Report of the DEEP-REST stakeholder workshop, 11 May 2022

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Purpose of this document

This report synthesizes the outcomes of the DEEP-REST stakeholder workshop held on May 11, 2022. It was produced by the DEEP-REST team members who facilitated the workshop, based on the contributions of the participants. The report includes a copy of all the written material produced during the break-out group discussions. It is intended for all workshop participants and members of the DEEP-REST consortium so that they have access to the material generated by all groups. This report may serve as a basis for further discussion in the next steps of the stakeholder consultation process within DEEP-REST and some elements may also be used in future academic work such as scientific publication.

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1. Background information

The workshop took place online via Zoom and was facilitated by the online tool Klaxoon.

Five break-out groups were constituted based on the type of organisation or the sector of activity of the participants (Table 1): 1) Authorities and policy makers composed of persons from intergovernmental and governmental agencies; 2) Conservation experts included essentially individuals from environmental NGOs; 3) Industry experts were from different sectors of activity (equipment manufacturing, industry organization, exploration, services provider, environmental monitoring and management, academic engineering sciences); 4) a group of research scientists including nine DEEP-REST scientists (from the fields of molecular biology, marine biology, marine microbiology, marine biogeochemistry, deep-sea biology and ecology, maritime law, economics and political sciences) and five scientists external to the DEEP-REST project (from the fields of maritime law, marine biology and ecology, and deep-sea ecology); and 5) a group of research scientists present on site (in Brest) composed exclusively of DEEP-REST scientists, from the fields of deep-sea ecology, deep-sea biology, geomicrobiology, marine biogeochemistry, and international law.

Table 1: Number of stakeholders invited and number of participants to the stakeholder workshop.

	Invited	Participants
Authorities & policy makers	49	4
Conservation experts	52	8
Industry experts	44	12
Research scientists (online)	21	14
Research scientists (on-site)	—	15

Break-out group discussions were organized around two phases:

Phase 1: identification of key issues and trigger factors

In this first phase, participants were asked to answer two questions about triggers and preventing factors for deep-sea mining (DSM), to be understood here as large-scale commercial deep-sea mining operations:

1. What may trigger the start of deep-sea mining?
2. What would make it impossible to start deep sea mining?

To answer each question, participants were asked to write ideas that first came to their mind on post-it notes (3 per person, 1 post-it note = 1 idea) and to place them on a dedicated board differentiating ideas concerning polymetallic nodule resource, seafloor massive sulphide deposit resource or both resources. The post-it notes were then sorted out by the facilitator and the participants following a “PESTEL” analysis grid (acronym for political, economic, social, technological, environmental, and legal). The results of the different groups are presented below.

Phase 2: identification of key actors and characterization of their interest and influence around deep-sea mining issues

In this second phase, participants were asked to name, in turn, one actor on a post-it note and to position it on a 2-axis chart on the basis of its interest (high interest/low interest) and influence (high influence/low influence) in relation to the issue of deep-sea mining. Actors had to be mentioned additively, so that when an actor was mentioned, it could not be cited again.

2. Synthesis of break-out group work

2.1 Authorities & policy makers group

PHASE 1: identification of key issues and trigger factors

QUESTION 1: What may trigger the start of deep-sea mining? (Figure 1)

Participants from the "authorities and policy makers" group highlighted that the adoption of regulations (by the International Seabed Authority for instance) could trigger the start of DSM, and that this approval of exploitation could be motivated by the pressure from contractors. In relation to this, the approval of a Plan of Work seems to be a major trigger that stands out from the social, technological, and environmental categories. The availability of the metals and the demand for these could also be key factors in the start of a large-scale commercial exploitation. Participants also cited the fact that with enough environmental data, and if the environmental impacts were acceptable, DSM would likely be able to start.

QUESTION 2: What would make it impossible to start deep-sea mining? (Figure 2)

Regarding the impediments to DSM, the political factors refer to (i) the absence of evidence of crucial need of the metals targeted, (ii) a situation where the voice of scientists would weigh more than the voice of contractors, and (iii) the absence of clear responsibilities to set the standards. The group also mentioned that high economic risks would be detrimental to such operations and that a lack of ISA regulations would probably mean no exploitation. Environmental factors cited here were the opposites of the ones cited for the previous question: lack of environmental data and inacceptable impacts would make it impossible to start DSM commercially. Environmental NGOs could also have a strong impact on the start of DSM, by interfering with operations at sea and by making "bad publicity" for the exploitation of these types of resources.

PHASE 2: Identification of key actors and characterization of their interest and influence around deep-sea mining issues (Figure 3).

Participants from the "authorities and policy makers" group identified a few stakeholders as having little interest: the general public, which they consider having little influence, and national NGOs focused on social issues, which tend to have a potentially strong influence (Figure 3). Environmental NGOs (such as WWF, Greenpeace, PEW, or the Deep-Sea Conservation Coalition) were identified as having high interest for the deep-sea mining issues, and moderate to high influence. With regard to this, the participants commented that it was difficult to position the various NGOs in relation to one another on the chart. The group members placed themselves ("involved administrations") as having a high interest but a rather low influence, due to the fact that even if they are asked for their opinion on the subject of DSM, they feel like it is not really considered. Regarding the industry, contracting parties were identified as having moderate influence and interest. The Metals Company (TMC) and its CEO were mentioned as having high interest and moderate to high influence. The most influential and interested actor cited by the participants was the Secretary-General of the International Seabed Authority (ISA). Participants commented that the influence of scientists and politicians on the ISA "depends on how much ISA likes them".

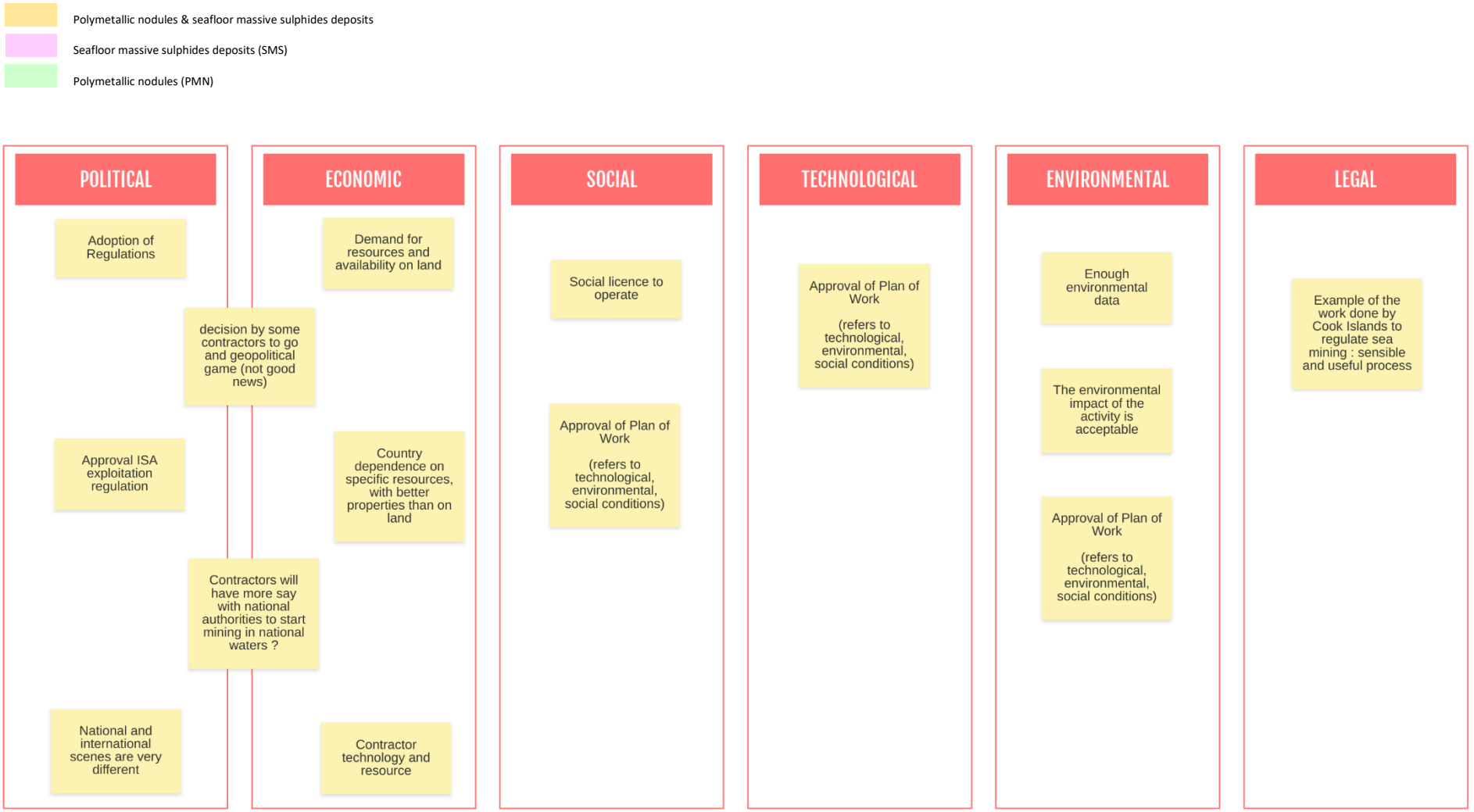

Figure 1: Answers of the "authorities and policy makers" group to question 1: What may trigger the start of deep-sea mining?

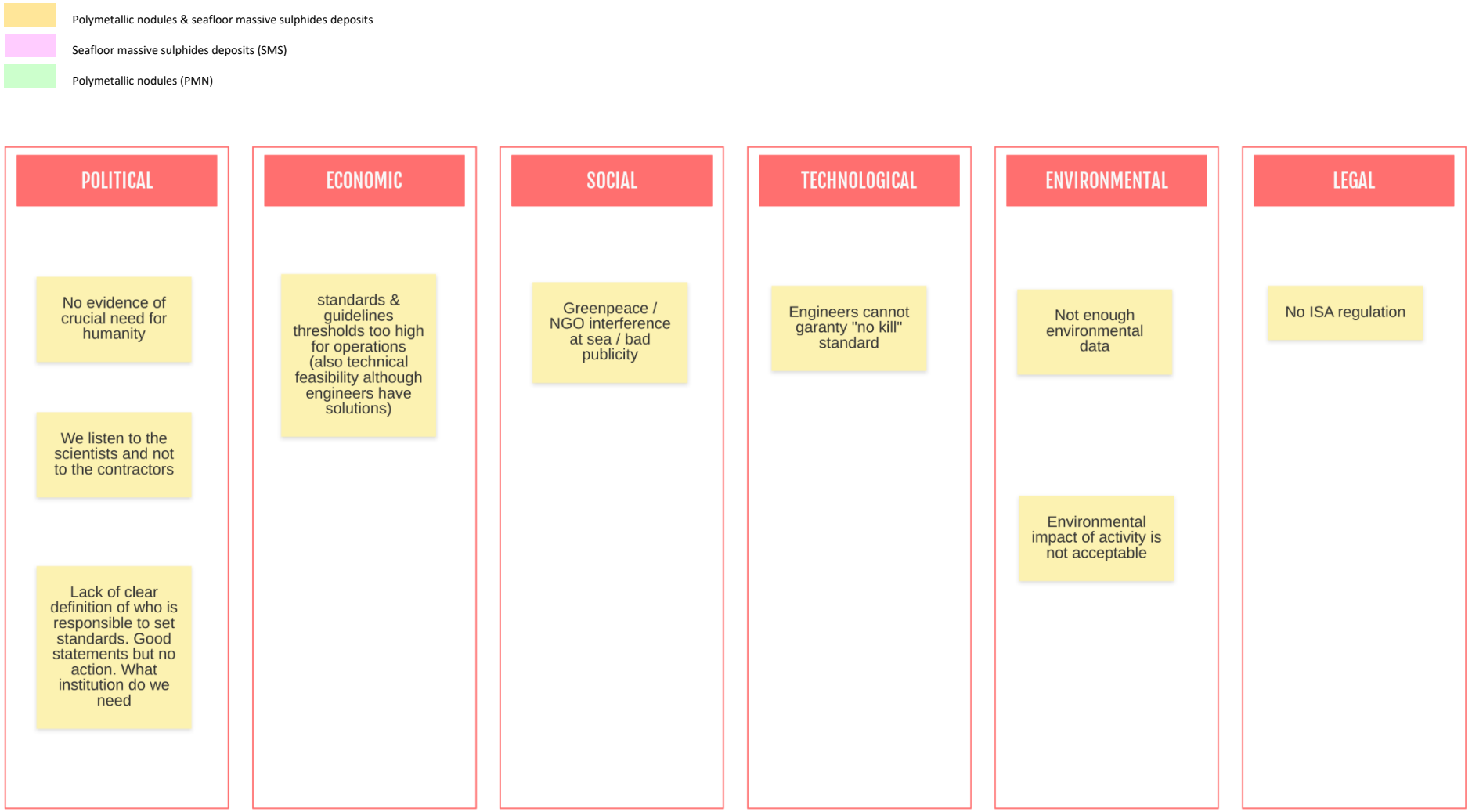

Figure 2: Answers of the "authorities and policy makers" group to question 2: What would make it impossible to start deep-sea mining?

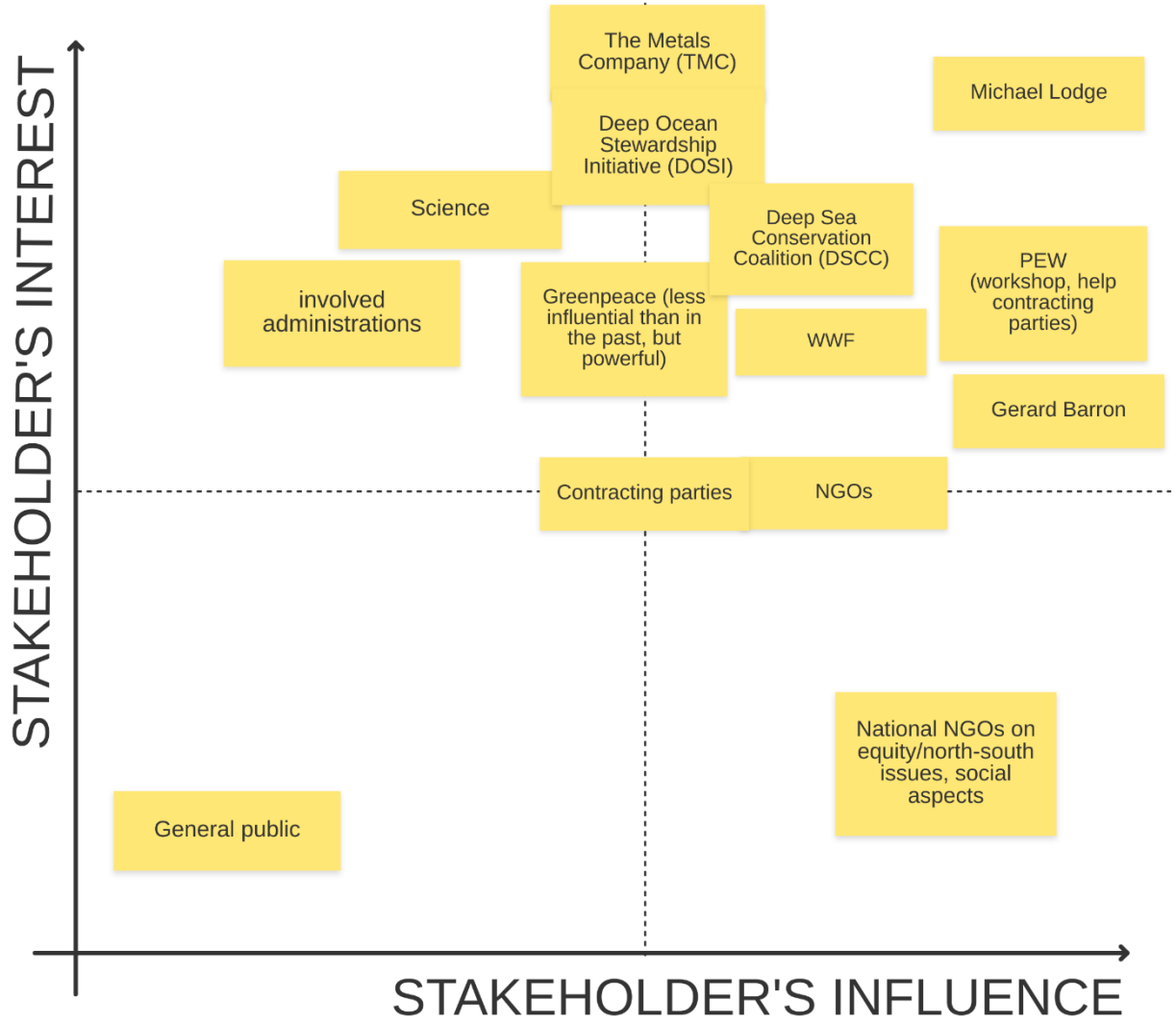

Figure 3: Identification of key actors and characterization of their interest and influence around deep-sea mining issues by the "authorities and policy makers" group.

2.2 Conservation experts group

Note: for timing reasons, participants of this group did not organize their ideas according to the PESTEL dimensions during the workshop. The categorization of ideas was carried out after the workshop by the authors of this report.

PHASE 1: identification of key issues and trigger factors

QUESTION 1: What may trigger the start of deep-sea mining? (Figure 4)

The participants of the "conservation experts" group identified three major elements constituting the political factors that could trigger the start of DSM. First, the structure and the functioning of the ISA, which, for them, are driven by members states with an interest in DSM and also make it impossible to engage all stakeholders and to find common interests. Second, a regulatory and legal system designed to facilitate DSM could ensure the start of exploitation operations. Third, self-interests were also widely mentioned, whether it is industry's self-interests or the states' self-interests. Another main trigger identified referred to the idea that DSM could be considered as "green", supported by the ideological driver that we always need more resources for the green transition (to support an economic growth, without serious considerations given to alternatives), and by the lack of knowledge about ecosystems, impacts, and restoration. Assumptions about the capacity to restore deep-sea ecosystems and to manage the impacts of the activity (despite the lack of knowledge) also stood out as a potential trigger for DSM. Regarding the technological factors, the transfer of industrial capacity from offshore oil/natural gas to mining was seen as enabling the start of DSM. The participants also mentioned the fact that the separation of DSM policies from other environmental policies (biodiversity and climate goals) may play in favour of the start of exploitation.

QUESTION 2: What would make it impossible to start deep-sea mining? (Figure 5)

Regarding preventing factors, the participants of the "conservation experts" group pointed out the possibility of a moratorium and the positioning of society against DSM and for alternative solutions. They also mentioned the effective application by the states of their legal obligations (e.g., article 145 UNCLOS - protection of the marine environment; environmental laws to stop the biodiversity loss), which includes the application of the precautionary approach. More generally, a transition away from the growth/extractive economy, as well as developing technologies that do not require deep-sea minerals and developing better reusing of metals would work against DSM, according to these stakeholders. The recognition by society of how the planet will be affected (in the long term) and the ocean role in the mitigation of climate change were also mentioned. Regarding the "legal" drivers, participants stressed the inclusion in the mining code that restoration is feasible, as well as the benefit sharing requirements in accordance with the "common heritage of mankind" principle.

PHASE 2: Identification of key actors and characterization of their interest and influence around deep-sea mining issues (Figure 6).

The "conservation experts" group members qualified environmental NGOs as having mostly little influence and according to them, few environmental NGOs are interested in DSM issues. Actors against DSM from the Pacific islands (such as NGOs or parliamentarians) were considered as having a high interest but little influence. Deep-sea biologists were considered as having a high interest but a moderate influence on the issues around DSM. The industry was identified with moderate to high influence and interest depending on whether they are directly involved in DSM operations or not.

According to the participants, the general public and the media have a potentially high influence capacity despite their moderate to low interest. The different ISA bodies and governments members of its council found themselves in the upper right quadrant of the chart (high interest and high influence) while international institutions and governments that are not members of the ISA were considered as having low interest but a high influence.

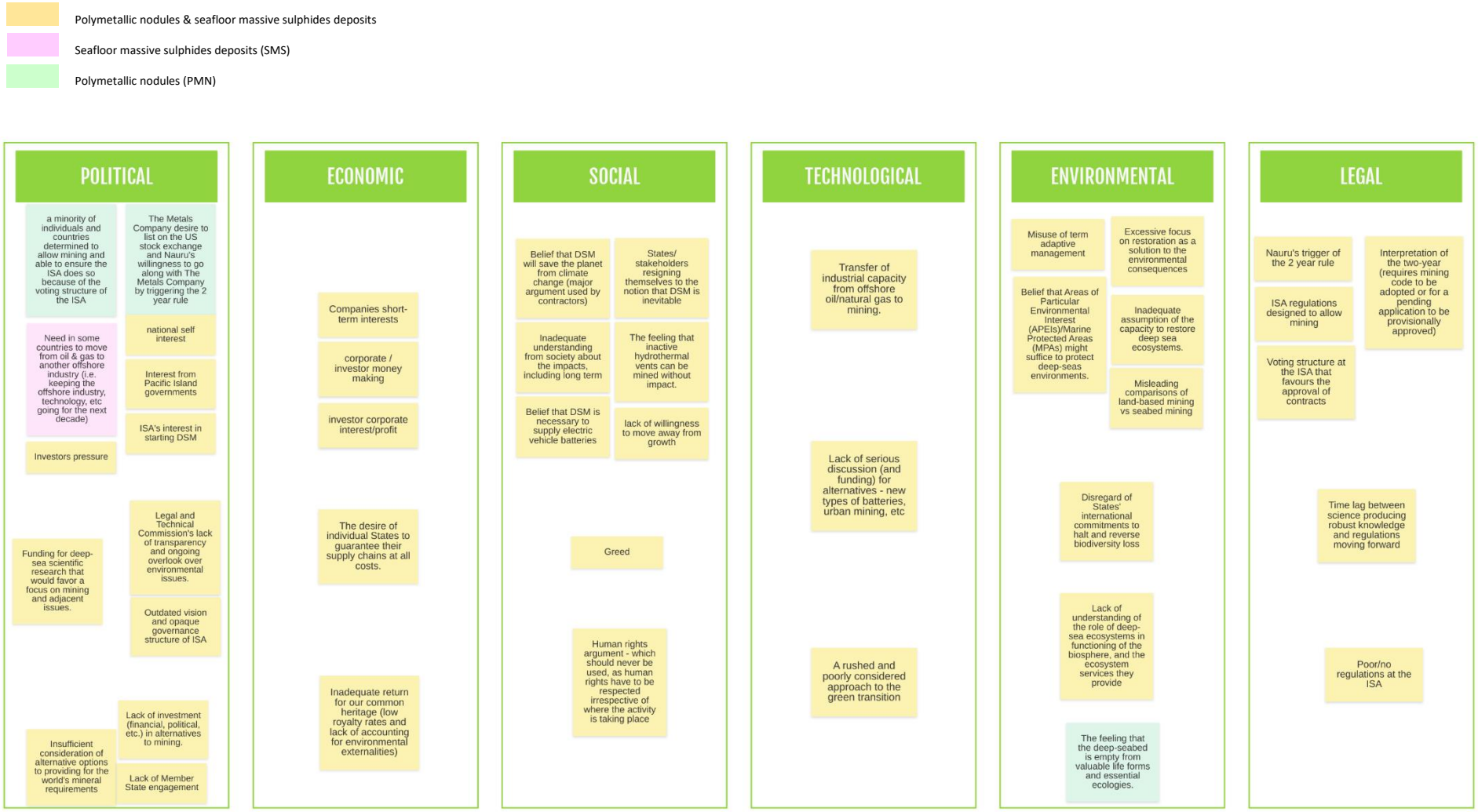

Figure 4: Answers of the "conservation experts" group to question 1: What may trigger the start of deep-sea mining?

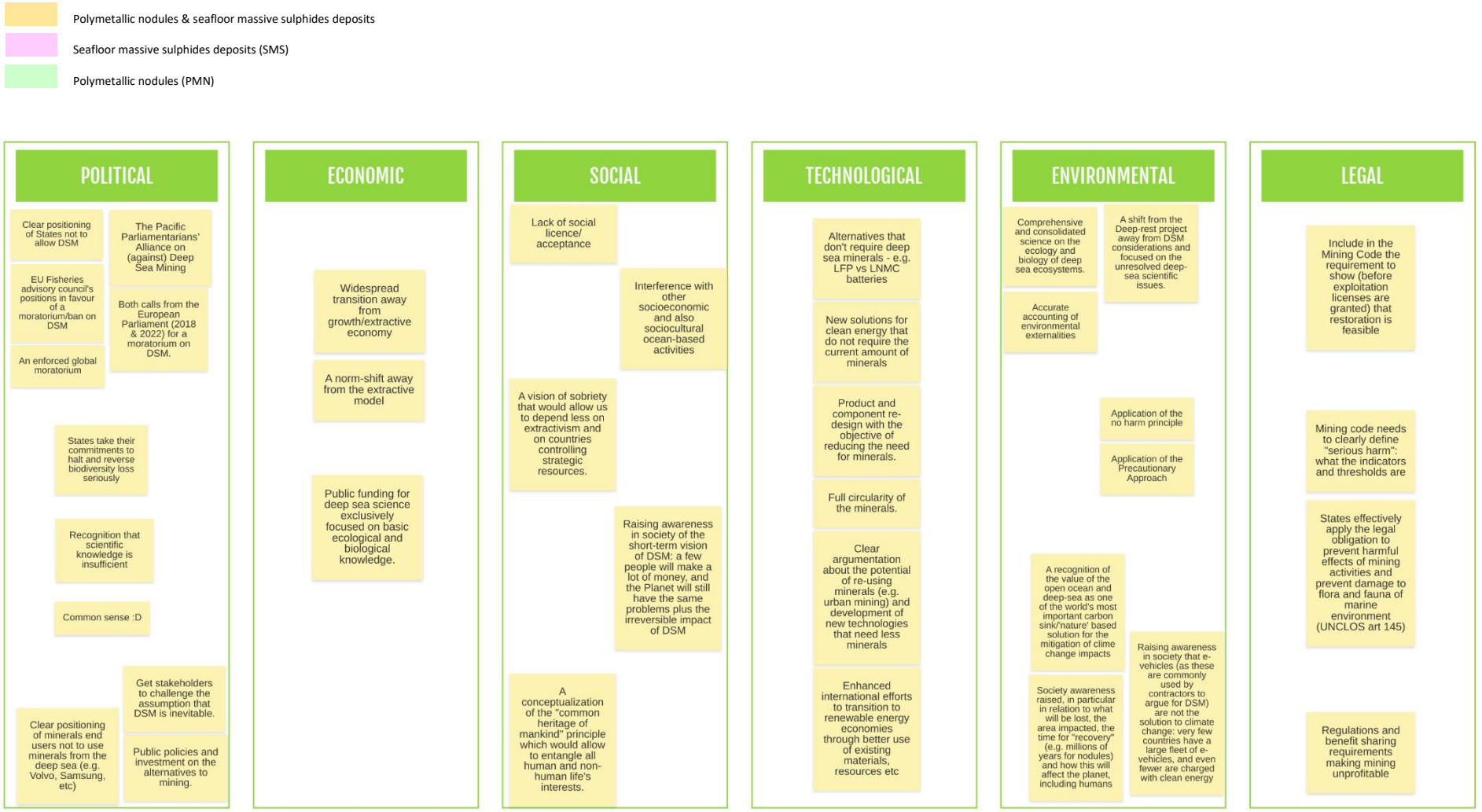

Figure 5: Answers of the "conservation experts" group to question 2: What would make it impossible to start deep-sea mining?

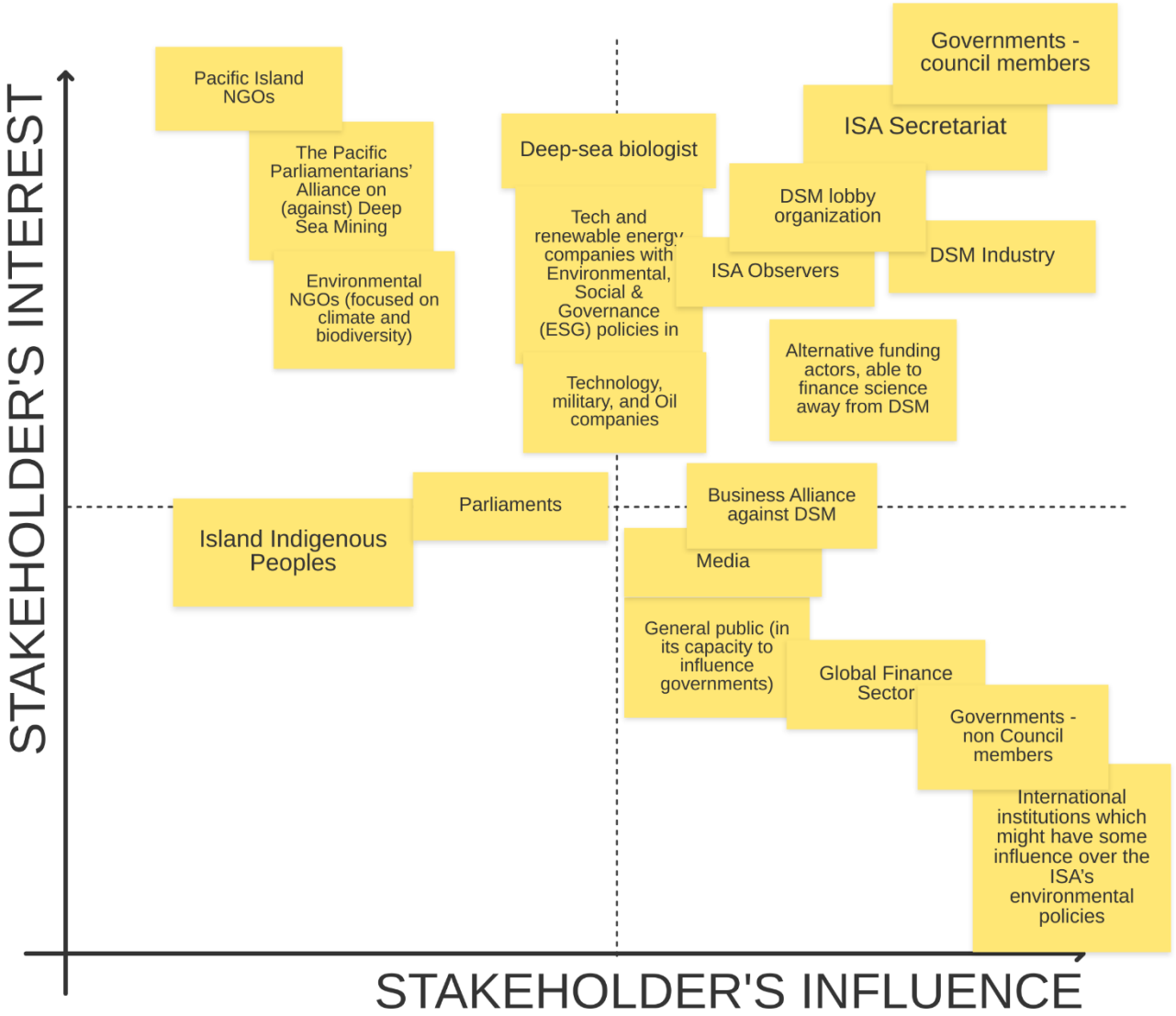

Figure 6: Identification of key actors and characterization of their interest and influence around deep-sea mining issues by the "conservation experts" group.

2.3 Industry experts group

PHASE 1: identification of key issues and trigger factors

QUESTION 1: What may trigger the start of deep-sea mining? (Figure 7)

The political elements mentioned by the participants of the "Industry experts" group referred mainly to the strategic access to minerals (a lack of access to land-based mines and a potential access at sea). The economic triggers mentioned were the increasing demand for minerals, the existence of lucrative opportunities, the potentially higher metal grades in marine minerals than on land, and the push from investors. The will to reduce pressures on human communities on land was also seen as a potential motivator to start large-scale exploitation operations at sea. The participants also highlighted that there must be acceptability in the supply chain of metal users and that having 167 nations together around the table to better manage the use of resources may be a significant step towards a framework for the development of the sector. Among the technological triggers, technological feasibility, the ability to monitor and supervise during and after the mining operations, but also a better understanding of the seafloor massive sulphides deposits (e.g. location, mechanisms of formation) were highlighted. The triggers relating to the environmental category included the drive to exert less pressure on land ecosystems, climate change and the need for clean energy solutions but also the need for a better understanding of marine ecosystems, their potential vulnerability to mining operations, and the associated environmental constraints on mining. Regarding legal drivers, the finalisation of the ISA mining code was mentioned as a key trigger; the participants also stressed that rules may be less stringent for the deep-sea than rules for land-based mining. The industry experts also highlighted the fact that effective national regulations in place (e.g. Cook Islands for polymetallic nodules and Norway for SMS) could influence the development of regulations for the Area and accelerate the start of operations.

QUESTION 2: What would make it impossible to start deep-sea mining? (Figure 8)

This idea of competition or even conflictual relations with land-based mining operations stood out in the discussion, including pressures to block DSM and the funding of activism against DSM from the countries currently supplying metals from land-based mines. In addition, political or investor pressure were seen as potentially resulting in a ban of large-scale commercial operations. The participants also mentioned that excessively high operation costs or a lack of efficiency in the operations would make DSM financially uninteresting. They also perceived that a lack of social acceptance (social license to operate) could result from NGO pressure or if metal users downstream the supply chain refuse to support these types of resources. The industry experts also mentioned that inappropriate management of pilot operations aimed at demonstrating exploitation would also undermine the possibility for further development of mining operations. The technological difficulty of the identification of large SMS deposits at inactive vent sites was also mentioned as a key development factor for these resources. Participants highlighted that the feasibility of mitigation solutions might have to be proven to allow DSM and that ecological impacts will certainly have to be under control before mining can start. Related to this, overly strict environmental regulations were identified as a potential key obstacle, as well as some other legal aspects such as the absence of a legal framework for operations, and legal battles over the access to the resources.

PHASE 2: Identification of key actors and characterization of their interest and influence around deep-sea mining issues (Figure 9).

Note: The participants did not write and place the post-it notes each in turn in an additive manner (rather, they did it simultaneously). This explains why some post-it notes mention the same stakeholder.

The participants of the "industry experts" group identified stakeholders that will directly benefit from DSM (various industry sectors, investors, contractors) as having a high influence, and generally a high interest. The ISA and governments linked to the ISA were also mentioned in the upper right quadrant (high interest and high influence). They also mentioned that some local populations which could benefit from this potential industry may have strong interest and influence, but at the same time indigenous people were identified with a moderate interest and a low level of influence. The general public was seen to have, according to the industry experts, low interest, and low influence. As for the NGOs, they were considered as having a high interest and high influence. Research institutes and universities were identified with moderate influence and interest. Finally, a participant also personified biodiversity by mentioning it as a stakeholder with a high interest in the subject, but a very low influence.

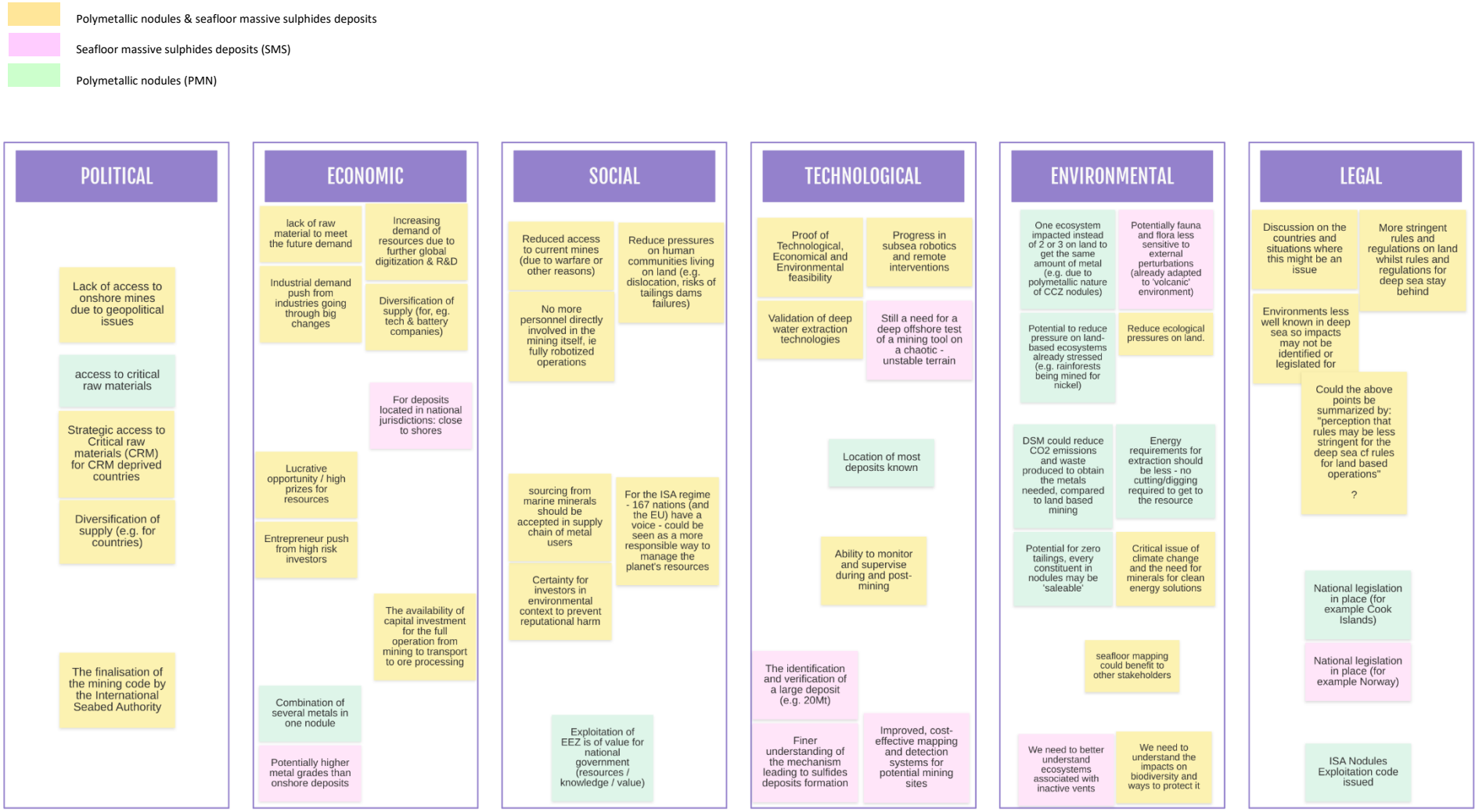

Figure 7: Answers of the "industry experts" group to question 1: What may trigger the start of deep-sea mining?

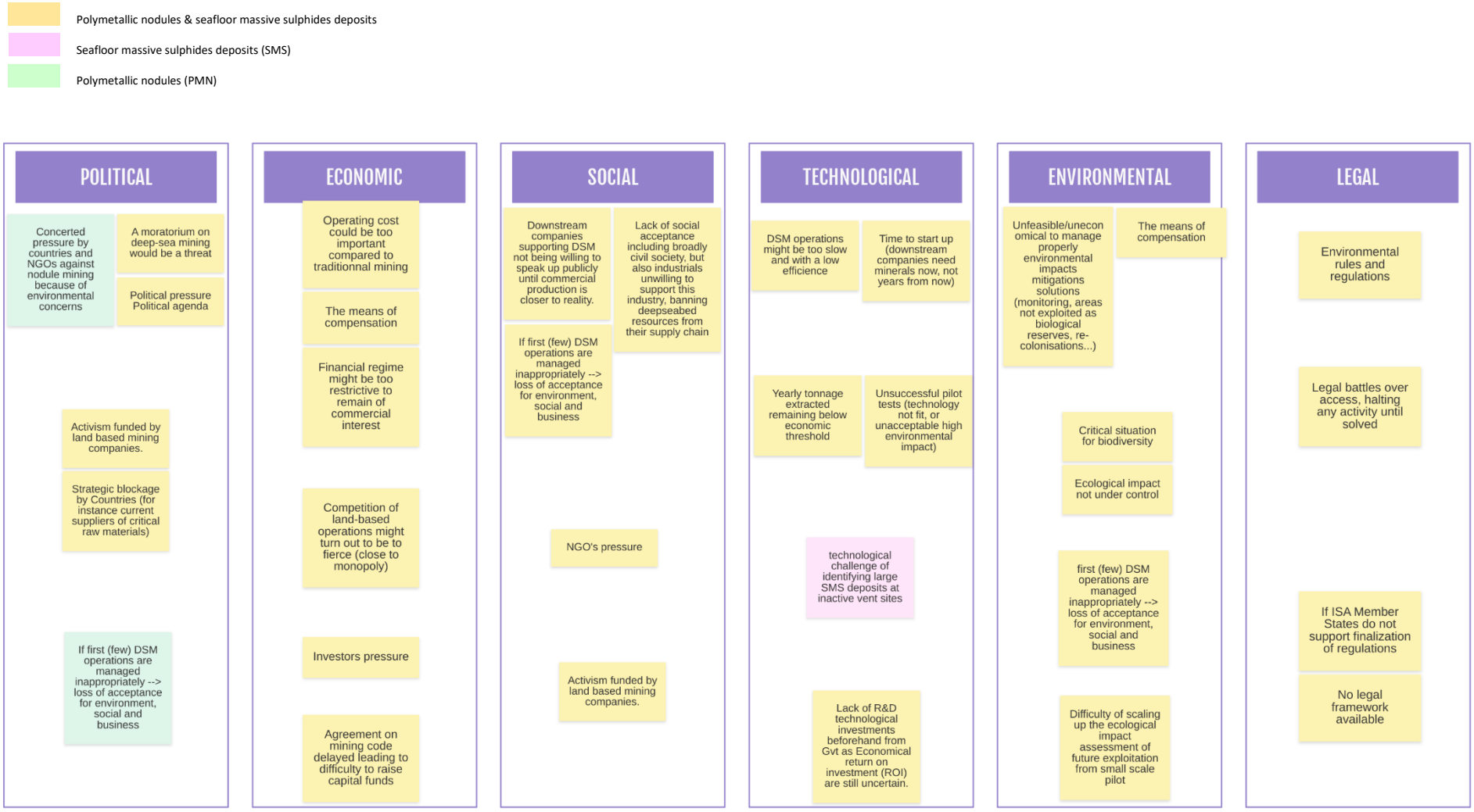

Figure 8: Answers of the "industry experts" group to question 2: What would make it impossible to start deep-sea mining?

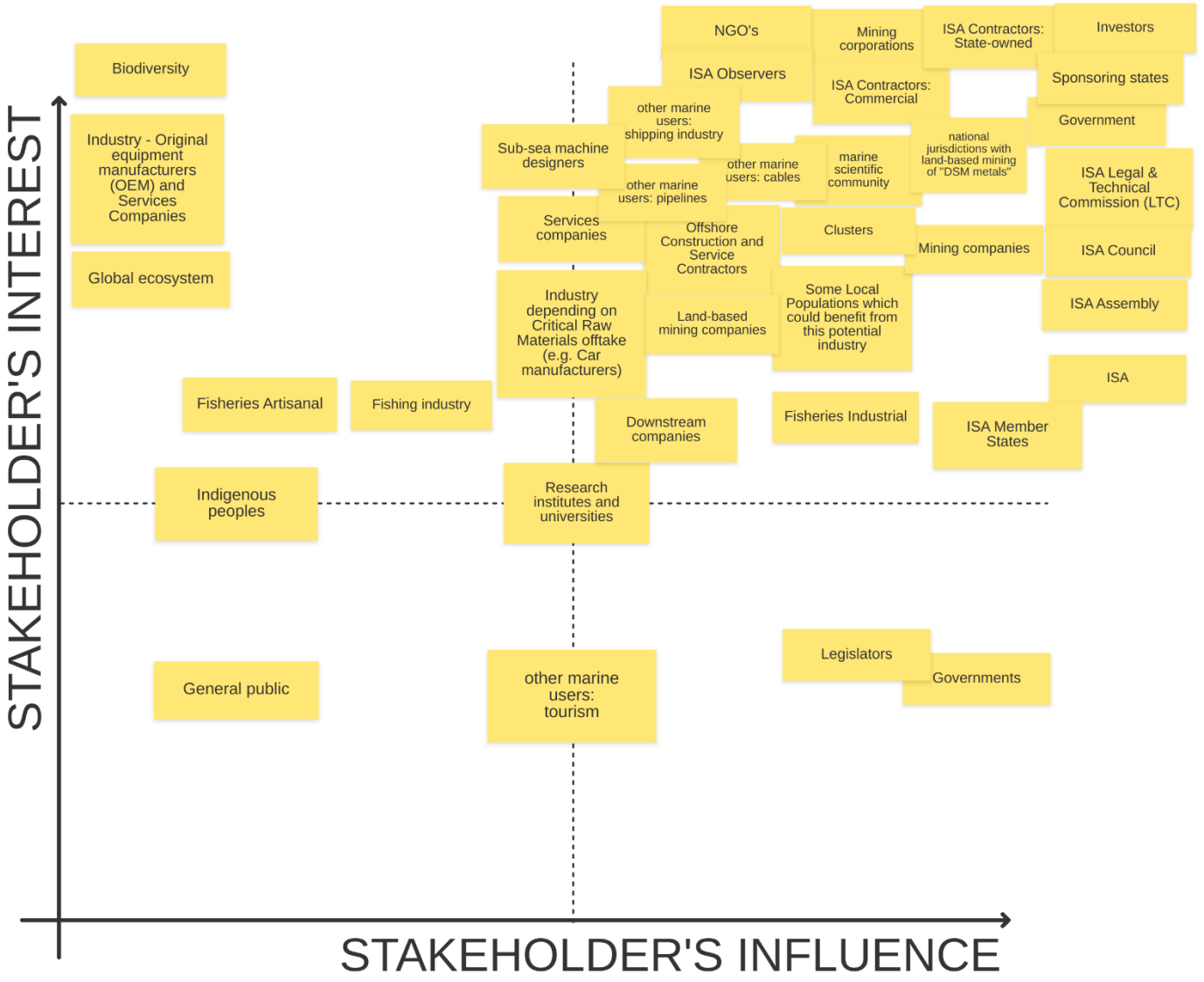

Figure 9: Identification of key actors and characterization of their interest and influence around deep-sea mining issues by the "industry experts" group.

2.4 Research scientists group (online)

PHASE 1: identification of key issues and trigger factors

QUESTION 1: What may trigger the start of deep-sea mining? (Figure 10)

The political triggers identified by this group referred to the need for minerals due to the green shift as well as due to the wish from countries to have an independent access to metals. Regarding the economic factors, participants cited the economic viability of the operations and the increase in metal demand. The latter is also found in the social category, along with the social acceptance of the operations and the social benefits offsetting the destruction of the deep-sea ecosystems. Regarding the technological category, the participants mentioned the technology being improved and becoming ready as well as the development of technologies minimizing the impacts on the ecosystems. In relation to environmental factors, participants highlighted the eventuality of effective restoration strategies and monitoring approaches, and the assumption that DSM impacts could be a lesser evil (compared to land-based mining impacts for instance), or the argument that exploration prior to DSM would help close knowledge gaps (participants commented that it is an argument that has been promoted by proponents of DSM). Finally, regarding the legal category, the group cited the finalization of the mining code (due to the 2-year rule), the submission of a Plan of Work to the ISA by contractors and the start of operations in national jurisdictions (e.g. in Norway for SMS) as potential triggers for exploitation in the Area.

QUESTION 2: What would make it impossible to start deep-sea mining? (Figure 11)

The political factors that emerged refer to a political decision not to exploit deep-sea resources. Regarding the economic category of impediments to DSM, the participants mentioned a possible ban on minerals by the markets, a decrease in the need and demand for the targeted minerals, but also the lack of investment in such industry and the lack of profitability of DSM operations. Social factors mentioned included a possible ban of DSM due to societal objections, the lack of transparency during the operations or unacceptable social and cultural impacts (such as conflicts with other marine activities and users). The technological elements identified as potential obstacles to DSM referred to constraints related to the identification of inactive hydrothermal vents, or to technological advances in recycling or batteries conception making the metal demand decrease. Participants also raised the possibility that the grades of the deposits might be too low for commercial exploitation. The main environmental issues that would impede DSM included important impacts on the ecosystems and endemic species, the lack of ecological sustainability, and the persisting knowledge gaps about ecological impacts. Finally, the legal factors identified referred to regulations and legal context preventing the start of DSM due for instance to the marine biodiversity conservation agreements (Biodiversity Beyond National Jurisdiction), to the large areas impacted by PMN mining and to the complexity of regulating activities when the management framework is particularly complex.

PHASE 2: Identification of key actors and characterization of their interest and influence around deep-sea mining issues (Figure 12).

The participants identified few stakeholders that have a low interest including the blue economy jobs (with little influence) and stakeholders related to the public such as social networks or influencers (with high influence). According to participants, the general public can also have a stronger interest

and a stronger influence when deep-sea mining happens in the EEZ, as it is more likely that people feel more concerned about something happening “in their backyard”. The group decided to make one post-it for high seas fisheries and another one for EEZ fisheries as they perceived that fisheries may have a higher influence on policy-making inside national jurisdictions. The stakeholders who may be impacted negatively by DSM activities were considered to have less influence (coastal communities, fisheries). In contrast, stakeholders who may benefit from DSM (industry, companies using the targeted metals) were considered to have a high influence and a high interest. Here, NGOs were considered as having a high interest but moderate to low influence, and scientists as having a high interest and a moderate to high influence. Finally, participants identified the ISA and the governments (and sponsoring states) as parties with a high interest and a high influence.

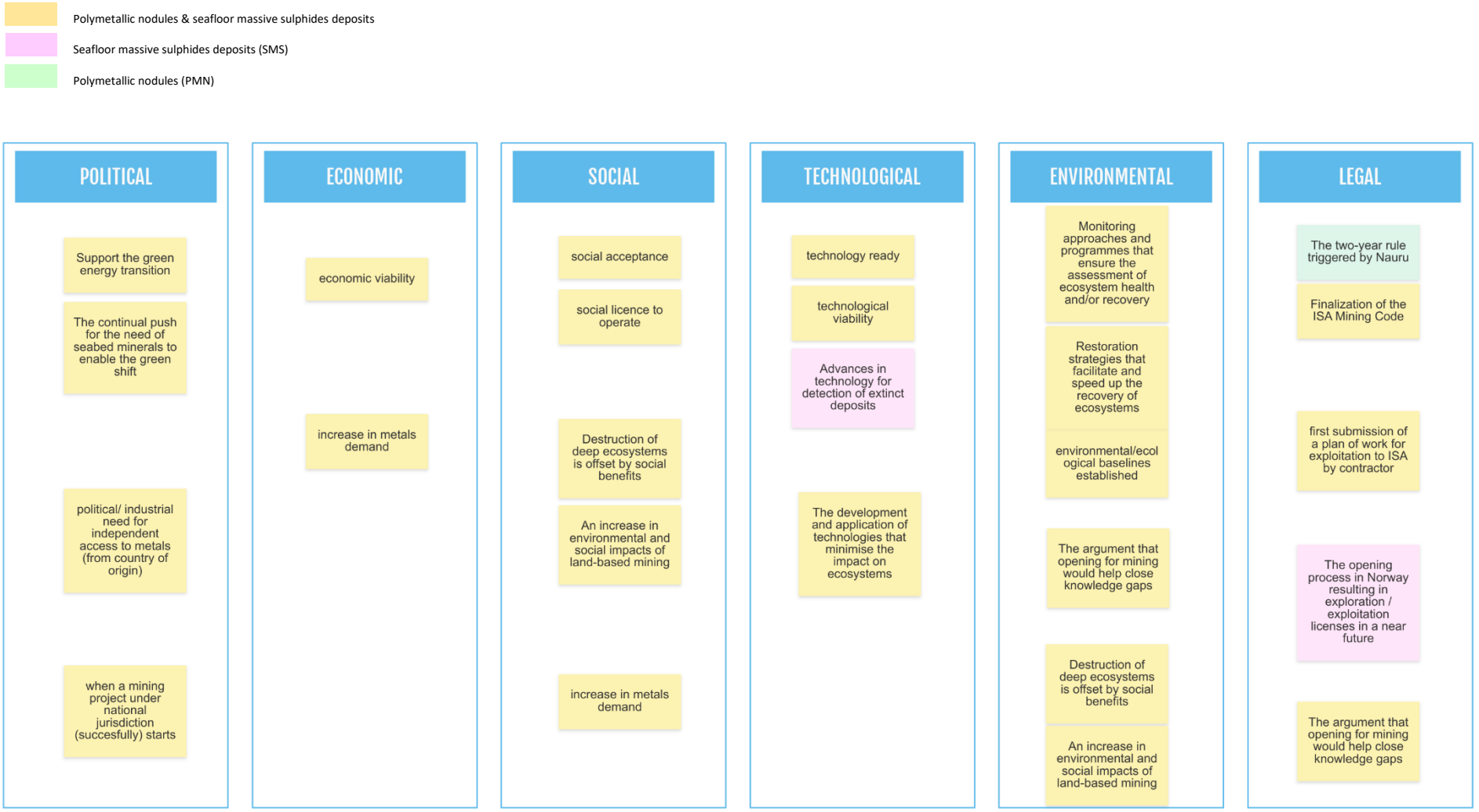

Figure 10: Answers of the "research scientists (online)" group to question 1: What may trigger the start of deep-sea mining?

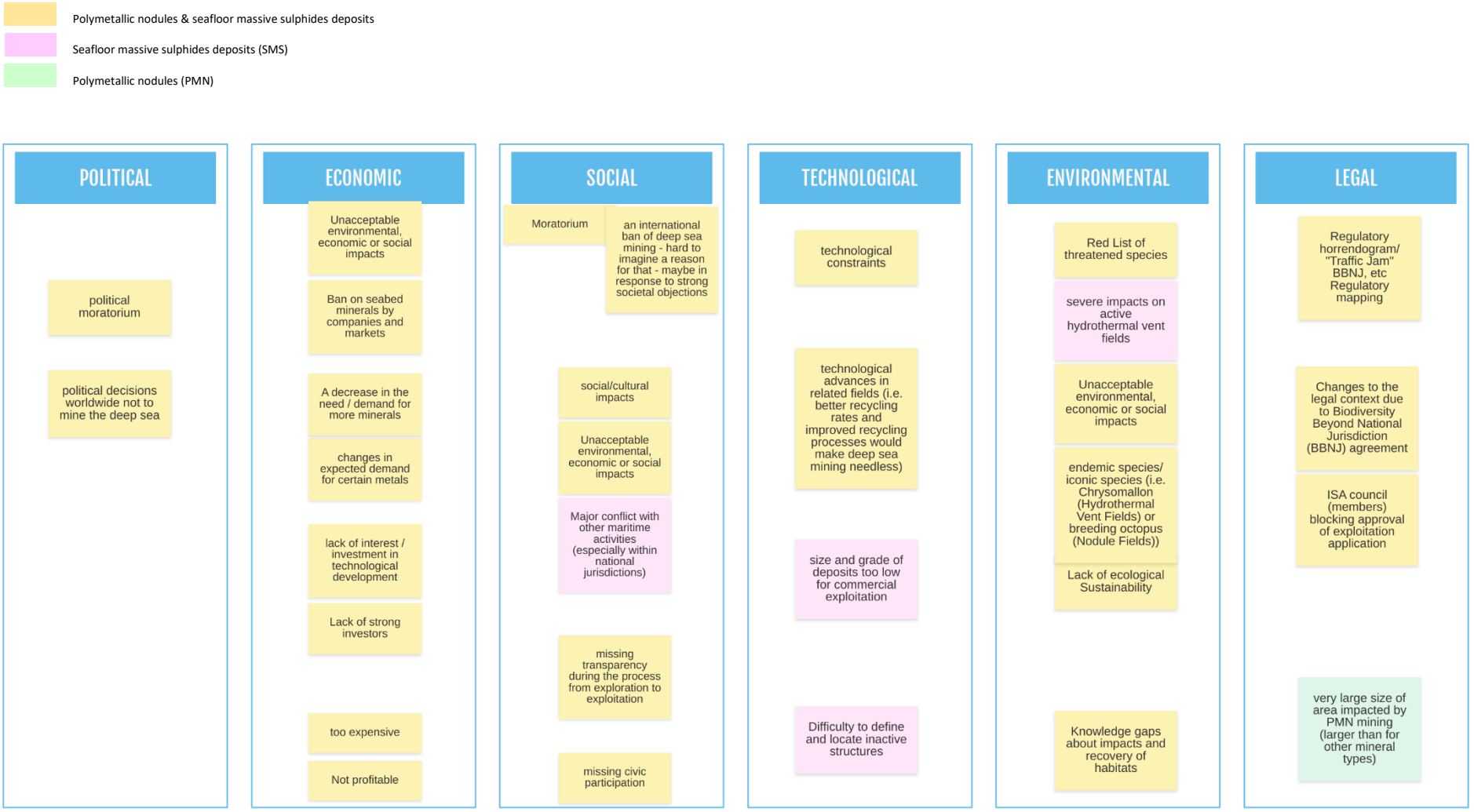

Figure 11: Answers of the "research scientists (online)" group to question 2: What would make it impossible to start deep-sea mining?

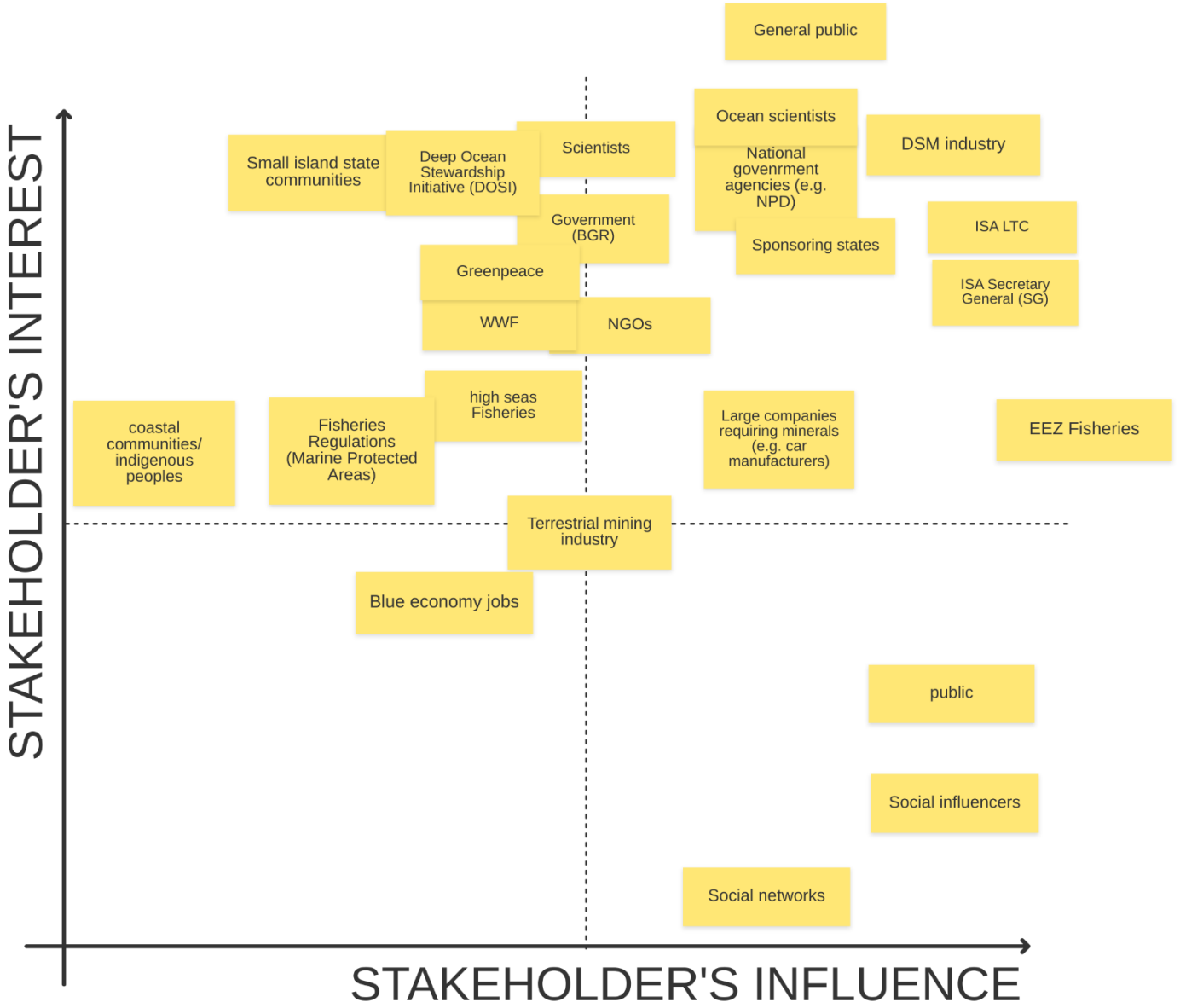

Figure 12: Identification of key actors and characterization of their interest and influence around deep-sea mining issues by the "research scientists (online)" group.

2.5 Research scientists group (on site)

PHASE 1: identification of key issues and trigger factors

QUESTION 1: What may trigger the start of deep-sea mining? (Figure 13)

The trigger factors identified by the participants of the "research scientists" group (on-site) were predominantly focused on the political, economic, and social dimensions. Regarding the political aspects, political decisions related to current access to the minerals as well as pressure from parties interested in DSM were cited. Economic factors mainly referred to the economic interests and the profitability of the mining operations. The potential social triggers mentioned included a shortage in minerals on land (due to the demand), and the idea that lack or misuse of knowledge may play in favour of the start of DSM. In other categories, the participants mainly mentioned the technology for commercial exploitation becoming effective/ready, the need for metals for the ecological transition, and the finalization of the mining code and the opening of the licences for exploitation as potential triggers of the start of DSM.

QUESTION 2: What would make it impossible to start deep-sea mining? (Figure 14)

Regarding factors that could hinder DSM, ideas that emerged referred for instance to a moratorium, to a lack of profitability of the operations or to the absence of a social license to operate (due to cultural issues or to the gaps of knowledge). The group also mentioned the absence of an effective technology to exploit the resources. The development of technologies that do not need targeted metals was also mentioned. Regarding the environmental factors, the lack of environmental knowledge as well as the evaluation of the damages that can be caused by DSM may make it impossible to start. Legal elements referred to stricter regulations and to the protection of endangered species.

PHASE 2: Identification of key actors and characterization of their interest and influence around deep-sea mining issues (Figure 15).

The general public was positioned as having moderate influence and interest. Artists or the media were positioned in the lower part of the graph according to the participants, which means they have mostly low interest for the subject (but different capacities to influence). Politicians were considered to have little interest but potentially high influence on the subject. The holders of traditional knowledge and the scientific parties were identified with high interest but low influence. The participants mentioned NGOs as a high interest stakeholder category but a moderate influence. The DSM industry was mentioned as high influence and high interest; other industrial users of the Area were considered as having a bit less influence and interest on the subject. The stakeholders with the most interest and influence mentioned by the participants referred to the ISA council and its Legal and Technical Commission (LTC).

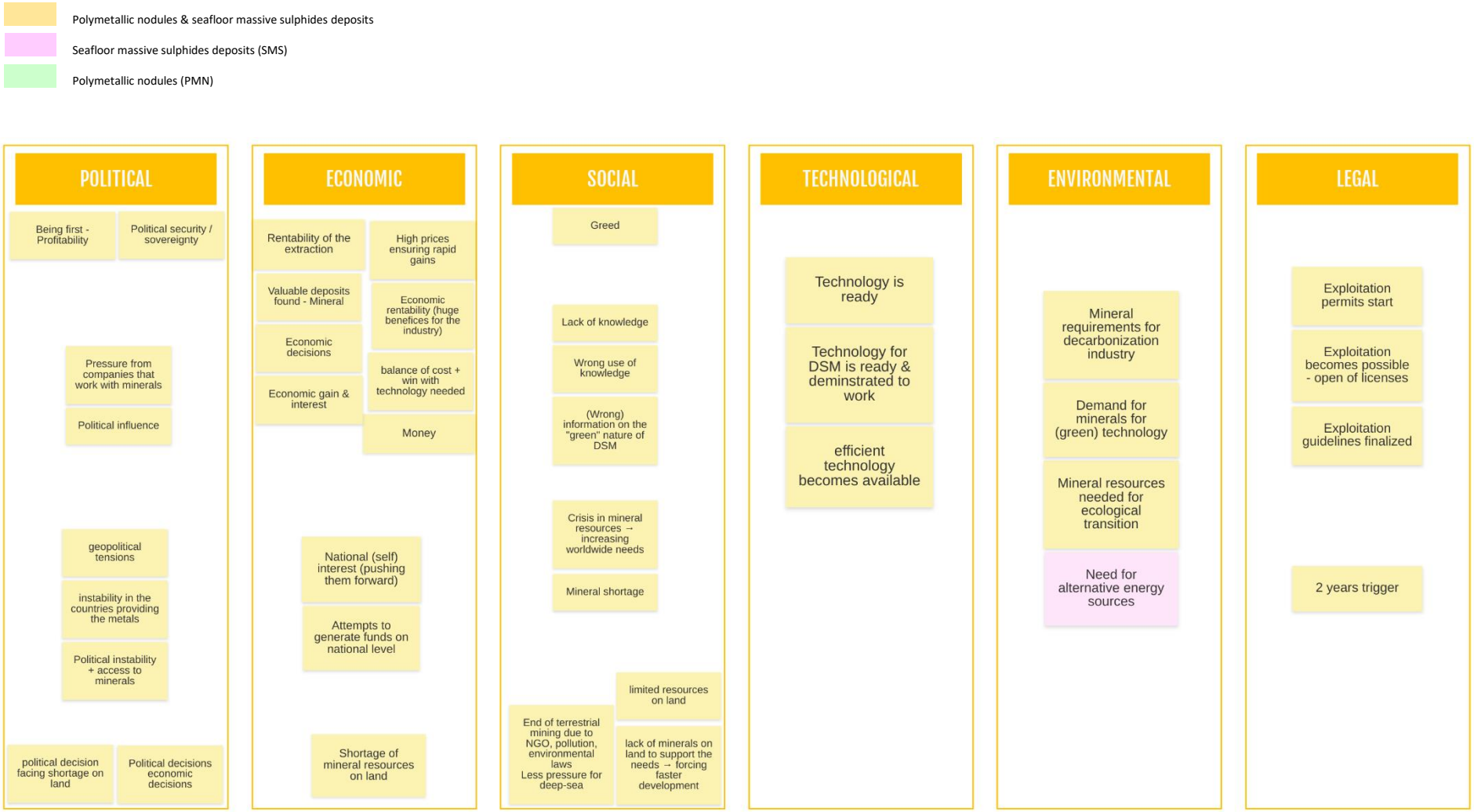

Figure 13: Answers of the "research scientists (on-site)" group to question 1: What may trigger the start of deep-sea mining?

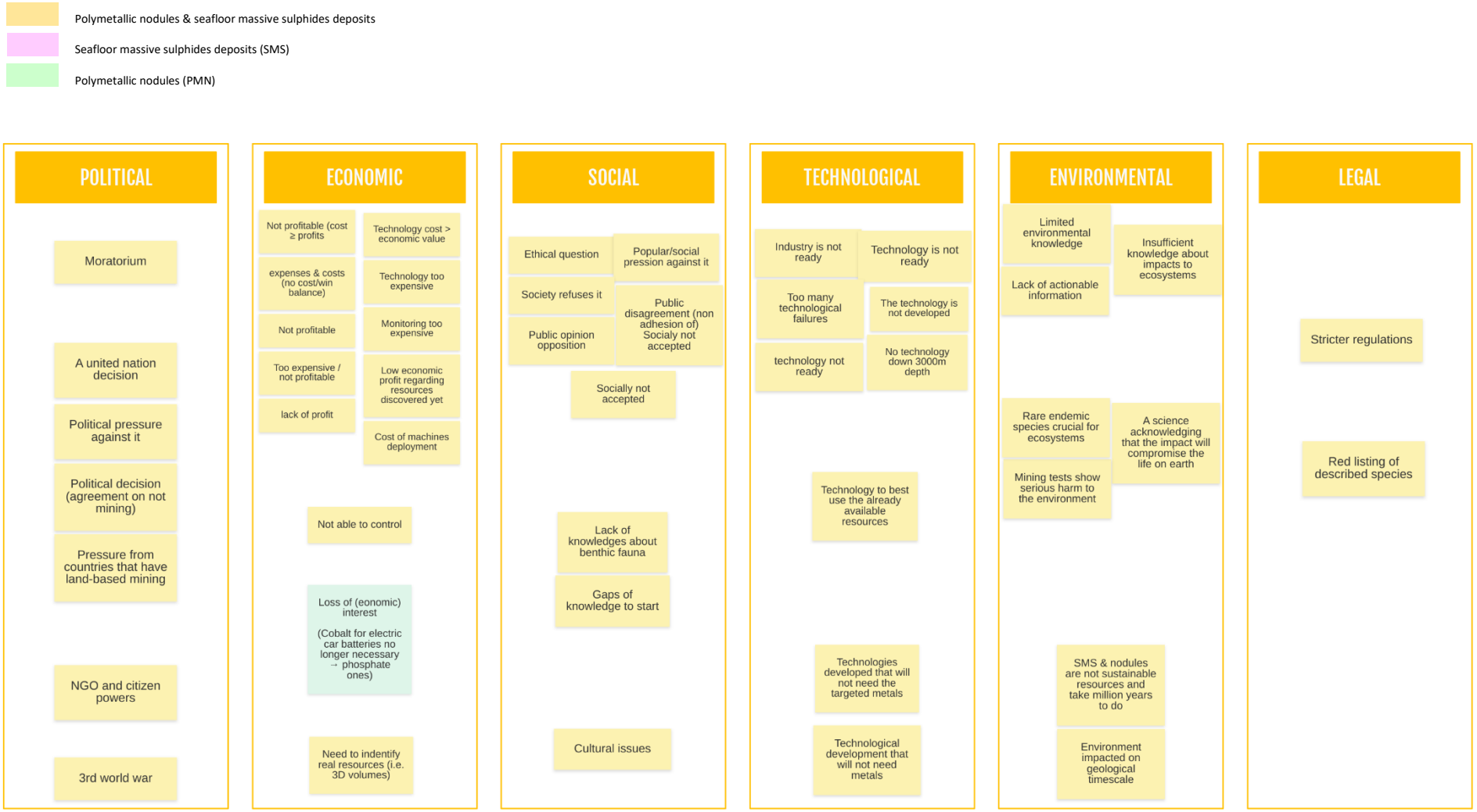

Figure 14: Answers of the "research scientists (on-site)" group to question 2: What would make it impossible to start deep-sea mining?

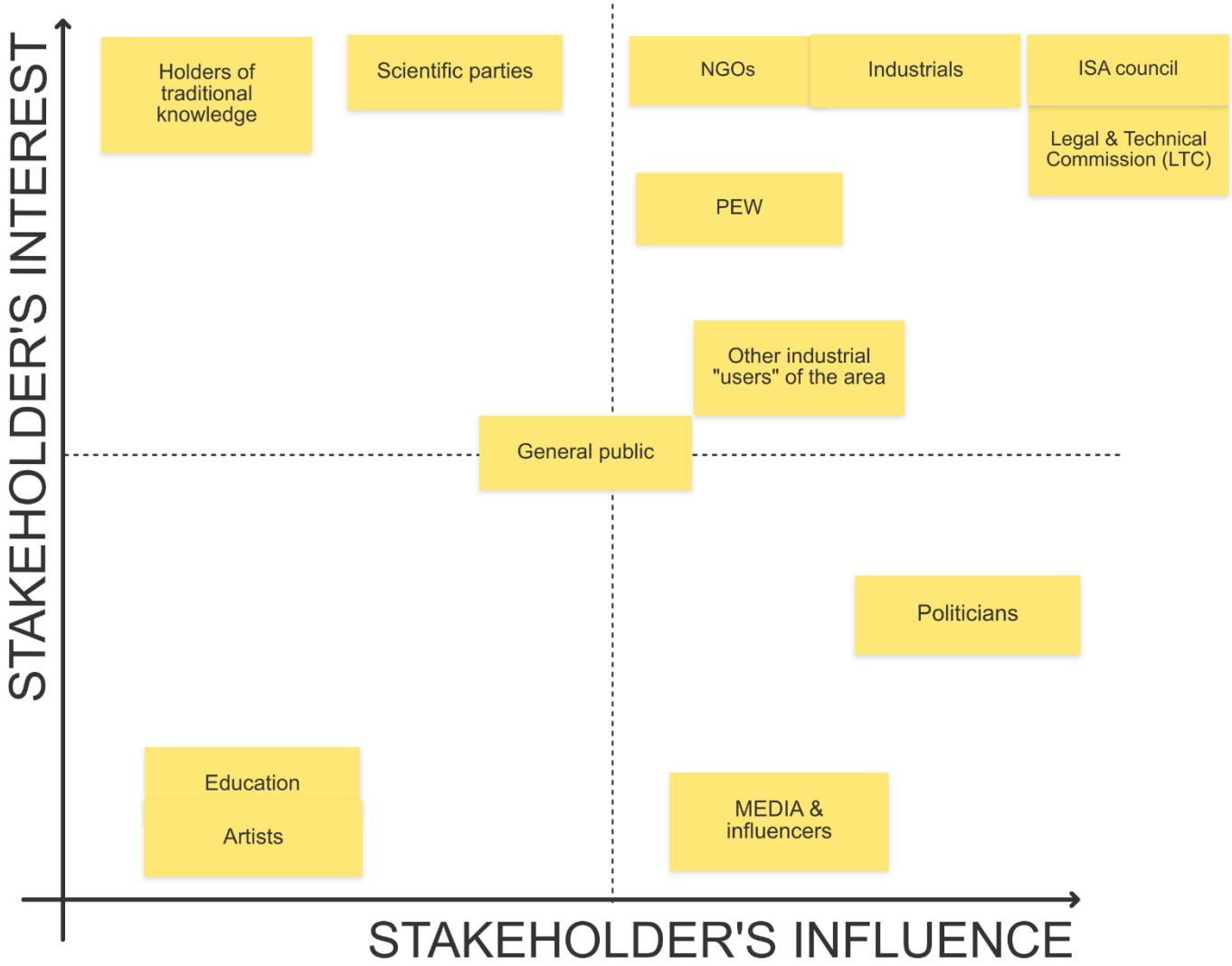

Figure 15: Identification of key actors and characterization of their interest and influence around deep-sea mining issues by the "research scientists (on-site)" group.

2.6 Cross-group comparison

For the purpose of the following comparisons, we examined the distribution of the post-it notes according to the PESTEL categories in each group[1]. However, the number of post-it notes is not used to make direct quantitative comparisons across the different groups as their number was dependent on the number of participants per group and the number of post-it notes written by each participant. Instead, we focused on the ranking of the number of post-it notes across the PESTEL categories within each group. For each group, we attributed each PESTEL category a score from 6 to 1, where 6 goes to the category with the most post-it notes and 1 to the one with the least post-it notes in it. When multiple categories had the same number of post-it notes, the median of their scores was assigned (e.g. if for one group, the political and the social factors come second ex-æquo in term of number of post-it notes, then they were both attributed the score 4.5, median of 5 and 4). This way, all groups have the same weight when we aggregate the scores.

For a complementary analysis, we gathered the different post-it notes referring to a common concept under "major ideas" (e.g. "combination of several metals in one nodule" and "potentially higher metal grades than onshore deposits" were summarized under the term "high ore grades") in order to compare their presence for the different groups and to identify the most cited ideas.

Regarding the comparisons of the strategic positioning of the actors, specific actors cited were associated to a generic actor category (e.g. "ISA council" and "ISA observers" were associated to "ISA") to facilitate the comparison of the placement of the actors on the graph by the different groups.

PHASE 1: identification of key issues and trigger factors

QUESTION 1: What may trigger the start of deep-sea mining?

The analysis of the distribution of answers across the PESTEL categories (Figure 16) showed that the environmental category has the highest aggregate score overall, highlighting the great importance of environmental factors as DSM triggers. Notably, the environmental category ranked first or second in terms of number of ideas for all groups except the on-site research scientists. For two groups (authorities & policy makers, and conservation experts), the political category was the one with the most answers. Ideas referring to the social factors came second for three groups (conservation experts and both research scientists groups) and the ones referring to the economic factors came first and second for the on-site research scientists and the industry experts groups, respectively. The technological category was the least or second least cited one for all but one group (industry experts).

[1] Note that, for timing reasons, participants of "Conservation experts" group did not organize their ideas according to the PESTEL dimensions during the workshop. The categorization of ideas was carried out after the workshop by the authors of this report.

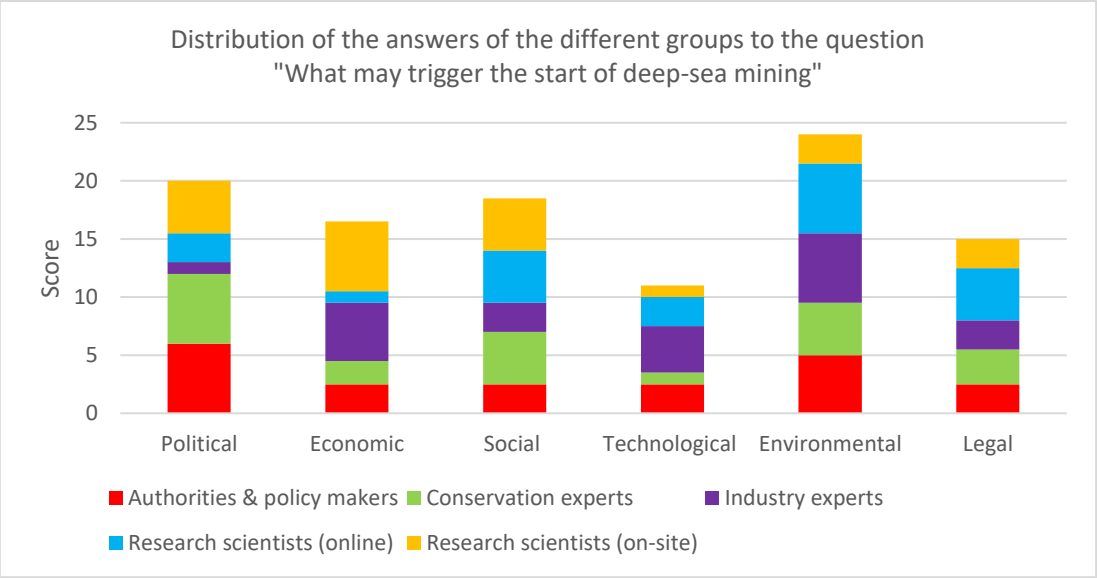

Figure 16: Ranking of PESTEL categories based on the number of post-it notes as answers to the first question: "What may trigger the start of deep-sea mining?". Scores are based on ranks in terms of number of post-it notes per category within each group of participants. Highest scores reflect the most cited categories.

Table 2 shows the ranking of idea regarding their number of occurrence across groups. No idea was mentioned by all groups. Three ideas were mentioned by four groups: the demand for minerals and the profitability as economic triggers and the issuance of the ISA mining code as legal trigger. At a lower rank, the access to minerals (political), social licence (social), the feasibility (technological) and the national jurisdiction regulations (legal) were mentioned by three groups. Despite the aforementioned great importance of the environmental factors, there seems to be a lower consensus on the ideas on this category as no similar ideas were mentioned by more than two groups.

Table 2: Major ideas cited by the different groups as answers to the question "What may trigger the start of deep-sea mining?", sorted by PESTEL factor and by the number of groups in which the ideas were mentioned. The coloured dots correspond to the groups that mentioned the idea.

WHAT MAY TRIGGER THE START OF DEEP-SEA MINING?						
Number of groups mentioning the idea	PESTEL factor to which the idea refers					
	Political	Economic	Social	Technological	Environmental	Legal
5						
4		Demand for minerals ●●●●●				ISA code issued ●●●●●
		Profitability ●●●●●				
3	Access to minerals ●●●		Social license ●●●	Feasibility ●●●		National jurisdiction regulations ●●●
2	Pressures ●●		Less pressures on human communities ●●		Better understanding of ecosystems ●●	
	Adoption of regulations ●●		Need for minerals ●●		Capacity to restore ecosystems & manage impacts ●●	
	Profitability / interest ●●		Greed ●●		Reducing terrestrial mining impacts ●●	
					Need for minerals for the green transition ●●	
1	ISA Structure ●	Pressures ●	Belief that DSM is necessary to support the green transition ●	Lack of discussion on alternatives ●	Acceptable impacts ●	The argument that DSM could help to close knowledge gaps ●
	Supporting the green transition ●	Securing supply chain ●	Approval of a plan of work ●	Approval of a plan of work ●	Approval of a plan of work ●	Submission of a plan of work to the ISA by a contractor ●
	Successful mining project under national jurisdiction ●	No accounting of the common heritage of mankind principle ●	Social benefits offsetting deep-sea ecosystems destruction ●	Rushed green transition ●	Lack of understanding of the deep-sea role and value may play in favour of DSM ●	No ISA regulations ●
	No considerations on alternatives to mining ●	Availability of capital investment ●	Holistic way of management ●	Transfer of technology from oil and gas industry to DSM ●	No commitment to halt biodiversity loss ●	Perception that rules may be less stringent for deep-sea mining than on land ●
		High ore grades ●	Wrong use of knowledge ●	Better knowledge of locations and mechanisms of deposits ●	The argument that DSM could help to close knowledge gaps ●	
		National self interest ●	Increase of terrestrial mining impacts ●	Ability to monitor and supervise ●	Social benefits offsetting deep-sea ecosystems destruction ●	
				Technologies minimising impacts on ecosystems ●		

● **Authorities and policy makers**
● **Conservation experts**
● **Industry experts**
● **Research scientists (online)**
● **Research scientists (on-site)**

QUESTION 2: What would make it impossible to start deep-sea mining?

The analysis of the distribution of answers given to the second question (Figure 17) showed that the economic category ranked first in aggregate, followed by the environmental and the political categories. The legal category stands out as the one with the least aggregate score. Economic impediments to DSM were widely mentioned by all groups except the conservation experts one (for which, conversely, it is the category with the least post-it notes attributed to it). Ideas referring to the political factors were the most cited category by the authorities & policy makers and the conservation experts. All groups listed rather evenly ideas referring to environmental factors. Notably, the technological and economic (respectively legal and environmental) categories have substantially higher (resp. lower) aggregate scores for the second question than for the first one.

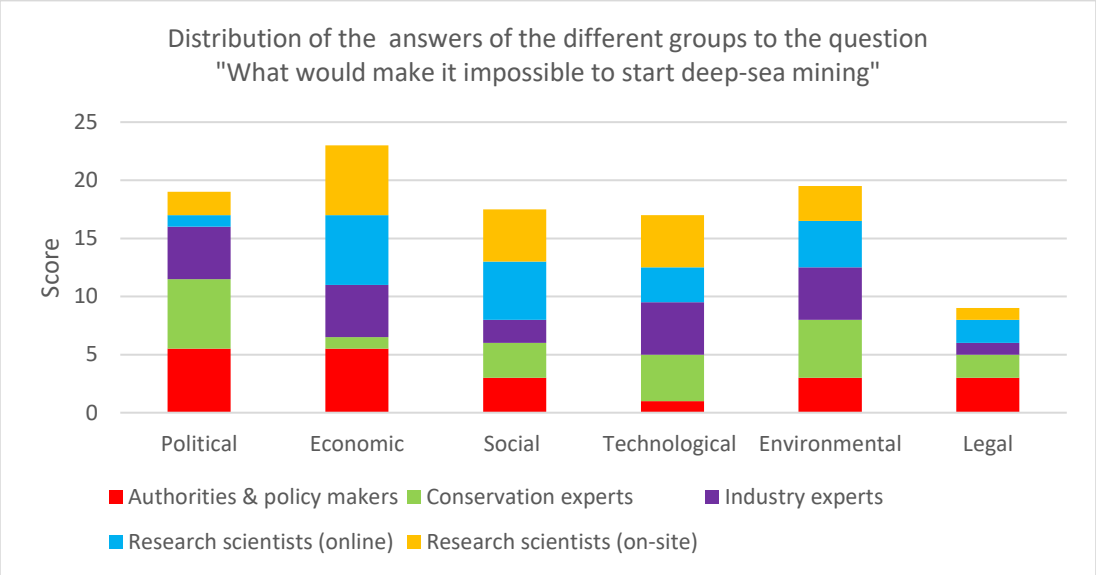

Figure 17: Ranking of PESTEL categories based on the number of post-it notes as answers to the first question: "What would make it impossible to deep-sea mining?". Scores are based on ranks in terms of number of post-it notes per category within each group of participants. Highest scores reflect the most cited categories.

In Table 3, we see that the fact that environmental impacts could be unacceptable is an impediment that was consensual across the five groups. The absence of social licence (social) and the adoption of a moratorium (political) are also relatively consensual as mentioned by four groups. Five impediments were mentioned by three groups: a worldwide decision not to mine (political), the absence of profit from DSM (economic), the development of technologies aiming at reducing the use of resource including recycling and the lack of efficiency of DSM operations (technological) and the lack of environmental knowledge (environmental).

Table 3: Major ideas cited by the different groups as answers to the question "what would make it impossible to start deep-sea mining?" sorted by PESTEL factor and by the number of groups in which the ideas were mentioned. The coloured dots correspond to the groups that mentioned the idea

WHAT WOULD MAKE IT IMPOSSIBLE TO START DEEP-SEA MINING?						
Number of groups mentioning the idea	PESTEL factor to which the idea refers					
	Political	Economic	Social	Technological	Environmental	Legal
5					Unacceptable impacts ●●●●●	
4	Moratorium ●●●●		No social licence ●●●●			
3	Worldwide decision not to mine ●●●	Not profitable ●●●		Technology aimed at better using available resources ●●●	Lack of environmental knowledge / knowledge gaps ●●●	
				Operations not efficient ●●●		
2	Pressures from countries and actors of land-based mining ●●	Less demand for minerals ●●	NGOs pressure ●●	Difficulty to identify deposits ●●		ISA members blocking approval of exploitation ●●
		Lack of investment ●●	Interference with other marine activities ●●	Not profitable ●●		No legal framework available ●●
1	No evidence of need of the metals ●	High economic risk ●	Moratorium ●	No-kill standards not guaranteed ●	Application of precautionary approach ●	Inclusion in mining code that restoration is feasible ●
	Scientists voice weighs more than contractors voice ●	Transition away from growth model ●	Lack of knowledge ●	Unsuccessful pilot tests ●	Difficulty of scaling up operations ●	Application of legal prevention of harmful effects ●
	Absence of clear responsibilities to set standards ●	Public funding on deep-sea science away from DSM ●	Missing transparency during DSM operations ●	Technological development that will not require targeted metals ●	Unfeasibility of mitigation solutions ●	Benefits sharing requirements ●
	Commitment to halt biodiversity loss ●	Investors pressure ●	Activism funded by land-based mining actors ●			Environmental regulations ●
	Recognition that scientific knowledge is insufficient ●	Ban on seabed minerals by companies & markets ●	Conceptualization of the "Common Heritage of Mankind" that would include non-human life forms interest ●			The complexity of regulating activities when the management framework is particularly complex ●
	Common sense ●	Not able to control ●	Sobriety ●			BBNJ agreement ●
	Pressures ●	Need to identify real resources ●	Cultural issues ●			Changes in legal context due to size of area impacted by PMN too large ●
	World War 3 ●	Competition with terrestrial mining ●				Stricter regulations ●
	NGO and citizen powers ●					Protection of endangered species ●

● **Authorities and policy makers**
● **Conservation experts**
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PHASE 2: Identification of key actors and characterization of their interest and influence around deep-sea mining issues.

For the purpose of the cross-group comparison below, we developed a typology of key actor interest and influence. This is illustrated in Figure 18, where quadrant 1 corresponds to actors with a low interest and a low capacity to influence, and quadrant 2 to the actors with a high interest but a low capacity to influence on the issue of deep-sea mining. Quadrant 3 of the graph refers to the stakeholders having a low interest and a high influence whereas quadrant 4 refers to the stakeholders with both high interest and capacity to influence.

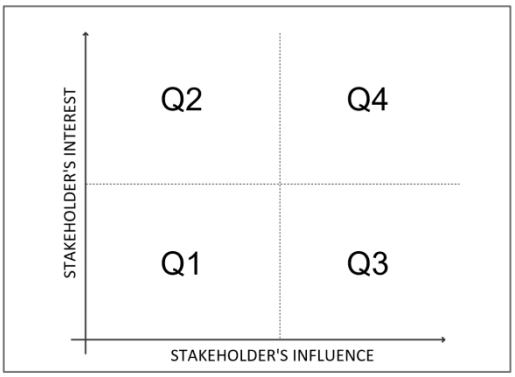

Figure 18: Diagram of the allocation of the different quadrants of the strategic positioning of the actors graph.

As the aim of phase 2 was to highlight the most important and relevant stakeholders, the post-it notes that were placed at the interfaces between different quadrants were demoted to the lower intensity quadrant(s) for the purpose of the analysis below.

Generally, the different groups tended to focus more on actors with a high interest for the subject of deep-sea mining (Figure 19). Indeed, 47 answers referred to stakeholders having both high interest and high influence (Q4), and 31 answers referred to stakeholders having a high interest but a low influence (Q3), whereas 19 answers referred to stakeholders having a low interest but a high influence (Q2) and 13 answers referred to stakeholders having both low interest and low influence in Q1 (Figure 19). The conservation experts' answers have an equal distribution of stakeholders mentioned across quadrants Q2, Q3, and Q4; the industry experts, in contrast, have an unequal distribution with the majority of stakeholders mentioned having a high influence and a high interest.

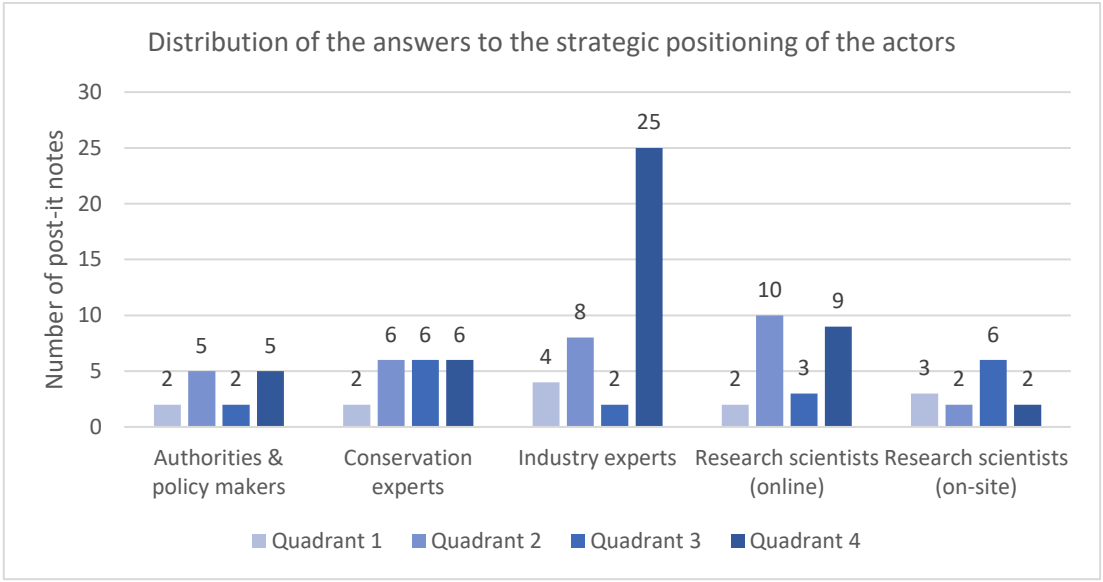

Figure 19: Number of post-it notes allocated in each quadrant of the strategic positioning of the actors chart, by each group. Quadrant 1: low interest – low influence; Quadrant 2: high interest – low influence; Quadrant 3: low interest – high influence; Quadrant 4: high interest – high influence.

We identified 6 categories of stakeholders that were cited by the 5 groups (“ISA”, “governments and administrations”, “DSM industry sector”, “scientific parties”, “NGOs” and “general public”) and 2 categories cited by 4 out of the 5 groups (“other industrials and maritime actors” and “local populations”) (Table 4). Their distributions on the interest-influence chart are presented in the Figure 20.

Among the different stakeholders categories that emerged, there was a consensus among the different groups on the high influence and interest of the “ISA” stakeholders (Figure 20-a). This reflects that fact that the ISA is the organization where all the interests of most stakeholder groups come together, in the sense that many stakeholders (including DSM proponents and opponents) aim to influence the decisions made by the ISA. The local populations (Figure 20-h) in general were considered by all groups as having a low influence, although the industry experts group considered the local populations that may benefit from DSM specifically as having a high influence. It also seems that there was a consensus between the different groups to consider that the DSM industry sector is highly interested (Figure 20-c), but their capacity to influence may vary regarding the actor, although they were mostly seen as having a high influence (including by industry experts themselves).

The scientific parties were also considered as having a high interest by the participants (Figure 20-d). The perception of their capacity to influence varied across groups but appeared rather low than high. However, the online research scientists group considered ocean scientists as having a rather high influence whereas the on-site research scientists group positioned the stakeholder “deep-sea biologists” as having a low influence, which showed differences among the participants from the marine scientific community in the perception of their own capacity to influence.

While the governments and administrations were viewed by most groups as rather influential (especially by the industry experts and the conservation experts), the Authorities & policy makers group placed themselves as not influential, which is in contrast to the other positions (Figure 20-b). This difference also appeared with the case of the NGOs, where they were seen as having a high influence by most groups while they tended to consider themselves as not influential (Figure 20-e). Other industrial and maritime actors were mostly considered as interested, while their capacity to influence was moderate (Figure 20-g). Regarding the general public, the groups of scientists and conservation experts considered that it may have moderate to high influence whereas the industry experts and the authorities & policy makers viewed it as not influential (Figure 20-f); the interest of the general public in the issue of deep-sea mining was viewed as predominantly low.

*Table 4: List of stakeholders cited by the different groups during the phase 2 "Identification of key actors", sorted by generic categories (in **bold**), and by the number of groups mentioning at least one actor belonging to the category. The coloured dots indicate the groups that mentioned the listed stakeholder.*

5	**ISA**	**Governments and administrations**	**Deep-Sea Mining Industry**	**Scientific parties**	**NGOs**	**General public**
	Michael Lodge ●	Involved administrations ●	The Metals Company ●	Science ●	NGOs ●●●●	General public ●●●●●
	ISA Secretariat ●	International institutions which might have some influence over the ISA's environmental policies ●	Gerard Barron ●	Deep Ocean Stewardship Initiative (DOSI) ●●	National NGOs on equity/north-south issues, social aspects ●	Education ●
	ISA Observers ●●	Parliaments ●	DSM lobby organization ●	Deep-sea biologist ●	WWF ●●	Artists ●
	ISA ●	The Pacific Parliamentarians' Alliance on (against) Deep Sea Mining ●	DSM Industry ●●	Research institutes and universities ●	Greenpeace ●●	
	ISA LTC ●●●	Governments ●	Mining corporations ●	Marine scientific community ●	PEW ●●	
	ISA Council ●●	Legislators ●	Mining companies ●	Scientists ●	Deep Sea Conservation Coalition (DSCC) ●	
	ISA Assembly ●	Government (BGR) ●	Clusters ●	Ocean scientists ●	Pacific Island NGOs ●	
	ISA Member States ●	National government agencies (e.g. NPD) ●	Offshore Construction and Service Contractors ●	Scientific parties ●	Environmental NGOs (focused on climate and biodiversity) ●	
	ISA SG ●	Politicians ●	Services companies ●			
		Governments - council members ●	Industry - original equipment manufacturer OEM and Services Companies ●			
		Governments - non-Council members ●	Sub-sea machine designers ●			
			Industrials ●			

4	**Other industrial and maritime actors (excluding downstream companies)**	**Local populations**	3	**Contracting parties**	**Downstream companies**	**Medias & social networks**
	Technology, military, and Oil companies ●	Island Indigenous Peoples ●		Contracting parties ●	Business Alliance against DSM ●	Media ●
	other marine users: tourism ●	Indigenous peoples ●		Sponsoring states ●●	Tech and renewable energy companies with ESG policies in ●	Social networks ●
	Other marine users: shipping industry ●	Some Local Populations which could benefit from this potential industry ●		ISA Contractors: Commercial ●	Downstream companies ●	Social influencers ●
	Other marine users: pipelines ●	Coastal communities/indigenous peoples ●		ISA Contractors: State-owned ●	Industry depending on Critical Raw Materials offtake (e.g. Car manufacturers) ●	MEDIA & influencers ●
	Other marine users: cables ●	Small island state communities ●			Large companies requiring minerals (e.g. car manufacturers) ●	
	Blue economy jobs ●	Holders of traditional knowledge ●				
	Other industrial "users" of the area ●					

2	**Terrestrial mining industry**	**Fisheries**	1	**Funding actors**	**Ecosystems & biodiversity**	
	National jurisdictions with land-based mining of "DSM metals" ●	Fishing industry ●		Global Finance Sector ●	Biodiversity ●	
	Land-based mining companies ●	Fisheries Artisanal ●		Alternative funding actors, able to finance science away from DSM ●	Global ecosystem ●	
	Terrestrial mining industry ●	Fisheries Industrial ●				
		Fisheries Regulations (MPAs) ●				
		High seas Fisheries ●				
		EEZ Fisheries ●				

● **Authorities and policy makers** ● **Conservation experts** ● **Industry experts** ● **Research scientists (online)** ● **Research scientists (on-site)**

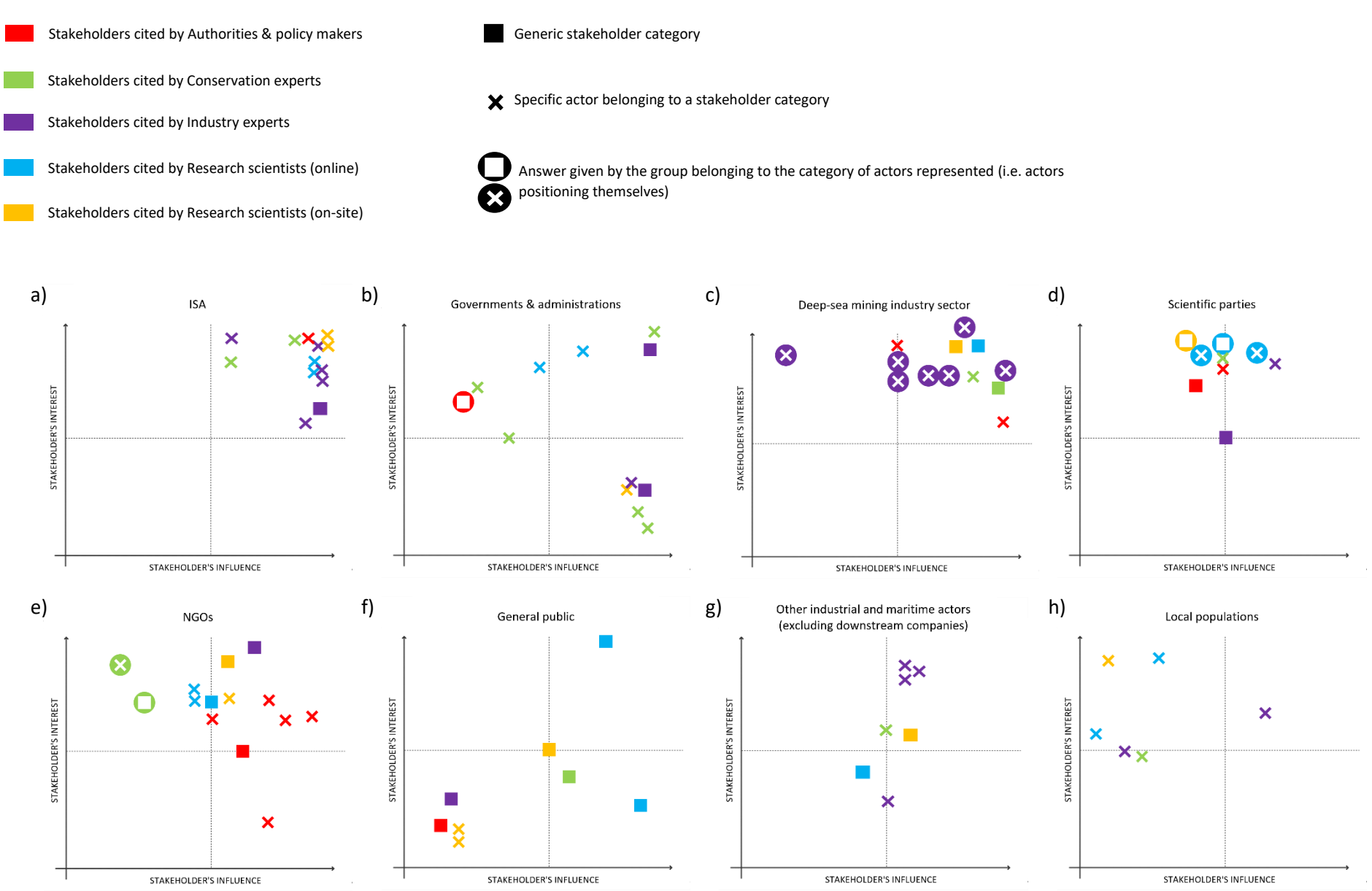

Figure 20: Graph summarising the placement of the categories of actors mentioned by the 5 groups of participants (a, b, c, d, and f) and by 4 of the 5 groups of participants (g and h). The squares refer to the stakeholder group in general and the crosses to more specific actors belonging to the stakeholder group. The white squares and crosses with a circle in the background correspond to the answers given by the participants belonging to the category of actors represented. The colours correspond to the different groups of participants.

3. Conclusion

As a first step of the stakeholder consultation process in the DEEP-REST project, the workshop allowed to start identifying the issues surrounding the triggering of deep-sea mining activities according to the views of the participants. The PESTEL categories were used to sort the ideas and to compare the results of the different groups. The most cited economic triggers included the demand for (and access to) minerals and the profitability of the operations. The main impediments to DSM included the social and environmental externalities. As such, establishing a social license to operate and closing environmental knowledge gaps may be required for DSM to start. Issues around the feasibility of the mitigation solutions were also raised and are highly relevant to the DEEP-REST project. The diversity of responses given by participants to the questions reflect the complexity of issues linked to DSM, ranging from socio-political (e.g. counter-lobbying by land-based mining actors) to technological (e.g. recycling) and legal factors (e.g. ISA mining code).

The workshop also enabled to depict a landscape of the stakeholders linked to the subject of deep-sea mining via the strategic positioning of the actors by the participants. It made it possible to highlight differing perceptions of the positioning of some stakeholders in this complex landscape, where all groups (except the industry) see themselves as less influent than they are seen by the other groups. The results also showed that the ISA is considered as the most influential and interested organization, although legal drivers were amongst the less cited DSM triggers and impediments. The DSM industry was also considered as highly influential by the majority of the groups. Conservation experts and research scientists considered the general public to have a moderate to strong capacity to influence, a view that was not shared by the industry experts and the authorities and policy makers. While some important actors such as the ISA, governments, NGOs and industries were mentioned by all groups, other influential actors including investors and terrestrial mining actors emerged from the discussions. The workshop thus enabled to identify important and influential stakeholders as well as the missing ones to bring around the table for the next steps of the DEEP-REST stakeholder consultation process.

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