Machine learning as a quali-quantitative method: investigating the composition of the IPCC Bureau

Tommaso Venturini
www.tommasoventurini.it
At the beginning of the 19th century natural and social scientists developed together a new discipline, "statistics", that helped them to interpret the new data available at that time. Today, the advent of digital data poses a similar challenge and calls for a similar alliance... efforts should be shifted from simulating to mapping and from simple explanations to complex observations.

Fill in the Gap: A New Alliance for Social and Natural Sciences
Journal of Artificial Societies and Social Simulation 18(2): 11

The Whole is Always Smaller than its Parts
The British Journal of Sociology 63(4): 590–615

Digital traces left by actors inside newly available databases might modify the very position of those classical questions of social order. Our aim is to test an alternative social theory developed by Gabriel Tarde in the early days of sociology, which never had any chance to be developed because of the lack of empirical tools.
Collective habits are expressed in definite forms such as legal or moral rules, popular sayings, or facts of social structure, etc. As these forms exist permanently and do not change with the various applications which are made of them, they constitute a fixed object, a constant standard which is always to hand for the observer, and which leaves no room for subjective impressions or personal observations (pp. 82-83).

The truth is that difference comes about by differing and that change comes about by changing ... change and difference attest to their necessary and absolute character (p. 37).

If Statistics continues to progress... a time may come when upon the accomplishment of every social event, a figure will at once be issued... with precise and condensed knowledge of all the peculiarities of social conditions (p. 133).

Re-purposing artificial intelligence

from categorization and prediction to interpretation and close reading
from quantitative methods to quali-quantitative methods

“If we abandon the idea that computational techniques can infallibly seize the richness of social phenomena and predict collective outcomes, their failures can be used to highlight dynamics that are interesting precisely because of their recalcitrance to quantification”
Becoming an IPCC Bureau Member
with Kari De Pryck and Tobias Blanke
Why the IPCC Bureau?

**Intergovernmental Panel on Climate Change**

- **plays a crucial role in the climate regime**, assessing the literature on climate change and providing the bases for the work of the UNFCCC

- **through the cohabitation of scientists and diplomats** the IPCC has provided a valuable interface between climate science and politics (but it also has been regularly criticised)

- **has become a model for other international expert organisations** (e.g. IPBES, IPAI)

**IPCC Bureau**

- The Bureau is composed of about **34 members** (the chair and vice-chairs of the IPCC and of its Working Groups and Task Force) **elected by the IPCC plenary at the beginning of each assessment cycle**

- **Bureau membership comes with substantial influence on the work of the IPCC and its bodies** (and with considerable prestige for both scientific and diplomatic careers)
The selection of organisational elites

Procedures for the election of the IPCC Bureau
Adopted by the Panel at the Twenty-Fifth Session (Mauritius, 26-28 April 2006), amended at the Thirty-Fifth Session (Geneva, 6-9 June 2012), Forty-First Session (Nairobi, 24-27 February 2015)

... the overall composition of the IPCC Bureau ... shall reflect balanced geographical representation with due consideration for scientific and technical requirements (rule 7)

Nominations for positions on the IPCC Bureau and any Task Force Bureau are to be made by the government of a Member of the IPCC. Governments of Members of the IPCC should refrain from nominating non-nationals without the consent of the nominee’s national government (rule 19)
The IPCC Dataset

The database

- Developed in two collaboratives projects which I’ve coordinated (EMAPS and MEDEA)

- contains the names of all the 5.676 individuals who contributed as author or delegates to the first five IPCC assessment cycles

- Separates the different roles held by the same individual, thus containing about 17.774 rows, corresponding to the contribution by a given individual in a given capacity
# Featurisation

## Individual trajectory features

- 1. Last AR where active
- 2. Number of plenary sessions
- 3. Number of chapter signed
- 4. Has been CLA, SPM, SYR, or Bureau
- 5. Degree
- 6. Temporal bridgeness
- 7. Thematic bridgeness
- 8. Functional bridgeness
- 9. Total bridgeness
- 10. Betweeness centrality
- 11. Closeness centrality
- 12. Eigen-centrality

## National affiliation features

- 13. Number of authors by the country
- 14. Number of delegates by the country
- 15. Financial contribution to the IPCC
- 16. GDP per Capita
- 17. % of GDP dedicated to R&D
- 18. Scientific and technical articles
- 19. CO2 equivalent emissions

### Directly from the database

- 1. Last AR where active
- 2. Number of plenary sessions
- 3. Number of chapter signed
- 4. Has been CLA, SPM, SYR, or Bureau

### Bipartite bridgeness

- 5. Degree
- 6. Temporal bridgeness
- 7. Thematic bridgeness
- 8. Functional bridgeness
- 9. Total bridgeness

### Monopartite centrality

- 10. Betweeness centrality
- 11. Closeness centrality
- 12. Eigen-centrality
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</table>
Bipartite network of capacity & contributors

Bridge contributors
Other contributors

WG1
WG2
WG3
SYR
Delegations
Degree example

Degree (N) = 2

Bridge contributors
Other contributors

WG1
WG2
WG3
SYR
Delegations
"bipartite-bridgeness" is defined as the summation of the number of connections created by a node, each weighted by its importance and by its rarity.

\[
BB(n) = \sum_{i,j} \frac{\text{neighbors}(i) \cup \text{neighbors}(j)}{\text{neighbors}(i) \cap \text{neighbors}(j)}
\]

\[
BB(n) = \sum_{ij} \frac{\text{union of the neighbourhoods of } i\&j}{\text{intersection of the neighbourhoods of } i\&j}
\]

importance

rarity
Bipartite bridgeness example

\[ BB(n) = \sum_{ij} \frac{\text{union of the neighbourhoods of } i \& j}{\text{intersection of the neighbourhoods of } i \& j} \]

\[ BB(N) = \]
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Escaping the “accuracy paradox”

Out of a total of 11,742 rows in our sub-set of training data
only 148 or 1.3% rows correspond to candidate or elected Bureau

A model predicting 0 candidate or elected Bureau
Would be 98.7% accurate
Anomalies detection
Isolation Forest (mean distance from root)


Isolation Forest (mean distance from root)

- 1,000 trees
- Average depth: 16
- 11,742 observations

Bureau elected or candidate (anomaly)


http://docs.h2o.ai/h2o/latest-stable/h2o-docs/data-science/if.html?highlight=isolation%20forest
## Features comparison

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Bureau / non Bureau comparison

Mean Root Distance

Bureau

Non Bureau
Interesting “errors”

Mean Root Distance

Bureau candidate or elected

Non Bureau
Top 20 anomalies (by average distance from root)

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Close reading of the results

Local Interpretable Model-Agnostic Explanations (LIME)
A quali-quantitative approach
Conclusions

Artificial intelligence and machine learning

• can be used not only to automate human tasks but also to kindle sociological imagination

• offer not only ways to handle large datasets but also tools for qualitative investigation

• are not infallible yet misalignments between model and reality can be sources of insights
5 misunderstandings about Digital Social Sciences

Tommaso Venturini
www.tommasoventurini.it
5 misunderstandings about digital social sciences

1. Digital sociology is not the sociology of the digital
2. Tracing collective phenomena hasn’t got any cheaper
3. Size matters, but less than diversity
4. Digital does not mean automatic
5. Data exploration is not a form of distant reading
Digital sociology is not the sociology of the digital
Bruno Latour, argued that the Web is mainly of importance to social science insofar as it makes possible new types of descriptions of social life. According to Latour, the social integration of the Web constitutes an event for social science because the social link becomes traceable in this medium. Thus, social relations are established in a tangible form as a material network connection. We take Latour’s claim of the tangibility of the social as a point of departure in our search (p. 342).


On Digital Methods

‘The Whole Is Always Smaller than Its Parts’: A Digital Test of Gabriel Tardes’ Monads
*The British Journal of Sociology* 63(4): 590–615

Venturini, Tommaso (2012)
Building on Faults: How to Represent Controversies with Digital Methods
*Public Understanding of Science* 21(7): 796–812
http://pus.sagepub.com/cgi/doi/10.1177/0963662510387558

Venturini, Tommaso, and Bruno Latour (2010)
The Social Fabric: Digital Traces and Quali-Quantitative Methods
Tracing collective phenomena hasn’t got any cheaper
... the price is just paid elsewhere

[Graph and text on tracking cable’s investment in infrastructure]

Hyperscalers are spending heavily on capital expenditures, mostly for data centers.

[Graph and text on hyperscaler capital expenditures]

www.ncta.com/broadband-by-the-numbers (cumulative unadjusted data)

www.mckinsey.com/industries/high-tech/our-insights/how-high-tech-suppliers-are-responding-to-the-hyperscaler-opportunity
Digital records are second-hand data ...

Digital records are second-hand data ...

... and come with bias

As anticipated, Google Suggest will be finally available at google.com. “Today we’re excited because Google Suggest will be graduating from Labs and available by default on the Google.com homepage. Over the next week, we’ll be rolling this out so that more and more of you will start seeing a list of query suggestions when you start typing into the search box,” says Jennifer Liu from Google.
Don’t confuse the mediation with what it mediates

A Reality Check(List) for Digital Methods
*New Media & Society* 20(11): 4195–4217
[https://doi.org/10.1177/1461444818769236](https://doi.org/10.1177/1461444818769236)

Venturini, Tommaso, Anders Munk, and Mathieu Jacomy (2019)
Actor-Network VS Network Analysis VS Digital Networks, Are We Talking About the Same Networks?
In *DigitalSTS: A Handbook and Fieldguide*, eds. David Ribes and Janet Vertesi
Size matters but less than diversity
More than Twitter

From 6 November to 19 November, all participants-generated 953,537 tweets about the conference. United Nations was the most influential participant. #cop23 and #climatechange were the top trends.

This interactive map offers a chronological view of the issues discussed in the negotiations within the United Nations Framework Convention on Climate Change. The streamgraph enables us to follow the absolute and relative importance of each issue as the Conferences of Parties. Issues are ordered from terms co-occurring in a corpus of reports on UNFCCC conferences from 1995 to 2013. Adaptation-related topics (particularly related to vulnerability and social & environmental impacts) show an increase towards the later negotiations.

HOW TO READ THE MAP

The stream graph diagram presents the absolute and relative visibility of different issues in the UNFCCC debate. Each issue is defined by a set of linguistic expressions occurring together in the negotiations. Each issue is then represented by a flow whose size varies from conference to conference proportional to the number of paragraphs in which at least two terms defining the issue are present. The flows are sorted according to the number of occurrences for each COP, the highest flow corresponds to the most visible theme while the lowest corresponds to the least visible. For example, "Adaptation Funding & Equity" is the most visible issue in the first COP and "Post-Kyoto and REDD" is the most visible in the last.

HOW THE MAP HAS BEEN BUILT

Our corpus is built from the 594 issues contained in the Volume 12 of the Earth Negotiations Bulletin, containing the reports on the UNFCCC conferences from 1995 in New York to 2013 in Bonn.

climatemaps.eu
Beyond platforms APIs

Venturini, Tommaso, and Richard Rogers (2019)
‘API-Based Research’ or How Can Digital Sociology and Journalism Studies Learn from the Facebook and Cambridge Analytica Data Breach

Venturini, Tommaso et al. (2014)
Three Maps and Three Misunderstandings: A Digital Mapping of Climate Diplomacy
Big Data & Society 1(2).
http://bds.sagepub.com/lookup/doi/10.1177/2053951714543804
Digital does not mean automatic
Climate Change

Volume 12 / Earth Negotiations Bulletin (ENB)

1995

Eleventh Session of The INC for the Framework Convention on Climate Change (UNFCCC)
INC 11 | 6-17 February 1995 | New York, USA

Issue #1 6 February 1995 PDF HTML
Issue #2 7 February 1995 PDF HTML
Issue #3 8 February 1995 PDF HTML
Issue #4 9 February 1995 PDF HTML
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First Conference of the Parties to the Framework Convention on Climate Change
COP 3 | 28 March - 7 April 1995 | Berlin, Germany

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First Session of the Ad Hoc Group on the Berlin Mandate
AQBIM 1 | 21-25 August 1995 | Geneva, Switzerland

Issue #22 Summary PDF HTML

First Session Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI)
SB 1 | 28 August - 1 September 1995 | Geneva, Switzerland

Issue #23 Summary PDF HTML

Second Session of the Ad Hoc Group on the Berlin Mandate
AQBIM 2 | 30 October - 3 November 1995 | Geneva, Switzerland

Issue #24 Summary PDF HTML

Year-End Update on the Framework Convention on Climate Change 1995
UNFCCC 1995 | December 1995

Issue #25 Summary PDF HTML
“Qatar, on behalf of the G-77/China, noted the impacts of recent climate-related disasters on developing countries and emphasized Annex I Parties’ responsibility for financial resource mobilization for adaptation, stressing the principle of common but differentiated responsibilities.”

“The Netherlands, on behalf of the EU, Bulgaria, Romania and Turkey, expressed continued commitment to addressing climate change and highlighted the launch of the EU emissions trading scheme in January 2005. He supported limiting global temperature rise to 2 degrees Celsius, noting that a greater increase would result in irreversible damages. Tuvalu, on behalf of the Alliance of Small Island States (AOSIS), highlighted the need for strong linkages with the 10-year review of the implementation of the Barbados Programme of Action for the Sustainable Development of Small Island Developing States (BPOA+10) and the World Conference on Disaster Reduction (WCDR), both to be held in January 2005, and emphasized the importance of dialogue on adaptation.”
"Qatar, on behalf of the G-77/China, noted the mobilization for adaptation, stressing the principle of "The Netherlands, on behalf of the EU, underlined that a greater increase would result in irreversible damage to Island Developing States (AOSIS), highlighted the need for implementation of the Barbados Programme of Action for Small Island Developing States (BPOA+10) and the work to be held in January 2005, and emphasized the..."
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Increasing scientific evidence about the possibility of global climate change in the 1980s led to a growing awareness that human activities have been contributing to substantial increases in the atmospheric concentrations of greenhouse gases. Concerned that anthropogenic increases of emissions enhance the natural greenhouse effect and would result, on average, in an additional warming of the Earth's surface, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC) in 1988. (The Panel is glossed on: assessing scientific information related to the various aspects of climate change; evaluating the environmental and socio-economic impacts of climate change; and formulating response strategies for the management of global climate change.) In 1990, the finalization and adoption of the IPCC report and the Second World Climate Conference focused further attention on climate change.

On 11 December 1990, the 45th session of the UN General Assembly adopted a resolution that established the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change (INC/FCCC). Supported by UNEP and WMO, the mandate of the INC/FCCC was to prepare an effective framework convention on climate change. The INC held five sessions between February 1991 and May 1992. During these meetings, participants from over 100 states discussed the difficult and contentious issues of binding commitments, targets and timetables for the reduction of carbon dioxide emissions, financial mechanisms, technology transfer, and common but differentiated responsibilities of developed and developing countries. The INC sought to achieve a consensus that could be supported by a broad majority, rather than drafting a treaty that dealt with specific policies that might limit participation.

The United Nations Framework Convention on Climate Change (FCCC) was adopted on 9 May 1992, and opened for signature at the UN Conference on Environment and Development in June 1992 in Rio, where it received 156 signatures. The Convention entered into force on 21 March 1994 (90 days after the receipt of the 50th ratification). The first session of the Conference of the Parties (COP) will take place in Belfort from 27 March - 7 April 1995. Since the adoption of the Convention, the INC has met five more times to consider the following items: matters relating to commitments; matters relating to arrangements for the financial mechanism and for technical and financial support to developing countries; procedural and legal matters; and institutional matters. During these INC sessions, scientific work was done to improve the methodologies for measuring emissions from various sources, but the larger scientific problem is choosing the best methodology to estimate the removal of carbon dioxide by sinks, namely oceans and forests. The other major task before negotiations has been to work on the difficult issue of financial support for implementation, particularly for developing country Parties who will require new and additional resources to obtain data and implement energy-efficient technologies and other necessary measures.

The INC held its ninth session from 7-18 February 1994, in Geneva. In discussions on matters relating to commitments, delegates examined methodologies for calculations/inventories of emissions and removal of greenhouse gases, the first review of information communicated by Annex I parties, the role of the subsidiary bodies established by the Convention, and criteria for joint implementation. Delegates also reviewed the adequacy of commitments. The need for broader action beyond the year 2000 on the commitments in Article 4.2(a) and (b) was considered, based on the understanding that the provisions of this article refer to the present decade. In its discussions on matters relating to the financial mechanism and technical and financial support to developing country Parties, the Committee chose to focus on the implementation of Article 11. It was agreed that only developing countries that are Parties to the Convention would be eligible to receive financial and technical support under this article.
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Automatic extraction terms with their different forms:

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Evidence about the possibility of global climate change in the 1980s led to a growing awareness that human activities have been substantial increases in the atmospheric concentration of greenhouse gases. Concerned that anthropogenic increases of emissions would result in a warming of the Earth's climate, the United Nations Framework Convention on Climate Change (UNFCCC) was established. The Convention entered into force on 21 March 1994 (the 50th ratification). The first session of the Conference of the Parties (COP) took place in Berlin from 27 March - 7 April 1994. Since the COP, the INC has met five times to consider the following items: matters relating to commitments; matters relating to the financial mechanism and technical and financial support to developing countries; and matters relating to the net balance of transfers. During these INC sessions, scientific work was done to improve the methodologies for measuring emissions from various sources. The text problem is choosing the best methodology to estimate the removal of carbon dioxide by sinks, namely oceans and forests. The task of the INC is to work on the difficult issue of technical support for implementation, particularly for developing countries who will require new and additional resources to obtain data and implement efficient technologies and other necessary measures. The ninth session from 7-18 February 1994, in Geneva. In discussions on matters relating to commitments, delegates examined or calculated inventories of emissions and removal of greenhouse gases, the first review of information communicated by Annex I Parties to the Convention and criteria for joint implementation. Delegates also reviewed the adequacy of the Kyoto Protocol, and for the implementation of Article 4.2(a) and (b), was based on the assumption that only countries that are Parties to the Convention would be eligible to receive financial support. The Kyoto Protocol's Article 4.2 provides a framework for the development of policies and measures (P&Ms) that address the commitment periods set out in its Annex I. It was agreed that only developing countries that are Parties to the Convention would be eligible to receive financial support.
Co-occurrence
20 years of negotiations on adaptation at UNFCCC COPs

Evolution of the different themes discussed during each COP in UNFCCC negotiation reports

**Methods**

The graph shows the evolution of the main themes discussed at each COP. Each theme is represented by a different color of the graph, but have been automatically and manually extracted from the text of the UNFCCC reports. The themes are grouped in horizontal bars and the text of UNFCCC COPs is organized in the same paragraphs.

The visibility of each theme is measured by the number of paragraphs in which at least one of the expressions defining the theme appear. This data is represented by the fact that paragraphs represent the thematic units of the report. Each paragraph is then assigned to one and only one subject.

In the graph, each theme is represented by a curve that shows the relative visibility of the theme in each of the COPs. The number of paragraphs in which the theme is mentioned, and the position of the thickness of the curve, correspond to the relative visibility of the theme in each of the COPs. A decrease in the thickness of the curve indicates a decrease in the relative visibility of the theme in that COP.
Narration
climaps.eu/#!/narrative/mitigation-and-adaptation-in-the-unfccc-debates

Migration and Adaptation in the UNFCCC Debates

According to some sectors of the climate debate, the world needs to understand how adaptation and mitigation are linked, as well as how we can create a new narrative for action.

The UNFCCC (UN Framework Convention on Climate Change) is a process that was established in 1992 and is designed to help countries mitigate and adapt to climate change. The organization is headquartered in Bonn, Germany.

Adaptation, on the other hand, is defined as "the measures intended to moderate or prevent damage or responses to the actual or expected effects of climate change." This includes a variety of actions, such as urban planning, agricultural practices, and disaster risk reduction.

Before we enter the discussion on adaptation and mitigation, let's briefly introduce the UNFCCC. The UNFCCC is an international treaty that was adopted in 1992 and entered into force in 1994. It is designed to reduce the growth of greenhouse gas emissions, which are the primary cause of climate change.

Figure 1: Diagram showing the relationship between adaptation and mitigation.

- **Adaptation** involves measures taken to prevent or reduce the impact of climate change on human activities, ecosystems, and economic systems.
- **Mitigation** focuses on reducing the emissions of greenhouse gases, typically through the use of renewable energy sources and energy efficiency measures.

Figure 2: Diagram illustrating the effects of climate change on various sectors.

The goal of the UNFCCC is to work towards a sustainable future, where human activities do not exceed the Earth's carrying capacity. This can be achieved through a combination of adaptation and mitigation strategies.

Figure 3: Diagram showing the role of public and private sectors in adaptation and mitigation.

In conclusion, adaptation and mitigation are two critical components of the climate change debate. While adaptation focuses on reducing the impacts of climate change, mitigation aims to reduce greenhouse gas emissions. Both strategies are necessary to achieve a sustainable and equitable future for all.
On digital data labour

Venturini, Tommaso, Mathieu Jacomy, Axel Meunier, and Bruno Latour (2017)
“An Unexpected Journey: A Few Lessons from Sciences Po Médialab’s Experience”
*Big Data & Society* 4(2): 205395171772094
http://journals.sagepub.com/doi/10.1177/2053951717720949

Venturini, Tommaso, Anders Munk, and Axel Meunier (2018)
“Data-Sprint: A Public Approach to Digital Research”
Data exploration is not a form of distant reading.
Critical proximity

Monadologie et sociologie (Gabriel Tarde, 1883)
Monadology and Sociology (2012 translation)

“when we arrive at human societies; here we are at home, we are the true elements of these coherent systems of persons which we call cities or states, regiments or congregations. We know everything that goes on in them”

(pp. 36)
1995 | USA, New York

INC-9

The INC held its ninth session from 7-18 February 1994, in Geneva.

In discussions on matters relating to commitments, delegates examined methodologies for calculations/inventories of emissions and removal of greenhouse gases, the first review of information communicated by Annex I parties, the role of the subsidiary bodies established by the Convention, and criteria for joint implementation.

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The need for broader action beyond the year 2000 on the commitments in Article 4.2(a) and (b) was considered, based on the understanding that the provisions of this article refer to the present decade. In its discussions on matters relating to the financial mechanism and technical and financial support to developing country Parties, the Committee chose to focus on the implementation of Article 11.
Chapitre 2 : Dispositions en faveur du climat

1ère Lecture - Assemblée - Commission

- L'article L. 311-1 du code de l'énergie est ainsi modifié :
- 1°) Il est inséré en tête de l'article le signe (;) ;
- 2°) L'article est complété par au début du premier alinéa, est ajoutée la mention :
- 2°) Il est ajouté un II après rédigé ;
- 3°) Il est ainsi rédigé :
- "Il est ainsi régi par le nouveau amendement du précédent article.
- Les émissions de gaz à effet de serre des émissions équivalentes de radiations thermiques dans le secteur de la production d’électricité et de la production de chaleur modifient le calcul des émissions pour l’exercice du secteur de 0,55 tonne d’équivalent diéthyle de carbone par mégawattheure, notamment la nature des combustibles combustibles, ainsi que la plafond d’émissions prévu au premier alinéa du présent II est définit par décret."
- 4°) Dans les conditions prévues à l’article 38 de la Constitution, le Gouvernement est habilité à prendre par voie d’ordonnance, dans un délai de six mois à compter de la publication de la présente loi, toute mesure relevant du domaine de la loi permettant de mettre en place d’un accompagnement spécifique :
- 5°) Pour les salariés des entreprises exploitant les installations de production d’électricité mentionnées au I du présent II, les mesures prévues à l’article L. 311-1 du code de l’énergie, affectées à ces installations et dont l’emploi serait supprimé du fait de la fermeture de ces installations résultant des dispositions de ce II,
- 6°) Pour les salariés des entreprises sous-traitantes des précédentes, même II,
- 7°) Pour les salariés de l’ensemble de la chaîne de sous-traitance des entreprises mentionnées au 3° du présent II dont l’emploi serait supprimé du fait de la fin d’activité de ces installations de production d’électricité mentionnées à l’alinéa précédent,
- Ces mesures n’auront pas d’effet immédiat
- Ces mesures favoriseront notamment à favoriser le rehaussement de ces salariés sur un emploi durable.
- Un projet de loi de ratification est déposé devant le Parlement, dans un délai de trois mois à compter de la publication de l’ordonnance prévue au précédent Il en priorité dans le budget d’emploi concerné. Ces mesures prévoient également des dispositifs de formation adéquats facilitant la mise en œuvre des projets professionnels de ces salariés. Elles prévoient les modalités de financement des dispositifs approuvés à favoriser l’accompagnement des salariés.
On quali-quantitative exploration


