

# CHALLENGES AND STRATEGIES TO STRENGTHEN RELATIONSHIP BETWEEN SCIENCE AND POLITICS REGARDING CLIMATE CHANGE<sup>1,2</sup>

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## I) Climate change: Sceneries of Complexity and Uncertainty

The main concern of this text is to place the relationship between science and politics in a climate change framework, on one side, analysing the factors provoking connectivity deficit between science and politics, and on other side, those factors promoting and facilitating such link. Our focus shall be on the discussion on how to overcome those obstacles affecting the connection between science and politics, emphasizing the triggering and mobilizing factors.

The socioenvironmental framework that characterizes contemporary societies shows that human impact on the environment is causing increasingly complex changes both in quantitative and qualitative terms. In this respect, the sustainability issue has assumed a main role regarding the appearing dimensions of development and alternatives. The worsening of the damage levels in socioenvironmental conditions have meant an increase of vulnerability and, despite the governmental and non-governmental initiatives to enlarge the access to information, this is not being done in a meaningful way, mainly regarding the perception of people on the possible effects, incidence or intensity of natural disasters or economic impacts.

The contemporaneous risks (1) shows the limits and consequences of social practices, bearing the need to control side effects and transform the unforeseen risks into foreseen risks, and the current risk indeterminacy becomes fundamental for all the society.

The constant environment degradation is affecting in deep interferences the support capacity of the ecosystems (2), setting up the argument of the Anthropocene time, in which human actions are the dominant strength of changes in the biosphere (3). Rockström et

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1. A brief of this text was published in *Diálogo Político* year 23, book.1, 2016. Fundación Konrad Adenauer, Montevideo, Uruguay. Pp.73-83.

2. Journal version of paper presented at II Simposio sobre Cambio Climático y Toma de Decisiones organizado por UNESCO entre 19 -20 de agosto de 2015 en Montevideo, Uruguay.

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al. (2009) (2) identify nine planetary frontiers, from which seven are measurable: climate change, oceans acidification, bio-geochemical cycle of nitrogen and phosphorus, use of fresh water, changes in the use of the earth, biodiversity, chemical pollution and concentration of aerosol in the atmosphere. Frontiers trespass shall mean the entrance to a risk zone of systematic environmental disruption. At least three of these nine planetary frontiers have already been trespassed: climate change, rate of biodiversity loss and nitrogen cycle. In this context, it has been strengthened and spread the concept of resilience<sup>i</sup> that implies the capacity of a system to relate with the incremental or abrupt change and continue in its development. The researches have shown that systems, instead of changing in a continuous and gradual way, generate abrupt, unexpected and many times irreversible, changes.

Considering that damages represented by global warming are not palpable, immediate, or visible day by day, the advances have been very slow, linked to a global framework demanding great transformations and in which climate change have stopped being an essential environmental worry, but these climate change have become a key factor of the calculus itself, even among the most important global actors. It is important to emphasize the dimension of the global ruling that allows to consider the increasing quantity of interactions which surrounds the frontiers of the global policy of the climate, being its best examples the IPCC reports.

For Giddens (2010) (4), climate change demands a convincing, continuous, multi sectorial action in which the Estate must be the great motivator and guarantor, in order to encourage and support the most dynamic sectors of society. Meanwhile, it cannot be ignored neither the market role nor the government role at a sub national level. The market role appears as *modus operandi* structuring agent within a system which has still shown a slow process as regards decarbonizing and important changes in the production and consumption logic, connecting development and sustainability. Regarding governance at a sub national level, the results of the actions are effective reductions of greenhouse gases and at the end, they make certain influence, direct or indirect, in the international negotiations on climate change. Therefore, the sub national initiatives in the environmental global governance reach a higher impact when the actors involved act in an organized way in horizontal cooperation and charity nets, which in general, act as platforms for interchange of information, techniques, practices and experiences in measures adopted to face climate change.

## II) Socioenvironmental Crisis: Need of Its Recognition and Construction of Practices Capable to Structure Basis of a Sustainable Society

For Giddens (2010) (4), there is a great difficulty in the international scenario regarding the setting up of national or international goals and of control mechanisms for the reduction of greenhouse gases. It is important to mention that the development of new technologies essential for the reduction of emissions, besides costs, depends mainly of the interest and political will.

The markets shall also have an important role in the mitigation of greenhouse gases, since there are lots of fields of production in which the Estate has little inference,

as it is the case of carbon markets, which could be driving agents inspiring the reduction of emissions through the stimulus of mechanisms of efficiency and competence among companies.

IPCC reports tends to express a universal character of the climate science, and this might hide the complex relations between science and climate politics, as long as this articulation does not necessarily reflect how different countries produce techno-scientific knowledges to define and answer to climate change (5, 6). Within this perspective, we must consider the importance of understanding how different societies and nationalities might produce, legitimate and use types of knowledges addressed to the climate politics. It is still very limited the number of scientists developing activities which articulate the existing knowledge, interpreting a wider scenario, which identifies new relevant frontiers for the society as a whole, as long as the living systems are integrated totalities and, as part of an ecosystem, they are not isolated, but interconnected to a wide net of relations. Andrew Hoffman (2015) (7) shows how different languages are still dealt with, when speaking about climate change.

Therefore, while being highlighted the complexity of the events and the need of a dialogue among science, managers and society, it calls the attention the prevalence of a cognitive instrumental rationality, which in general does not consider the interdisciplinary dimension of problems affecting and maintaining life in our planet, problems bearing global nature and revealing political, economic, institutional, social and cultural dimensions. Consequently, there appears the need of a break with the compartmentalization of the knowledge and the challenge that this represents for the field of formation and production of knowledge. Perhaps, one of the greatest challenges which is currently placed to enlarge dialogue between science and politics is to strengthen and expand the field of relevant actors and emphasize contents and knowledge supported by sustainable values and practices, necessary to stimulate the interest, involvement and stimulus to share responsibility. The environmental issue relocates the human being in the centre of worries and scientific programs. Consequently, it appears a great existing potential to work with issues that stimulate changes in the behaviour, in the socio environmental responsibility and the environmental ethnic, stimulating other views. This reveals the importance of understanding the complexity and need to promote and multiply initiatives generating collaborative processes within the context of a risk society.

### III) Post Cop21 – Challenges Facing Climate Change

After hard negotiations, it has recently finished in Paris (France) 21st Summit of Nations Climate Change (COP21). It was held from November, 30th to December 11th 2015. It gathered 195 countries, and the results were considered positive, as long as it was reached a first universal agreement confronting climate change. This agreement has as purpose to maintain the average world temperature much below 2 centigrade in respect of pre-industrial levels, even though the countries agree to perform all necessary efforts in order not to overpass 1.5 grades, avoiding in this way catastrophic impacts. It is a legally binding agreement, but not the decision made therein or the national goals of reductions

of emissions because the revision mechanism of commitments of each country is legally binding in order to guarantee the fulfillment.

Regarding the reduction of emissions, 187 countries out of 195 which have participated in COP21 have shown their national commitments of fight against the climate change which shall enter into force in 2020.

The countries shall revise their commitments each 5 years, in order to assure the goal achievement to maintain the agreed temperature, below 2 grades.

It is important to mention that no sanctions were agreed. A transparent follow up mechanism of fulfilment was proposed in order to guarantee all the world perform what was promised

Meanwhile, Paris Agreement does not content stated obligations (neither objectives of reductions of emissions nor their revision or the implementation means, especially the financial ones) which strengthen the confidence facing the challenge of limiting the warming to 1.5 °C. The question placed is how parties shall interpret the goals according to their needs and national preferences. By this means, it should be taken into account that there exist huge hiatuses. The initiatives based on scientific scenarios revised by IPCC limiting the warming to 1.5 °C, request for decision made. The neutral balance is postponed during the second half of XXI century since the agreement is shortly precise regarding concrete actions to reach the reduction of emissions, without clear goals and contribution revision each 5 years.

#### **IV) The Need to Promote an Approach Among Science, Public Power, Private Sector and Civil Society.**

##### **1. Barriers and Challenges to Overcome**

Historically the *Adaptation* was marginal in the agenda of climate change if compared to *Mitigation* almost up to the end of 2000, when getting visibility in the debate.

According to the intensification of the effects of climate change and the limitations of mitigation strategies confronting them, the issue of adaptation has been getting more importance each time. The adaptation of the human systems is a process demanding a vast compound of interested parties being involved, acting with the multiple levels and sectors of the society. It requires analyses of the impacts generated by not only climate pressures but also models of future impacts. It also requires the consideration of existing vulnerabilities and social asymmetries, and the institutional, political, social and biophysics environment.

It cannot be ignored the adaptive deficit in the management of the natural variability of the climate, especially in developing countries which are periodically affected by climate disasters.

When dealing with the connectivity deficit between science and politics on one hand, and those who can promote it on the other hand, some factors are presented characterizing the lack of connectivity between the producers and users of climate information and to follow the triggering factors (8).

## Barriers in Communication and Climate Information

A first category is linked to the inability that the climate information at short and long term corresponds to the information needs, communication challenges and the absence of *brokers* translating and being facilitators together with the decision makers. Should the decision makers do not care of the relevance and practical utility of climate information, the motivation to use it shall be limited. This brings the need of generating connection (*bridging*) among communities of practices stating dialogues regarding mediating or binding organizations (*boundary organizations*) and playing a strategic role in the creation of collaborative dynamics and interactive arenas in which ones scientists and decision makers reach an understanding on common interest matters (*boundary objects*) (9). Among the communicative challenges, perhaps one of the most difficult to confront is to translate science in practical and orientation options. The producers of climate information frequently present lack of experience to communicate results in accessible and comprehensive formats for decision makers, who in most of the cases do not have the habit of interpreting scientific results.

Studies analysing the barriers in the communicational field also show that there are diverse limiting factors linked to the uncertainty inherent to the climate information being exposed by misunderstanding on results, making true levels of uncertainty linked to future projections (8).

### Political-institutional Barriers

Other aspects highlighted by Jones et al. (2015) (8) are linked to political and institutional barriers, being perhaps one of the most common factors, the incompatibility between the climate information and the political cycles, as long as these ones with duration between 4 and 5 years, in general do not correspond with the time scales linked to the climate information of short and long term, which are generally multi decadal in duration. The decision makers are more worried with the next 10 years than the next 100 years ahead. In the developing countries, this situation appears in a more concrete way, since the need of facing the most urgent socio - economic issues, frequently lead the policy makers to short term agendas. It is also important to mention the institutional resistance linked to other priorities or because of the use of information source overcome by time, or finally for the lack of flexibility of the institutional decision structure, addressing of actions and budget.

These barriers are linked to the need of promoting institutional learning mechanisms and the strengthening of the local government, which requests an articulated and strong governance with the participation of the public, private, civil, national and also international environment.

Facing a reality where the adverse effects of the climate change represent a threaten for the sustainable development of a country, it is responsibility of the Estate to take a strategic role overcoming the existing barriers regarding adaptation and reduction of the current and future vulnerabilities, strengthening planned initiatives of adaptation.

Other barrier to overcome in order to improve the institutionalism of the adaptation to the climate change is related to the prevalent legal logic, which in many cases hinders the promotion of efficient actions that make possible the incorporation of new functions to public organisms, in order to give an answer to challenges imposed by the climate change and the need of adaptation, to guarantee the implementation of actions and resources.

### Psycho Social Barriers

Regarding psycho social barriers, two aspects are observed, the first one link to the hiatus connected to the risk perception between scientists and decision makers, and the second aspect related to the lack of confidence and credibility in the climate information (8).

In this context, it appears the need of breaking what it has been called “science-policy divide” related to a compound of aspects considered as barriers that Hoffman (2015) (7) shows in a provocative way, as long as it affirms that the recent public debate on climate change is in part responsibility of the academic community. The dominant logic is reflected as scientists develop data, models, conclusions and expect the society to accept its conclusions since its methods and interests are stated within the scientific community and they should not be questioned. But science is neither social nor politically neutral, mainly if its conclusions request changes in the life style of society. And scientists have the difficult work of recognizing its scope on the society and communicate its impact to all of those who may have to live with their consequences.

Paraphrasing Nietzsche, Hoffman (2015) (7) highlights that convictions are the most dangerous enemies of truth than of lies. It is just on these aspects that we should wonder why many people accept the climate change science and others deny such science, even including decision makers. The social scientists understand that the comprehension of the climate change by most people is not due to the lack of adequate information, but mainly to an intentional or non-intentional denial attitude. This attitude is based on cultural and socio psychological values which can be summarized in four main aspects: our use of cognitive filters, as long as our cognitive filters reflect our cultural identity, and our identity might overcome the scientific reasoning and that the prevailing economic model generates a view of inertial world regarding changes. Likewise, the mental models have to be taken into account since they can stimulate thinking and action, but also be restrictors. For example, the political and economic interests threatened by the climate change issue, adopt strategies to confuse and polarize the debate to defend their interests. When opinions are much polarized, people defend entrenched values that are believed to be attacked. This means that when referring to “climate change”, some think it refers to scientific consensus and the need of a “carbon price”, and others understand that it refers to “more governments, radical environmentalists, restrictions to freedom, restrictions to free market” and even “a challenge to notion of God”. A common opinion, the recent Papal encyclical in which Francis I analyses the relations with the “common house”, it highlights a compound of interdependent factors, and all of these point out that solutions are and shall be in increase due to the recognition of the complexity of this matrix and

the enlargement of scenarios and actors involved that deal with the issue in an open way, in all its scope and with transparency. And also, due to the consideration of other aspects linked to the world views and lenses too by which the cultural values are seen as opposites.

All these aspects correspond to a complex framework of the reality built along human society history. The solutions are and shall be in increase due to the recognition of the complexity of this matrix and the enlargement of scenarios and actors involved and nets that deal with the issue in an open way, in all its scope and with transparency. Therefore, there is a huge challenge of considering all aspects linked to the world views and lenses by which the cultural values as opposites are observed. In other words, it is essential to recognize the basis for debate on climate change in order to make the dialogue effective and overcome and connect the cultural schism.

## **2. Triggering Factors: How to Strengthen the Link?**

We can characterize four central subjects as triggering factors. These are the boosting of cooperative logics, the strengthening of technical capacity of decision makers, opportunity windows and dialogue, comprehension on scientific results.

### **Cooperative Logics Between Information Producers and Users**

In order to meet this objective, the Estate shall promote, coordinate, supervise and execute, when corresponding, activities increasing capacity of adaptation of sectors exposed to climate change. Because of the transversal feature of the adaptation to the climate change and its relation with other development policies of the Estate, it is absolutely necessary that the execution and implementation of such occurs at level of different sectors of society and regions of the country. In this sense, it is the role of the Estate to assure coherence among these policies, take advantage of efforts and generate shared benefits.

An essential aspect is the increase among levels of collaboration and a double way among between producers and users of climate information. This process contributes to increase the confidence and strengthen the coproduction of knowledge. The triggering factors or facilitators support each other in collaboration, convergence of information with needs of the users and effective mediator agents.

However, according to Hoffman (2015) (7) there are obstacles in this way which request from scientists to guarantee the legitimacy in the public debates. Firstly, it appears the need that the scientist defines in an objective way, his manner to act and consider the matters linked to his/her expertise field, opening space for interdisciplinary articulations and helpful approach among areas of knowledge. Other aspect scientists must consider is the logic of public debates, in which it is important that his/her message be linked to risk emergency, as a result of its academic work, avoiding catastrophic contents which drive away to decision makers. The risk is the imprecision concerning the comprehension of scientific results presented, which when used in an inadequate way, creates a resistance currency regarding the data and models, which are the basis of its argument.



Different published works show the good results arising from open dialogues between producers of information and users (10), as long as the information is suitable to answer the needs of the decision makers and planners with adaptive focus. The qualitative jump takes place while being strengthened when decodifying the language in a format understandable for each audience, making use of adequate communication channels.

### Strengthening of the Technical Capacity of Decision Makers

It is also very important the performance of mediating organizations, which have as final goal and agenda of action, the function of facilitating, training and translating scientific results for public and private agents, with the purpose of strengthening mutual understanding.

It cannot be also ignored the institutional barriers and the need of reducing them internally in order to guarantee that institutions and organizations disposing technical frameworks or having more flexible and dialogue based decision processes enlarge the possibilities of creating better conditions for the use of climate information. This means that those institutions, which align best scientific results with the policy needs, can create institutional space to incorporate the management of climate risks in their broader strategies (8).

### Opportunity and Dialogue Windows

The local strategic alliances are strengthened when positioning as main agents in the participation at local level of the design, development and application of adaptation policies to climate change.

Changes might occur in each organization as long as the decision makers are more open and state strategic alliances, confidence levels which might make possible the coproduction of contents and therefore increase understanding among *stakeholders*. Dilling and Lemos (2011) (10) point out that the aspects of credibility, legitimacy and prominence well defined are fundamental elements in the use of climate information in the deciding processes. We are lead again not to take out of scope the aspects shaping relations between science and politics as information properly de codified facilitates the articulation and interaction based on confidence and legitimacy of both actors.

Regarding opportunity Windows, frequently the decision made is given by extreme events or critical situations linked to climate, which represents the repetition of pragmatic logics and do not break with a vicious circle in which prevails the *ex post*. Therefore, the municipal and/pr regional policies must be innovating, which depends on the capacity of the municipalities to learn and take advantage of the opportunity windows to promote changes which based on concrete practices, turn into knowledge which might give birth to new strategies and shared and agreed actions.

The issue is to advance in preventive and precautionary logics, and in this sense, the producers of climate data need to improve their dialogue to take better advantage



what might be called opportunities to reinforce shared practices to promote higher responsibility of decision makers.

One of the greatest challenges is the confronting of the fragmentation, the lack of communication and coordination from the local, municipal, inter municipal, regional and national level, that means, to reinforce the coordination between the different governmental levels, in the sense of advancing for consensus and the agreed definition as, for example, a provincial or municipal climate agenda, without forgetting the financing issue.

### Comprehension on Scientific Results

It is important to mention the importance of guarantying the citizenship participation, with emphasis in nets and coalitions in decisions, facilitating the implementation of action plans and reinforcing the legitimacy of the decisions.

Consequently, a triggering factor is the democratic information, accessible not only for the communities but for other decision maker/s, that means, the easy, quick and without economic cost access, disaggregated at the desired level of the user, to be communicated at different levels of comprehension, especially the technical one. This enlarges the possibilities of an informed participation in the decision and the construction of communication bridges with all interested parties, institutions, civil organizations and general public, through the better access to new knowledge, by means of a permanent production of material and the performance of education and diffusion activities, so that the process of adaptation is known, accepted and shaped to the needs.

### V) Social Learning, Climate Change and Adaptive Government

The new problems relating risks and environment contain common aspects which distinguish them from traditional scientific problems. According to Funtowicz and Ravetz (1993, 1997, 2000) (11,12,13) the increase of uncertainty, the weight in values and interests in the decisions and the multiplicity of legal perspectives in a determined situation request for new means of approach regarding social actors involved in complex scenarios.

So, the dialogue on quality and formulation of policies must be extended to what authors define as “extended peer community”, described through consensus conferences, consulting forums whose *stakeholders* bear some level of legitimacy and influence, strategic actors to stimulate and legitimize the dialogue and collaboration among different fields of knowledge and make possible more quality and validity for the scientific knowledge and enlarge its scope. Meanwhile, it is important to mention that this dialogue includes political processes, while existing huge difficulties to generate explanations for complex situations and emerging phenomenon, with risks and serious consequences demanding urgent actions in front of systematic uncertainties.

Facing the uncertainties, it appears the need to promote practices encouraging a logic not only of prevention<sup>ii</sup>, but mainly of precaution<sup>iii</sup>, able to deal with and orientate action plans in front of unexpected occurrences. It is important the formation and training of frameworks not only in the public area but also in the private one in order to have

better comprehension and dominance of the aspects integrating the risk confrontation. This becomes determining to confront the increase in the magnitude of natural events, and consequently, strengthening the reduction of communities' vulnerability. Therefore, minimizing the intensity of disasters and indirect risks which interact in a systematic way with other environmental and social aspects in different space and time scales.

Consequently, it is so important to enlarge the dialogue between science and society, and the greatest challenge is to create active social learning opportunities, promoting training processes in which ones prevail the acting of decision makers in dialogue relationships. This shall be in favor of the perception and recognition of diverse opinions, the mediation between group interests and collective interests, and the understanding as regards the complexity of climate questions which need to be approached by the decision made processes. This reinforces the participative dimensions, of shared practices of knowledge and stimulus to decide which sustainable scenarios are desired (15). The existing challenges to articulate these actors in processes that generate decisions in a complexity context are multiple and are strongly associated to the need of giving transparency and get the actors closer to issues proposed by society in risk. These contexts, characterized by complexity and different ways of uncertainty, highlights the need of multiplying knowledge and space of dialogue and debate

We see that the social learning as a process in which the involved agents in different contexts and situations need to demarcate the corresponding issues and produce relating contents and capacities to deal with common problems. This also represents a cultural learning, as long as the learning is emphasized as aspect of the shared management of natural resources. In this way, the action scope to confront the complexity, the need of change of socio- institutional practices and policies is widen, in a perspective of dialogue and thinking and values reform regarding the mechanisms of adaptation of society to climate change. Consequently, a last issue is involved, linked to the concept of questions of decision makers facing scientific data, when this issue is not solved by means of a slight technological adjustment, but mainly in the perspective of reflexive processes demanding much dialogue and interchange of experiences and shared practices among scientists, decision makers and civil society.

Therefore, it appears the importance of multiplying training activities of the key social actors such as local governments and economic agents, taking into account that by means of practices based on the social learning concept, it arises a troublesome thinking searching for answers.

Besides local governments and economic agents, other key element is to understand barriers and opportunities to enlarge the social participation in climate politics. This has been a constant and increasing worry of sociology and other social sciences as well as public authorities and private organizations. It is important to recognize the role of the public in general in the decision making process and consider the correlations between the communicational barriers and the limits placed to the effectively democratic participation of people such as voters, consumers and citizens (16, 17). As actors of climate politics, people may request the fulfilment of agreements and necessary changes in politics, including, their relation with the economy or on the contrary, they may act against the

introduction of climate politics. As resource consumers, people may adopt favourable behaviours to mitigation and adaptation, or on the contrary, unfavourable behaviours. That is why, governments, associations, companies and scientists have encouraged a widest disclosure about impacts on climate change. This requires that the scientific community should increasingly promote communication and education initiatives in order to enhance the public awareness on the subject. These initiatives shall be fundamental for the strengthening of a participative, multiple and democratic process in the decision making in front of climate change, and for the construction of a shared perception which enhances science and society and the recognition of inter independencies among actors

## Notes

- i Resilience in the context of ecology, is the capacity of a certain system that allows to recover equilibrium after suffering a perturbation. This concept refers to the capacity of restauration of a system.
- ii Prevention in the sense of preparing in advance the necessary stuff to set a goal, being a step ahead in front of a difficulty to prevent a damage, warn somebody about something.
- iii Precaution means caution or care taken in the performance of something to avoid or prevent damage or danger

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Submitted on: 13/02/2016

Accepted on: 29/08/2016

<http://dx.doi.org/10.1590/1809-4422ASOCEX0005V1942016>

# CHALLENGES AND STRATEGIES TO STRENGTHEN RELATIONSHIP BETWEEN SCIENCE AND POLITICS REGARDING CLIMATE CHANGE

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**Abstract:** The socioenvironmental framework that characterizes contemporary societies shows that human impact on the environment is causing increasingly complex changes both in quantitative and qualitative terms. Therefore, while highlighting the complexity of the events and the need of dialogue among science, managers and society, it emphasizes the prevalence of an instrumental cognitive rationality, which generally disregards the interdisciplinary dimension of problems affecting and maintaining life in our planet. The main objective of this work is to analyze factors affecting the connection between science and politics and to overcome those obstacles, emphasizing triggering and mobilizing factors.

**Key words:** Climate Change, Complexity, Socioenvironmental Crisis, Science, Politics.

**Resumen:** El cuadro socio-ambiental que caracteriza a las sociedades contemporáneas revela que el impacto de los humanos sobre el medio ambiente está causando alteraciones cada vez más complejas, tanto en términos cuantitativos como cualitativos. Así, al paso en que se destaca la complejidad de los eventos y la necesidad de un diálogo entre ciencia, gestores y sociedad, llama atención la prevalencia de una racionalidad cognitivo-instrumental, que, en general, desconsidera la dimensión interdisciplinar de los problemas que afectan y mantienen la vida en nuestro planeta. El objetivo central de este trabajo es analizar los factores que afectan la conexión entre ciencia y política y cómo superar esos obstáculos, enfatizando los factores activadores y movilizadores.

**Palabras clave:** Cambio Climático, Complejidad, Crisis Socioambiental, Ciencia, Política

**Resumo:** O quadro socioambiental que caracteriza as sociedades contemporâneas revela que o impacto humano sobre o meio ambiente está causando mudanças cada vez mais complexas, tanto em termos quantitativos quanto qualitativos. Assim, na medida em que se destaca a complexidade dos eventos e a necessidade de um diálogo entre ciência, gestores e sociedade, chama atenção a prevalência de uma racionalidade cognitivo-instrumental, que geralmente ignora a dimensão interdisciplinar dos problemas que afetam e mantêm vida

em nosso planeta. O principal objetivo deste artigo é analisar, no contexto das mudanças climáticas, os fatores que tem impacto na relação entre ciência e política e a forma de superar estes obstáculos, enfatizando os fatores ativadores e mobilizadores.

**Palavras-chave:** Mudanças Climáticas, Complexidade, Crise Socioambiental, Ciência, Política

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