# BIBLIOMETRIC ANALYSIS

MSc in Economics

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**Bibliometric analysis** Types of bibliometric analysis



Method Step by step process



**Conclusion** Final thoughts







**Bibliometric analysis** Types of bibliometric analysis



Method Step by step process



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# Introduction

Basic concepts



Source: Onyancha, O. B. (2014). Can informetrics shape biomedical research? A case study of the HIV/AIDS research in sub-Saharan Africa 1. *Inkanyiso: Journal of Humanities and Social Sciences*, 6(1), 49-65.



Informetrics Quantitative aspects of information



Scientometrics Quantitative aspects of scientific literature



# Bibliometrics

Quantitative aspects of recorded information



# Cybermetrics

Quantitative aspects of electronic resources



Webometrics Quantitative aspects of WWW



Altmetrics Complement to citation impact metrics









Moving forward



# Introduction

Measuring "academic success"



# H-index

A scientist has index h if h of his/her Np papers have at least h citations each, and the other (Np-h) papers have no more than h citations each.

# **G-index**

given a set of articles ranked in decreasing order of the number of citations that they received, the g-index is the unique largest number such that the top g articles received together at least g2 citations.

# **Impact Factor**

The Impact Factor measures the average number of citations received in a particular year by papers published in the journal during the two proceeding years.

# CiteScore

CiteScore values are based on citation counts in a range of four years to peer-reviewed documents published in the same four calendar years, divided by the number of these documents in these same four years.





Introduction Stablishing a common language



**Theories** Lens to understand the world



**Question** Common analysis questions



**Bibliometric analysis** Types of bibliometric analysis



Method Step by step process



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# DEFINITION

"A theory will be defined as a set of statements, systems, or principles used to describe or explain phenomena [...]"

Sugimoto (2016, p. 1)







### **CRITICAL INFORMETRICS**

Citation X Quality / Displace x Rigor Social constructivist view

STATISTICAL THEORIES

Citation x Originality

Zipf (words), Lotka (authors), and Bradford (journals)



### **AUTHOR THEORIES**

Authorship X Co-authorship

Place and Personal Relationships

### **KNOWLEDGE ORG THEORIES**

Visible X Invisible

Role of search engines

**ALTMETRIC THEORIES** 

Impact: Academy X Society

Going beyond citation







**Bibliometric analysis** Types of bibliometric analysis



Method Step by step process



**Conclusion** Final thoughts

# Analysis questions What do you want to know?





**QUESTION 5** 

over time?

What are the topics discussed by the knowledge base related to my research question?



**OUESTION 7** How the knowledge base evolved **QUESTION 2** 

Are there any missing keywords in my search query?



What is the knowledge base related to my research question?

### **QUESTION 6** ↓ . × ₩ . ♠

What are the main documents within the topics discussed by the knowledge base related to my research question?









# Stablishing a common language



Theories Lens to understand the world



Question Common analysis questions



**Bibliometric analysis** Types of bibliometric analysis



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Countries





All keywords

Authors' keywords

Keywords Plus









Fast and best at detecting emerging fronts

Largest number of clusters

Local x global





Organisations

Countries





# Types of analysis Answering different questions



Countries

Countries







**Bibliometric analysis** Types of bibliometric analysis



Method Step by step process



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What is your research objective?

**CIMO Framework** Context Intervention Mechanism Outcome

What search engines will be used?

Search

- Web of Science
- Scopus
- Dimensions
- **Google Scholar**

What is your search query?

Keywords -

# Data extraction

Filtering

#### Exporting

What data do I need to extract?

- Title -
- Keywords -
- References \_
- Counts -

In which format?

# Analysis

What is the best analysis method to answer your research question?

- Co-authorship -
- Co-occurrence -
- Citation -
- **Bibliography coupling** -
- Co-citation \_

# Synthesis

So what?

What is the answer to your research question?

What new ideas I could find?



Step 1: Research objective

# What is your research objective?

Context (C) Which individuals, relationships, institutional settings, or wider systems are being studied?

E.g: industry, group, circunstance, etc

Outcomes (O) What are the effects of the intervention? How will the outcomes be measered?

E.g.: performance, cost reduction, error rates, success, etc

 4
 3

 Similar
 3

 Similar
 3

 Examples:
 1

 How leadership styles (I) motivates (M) people to perform better (O) on aerospace projects (C)?

CIMO

What are the competencies (I) most valued by professionals on defence projects (C)?

Int The their

Interventions (I)

The interventions managers have at their disposal to influence behaviour.

E.g.: leadership style, planning and control systems, training, incentives, etc

Mechanisms (M) The mechanism that in a certain context is triggered by the intervention.

E.g.: motivation, interest, participation, action, responsibility, etc



8.4



\* Chemical & Material Sciences Engineering & Computer Science Health & Medical Sciences Life Sciences & Earth Sciences Physics & Mathematics

7.6





What is your search query?

# Database



- Web of Science Core Collection
- BIOSIS Citation Index
- Derwent Innovations Index
- KCI Korean Journal Database
- MEDLINE
- Russian Science Citation Index
- SciELO Citation Index



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Index

# What is your search query?

What are the competencies (I) most valued by professionals on defence projects (C)?

Competence Competences Competency Competencies Skill Skills Ability Abilities Knowledge

Defence Defense Military

Project Projects Program Programs Programme Programmes Portfolio Portfolios Initiative Initiatives



Phrase "" and -

-

-

# What is your search query?

Asterisk (\*) Examples s\*food matches: seafood soyfood

enzym\* matches: enzyme enzymes enzymatic enzymic

**Dollar Sign (\$) Examples** 

colo\$r matches:

grain\$ matches:

color

grain grains

colour

# Question Mark (?) Example wom?n matches: woman women

Multi-wildcard Example

organi?ation\* matches: organisation organisations organisational organization organizations organizational



Database

02

STEP

- Web of Science Core Collection
- BIOSIS Citation Index
- Derwent Innovations Index
- KCI Korean Journal Database
- MEDLINE
- Russian Science
   Citation Index
- SciELO Citation Index

Keywords

Keywords from:

Context

Intervention

Mechanism

Outcome

-

Operators

Method

Step 2: Search Query

#### **Boolean operators**

- NEAR/x
- SAME
- AND
- OR
- NOT
- Wildcards
- \* (group)
- \$ (zero or one)
- ? (single)

Parentheses Phrase "" and -

### influenza OR flu AND avian

= finds records containing the word influenza. It also finds records containing both flu and avian.

### (influenza OR flu) AND avian

= finds records containing both influenza and avian or both flu and avian.

#### copper OR lead AND algae

= finds all records in which both lead AND algae are present as well as all records in which the word copper is present.

#### (copper OR lead) AND algae

= finds all records in which the word algae is present together with either copper or lead.



# Method

# Database

02

**STEP** 

- Web of Science Core Collection
- **BIOSIS Citation Index**
- **Derwent Innovations** Index
- KCI Korean Journal Database
- MEDLINE
- **Russian Science** Citation Index
- SciELO Citation Index

Keywords

Context

-

- Intervention
- Mechanism

**Operators** 

Step 2: Search Query

# **Boolean operators**

- NEAR/x
- SAME
- AND
- OR
- NOT

# Wildcards

- \* (group)
- \$ (zero or one)
- ? (single) **Parentheses**

Phrase "" and -

# energy conservation

= retrieve records that contain all of the words you entered. The words may or may not appear close together.

# "energy conservation"

= retrieve records that contain the exact phrase energy conservation.

### waste-water

= find records containing the exact phrase *waste-water* or the phrase waste water. It will not match water waste, waste in drinking water, or water extracted from waste.

# "m\$croeconomic theory"

= matches *macroeconomic theory* and *microeconomic* theory.

# Keywords from:

- Outcome



SciELO Citation Index

-

-

-

- \$ (zero or one)
- ? (single)

Parentheses Phrase "" and - What is your search query?

**Research Question:** 

What are the **competencies** (I) most valued by professionals on **defence projects** (C)?

Defence	Project
Defense	Projects
Military	Program
	Programs
	Programme
	Programmes
	Portfolio
	Portfolios
	Initiative
	Initiatives
	Defence Defense Military







- Chemical Indexes







# Filtering

	•	
Search	Tools   Searches and alerts	Search History Marked List
Results: 3,250 (from Web of Science Core Collection)	Sort by: Date 1.₹ Times Cited Usage Count Relevance More ▼	▲ <u>1</u> of 325 ▶
You searched for: TOPIC: (compete nc* OR skill\$ OR abilit* OR knowledg e) AND TOPIC: (defen?e OR military) A ND TOPIC: (project\$ OR program* O R portfolio* OR initiative\$)More	<ul> <li>Select Page  Export Add to Marked List</li> <li>1. Cosmopolitan arrogance, epistemic modesty and the motivational prerequisites for solidarity By: Beckstein, Martin</li> </ul>	Analyze Results  Create Citation Report  Times Cited: 0  (from Web of Science Core Collection)
Refine Results	ETHICS & GLOBAL POLITICS Volume: 13 Issue: 3 Special Issue: SI Article Number: 1816001 Published: DEC 4 2020	Usage Count 🛩
Search within results for Q Filter results by:	<ol> <li>Providing an Integrated Multi-Objective Model for Closed-Loop Supply Chain under Fuzzy Conditions with Upgral Approach</li> <li>By: Ayoughi, Hamidreza; Podeh, Hossein Dehghani; Raad, Abbas; et al.</li> <li>INTERNATIONAL JOURNAL OF NONLINEAR ANALYSIS AND APPLICATIONS Volume: 11 Issue: 1 Pages: 107-136 Published: WIN-SPR 2020</li> </ol>	Times Cited: 0 (from Web of Science Core Collection) Usage Count ~
<ul> <li>Open Access (1,182)</li> <li>Associated Data (49)</li> </ul>	Find it @ MCR View Abstract ▼	
Publication Years            2020 (305)         2019 (359)           2018 (299)         2018 (299)	3. A CASE STUDY ON THE RECOGNITION OF PRIOR LEARNING (RPL): PERCEPTIONS OF UNIVERSITY FACULTY         By: Browning, Kimberly F.         CANADIAN JOURNAL FOR THE STUDY OF ADULT EDUCATION Volume: 32 Issue: 1 Pages: 15-40 Published: WIN 2020         Find It @ MGR       View Abstract ▼	Times Cited: 0 (from Web of Science Core Collection) Usage Count ~
<ul> <li>2017 (251)</li> <li>2016 (240)</li> <li>more options / values</li> <li>Refine</li> </ul>	4. Neotectonics and pastoralism: How they impact flood regimes in Madagascar's highlands By: Mietton, Michel; Gunnell, Yanni; Andriamitia, Jocelyn; et al. SCIENCE OF THE TOTAL ENVIRONMENT Volume: 742 Article Number: 140633 Published: NOV 10 2020	Times Cited: 0 (from Web of Science Core Collection)

**03** STEP

#### Main filters:

Web of Science Categories Document Types Research Areas Languages Titles (conference and books)



# Filtering

Search	Tools	earch History Marked List
Results: 3,250 (from Web of Science Core Collection)	Sort by: Date 1.7 Times Cited Usage Count Relevance More ▼	▲ <u>1</u> of 325 ▶
You searched for: TOPIC: (compete nc* OR skill\$ OR abilit* OR knowledg e) AND TOPIC: (defen?e OR military) A ND TOPIC: (project\$ OR program* O	□ Select Page	Analyze Results
R portfolio <sup>®</sup> OR initiatives)More	1.       Cosmopolitan arrogance, epistemic modesty and the motivational prerequisites for solidarity         By: Beckstein, Martin         ETHICS & GLOBAL POLITICS       Volume: 13       Issue: 3       Special Issue: SI       Article Number: 1816001       Published: DEC	<b>Times Cited: 0</b> (from Web of Science Core Collection)
Refine Results	4 2020 Find it @ MCR 3 Free Full Text from Publisher View Abstract	Usage Count 🗸
Search within results for Q	2. Providing an Integrated Multi-Objective Model for Closed-Loop Supply Chain under Fuzzy Conditions with Upgral Approach	<b>Times Cited: 0</b> (from Web of Science Core Collection)
Filter results by:	By: Ayoughi, Hamidreza; Podeh, Hossein Dehghani; Raad, Abbas; et al. INTERNATIONAL JOURNAL OF NONLINEAR ANALYSIS AND APPLICATIONS Volume: 11 Issue: 1 Pages: 107-136 Published: WIN-SPR 2020	Usage Count ~
<ul> <li>Open Access (1,182)</li> <li>Associated Data (49)</li> </ul>	Find it @ MCR View Abstract ▼	
Refine Publication Years	3. A CASE STUDY ON THE RECOGNITION OF PRIOR LEARNING (RPL): PERCEPTIONS OF UNIVERSITY FACULTY By: Browning, Kimberly F.	<b>Times Cited: 0</b> (from Web of Science Core Collection)
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<ul> <li>2017 (251)</li> <li>2016 (240)</li> <li>more options / values</li> </ul>	4. Neotectonics and pastoralism: How they impact flood regimes in Madagascar's highlands By: Mietton, Michel; Gunnell, Yanni; Andriamitia, Jocelyn; et al.	Times Cited: 0 (from Web of Science Core Collection)
Refine	SCIENCE OF THE TOTAL ENVIRONMENT Volume: 742 Article Number: 140633 Published: NOV 10 2020	

**03** STEP

First analysis:

Create Citation Report Analyse Results



03

STEP

# Filtering





# Filtering

0 **Results Analysis** Showing 61,952 records Total Citing Articles: TOPIC: (competenc\* OR skill\$ OR abilit\* OR knowledge) for AND TOPIC: (defen?e OR military) AND TOPIC: (project\$ OR program\* OR <<Back to previous page portfolio\* OR initiative\$) Web of Science Categories Visualization Treemap -Number of results 10 -📥 Download Hide Publication Years 48,038 3,185 1,204 937 ARTICLE PROCEEDINGS PAPER EDITORIAL MATERIAL EARLY ACCESS **Document Types** Organizations-Enhanced **Funding Agencies** Authors Source Titles 2,549 10,243 BOOK CHAPTER 29 178 REVIEW **Book Series Titles Meeting Titles** 172 25 **Countries/Regions** LETTER MEETING ABSTRACT Editors Group Authors Sort by Record count Show 25 Minimum record count 1 Update --How are these totals calculated? Languages Select records to view, or exclude. Choose "View records" to view the selected records only or "Exclude records" to view the unselected records only. **Research Areas** Select Field: Document Types **Record Count** % of 61,952 Bar Chart Grant Numbers ARTICLE 48,038 77.541%

03

STEP

**Results analysis** 



# Exporting



03

**STEP** 

Step by step:

Export

**Other File Formats** 

#### Note:

- Register the dates (older and newer)



# Exporting



03

STEP

Step by step:

Records from ### to ###

Record content:

- Full Record and Cited References

File format:

- Plain Text

File name:

- downloads\_#\_###.txt

Move to the dataset folder



03





**DOWNLOAD APP:** 

https://www.vosviewer.com/

DOWNLOAD DATASET

http://shorturl.at/jlLSX



https://1drv.ms/u/s!An-kQOjV6B6QiNEBrH6kAtyNCg9kTg?e=QArnHp



**04** Step

s VOSviewer	Network Visualization Density Visualization	×	
File Items Analysis		Visualization Scale:  Labels Size variation:	Step by step:
Map Create		© Circles © Frames Max. length: 30 ℃ Font: Open Sans ♥	Create
Info Manual About VOSviewer		Colors D Black background	Create a map based on bibliographic data
		>	Read data from bibliographic database files
			Web of Science
			Choose files
		VOSviewer version 1.6.15	





04

STEP

### Analysis questions:

Is my research objective relevant and new?

Are there any missing keywords in my search query?

#### Step by step:

### Analysis:

- Keyword clusters (network + items)
- Overlay Visualisation:
  - Occurrences x Avg. Pub Year
  - Occurrences x Avg. Citations



#### **Analysis questions:**

What are the main documents related to my research question?



04

### Step by step:

#### Analysis:

- Document clusters (network + items)
- Overlay Visualisation:
  - Citations x Avg. Pub Year
  - Links x Avg. Pub Year
  - Links x Citations



#### **Analysis questions:**

What is the knowledge base related to my research question?



04

STEP

#### Step by step:

#### Analysis:

- Document clusters (network + items)
- Density visualisation

# What are these cluster discussing? Research areas within my field.



03



# 01 CHOOSE APP CiteSpace

**DOWNLOAD APP:** 

http://cluster.ischool.drexel.edu/~cchen/citespace/download/

### DOWNLOAD DATASET

http://shorturl.at/jlLSX



https://1drv.ms/u/s!An-kQOjV6B6QiNEBrH6kAtyNCg9kTg?e=QArnHp

		Analysis questions:
04 STEP	Step 4: Analysis	What are the topics discussed by the knowledge base related to my research question?
Crespace 5.7.82 (64-bit) - (c) 2003-2020 Chaomei Chen - Home: CAUsers/Leandor File Projects Data Network Visualization Geographical Overlay Maps / Web of Science Projects New Demo 1: Terrorism (1996-2003) More Actions • Project Home: C:USers/Leandro.clespace/Examples/WoS/Terrorism 1990 Data Directory: C:USers/Leandro.clespace/Examples/WoS/Terrorism 1990 Data Directory: C:USers/Leandro.clespace/Examples/WoS/Terrorism 1990 FOC Stop Reset JVM Memory 1539 (MB) Used 11 % Space Status Process Reports Process Reports Description This is	Analytics       Text Preferences       Tutorialis       Resources       Community       Help       Donate         Ime       Sticing       Ime       From       996       JAN       To       2003       DEC       #Years Per Slice       Ime       Ime       Slicing       Ime       Slicing       Ime       Ime       Ime       Slicing       Ime       Ime </th <th><ul> <li>Step by step:</li> <li>New Project</li> <li>Title</li> <li>Select Project Home (project folder)</li> <li>Select data (dataset folder)</li> <li>LRF = 3</li> <li>LBY = 5</li> <li>e = 2.0 or 1.0</li> </ul></th>	<ul> <li>Step by step:</li> <li>New Project</li> <li>Title</li> <li>Select Project Home (project folder)</li> <li>Select data (dataset folder)</li> <li>LRF = 3</li> <li>LBY = 5</li> <li>e = 2.0 or 1.0</li> </ul>

5

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	2013-2017	g=9, k=25	3207	100	29//443		
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04

Netwo Proje Terms Centr

# Analysis questions:

What are the topics discussed by the knowledge base related to my research question?

### Step by step:

- Select time slicing
- Co-citation = Reference
- g-index, Top N, etc...
- Pruning
- GO!

# Method

#### Step 4: Analysis 0 LSI LLR MI USR /// 🧿 🦳 λ Σ 🔩 🔩 WoS WoS WoS TC U180 U2013 2014 2015 2016 EHT <<< Q 🕩 🔍 Search: ti:q1 | fu:' # clusters 🙆 Control Panel Management (1979 - 2020)

#### File Data Visualization Display Nodes Links Labels Clusters Overlays Filters Uncertainty Export Windows Help 🕅 I 🏁 🗥 🛝 🐽 😡 10 Visib... Count Cent... Year Cited References Spotlight Citation/Frequency Burst >>> 0.00 2017 Nisler J, 2017, VISION 20 18 0.03 2014 Anderson N. 2014, J MA. cite Space 2009/09/2012 (2012) November 2012 (2012) (2012 ▶ 18 0.07 2014 West J, 2014, J PROD I.. 14 0.00 2017 Nambisan S, 2017, MIS... ✓ 13 0.02 2015 Brunswicker S, 2015, J Colormap Burstness Search Clusters 13 0.01 2013 TIDD J, 2013, MANAGIN... Largest CC: 359 (79%) Nodes Labeled: 5.0% Labels Layout Views Image: Instant Control (1000) <td Pruning: None Harmonic Mean(Q, S)=0 Keyword | Term | Overlay Labels 0.01 2017 Bogers M, 2017, IND IN. 10 0.06 2014 West J, 2014, RES POL. By Degree Show Frequency 0.08 2015 Chrisman JJ, 2015, J P. 0.02 2014 Yin R K, 2014, CASE ST 10 Threshold 0.09 2005 von Hippel E, 2005, DE. 0.01 2016 Randhawa K, 2016, J P. 15 💶 🕨 Font Size 0.10 2008 Hidalgo A, 2008, R&D ... 0.01 2006 Adams R, 2006, INT J 10 • Node Size 0.00 2012 Kim DY, 2012, J OPER Anderson N (2014) 0.19 2013 Carvalho MM, 2013, TE Node Labels 0.00 2014 Demirkan H. 2014, J R. 0.02 2005 Tidd J, 2005, MANAGIN Show Frequency By Citation 0.00 2016 Adams R, 2016, INT J 0.08 2011 Zott C, 2011, J MANAGE 10 🔳 🕨 🕨 Threshold 0.11 2010 Crossan MM, 2010, J M 0.00 2010 Dahlander L. 2010, RE., Font Size 5 4 0.01 2012 Parida V, 2012, J SMAL 0.00 2009 Tidd J, 2009, MANAGIN 200 ( Node Size 0.02 2012 Schiederig T, 2012, R&... 0.10 2014 Felin T. 2014, RES POL. West J (2014) Link Labels 0.00 2013 Spithoven A, 2013, SMA. runswicker S (2015) 0.00 2013 Hayes A F, 2013, INTR. Show Link Labels Show Link Strengths 0.00 2013 De Massis A, 2013, FA. 0.00 2015 Liedtka J. 2015, J PRO... Font Size 8 4 1 0.01 2012 Damanpour F, 2012, M. Nambisan S (2017 TIDD J (2013) ~ 0.11 2010 Chesbrough H, 2010, L Cluster Labels 0.05 2007 Linton JD, 2007, TECH. 0.01 2015 Benner MJ, 2015, ACAD. Threshold 0 4 1 0.00 2015 Piezunka H, 2015, ACA. Font Size 16 4 🔳 🕨 0.01 2014 Klewitz J, 2014, J CLEA. 0.14 2012 Afuah A, 2012, ACAD M.. Show Cluster Labels Over Time 0.07 2013 Boons F, 2013, J CLEA. 0.27 2018 Polanyi M, 2018, TACIT Max Length 30 0.14 2009 Verganti R, 2009, DESI.. 0.04 2014 Chesbrough H, 2014, R. Minimizing Overlaps 0.00 2015 Ringle CM, 2015, SMAR 0.01 2014 Laursen K, 2014, RES. Cluster Labels Node Labels 0.00 2007 Biemans W. 2007, J PR. 0.03 2007 Eisenhardt KM, 2007, A 0.03 2004 Linton JD, 2004, J PRO. 0.01 2014 Wendelken A, 2014, R&.. 0.00 2017 Pantano E, 2017, J RET. 0.00 2016 Hagberg J, 2016, INT J 0.00 2015 Henseler J, 2015, J AC. 0.00 2013 Kotlar J, 2013, J PROD . 0.00 2015 Nylen D, 2015, BUS HO.. 0.00 2014 Bocken NMP 2014 LC

04

STEP

### **Analysis questions:**

What are the topics discussed by the knowledge base related to my research question?

### Step by step:

- Link walkthrough
  - Is my time slicing ok? -
  - Rerun
- Node size (tree ring history)
- Adjust node size
- Adjust node label threshold



# Step 4: Analysis

### **Analysis questions:**

What are the topics discussed by the knowledge base related to my research question?

#### Step by step:

- Clusters names with
  - Titles
  - Keywords
  - Abstract
  - Subject category
  - Year by Year
- Clusters names by
  - LSI
  - LLR
  - MI
  - ///



04

# Method

# Step 4: Analysis



What are the main documents within the topics discussed by the knowledge base related to my research question?



04

STEP

#### Step by step:

- Tree history citation
- Centrality
  - Nodes > compute node centrality
- WoS
  - 180 days
  - Since 2013
- Burstness
  - Citation / Frequency Burst
- Sigma

# /\_ Analysis questions: Method Step 4: Analysis 0 🗟 CiteSpace: Display Merged - (c) 2003-2020 Chaomei Chen - Project Home: C:\Users\Leandro\OneDrive\Ensino\UnB - AEB\Bibliometrics\Dataset\Innovation Management (1979 - 2020)\Project ile Data Visualization Display Nodes Links Labels Clusters Overlays Filters Uncertainty Export Windows Help LSI LLR MI USR /// 0

 
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STEP

Step by step:

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- Link walkthrough
- Right click for more information

How the knowledge base evolved over

#### Timeline

# Method

# Step 4: Analysis

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# Exporting

# Step by step:

- Export > Network Summary Table
- Export > Generate a Narrative













Theories Lens to understand the world



Question Common analysis questions



**Bibliometric analysis** Types of bibliometric analysis



Method Step by step process



Conclusion Final thoughts





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