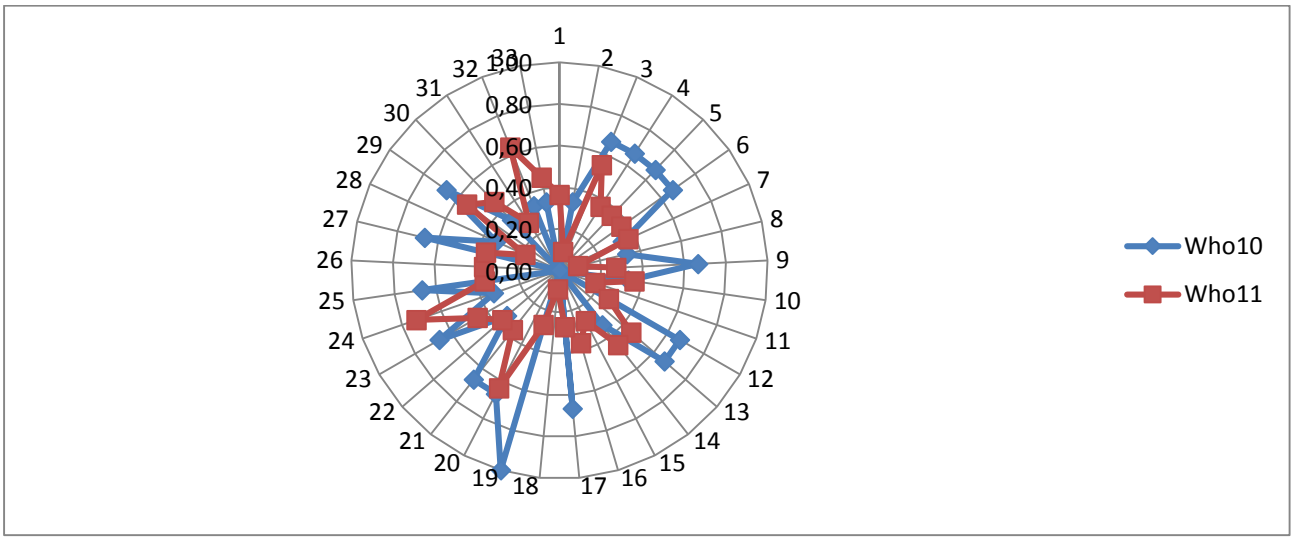


Figure 10. Distribution of votes among the 33 stakeholders on the *what* options.

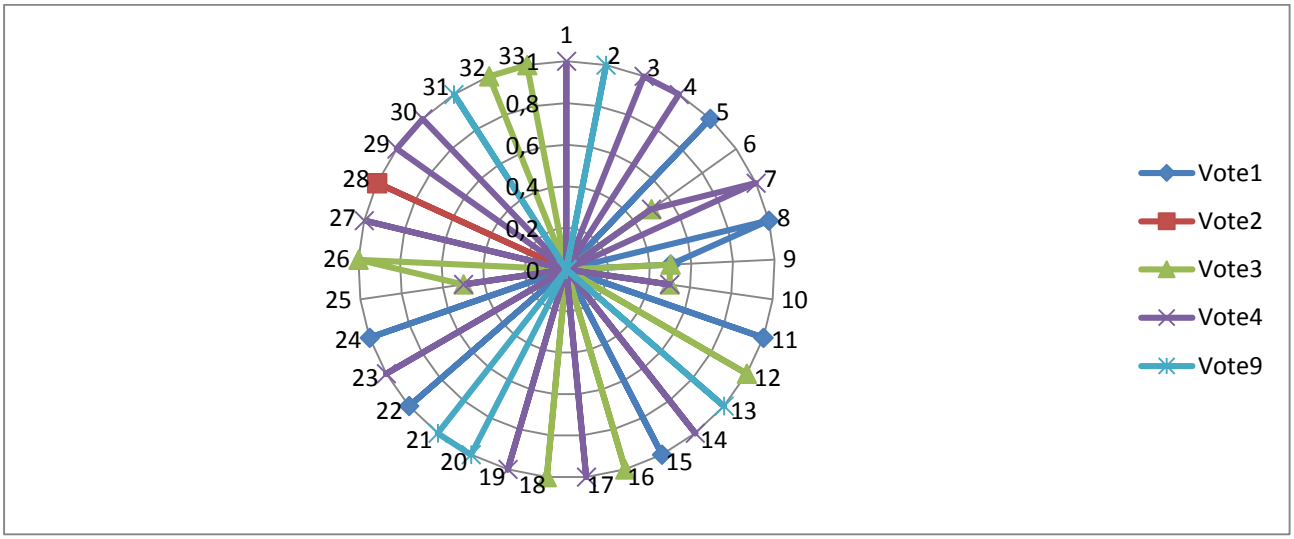


Figure 11. Distribution of votes among the 33 stakeholders on the *who* options.

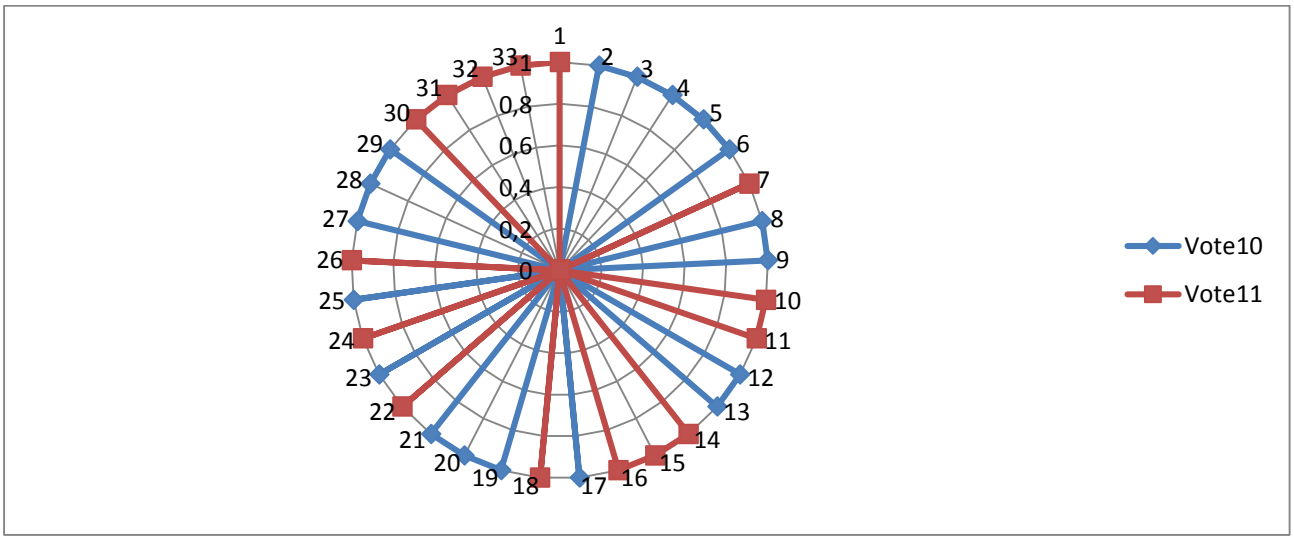


Table 6. Correlations of scores by the 33 stakeholders. Underlined = uncertainty between alternative *what* options; italics = inconsistency between *what* and *who* options; bold = consistency between *what* and *who* options.

	What2	What3	What4	What9	Who10	Who11
What1	-0.15	<u>0.49</u>	-0.08	-0.09	-0.06	-0.02
What2	1	-0.05	0.07	<u>0.27</u>	*0.30*	0.04
What3		1	-0.36	-0.23	-0.31	-0.12
What4			1	-0.01	**0.24**	*0.37*
What9				1	*0.19*	**0.43**
Who10					1	<u>0.25</u>

Table 7. Correlations of votes by the 33 stakeholders. Underlined = uncertainty between alternative *what* options; italics = inconsistency between *what* and *who* options; bold = consistency between *what* and *who* options.

	What2	What3	What4	What9	Who10	Who11
What1	-0.09	-0.26	-0.42	-0.21	-0.16	0.16
What2	1	-0.11	-0.15	-0.07	*0.16*	-0.16
What3		1	-0.38	-0.26	-0.29	**0.29**
What4			1	-0.35	**0.16**	-0.16
What9				1	*0.22*	-0.22
Who10					1	**-1**

In summary, the comprehensive SBM proposed by Lüdeke-Freund et al. (2018), combined with the methodology suggested in this paper, lead to an *empirical* sustainable decision for a complicated case (due to the absence of previous stakeholders' experiences at local and national level) which is consistent with relative weights expressed by stakeholders. However, this decision is *theoretically* wrong, since option *what* 3 (empirically correlated with the proper option *who* 11) should have been preferred to option *what* 4 (empirically correlated with the proper option *who* 10).
Note that if all four indecisive stakeholders (i.e., the same scores attached to two options) removed their uncertainty in favour of option *what* 3, the choices in terms of votes would be 30% for option *what* 3 and 33% for option *what* 4.

5. Discussion

In this paper we applied established procedures to estimate relative weights attached to economic, social and environmental features (Zagonari, 2016). We applied these relative weights to a comprehensive SBM (Lüdeke-Freund et al., 2018) to identify the theoretical choice consistent with stakeholders' concerns. We attached an option to each answer of the questionnaire to identify potential biased, inconsistent or wrong decisions. We compared alternative perspectives in taking a collective decision. We checked for sample size issues.
The main results of this paper can be summarised as follows. An adequate (large) sample of involved stakeholders and a necessary involvement of experts enable to practically obtain sustainable and rational (majority) decisions within a theoretical framework provided by SBMs.
The main weakness of the present study are the following:

- we referred to a specified SBM. However, the theoretical framework by Lüdeke-Freund et al. (2018) includes all essential features of sustainable decision making
- we focused on reuse. However, comparing decommissioning and reusing requires the preliminary identification of reuse options (Zagonari, 2021)

The main strengths of the present study are the following:

- we provided a general methodology to highlight *all* problems related to sustainable and rational decisions (i.e., participation, economic, social and environmental features, coherence with concerns, information gaps)
- we provided a simple methodology to solve these problems (i.e., majority, relative weights, 3-dimension simplex, involvement of experts)

In summary, we showed that majority decisions (as opposed to representative decisions) can avoid biased choices (i.e., option *what* 1 preferred to option *what* 3); a large sample (rather than a small sample) can avoid inconsistent choices (i.e., option *what* 4 uncorrelated with option *who* 10); additional meetings between experts and stakeholders can avoid wrong choices (i.e., option *what* 4 preferred to option *what* 3).

6. Conclusion

The *purpose* of this paper was to suggest an empirical methodology to make SBMs a theoretical framework which practically recommends *what*, *who*, *when*, *where* and *how* to do within sustainable decision making. The main result obtained in the present study is that a SBM might not be accurate in identifying the best choice. In particular, while *when* and *where* depended on the case study, we suggested the involvement of experts to solve information gaps (about *what* or *who*); a tight check for sample size issues to improve stakeholders' representativeness; a perspective based on stakeholders' votes (about *how*) to cope with multi-modal and asymmetric preferences.
In summary, in terms of votes rather than in terms of scores and for a large rather than for a small sample of stakeholders, we obtained the right correlation between option *what* 3 with option *who* 11 as well as between option *what* 4 with option *who* 10, without uncertainty about *who* options, but with an overemphasis on the cooperation approach as opposed to the institutional approach together with a preference for eco-design (although properly correlated with an institutional approach) over circular economy (although properly correlated with a cooperative approach).

Appendix

PART I

1. Which of the following activities, in your opinion, could be considered relevant as a value creation proposal in the process of converting an offshore platform? Select max 2 answers:

 Scientific / ecological application activities (artificial reefs, biodiversity hot spots and fish restocking sheltered from fishermen's nets and underwater paradise for underwater, naturalistic and sports tourism). [3]

 Productive activities in support of the Circular Economy and Blue Growth (e.g. marine culture or exploitation of renewable energies - off-shore wind-farm). [4]

 Environmental activities (environmental monitoring, maritime traffic control, etc.). [9]

 Tourist / recreational activities with high experiential content (hotel structures - temporary islands, activities related to underwater tourism and fishing). [1]

 Activities related to the construction of a regasification station. [2]

 Other (specify what)

2. Which of the following key partners, in your opinion, should play a key role in the conversion process of an offshore platform? Select max 3 answers:

 Ship-owners and naval cooperatives [10]

 Associations to protect the environment [11]

 Diving club [1]

 Region and municipalities [11]

 Chamber of commerce [1]

 Port authority [11]

 Zoo prophylactic Institute [11]

 University [11]

 Research centres [11]

 United Nations Convention [11]

 International Maritime Organization [11]

 Engineering company [2]

 Industrial Federation [2]

 Other

3. Which of the following key activities, in your opinion, are most important in the process of converting an offshore platform? Select max 3 answers:

 Redevelop the offshore structure [3]

 Protection of biodiversity [4]

 Creation of artificial reefs [9]

 Residential conversion of platforms [2]

 Encourage tourism in the area [1]

 Enhance local resources [9]

 Producing energy from renewable sources: photovoltaic systems, wind turbines, collectors of energy from waves [2]

4. Which of the following key resources, in your opinion, should play a key role in the process of converting an offshore platform? Select max 3 answers:

 Managerial [2]

 Regulations [11]

 Safeguarding marine flora and fauna [10]

 Policy making [11]

 Engineering [1]

 Others

5. What, in your opinion, should be the aim to be pursued in a process of converting an offshore platform, from the point of view of customer relations? Select max 1 answer:

 Ecology and sustainability [3]

 Building a culture that encourages change and innovation [9]

 Circular and shared economy [4]

 Other

6. In your opinion, what could potential customers be in a hypothesis of converting an offshore platform? Select max 2 answers:

 High spending people [2]

 People looking for a high experiential content [11]

 Athletes and sportsmen [1]

 Non-profit organizations and organizations [10]

 Other

7. The issue of the recovery of offshore platforms has become a key activity for the coming years: both in terms of environmental sustainability and potential source of revenues (in our seas there are currently 120 production platforms, 10 production support platforms and 9 non-operational platforms). How much do you agree with this statement? (on a scale of 1 to 7, where 1 corresponds to "strongly against" and 7 corresponds to "extremely agree"). [1]

8. When an offshore mining platform reaches the end of its production phase, can the alternatives be pursued, from a COST point of view, how do you evaluate the different hypotheses? [2]

Please provide an evaluation for each individual option:

OPTION I

TOTAL REMOVAL HYPOTHESIS (dismantling and complete removal of the implant) that implies:

- Design and management costs of decommissioning
- Removal, transport and grounding costs
- Remediation and disposal costs of polluting substances

Answer options:

- Extremely inappropriate hypothesis
- Hypothesis neither appropriate nor inappropriate
- Extremely appropriate hypothesis

OPTION II

PARTIAL REMOVAL HYPOTHESIS (you only remove a part of the structure, in most cases the deck, while the remaining part immersed is left on site) that implies:

- Design and management costs of partial removal
- Installation and maintenance costs
- Cost of disposal of polluting substances

Answer options:

- Extremely inappropriate hypothesis
- Hypothesis neither appropriate nor inappropriate
- Extremely appropriate hypothesis

OPTION III

RECONVERSION HYPOTHESIS (whole platform redevelopment for multiple uses) that implies:

- Costs of planning and management of the conversion
- Investment costs for the conversion
- Installation and maintenance costs

Answer options:

- Extremely inappropriate hypothesis
- Hypothesis neither appropriate nor inappropriate
- Extremely appropriate hypothesis

9. In your opinion what other relevant COSTS could be, not listed in the hypotheses mentioned above.

10. When an offshore mining platform reaches the end of its production phase, there may be different alternatives to pursue, from a REVENUE point of view, as it evaluates the various hypotheses. [2]

Please provide an evaluation for each individual option:

OPTION I:

TOTAL REMOVAL HYPOTHESIS (dismantling and complete removal of the plant) which implies possible Revenues deriving from:

- Recovery and sale of materials resulting from removal

Answer options:

- Extremely inappropriate hypothesis
- Hypothesis neither appropriate nor inappropriate
- Extremely appropriate hypothesis

OPTION II:

PARTIAL REMOVAL HYPOTHESIS (only a part of the structure is removed, in most cases the deck, while the remaining immersed part is left on site) which implies possible Revenues deriving from:

- Different use of the deck moved to other sites
- Construction of an artificial reefs
- Renewable energy production (solar, wind, marine waves etc.)
- Sale of aquaculture products

Answer options:

- Extremely inappropriate hypothesis
- Hypothesis neither appropriate nor inappropriate
- Extremely appropriate hypothesis

OPTION III:

RECONVERSION HYPOTHESIS (conversion of the entire platform left at sea intact) which implies possible Revenues deriving from different uses of the platform for multiple uses, including possible:

- Scientific / ecological application activities (e.g. zoo marine stations)

- Productive activities (e.g. fish farming)
- Environmental activities and monitoring (e.g. environmental monitoring station)
- Tourist / recreational activities with high experiential content (luxury hotel and restaurant, temporary Islands, issuing and issuing scuba diving patents)

Answer options:

- Extremely inappropriate hypothesis
- Hypothesis neither appropriate nor inappropriate
- Extremely appropriate hypothesis

11. In your opinion, what could be other relevant REVENUES, not listed in the aforementioned hypotheses?
12. How informed do you think you are about the opportunities and challenges arising from the decommissioning of offshore oil and gas infrastructure? (On a scale of 1 to 7, where 1 corresponds to "not at all informed" and 7 corresponds to "strongly informed")

PART II

13. By taking into account the economic, social and environmental impacts of reuse activities, could you please rank three cards representing these issues? (For example, social THEN economic THEN environment)
14. If you had the possibility to divide your cards by introducing blank cards, would you do (i.e., you might decide not to introduce additional cards)? This will suggest us that the card ranked above another card is much more important to you. (For example, social THEN 2 blank cards THEN economic THEN 1 blank card THEN environment)

Acknowledgments

This study was performed within the framework of the project PLaCE (PON Ricerca e Innovazione 2014-2020, project code: ARS01_00891), co-funded by the European Union.

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