Report on the origin and routes of disinformation in Latin America.

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1. Introduction

Climate change disinformation has become one of the main challenges to climate action, public policymaking, and the quality of democratic debate in recent years. Far from being limited to the explicit denial of scientific evidence, contemporary forms of climate disinformation operate through more subtle and sophisticated narratives that formally accept the scientific diagnosis but systematically undermine the legitimacy, urgency, or feasibility of the political and social responses needed to address the climate crisis.

In Latin America, this phenomenon takes on particular characteristics. The region combines high socio-environmental vulnerability with economies heavily dependent on extractive activities, making climate change a highly intense arena of political, economic, and symbolic struggle. In this context, digital social networks have become privileged spaces for the circulation of narratives that contest meanings surrounding development, energy, sovereignty, science, and the future, amplifying both accurate information and disinformation.

Recent literature on climate disinformation in Spanish-speaking contexts reveals an expanding field of research, albeit one marked by significant geographical disparities, methodological limitations, and a predominantly reactive approach to specific political circumstances. While there is growing conceptual sophistication—especially stemming from the analytical shift from “climate denialism” to “obstruction of climate action”—significant gaps remain in the study of dissemination mechanisms, the structure of digital ecosystems, and the role of actors in amplifying disinformation narratives.

In particular, most existing studies have focused on content or discourse analysis, with little incorporation of computational approaches, social network analysis, or longitudinal studies that would allow us to understand how disinformation is organized, circulated, and reproduced over time. Furthermore, regional research shows a pronounced geographic concentration, with a predominance of studies in Brazil and Spain, while other Latin American countries remain underrepresented. This configuration limits the possibility of constructing comparative diagnoses and identifying common structural patterns in the region.

Given this scenario, this report aims to analyze socio-environmental disinformation on social media using an exploratory-explanatory approach that integrates content analysis, conceptual classification, and social network analysis (SNA). The study focuses on seven cases distributed across three Latin American countries: Argentina (three cases), Brazil (two cases),

and Mexico (two cases), all linked to controversies surrounding climate change, the energy transition, extractivism , and strategic infrastructure.

The overall objective of this work is to identify how climate disinformation narratives are structured, circulated, and amplified on social media, paying particular attention to the role of actors, interaction dynamics, and the centrality of certain discourses within digital ecosystems. Specifically, the aim is to: (i) characterize the main types of disinformation present in each case; (ii) analyze the distribution and temporal evolution of this content; (iii) examine the structure of interaction networks and the position of disinformation within them; and (iv) provide metrics that allow for the evaluation of the relative impact of disinformation beyond the volume of posts.

The approach adopted assumes a moderately critical stance. While the analysis relies on explicit and replicable methodological criteria, it recognizes that climate disinformation constitutes not only an informational problem but also a potential threat to democratic deliberation and environmental governance. In contexts of high political polarization and a crisis of confidence in institutions, the persistent circulation of anti-science, obstructionist, or extractivist narratives can erode the social capacity to build minimal consensus around the climate emergency and development alternatives.

Finally, this report explicitly engages with previous literature while also seeking to overcome some of its identified limitations. In particular, it proposes a methodological approach that integrates computational network analysis with a refined conceptual typology of climate disinformation, aimed at producing empirically robust and potentially actionable knowledge for researchers, communicators, public policymakers, and civil society actors. In this sense, the work is part of a research agenda that seeks to move beyond the repeated diagnosis of the problem toward a more structural understanding of the mechanisms that sustain disinformation in contemporary digital ecosystems.

2. Conceptual Framework

2.1. Disinformation, infodemic and digital ecosystems

The concept of disinformation has been widely discussed in recent literature, especially since its consolidation as a public problem during the COVID-19 pandemic and its subsequent spread to other fields, including climate change. Generally speaking, disinformation can be defined as the circulation of false, misleading, or decontextualized information that is disseminated independently—or even in the absence—of a deliberate intention to deceive, but which produces significant social and political effects.

Within contemporary digital ecosystems, disinformation is embedded in what various authors have conceptualized as an infodemic: an overabundance of information—true, false, and ambiguous—that hinders the ability of individuals and groups to identify reliable sources, evaluate evidence, and make informed decisions. In this context, disinformation does not operate in isolation but rather interacts with algorithmic dynamics, visibility incentives, viral logics, and the interaction structures inherent to digital platforms.

From this perspective, disinformation ceases to be a phenomenon strictly linked to content and becomes a structural problem of the digital communication system. Analytical relevance

thus shifts from the factual veracity of each individual message to the patterns of circulation, amplification, and legitimization of certain discourses within complex social networks.

2.2. Anti-science narratives and erosion of epistemic authority

One of the central components of contemporary climate disinformation is the proliferation of anti-science narratives. These narratives are not limited to denying specific data, but rather seek to erode the legitimacy of scientific institutions, experts, and knowledge production mechanisms. Expressions such as accusations of “bought scientists,” “manipulated data,” or “ideologized science” form part of a discursive repertoire that undermines the epistemic authority necessary to support climate action.

Recent literature indicates that these narratives serve a strategic function: by weakening trust in science, they reduce the capacity of climate diagnoses to serve as a normative basis for public policy. Instead of directly challenging the facts, anti-science narratives shift the debate into the realm of suspicion, conspiracy theories, or the relativization of expert knowledge.

In Latin American contexts, these dynamics are reinforced by historical deficits in institutional trust and by the increasing politicization of technical knowledge. The result is a discursive environment in which science appears as just another actor in an ideological dispute, rather than as a fundamental input for collective decision-making.

2.3. From climate denial to obstruction of climate action

A key contribution of the most recent literature is the distinction between climate denialism and climate obstructionism . While denialism is characterized by the explicit denial of the existence of climate change or its anthropogenic origin, obstructionism takes more subtle and adaptive forms.

Climate obstructionism accepts, at least outwardly, the existence of the problem, but systematically questions the urgency, priority, or feasibility of the responses. Phrases like “it’s not the right time,” “there are more important problems,” or “the transition is unworkable” operate as discursive devices that indefinitely postpone climate action without directly confronting the scientific evidence.

This conceptual shift is particularly relevant for empirical analysis, since much of contemporary climate disinformation is not presented as outright denial, but rather as a form of discursive obstruction that preserves the status quo. Analytically , this requires tools that allow us to capture not only explicit falsehoods, but also interpretive frameworks that hinder the translation of climate diagnoses into political action.

2.4. Greenwashing , extractivism and false energy urgency

Another central axis of the conceptual framework is the analysis of greenwashing and discursive extractivism . Greenwashing refers to the strategic appropriation of environmental language by political or economic actors to legitimize practices that, in reality, reproduce unsustainable models. Concepts such as “orderly transition,” “clean energy transition,” or “green growth” can operate as legitimizing frameworks that neutralize criticism without substantially modifying extractive dynamics.

For its part, discursive extractivism is frequently linked to the notion of a false energy urgency. Within this framework, the exploitation of natural resources is presented as an unavoidable and immediate necessity, associated with economic survival, national sovereignty, or development, displacing or delegitimizing any environmental or social considerations as secondary or " anti-progress ."

These narratives are particularly relevant in Latin America, where debates about energy, infrastructure, and natural resources are embedded in long histories of dependency, inequality, and territorial conflict. Disinformation, in this sense, not only distorts facts but also contributes to normalizing certain development trajectories as unique or inevitable.

2.5. Disinformation as a structural and relational phenomenon

The approach adopted in this work conceives of climate disinformation as a structural and relational phenomenon, rather than as a sum of isolated pieces of content. This implies shifting the analytical focus towards the networks of interaction, the key actors, the dynamics of amplification, and the discursive communities in which disinformation is embedded.

From this perspective, the central question is not only what is said, but who says it, how it circulates, with what level of amplification, and what position it occupies within the digital ecosystem. Social network analysis thus allows us to identify patterns of centrality, coordination, and concentration that are invisible to purely descriptive approaches.

This conceptual framework justifies the methodological combination used in the study: a refined typology of climate disinformation, applied through explicit dictionaries and replicable decision rules, integrated with network metrics that allow the structural impact of disinformation to be assessed beyond the volume of publications.

3. Methodological design

3.1. General approach and unit of analysis

This study adopts an exploratory-explanatory approach that combines content analysis, conceptual classification, and social network analysis (SNA) to examine climate change-related disinformation on digital social networks. The methodological design is structured around two complementary levels of analysis: (i) individual posts, as the basic unit of discursive production, and (ii) actors (accounts), as nodes within networks of interaction and amplification.

This multi-level strategy allows for the simultaneous analysis of the content of disinformation, its volume and temporal evolution, as well as its structural insertion within digital ecosystems, overcoming approaches focused exclusively on the text or on aggregate behavior.

3.2. Platform analyzed

The analysis focuses exclusively on platform X (formerly Twitter), selected for its relevance in the circulation of public debates, its predominantly open nature, and its intensive use by political, media, and activist actors. While other platforms such as Facebook and Instagram play a significant role in the dissemination of socio-environmental narratives, this study is restricted to X due to the possibility of providing a longer timeline comparable to all cases under study, while maintaining methodological consistency across the analyzed cases.

This decision implies recognizing that the results do not capture the entirety of the digital ecosystem, but a relevant and strategically influential portion of it.

3.3. Data collection strategy

Data collection was performed using third-party tools, specifically Apify using the Apidojo actor , which allows the extraction of public X publications based on thematic queries and temporal reconstruction. This strategy was prioritized over using the platform's official API due to cost and access restrictions, with the latter remaining as a secondary alternative if needed.

The queries were designed using combinations of keywords, phrases, and territorial references specific to each case, with the aim of capturing relevant conversations without imposing overly restrictive filters. The queries were capable of capturing monthly volumes of 1,000 posts per topic, thus providing a consistent and comparable sample across the cases under study. The data were exported in CSV format, subsequently processed using R scripts, and visualized using Gephi .

3.4. Temporary Window

The study's timeframe spans from January 1, 2024, to December 31, 2025. Adopting this extended timeframe is based on two main criteria. First, it allows for capturing the emergence, persistence, and reactivation of disinformation narratives in contexts of low thematic density. Second, it enables the analysis of longitudinal dynamics and activity peaks associated with current events, legislative debates, or territorial conflicts.

The same time frame is applied uniformly to all cases analyzed, ensuring comparability between countries and topics.

3.5. Selection of cases and thematic delimitation

The study is structured around seven cases distributed across three Latin American countries, selected for their relevance to debates on climate change, energy, extractivism , and strategic infrastructure. For each country, academic analytical labels were defined to unify criteria and facilitate comparison:

Argentina

- Climate change and global governance (2030 Agenda, SDGs, UN, COP)
- Unconventional hydrocarbons and socio-environmental conflict (Vaca Muerta, fracking , earthquakes)
- Hydrocarbon exploration Offshore and coastal conflict (Mar del Plata)

Brazil

- Amazonia, deforestation and environmental crisis
- State energy policy and extractivism (Petrobras)

Mexico

- Railway infrastructure and regional development (Maya Train)
- Natural gas and energy megaprojects (Saguaro Project)

This selection allows us to capture a diversity of disinformation narratives linked to climate change in different institutional and territorial contexts.

3.6. Detection and classification of disinformation

The identification of publications containing disinformation was carried out using a strategy based on case-specific thematic dictionaries, combined with explicit and hierarchical decision rules. This approach prioritizes transparency, auditability, and replicability over supervised machine learning models, whose application is limited by the availability of labeled data and the discursive heterogeneity of the cases.

single - label classification was adopted , in which each publication is assigned to a single dominant category within a predefined typology, including: disinformation, anti-science, denialism, climate obstructionism, greenwashing , and discursive extractivism . The hierarchy of categories was designed to prioritize more severe forms of disinformation over more ambiguous or indirect expressions.

3.7. Validation and quality control

The classification process underwent quality control through manual review of random samples of publications classified in each category. This procedure allowed for iterative adjustment of the dictionaries, reduction of false positives, and assurance of conceptual consistency across cases. Given the exploratory nature of the study, supervised models and

manual mass labeling processes were not employed; instead, a hybrid approach combining automation and human validation was prioritized.

3.8. Social network analysis

To analyze the disinformation diffusion structure, directed networks of mentions between accounts were constructed, where nodes represent actors and edges represent explicit interactions through mentions (@user). Edges were weighted according to the frequency of interaction, allowing the capture of the relational intensity between actors.

The network analysis included classic structural metrics such as in-degree and out-degree, PageRank, and betweenness , as well as component and community analysis. The networks were visualized and explored using Gephi , complementing the quantitative analysis with structural inspection.

3.9. Specific metrics of disinformation

With the aim of highlighting the impact of disinformation beyond the volume of publications, specific metrics were incorporated, including:

- ***Disinformation Amplification Index (DAI):*** proportion of an actor's total *engagement* associated with disinformation posts.
- **Disinformation centrality:** centrality measures calculated on interactions linked to problematic posts.
- ***Disinformation/Information Ratio (DIR):*** relationship between disinformation and non-disinformation content at different levels of aggregation.

These metrics make it possible to identify actors, communities, and dynamics with a high capacity for amplifying disinformation, even when their absolute volume of publications is small.

3.10. Scope and limitations

The methodological design combines analytical rigor with operational feasibility, but it has limitations that must be considered. In particular, the analysis is restricted to a single platform, does not allow for inferring the actors' intentions, and depends on the quality and coverage of the constructed dictionaries. Nevertheless, the approach adopted provides a solid foundation for understanding climate disinformation as a structural and relational phenomenon, and lays the groundwork for future comparative studies and methodological expansions.

4. Dictionary construction and validation

The detection of disinformation in this study is based on the use of discourse dictionaries, conceived not as an auxiliary tool, but as a central hybrid component of the methodological design. These dictionaries operate at the intersection of content analysis and structural network analysis, allowing the identification of specific narrative patterns and, at the same time, the evaluation of their insertion and amplification within digital ecosystems.

Unlike approaches focused exclusively on the factual verification of individual claims, the strategy adopted is oriented towards capturing discursive regularities associated with climate disinformation, understood as a relational, contextual and dynamic phenomenon.

4.1. Origin and logic of dictionary construction

The dictionaries used in the study were constructed from a combination of two main sources. On the one hand, they draw on previous literature on climate disinformation, infodemics, denialism, obstructionism, and discursive extractivism , which allowed for the definition of consistent conceptual categories and interpretive frameworks. On the other hand, they were empirically induced from the collected corpus, incorporating expressions, terms, and discursive turns of phrase actually used in the analyzed conversations.

The construction process was iterative, beginning with initial lists of terms and expressions that were progressively refined based on exploratory inspections of the corpus, classification tests, and manual revisions. This inductive-guided approach avoided both the imposition of external categories poorly suited to the context and the uncritical capture of discourse noise.

4.2. Specific dictionaries and cross-cutting typology

The adopted design combines case-specific dictionaries with a common, cross-cutting typology of disinformation. Each case—for example, climate change and global governance, unconventional hydrocarbons, the Amazon, or mega-infrastructure projects—has its own dictionary, built to capture the discursive particularities of the corresponding debate.

At the same time, all the dictionaries fall within the same conceptual typology, ensuring comparability across countries and cases. This strategy allows us to recognize that disinformation takes on contextually situated forms, without abandoning a common analytical framework that articulates the different scenarios analyzed.

4.3. Language and contextual adaptation

The dictionaries were compiled in Spanish and Portuguese, respecting the linguistic and discursive specificities of each country. Literal machine translations between languages were not used; instead, contextual adaptation processes were employed, taking into account local expressions, cultural frameworks, and political references specific to each national context.

This criterion is particularly relevant in the analysis of climate disinformation, where seemingly equivalent concepts can fulfill different discursive functions depending on the context, and where certain expressions acquire specific meanings in concrete national debates.

4.4. Types of disinformation used

The classification of publications is organized around a cross-cutting typology composed of six categories, defined briefly and operationally:

Disinformation: false or misleading claims presented as facts, including conspiracy narratives or fabricated data.

Anti-science: discourses that discredit science, experts, or scientific institutions, without necessarily denying specific facts.

Climate denialism: explicit denial of the existence of climate change or its anthropogenic origin.

Climate obstructionism: formal acceptance of the climate problem accompanied by arguments that systematically block or postpone action.

Greenwashing : strategic use of environmental language to legitimize unsustainable practices or minimize impacts.

Extractivism / false energy urgency: narratives that present the exploitation of resources as inevitable or a priority, delegitimizing environmental alternatives.

These categories do not aim to exhaust the complexity of the phenomenon, but rather to offer an operational framework that allows us to distinguish different discursive mechanisms of disinformation

4.5. Decision and classification rule

The assignment of categories was carried out using a single - label classification , in which each publication is associated with a single dominant category. This decision is based on criteria of analytical clarity and comparative consistency, avoiding ambiguities in the interpretation of the results.

The decision rule is based on a descriptive hierarchy of categories, prioritizing more severe forms of disinformation over more indirect or ambiguous expressions. If a post contains indicators of multiple categories, the one that best represents the core message is assigned.

4.6. Validation and quality control

The classification process involved manual review of random samples of publications in each category, allowing for the identification of recurring errors, adjustment of problematic terms, and refinement of the dictionaries. This iterative adjustment was repeated until levels of conceptual coherence satisfactory for the purposes of the study were achieved.

Classical performance metrics typical of supervised models (such as accuracy or recall) were not used, since the objective was not to optimize a predictive classification, but to build a transparent and controllable analytical instrument, suitable for an exploratory-explanatory approach.

4.7. Scope and limitations of the dictionary-based approach

The dictionaries used are geared toward detecting discourse patterns, not inferring intent or exhaustively verifying each claim on fact. Consequently, the classification does not distinguish between intentional and unintentional disinformation, nor does it replace in-depth qualitative analysis of specific cases.

However, this approach is particularly suitable for large-scale comparative analysis of digital conversations, allowing the identification of regularities, contrasts, and structural dynamics of climate disinformation in different national and thematic contexts.

5. Descriptive analysis of the corpus

5.1. Volume of publications by country and case study

The corpus presents a large and relatively homogeneous volume of publications across the different cases analyzed. In all cases, the total number of observations falls within a narrow range, approximately between 21,500 and 24,000 publications per case, thus ensuring a comparable empirical base across countries and topics.

In Argentina, the three cases —climate change and global governance, unconventional hydrocarbons (Vaca Muerta) and hydrocarbon exploration Offshore —show similar volumes, with a slightly greater presence in debates related to unconventional hydrocarbons. In Brazil, both the Amazon case and the state energy policy case show only slightly lower volumes, while in Mexico the Maya Train and Saguaro Project cases are among those with the highest number of publications.

This relative homogeneity in volume allows us to rule out that the differences observed later in the proportion and typology of disinformation are simply due to disparities in the size of the corpus.

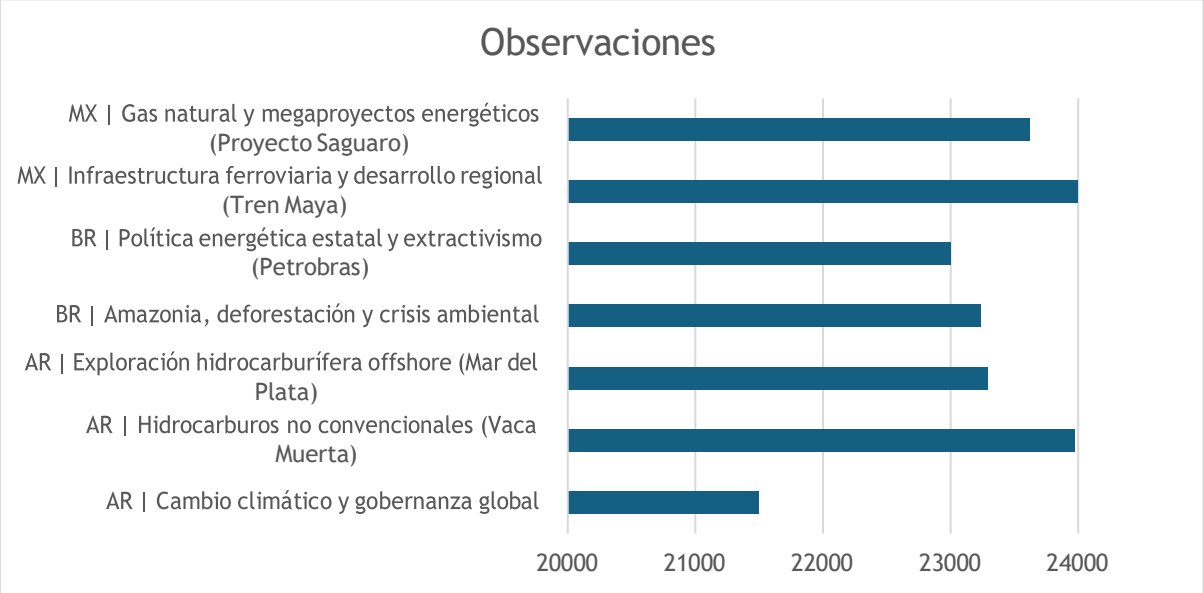


Chart No. 1: Total number of publications per case study.

5.2. Proportion of disinformation publications (RDI)

The analysis of the Disinformation/Information Ratio (DIR) consistently shows that disinformation constitutes a very small fraction of total publications in all cases analyzed. Considering the broad definition of problematic content (publications classified in any category other than “Non-disinformation”), DIR values range from 0.17% to 0.56%.

The case with the highest relative proportion of problematic publications is the Saguaro Project in Mexico (0.55%), followed by Climate Change and Global Governance in Argentina (0.43%). At the lower end are the cases of Vaca Muerta (0.17%) and Amazonia (0.18%). The remaining cases show intermediate values, always below 0.30%.

This result confirms that disinformation does not quantitatively dominate the digital conversation in any of the cases studied. However, the persistence of problematic posts in all

the contexts analyzed suggests that disinformation is a cross-cutting, albeit low-frequency, phenomenon whose relevance cannot be assessed solely in terms of volume.

Case Study	Not disinformation	Disinformation
AR | Climate change and global governance	99.57	0.43
AR | Unconventional hydrocarbons (Vaca Muerta)	99.82	0.18
AR | Hydrocarbon exploration offshore (Mar del Plata)	99.70	0.30
BR | Amazonia, deforestation and environmental crisis	99.81	0.19
BR | State energy policy and extractivism (Petrobras)	99.77	0.23
MX | Railway infrastructure and regional development (Maya Train)	99.75	0.25
MX | Natural gas and energy megaprojects (Saguaro Project)	99.44	0.56

Table No. 1: RDI by case study, with percentage values.

5.3. Distribution by types of disinformation

The breakdown of problematic publications by type reveals substantial differences between the case studies. In the case of Climate Change and Global Governance in Argentina, the categories of greenwashing and denialism clearly predominate, while outright disinformation appears only marginally. This pattern suggests a debate dominated by institutional narratives and discursive frameworks that minimize or deflect the climate discussion, rather than by explicit factually false claims.

In Vaca Muerta, most problematic publications focus on disinformation and greenwashing , with a limited presence of discursive extractivism . The offshore case of Mar del Plata, on the other hand, shows a notable concentration on disinformation and extractivism, with no records of direct disinformation, indicating a debate heavily influenced by ambiguous or incomplete statements rather than explicit falsehoods.

In Brazil, the Amazon case shows a distribution dominated by extractivism and disinformation, while Petrobras exhibits greater typological diversity, including direct disinformation, obstructionism, and extractivism . In Mexico, both the Maya Train and the Saguaro Project show a significant presence of disinformation and extractivism, with the latter having the highest absolute number of publications classified as direct disinformation.

Taken together, these results indicate that climate disinformation takes on different forms depending on the type of conflict analyzed, with a greater relative weight of indirect narratives — disinformation , extractivism and greenwashing — compared to explicit disinformation.

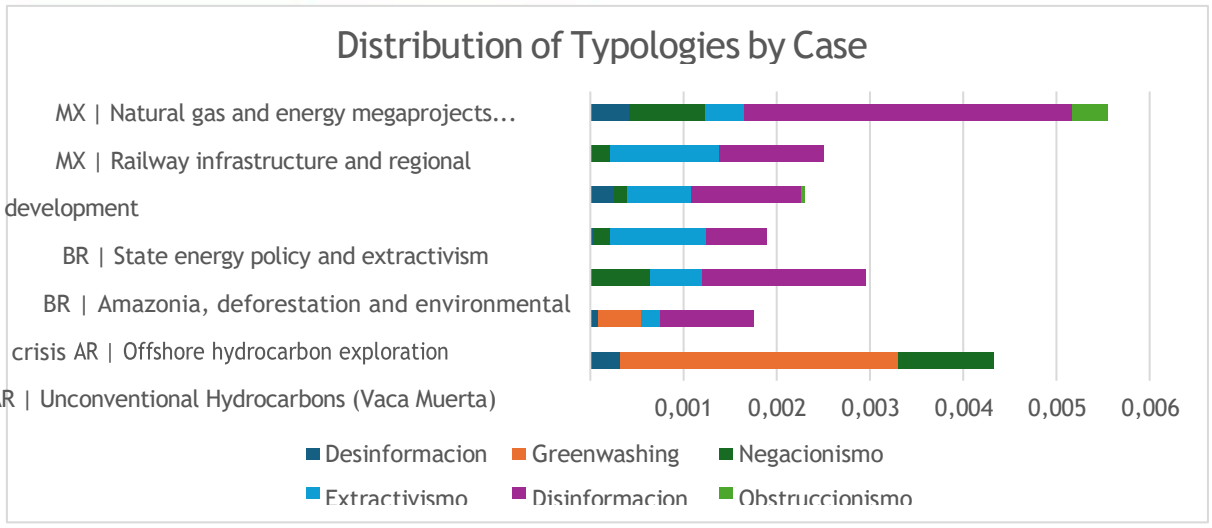


Chart No. 2: Distribution of typologies by case study.

5.4. Size of interaction networks

As a complement to the content analysis, the size of the networks of mentions associated with each case was examined, considering the number of nodes (accounts) and edges (interactions). The results show significant differences in the scale of the networks, even when the volumes of publications are comparable.

The case of Climate Change and Global Governance in Argentina presents the network with the highest number of nodes, while the Saguaro Project in Mexico exhibits the highest number of edges, suggesting greater relational intensity. In contrast, the Brazilian cases present networks that are more limited in terms of nodes, although with a comparable number of edges, which anticipates potentially denser configurations.

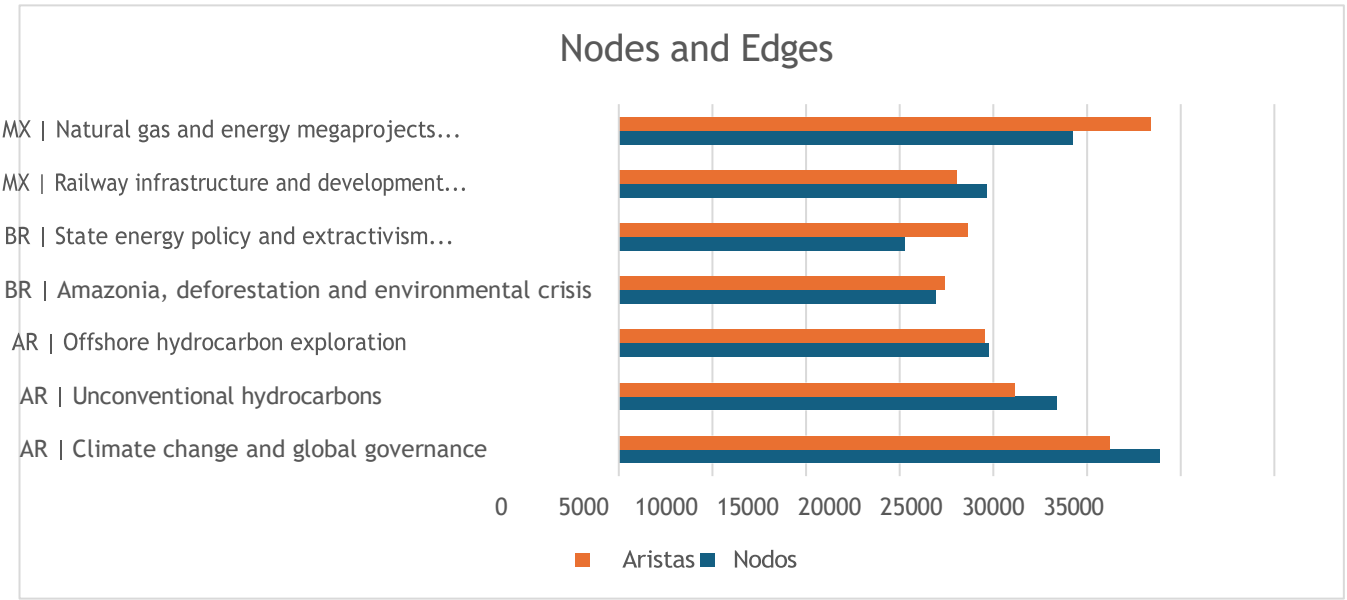


Chart No. 3: Nodes and edges by case study.

5.5. Descriptive summary

The descriptive analysis of the corpus allows us to establish three preliminary conclusions.

1. Climate disinformation represents a very small proportion of the total volume of publications in all cases analyzed.
2. Its typological composition varies significantly between cases, with a general predominance of indirect forms of disinformation over explicit denial.
3. The sizes of interaction networks show heterogeneous configurations that are not solely explained by the volume of publications.

These observations justify the need to move towards a structural analysis of the networks, aimed at evaluating whether the low frequency of disinformation corresponds to a low impact in terms of amplification and centrality.

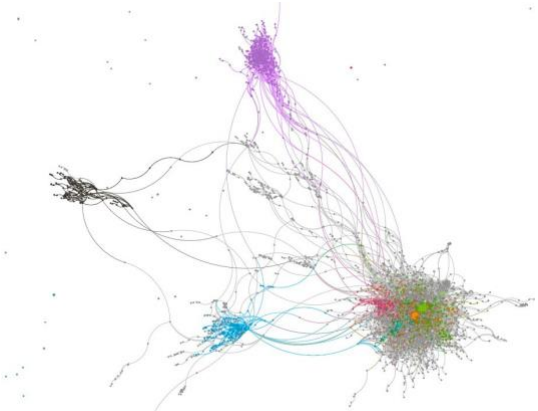
6. Social network analysis

The networks were filtered considering only interactions with a weight equal to or greater than two mentions, in order to reduce noise and concentrate the analysis on minimally consolidated relational links.

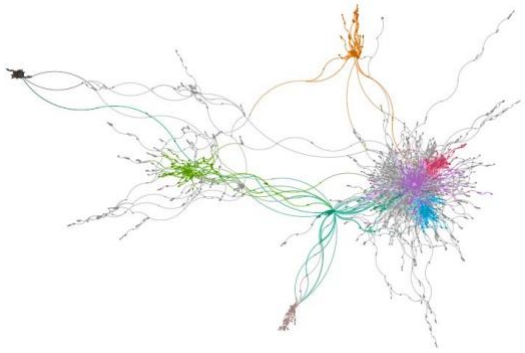
6.1. General network configuration by country

The analysis adopts a mixed approach, combining an aggregated view by country with specific references to the cases that comprise it. For each country, a targeted network of mentions was constructed, visualized using the ForceAtlas2 algorithm in Gephi , with nodes scaled according to degree and colored by community detected using the modularity algorithm of Blondel et al. (2008), adjusted for resolution according to Lambiotte et al. (2009).

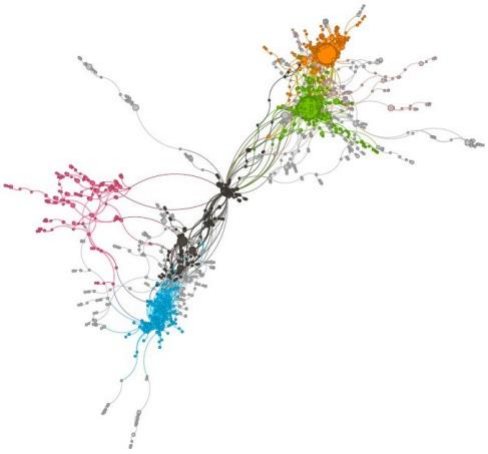
In all cases, the networks exhibit extensive, fragmented, and highly modular structures, suggesting the coexistence of multiple relatively autonomous discursive communities within each national debate.



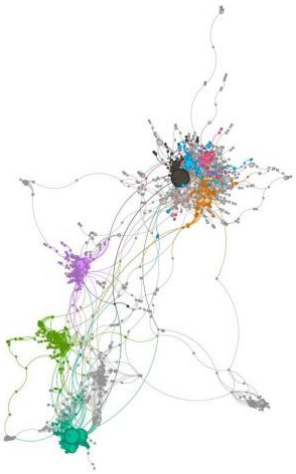
Network No. 1: Argentina | Climate Change and Global Governance



Network No. 2: Argentina | Unconventional Hydrocarbons (Vaca Muerta)

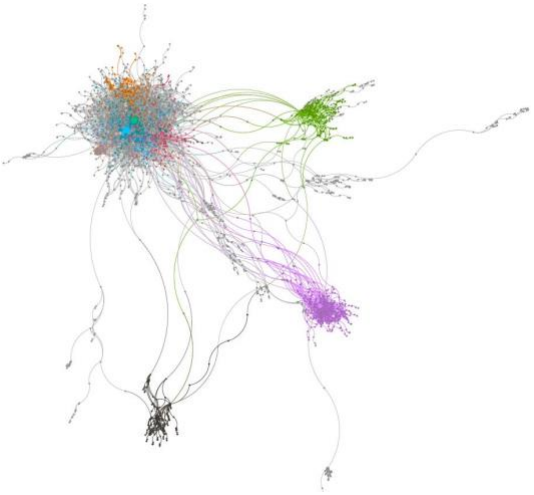


Network No. 3: Argentina | Hydrocarbon Exploration offshore (Mar del Plata)

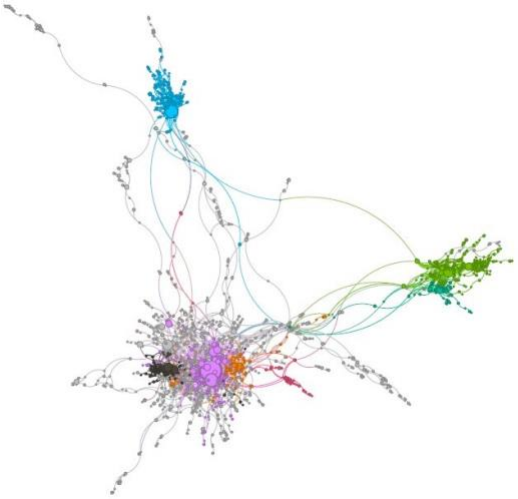


Network No. 4: Brazil | Amazon, deforestation and environmental crisis

Network No. 5: Brazil | State energy policy and extractivism (Petrobras)



Network No. 6: Mexico | Railway infrastructure and regional development (Maya Train)



Network No. 7: Mexico | Natural gas and energy megaprojects (Saguaro Project)

6.2. Size and connectivity of networks

The networks analyzed differ in size and level of connectivity, even though the volume of publications per case is relatively homogeneous. In terms of average degree, the values are around 1 in most cases, with significant variations between countries and topics.

The Argentine cases show mean degrees of connection below 1 in two of the three scenarios analyzed, indicating relatively dispersed networks with a large number of nodes maintaining few recurring mention links. The offshore case of Mar del Plata approaches the unit mean degree threshold, suggesting a slightly more intense interaction.

In Brazil, the Amazonia case shows an average degree greater than 1, while the Petrobras case reaches the highest value in the set (1.223), indicating a more densely connected network with actors that interact more frequently. In Mexico, the Saguaro Project presents a similar pattern, with a high average degree (1.173), in contrast to the Maya Train case, which exhibits lower connectivity.

These results suggest that debates associated with energy and energy megaprojects tend to be structured in networks with greater relational intensity than those linked to general climate governance.

6.3. Community structure and modularity

One of the most consistent features observed in the analyzed networks is their high level of modularity. In six of the seven cases, the modularity values far exceed the threshold of 0.94, indicating a very marked segmentation into communities that are densely connected internally and weakly connected to each other.

The Argentine cases and the Amazon case in Brazil exhibit particularly high modularity values, suggesting highly fragmented debates organized into discursive communities with little cross-cutting interaction. In contrast, the Petrobras and Saguaro Project cases show somewhat

lower (though still high) modularity values, indicating a relatively more integrated structure with greater circulation of mentions among communities.

From a descriptive perspective, these results point to the existence of distinct conversational chambers, where exchanges are concentrated within relatively closed groups. This configuration is consistent with dynamics of discourse polarization, although analyzing its content and orientation requires additional metrics that will be developed in later sections.

6.4. Central actors and interaction dynamics

While this section does not aim to exhaustively identify the most influential actors, a visual inspection of the networks and the distribution of influence reveals the presence of central nodes that concentrate a significant proportion of the mentions. These actors function as points of convergence within specific communities, articulating interaction flows without necessarily connecting communities to one another.

The observed centrality is not homogeneous across cases. In denser networks, such as Petrobras and Proyecto Saguaro, centrality is distributed among several relevant nodes, while in more fragmented networks it tends to concentrate in a few dominant actors within each community.

The precise identification of the role of these actors—and their relationship with the circulation of disinformation—will be addressed systematically in the following section, using specific metrics of centrality and amplification.

6.5. Structural Synthesis

Overall, the network analysis shows that the socio-environmental debates studied are organized into extensive, sparse, and highly modular networks, with interaction patterns that vary according to the type of conflict and the national context. The high degree of fragmentation observed suggests that the circulation of information—and potentially disinformation—occurs primarily within relatively closed communities, rather than through an integrated public sphere.

These structural characteristics provide the necessary framework to analyze, in the following section, whether and how disinformation is inserted into these networks, which actors amplify it, and what position it occupies in terms of centrality and reach.

7. Metrics of disinformation on social networks

This section introduces specific metrics aimed at assessing the structural impact of disinformation within the analyzed interaction networks. Unlike previous descriptive analyses, which focused on the volume and composition of content, the focus here shifts to amplification capacity, the structural position of actors, and discursive specialization in disinformation.

The analysis is conducted at a mixed level—actors, communities, and cases—and relies on three complementary metrics: the Disinformation Amplification Index (DAI), Disinformation Centrality (DC), and the Disinformation/Information Ratio (DIR). In all cases, the metrics are calculated on networks of targeted mentions filtered by a weight ≥ 2 and excluding

communities with fewer than three actors, with the aim of focusing the analysis on minimally consolidated relational structures.

7.1. Disinformation Amplification Index (DAI)

The Disinformation Amplification Index (DAI) measures the proportion of an actor's total engagement that is associated with problematic posts. Unlike metrics based on posting frequency, the DAI captures relative impact, allowing the identification of actors who, even with a low volume of content, concentrate a significant fraction of amplification around disinformation.

At the operational level, the IAD is defined as the ratio between the engagement associated with problematic posts and the actor's total engagement . This metric is calculated independently for each case study, allowing for intra-case comparisons without assuming direct equivalencies between national or thematic contexts.

The rankings of actors with the highest AI per case show significant heterogeneity. However, the official AI account of X, called Grok, appears in 6 out of 7 cases, reflecting the dynamics of users checking whether posts are true or false.

In some scenarios, high IAD values are concentrated among peripheral actors in terms of publication volume, while in others they appear associated with accounts with high overall visibility. This pattern reinforces the idea that disinformation is not necessarily amplified through the most prolific actors, but rather through more selective impact configurations.

Cases from Argentina

Climate Change	IAD	Offshore	IAD	Vaca Muerta	IAD
apccolombia	**1.00**	capitankechum	**1.00**	agustinbaiud	**1.00**
ceciliaismaylov	**1.00**	carloszonaoeste	**1.00**	angelavera21	**1.00**
cristian760377	**1.00**	facundog128	**1.00**	azereus	**1.00**
eldelasonic1	**1.00**	jupeterrj	**1.00**	crybwnniep	**1.00**
elinformantemx	**1.00**	karkus_ro	**1.00**	the roast	**1.00**
lessterrez	**1.00**	lulysuarezher	**1.00**	elronesvidaa	**1.00**
mirtasusana _	**1.00**	nico_debole	**1.00**	estebanmarti69	**1.00**
robnpupp	**1.00**	paradelajsr	**1.00**	hermanseguiluz	**1.00**
susanammlpqtp	**1.00**	susy_rivera _	**1.00**	jimolina82	**1.00**
unfpacostarica	**1.00**	uahernandez	**1.00**	jupeterrj	**1.00**
onumujeresmx	**1.00**	lifepresidency	**1.00**	kar75318	**1.00**
gobcordoba _	**1.00**	goldsmith	**0.83**	kareenrock	**1.00**
assembly	**1.00**	carlosbook11	**0.43**	kelly_con_k	**1.00**
lastcolinesian	**0.99**	summeroftherose	**0.25**	lourdescoria8	**1.00**
millennials	**0.89**	unamigook	**0.23**	lulysuarezher	**1.00**
ambientegobpue	**0.80**	Norway in Argentina	**0.18**	nicienvolando	**1.00**
revistavistazo	**0.27**	marcelopasetti	**0.12**	paco10mendoza	**1.00**
checked	**0.19**	garyernesto	**0.05**	ducklingofgreece	**1.00**
UNDPLAC	**0.05**	lacapitalmdq	**0.01**	power to legislate	**1.00**
grok	**0.01**			profedemilei	**1.00**

tecnoenergyarg	**1.00**
yessi1132014425	**1.00**
wizardofgalileo	**1.00**
goldsmith	**0.83**
juanfloreschaar	**0.80**
teidetweet	**0.33**
naura_m	**0.29**
xtu_culpa	**0.25**
unamigook	**0.23**
blackhawk_8752	**0.20**
grok	**0.05**
earthquake	**0.02**
elviejomike1	**0.02**

Cases from Brazil

Amazonia	IAD	Petrobras	IAD
carvalho3838	**1.00**	74ylors	**1.00**
clarke_de_souza	**1.00**	erisnandojr	**1.00**
dadsdaughter777	**1.00**	ilde_fonso9	**1.00**
danilosebe	**1.00**	Senator Rogerio	**1.00**
formighony	**1.00**	sr_greg	**1.00**
Guidocavalcanti	**1.00**	USA World Race	**1.00**
hdoebeli	**1.00**	novosclassicos	**0.95**
josevandea96085	**1.00**	eurobo36	**0.88**
lobadobolsonaro	**1.00**	rocha_lcr	**0.76**
marciofl2022	**1.00**	guimaraes13pt	**0.57**
r2elton	**1.00**	ciroleonardo5	**0.50**
vilimigu_tex	**1.00**	lbsolit4rio	**0.50**
emanuelschott	**0.67**	pborboremaa	**0.40**
jordanblakthorn	**0.26**	pamsilva2020	**0.33**
fauna focus	**0.14**	Giraldirenato	**0.17**
clubedoremo	**0.05**	eu_o_capiau	**0.14**
grok	**0.00**	filipevillegas	**0.13**
		ojoaogabriel	**0.07**
		marcosaljr	**0.04**
		caioaugstor	**0.01**
		erikamdaveiga	**0.01**
		martateodora3	**0.00**
		grok	**0.00**

Cases from Mexico

Saguaro	IAD	Maya Train	IAD
aguscvc2022	**1.00**	rods_o	**1.00**

almond433	**1.00**	donnie_brasco_7	**1.00**
ansima436319	**1.00**	elchaquenioo	**1.00**
the_trimax	**1.00**	00_al_plato	**1.00**
gazette_es	**1.00**	adanj4275	**1.00**
giannini_ann	**1.00**	adriamezquitaa	**1.00**
her_dsok	**1.00**	beto_ev	**1.00**
julianpatino93	**1.00**	bikerboi22	**1.00**
kevter93	**1.00**	davidde91200721	**1.00**
mroldannogueira	**1.00**	dflotaa	**1.00**
naty37412221	**1.00**	dmatossnachez	**1.00**
rep100_	**1.00**	dvelmir24291	**1.00**
roicv	**1.00**	guido_sm	**1.00**
tism98905665	**1.00**	jccalymayor	**1.00**
Mattsalic	**1.00**	languages001	**1.00**
moredogmorelove	**1.00**	lilyop	**1.00**
juanpereyra2019	**0.80**	lmerchant6	**1.00**
astra_nyssa369	**0.78**	lruizram	**1.00**
betancourtnat	**0.50**	lsaltosf	**1.00**
blue8goldjoker	**0.50**	noewildcur	**1.00**
aquiles_ok_si	**0.33**	payacahuite	**1.00**
barci_2010	**0.31**	pinoleroni	**1.00**
manuelcl10	**0.28**	putneymu	**1.00**
eduardols_tx	**0.14**	rafaelrex92	**1.00**
orsettabellani	**0.11**	ricardotcevada	**1.00**
claudiodesanm10	**0.01**	vicentemaass_r	**1.00**
grok	**0.00**	virgiliosando11	**1.00**
		watcherofsky	**1.00**
		yezel21	**1.00**
		monicasaadex	**1.00**
		itaihagman	**1.00**
		javiera00720925	**1.00**
		agustinciitoo29	**0.89**
		recubrenano	**0.83**
		jcito007	**0.76**
		juanjos51301540	**0.50**
		maxdlasse	**0.50**
		Natalia Gar	**0.46**
		gustavo21842661	**0.33**
		notisurmx	**0.30**
		emmarincon	**0.27**
		reporterosmx _	**0.23**
		madolfomg	**0.14**
		grok	**0.01**

7.2. Disinformation/Information Ratio (DIR) at the actor level

The Disinformation-to-Information Ratio (DIR) expresses the proportion of problematic publications relative to the total number of publications from an actor. Unlike the IAD, the DIR is a metric of discourse specialization, not impact.

In the cases analyzed, RDI values at the actor level tend to be low, even among actors with high IAD. This combination—low RDI and high IAD—is particularly relevant from an analytical perspective, as it indicates the existence of actors who mostly publish non-problematic content, but whose disinformation output receives disproportionate amplification.

Conversely, actors with high RDI but low IAD tend to occupy less central positions in the network, functioning as producers of problematic content with limited reach. This distinction allows us to empirically separate discursive specialization from amplification capacity, avoiding simplistic interpretations based solely on volume.

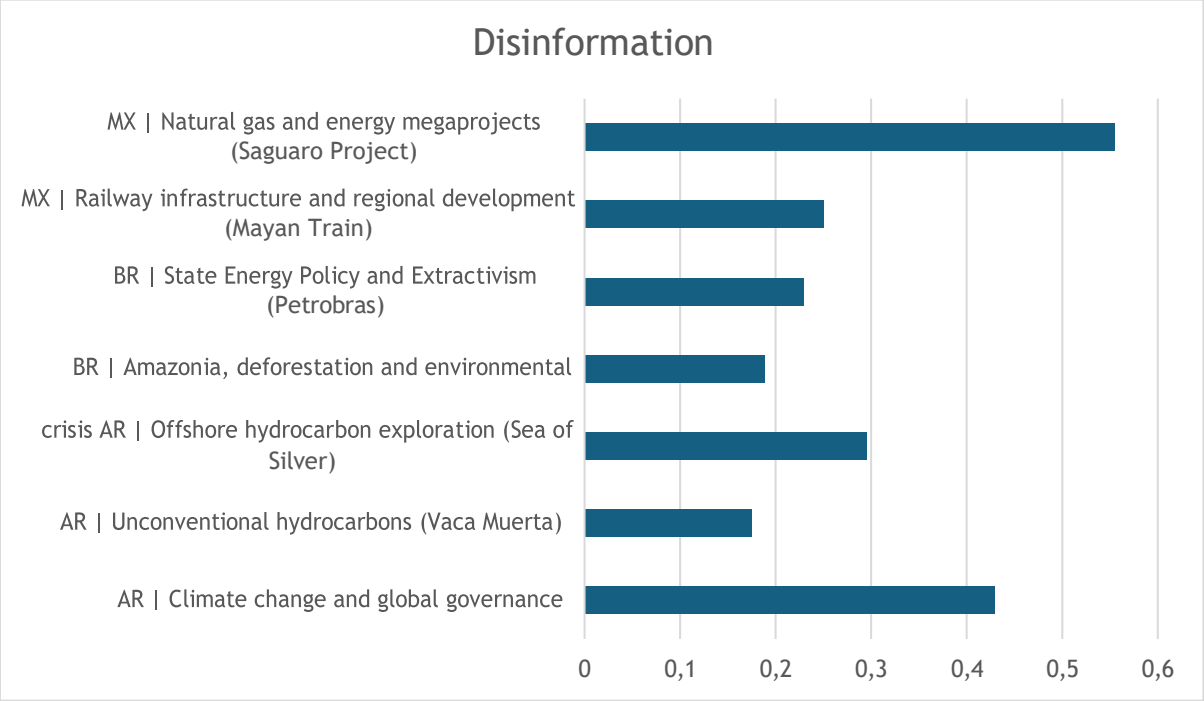


Chart No. 4: Disinformation Ratio.

7.3. Analysis of RDI vs IAD scatters by case study

Argentina | Climate change and global governance

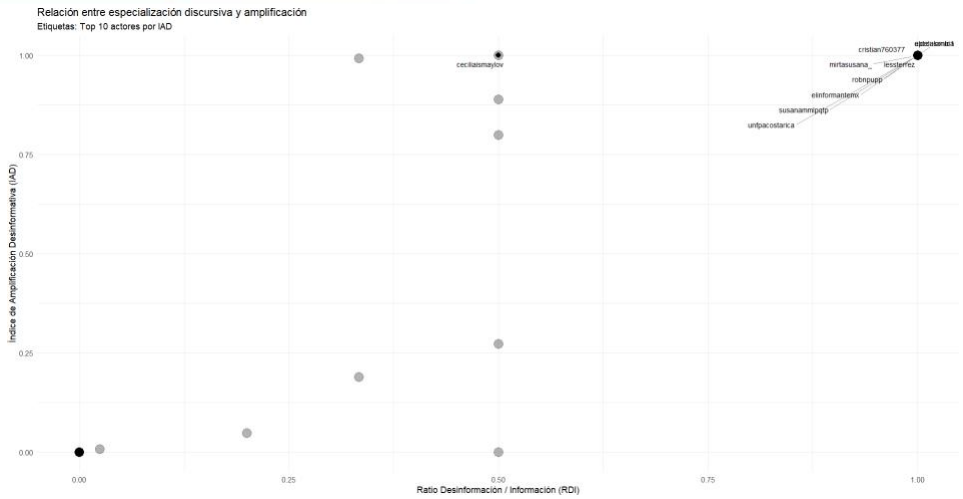


Chart No. 5: IAD vs RDI for Argentina | Climate Change and Global Governance

Dominant pattern:

- Strong concentration of actors in RDI ≈ 0 / IAD ≈ 0.
- Presence of very few actors with IAD close to 1, some with intermediate RDI (≈ 0.5).

The general debate on climate change and global governance presents a largely unproblematic information ecosystem, where disinformation appears only marginally in volume, but is highly amplified when it emerges. The actors with the greatest media impact are not highly specialized, reinforcing the idea of episodic rather than militant amplification.

Offshore Exploration (Mar del Plata)

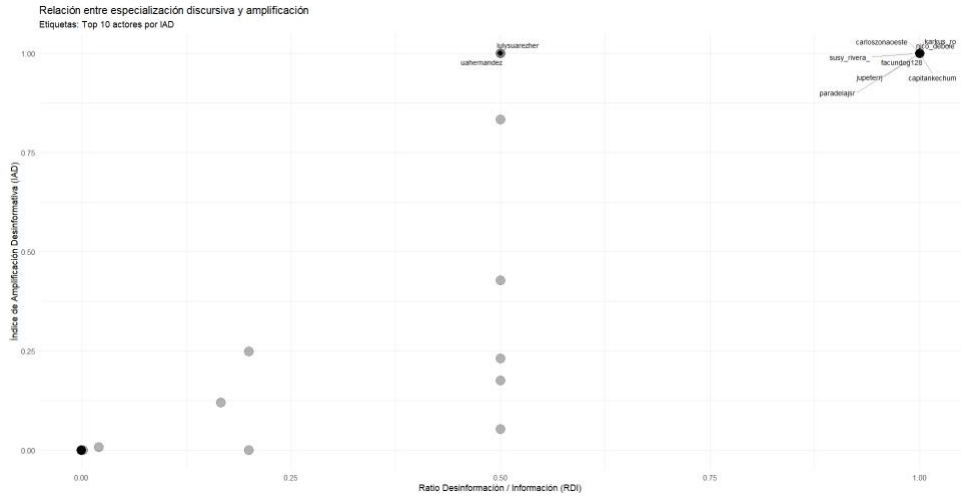


Chart No. 6: IAD vs RDI for Argentina | Offshore Exploration (Mar del Plata)

Dominant pattern:

- Very clear vertical polarization structure:
  - actors with low RDI and low IAD,
  - actors with RDI ≈ 0.5 and high IAD.

offshore conflict presents a scenario where half of the content from certain actors is problematic, and that content receives significant amplification. This is one of the cases where discursive specialization and amplification begin to partially align, although without forming a massive core.

Argentina | Unconventional hydrocarbons (Vaca Muerta)

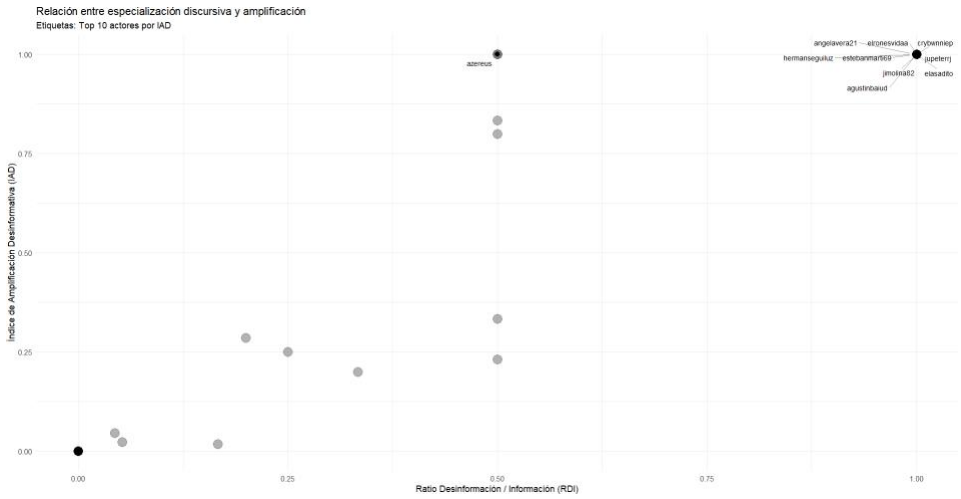


Chart No. 7: IAD vs RDI for Argentina | Unconventional Hydrocarbons (Vaca Muerta)

Dominant pattern:

- Greater dispersion in RDI (values between 0.1 and 0.4).
- Several actors with intermediate IAD and some with high IAD (≥ 0.8).

This case shows a greater degree of discursive specialization than the previous one. However, again, high IAD values are not concentrated exclusively among actors with higher RDI. Disinformation appears more integrated into the debate, but its impact continues to depend on relational positions, not just sustained production.

Brazil | Amazon, deforestation and environmental crisis

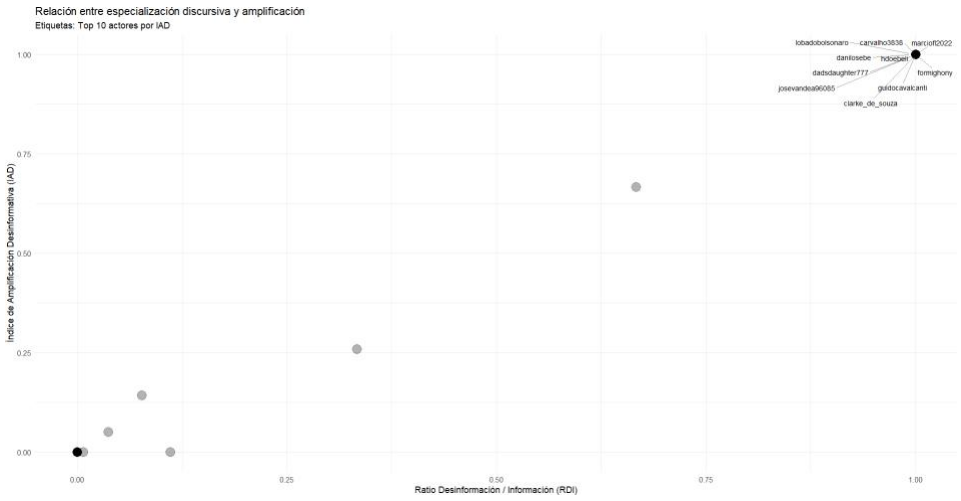


Chart No. 8: IAD vs RDI for Brazil | Amazon, deforestation and environmental crisis

Dominant pattern:

- Limited presence of actors with high RDI.
- Some actors with high IAD and intermediate RDI.

In the Amazonian case, disinformation does not take the form of systematic production, but rather appears to circulate through actors with mixed production methods, yet with a high capacity for amplification. This pattern is consistent with a highly fragmented debate, where certain problematic messages gain visibility without dominating the overall volume.

Brazil | State energy policy and extractivism (Petrobras)

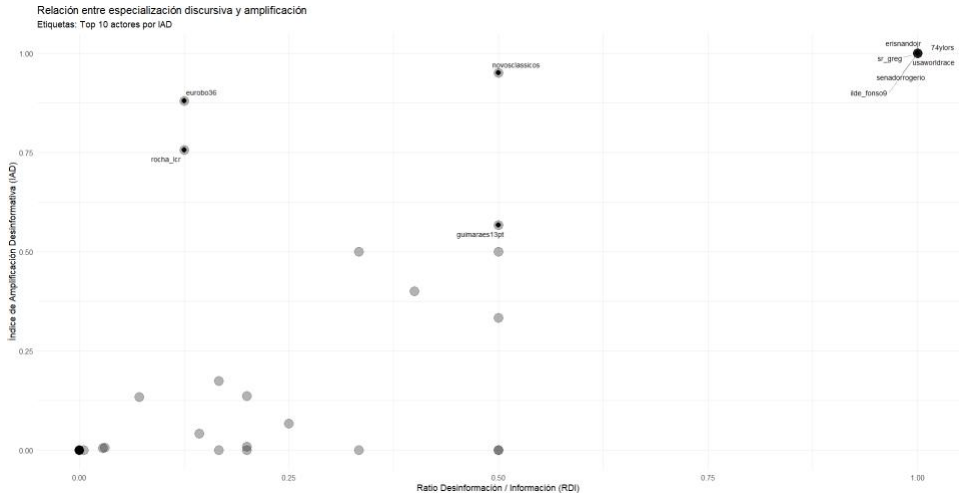


Chart No. 9: IAD vs RDI for Brazil | State energy policy and extractivism (Petrobras)

Dominant pattern:

- Clear presence of a reduced nucleus with high RDI (≈ 1) and high IAD (≈ 1).
- Greater alignment between specialization and amplification than in other cases.

This is one of the scenarios where disinformation takes on a more structured and coherent form, with actors combining systematic production and high amplification. Even so, these actors are numerically in the minority, indicating that the overall debate remains heterogeneous.

Mexico | Natural gas and energy megaprojects (Saguaro Project)

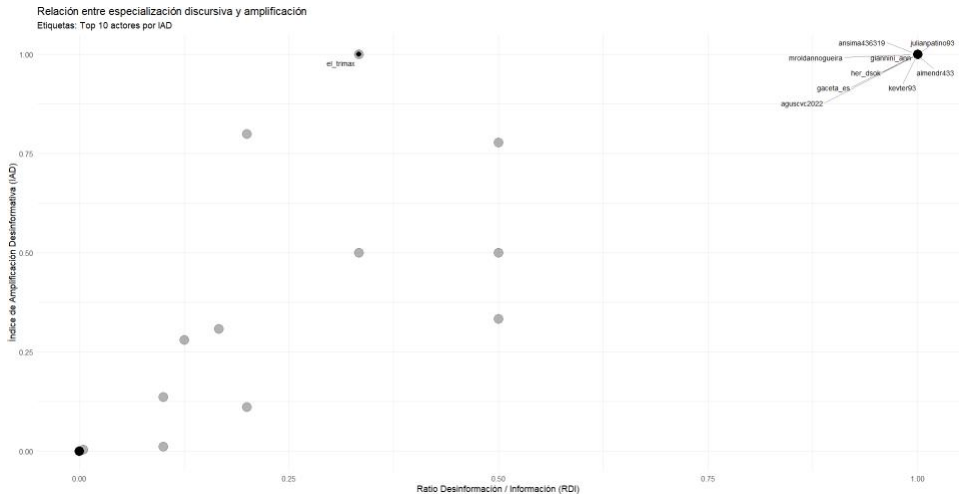


Chart No. 10: IAD vs RDI for Mexico | Natural gas and energy megaprojects (Saguaro Project)

Dominant pattern:

- Wide dispersion in RDI (0.1–0.3).
- Several actors with intermediate-high IAD, without reaching an extreme concentration.

The Saguaro Project reveals a pattern of distributed disinformation, where multiple actors contribute to amplification, but none clearly dominates the space. The relationship between RDI and IAD is weak, suggesting an ecosystem where amplification depends more on network dynamics than on individual specialization.

Mexico | Railway infrastructure and regional development (Maya Train)

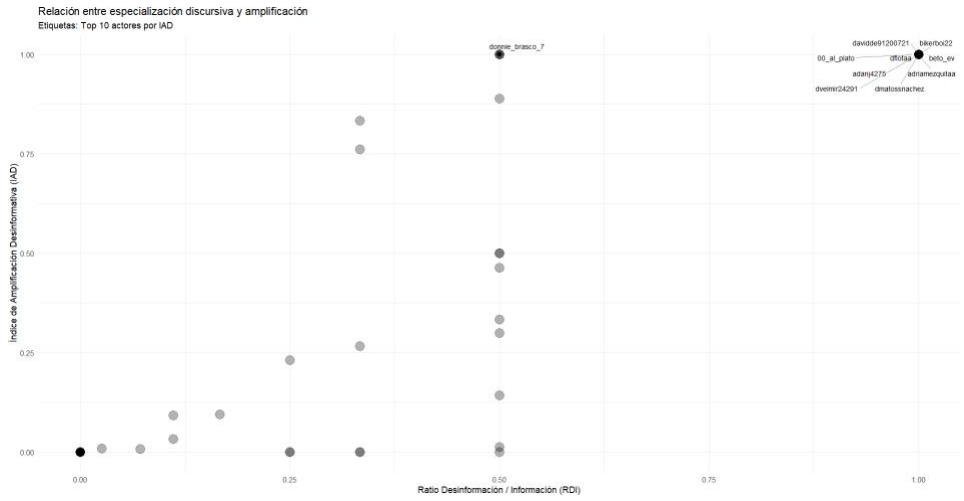


Chart No. 11: IAD vs RDI for Mexico | Railway infrastructure and regional development (Maya Train)

Dominant pattern:

- Presence of one or two actors with maximum IAD, but with intermediate RDI.
- Large mass of actors with low values in both metrics.

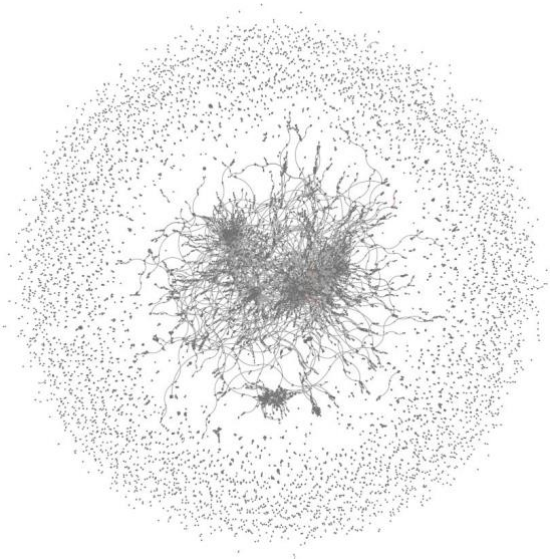
The case of the Maya Train reproduces the pattern observed in other territorial conflicts: disinformation is not dominant in terms of volume, but it can reach high levels of amplification through specific actors, strategically located in the network.

7.4. Disinformation Centrality (CD)

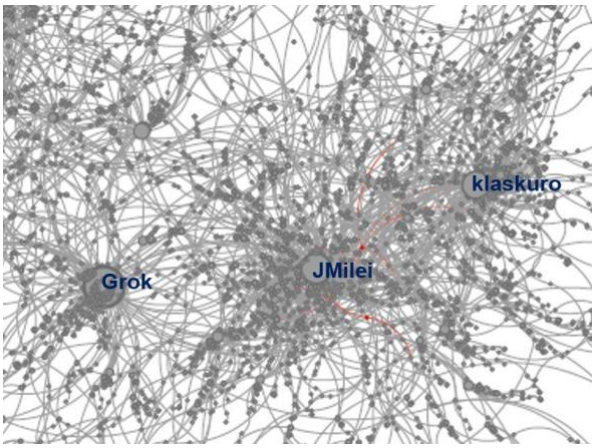
Disinformation Centrality (DC) assesses the structural position of actors linked to disinformation within the network. In this study, DC is operationalized as a normalized composite index, which integrates classic centrality metrics—ingress degree, PageRank, and betweenness —standardized and combined to capture different dimensions of structural relevance.

This approach allows us to identify actors who, beyond volume or engagement , are strategically positioned for the circulation of information. CD does not measure content or direct impact, but rather the potential capacity for intermediation and dissemination.

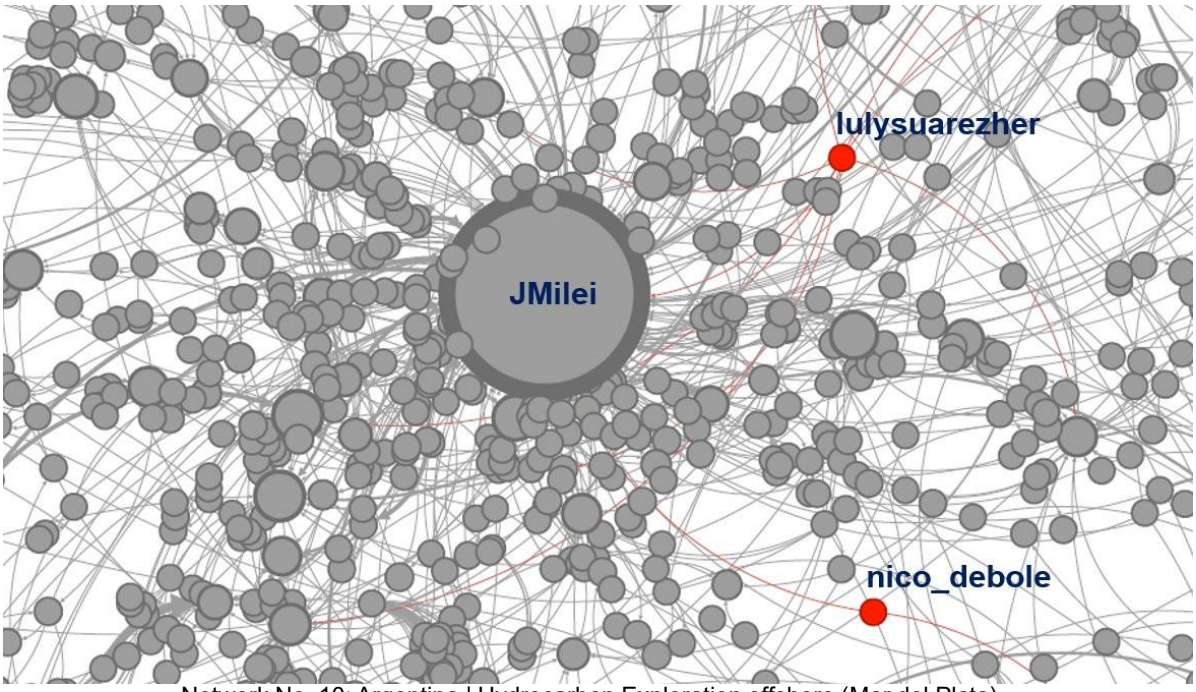
The analysis shows that actors with higher CD do not necessarily coincide with those with higher IAD or RDI. In several cases, actors with high structural centrality exhibit low levels of disinformation production, suggesting that the network's relational infrastructure can be exploited episodically to amplify problematic content, without this defining the actor's discursive identity.



Network No. 8: Argentina | Hydrocarbon Exploration Offshore (Mar del Plata). Force Atlas 2 Algorithm



Network No. 9: Argentina | Hydrocarbon Exploration Offshore (Mar del Plata). Main component



Network No. 10: Argentina | Hydrocarbon Exploration offshore (Mar del Plata).

Hydrocarbon Exploration Network Offshore on the coast of Mar del Plata, Argentina. We see that the main nodes linked to the Centrality of Disinformation are @Grok, X's artificial intelligence, which users consult about the veracity of information. Another relevant figure is the account of the President of Argentina, Javier Milei (@JMilei), as a point of reference regarding the dispute over the veracity of circulating information. And, the account @klaskuro, which clearly aligns with the Argentine center-right , and whose sole function is *to retweet* ideologically biased information.

On the other hand, the accounts @lulysuarezher and @nico_debole, both with a clear ideological stance towards the Argentine left, have minimal relevance in terms of

Disinformation Centrality. However, their close relationship with the previously mentioned accounts gives them a high Disinformation Amplification Index (DAI), confirming that, despite having a low volume of content, they concentrate high *engagement* with problematic posts, directly impacting the most relevant problematic publications.

7.5. Articulation between IAD, CD and RDI

The combined analysis of the three metrics allows for the identification of distinct configurations of disinformation risk. In particular, four recurring patterns are observed: actors with low specialization and low impact; specialized actors, but with limited reach; actors with high amplification capacity but without discursive specialization; and a small set of actors that combine high IAD and CD values, constituting structurally relevant nuclei for the circulation of disinformation.

This latter group, although a minority, is analytically significant, as it concentrates both impact and strategic position within highly fragmented networks. Identifying these actors does not imply attributing intent, but it does allow us to pinpoint critical points within the information ecosystem where disinformation can gain greater visibility.

7.6. Analytical synthesis

Disinformation metrics applied to interaction networks confirm that the impact of climate disinformation cannot be assessed in terms of the volume of posts. Rather, its relevance lies in the combination of amplification, structural positioning, and discursive specialization, articulated in a non-linear fashion. In networks characterized by high modularity and low density, even a small number of actors can play a disproportionate role in the circulation of problematic narratives.

7.7. Cross-cutting patterns

From the set of scatters , four robust empirical regularities emerge:

Low general specialization: In all cases, most actors exhibit low RDI, indicating that disinformation is not the main focus of discursive production.

Decoupling between RDI and IAD: No linear relationship is observed between discourse specialization and amplification. Actors with intermediate or low RDI can reach very high IAD values.

Structurally relevant minority: Actors with high IAD are few, but consistently visible in all cases, which reinforces the idea of concentrated, not diffuse, risk.

Variation according to type of conflict: Energy cases (Petrobras, Offshore, Saguaro) show a greater alignment between RDI and IAD than general climate governance cases, suggesting that conflicts with a stronger territorial and economic anchor favor more structured narratives.

8. Main Results

This section synthesizes the study's main empirical findings, integrating the results derived from content analysis and social network analysis. The focus is on the relationship between discursive specialization in disinformation and amplification capacity, operationalized using the

Disinformation-to-Information Ratio (DIR) and the Disinformation Amplification Index (DAI), respectively. The presentation adopts a mixed-methods approach, prioritizing cross-sectional patterns, followed by differences between countries, and finally, specific characteristics of each case study.

8.1. Cross-cutting patterns

The main finding of the comparative analysis is that climate disinformation on social media does not manifest as a massive or homogeneous phenomenon, but rather as a highly concentrated process. In all cases analyzed, most actors exhibit low values for both RDI and IAD, indicating a predominantly non-problematic discursive output with little amplification of disinformation content.

However, a small group of actors consistently emerges with high IAD values. These actors do not necessarily exhibit high levels of discursive specialization in disinformation, resulting in intermediate or even low RDI values. This empirical configuration highlights a systematic decoupling between the volume of problematic production and amplification capacity.

The analysis of the RDI-IAD diagrams also shows the absence of a linear relationship between the two metrics. Publishing a higher proportion of problematic content does not, in itself, guarantee greater amplification. On the contrary, actors with mixed or episodic output can achieve very high levels of impact, suggesting that the circulation of disinformation depends more on structural positions within fragmented networks than on systematic production.

8.2. Differences between countries

When comparing the results by country, common patterns are observed, but also relevant variations in the form that the relationship between specialization and amplification takes.

In Argentina, the cases analyzed show a clear predominance of actors with low discursive specialization. Disinformation appears sporadically, but when it does, it can reach high levels of amplification. This pattern is particularly visible in conflicts associated with offshore exploration and unconventional hydrocarbons, where some actors with intermediate RDI (Relationship Disinformation Index) concentrate high values of IAD (Intermediate Disinformation Index).

In Brazil, the Amazon case replicates a similar pattern, with low- specialization disinformation amplified through specific actors. However, in the case linked to state energy policy (Petrobras), a greater alignment between RDI and IAD is observed. There, a small core of actors combines systematic production of problematic content with a high capacity for amplification, although they remain a minority in absolute terms.

In Mexico, both the Saguaro Project and the Maya Train present scenarios where the amplification of disinformation is concentrated among a few actors, with high IAD values and intermediate levels of RDI. The observed dispersion suggests that amplification does not depend on a single dominant actor, but rather on the interaction between several relevant nodes within fragmented networks.

8.3. Differences according to type of conflict

Beyond national borders, the results show systematic differences associated with the type of socio-environmental conflict.

Debates related to general climate governance (climate change, the 2030 Agenda, SDGs, COPs) exhibit the lowest levels of discursive specialization and amplification concentrated among very few actors. In these cases, disinformation does not structure the debate, but it can gain visibility through specific incidents.

In contrast, energy and extractive conflicts (unconventional hydrocarbons, offshore, Petrobras, Saguaro Project) show a greater alignment between RDI and IAD. While most actors still do not specialize in disinformation, there is a higher proportion of accounts that combine recurring problematic content with high levels of amplification.

Territorial and infrastructural conflicts, such as the Maya Train, occupy an intermediate position. In these cases, discursive specialization is limited, but amplification can be significant, especially when the problematic issues are embedded in highly cohesive communities.

8.4. Summary of findings

In summary, the results allow us to state that:

1. Climate disinformation has a relatively low volume, but a high potential impact.
2. The amplification is concentrated in a small set of actors, who do not necessarily specialize in disinformation.
3. The relationship between discursive specialization and amplification is non-linear and depends on the structure of the networks.
4. Energy and extractive conflicts show a greater convergence between the production and amplification of disinformation than general climate governance debates.

9. Final Implications

The empirical evidence presented in this study allows us to advance a more precise understanding of the contemporary dynamics of climate disinformation on social media. Far from being a massive, homogeneous phenomenon or one based exclusively on the systematic production of false content, disinformation emerges as a selective, structurally conditioned, and highly concentrated process in terms of amplification.

This finding is consistent with recent literature on infodemics and scientific disinformation, which has pointed to a shift in the problem from the mere circulation of false content to the mechanisms of visibility, amplification, and algorithmic ranking. In this sense, the results reinforce the need to analyze disinformation not only as an attribute of content, but also as a relational phenomenon, dependent on the architecture of networks and the position occupied by certain actors within them.

9.1. Disinformation without mass reach: the role of amplification

One of the study's key contributions is demonstrating that climate disinformation does not dominate the volume of digital public debate, even in highly contentious contexts. In all cases

analyzed, the Disinformation-to-Information Ratio (DIR) remains low at an aggregate level, and most actors exhibit minimal levels of discursive specialization in problematic content.

However, this low quantitative presence contrasts with the high amplification capacity observed in a small subset of actors. The Disinformation Amplification Index (DAI) reveals that certain nodes manage to concentrate a significant proportion of the engagement associated with disinformation, even though this represents a small fraction of their total output. This dissociation between volume and reach suggests that the impact of disinformation depends less on its frequency than on who disseminates it, when, and from what relational position.

From a broader perspective, this pattern challenges approaches focused exclusively on detecting and removing false content, and puts the spotlight on amplification dynamics, which can turn isolated episodes into socially relevant narratives.

9.2. Fragmentation, communities and differential circulation

The discussion of these results cannot be separated from the structure of the analyzed networks. The mentioned networks show high levels of modularity and low density, indicating the existence of relatively closed discourse communities with little cross-cutting interaction. In this context, disinformation does not need to circulate massively to be effective: it is enough to become embedded in cohesive communities with key players to achieve significant visibility.

This fragmentation fosters the coexistence of multiple interpretations of climate change and socio-environmental conflicts, some of which clash with the scientific consensus. The spread of disinformation thus becomes selective, targeting specific audiences, which hinders its early detection and countermeasures through general communication strategies.

Furthermore, the Disinformation Centrality (DC) model reveals that the most relevant actors in the circulation of problematic content are not always the most visible or active. In several cases, actors with strategic structural positions amplify disinformation episodically, leveraging their online presence without making it the core of their discursive identity.

9.3. Energy conflicts, extractivism and narratives of urgency

The results also show that the relationship between discursive specialization and amplification varies depending on the type of conflict analyzed. Cases related to energy, extractivism , and infrastructure exhibit a greater alignment between RDI and IAD than general climate governance debates. In these scenarios, disinformation tends to be articulated with narratives of energy urgency, sovereignty, economic development, or technical inevitability, which facilitates its integration into broader and more socially resonant discourses.

This finding aligns with the literature on extractive narratives and greenwashing , which has highlighted how certain discursive frameworks legitimize controversial projects by minimizing environmental impacts or discrediting critical voices. In this sense, disinformation operates not only as explicit denial of climate change, but also as obstructionism, decontextualization, or relativization of risks—strategies that are more difficult to identify and classify.

9.4. Democratic and environmental implications

While this study does not aim to assess direct regulatory impacts, the results raise relevant

questions regarding the quality of public deliberation and environmental governance. The

existence of actors with a high capacity for amplifying disinformation, embedded in fragmented networks, suggests an information environment where visibility is not distributed proportionally to the quality or rigor of the information.

In the context of decision-making regarding climate, energy, or land-use policies, this dynamic can contribute to distorting social perceptions, exacerbating conflicts, and hindering the building of informed consensus. The threat lies not in the omnipresence of disinformation, but in its capacity for strategic disruption at key moments in public debate.

9.5. Contributions, limitations and future directions

From a methodological standpoint, the study offers an integrated approach that combines content analysis, amplification metrics, and social network analysis, allowing for the capture of dimensions of the phenomenon that are typically analyzed separately. The articulation between RDI, IAD, and CD proves particularly useful for distinguishing between production, impact, and structural position.

However, the approach has limitations. The analysis is restricted to one platform and a limited set of cases, and it does not incorporate subtle temporal dynamics or interactions between platforms.

These limitations open up future lines of research aimed at exploring the temporal evolution of amplification, cross-platform circulation, and the role of institutional and media actors in shaping these information ecosystems.

9.6. Closure

Taken together, the discussion reinforces a central idea: climate disinformation on social media should not be understood as a problem of an excess of false content, but rather as a structural, selective, and relational phenomenon. Its impact depends less on the quantity of messages than on the architecture of the networks, the position of certain actors, and their capacity for amplification in highly fragmented debates.

This approach allows us to shift the analysis from the question *"how much disinformation is circulating?"* to more productive questions about how, through whom, and in what contexts certain content acquires public relevance, thus contributing to a more sophisticated understanding of the challenges facing climate communication in the 21st century.