

# INTRODUCTION À LA BIBLIOMÉTRIE ET SES OUTILS

Abdelghani Maddi, ingénieur de recherche au GEMASS

# CONTENU DE LA PRÉSENTATION

- Contexte scientifique, politique et économique
- Bibliométrie : de quoi parle-t-on ?
- Quels outils ?
- Quels enjeux ?
- Exemple d'analyse

# ÉLÉMENTS DE CONTEXTE

# CONTEXTE ÉCONOMIQUE ET POLITIQUE

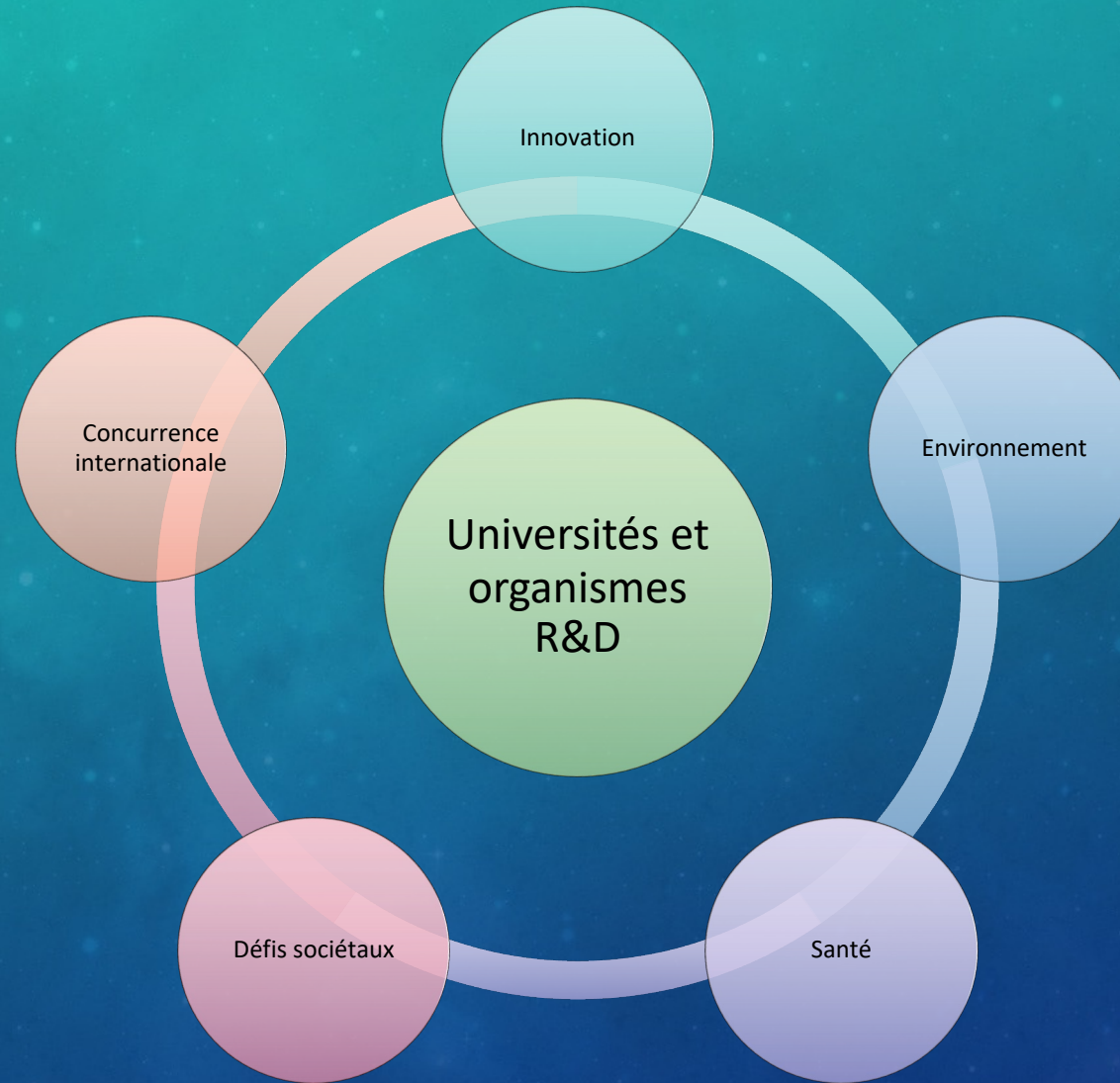
## Transformation des politiques économiques des pays à hauts revenus

### Vers une économie basée sur la connaissance

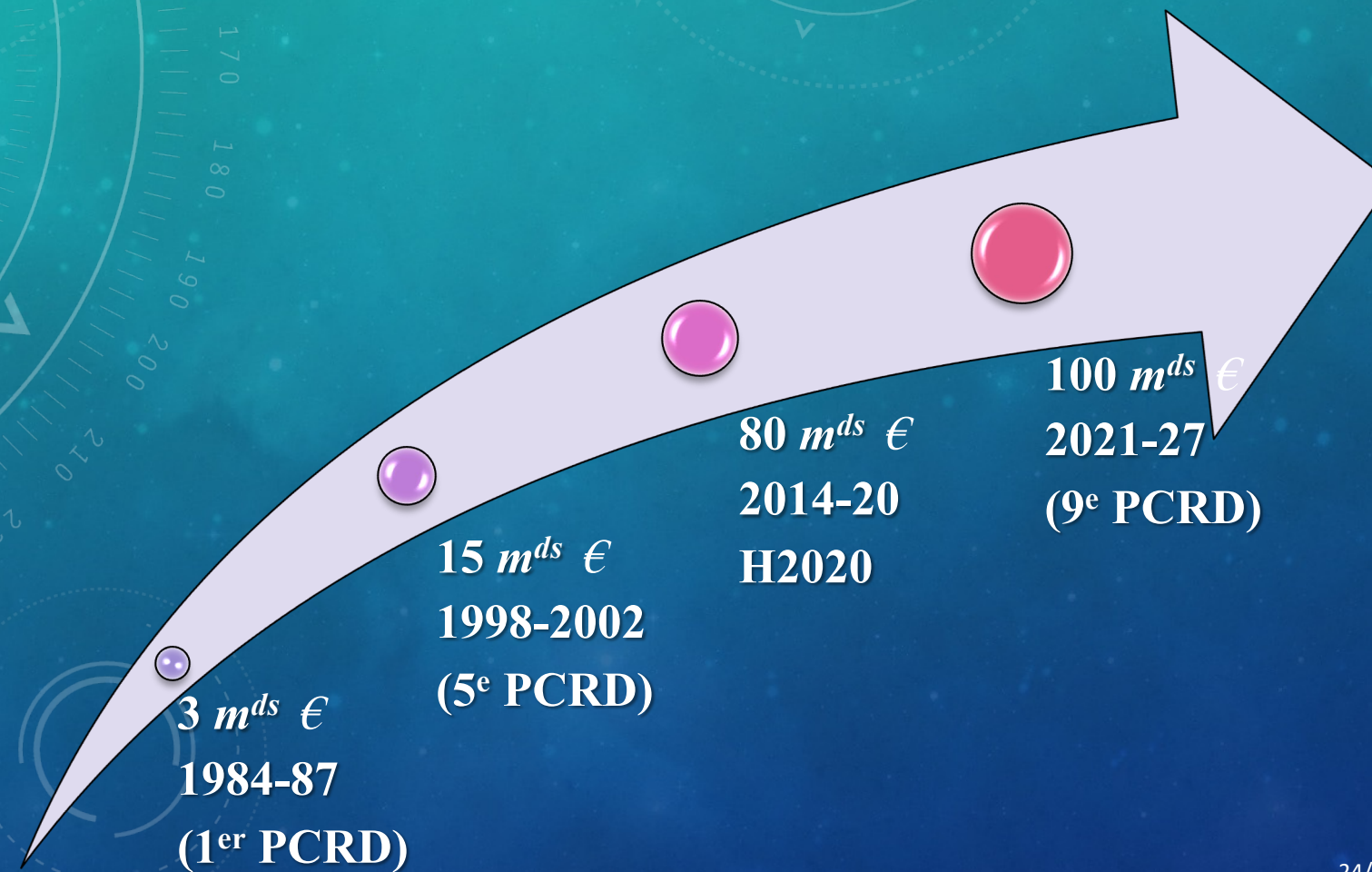
Les universités et organismes de recherche sont devenus au centre des politiques publiques



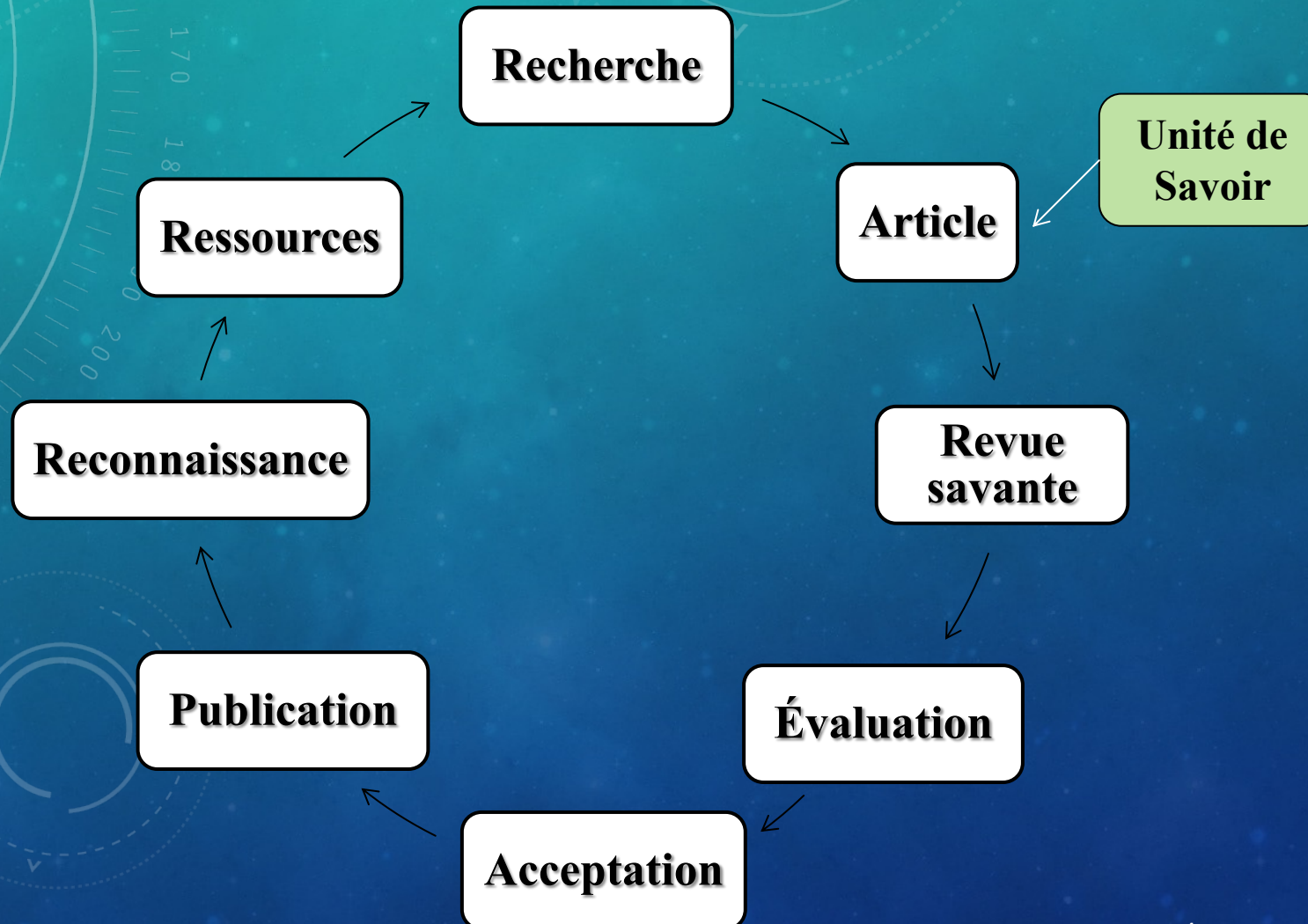
# LES UNIVERSITÉS ET ORGANISMES DE RECHERCHE AU CENTRE



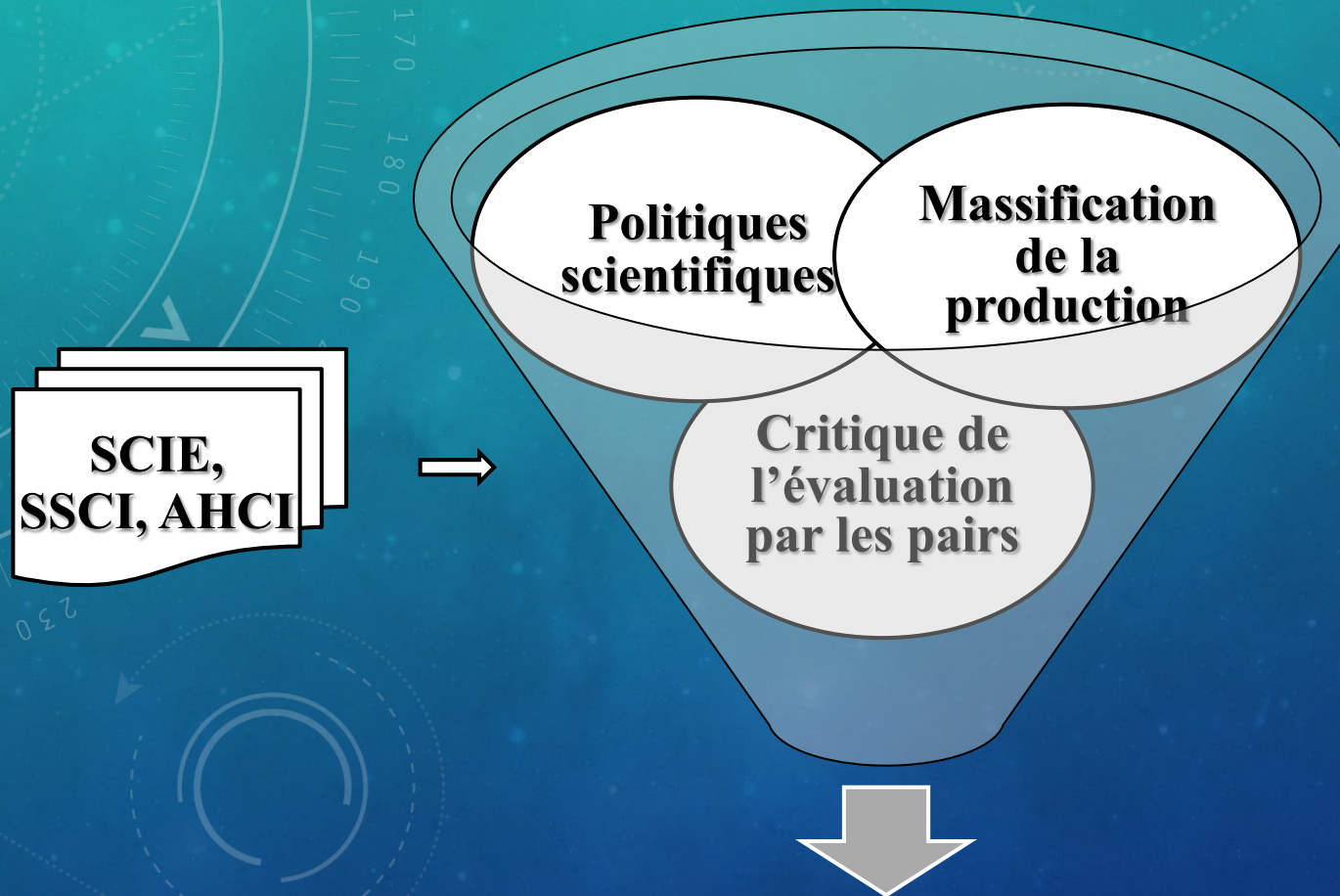
## Montants alloués aux programmes cadres R&D européens



# Processus « classique » de création du savoir scientifique

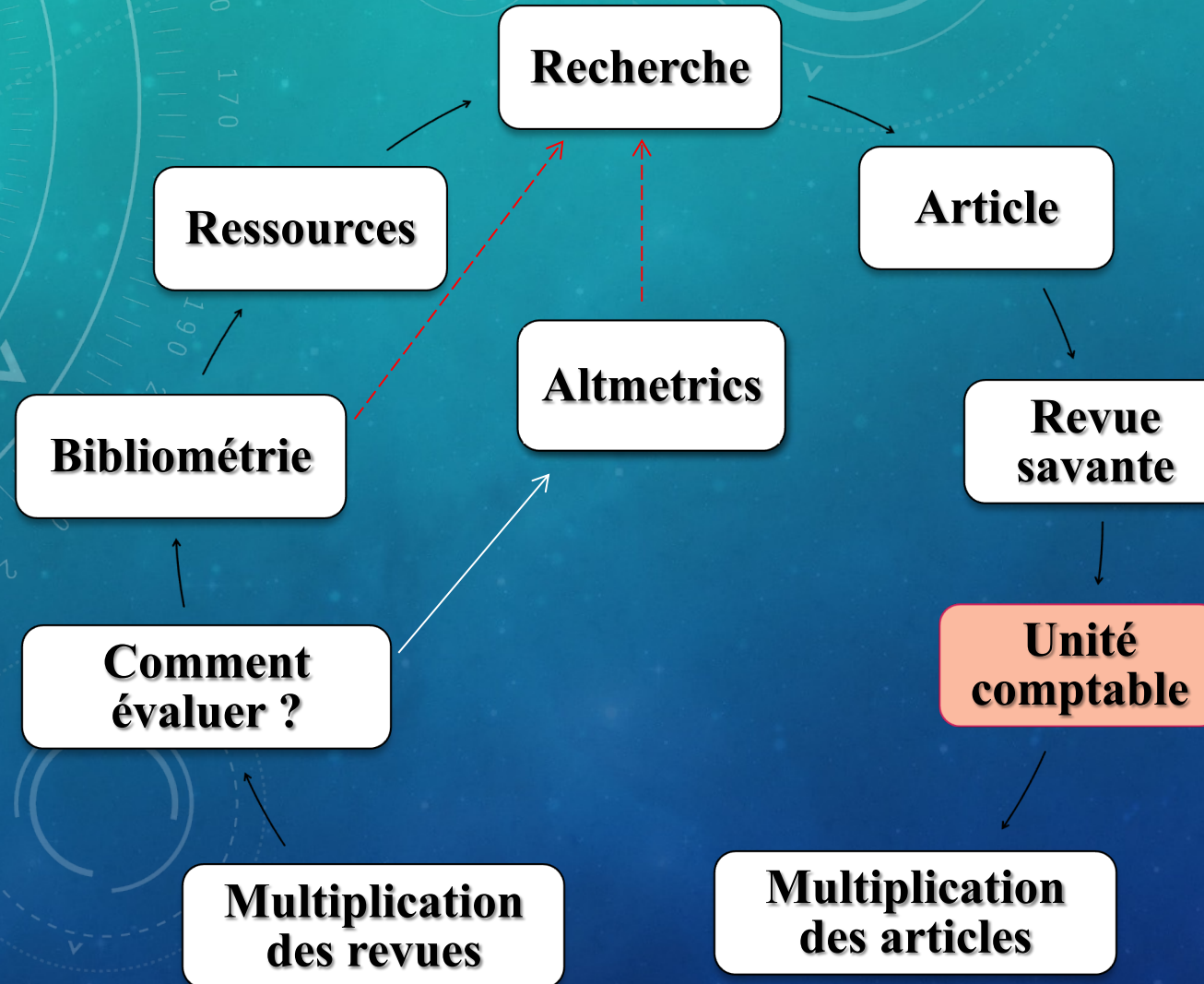


# Évolution du processus de création du savoir scientifique



Bibliométrie évaluative

# Évolution du processus de création du savoir scientifique



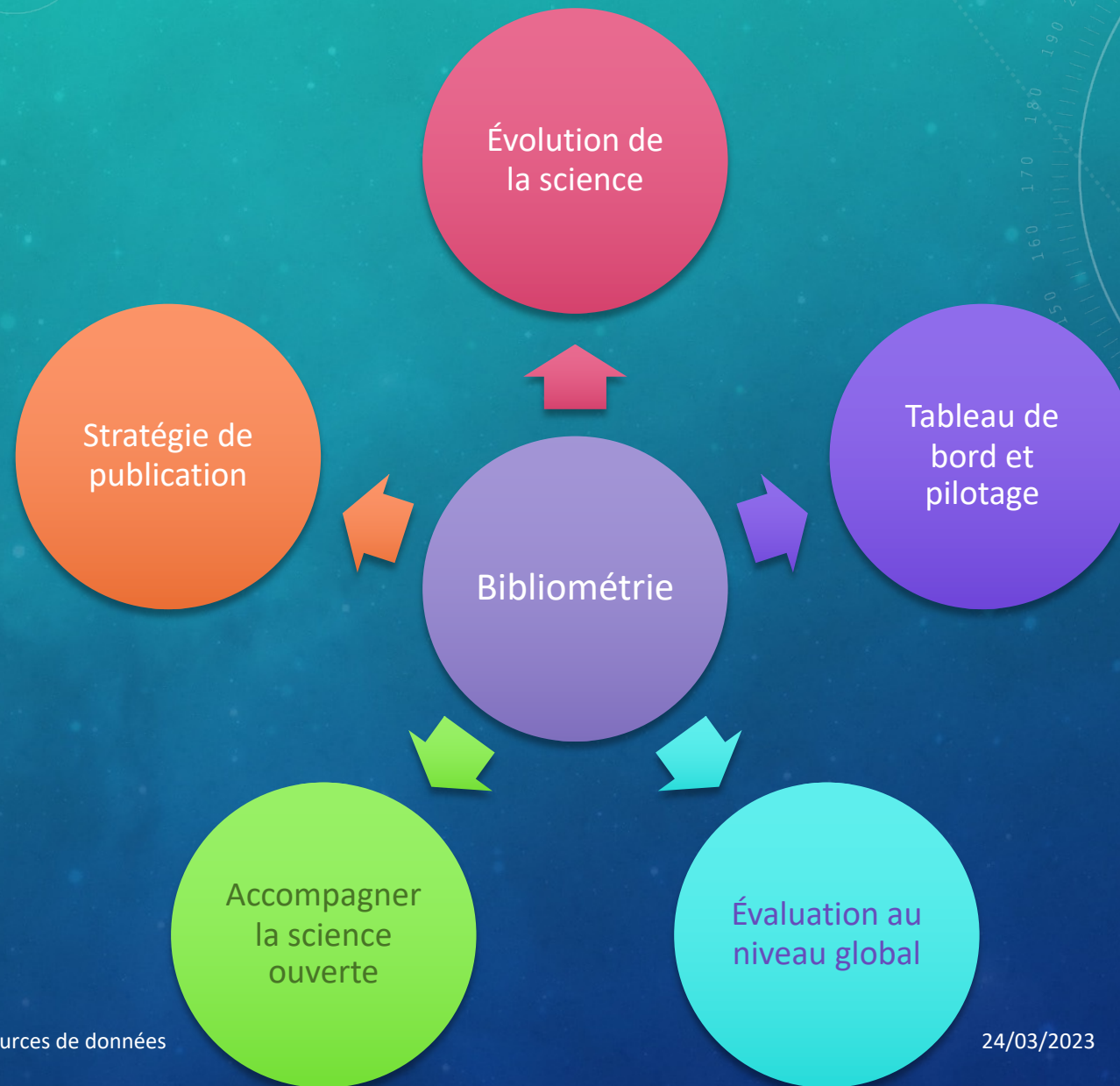
Source : Gingras (2014, 2016)

# LA BIBLIOMÉTRIE

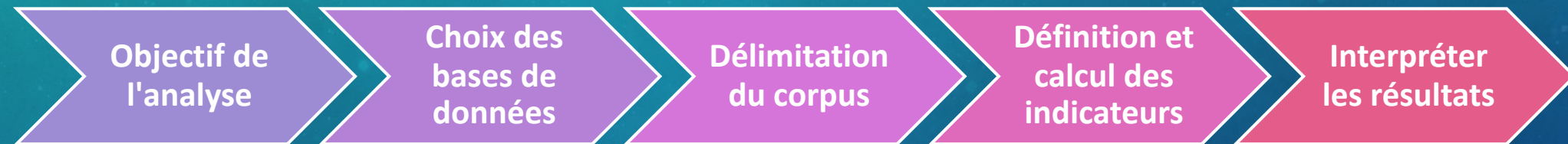
*“bibliometrics is the application of mathematical and statistical methods to books and other media of communication”.*

*Pritchard A. Statistical Bibliography or Bibliometrics. Journal of Documentation. 1969;25(4):348-9.*

# USAGES DE LA BIBLIOMÉTRIE



# MÉTHODE

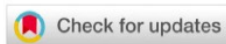


# BOITE À OUTILS

# MÉTADONNÉES UTILISÉES EN BIBLIOMÉTRIE



an open access journal



Citation: Pontika, N., Klebel, T., Correia, A., Metzler, H., Knoth, P., & Ross-Hellauer, T. (2022). Indicators of research quality, quantity, openness and responsibility in institutional review, promotion and tenure policies across seven countries. *Quantitative Science Studies*, 3(4), 888–911. [https://doi.org/10.1162/qss\\_a\\_00224](https://doi.org/10.1162/qss_a_00224)

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RESEARCH ARTICLE

Type de publication

# Indicators of research quality, quantity, openness, and responsibility in institutional review, promotion, and tenure policies across seven countries

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<sup>5</sup>Medical University of Vienna, Vienna, Austria

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<sup>7</sup>Open and Reproducible Research Group, Graz University of Technology, Graz, Austria

Keywords: indicators, open science, research assessment, responsible research and innovation, rewards and recognition

## ABSTRACT

The need to reform research assessment processes related to career advancement at research institutions has become increasingly recognized in recent years, especially to better foster open and responsible research practices. Current assessment criteria are believed to focus too heavily on inappropriate criteria related to productivity and quantity as opposed to quality, collaborative open research practices, and the socioeconomic impact of research. Evidence of the extent of these issues is urgently needed to inform actions for reform, however. We analyze current practices as revealed by documentation on institutional review, promotion, and tenure (RPT) processes in seven countries (Austria, Germany, India, Portugal, the United Kingdom and the United States). Through systematic coding and analysis of 143 RPT policy documents from 107 institutions for the prevalence of 17 criteria (including those related to qualitative or quantitative assessment of research, service to the institution or profession, and open and responsible research practices), we compare assessment practices across a range of international institutions to significantly broaden this evidence base. Although the prevalence of indicators varies considerably between countries, overall we find that currently open and responsible research practices are minimally rewarded and problematic practices of quantification continue to dominate.

Titre

Auteurs

Adresses

Mots-clés

Résumé

Financement

Données

Indicators of research quality, quantity, openness, and responsibility

## AUTHOR CONTRIBUTIONS

Nancy Pontika: Conceptualization, Data curation, Investigation, Methodology, Project administration, Writing—Original draft, Writing—Review & editing. Thomas Klebel: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing—Original draft, Writing—Review & editing. Antonia Correia: Data curation, Investigation, Writing—Review & editing. Hannah Metzler: Conceptualization, Data curation, Investigation, Methodology, Project administration, Writing—Review & editing. Petr Knoth: Conceptualization, Funding acquisition, Methodology, Project administration, Supervision, Writing—Review & editing. Tony Ross-Hellauer: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Writing—Original draft, Writing—Review & editing.

## COMPETING INTERESTS

The authors have no competing interests.

## FUNDING INFORMATION

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## DATA AVAILABILITY

All supporting data and required code are available in Zenodo (Pontika et al., 2022b).

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# BASES DE DONNÉES

# PRINCIPAUX UTILISATEURS DES BASES DE DONNÉES BIBLIOMÉTRIQUES (Leydesdroff et al. 2016)

## Producteurs

- Fournisseurs de données (WoS, Scopus, etc.)
- Développeurs d'indicateurs (CWTS, OST, ECOOM, etc.)

## Bibliomètres

- Spécialistes dans le domaines qui font les développements théoriques

## Scientifiques

- Communauté scientifique au sens large (auto-évaluation, recherche documentaire, etc.)

## Gestionnaires

- Universités (RH, administrateurs, etc.)
- Agences de financement (ANR, ERC, etc.)
- Agences d'évaluation (Hcéres, ANVUR, REF, etc.)

# QUELLE(S) BASE(S) DE DONNÉES ?

Clarivate™



Scopus®

unpaywall

Google Scholar

ORCID

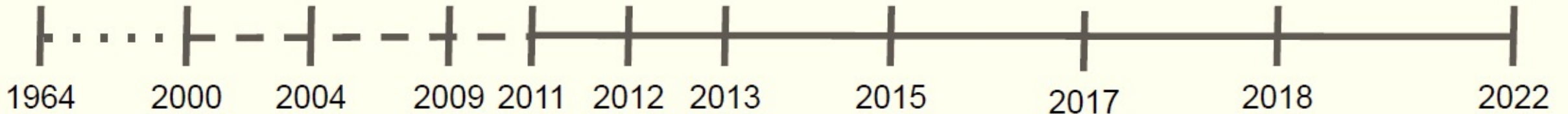
Connecting Research  
and Researchers



Microsoft Academic



Dimensions



PubMed  
Central



DataCite  
FIND, ACCESS, AND REUSE DATA



PLUMX



LENS.ORG

"Solving The Problem Of Problem Solving"



Altmetric



Crossref

I40C



OpenAlex

| Base de données   | Gratuite | Propriétaire |
|---|----------|--------------|
|    |          | ✓            |
|    | ✓        |              |
|    | ✓        |              |
|    | ✓        |              |
|    | ✓        |              |
|    | ✓        |              |
|    | ✓        |              |
|    | ✓        |              |
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|  |          | ✓            |
|  | ✓        |              |
|  | ✓        | ✓            |

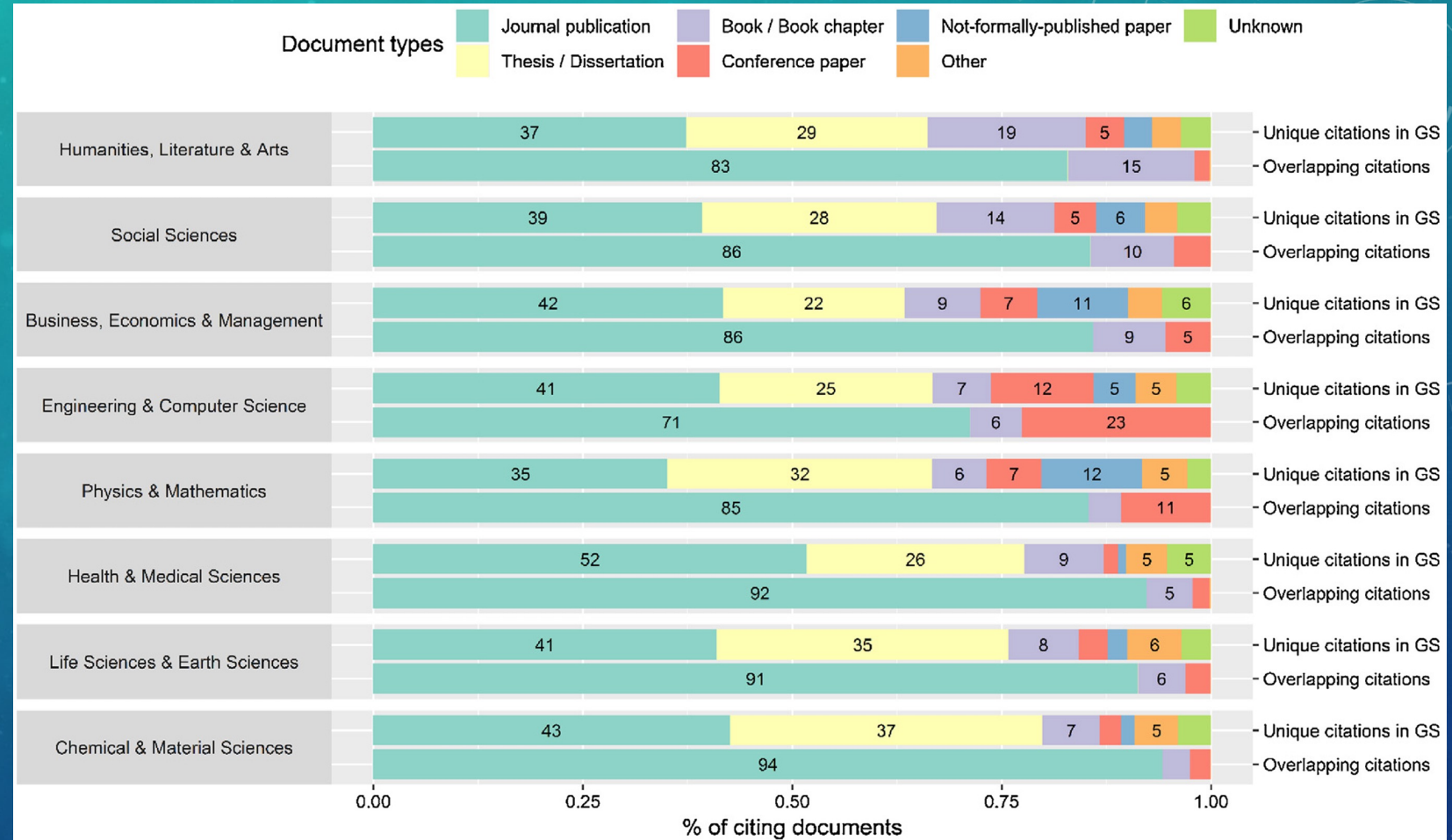
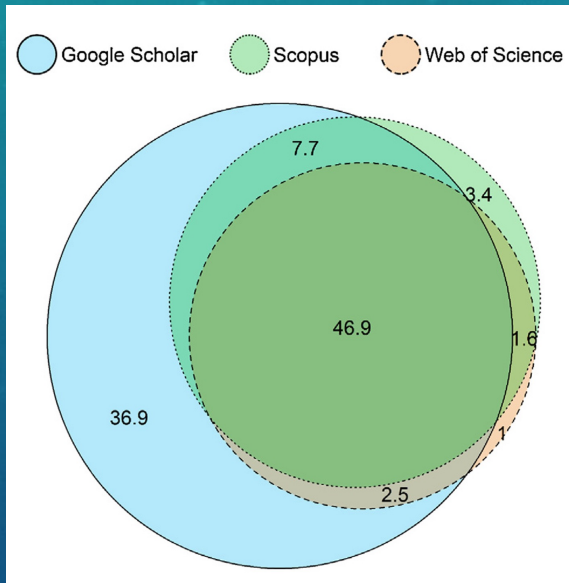
# PRINCIPALES BASES DE DONNÉES

Le choix de la base de données dépend de plusieurs facteurs, notamment :

- 1- La qualité de ses données,
- 2- Son niveau de couverture,
- 3- Le sujet de recherche.

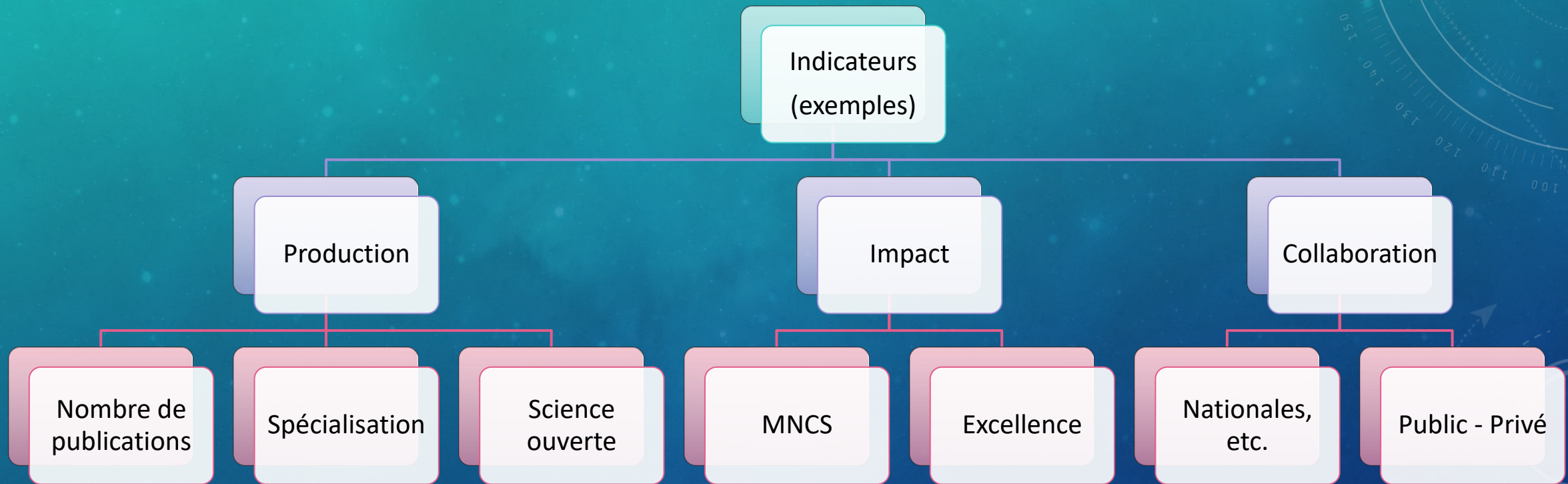
# COUVERTURE DES PRINCIPALES BASES DE DONNÉES

- Types de document (articles, livres, conférences, etc.)
- Couverture géographique
- Couverture disciplinaire










Source : <https://www.sciencedirect.com/science/article/abs/pii/S1751157718303249>

# QUELS OUTILS À DISPOSITION ?



# QUELS OUTILS À DISPOSITION ?

| Outils gratuits<br>(liste indicative)   | Type d'analyse   |
|---|--|
|  python™     | Moissonnage et récupération des données via API, préparation des données, analyse sémantique, désambiguïsation, NLP, ... |
|  R Studio®   | Analyse statistique, topic modeling, visualisation des données, ... (moins performant pour le moissonnage)               |
|  CORTEXT     | Traitement et visualisation des données (marche mieux avec données issues des interfaces en ligne, ex. WoS, Scopus)      |
|  vosViewer   | Cooccurrences, cocitation, réseaux de collaboration, ... (moins de possibilités que Cortext, mais plus puissant)         |
|  Gargantext | Traitement du texte / text-mining  |
|  Gephi     | Visualisation des données (analyse des réseaux)  |
|  Khartis   | Visualisation des données géographiques  |

# ENJEUX DE LA BIBLIOMÉTRIE

# Quelques problèmes des mesures quantitatives

- Biais ex-ante (caractéristiques des évalués : ex. sexe).
- Bases de données non exhaustives (pas inclusives)
  - Types de produits indexés => biais disciplinaire.
  - Biais linguistiques et géographiques.
- Problèmes de construction de certains indicateurs (indice H, facteur d'impact, MNCS, etc.).

# Exemple du Mean Normalized Citation Score (MNCS)

Soit 2 équipes de recherche de même taille :

## Équipe de recherche 1

- Discipline : économie de la santé
- Ressources : 20 000 €
- Production :
  - 80 publications dont :
    - 50 => NCS = 2,00
    - 30 => NCS = 0,50
    - $MNCS = ((50*2)+(30*0,5))/80 = 1,44$

## Équipe de recherche 2

- Discipline : économie de la santé
- Ressources : 20 000 €
- Production :
  - 120 publications dont :
    - 60 => NCS = 2,00
    - 60 => NCS = 0,50
    - $MNCS = ((60*2)+(60*0,5))/120 = 1,25$

➔ En utilisant le MNCS le group de recherche 1 > 2

- L'équipe 2 a produit 60 publications hautement citées contre 50 pour le groupe 1
- L'équipe 2 a produit 60 publications faiblement citées contre 30 pour le groupe 1
  - ➔ l'équipe 2 est meilleure (voir : Abramo et d'Angelo, 2016)

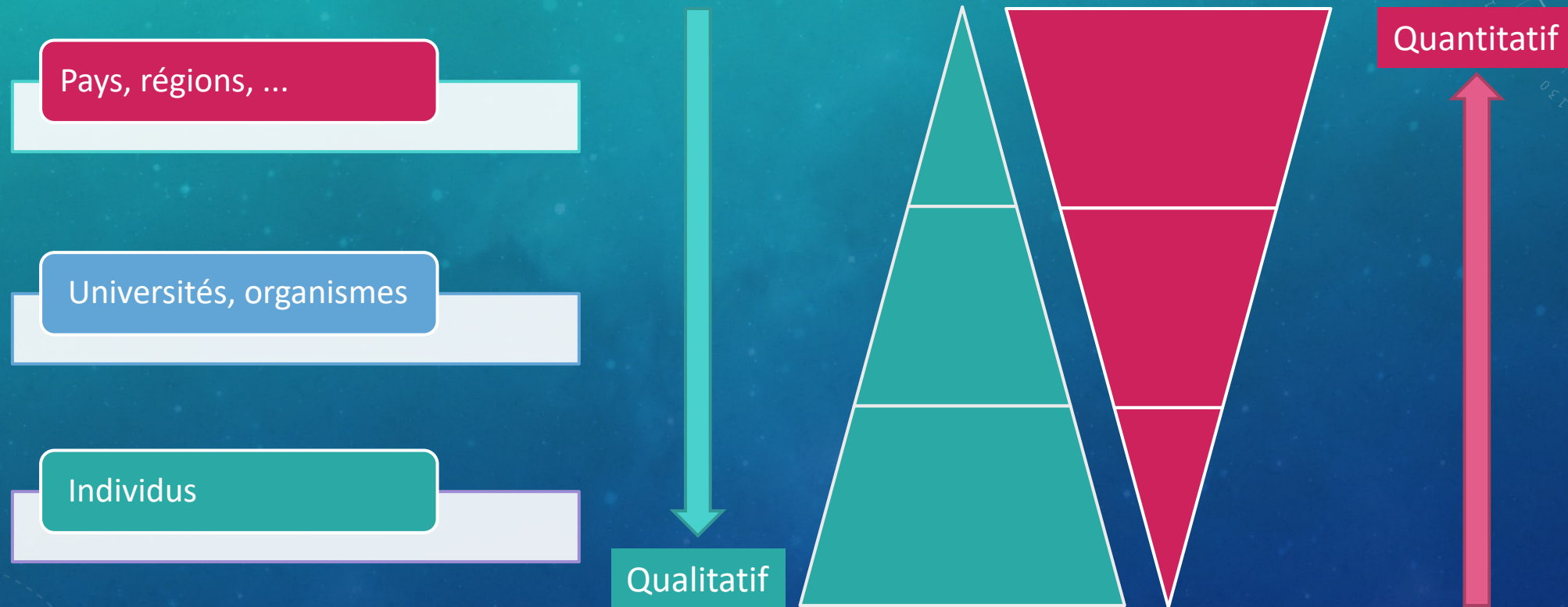
# Spécificités des SHS

Orientation nationale et régionale

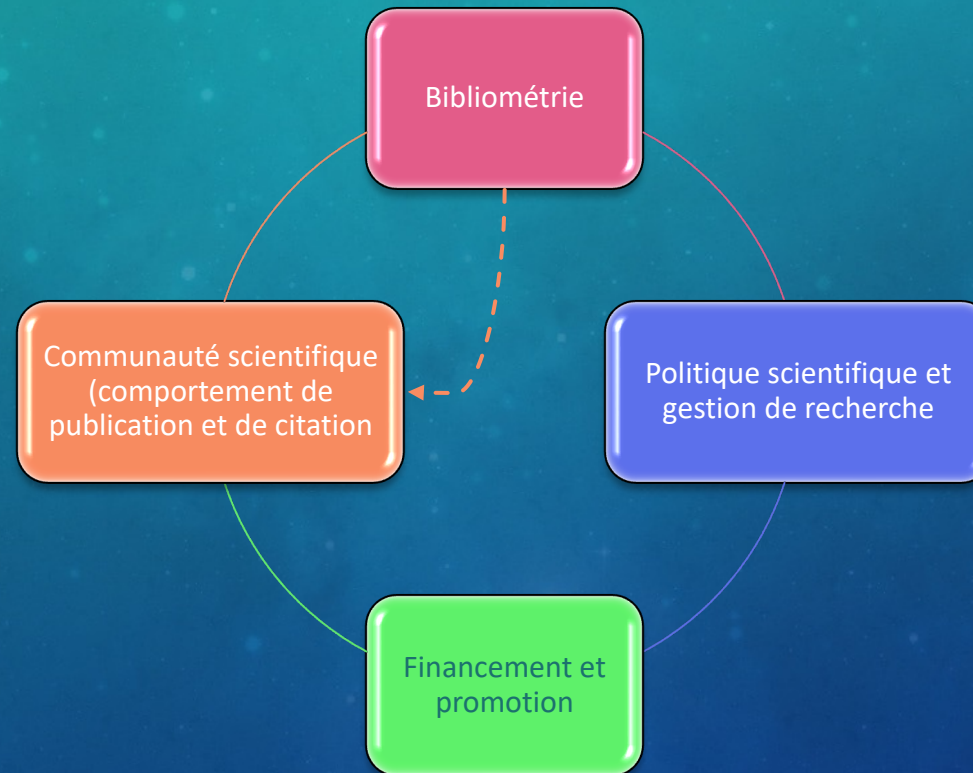
Visent un public plus large (autres produits que les articles)

Pratiques de citation différentes

# ADAPTER L'ANALYSE / L'ÉVALUATION EN FONCTION DE LA GRANULARITÉ



# IMPACT DES MÉSUSAGES DE LA BIBLIOMÉTRIE SUR LA RECHERCHE SCIENTIFIQUE





RAPPEL SUR LES MÉTHODES DE  
« *CLUSTERISATION* »

# EXEMPLE SUR L'ANALYSE DE RÉSEAUX

Objectif

- Analyser les publications qui traitent la thématique du Covid-19

Base de données

- Exemple sur la base Web of Science : <https://access.webofknowledge.com/>

Corpus

- Toutes les publications qui contiennent « Covid-19 » dans le titre, résumé ou mots-clés

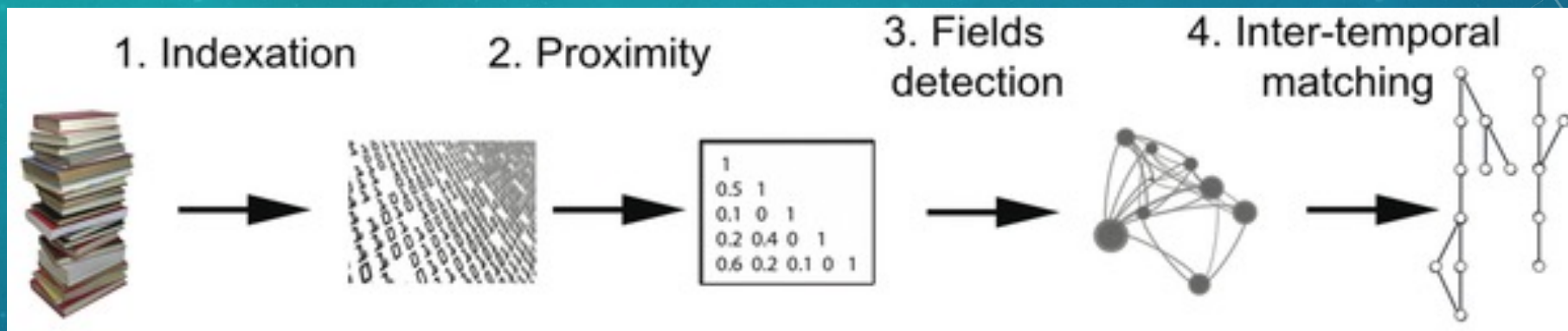
Indicateurs

- Exemple : indicateurs de collaboration, analyse de cooccurrence, etc.

Interprétation

- Analyser et visualiser les données avec Vosviewer : <https://www.vosviewer.com/download>

•Steps contributing towards the reconstruction of a phylomemy.



Chavalarias D, Cointet JP (2013) Phylomemetic Patterns in Science Evolution—The Rise and Fall of Scientific Fields. PLOS ONE 8(2): e54847. <https://doi.org/10.1371/journal.pone.0054847>  
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0054847>

# Textual Analysis

We believed we could reduce our dependence on foreign oil and protect our planet. And today, America is number one in oil and gas.

# Textual Analysis

## Part-Of-Speech Tagging

PRP VBD PRP MD VB PRP NN IN JJ NN  
We believed we could reduce our dependence on foreign oil

CC VB PRP NN. CC NN NNP VBZ NN CD IN  
and protect our planet. And today, America is number one in

NN CC NN  
oil and gas.

# Textual Analysis

## Chunking

PRP VBD PRP MD VB PRP NN IN JJ NN  
We believed we could reduce our dependence on foreign oil  
CC VB PRP NN. CC NN NNP VBZ NN CD IN  
and protect our planet. And today, America is number one in  
NN CC NN  
oil and gas.

*Extracted noun phrases:*

- dependence
- planet
- oil
- gas

# Textual Analysis

## Chunking

PRP VBD PRP MD VB PRP NN IN JJ NN  
We believed we could reduce our dependence on foreign oil  
CC VB PRP NN. CC NN NNP VBZ NN CD IN  
and protect our planet. And today, America is number one in  
NN CC NN  
oil and gas.

*Extracted noun phrases:*

- *dependence*
- *planet*
- *oil*
- *gas*
- *foreign oil*

# Textual Analysis

## Chunking

PRP VBD PRP MD VB PRP NN IN JJ NN  
We believed we could reduce our dependence on foreign oil

CC VB PRP NN. CC NN NNP VBZ NN CD IN  
and protect our planet. And today, America is number one in

NN CC NN  
oil and gas.

*Extracted noun phrases:*

- *dependence*
- *planet*
- *oil*
- *gas*
- *foreign oil*
- *dependence on foreign oil*
- *oil and gas*

# Textual Analysis

## Stemming, Filtering and Standardizing

PRP VBD PRP MD VB PRP NN IN JJ NN  
We believed we could reduce our dependence on foreign oil

CC VB PRP NN. CC NN NNP VBZ NN CD IN  
and protect our planet. And today, America is number one in

NN CC NN  
oil and gas.

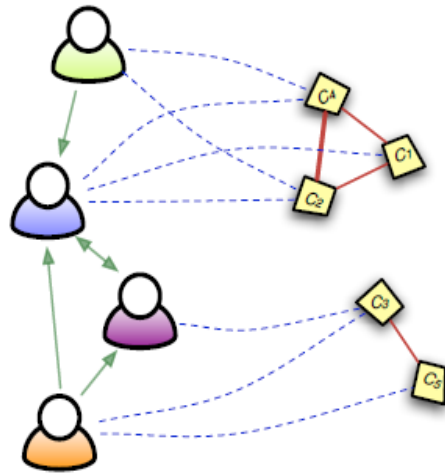
*Extracted classes:*

- *dependence on foreign oil: {dependence on foreign oil ; foreign oil dependence}*
- *oil and gas: {oil and gas; gas and oil}*
- *planet: {planet, planets}*
- *etc.*

# Cooccurrences matrices

## Cooccurrences matrices construction

- Occurrence matrix  $O$  :  $O_{ij} = 1$  iff item  $i$  is used in document  $j$ , 0 otherwise
- The cooccurrence matrix enumerates every joint appearances of two items in the same document.  $C = O^t O$

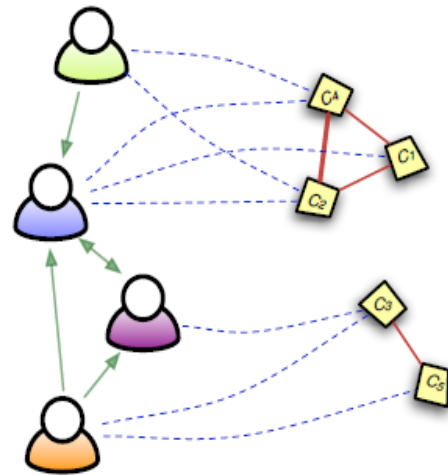


| documents \ items | A | B | C | D |
|-------------------|---|---|---|---|
| C1                |   | 1 |   |   |
| C2                | 1 | 1 |   |   |
| C3                |   |   | 1 | 1 |
| C4                | 1 | 1 |   |   |
| C5                |   |   |   | 1 |

# Cooccurrences matrices

## Cooccurrences matrices construction

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|    | C1 | C2 | C3 | C4 | C5 |
|----|----|----|----|----|----|
| C1 | x  | 1  |    | 1  |    |
| C2 | 1  | x  | 1  | 2  |    |
| C3 |    |    | x  |    | 1  |
| C4 | 1  | 2  |    | x  |    |
| C5 |    |    | 1  |    | x  |

# Proximity Measures

## Cooccurrences variables

- Co-Occurrence matrix  $C$  :  
 $C_{ij}$  = number of joint occurrences of  $i$  and  $j$  in the same document
- total number of cooccurences of  $i$  :  $s_i = \sum_{j, j \neq i} c_{ij}$
- global number of co-occurences :  $N = \sum_i s_i$
- expected number of cooccurences :  $e_{ij} = \frac{s_i s_j}{N}$

|    | C1 | C2 | C3 | C4 | C5 |
|----|----|----|----|----|----|
| C1 |    | 1  |    | 1  |    |
| C2 | 1  |    | 1  | 2  |    |
| C3 |    |    |    |    | 1  |
| C4 | 1  | 2  |    |    |    |
| C5 |    |    | 1  |    |    |

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|----|----|----|----|----|----|
| C1 |    | 1  |    | 1  |    |
| C2 | 1  |    | 1  | 2  |    |
| C3 |    |    |    |    | 1  |
| C4 | 1  | 2  |    |    |    |
| C5 |    |    | 1  |    |    |

# Proximity Measures

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- expected number of cooccurences :  $e_{ij} = \frac{s_i s_j}{N}$

|    | C1 | C2 | C3 | C4 | C5 |
|----|----|----|----|----|----|
| C1 |    | 1  |    | 1  |    |
| C2 | 1  |    | 1  | 2  |    |
| C3 |    |    |    |    | 1  |
| C4 | 1  | 2  |    |    |    |
| C5 |    |    | 1  |    |    |

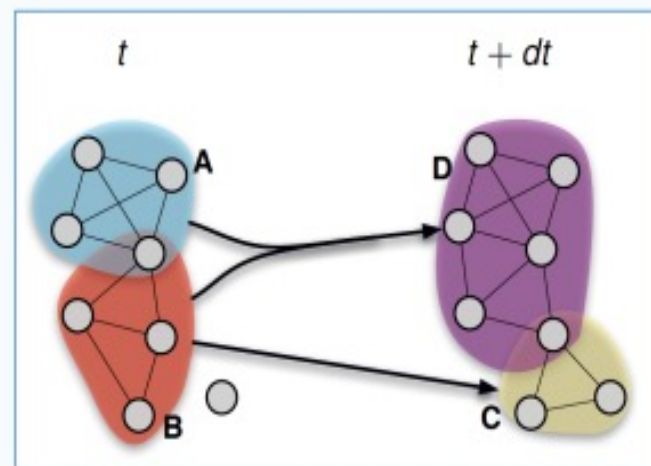
# Proximity Measures

## Cooccurrences variables

- *Co-Occurrence matrix C :*  
 $C_{ij}$  = number of joint occurrences of  $i$  and  $j$  in the same document
- total number of cooccurences of  $i$  :  $s_i = \sum_{j, j \neq i} c_{ij}$
- global number of co-occurences :  $N = \sum_i s_i$
- expected number of cooccurences :  $e_{ij} = \frac{s_i s_j}{N}$

## Direct Measures of Similarity :

- *Raw cooccurences :*  $S_R(i, j) = c_{ij}$
- *Association strength :*  $S_A(i, j) = \frac{c_{ij}}{s_i s_j}$
- *Mutual Information :*  $S_{MI}(i, j) = \log\left(\frac{c_{ij}}{e_{ij}}\right)$
- *Cosine :*  $S_C(i, j) = \frac{c_{ij}}{\sqrt{s_i s_j}}$
- *Inclusion index :*  $S_I(i, j) = \frac{c_{ij}}{\min(s_i, s_j)}$
- *Jaccard index :*  $S_J(i, j) = \frac{c_{ij}}{s_i + s_j - c_{ij}}$
- $\chi^2$  score :  $S_{\chi^2}(i, j) = \frac{c_{ij} - e_{ij}}{\sqrt{e_{ij}}}$
- *Cramer index :*  $S_{\text{cramer}}(i, j) = \frac{c_{ij} - e_{ij}}{e_{ij}}$



## The epistemology of Dynamic Clustering

