



Bibliometric analyses in research management and evaluation

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Universiteit
Leiden

Content

- Introduction to CWTS
- Data infrastructure and main indicators
- Example: performance analysis Univ Helsinki
- Example: funding landscape analysis
- Track-record

Centre for Science and Technology Studies (CWTS)

- Institute of Leiden University
- Services for research evaluation, research management and science policy
- Research programme 2017-2022 *Valuing science & scholarship*



Valuing science and scholarship

- growing needs for information about research:
 - inform national and international science and innovation policies
 - develop strategic visions by universities and research institutes
 - formulate research programs and set priorities
 - evaluate research and its scientific and societal impact
- synergy between quantitative and qualitative methods
- develop richer variety of evaluation practices:
 - novel forms of evaluation
 - new performance criteria
 - new contextualized indicators
 - new interesting data sources

The Leiden Manifesto

- Ten guiding principles for research evaluation
- CWTS/SPRU/Georgia Tech
- Nature 2015
DOI:10.1038/520429a

COMMENT

| | | | |
|--|--|---|--|
| SUSTAINABILITY Data needed to drive UN development goals p.432 | CONSERVATION Economics and environmental catastrophe p.434 | GEOLOGY Questions raised over proposed Anthropocene dates p.436 | HISTORY Music inspired Newton to add more colours to the rainbow p.436 |
|--|--|---|--|



The Leiden Manifesto for research metrics

Use these ten principles to guide research evaluation, urge **Diana Hicks, Paul Wouters** and colleagues.

Responsible metrics

- Robustness
- Transparency
- Diversity
- Reflexivity
- Humility



Clients face key questions

- How should we monitor our research performance?
- What/where is our value and how can we illustrate this?
- What is our societal impact?
- How can we profile ourselves to attract the right students and staff?
- What does the research in field x look like in my country and globally?
- What are we and others funding?

Three types of services

- Monitoring and evaluation
- Advanced analytics
- Training and education

CWTS Leiden Ranking 2019

The CWTS Leiden Ranking 2019 offers important insights into the scientific performance of nearly 1000 major universities worldwide. Select your preferred indicators, generate results, and explore the performance of universities.

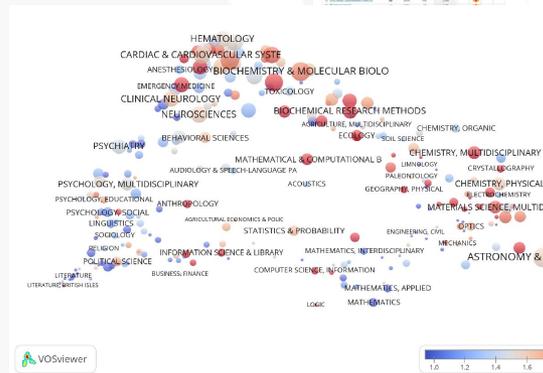


| University | Country | Indicators |
|------------|---------|------------|
| ... | ... | ... |



Chart view

Map view



Bibliometrics and Scientometrics for Research Evaluation

We are happy to announce the November 2020 edition of the course Bibliometrics and Scientometrics for Research Evaluation to be organized in Leiden, The Netherlands. The course is a three days edition of the well-established five days course for professionals Measuring Science and Research Performance provided in Leiden by CWTS during many years.

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CWTS Citation index system

- Enhanced version of Clarivate Analytics' Web of Science core collection database
- Robustness: built upon SQL
- 35 years of research and cleaning/data handling

CWTS Citation index system

- Unifications of names and addresses: organisational data of universities and institutes
- Own algorithms for citation counting and filtering of self-citations
- Proprietary technologies implemented:
 - author clustering algorithm
 - publication classification system of science

Continuously expanding

- Altmetric
 - news feed, blogs, policy docs



- PATSTAT: patent citations



- Orbis: company information



- Unpaywall: open access



Vast range of analytical dimensions

- Publication output
- Citation impact
- Collaboration
- Collaboration with industry
- Societal impact
- Contribution to innovation
- Etc.

Accuracy

CITED REFERENCE INDEX
References: 1 - 5 of 5

◀ Page 1 of 1 ▶

Select Page Select All* Clear All Finish Search

| Select | Cited Author | Cited Work [SHOW EXPANDED TITLES] | Year | Volume | Issue | Page | Identifier | Citing Articles ** | View Record |
|--------------------------|------------------------------------|--------------------------------------|------|--------|-------|------|------------------------------|-----------------------|---|
| <input type="checkbox"/> | Cooper, F. + [Show all authors] | PHYS REP | 1995 | 251 | | 385 | | 2 | |
| <input type="checkbox"/> | Cooper, F. + [Show all authors] | PHYS REP | 1995 | 251 | | | 267385 | 2 | |
| <input type="checkbox"/> | Cooper, F. + [Show all authors] | Physics Reports | 1995 | 251 | 5-6 | 267 | 10.1016/0370-1573(94)00080-M | 1165 | |
| <input type="checkbox"/> | COOPER, F. + [Show all authors] | PHYS REP | 1995 | 251 | 5-6 | 268 | | 488 | View Record in Web of Science Core Collection |
| <input type="checkbox"/> | Cooper, F. + [Show all authors] | SUKHATME PHYS REP | 1995 | 251 | | 267 | | 1 | |
| Select | Cited Author | Cited Work | Year | Volume | Issue | Page | Identifier | Citing Articles ** | View Record |

Select Page Select All* Clear All Finish Search

symmetry between a boson and a para-fermion of order p.

- CWTS CI-system 1 524 citations including self-citations

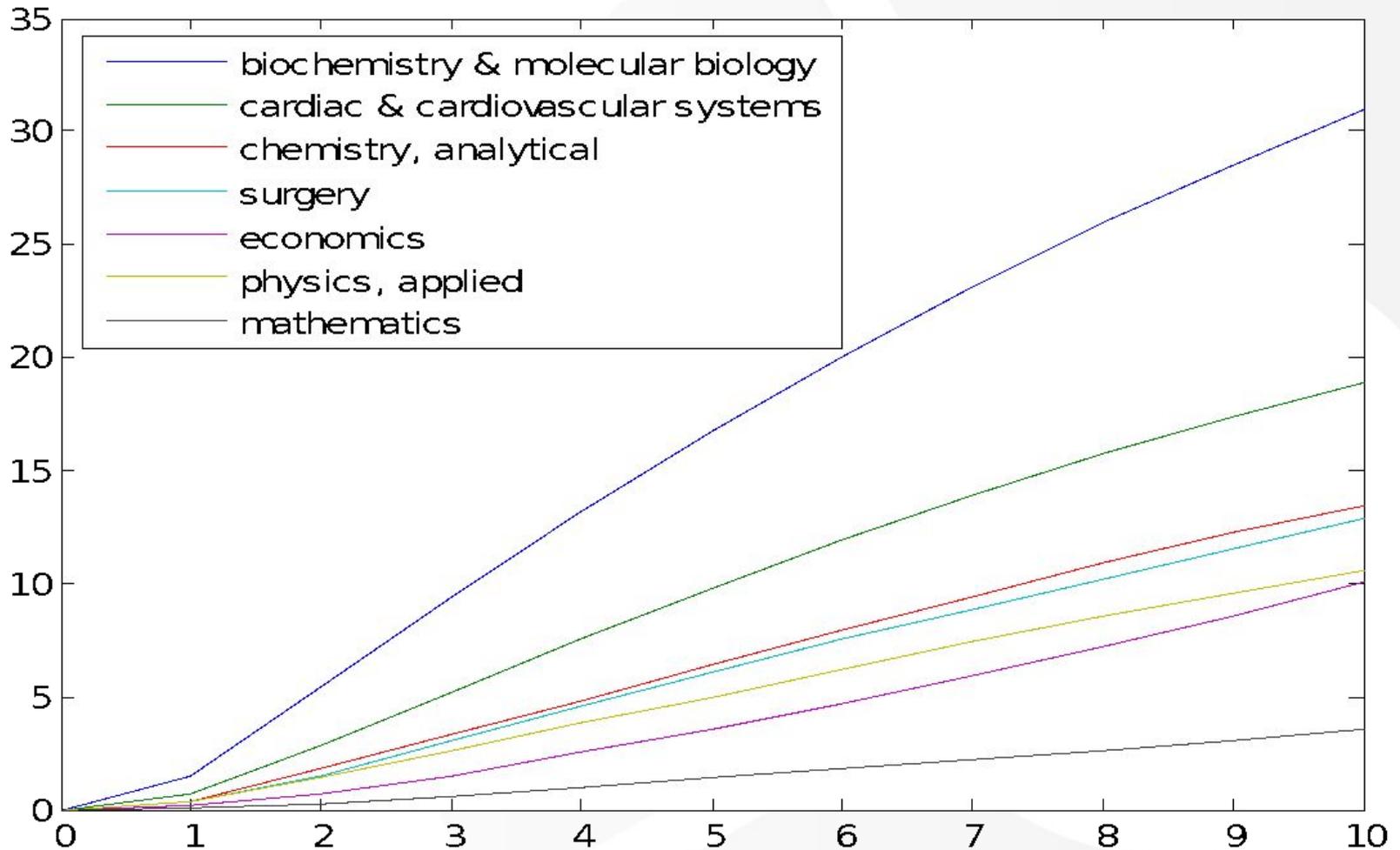


Transparency

- Aarhus University
- Ca. **700** different name variations
- Searching for “AARHUS UNIV” or “UNIV AARHUS” captures ca. 70% of all papers

| | | |
|------|-----------|------------------------|
| 8452 | AARHUS | AARHUS UNIV |
| 4886 | AARHUS | AARHUS UNIV HOSP |
| 4496 | AARHUS | UNIV AARHUS |
| 1421 | TJELE | DANISH INST AGR SCI |
| 896 | AALBORG | AALBORG HOSP |
| 765 | ROSKILDE | NATL ENVIRONM RES INST |
| 431 | SILKEBORG | NATL ENVIRONM RES INST |
| 316 | AARHUS | AARHUS KOMMUNE HOSP |
| 273 | AARHUS | AARHUS SCH BUSINESS |
| 257 | AALBORG | AARHUS UNIV HOSP |
| 242 | RISSKOV | UNIV AARHUS |
| 238 | SLAGELSE | DANISH INST AGR SCI |
| 227 | AARSLEV | DANISH INST AGR SCI |
| 214 | TJELE | RES CTR FOULUM |
| 198 | RONDE | NATL ENVIRONM RES INST |
| 159 | AARHUS | SKEJBY UNIV HOSP |
| 155 | AALBORG | AALBORG UNIV HOSP |
| 130 | RISSKOV | AARHUS UNIV HOSP |
| 113 | AARHUS | SKEJBY HOSP |

Differences among fields



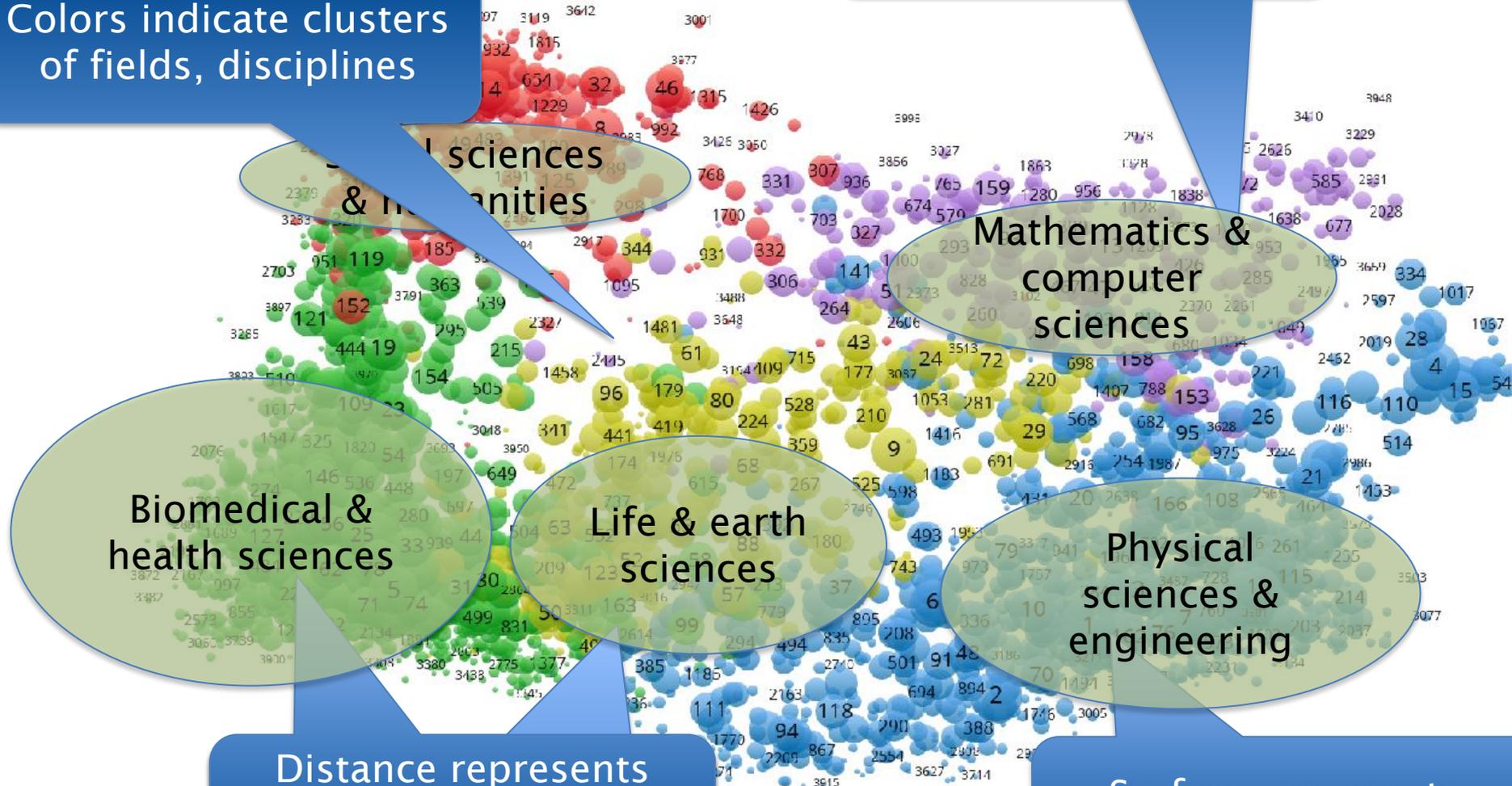
CWTS Publication classification system

- Proper and robust classification because of true citation relations of all WoS publications 2000-2019
- No issues with multidisciplinary journals
- No human involvement
- Better/finer grain than all other classification systems
 - Around 4500 (sub-)fields

Map of all sciences - 4535 fields of science

Each circle represents a cluster of pubs

Colors indicate clusters of fields, disciplines



Social sciences & humanities

Mathematics & computer sciences

Biomedical & health sciences

Life & earth sciences

Physical sciences & engineering

Distance represents relatedness (citation traffic)

Surface represents volume

Methodology

- Size dependent indicators -

- Impact Indicators:
 - Number of publications (P)
 - Total citation score (TCS)
 - # highly cited papers (P_{top 10%})
- Calculation:
 - Only articles and reviews
 - Self-citations are ignored
 - Citation window length must be at least 1 full year

Methodology

- **Size independent indicators**

- Impact Indicators:
 - Mean citation score (MCS)
- Normalised indicators
 - Mean normalised citation score (MNCS)
 - Proportion publications in top 10% (PPtop 10%)
 - Mean normalised journal score (MNJS)
- Calculation:
 - Citation window length must be at least 1 full year

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Example results – Univ Helsinki

- full

Bibliometric Report



Research performance analysis for the University of Helsinki 2012- 2016/17

February 2019

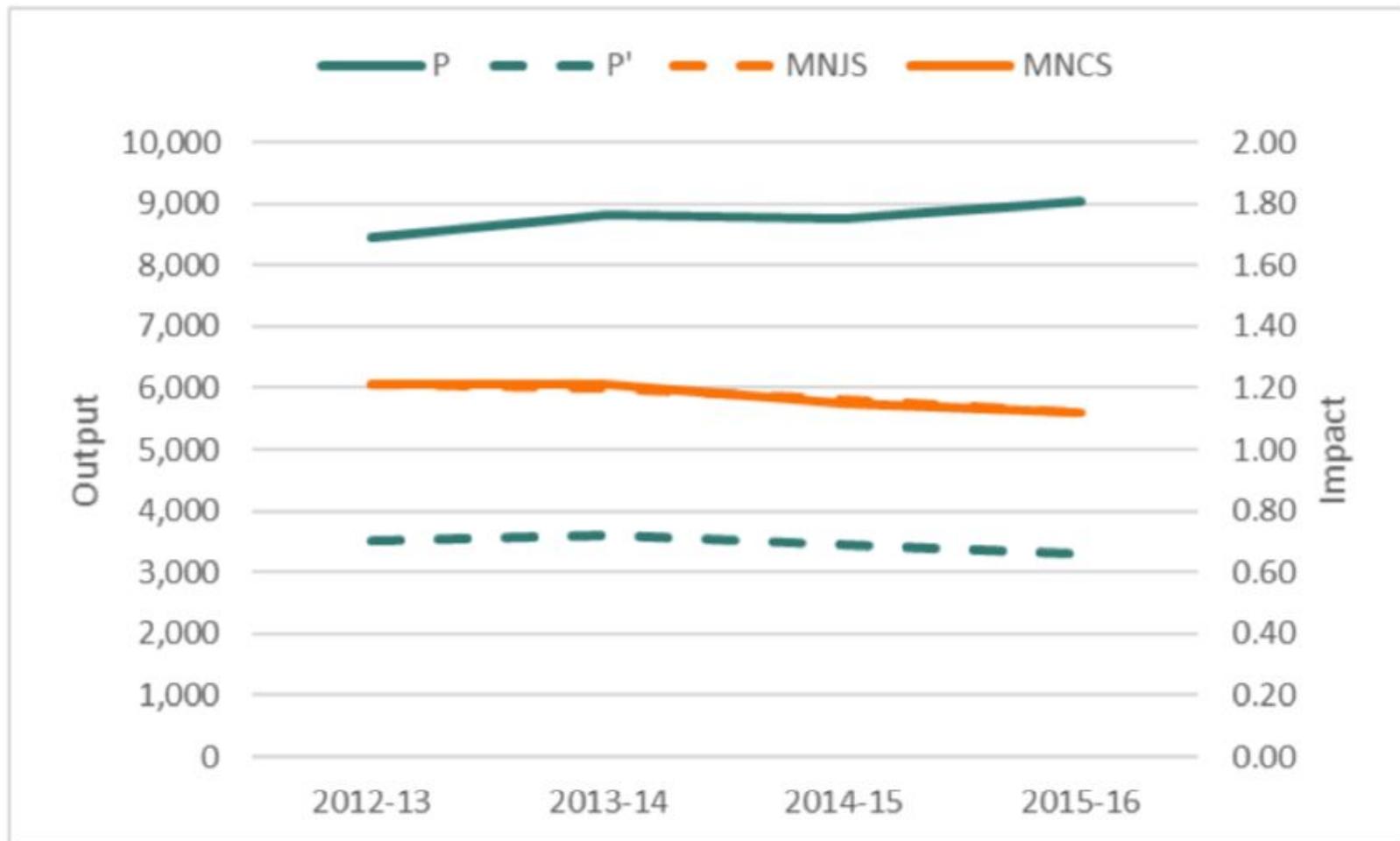
Ed C.M. Noyons & Anssi M. Mälkki



Example results – Univ



Figure 4-1 Performance trend (output and impact) of University of Helsinki



Example results – Univ Helsinki

Figure 4-2 Research profile (output and impact) of University of Helsinki

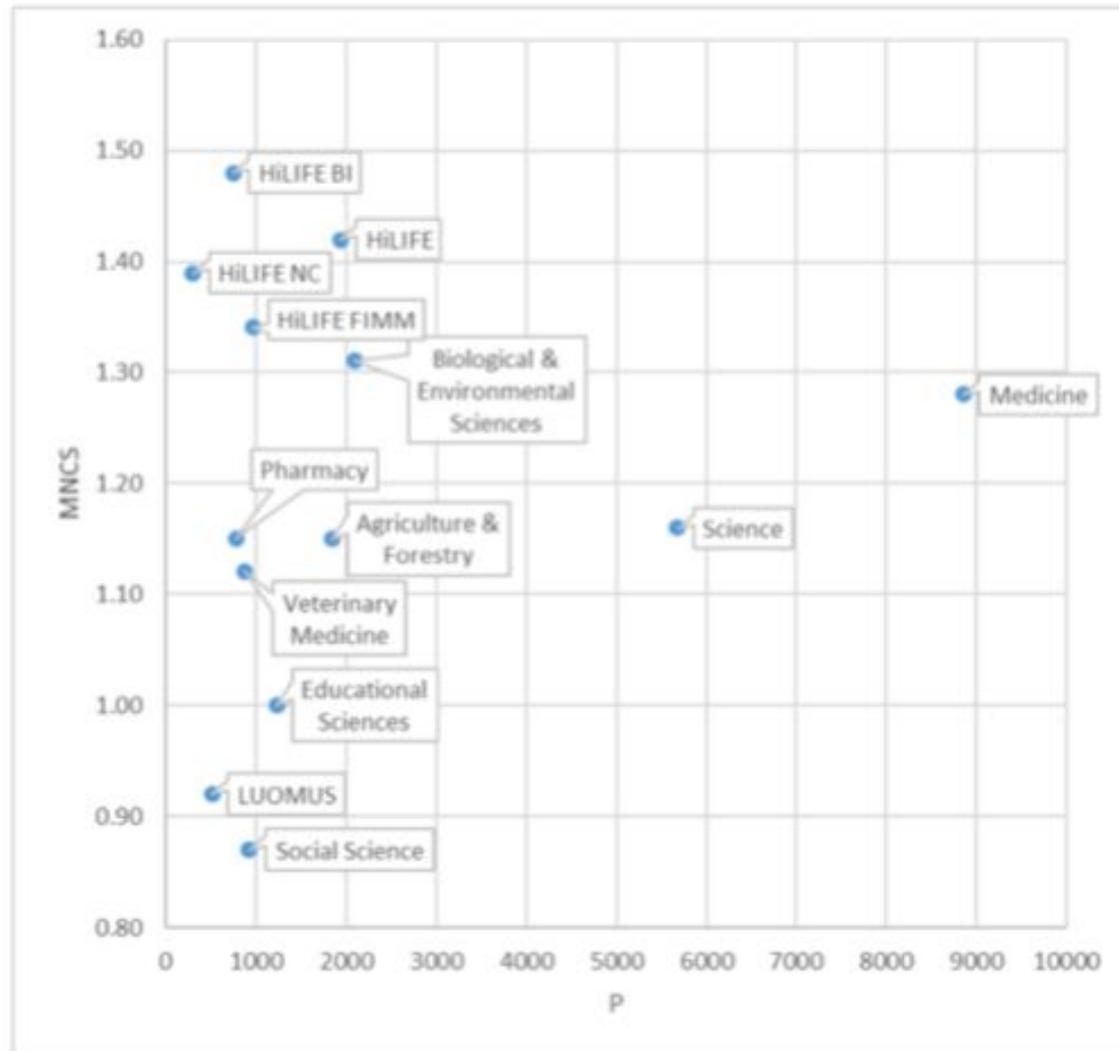
| WoS field | P | P' | MNCS | MNJS |
|------------------|-------|-----|------|------|
| MULTIDISCIPL SC | 1,193 | 386 | 1.57 | 1.56 |
| ASTRON&ASTROPH | 693 | 134 | 1.05 | 1.15 |
| PHYSICS,PART&FIE | 572 | 78 | 1.11 | 1.14 |
| GENETICS&HEREDIT | 551 | 132 | 1.57 | 1.57 |
| ONCOLOGY | 535 | 147 | 1.37 | 1.29 |
| ENDOCRIN&METABOL | 490 | 115 | 1.38 | 1.54 |
| PUBL,ENV&OCC HLT | 468 | 155 | 0.94 | 0.98 |
| ENVIRONMENTAL SC | 464 | 198 | 1.00 | 1.10 |
| ECOLOGY | 460 | 192 | 1.34 | 1.36 |
| NEUROSCIENCES | 448 | 175 | 1.13 | 1.28 |
| METEOR&ATMOS SC | 445 | 137 | 0.97 | 1.17 |
| CLIN NEUROLOGY | 430 | 148 | 1.43 | 1.29 |
| BIOCHEM&MOL BIOL | 420 | 166 | 1.45 | 1.33 |
| PHARMACOL&PHARMA | 366 | 164 | 1.23 | 1.24 |
| PLANT SCIENCES | 337 | 147 | 1.25 | 1.22 |
| SURGERY | 330 | 169 | 1.21 | 1.20 |
| MEDICINE,GEN&INT | 328 | 85 | 3.27 | 3.11 |
| MICROBIOLOGY | 320 | 141 | 1.19 | 1.22 |
| PSYCHIATRY | 287 | 78 | 1.17 | 1.11 |

Example results – Univ Helsinki

Figure 4-3 Collaboration profile (output and impact) of University of Helsinki

| Collaboration | P | MNCS | MNJS |
|---------------|--------|------|------|
| Intl collab | 13,330 | 1.40 | 1.33 |
| Nat collab | 5,020 | 1.02 | 1.06 |
| Single inst | 3,562 | 1.05 | 1.09 |

Example results – Univ Helsinki



Example results – Univ



Faculty of Agriculture

The Faculty of
responsible use of
worldwide. We fo
and nutrition

Source: UH website

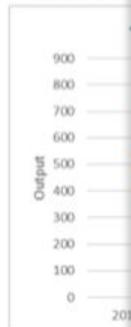
Table 4-3 Overall and trend pe

| Indicator | 201 |
|--------------|------|
| P | 1,83 |
| P' | 843 |
| WoS coverage | 0.75 |
| MNS | 1.18 |
| TCS | 5,96 |
| MCS | 7.02 |
| MNCS | 1.15 |
| PP(top10%) | 0.11 |
| P'(top10%) | 93 |

The research at the Faculty
resulted in 1,839 articles an
which means that the samp



Figure 4-4 Performance tr



The output of this Fac
publications per year.
(for both MNCS and PP
published is at the sam

Figure 4-5 Research profil

| WoS f | | | | |
|---|----|----|------|------|
| FORESTRY | | | | |
| ENVIRONMENTAL SCIENCES | | | | |
| PLANT SCIENCES | | | | |
| FOOD SCIENCE AND TECHNOLOGY | | | | |
| ECOLOGICAL AND ENVIRONMENTAL SCIENCES | | | | |
| MULTIDISCIPLINARY | | | | |
| MICROBIOLOGY | | | | |
| BIOTECHNOLOGY | | | | |
| NUTRITION | | | | |
| REMOTE SENSING | 42 | 16 | 1.08 | 1.47 |
| SOIL SCIENCE | 41 | 20 | 1.34 | 0.99 |
| AGRONOMY | 35 | 17 | 0.81 | 0.95 |
| METEOROLOGICAL AND ATMOSPHERIC SCIENCES | 35 | 11 | 1.17 | 1.36 |
| BIOCHEMISTRY AND MOLECULAR BIOLOGY | 34 | 13 | 1.09 | 1.01 |
| AGRICULTURE, DAIRY AND ANIMAL SCIENCE | 34 | 18 | 1.01 | 1.14 |



Feb 2019
CWTS B.V.
Leiden University

The research profile of this Faculty matches the mission as presented in the description of the Faculty on the UH website. In the WoS fields of Forestry, Plant Sciences, Food S&T and Ecology, the Faculty contributed to 90 publications or more with an impact above world average. In Environmental Sciences is the impact just below world average. In the field of Microbiology the Faculty contributed to 85 publications, with an impact well above world average. The fields of Economics and Management are not in the top 15 most prominent fields. Research in this area may have been published in one of the top 15 fields, but it is not visible as such.

Figure 4-6 Collaboration profile (output and impact) of the Faculty of Agriculture and Forestry

| Collaboration | P | MNCS | MNUS |
|---------------|-------|------|------|
| Intl collab | 1,004 | 1.33 | 1.26 |
| Nat collab | 505 | 0.98 | 1.11 |
| Single inst | 330 | 1.08 | 1.16 |

The majority of output to which the Faculty contributed involved international collaboration (55%). This type of output has the highest impact and is published in high-impact journals.

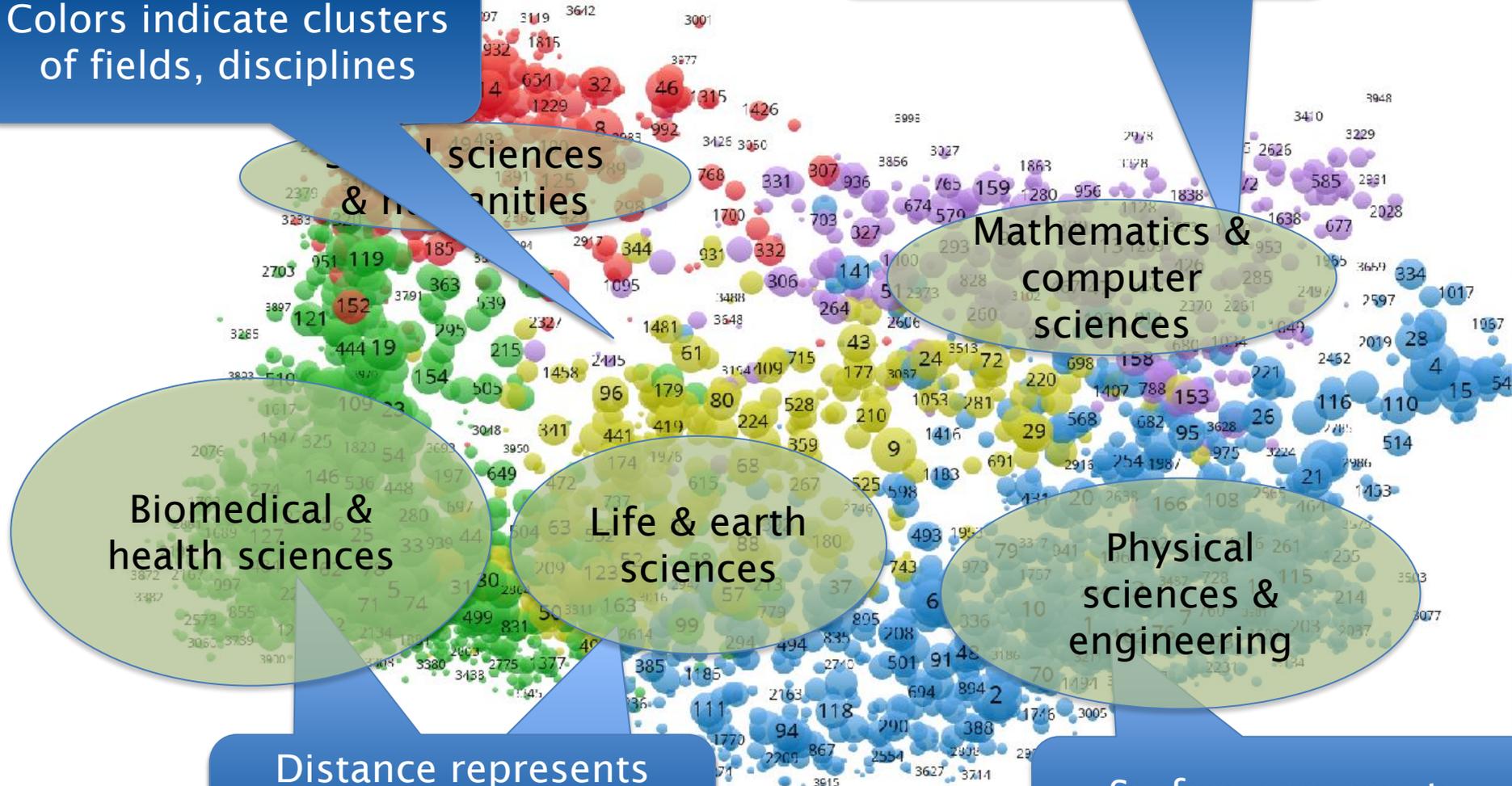
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Map of all sciences - 4535 fields of science

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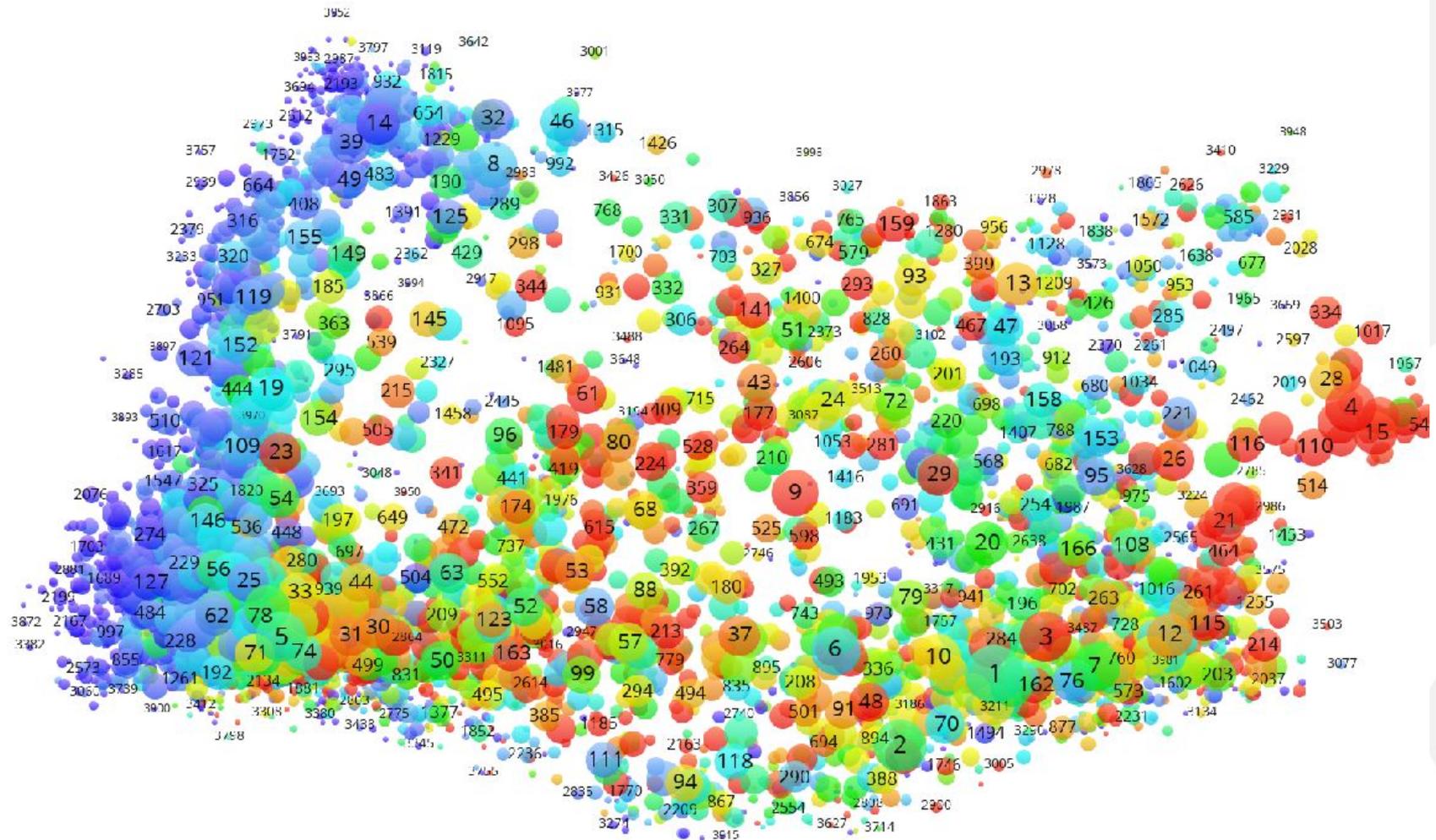
Colors indicate clusters of fields, disciplines



Distance represents relatedness (citation traffic)

Surface represents volume

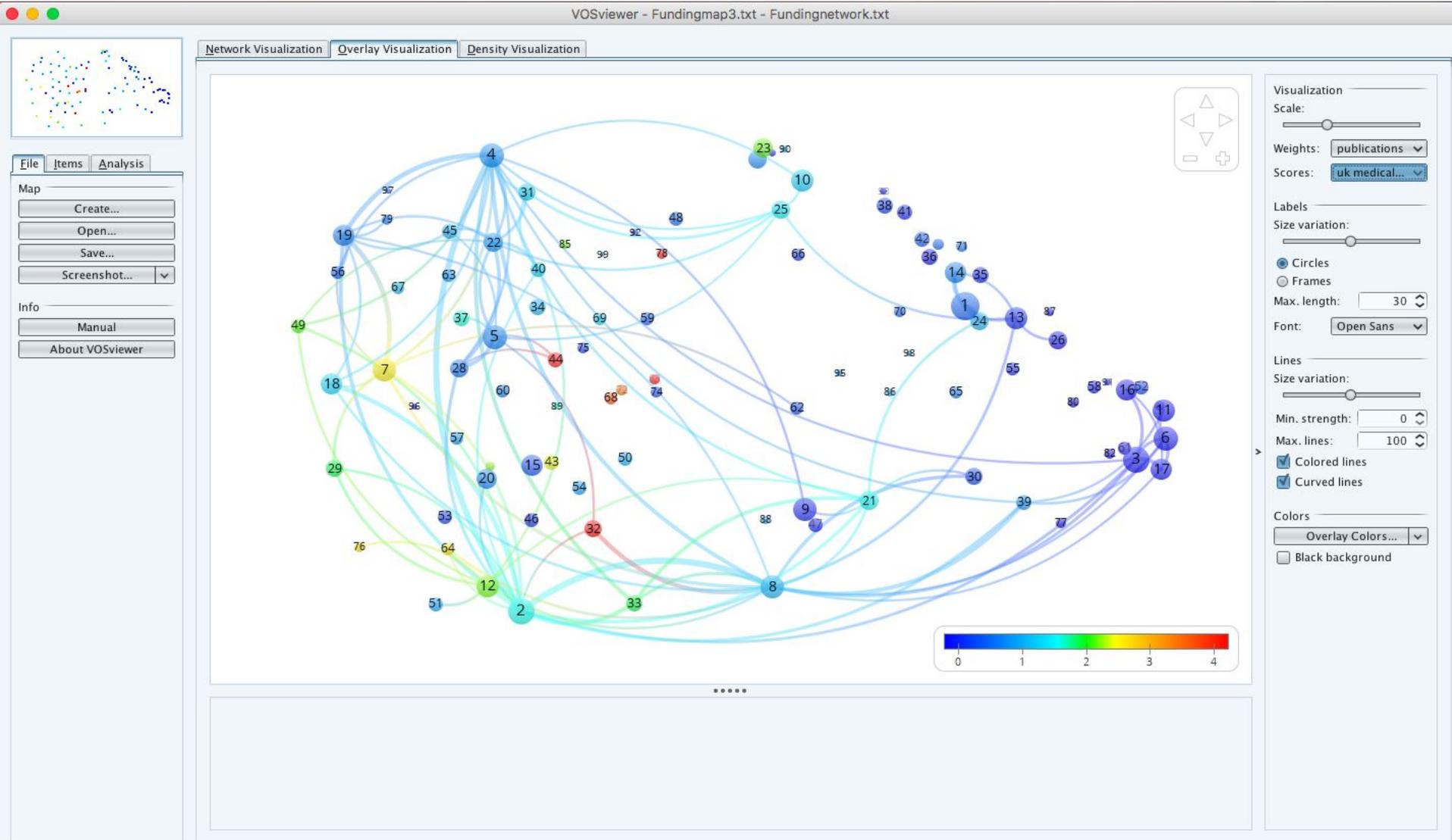
Funding acknowledgements: funding by EC



Delineate the field 'Genomics and genetics research'

- Select relevant clusters by using a training set:
 - Core journals
 - Core publications
 - Key authors
- Carve out the field by setting thresholds in collaboration with the client
- Use the funding acknowledgements in publications

Funding landscape analysis - Genomics and genetics research -



Cluster/field characteristics

- Growth
- Average age
- Important actors/peers
- Disciplinary connections
- Other funding agencies
- Private entities active
- Citation relation to patents -> who owns these

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Track-record

- Global clients, with an emphasis on Europe
- Spectrum of clients:
 - Universities & Academic Hospitals
 - Research Institutes
 - Funding agencies
 - Government/EU
 - Industry
 - Network Organizations
- Developed SNIP for Elsevier

Track-record

- LERU
- Amsterdam UvA
- TU Delft
- Erasmus University Rotterdam
- Uppsala University
- University of Manchester
- ETH Zürich
- University of Helsinki
- University of Oulu
- Hasselt University
- University of Graz
- University of Zagreb

Track-record

- NWO (NL) ‘Arctic- and Antarctic research NL’
- EPSRC (UK) ‘relationship between engineering- & physical sciences with health- & life sciences by advanced bibliometric methods’
- VINNOVA (SE) ‘research strengths of Sweden and public and private collaborations’
- BMBF (DE) ‘German excellence in nanosciences and nanotechnology’
- KFAS (KW) ‘Developments in Kuwaiti scientific impact and output’

Latest developments

- Scopus
- Dimensions
- Microsoft Academic Graph
- Repository management services
- Workforce analysis
- Societal response analyses: Google (Scholar)
- Mixed method approaches to contextualise metrics and create narrative