

A SERVICE ECOSYSTEMS PERSPECTIVE ON DECOMMISSIONING OF OFFSHORE PLATFORMS: HIGHLIGHTS BY THE ITALIAN CONTEXT

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Purpose – Nowadays, the decommissioning of offshore platforms has been increasingly discussed because of its great social, economic, and environmental impact. The large number of actors involved and the complexity of regulatory framework push as well to adopt an ecosystems view able to explore the different resources, value propositions and co-creation practices arising from actors' engagement.

Methodology – This study is based on semi-structured interviews conducted with oil and gas key informant and stakeholders related to the Italian context.

Findings – The results of the analysis highlight the main ecosystem's elements at micro, meso and macro level related to the actors, resources, technologies, institutions and value propositions occurring in the Italian context of offshore platform decommissioning.

Research Implications – This work shed light on the importance to adopt a sustainable perspective as a critical driver in the predisposition of a governance framework relates to the future of the offshore platforms. In this sense, the study highlights several implications for both researchers and professionals in the field of governance and in the oil and gas industry.

Practical Implications – The results of the analysis underlined the great potential of a sustainable approach to the offshore platform decommissioning process. In this regard, offshore green farms, along with aquaculture and other local entrepreneurial activities, have emerged as suitable candidates for the co-location/multiple use of these assets and as a viable economic and social stimulus.

Originality – This work adopts an ecosystems view in order to re-read the Italian oil and gas industry and explore the different resources, value propositions and co-creation practices arising from actors' engagement. The analysis reveals that understanding the participation mechanisms utilized by communities is fundamental for improving the management and success of sustainable development in the context of offshore platforms decommissioning.

Keywords: *offshore platform; decommissioning; service ecosystem; sustainable development*

Paper type – Empirical paper

1. Introduction

Worldwide, the future of offshore platforms is increasingly discussed, mainly because their service life is forthcoming the end (Kruse et al., 2015; Day and Gusmitta, 2016; Tan et al., 2018). Offshore platforms are highly complex engineering structures that, over the years, have led to several both environmental, economic, and social reflections (El-Reedy, 2019).

Therefore, how manage these facilities has become increasingly a collective problem due to its social, economic, and ecological impact (Lakhal et al., 2009). The complexity of each removal activity, the high costs involved, the intricacy of regulatory framework (Hamzah, 2003), as well as the environmental impact (Schroeder and Love, 2004; Parente et al., 2006; Kruse et al., 2015) push to adopt an ecosystems view able to explore the different resources, value propositions and co-creation

practices arising from actors' engagement (Akaka et al., 2012; Vargo and Lusch, 2011;2016; Vargo et al., 2015; Polese et al., 2017, 2018; Troisi et al., 2019a,b).

In such a direction, this paper is aimed to investigate the main ecosystem's elements (actors, resources, technologies, institutions and value propositions) in the context of offshore platform decommissioning.

The paper is structured as follows: in the first section, a literature review on the definition of opportunities and issues related to decommissioning of offshore platforms is performed in order to identify a gap in the extant research stressing the need to accomplish an integrated view based on service ecosystems. Then, by applying a qualitative approach, the findings from the Italian case study allow the development of a theoretical framework that identifies the main drivers for sustainable growth in the process of reconversion of oil and gas assets. Finally, the discussion, implications and limitations of the study are considered.

2. Theoretical background

2.1 The decommissioning of offshore platforms

The decommissioning of offshore platforms process refers to a multidimensional and interdisciplinary process which can deeply impact macro factors like PESTLE (Political, Economic, Social, Legal, and Environmental) variables. As also highlighted by Capobianco et al. (2021), a sustainable approach in the process of decommissioning based on initiatives of readaptation of reusing can offer several advantages to the community and the environment.

The reconversion options, indeed, can impact positively the environmental sustainability by offering outcomes in terms of biodiversity enhancement, provision of reef habitat, and protection from bottom trawling, which instead are negatively affected by complete removal option. Also, other benefits can be obtained from the (total or partial) reuse of platforms by producing renewable energy which would lead to a "green decommissioning" (Smyth et al., 2015; Topham & McMillan, 2017; Pimentel Da Silva et al., 2018).

Therefore, by adopting a sustainable perspective, a revision of offshore decommissioning regulatory framework appears necessary in favour of a temporary suspension of obligatory removal (Fowler et al., 2014, 2018).

From a technical and safety point of view, several decision-making tools have been developed for evaluating the structures conditions, predicting the remaining useful life and for defining how to readapt and reengineering the platforms in order to create new sustainable value (Shafiee and Animah, 2017; Animah and Shafiee, 2018; Yang et al., 2019; Murray et al., 2018).

In addition, the offshore platforms could bring several social benefits, including from an employment perspective. In fact, the marine environment provides an increasing number of maritime-related job opportunities related to goods and services on seafood, shipping, fishing, as well as tourism activities: the largest share of such jobs is related to seafaring tourism and the enormous range of activities on offer (e.g., health, cultural, creative) (Froehlich et al. 2017).

2.2 A service ecosystem view on the reconversion of offshore platforms

A service ecosystem perspective is intended as “*relatively self-contained, self-adjusting systems of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange*” (Vargo and Lusch, 2016, pp. 10-11). This definition highlights the “*systemic, interconnected, interdependent nature of relationships*” (Frow et al., 2019, p. 2659) occurring among ecosystem actors, disposed to co-create value through the participation to resource-integrating practices. In a ecosystems view, the value can be considered as “*an increase in the viability (survivability, wellbeing) of the system*” (Vargo and Lusch, 2011). The interest in value co-creation in the ecosystem’s perspective has made clearer in recent years that “*the narrative of value co-creation is developing into one of resource-integrating, reciprocal-service-providing actors co-creating value through holistic, meaning-laden experiences in nested and overlapping service ecosystems, governed and evaluated through their institutional arrangements*” (Vargo and Lusch, 2016, p. 3). Accordingly, the value is not limited to the evaluation of an individual person but is based on the ability for a particular actor, or service system, to adapt and prosper in its social environment. That being said is aligned with various theories on systems (Barile and Polese, 2010, 2011) and provides a conceptual foundation for the consideration of a service system as a network of agents that integrate resources for value co-creation and interact dynamically and recursively in multi-level contexts of exchange and resource integration (Ng et al. 2012; Storbacka et al. 2016).

What has been said is suitable in light of the considerations about the reusing of offshore platforms where the adoption of a multi-level perspective that starts at the micro level and ends at the macro to encourage social and political-institutional paths of shared growth is fundamental. Indeed, the ecosystems’ view allows a multi-level analysis of a community’s actors, purposes, resources engaged, co-creation practices and allows light to be shed on stratified governance, decision-making and policymaking to capture challenges and implications at each level. All these dimensions promote the overall system’s growth. In this sense, the key elements of ecosystems are: 1) actors: the generic “users” engaged in value co-creation; 2) institutions: norms, social rules, practices and coordination mechanisms to attain shared purposes (Akaka et al. 2013; Vargo and Lusch 2016); 3) value propositions (VP): the proposal and the sharing of common values; 4) resource integration: the combination of value and knowledge; 5) technology: the enabling tools that improve interactions and actor’s engagement (Storbacka et al. 2016; Barile et al. 2017). Ecosystem’s elements are embedded across multiple contexts: micro (interactions between single actors), meso (networks of relationships) and macro (broader social and institutional context). By rereading the context of the offshore platforms as an ecosystem, the role of technology appears to be fundamental because able to mediate interactions based on the acceptance of common institutions and foster resource integration among actors and value co-creation processes at micro, meso and macro level.

Therefore, this paper is aimed at investigating the main ecosystem’s elements (actors, resources, technologies, institutions and value propositions) in the context of offshore platform decommissioning.

2 Methodology

2.1 Research design

In order to investigate the research question highlighted in the previous paragraph, this study aims to carry out a qualitative approach (Table 1). The results can help to identify the actors involved and the resources exchanges, the technologies, as well as the role of institutions. On the other hand, further considerations can help to shed light on the proper governance approach able to attain a sustainable development for the whole ecosystem (Frow et al., 2016).

The Italian context of offshore platforms has been selected for the analysis. A case study approach, in fact, can help for investigating in-depth the dynamics in a complex context from a particular standpoint (Eisenhardt, 1989; Yin, 1994). This qualitative methodology can be particularly suitable for investigating, as in this case, the phenomena which refer to multi-dimensional constructs that are not well operationalized (through quantitative variables) and defined semantically in all their shades of meaning in the extant research.

The Italian context has been selected because characterized by a large number of platforms. In particular, 116 Italian offshore platforms are still in operation (MISE, 2020), which are nearing the end of their production cycle and will thus have to be dismantled. In according with the application of the “Blue Economy principles” (European Commission, 2017) and the “Italian guidelines of decommissioning of offshore platforms”, some of these platforms could be re-use and re-conversion (MISE, 2019)

5 semi-structured interviews have been conducted with key informant and stakeholders – including experts, practitioners and scholars – belonging not only to the oil and gas sector, but also to energetic, tourism, academic, as well as aquafarm industry in the Italian context in order to consider the whole territorial system.

Table 1. Research design

Research question	Levels of analysis	Research aims	Methodology
Which are the main ecosystem’s elements (actors, resources, technologies, institutions and value propositions) in the context of offshore platform decommissioning?	Micro/Meso/Macro	Exploration of main ecosystem’s levels and elements: 1) actors 2) technologies 3) resources exchange 4) institutions	Semi-structured interviews (primary data)

Source: Authors’ elaboration.

3 Findings

3.2.1 Micro-level

The decommissioning of offshore platforms, indeed, can promote several entrepreneurial initiatives which can regard:

- Creation of marine weather centres;
- Extraction plant of salts or minerals from seawater (e.g., the extraction of magnesium from seawater);
- Construction of a regasification station (the liquid gas would arrive with ships, treated on the platform and sent ashore with the same sealine that transported the gas extracted in the previous life of the plant);
- Wind turbines, solar panels, and tidal energy;
- Popular point of interest for tourism initiatives and sport activities (e.g., scuba diving, water skiing, parasailing);
- Creation of an artificial reef suitable for marine repopulation, which would also have a function of attraction;
- Development of sustainable aquaculture business.

The economic stimulus derived from these entrepreneurial initiatives can also improve the employment rates in the territory (Todeschini et al., 2017). Therefore, as previously highlighted in the literature, a readaptation of offshore platforms can contribute to increase the jobs opportunities related to green energy as well as maritime context linked to technical diving, aquaculture, shipping, fishing, as well as tourism activities thanks to the provision of innovative recreational and wellbeing outdoor services (Kruse et al., 2015).

3.2.2 Meso-level

At meso level of the decommissioning of offshore platforms ecosystem several organizations which host most of the interactions between the users and the providers of service can be identified. This leading stakeholder group is composed of all organizations involved in the decommissioning of offshore platforms such as ship-owners and naval cooperatives, environmental association, United Nations Convention, International Maritime Organizations, chamber of commerce, engineering companies, port authority, industrial federation, zoo prophylactic institute, logistic partner, professional association of diving instructor such as PADI, IANTD, TDI, diving club, and sports federation. These organizations can support the process of decommissioning in terms of a sustainable approach and provide employment opportunities and at revitalizing, both economically and socially, related to readaptation of these assets.

3.2.3 Macro-level

The macro level of the decommissioning of offshore platforms ecosystem is based on state-level oil and gas agencies, national associations, and other relevant actors who are able to influence offshore platforms decommissioning policymaking. These actors directly or indirectly affect the establishment of the offshore service ecosystem, shaping the behaviours of users and providers of service at both the micro and the meso levels. State-level governing agencies set the institutional and policy conditions for the implementation and proper functioning of the decommissioning service system. As well as, major state-owned oil and gas companies in the world have the opportunity to affect the organizational policies and the operations of oil and gas organizations, stimulating them to adhere to an ecosystem perspective at the strategic and the operational level.

4 Theoretical and practical implications, limitations and future research

The analysis carried out reveals that, albeit the readaptation of the assets can contribute to the economic benefits for public and private organizations, a sustainable perspective should be considered as a critical aspect in the predisposition of a governance framework related to the predisposition of national and international guidelines about the offshore platforms (Hawkins & Wang, 2012; Haque & Ntim, 2018). However, knowledge exchange (through the numerous educational and formative events and activities which can be held on the platforms) and the strengthening of relationships among stakeholders (partnerships, consortia, social farms, etc.) appears to be a fundamental aspect for fostering the enhancement of a sense of sustainable activities shared by the community. At the macro-level, the knowledge exchanged gives birth to new knowledge and to a new mindset for the entire ecosystem, which is aimed at gaining social, economic and environmental sustainability.

Although local governments are becoming more active in pursuing environmental sustainability initiatives, understanding the participation mechanisms utilized by communities is critical for improving the management and success of sustainable development in the context of offshore platforms decommissioning. In this sense, the study provides several insights for researchers and professionals in both the local and national governance field and in the oil and gas industry.

From a managerial point of view, this work underlines the great potential of a sustainable approach to the offshore platform decommissioning process. In this regard, offshore green farms, along with aquaculture and other local entrepreneurial activities, have emerged as suitable candidates for the co-location/multiple use of these assets and as a viable economic and social stimulus for the local system.

However, this work provides preliminary results which open the way for more examinations aimed at reaching a profound understanding regarding the decommissioning of offshore platforms. In fact, the study carried out could be improved, since it is limited to a restricted number of interviews and mainly to the Italian context.

Future works can investigate specific Italian projects related to the decommissioning of offshore platforms in light of reconversion in order to analyse vertical cases and recognize best practices. In addition, quantitative studies can empirically detect the main drivers of value co-creation and sustainable practices through quantitative analysis aimed at analysing the statistical relations between the implementation of reconversion of offshore platforms, sustainable strategies, value co-creation and innovation. Also, it might be interesting associate to each ecosystem's context different co-creation practices with the aim to elaborate the targeted strategies to enhance co-creation and strengthen the relationships and trust among the actors in each level and in each phase of the delivery of service.

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