Publications in Citizen Science Field

Identification and Valorisation Issues

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Introduction

How to identify Citizen Science publications?



- Strong directives for Science With and For the Society and Participatory Science & Research (PSR) (= Citizen Science) in French universities since 2021.
- The Bordeaux University asked the academic library for a list of publications related to Participatory Science and Research/Citizen Science between 2018 and 2022.
- But!

A problem of bibliometry and of definition

How to identify these publications?

"It overlaps with a wide array of terms that are used to describe various forms of participatory action research and digital volunteerism, including Community Science, Civic Science, People-Powered Science, Participatory Mapping, Participatory Science, Volunteered Geographic Information (VGI), Community Remote Sensing, Citizen Observatories, Crisis Mapping and Citizen Generated Data."

Haklay M., et al. Contours of citizen science: a vignette study, Royal Society Open Science, 8 – 2021

What keywords to identify articles in Citizen Sciences?

Issues

- Improving the indexing of Citizen Science publications to increase their visibility and citations
- Enhancing the identification of CS publications to better understand the diverse range of CSs and assist researchers in utilising them.
- Enhancing the identification of CS publications to facilitate their valorisation, especially within libraries.

A thesaurus for Citizen Science?

If there are numerous keywords, can we identify one or several keywords that would be selfsufficient, such as Citizen Science for instance?

Can we identify relations (and which ones) between main keywords – that are almost selfsufficient – and secondary keywords – that are dispensable?

Can we identify keywords suiting every CS specifity?

On what conditions can a suitable thesaurus be designed?

General Method

- Step 1: Publications corpus analysis
- Step 2: Semantic analysis of the keywords
- Step 3: Assessing users' perception through a survey analysis

Literature Review

From Bibliometry to Thesauri

Literature Review

Research Literature

- Bibliometric studies focusing on Citizen Science
- Studies on definition of CS
- In the CS field of research, not in library and information science

Documentation

• Pre-existing Thesauri

Literature Review

Grid and criteria

Complexity to articulate:

- Terminology: CS, Public participation research in science, geographic volunteering, etc.
- Analysis: engagement, forms, goals, knowledge production, etc.
- Description items: For each terminoly and analysis, authors defined 3 or 4 words to describe CS practices

Keywords

Publications analysis

- Citizen Science : pole position
- Other keywords defined in relation to the academic discipline
- Principal keywords seems to be selfsufficient to describe the CS practices.

Thesauri

- **INRAE** (National Research Institute for Agriculture, Food and Environment)
 - Languages: French + English
 - Reference document within the organisation to index publications regarding agriculture, food, environment and scientific research in general

• LOTERRE (Linked Open TERminology REsources)

- Designed by the INIST (Institute of Scientific and Technical Information) from the CNRS (French National Centre for Scientific Research)
- Platform for exhibition and sharing of scientific terminologies
- MeSH (Medical Subject Headings)
 - Created by the NML (U.S. National Library of Medicine)
 - Biomedical reference thesaurus

Thesauri – Contents (Spring 2023)



• Participatory Trial

- Participatory Action Research
- Participatory Monitoring
- Public Participation in Scientific Research
- Volunteer Monitoring

Thesauri: Keywords

1 or 2 main keywords:

- Citizen Science (INRAE, LO, MESH)
- Community Science
 - Only in LOTERRE
 - but 7 Keywords related versus 2 for Citizen Science in LO and 10 in the 3 thesauri
- One level hierarchy
 - \odot No hierarchy outside these two terms
 - \odot No hierarchy between the other terms
 - \odot No concept explanations

Thesauri: Keywords

- Wide difference from a thesaurus to another: few words are shared
- Only 2 Keywords used in at least 2 thesauri :

 Community-Based Participatory Research (INRAE + MESH)
 Participatory Action Research (INRAE + LOTERRE)
- The shared Keywords are not linked to the same main Keyword :

 Community Based Participatory Research < Citizen Science (INRAE)
 Community Based Participatory Research < Community Science (LOTERRE)

Our research

To design a thesaurus that:

 \odot Shows the complexity of Citizen science

 Gives visibility to the interdisciplinarity of CS: sociological, political, methodological issues, etc.

• Offers different levels of hierarchies

• How to? First step: conduct a study of publications to understand how these Keywords are used.

Step 1: Publication Corpus Analysis Methods & Results

Objectives

- Constitute a sufficiently large corpus of publications to analyse the use of keywords
 - To observe or not a « natural » hierarchy between the keywords, considering the number of publication using them.
 - To observe the emergence or the disappearance of some keywords
 - To observe a Citizen Science ecosystem

Corpus Conception Method

- Method based on the PEO model (Bettany- Saltikov, 2016) used previously by colleagues to identify relevant literature for Bordeaux University
 - Population: Worldwide science literature
 - Exposure: Citizen Science (first tested on CS)
 - Outcomes: Good practices and recommendations
- Initial steps
 - · Finding keywords associated to 'Citizen Science'
 - Narrowing for numerous meta-articles were found
 - Keeping the author keywords field only since it describes the method rather than the core content
 - Excluding the 'Keywords Plus' in the query to centre the analysis on keywords chosen by the authors
- Final query
 - "CITIZEN SCIENCE" (AUTHOR KEYWORDS) NOT "CITIZEN SCIENCE" (TITLE) NOT "CITIZEN SCIENCE" (ABSTRACT) AND "> 2018-01-01 < 2023-12-31" (PUBLICATION DATE)
 - And for all keywords of the three thesauri : "COMMUNITY SCIENCE" (AUTHOR KEYWORDS) NOT "CITIZEN SCIENCE" (TITLE) NOT "CITIZEN SCIENCE" (ABSTRACT) NOT "CITIZEN SCIENCE" (AUTHOR KEYWORDS) "> 2018-01-01 < 2023-12-31" (PUBLICATION DATE)



Data

- From 0 to Thousands of publications
 - Four keywords > 1000
 - $\circ~$ Citizen Science : 1083
 - Community-Based Participatory Research : 1391
 - Community Participation : 1206
 - Participatory Action Research : 1238
 - Ten keywords between 0 and 30
 - One keyword 100>x>200
 - $\circ~$ Community Science : 132
 - One keyword not to be used because of the generated noise
 - $\circ~$ CS = 4258 results unrelated to Citizen Science

Keywords	Results Nb	Thesauri
Citizen Science	1083	INRAE, LOTERRE, MeSH
Citizen Research	1	INRAE
Cooperative Research	19	INRAE
Participatory Experiment	2	INRAE
Participatory Trial	3	INRAE
Crowd-Sourced Science	0	LOTERRE
CS	4258	LOTERRE
Participatory Monitoring	30	LOTERRE
Public Participation in Scientific Research	0	LOTERRE
Volunteer Monitoring	3	LOTERRE
Community Science	132	LOTERRE
Crowd Science	13	LOTERRE
Civic Science	8	LOTERRE
Community-Based Participatory Research	1391	INRAE, MeSH
Community Participation	1206	MeSH
Participatory Action Research	1238	INRAE, LOTERRE

1st Result / Recommendations

Discussing the content through the three main keywords (except Citizen Science and Community Science)

- Community-based participatory research: totally Citizen Science
- Participatory Research Action : totally Citizen Science: This is the evolution of "research action" method that was criticized for not being sufficiently participatory.
- Community participation, that can be found in 2 or the 3 thesauri, is not specific to Citizen Science. Related via participation, but not specific. That's a problem with social science: participation or not?

>>>> Recommendation: Suggesting a structure with link between specific Citizen Science terms and specific participation-but-non-citizenscience terms.

Main corpus Analysis

Main corpus:

Keyword	Publications
Citizen Science	1083
Community-Based Participatory Research	1391
Community Participation	1206
Participatory Action Research	1238

- Community science : not enough publications.
- Focus on:
 - Keywords
 - Publication Year
 - Publisher
 - Times Cited
 - WoS Categories/Research Areas
 - Considered approach to explore: Geographic Areas

2nd Result / Recommendations

Discussing the two-level thesaurus:

- The two terms that were "main terms" in the thesauri : Citizen Science and Community Science are not necessarily more used than the 3 others important keywords.
- \circ We can see a first structure with 4 (5) main keywords and 11 secondary
- Seems to be confirmed (see next slide): the increasing number of publication in the secondary terms.

>>>> Recommendation: Suggesting a thematic structure instead of a hierarchical structure?

Increasing Number of Articles in Citizen Science



- Significant surge in the number of articles related to Citizen Science.
- From 2018 to 2022, increase ranging between 33% and 72%
- Growing recognition and adoption of Citizen Science as a valuable approach in scientific research

Abb.	Keyword	Growth
CS	Citizen Science	51%
СР	Community Participation	72%
PAR	Participatory Action Research	33%
CBPR	Community-Based Participatory Research	42%

Number of results per keyword query from 2018 to 2023

• But!

High Citation Rates Make 'Citizen Science' a Keyword of Significance in Articles



Cumulative citation counts per result per keyword

Publications using 'Citizen Science' as a keyword are slightly more likely to be cited

Citation rate = Number of results per keyword / cumulative number of citations per keyword

CS: 7,8 Other KWs between: 4,2 et 5,9

Key:

CS: Citizen Science CP: Community Participation PAR: Participatory Action Research CBPR: Community- Based Participatory Research

Exploring Keyword Usage across Disciplines

- The four main identified keywords show a differentiated usage across academic disciplines
- Rather trends than exclusive usage per discipline
 - Citizen Science (CS): Ecology
 - Participatory Action Research (PAR): Education & Educational Research
 - Community Participation (CP): Public, Environmental & Occupational Health
 - Community-Based Participatory Research (CBPR): Public, Environmental & Occupational Health
- Only relying on disciplines to differentiate the usage of keywords is not accurate, as keywords are employed across various fields of study



Most_Represented_WoS_Categories_Citizen Science

Most_Represented_WoS_Categories_Community-Based Participatory Research

Environmental Sciences; Public, Environmental & Occupational Health	Health Policy & Services; Public, Environmental & Occupational Health
Nursing	Public, Environmental & Occupational Health; Psychology, Multidisciplinary; Social Work
	Medicine, Research & Experimental

Social Sciences, Interdisci	plinary	Public, Environmental & Occupational Health
	Environmental Sciences; Public Environmental & Occupational He	, alth Nursing Public, Environmental &

Most Represented WoS Categories Community PArticipation

			Hospitality, Leisure, Sport	& Tourism	Green Techi Science	& Sustainable Science & nology; Environmental s; Environmental Studies
Public, Environ	mental & Occupational	Health	Social Sciences, Interdisciplinary	Education & Education Research	ıal	Environmental Studies
				Health Care Scienc Services; Health Pol Services; Public Environmental & Occu Health	es & licy & :, pational	Nursing

3rd Result / Recommendations

• Moving Beyond Single Keywords

Recommandations

- Avoiding the use of a single keyword: combining Citizen Science with something else. Not making Citizen Science the sole entry point in the thesaurus.
- Avoiding the use of a single keyword in general: exploring connections between different terms to understand what brings them together and sets them apart, beyond disciplinary boundaries.
- Not relying solely on disciplines to select keywords.

Through the next step

- How to structure a thematic thesaurus on Citizen Science?
- How to define relations between terms?
- Is there some other keywords to study, apart from the list of the 3 thesauri? And how to study them?

Semantic Analysis

Step 2: Semantic Analysis Methods & Results

Goals

- To identify a wide amount of keywords related to the Citizen Science Field.
- To identify relations (thematic, conditionnel, hierarchical) between all of the keywords.

Corpus

- First corpus / Citizen Science: **1 083** publications
 - Unique keywords (Including Author Keywords and Keywords Plus): 5 574
- Second Corpus / PAR, CBPR, CP : **3914** publications
 - Unique keywords (Including Author Keywords and Keywords Plus): **16 291**

Methodology 1

Selection in the 5574 + 16994 Keywords of the Citizen Science related Keywords

- Line after line
- Based on our knowledge and experience of CS, as a teacher, trainer and researcher practising CS methodology.

Data:

Total of keywords identified as related to CS field.

- Total with duplicates: 830 keywords studied line after line.
- \circ ~ Use of the Excel Data Tool 'Remove Duplicates'

• Total without duplicates : 505 words

- 0 124: PAR (total: 224 ; 55%)
- 103: CP : (total : 165 ; 62%)
- 117: CBPR (total : 205 ; 57%)
- 161: CS (total 237 ; 68%)

Common Words to the 4 Corpora

- 9 participation-related keywords in common within the 4 corpora
 - Not necessarily strongly related to Citizen Science, then not self-sufficient to describe it, such as
 - Participation
 - Co-creation
 - Co-design
 - Citizen Participation
 - Community Participation
- The 4 studied keywords are present in each corpus and suggest a usage going beyond research field specificities.

- Citizen Participation
- Citizen Science
- Co-Creation
- Co-Design
- Community
 Participation
- Community-Based
 Participatory Research
- Participation
- Participatory Action Research
- Participatory Research

Method 2

- Analysis of keywords based on their meaning in context.
- Grouping of words with the same semantic field.
- Surveys in WoS (Web of Science) to explore articles related to specific words.
- Confirmation through readings.

Semantic Fields

Three thesauri (INRAE, LOTERRE, MESH): 15 Keywords related to 6 topics (see table below)

Торіс	Keywords
Monitoring	Participatory Monitoring and Volunteer monitoring (LO)
Community	Community-based participatory research (INRAE + MESH), Community Science and CS (LO), Community Participation (MESH).
Citizen	Citizen Science (INRAE, LO, MESH) ; citizen research (INRAE); Civic Science and CS (LO)
Cooperation	Cooperative research (INRAE)
Crowd	Crowd Science and Crowd-Sourced Science (LO)
Participation	Community-based participatory research (INRAE + MESH) ; participatory action research (INRAE + LO) ; participatory experiment (INRAE) ; Participatory Trial (INRAE) ; Participatory Monitoring (LO) ; Public Participation in Scientific Research (LO) and Community Participation (MESH).

Example 1: Semantic Fields – Citizen Science

Keywords Citizen Science corpus: 237 Keywords related to the 6 topics + 1 shared topic Knowledge + 7 extra words

Some keywords belong to two semantic fields

Торіс	Keywords
Monitoring	35 Monitoring + 14 Observatory/inventory + 14 Volunteer = 63
Community	31 community + 9 patient = 40
Citizen	30 citizen + 4 civic + 7 public = 41
Cooperation	24
Crowd	15 Crowdsourcing + 3 Mass + 1 Folksonomy = 19
Participation	27
Knowledge	16

Importance of Ecology : monitoring/Crowdsourcing : Conservation projects

Example 2: Semantic Fields – PAR

Keywords PAR corpus: 224 Keywords related to the 6 topics + 1 shared topic Knowledge + 15 extra keywords

Some keywords belong to two semantic fields

Торіс	Keywords
Monitoring	1
Community	8 community + 22 specific communities (patient, First Nations, Youth, etc.)
Citizen	3
Cooperation	29
Crowd	0
Participation	32 (6 related to specific communities)
Knowledge	24

Very « social science » + « critical science » + Very « community knowledge oriented »

What relations ?

Relations	Description
Relations 1	Within a semantic field
Relations 2	Term by term
Relations 3	

The goal is to cross-reference the two relation files to obtain a view on hierarchical as well as conditional relationships.

Relations 1: Within the Semantic Field

- Equivalent Term
- Term indicating the method
- Term indicating the organisation
- Term indicating the article's orientation
- Term indicating the discipline or the main theme
- Term linked but term not specific to CS field (even if specific to participation field)
- CS public Specificity, when the public is not identified by a previous term
- Utilised Knowledge

Relations 2: Term by Term

Among other studies, we leaned on a comprehensive overview of the various matrices for describing Citizen Science practices led by Haklay et al, 2021 (see table below that presents the first lines of the Hacklay's table)

Multi-dimensional focus on types of the activity	Action-oriented, conservation, investigation, virtual and education [12]
Knowledge producer and activity/project goal and focus	Matrix approach: Citizens or researchers as main knowledge producers, addressing a research question or intervention in a socio-ecological system [13] based on [12,14]
Nature of the participatory task	Passive sensing, volunteer computing, volunteer thinking, environmental and ecological observations, participatory sensing and civic/community science [<u>15,16</u>]
Learning dimensions	Learning of project mechanics, pattern recognition skills, on-topic extra learning, scientific literacy, off-topic knowledge and skills and personal development [<u>17</u>]
Complexity of the citizen science approach and participation structure	Matrix approach: Elaborate approach vs. simple approach, and mass participation vs. systematic monitoring, and in addition computer-based projects [<u>18</u>]
Communication goals of a citizen science project	Goals of communication messages from citizen science projects: Awareness, Conversion, Recruitment, Engagement, Retention [<u>19</u>])

Relations 2: Term by Term

Additional lines:

- Discipline / Field if very specific
- Type of action : collective or individual (Do we take part to the project as a collective or as an individual?)
- Group 1 Definition:
 - Is it a random group or a group that has been defined by particular caracteristics?
- Group 2 Definition :
 - What are the group caracteristics? ethnics, administratives, legal, territorial, age, captivity-context (school groups)?

Then...

- Ready to move on the thesaurus design!!!
- However, it feels necessary to address users' perception first, not to stay confined to statistics only.

>>> An evaluation survey was disseminated for a week to Bordeaux academic libraries' patrons.

Step 3: User's appreciation of Keywords Methods & Results

Goals

- Understanding practices, cultural and linguistic meanings
- Making connections between profession and respondents' discipline
- Is it necessary to
 - weight keywords?
 - Assess their usage frequency?
 - Question the cultural approach?

Our plan

- Note that it is a survey and not a large-scale investigation
- One week survey! Just to check the pulse of our community, but our community was basically on holiday (because our project begun later than expected)
- Our intern went into the main libraries of our university : Sciences, Management, Law, Health (Social Science is closed since strikes).

Survey and Questions

- Serial Q1: Who are you? Occupation, discipline
- Serial Q2: Needs for identification of CS paper and terms that would be chosen to describe a CS-related paper related?
- Serial Q3: Appreciation of the relevance to describe a paper in CS Field of a serial of terms? (see next slide)

Serial of Terms

- Following the 6 semantic field identified in step 2.
- We put in these fields:
 - The keywords of the three thesauri, except « Participatory Trial » that we can't find anywhere. Total= 13 keywords
 - o Completed with some keywords identified in the step 2 and that are not in the thesauri. Total= 21 keywords

Monitoring

Monitoring

Monitoring Programme

Volunteer Monitoring

Participatory Monitoring

Community

- Community-Based Participatory Research
- Community Driven Research
- Community Science
- Community-Academic Partnership

Community Participation

Citizen

Citizen Science

Citizen Scientist

- Civic Science
- Public Participation in Science
- Public Participation in scientific Research
- Citizen Research

Crowd Source Data

Crowd

- Crowdsourced Science
- Mass Participatory Experiment
- Crowd Science

Participation

- Participant-led Research
- Participatory Science
- Participatory Research
- Participatory Action Research
- Participatory Experiment

Cooperation

- Cooperative Research
- Co-production of Knowledge
- Co-created Citizen Science
- Collaborative Research
- Co-design
- Co-creation

General Survey Analysis

- 41 respondents
- Difficulty to engage people to respond as CS are not well known yet
- More than half of the librarians didn't know about CS
- All researchers (including PhD students) know about CS
- 93% of the respondents agree to say that it's interesting to identify a CS publication

Terms appreciation Analysis

- Influence of language on chosen keywords
- Most suggested keywords are considered relevant by the respondents
- Highlight the reluctance of researchers and librarians towards the role that citizens can play in the research and production process of science.

Semantic Field: Monitoring

- Shows the importance of the translation
 - Clear preference for 'Participatory Monitoring'
 - Surprising non-adhesion to the term 'Monitoring' probably because of the chosen French translations that are synonyms to 'Control' and 'Surveillance'



Semantic Field: Community

 Results corroborate what has been noticed from the Web of Science extraction: CBPR is considered as a clearly identified keyword related to 'Citizen Science'

Research

Community Science



Semantic Field: Citizen/Civic/Public

- Contrasted perceptions from the respondents
- No consensus on the terms 'Citizen Scientist' and 'Citizen Science' since it might engage the citizen too close to the researcher's position.
- 'Civic Science' is probably less popular since it is connoted with the idea of morality in French.



Semantic Field: Crowd/Mass

 Results are uniform but looking deeper in the results, a difference regarding **Crowdsourced Science and Mass** Participatory Experiment can be noticed, where librarians tend to less associate these keywords to relevant type of Citizen Science.

Crowd Science



Semantic Field: Participation

- A dissensus is noticeable for 'Participant-led research' as it clearly states that the research is no longer led by the researchers but by the participants.
- As for 'Citizen Scientist', it rather questions the place and legitimacy of the citizen within a research project



Semantic Field: Cooperation

 'Co-design' and 'Co-creation' encounters slightly less consensus as it doesn't suggest a relation to science nor research.

Cooperative Research

Collaborative Research

Co-design

Co-creation



Recommendations

- Finding accurate translations
- Making the terms explicit
- Clarifying the citizens' implication levels

>>> On our coming thesaurus: possibility to add definitions, annotations, translations and to link to references

Discussion

From Thesaurus to Decision Tools

About our thesaurus

How to create a thesaurus that can really show the relations in-between and be enough explicit regarding definitions and relations? With what tools?

• Huma-Num Thesaurus (see next slide)

What kind of usage could be done out of this thesaurus?

- For librarians: Tools to identify the publications of researchers from their university in CS field, and to analyse the corpora with more information about the kind of CS they are reflecting.
- For researchers: Attention to the size of thesaurus : they may need something easier to help then choosing their suited keywords. Importance to let them know about this thesaurus: librarians as relay of information.

♣ Concept 🛛 🗮 Index

Collection

2

 \equiv

Collection Concept

+ culture et éducation > coutume et tradition > fête > ducasse

Libelle		ducasse (fr)
Variante du libellé		fête foraine
Collection		Patrimoine minier
Total de la branche		
Concept	t	fête
générique		
Concept	ļ	
spécifique		
Concept associé	++	
Traduction	AZ	
Définition		Grande fâte nonulaire dans le nord
Notation		
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- > 🗅 risque sanitaire
- > 🗅 temps-travail
- > 🗅 bâti
- ✓ ▷ culture et éducation
 - > 🗅 activité domestique
 - > 🗅 art
 - ➤ ▷ coutume et tradition
 - Commémoration
 - Costume traditionnel
 - danse traditionnelle
 - ✓ ➢ distinction
 - 🗅 médaille
 - 🗸 🗁 fête
 - 🗅 bal
 - 🗅 banquet
 - 🗅 ducasse
 - 🗅 nouvel an

From Thesaurus to Decision Tools

Maybe the solution to

- 1. Show the relations
- 2. Express the condition
- 3. Offer a useful tool, easy to use, even if there are more than 500 words in it

would be to propose an interactive thesaurus.

Example :

I do research in sociology and information science, I work with a group of Indigeneous people, that are also librarians, to study how their collective tales/myths can be dialoguing with research data on a forest study. The participants have been co-opted. And the participants take part to collect data, analyze data, interpretation and definition of new research question.

How to define the perfect keywords to describe our future paper ?

- $\circ~$ Flow diagram
- Decision database



https://www.flickr.com/photos/dikdik/3344544455/in/photostream/



II WIREDIMPACT

https://wiredimpact.com/blog/nonprofit-email-marketing-mistakes/



Decision tools

Useful for researchers:

- \circ To define keywords;
- To define the kind of CS project that will be made;
- To discuss with participants their implication and the terms used to describe their participation.

Useful for librarians:

- For their own CS projects
- To help researchers in their paper research
- To help researchers to define their keywords
- To help governance to define what kind of bibliometry related to CS they want you to produce
- To train themselves to the diversity of CS

Work in progress

 <u>http://weburfist.univ-</u> <u>bordeaux.fr/citizen-science-</u> <u>thesaurus/</u>





Conclusion

Are we crazy? That's possible

What we hope having achieved:

- Better understanding of the CS ecosystem of information
- Creating a tool that reflects this ecosystem
- Making recommendations for librarians to find their way through CS field, as a bibliometric task.
- Proposing some content for services dedicated to CS information like BESPOC or ECODOC.

We hope that it could help academic libraries to act and to be seen as a pivot within the university, connecting Citizen Science projects and their visibility and their accessibility, to students, to researchers, but also to citizens.

Thank you!



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