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## 3D: From Social Readiness to Social Acceptance

Guillaume Marchand<sup>a</sup>, Lolita Troilo<sup>b</sup>, Stéphane Jouenne<sup>b</sup>, Fabrice Devaux<sup>b</sup>, Vania Santos Moreau<sup>c</sup> et Vincent Pudys<sup>d</sup>

<sup>a</sup>Akkodis/TotalEnergies, France

<sup>b</sup>TotalEnergies, France

<sup>c</sup>IFPEN, France

<sup>d</sup>ArcelorMittal, France

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### Abstract

The "3D" industrial pilot aims to demonstrate an innovative process for capturing CO<sub>2</sub> from industrial activities (the DMX™), currently operational at ArcelorMittal's Dunkirk site. Supported by the European Union's Horizon 2020 Research and Innovation program, the project seeks to validate replicable technical solutions for Carbon Capture and Storage (CCS). It is driven by a consortium that includes TotalEnergies, ArcelorMittal, Axens, and IFP Energies Nouvelles (IFPEN). The paper will present the results from research focusing on social acceptance, led by TotalEnergies and with the collaboration of ERM and SYSTRA. A two-phased methodology was employed. The first analysed the context and stakeholders' perceptions through literature review and interviews with them (35 persons contacted, 30 interviewed among the principal groups of stakeholders identified). The second phase of the study involved forming a Civil Exploration Committee (CEC), comprising a selection of these stakeholders with the main ambition to strengthen dialogue on the technology and its deployment and co-construct an effective information and communication system for the future phases of the project 3D. Five CEC sessions were planned on different themes, co-defined with stakeholders (installation, visit of the demonstrator, landfill/storage, employment/training, safety/environment). These works done with stakeholders showed that the territory of Dunkirk offers good conditions for the development of the project 3D in terms of political support and industrial dynamics (energy and hub projects around the port, existing of the industrial ecosystem), which is positive in terms of social readiness. They also reveal positive elements for the social acceptance, because the interviewed stakeholders have trust in the Consortium and the technology of CCUS to fight climate change and believe that the project will bring economic and reputational benefits to the territory. In addition, participants of the CEC also recognized the efforts made by the Consortium to engage dialogue with them and appreciated the format of this committee. Nevertheless, some factors, such as the lack of knowledge on CCUS, the concerns about CO<sub>2</sub> storage and local risks or the decline of the participation within the CEC may challenge this acceptance and must have been considered with attention. This papers also presents how these challenges are addressed for the preparation of the future dialogue strategy of the Consortium.

*Keywords:* Social Acceptance, Social readiness, CCS, Dunkirk, Citizen committee

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### 1. Introduction

The following paper presents the results of the Work Package 7.3 of the project 3D: DMX Demonstration in Dunkirk. 3D is a pilot project of CO<sub>2</sub> capture driven by a Consortium grouping eleven European economic and R&D players and more especially ArcelorMittal France (AMF), Axens, TotalEnergies (TTE), IFP Energies Nouvelles (IFPEN).

The ambition of 3D is:

- To show the efficiency of the DMX<sup>tm</sup> process for capturing CO<sub>2</sub> at the scale of an industrial pilot, implemented at the site of the blast furnaces of AMF, located in Grande-Synthe in France.
- To prepare the development of the first industrial unit on the same site
- To study the feasibility of a potential CO<sub>2</sub> hub at the port of Dunkirk for collecting and exporting CO<sub>2</sub> to storage sites in the North Sea.

The WP 7.3 focuses on analysing social weak signals and determining social acceptance of the 3D Pilot and the potential next stages of the project 3D, if the Consortium choose to go to the industrial phase. In relation with this main objectives, three sub-objectives have been defined:

- Analysing the socio-economic and politic dimensions of the local context of the 3D Project and driving a mapping of its external stakeholders (public, civil and industrial partners around AMF facility).
- Testing a Civil Exploration Committee (CEC) to inform, explore and discuss the different parts and stages of the project and possibilities associated with CO<sub>2</sub> management.
- Building a strategy for stakeholder engagement based on the previous works, considering risk and opportunities, and key messages for communication relative to the project 3D itself and the deployment of a regional CCUS industry in the region (H<sub>2</sub> and CO<sub>2</sub> hub of Dunkirk).

#### Nomenclature

AMF	ArcelorMittal France
CUD	Urban Community of Dunkirk
IFPEN	Institut Français du Pétrole Energies Nouvelles
TTE	TotalEnergies

## 2. Methods

The methodology of the WP 7.3 has been defined by the 3D Consortium, particularly TotalEnergies, ArcelorMittal, and IFPEN, with the assistance of consultancy firms ERM and SYSTRA. These companies were responsible for gathering data, analysing them, reporting main results and animating meetings with stakeholders. The study of the social acceptance relied on mixed methods.

- The analysis of the social and territorial context involved a documentary review of regional press, Internet sites (including those of public services, entities, personal blogs of elected officials, and associations), and social media content from the previous year.
- The results of this documentary review were also used for stakeholders mapping and completed with 30 interviews (semi-directive interviews) with territorial players and representatives of the Consortium (1 for TTE, 2 for AMF, 1 for IFPEN). The objective of this work was to have a better understanding of their perception of the project, and to identify actors who support or oppose the project, certain aspects of the project, or CCS in general.
- The observation of the citizen committee (Comité d'Exploration Citoyen - CEC) and the completion of a specific survey to evaluate the perception of its participants on its functioning and its results and to gather their insights on how to prepare the future dialogue strategy of the project 3D.

The whole process of analysis was completed between November 2020 and August 2024.

### 3. Results

#### 3.1. Socio-political context

The Urban Community of Dunkirk (CUD), located in the Nord department of Hauts-de-France, consists of 17 municipalities and has a population of 196,901 inhabitants [1]. It plays a crucial role in economic development of these municipalities and at a regional scale, considering that the CUD collaborates with neighbouring regions (such as Côte d'Opale and Flanders in Belgium) and engages in negotiations at various levels. Despite demographic challenges such as population decline and high unemployment rate (the local rate is 2,5% higher than the national one), the industrial sector, particularly in chemical and pharmaceutical industries, sustains employment with one quarter of the active population working for these industries. The CUD and other public and private actors still invest in the port zone to attract new industrial actors. Other investments are related to energy, Dunkirk is also known as a European leading energy platform with recent project related to renewables, hydrogen and biofuels. Dunkirk is France's largest CO<sub>2</sub> emission zone due to its port activities and steel industries (circa 15Mt/year) and its decarbonization is a major challenge.

The analysis of the socio-political context reveals important aspects in terms of social readiness and social acceptance. One positive aspect is that for some local and regional actors, such as the president of the CUD, this challenge of decarbonization is seen as an opportunity rather than a normative constraint. Their idea is to turn Dunkirk's territory into a pioneer of French decarbonization activities which paves the road for the development of several transition technologies such as CCUS. Another positive aspect relates to the synergies between different economic sectors and the lack of conflicts between the political actors. In addition, the territory and its residents have a kind of culture of industrial risks which could reduce the worries towards a new activity such as the CCUS. Which are positive aspects for social readiness. Finally, in terms of social acceptance, civil society entities working on social or environmental issues which are usually inclined to oppose industrial projects, do not practice here a policy of empty chairs and are open to dialogue.

Notwithstanding, some elements of the local context must be taken into consideration to avoid potential social risks. First, even though the industrial activities seem to be perceived positively by the local population, the acceptance of new industrial activities is not guaranteed, for instance, projects of offshore windfarms raised several oppositions from various actors. Second, some economic and political actors expressed their concerns about the high level of dependency of the CUD to the industrial activities and more especially the dependency to AMF which accounts for 45% of the port's activities. Some of them want to raise the share of other economic sectors such as tourism which could not be compatible with the objectives of developing a new CO<sub>2</sub> and H<sub>2</sub> hub and all the related infrastructure. Third, in general, places with high social or environmental value ecosystems or landscapes are less inclined to accept new industrial activities [2] [3]. In this regard, the territory of the CUD is highly artificialized, but it contains ZNIEFFs (zones of ecological interest) in marine and wetland environments and two terrestrial Natura 2000 areas, which could be obstacles to local acceptance of new infrastructures or new activities.

#### 3.2. Stakeholder mapping

For the stakeholder mapping and the analysis of their perception of the 3D project, 35 actors were contacted for being interviewed but only 30 accepted, nevertheless this sample covers the main categories of stakeholders expected for this kind of project in the French context. It contains local elected, economic players, local environmental and social associations, actors of the sector of energy, local unions, residents, representatives of state services and representatives of higher education institutions [4]. After the interviews, their discourses and their stances towards the project have been analysed and the main results are presented in the next two next figures.

The first one (fig.1) is a map analysing the potential level of engagement of the stakeholders according to their level of involvement in the project and their attitude towards it. This map reveals that most part of the stakeholders

interviewed who belong to the economic and public sectors are favourable to the 3D project, although their involvement in the project may vary. On the other hand, as expected, associative players, groups of residents and unions are more cautious [5] [6]. This map also helps us to define strategies of stakeholder engagement. For those in the upper-left quadrant, our goal is to strengthen the relation with them and make them key interlocutors of our project. For those in the lower left quadrant, the objective is to increase their involvement or, at least, keep them satisfied with our activities. Finally, the more cautious actors must be kept informed and reassured that we take into consideration their concerns.

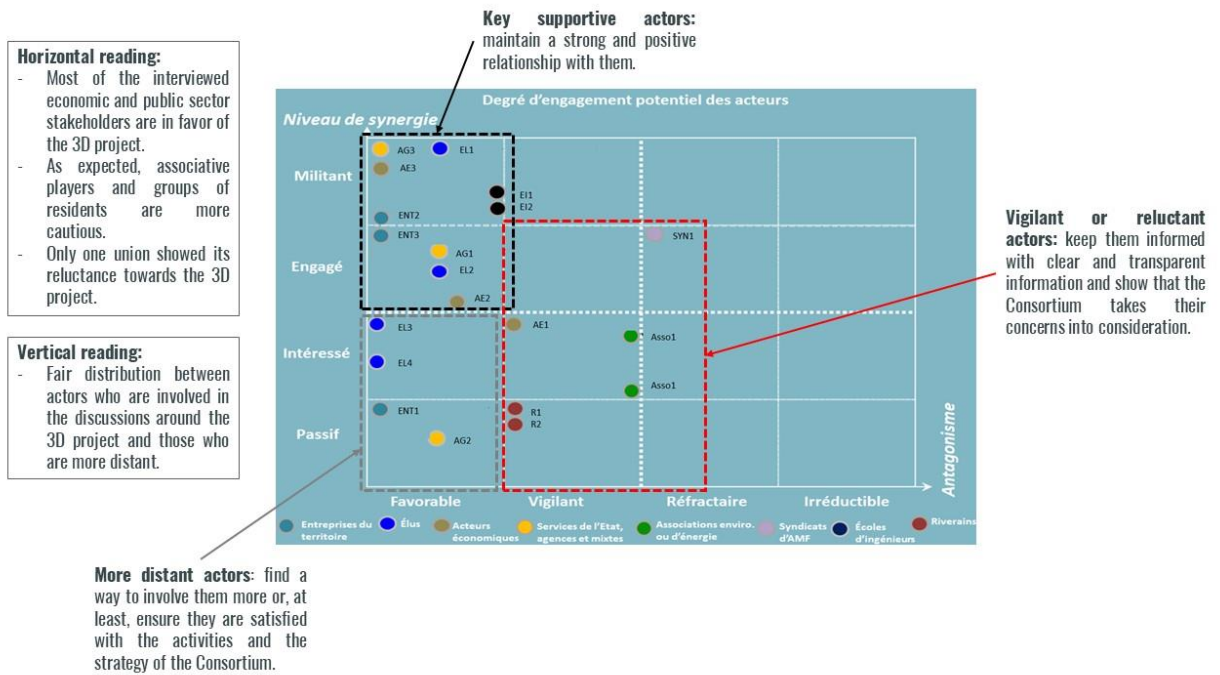


Fig. 1. Results of the mapping of the 3D project's stakeholders

The second figure (fig.2) highlights the stakeholders' perceptions of the 3D project detailing some of the main positive and most challenging aspects. Among the most positive aspects, it should be noted that our stakeholders perceive the 3D project as a solution to struggle against climate change and local emissions which is not always the case in the French context [7] [8]. They also consider that the project 3D will maintain and develop industrial activities, and, consequently, will preserve local jobs and offer new perspective of career. From their point of view, the 3D project fits to the territory of Dunkirk and its local industrial ecosystem. Nevertheless, they express some concerns on potential local industrial and environmental risks and express their preference for CO<sub>2</sub> reuse over offshore geological storage. The interviewed actors believe in the capacity of the Consortium to drive the project responsibly but have some doubts on their climate motivations. Because TTE and AMF have recently closed facilities in other parts of the French territory, our interviewees also have some doubts on their territorial commitments.

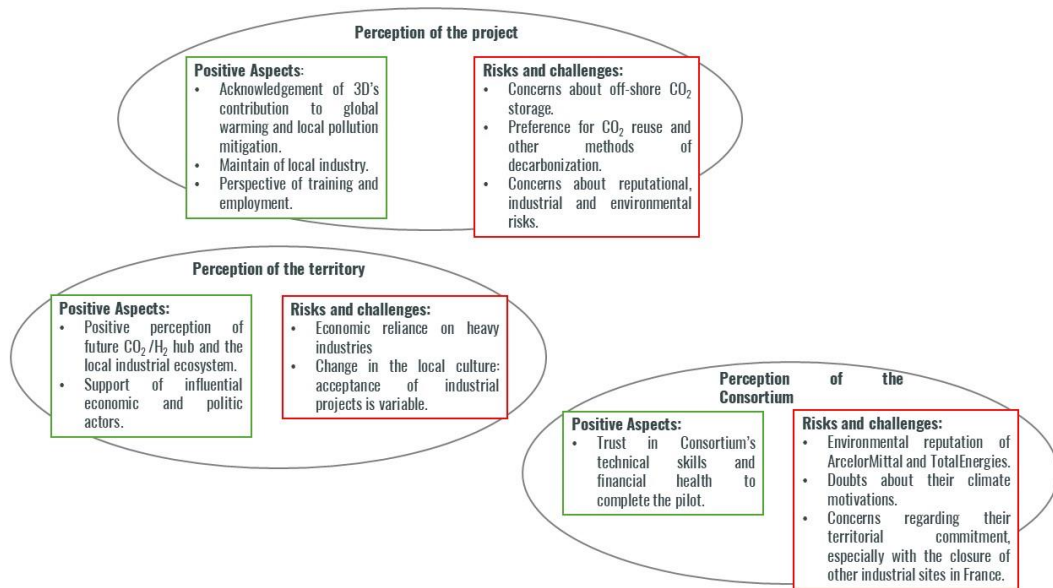


Fig. 2. Analysis of the perception of the 3D pilot's stakeholders

### 3.3. The results of the Civil Exploration Committee

The Civil Exploration Committee was built on the results of the stakeholder analysis. Its main objectives were defined collaboratively between the Consortium and representatives from the local area (CUD, Grand Port Maritime de Dunkerque, Chambre de Commerce et d'Industrie). The CEC's primary purpose is to assist the Consortium in defining its actions in terms of information and dialogue with the public (content, methods, channels, frequency, scope), aiming to promote mutual understanding and the acceptance of CCS (Carbon Capture and Storage) initiatives and the 3D project. In addition, the CEC seeks to gain experience and feedback from the dialogue with civil society to prepare future phases of public discussions if the Pilot evolves into a commercial project. The CEC had a duration of 2 years (2022-2024).

The CEC was composed of 15 members selected among residents, environmental associations and representatives from schools and universities in the area. In addition, three permanent representatives from TotalEnergies, IFPEN and ArcelorMittal were appointed to answer their questions and act as intermediaries with the Consortium. This CEC was supervised by a specific steering committee constituted of internal and external stakeholders and governed by a charter of good conduct and commitment. This charter defined sincerity, mutual respect, mutual listening and transparency as the key principles of the CEC, it also established that the consideration or non-consideration of expressed opinions must be justified to maintain the group's trust, in consequence the reasons leading the Consortium to accept or reject proposals from CEC members should be explained. All the integrates were involved in the definition of the agenda of the 5 planned meetings (see table). Participants of the CEC received 4 newsletters informing them about the progress of the 3D project.

Date of the meeting	Main subjects
May 18 <sup>th</sup> , 2022	Presentation of the 3D project and CEC objectives
September 20 <sup>th</sup> , 2022	Visit of the 3D pilot's site, signature of the commitments charter
December 6 <sup>th</sup> , 2022	CO2 transport and storage
April 4 <sup>th</sup> , 2023	Decarbonization in Dunkirk area, employment and training
January 18 <sup>th</sup> , 2024	Safety/environment and CCS worldwide

Table 1. Agendas of the CEC meetings

In general, each meeting registered an average of 8 members (60% of the expected attendance) but, it should be noticed that the participation declined through the cycle of the meetings. Most part of the stakeholders involved were satisfied with the CEC with a satisfaction score of 7.9 out of ten. They appreciated the format of the meetings and the quality of the information given even though they would like to have more information on specific subjects, such as CCUS maturity and the existing alternatives for decarbonizing industrial activities. They also raised punctual problems of language clarity and lack of pedagogy (use of too many technical terms and anglicisms by the Consortium's experts). 56% of the CEC members felt that the resources deployed (logistical organization, information communicated in advance of meetings, invitations, etc.) were more than adequate, and 44% considered them to be sufficient. 89% of them agreed or fully agreed that the CEC had achieved its main objective of explaining the Project 3D and the decarbonization strategy of ArcelorMittal.

The figure 3 shows the main topics raised by stakeholders during the meetings. While one might have expected questions about risks and benefits to be more prominent during discussions with external stakeholders, it is noted, on the contrary, that they are more interested in learning about the technical aspects of the project (capture via DMX<sup>™</sup> solvent, transport, and storage), its implementation, and its integration into the region.

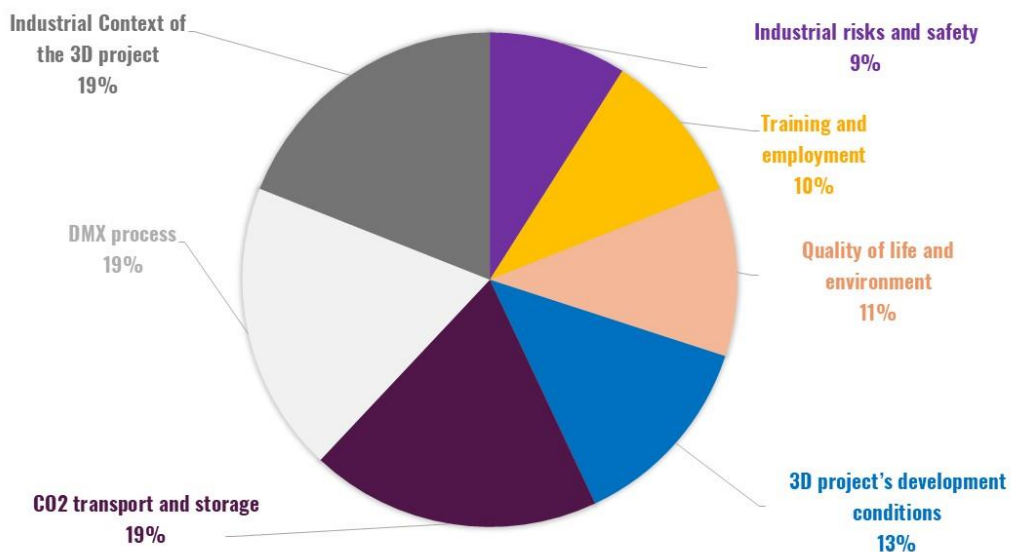


Fig. 3. Main topics raised by stakeholders during CEC meetings.

Despite the Consortium's efforts to cover a wide variety of topics during the CEC meetings and even though external stakeholders have expressed their satisfaction with the information provided, two important things must be noted. The first is that CCUS is still a poorly understood technology, and it is necessary to redouble efforts to ensure it is better comprehended. Considering this specific point, the situation of Dunkirk is aligned with the rest of the French territory and other European countries [9] [10] [11]. Our interlocutors, for example, have pointed out that they would like to have more information on the maturity level of CCUS technologies, more feedback on existing projects, and better information on how CCUS fits into efforts at various scales to combat climate change. The second is that our interlocutors also want to know more about existing alternatives to the deployment of CCUS for decarbonizing heavy industry.

In addition to the previously mentioned elements, the CEC members highlighted aspects to consider for the future dialogue strategy of the 3D project. They emphasized the need for more scientific data (simplified for better understanding by a general audience) and the expansion of information channels (local newspapers, social media, small group discussion workshops, local and regional radio). They also stressed the importance of developing local spokespeople to discuss CCUS, favouring community actors involved in education, community centres, and neighbourhood associations. Finally, they consider the organization of open house days as one of the best ways to better explain the project, which is one of the CEC actions they appreciated the most.

#### **4. Main findings and conclusions**

As mentioned before, the local context of Dunkirk is favourable to social readiness considering the strong political support and the positive dynamics around the local industrial ecosystem (large investments, development of new projects related to transition technologies, lack of conflicts among the political class).

Regarding the social acceptance of the 3D project, several factors indicate also a positive attitude among interviewed stakeholders. First, they have trust in the Consortium's ability to manage the project responsibly. Second, they recognize the process of CO<sub>2</sub> capture as a viable solution for industrial decarbonization. Third, they consider that the project will have positive impacts on the region's image and on the local industrial activities. Our Interviewed stakeholders see the CCUS value chain as an opportunity to protect local industrial jobs and develop new professions. Finally, the project gained support from influential local political and economic figures and did not face principled oppositions from civil society. Trust, legitimacy, spatial fit, perception of benefits and local political support are among the main factors for obtaining social acceptance described in the academic literature [12] [13] [14] [15].

However, some factors may challenge this acceptance and must have been considered with attention. The knowledge of CCUS technologies remains limited among the general population which could be a source of mistrust and concern if the project goes to industrial and commercial phases. Knowledge also needs to be addressed to prevent stakeholders from being influenced by preconceived notions, biases and misinformation from third parties. In addition, CO<sub>2</sub> storage is sometimes viewed negatively, likened to "sweeping under the rug" and interviewees revealed that local stakeholders prefer CO<sub>2</sub> reutilization. In terms of alternatives, some stakeholders have questioned the investment in CCS, suggesting that frugality, efficiency, and renewables will be better options to decarbonize heavy industry. Moreover, CCUS is sometimes seen as an industry backed by major polluter, which can make it less desirable than other means to fight against climate change. Two other elements are very important. First, we saw that concerns have been raised about potential local environmental and industrial risks, prompting requests for additional information. If these requests were not satisfied, the level of trust in CCUS and its supporters might decline. Second, the level of local acceptance of industrial projects has become more variable than before, if this trend evolves towards less tolerance to industrial activities and their nuisance, the adoption of new CCUS infrastructures could be difficult.

The table 2 summarizes the situation of the 3D project regarding the main factors of acceptance identified in the academic literature about CCUS, more especially [16] [17] [18] [19]. It shows that different principles of social acceptance were addressed positively.

Factors of acceptance	Description of what is analysed or assessed in the academic literature	Situation of the 3D pilot
<b>Procedural justice</b>	It relates to the implementation of an open, transparent and two-way dialogue, and inclusion of stakeholders in the decision-making process	<p style="text-align: center;"><b>Very Positive</b></p> <ul style="list-style-type: none"> <li>• Implementation of the CEC and respect of the established commitments in terms of dialogue.</li> <li>• Co-construction of the future dialogue and construction strategy.</li> </ul>
<b>Distributive justice</b>	It observes the way the benefits, costs and risks of a project or a technology are distributed among the population, when nuisance and damage cannot be avoided, populations must be compensated.	<p style="text-align: center;"><b>To be improved</b></p> <p>The CEC provided clear and transparent information on the potential benefits, nuisances, and risks related to CCUS activities, however the participants requested more information on these subjects. Compensation and specific measures for vulnerable groups were not addressed yet.</p>
<b>Trust</b>	This refers to the trust in operators, public authorities and legislation, and the trust in the developed technology or technologies in general.	<p style="text-align: center;"><b>Positive with some elements of concerns</b></p> <ul style="list-style-type: none"> <li>• CCUS is seen as a legitimate approach to combating climate change.</li> <li>• The Consortium is seen as able to responsibly manage the pilot and future CCUS activities.</li> <li>• CCUS is perceived as a solution supported by major polluters.</li> <li>• AMF and TTE face reputation issues that could affect trust in them.</li> </ul>
<b>Territorial context</b>	This factor analyses whether a technology or a project fits the identity of a territory or integrates local socio-economic and political dynamics. A good project does not disturb emotional or existential bonds to this territory.	<p style="text-align: center;"><b>Positive</b></p> <ul style="list-style-type: none"> <li>• The 3D project is viewed to improve the image of the territory, preserve local industries and reduce local pollution.</li> <li>• Strong support from local political and institutional actors.</li> </ul>
<b>Relationship between community and operators</b>	In this category are analysed the quality of the contact and the equity in the relationship between operators and communities. The presence of mediator/facilitators can improve this relationship (e.g., CLO or specific committees).	<p style="text-align: center;"><b>Very positive</b></p> <ul style="list-style-type: none"> <li>• Good level of satisfaction with the CEC and the quality of the dialogue between the consortium and external stakeholders.</li> <li>• The CEC identified local relays to facilitate the dialogue in the future.</li> </ul>
<b>Perception of risks/benefits balance</b>	Perception of the balance between socio-economic benefits and socio-economic and environmental risks at different scales (individual, community, global).	<p style="text-align: center;"><b>Positive with some elements of concerns</b></p> <p>Although interviewed external stakeholders sometimes expressed concerns about potential negative impacts at the local scale, it appears that the socio-economic opportunities mentioned above outweigh these concerns. Nevertheless, if their demands on supplementary information about risks were not satisfied, this could become a factor of risk.</p>
<b>Cognitive and psychological factors</b>	It relates to the level of knowledge about a technology or a project, feelings and emotions towards them, and, finally, individual values and beliefs. It addressed elements of theories about behaviour changes and the pressure of social norms.	<p style="text-align: center;"><b>To be improved</b></p> <ul style="list-style-type: none"> <li>• Lack of knowledge about CCUS</li> <li>• Some actors expressed their desire to reframe the debate on the 3D pilot within a broader perspective, that of the energy transition and the existing levers of industries decarbonization</li> <li>• This issue of the local social norms and other psychological factors need more research.</li> </ul>

Table 2. Insights on the acceptance of the 3D project considering the main factors of social acceptance identified in the academic literature



Furthermore, the contact established within the CEC between the Consortium and the stakeholders has allowed the former to become familiar with issues of acceptance and best practices for dialogue, and the latter to be involved in the co-construction of the public dialogue strategy. Nevertheless, we observed clear signs of demobilization as the process of the CEC progressed and, currently, we lack an explanation for this decline in attendance. This situation raises other research questions that need to be addressed for the preparation of the future strategy of dialogue e.g. how does increased knowledge impact public involvement? What mechanisms can sustain long-term engagement in contentious topics? What role does transparency play in shaping trust and continuous participation? It may be interesting to explore such research questions to sustain long-term public engagement in the case of 3D project.

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