



Reform University and Research Today

Profiling of Research Portfolio
of ERUA

30 June 2023

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List of abbreviations

| | |
|---------|---|
| NBU | New Bulgarian University (Нов български университет) |
| Paris8 | Paris 8 University Vincennes-Saint-Denis (Université Paris 8 Vincennes-Saint-Denis) |
| RUC | Roskilde University (Roskilde Universitet) |
| UAegean | University of the Aegean (Πανεπιστήμιο Αιγαίου) |
| UKON | University of Konstanz (Universität Konstanz) |

Executive summary

This report presents the second of a two-part study that examines what it means to be a 'Reform University' for the five ERUA partner universities. The focus of this report is an outline of the current state of the research portfolio of ERUA partner universities, while the first report explores the historical emergence, organizational models, and study courses of the universities today. We recommend reading both reports to gain a comprehensive understanding of the education and research profiles of the ERUA universities. Together, these two reports aim to initiate discussions on how Reform Universities and ERUA are positioned in the contemporary higher education landscape.

In this report, we outline the current state of the research portfolio of the ERUA partner universities, by examining and identifying the research fields and research themes in which they are engaged. The methodological approach of this report is centred around bibliometric analyses of scientific publications. It is important to acknowledge the methodological limitations inherent in this study, which are addressed in detail in the report. However, despite these limitations, we consider our analysis as a first exploration to shed light on whether researchers within the alliance contribute to and engage in discussions within similar research areas. Our findings provide the foundation for further discussions and reflections.

Overall, the examination of the research portfolio shows that each university has its own distinct academic interests with some overlaps in particular fields or areas. We find a considerable overlap within the field of social sciences and humanities. All five universities demonstrate a strong interest in the relationship between society and various other factors, for instance, politics and economy. These findings are not a surprise given that the social sciences and humanities serve as the focal point for the academic profile of the five Reform Universities, representing a collective strength. We did not find significant overlap within the fields of physical sciences, life sciences, health sciences, and multidisciplinary fields. However, this does not exclude the possibility of overlap in the techniques or methods employed.

This report will be of interest to university management responsible for shaping research strategies and determining the positioning of their respective institution. Moreover, the findings of this study can inform discussions on the future development of scientific collaboration within the alliance as a whole. Furthermore, researchers seeking an understanding of the research conducted by the partner universities in ERUA may also find this study valuable.

We encourage that the findings presented in this report should be supplemented with local knowledge on the specific research portfolio of the partner universities in mind as this report only display a specific subset of the research carried out. Based on the findings of this report, we encourage further research to explore the question of whether Reform Universities approach research differently than more ‘traditional’ universities. For instance, do the shared values of ‘interdisciplinarity’, ‘societal engagement’, and ‘experimentation’ also reflect an approach to research that is unique for Reform Universities?

1. Introduction

Building upon the report ‘Reform University and Education Today’, which explores the historical emergence of Reform Universities and provides an overview of the history, organisational structure, and present-day educational profile of the five partner universities of the European Reform University Alliance (ERUA), this study approaches the topic of ‘Reform University and Research Today’. We recommend reading both reports to gain a comprehensive understanding of the education and research profiles of the ERUA universities. Together, these two reports aim to initiate discussions on how Reform Universities and ERUA are positioned in the contemporary higher education landscape.

The following study aims to outline the current state of the research portfolio of the ERUA partner universities (UKON, Paris8, RUC, UAegean, and NBU), examining and identifying the research fields and research themes in which they are engaged. Furthermore, by reviewing the research profiles of the partner universities, we seek to identify areas of overlap and divergence in their research focus. Are researchers within the alliance contributing to and engaging in discussions within the same research areas, or do notable differences exist in their research priorities?

By facilitating discussions around these research interests, we aim to critically assess the potential for scientific collaboration and exchange among the partner universities. So far, research on the European Universities Initiative and European University Alliances has been primarily focused on the organisational processes (see, e.g., Charret & Chankseliani, 2022; Maassen et al., 2022), while less attention has been given to the scholarly communication and scientific collaboration among university alliances.

The report centres around bibliometric analyses of scientific publications, utilizing a data-driven approach to explore the research landscape of the five partner universities (Donthu et al., 2021; Hossain et al., 2022; Moral-Munoz et al., 2019). In the beginning, we outline our methodological approach and data sources, providing the framework for our analysis. Following this, we provide an overview of the publication output across different research fields, shedding light on the prominence of different research areas. The primary focus of the report lies in the mapping of research themes. To achieve this, we employ a co-word analysis of abstracts, allowing us to identify and explore the connections between different terms within publications. The report concludes with a discussion, where we synthesize the findings and discuss the broader implications for scientific collaborations in ERUA.

This report will be of interest to university management responsible for shaping research strategies and determining the positioning of their respective institution. Moreover, the findings of this study can inform discussions on the future development of scientific collaboration within the alliance as a whole. Furthermore, researchers seeking an understanding of the research conducted by the partner universities in ERUA may also find this study valuable.

Within the scope of the project, we have compiled information on innovation spaces for interdisciplinary and collaborative research and education. This collection of resources can be accessed through the website (<https://erua-eui.eu/open-database/open-laboratories/> and <https://erua-eui.eu/open-database/collaboratories/>), offering a catalogue for inspiration.

2. Research Portfolio

2.1. Methodological Approach

This study uses bibliometric analyses to uncover the research portfolio of the five partner universities. In recent years, the increase in scientific output, along with the aggregation of scholarly information within bibliographic databases, has resulted in the adoption of 'bibliometrics' as an effective means for assessing scientific output through statistical examination of quantitative information derived from academic literature. Bibliometric methods can extract and analyse the characteristics of publications, including years, journals, authors, countries, and keywords, to provide insights on development trends or research orientations within a specific subject (de Oliveira, et al., 2019; Sánchez et al., 2017).

The following analyses are based on publication data in Scopus spanning the years 2010 to 2022. Scopus is an abstract and citation database consisting of peer-reviewed scientific content (Baas et al., 2020). In its most basic form, Scopus may be considered a scientific search engine that provides relevant documents based on criteria such as keywords, article titles, journal names and author names (Schotten et al., 2017, p. 34). When aggregated among research institutions, the data offers a view into their research output. For more information on the methodology and data source see the appendix.

However, as with any data source, there are some caveats and limitations to consider. Scopus data has been shown to be biased toward Natural Sciences, Engineering, and Biomedical Research, while Social Sciences and Humanities (SSH) are underrepresented in the dataset (Mongeon & Paul-Hus, 2016). Furthermore, the dataset prioritizes publications in the English language and has relatively limited coverage of regional literature (Pranckute, 2021). This means that research in languages other than English may not be adequately represented. For the ERUA universities, which are particularly strong in the humanities and social sciences and in research that engages with local communities, this may give a somewhat skewed impression of the research output. The dataset may unintentionally favour Nordic and Western European countries at the expense of Eastern European countries that, in the humanities and social sciences, tend to publish more in national languages (Kulczycki et al., 2018, p. 483)

When interpreting the following results, it is important to consider these limitations and biases. Rather than providing a comprehensive depiction of the research output, this study seeks to provide an overview and examination of research carried out by the ERUA universities that is

(more) internationally oriented and, thus, emphasizes opportunities for collaboration among partner universities. By adopting this perspective, the analysis aims to highlight the areas of research where synergies and collaborative efforts can be explored among the partner universities.

2.2. Mapping the research output of the ERUA universities

2.2.1. Research fields (Subject areas)

In order to gain an initial understanding of the research portfolio of the ERUA universities, we analyse the distribution of their publication output by research fields based on Scopus data for the period 2010-2022. We follow the five major subject areas by Scopus as categorization for the research fields: Social Sciences & Humanities, Physical Sciences, Life Sciences, Health Sciences, and Multidisciplinary.¹ It should be noted that this categorisation is rather crude and does not reflect the depth of the subject matters studied (see e.g. Wang & Ludo (2016)).

Keeping the previously mentioned limitation of the Scopus database in mind, the following should not be understood as a comprehensive analysis of *all* publications by the ERUA universities. Instead, it provides a first look at the prominence of the different research fields in the analysed data. Given the inherent variability in publication processes, we opted not to analyse the data on a yearly basis but instead examined the entire period (2010-2022) as an aggregated unit.

As the following illustration shows, UKON and UAegean have the highest share of publications in the Physical Sciences, whereas Paris8 and RUC have a particularly strong profile in the Social Sciences & Humanities. NBU demonstrates a relatively equal distribution between the Physical Sciences and the Social Sciences & Humanities.² The remaining three categories account for less than half of the publication outputs. Notably, the category of Multidisciplinary represents only a small portion of the publications. Based on the available data, it is not possible to verify

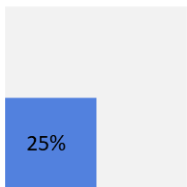
¹ The Scopus classification system is established upon the All Science Journal Classification (ASJC). While there is no official description available about the construction of the ASJC, a list of all the ASCJ categories and their subject areas can be found here: https://service.elsevier.com/app/answers/detail/a_id/15181/supporthub/scopus/.

² When interpreting the results of NBU, it is important to consider the relatively low number of abstracts. NBU has only in recently shifted its focus towards research, which has influenced the number of publications.

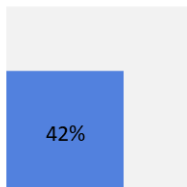
the extent to which this distribution in the dataset reflects the actual distribution of publications. However, it is worth noting that UKON and UAegean also place a greater emphasis on Natural Sciences in their education profiles compared to the other three universities.

UKON (n=12,870)

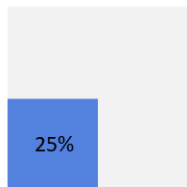
Social Sciences & Humanities



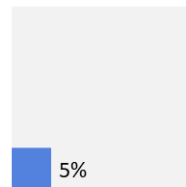
Physical Sciences



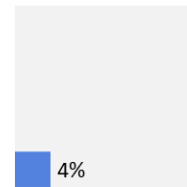
Life Sciences



Health Sciences

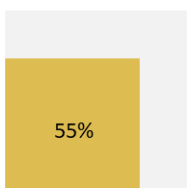


Multidisciplinary

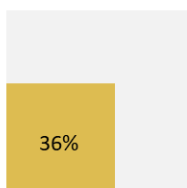


Paris8 (n=2,925)

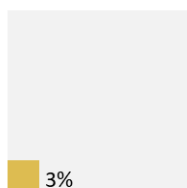
Social Sciences & Humanities



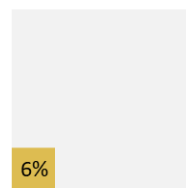
Physical Sciences



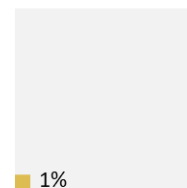
Life Sciences



Health Sciences

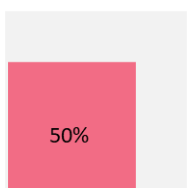


Multidisciplinary

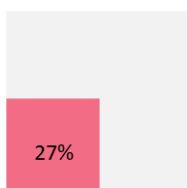


RUC (n=4,377)

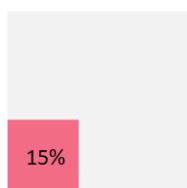
Social Sciences & Humanities



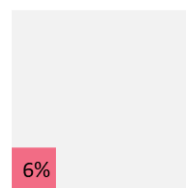
Physical Sciences



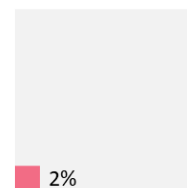
Life Sciences



Health Sciences

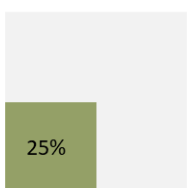


Multidisciplinary

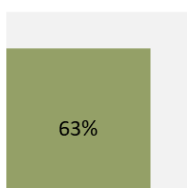


Uaegean (n=5,708)

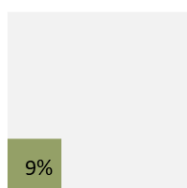
Social Sciences & Humanities



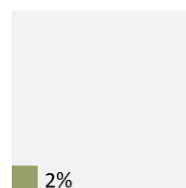
Physical Sciences



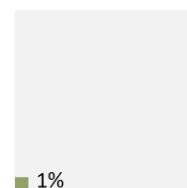
Life Sciences



Health Sciences

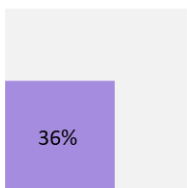


Multidisciplinary

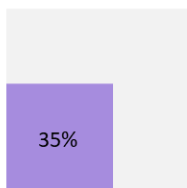


NBU (n=661)

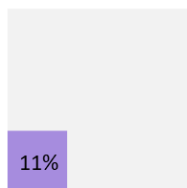
Social Sciences & Humanities



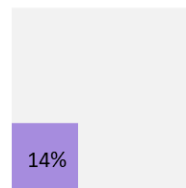
Physical Sciences



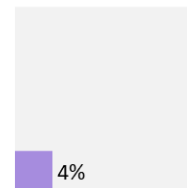
Life Sciences



Health Sciences



Multidisciplinary



Scopus Data | 2010-2012

2.2.2. Research themes

In order to gain insights into prevalent research themes among ERUA universities, we employed a *co-word analysis* approach. Co-word analysis is a bibliometric method that examines the actual content of a scientific publication itself to select highly frequent words to reflect the hotspots of a certain research field (van Eck & Waltman, 2014; Whittaker et al., 1989). We focused on analysing the abstracts, as they provide a concise summary of the research conducted. The co-word technique extracts terms and counts the co-occurrences of term pairs (for more details on the methodology see the appendix). By examining the patterns of word co-occurrences within the abstracts, we aimed to identify recurring themes and topics across the five partner universities. We see our analysis as a first exploration to contribute to a better understanding of the research areas of potential interest for collaboration among ERUA partners.

As previously, the analysis was carried out across the five subject areas for each university based on the Scopus categorization (Social Sciences & Humanities, Physical Sciences, Life Sciences, Health Sciences, Multidisciplinary). It is important to note that this classification is somewhat limited and may not fully capture the breadth and depth of each subject area. However, we consider this analysis as an initial exploratory approach and, therefore, the broad classification seems sufficient. This comparative approach resulted in a total of 25 analyses. In the following section, we present the results in two formats. Firstly, we visually present the relationships between the identified co-occurring terms in a network analysis, which displays the top 30 most frequent words and their co-occurring terms, highlighting the interconnections and clusters of research themes. Secondly, we provide an overview of the findings in a table format, which includes the top 30 most co-occurring terms presented as word pairs.

Together, the network analysis and the table of co-occurrences provide an explorative mapping of the research themes ERUA universities are engaged in, offering insights into their areas of focus. They not only highlight prominent research topics within each university but also reveal the extent of overlap among their research interests.

Reader's guide

In the following pages, we will present network visualizations and tables that display co-occurrences for each university, categorized by the five broad subject areas. After presenting the data for each subject area, we will discuss the overlaps or distinctive features, aiming to identify common research interests among the universities. The purpose of this guide is to assist

readers in reading and interpreting the network visualizations and tables effectively. We encourage especially researchers from different fields to go through the graphics and expand our first explorative interpretation with their domain knowledge, and thus carry the discussion further towards a deeper understanding of the research landscape across different universities and subject areas.

A network visualization represents relationships between entities (in our case ‘words’) as nodes and connections (in our case ‘co-occurrences’, i.e., the frequency with which two words appear together) between them as edges. Thicker edges indicate a higher level of co-occurrence between the corresponding words. This means that the words connected by thicker edges tend to appear together more frequently, suggesting a stronger relationship. Nodes that are closer together in the visualization indicate stronger connections. Central nodes in the visualization indicate higher importance within the co-occurrence network, suggesting that these words are more influential.

In the table, the word pairs of co-occurring terms are listed in descending order, showcasing the most prevalent associations between terms.³ The count indicates how often two words co-occur in the analysed text data (in our case abstracts).

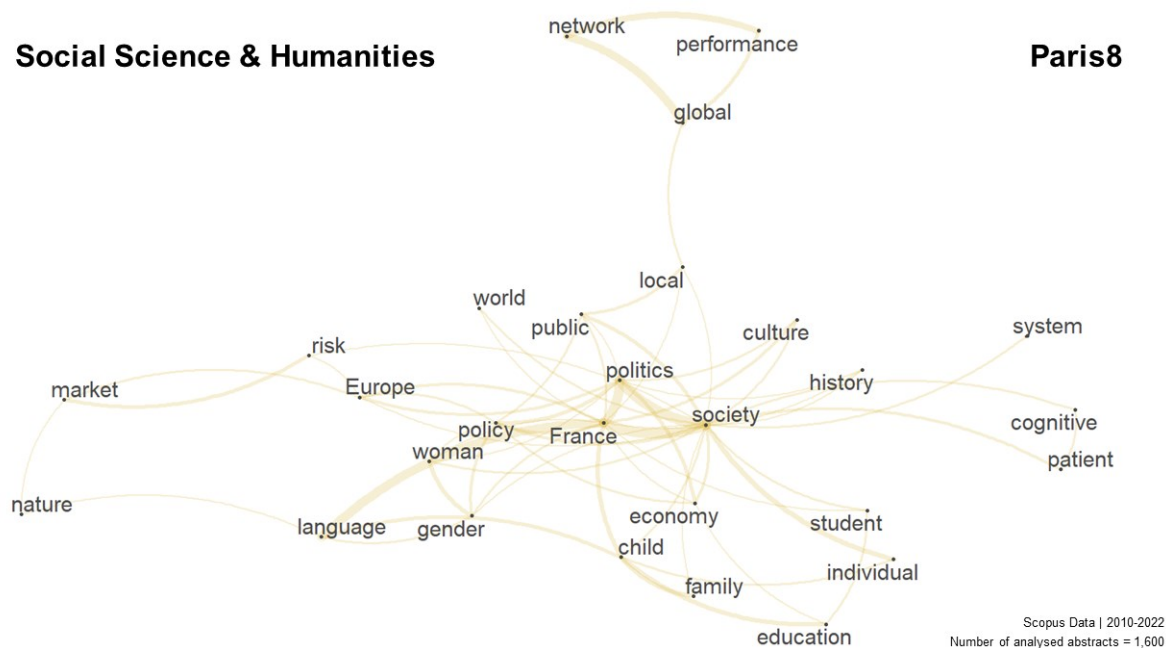
While comparing the networks and counts of co-occurrences among the five universities, we have to keep in mind that the number of analysed abstracts varies significantly. This variation in sample size can influence the frequency of co-occurrences observed. Universities with a higher number of abstracts may have a higher threshold for co-occurrence inclusion, resulting in a more stringent selection process for terms to be represented in the network and the tables. Conversely, universities with a smaller dataset may have a lower threshold, leading to a comparatively higher representation of terms in the network and the tables. While a term may not appear in the co-occurrence rankings of a university, it does not imply an absence of research interest; rather, it reflects the relative prominence of specific research areas within each university. In that sense, the networks and tables highlight the research areas that have received greater attention in the analysed abstracts. The absence of a term suggests that it may

³ It is important to note, that the network visualisations display a broader range of terms and their relationships than the tables as they include the top 30 frequent words and their co-occurring terms, whereas the tables focus specifically on the top 30 frequent co-occurring word pairs, highlighting the most significant associations between paired terms.

not be as extensively explored, in comparison with other terms, within the research community of that particular university.

Social Science & Humanities

Paris8

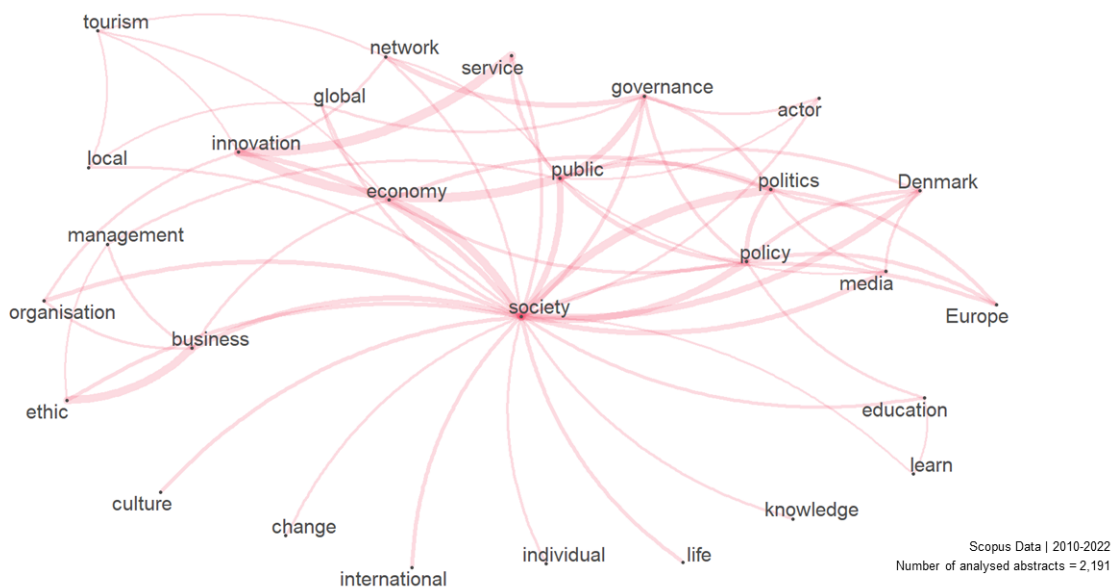


| Paris8 | | | | | | | |
|--------|---------------|-------------|-------|------|---------------|-----------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | society | politics | 502 | 16 | public | society | 187 |
| 2 | society | France | 498 | 17 | risk | market | 177 |
| 3 | politics | France | 462 | 18 | Europe | France | 172 |
| 4 | language | France | 448 | 19 | local | public | 172 |
| 5 | network | global | 391 | 20 | society | economy | 169 |
| 6 | network | performance | 317 | 21 | politics | Europe | 167 |
| 7 | individual | society | 250 | 22 | culture | France | 164 |
| 8 | child | France | 243 | 23 | society | policy | 162 |
| 9 | gender | woman | 227 | 24 | France | policy | 147 |
| 10 | education | child | 221 | 25 | society | patient | 147 |
| 11 | family | child | 216 | 26 | gender | policy | 141 |
| 12 | language | child | 204 | 27 | system | society | 137 |
| 13 | performance | global | 199 | 28 | student | education | 136 |
| 14 | politics | economy | 193 | 29 | Europe | policy | 133 |
| 15 | politics | policy | 191 | 30 | cognitive | patient | 132 |

Scopus Data | 2010-2022
Number of analysed abstracts = 1,600

Social Science & Humanities

RUC

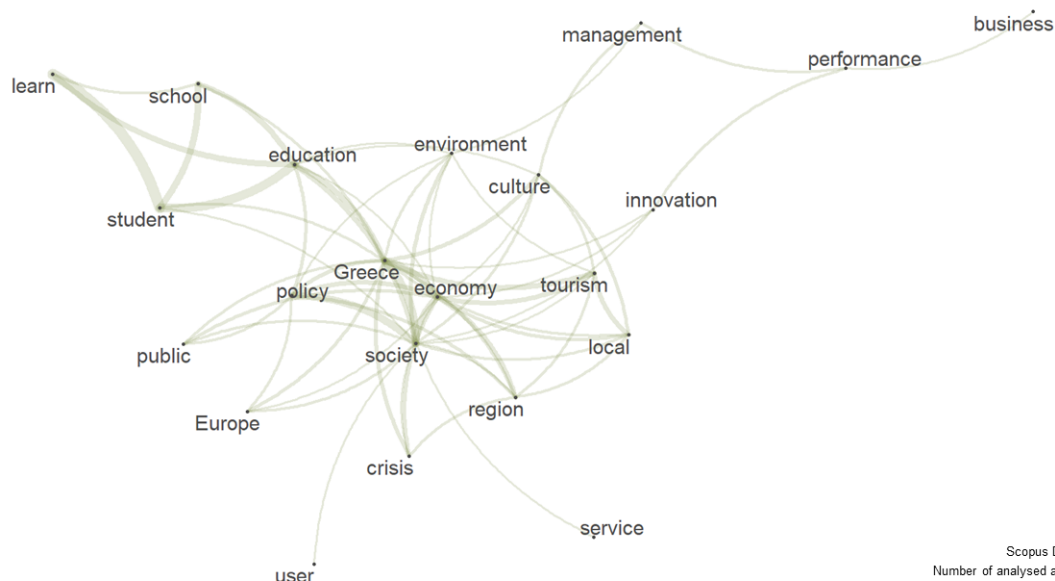


| RUC | | | | | | | |
|------|---------------|------------|-------|------|---------------|----------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | service | innovation | 1,214 | 16 | organisation | society | 598 |
| 2 | public | innovation | 1,186 | 17 | policy | public | 591 |
| 3 | economy | society | 1,121 | 18 | life | society | 583 |
| 4 | society | politics | 1,117 | 19 | culture | society | 572 |
| 5 | business | ethic | 1,046 | 20 | society | Europe | 570 |
| 6 | policy | society | 926 | 21 | public | service | 556 |
| 7 | public | society | 857 | 22 | international | society | 550 |
| 8 | Denmark | society | 850 | 23 | ethic | society | 547 |
| 9 | governance | public | 847 | 24 | policy | Europe | 546 |
| 10 | media | society | 712 | 25 | economy | politics | 545 |
| 11 | innovation | society | 698 | 26 | politics | Europe | 540 |
| 12 | governance | network | 684 | 27 | governance | politics | 540 |
| 13 | business | society | 676 | 28 | policy | Denmark | 513 |
| 14 | policy | politics | 611 | 29 | governance | society | 511 |
| 15 | public | politics | 606 | 30 | service | society | 477 |

Scopus Data | 2010-2022
Number of analysed abstracts = 2,191

Social Science & Humanities

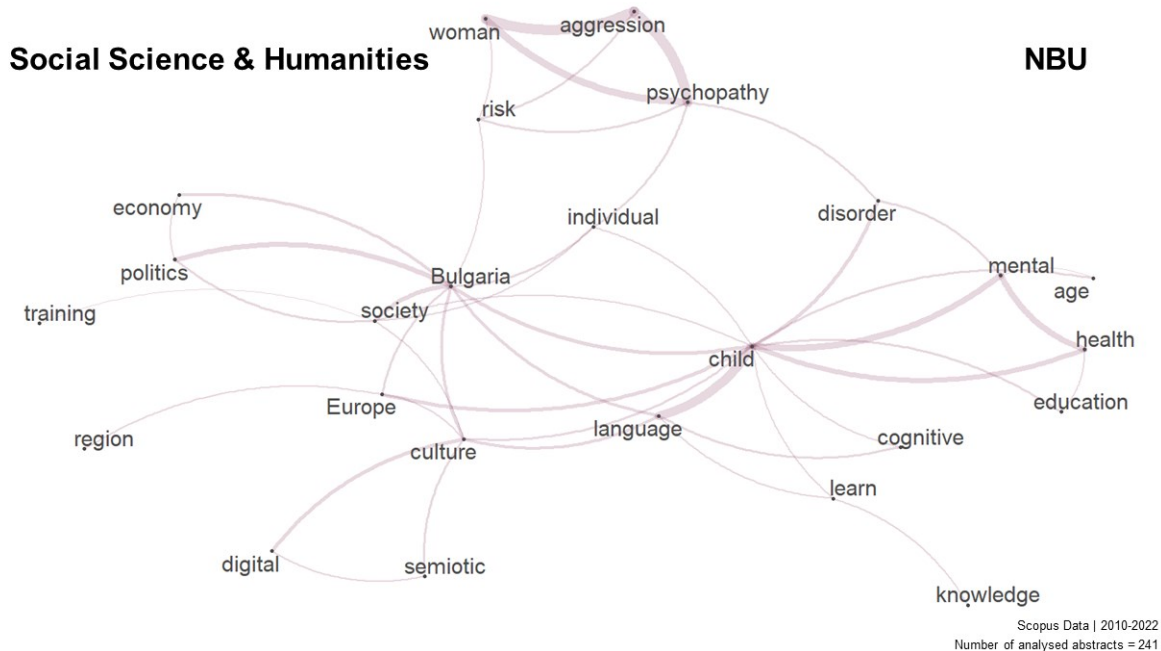
UAegean



Scopus Data | 2010-2022
Number of analysed abstracts = 1,434

| UAegean | | | | | | | |
|---------|---------------|-----------|-------|------|---------------|-------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | learn | student | 1,092 | 16 | tourism | economy | 468 |
| 2 | education | student | 872 | 17 | crisis | Greece | 456 |
| 3 | Greece | society | 864 | 18 | crisis | economy | 451 |
| 4 | policy | society | 765 | 19 | society | environment | 412 |
| 5 | Greece | economy | 736 | 20 | culture | Greece | 404 |
| 6 | society | economy | 705 | 21 | policy | Greece | 402 |
| 7 | school | student | 690 | 22 | culture | local | 371 |
| 8 | education | learn | 659 | 23 | education | policy | 368 |
| 9 | education | Greece | 641 | 24 | policy | region | 366 |
| 10 | school | education | 561 | 25 | Greece | Europe | 365 |
| 11 | tourism | Greece | 534 | 26 | public | economy | 352 |
| 12 | policy | economy | 521 | 27 | Greece | region | 345 |
| 13 | local | tourism | 517 | 28 | local | economy | 341 |
| 14 | economy | region | 510 | 29 | public | society | 325 |
| 15 | education | society | 494 | 30 | policy | Europe | 322 |

Scopus Data | 2010-2022
Number of analysed abstracts = 1,434



| NBU | | | | | | | |
|------|---------------|-------------|-------|------|---------------|------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | aggression | psychopathy | 195 | 16 | language | Bulgaria | 59 |
| 2 | aggression | woman | 194 | 17 | society | politics | 51 |
| 3 | child | language | 172 | 18 | semiotic | culture | 50 |
| 4 | psychopathy | woman | 149 | 19 | psychopathy | risk | 49 |
| 5 | mental | child | 124 | 20 | Europe | Bulgaria | 47 |
| 6 | health | mental | 119 | 21 | language | cognitive | 47 |
| 7 | politics | Bulgaria | 106 | 22 | age | child | 46 |
| 8 | society | Bulgaria | 86 | 23 | education | child | 45 |
| 9 | digital | culture | 78 | 24 | psychopathy | individual | 45 |
| 10 | child | Europe | 78 | 25 | aggression | risk | 45 |
| 11 | child | Bulgaria | 75 | 26 | child | culture | 45 |
| 12 | disorder | child | 72 | 27 | psychopathy | disorder | 44 |
| 13 | economy | Bulgaria | 67 | 28 | individual | Bulgaria | 43 |
| 14 | language | culture | 62 | 29 | disorder | mental | 43 |
| 15 | culture | Bulgaria | 61 | 30 | Europe | culture | 40 |

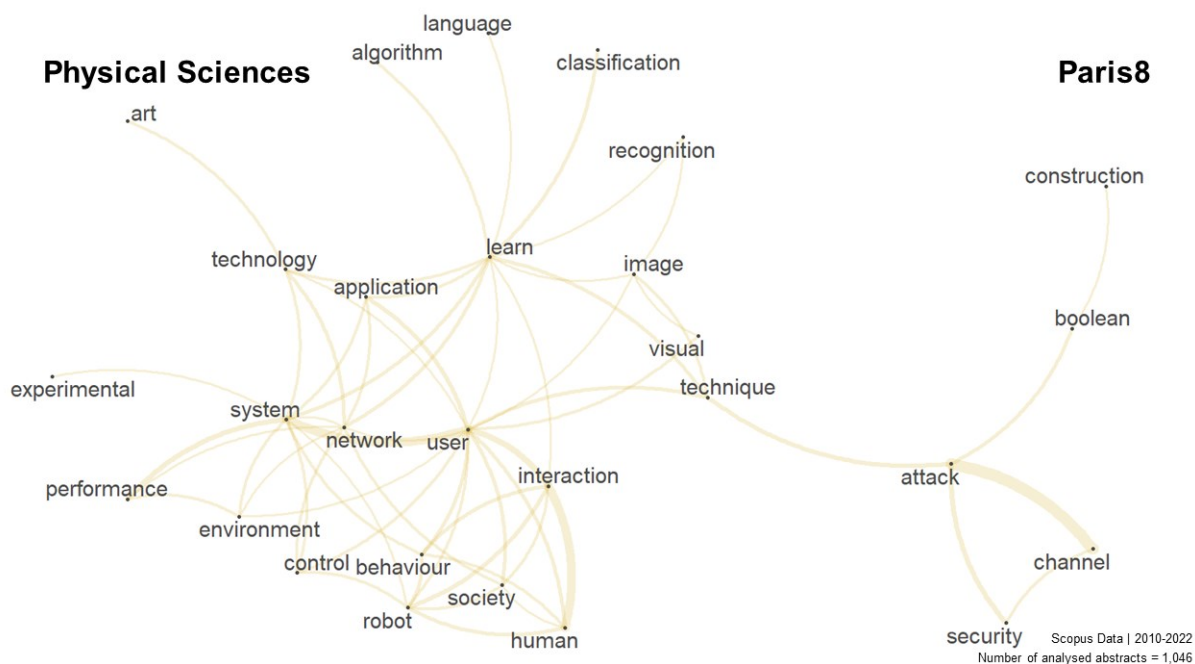
Scopus Data | 2010-2022
Number of analysed abstracts = 241

Summary – Social Sciences & Humanities

All five universities demonstrate, not surprisingly, a strong interest in the relationship between society and various other factors. The co-occurrence patterns reveal a particular emphasis on the intersection of society and politics, evident through the terms “society” and “politics” appearing for UKON, Paris8, RUC, and NBU. Notably, for UAegean, the term “society” is frequently associated with “economy”, a pairing also observed for RUC and Paris8.

Another common research theme is “education”, which occurs for all five universities in the network analysis in different contexts. Related terms are “student”, “child”, “policy”, “society”, “teacher”, and “school”. Furthermore, the emphasis on language is noteworthy. UKON, Paris8 and NBU include relations between “language” and “child”. For RUC and UAegean, the terms “economy” and “tourism” are more prevalent than for the other universities.

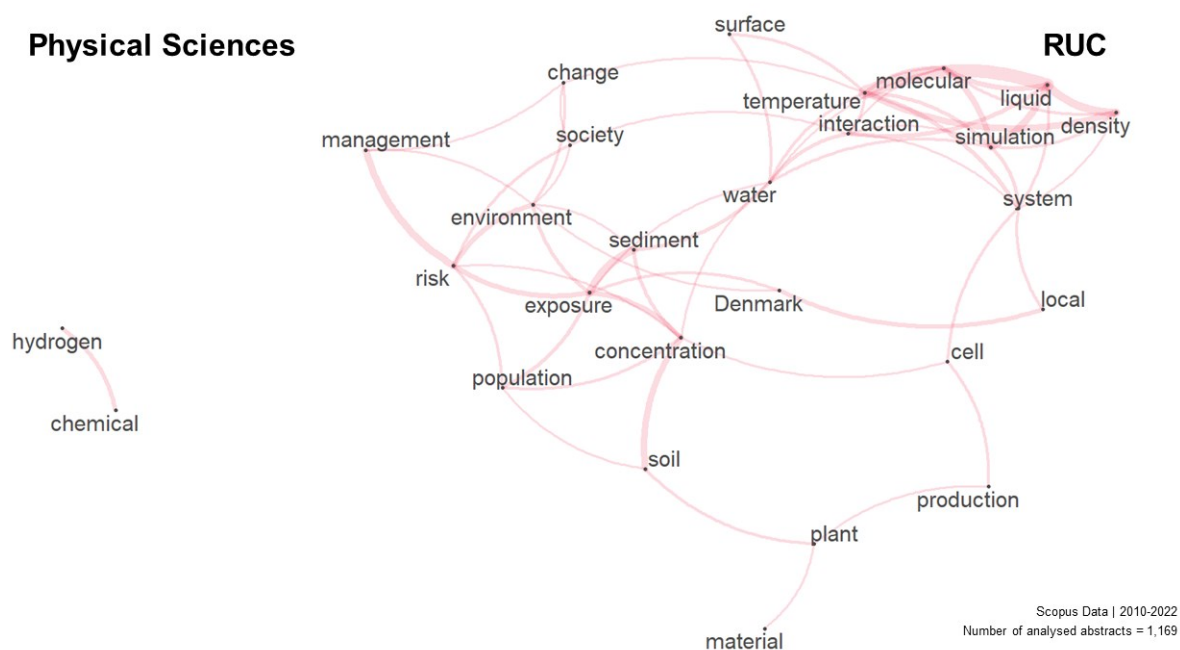
The inclusion of the national context, as indicated by respective country terms, is notable within the most frequent co-occurrences for all five universities, most visibly in the analysed texts from UAegean (with Greece occurring nine times in the top 30 co-occurrences, see table) and NBU (with Bulgaria occurring eight times). Furthermore, the frequent pairing of the respective country terms with “Europe” suggests that the national setting is often explored in relation to the broader European context.



| Paris8 | | | | | | | |
|--------|----------------|-------------|-------|------|---------------|------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | attack | channel | 283 | 16 | user | technique | 95 |
| 2 | interaction | human | 215 | 17 | technology | network | 94 |
| 3 | user | system | 212 | 18 | user | human | 88 |
| 4 | user | interaction | 137 | 19 | learn | network | 86 |
| 5 | security | attack | 124 | 20 | human | robot | 85 |
| 6 | performance | system | 120 | 21 | behaviour | robot | 85 |
| 7 | attack | technique | 111 | 22 | society | network | 84 |
| 8 | interaction | robot | 108 | 23 | user | control | 83 |
| 9 | application | user | 104 | 24 | interaction | society | 82 |
| 10 | boolean | attack | 101 | 25 | learn | technology | 80 |
| 11 | learn | system | 100 | 26 | control | network | 79 |
| 12 | behaviour | interaction | 99 | 27 | behaviour | system | 79 |
| 13 | user | behaviour | 99 | 28 | algorithm | learn | 76 |
| 14 | society | user | 99 | 29 | user | robot | 74 |
| 15 | classification | learn | 97 | 30 | security | channel | 74 |

Scopus Data | 2010-2022
Number of analysed abstracts = 1,046

Physical Sciences

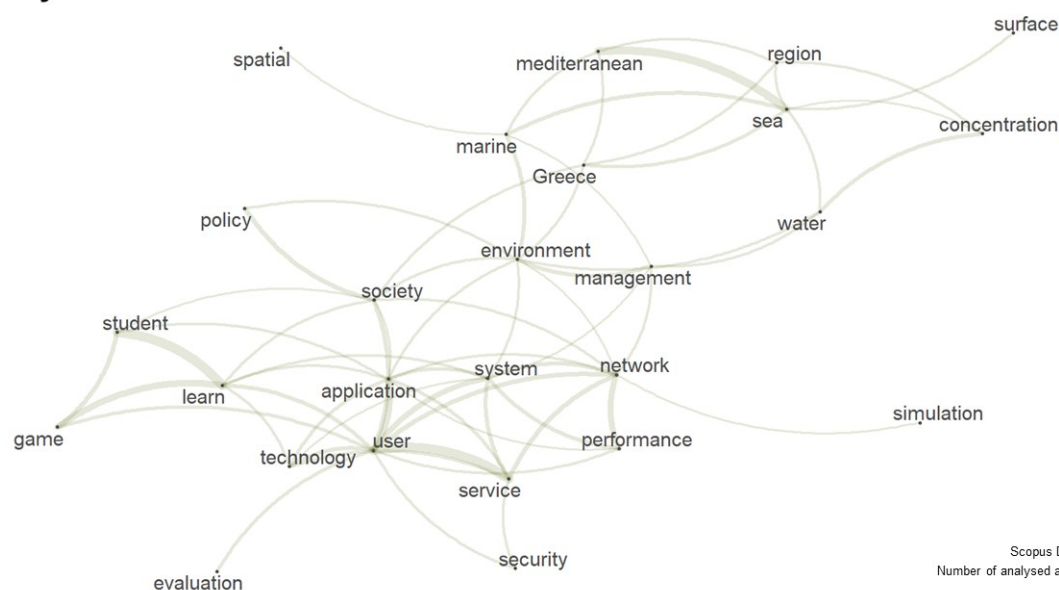


| RUC | | | | | | | |
|------|---------------|---------------|-------|------|---------------|-------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | temperature | liquid | 384 | 16 | water | interaction | 124 |
| 2 | exposure | sediment | 241 | 17 | concentration | sediment | 123 |
| 3 | density | liquid | 231 | 18 | simulation | system | 119 |
| 4 | liquid | simulation | 222 | 19 | exposure | population | 117 |
| 5 | risk | management | 214 | 20 | temperature | simulation | 113 |
| 6 | soil | concentration | 201 | 21 | water | sediment | 110 |
| 7 | density | temperature | 200 | 22 | exposure | environment | 110 |
| 8 | molecular | simulation | 177 | 23 | temperature | molecular | 110 |
| 9 | liquid | molecular | 166 | 24 | cell | system | 100 |
| 10 | exposure | concentration | 161 | 25 | density | simulation | 99 |
| 11 | risk | environment | 155 | 26 | local | system | 98 |
| 12 | temperature | system | 145 | 27 | surface | water | 98 |
| 13 | local | Denmark | 139 | 28 | change | environment | 97 |
| 14 | hydrogen | chemical | 139 | 29 | liquid | system | 96 |
| 15 | liquid | interaction | 136 | 30 | risk | society | 95 |

Scopus Data | 2010-2022
Number of analysed abstracts = 1,169

Physical Sciences

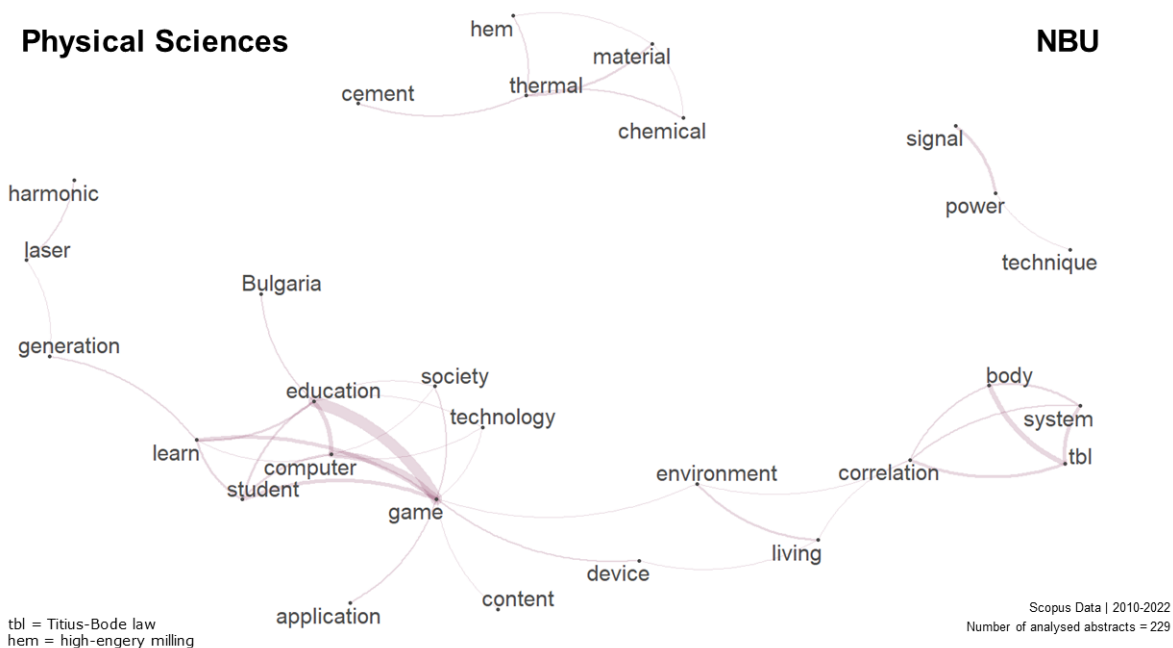
UAegean



Scopus Data | 2010-2022
Number of analysed abstracts = 3,611

| UAegean | | | | | | | |
|---------|---------------|-------------|-------|------|---------------|---------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | user | service | 1,041 | 16 | service | system | 475 |
| 2 | student | learn | 1,016 | 17 | marine | sea | 462 |
| 3 | mediterranean | sea | 866 | 18 | system | network | 451 |
| 4 | game | learn | 761 | 19 | management | environment | 436 |
| 5 | application | user | 747 | 20 | technology | user | 435 |
| 6 | performance | network | 704 | 21 | water | concentration | 433 |
| 7 | user | system | 600 | 22 | game | user | 431 |
| 8 | user | network | 569 | 23 | evaluation | user | 414 |
| 9 | service | network | 555 | 24 | application | system | 402 |
| 10 | society | user | 536 | 25 | application | service | 381 |
| 11 | society | policy | 534 | 26 | technology | service | 368 |
| 12 | student | game | 528 | 27 | technology | application | 365 |
| 13 | performance | system | 497 | 28 | sea | Greece | 363 |
| 14 | learn | user | 492 | 29 | policy | environment | 354 |
| 15 | marine | environment | 485 | 30 | society | network | 352 |

Scopus Data | 2010-2022
Number of analysed abstracts = 3,611



| NBU | | | | | | | |
|------|---------------|-------------|-------|------|---------------|-------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | education | game | 302 | 16 | material | thermal | 58 |
| 2 | computer | game | 201 | 17 | student | computer | 57 |
| 3 | tbl | body | 140 | 18 | body | system | 56 |
| 4 | education | computer | 128 | 19 | body | mass | 56 |
| 5 | learn | game | 104 | 20 | thermal | cement | 50 |
| 6 | student | game | 103 | 21 | society | game | 49 |
| 7 | tbl | system | 100 | 22 | harmonic | laser | 47 |
| 8 | signal | power | 82 | 23 | correlation | body | 46 |
| 9 | tbl | correlation | 75 | 24 | thermal | chemical | 44 |
| 10 | student | education | 67 | 25 | education | Bulgaria | 43 |
| 11 | education | learn | 64 | 26 | game | application | 41 |
| 12 | living | environment | 63 | 27 | mass | system | 39 |
| 13 | student | learn | 61 | 28 | correlation | system | 38 |
| 14 | material | thermal | 58 | 29 | material | chemical | 36 |
| 15 | student | computer | 57 | 30 | technology | game | 35 |

tbl = Titius-Bode law

Scopus Data | 2010-2022
Number of analysed abstracts = 229

Summary – Physical Sciences

Before reflecting on the results, it is important to emphasise that within the Scopus categorisation the subject area of ‘Physical Sciences’ includes a broad range of subjects, including Computer Science and Environmental Science. As we have shown in the report ‘Reform University and Education Today’, the ERUA universities have in their educational profile a shared interest in Computer Science. Therefore, it is not surprising to observe this field in their research portfolio as well.

After initial exploration of the data and feedback from researchers in the field, we decided to remove terms like “energy”, “mass”, and “code”, which showed high frequency in the analysis, but do not support a deeper understanding of the research topic in question in the subject area of ‘Physical Sciences’.

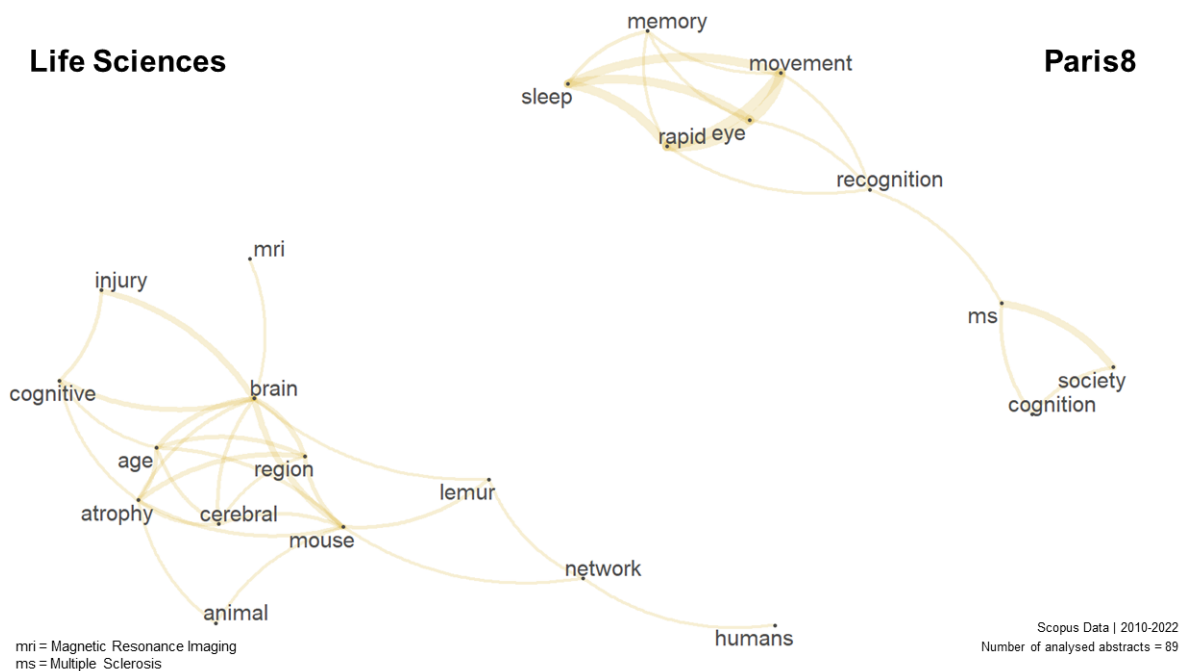
The term “user” is present in the co-occurrence network visualisation and table of UKON, Paris8, and UAegean. It is associated with terms like “interaction”, “network”, “application”, and “learn”. This implies a focus on Computer Science and on human-computer interaction, user interfaces, and educational technologies. The terms “learn” in the visualisations and tables of Paris8, UAegean, and NBU suggest a shared research interest in Learning and Technology. It is associated with terms like “user”, “game”, and “student”.

There are also unique features for each university: The term “quantum” appears prominently in the network visualisation and the co-occurrence table of UKON. It is associated with terms like “electron”, “magnet”, and “interaction”. This suggests a focus on quantum phenomena, such as quantum mechanics and quantum interactions. The term “environment” appears in the network visualisation and the co-occurrence table of UAegean, specifically in relation to “marine” and “species”, “Mediterranean”, and “Greece”. This indicates a prominent focus on the marine environment and ecosystems. The term “temperature” is more prominently represented in the table of RUC, related to terms like “system”, “liquid”, and “temperature”.

Moreover, we received feedback from researchers in the field of physical sciences indicating that, in terms of potential collaborations, the focus is often on the technique and methods employed rather than the specific research topics. This highlights the significance of further research to gain a better understanding of this aspect.

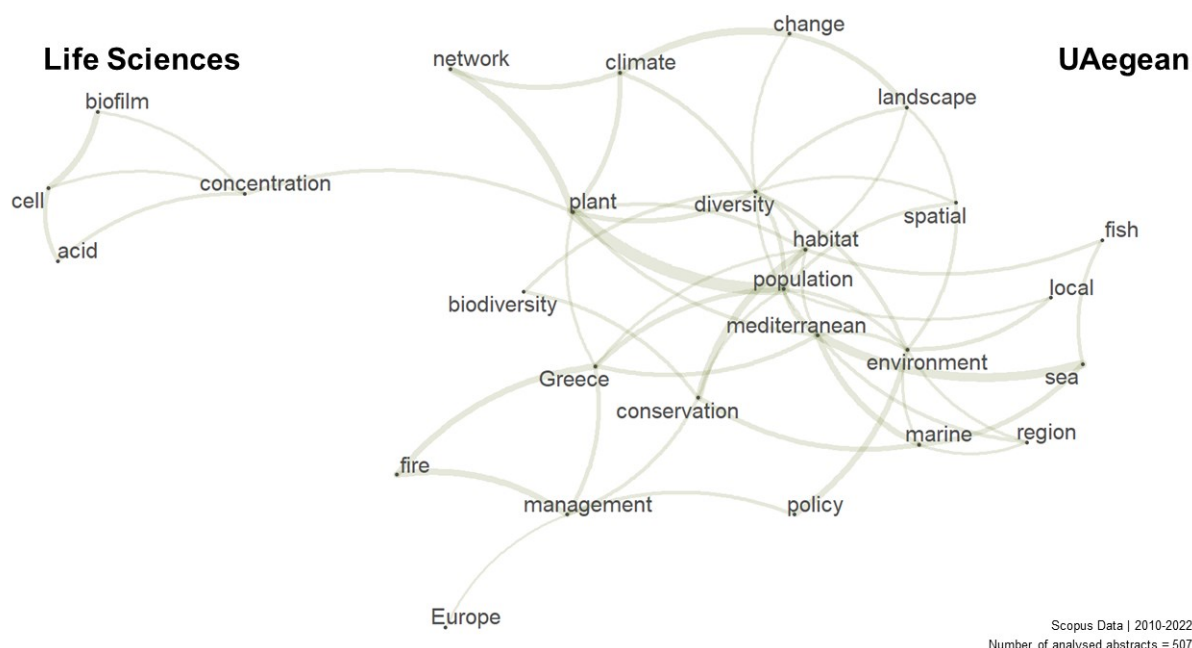
Life Sciences

Paris8



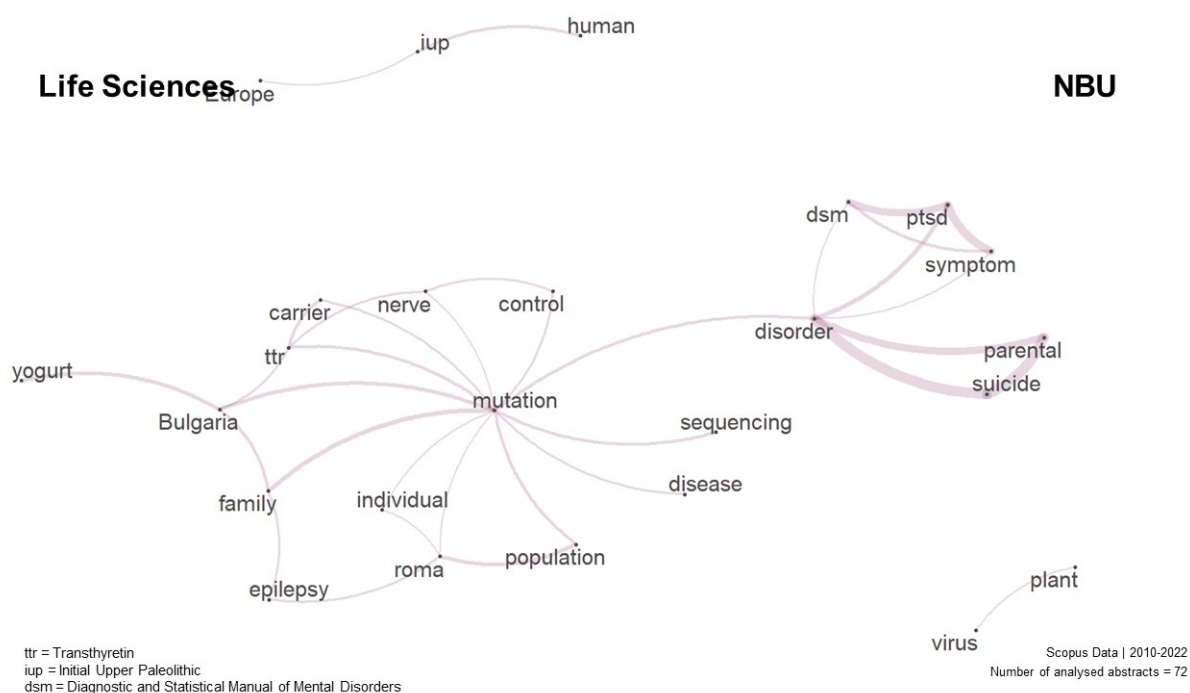
| Paris8 | | | | | | | |
|--------|---------------|-----------|-------|------|---------------|-----------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | movement | eye | 173 | 16 | age | region | 73 |
| 2 | eye | rapid | 169 | 17 | mouse | atrophy | 72 |
| 3 | movement | rapid | 169 | 18 | cognition | ms | 72 |
| 4 | sleep | rapid | 156 | 19 | injury | cognitive | 71 |
| 5 | sleep | eye | 156 | 20 | age | mouse | 66 |
| 6 | sleep | movement | 156 | 21 | cerebral | atrophy | 65 |
| 7 | ms | society | 125 | 22 | cerebral | mouse | 65 |
| 8 | mouse | brain | 116 | 23 | cognition | society | 65 |
| 9 | injury | brain | 97 | 24 | sleep | memory | 64 |
| 10 | brain | region | 90 | 25 | atrophy | brain | 64 |
| 11 | atrophy | region | 88 | 26 | memory | sleep | 64 |
| 12 | brain | cognitive | 87 | 27 | cerebral | age | 63 |
| 13 | age | brain | 85 | 28 | cerebral | brain | 62 |
| 14 | age | atrophy | 83 | 29 | lemur | mouse | 61 |
| 15 | mouse | region | 79 | 30 | cerebral | region | 60 |

Scopus Data | 2010-2022
Number of analysed abstracts = 89



| UAegean | | | | | | | |
|---------|---------------|---------------|-------|------|---------------|-------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | population | plant | 378 | 16 | climate | plant | 156 |
| 2 | sea | mediterranean | 266 | 17 | diversity | plant | 155 |
| 3 | conservation | habitat | 232 | 18 | diversity | population | 153 |
| 4 | climate | change | 230 | 19 | mediterranean | Greece | 153 |
| 5 | network | plant | 223 | 20 | Greece | management | 148 |
| 6 | fire | management | 217 | 21 | climate | diversity | 148 |
| 7 | biofilm | cell | 206 | 22 | acid | cell | 148 |
| 8 | environment | policy | 197 | 23 | diversity | environment | 146 |
| 9 | marine | mediterranean | 186 | 24 | local | environment | 141 |
| 10 | climate | network | 174 | 25 | diversity | habitat | 131 |
| 11 | population | habitat | 166 | 26 | plant | habitat | 130 |
| 12 | Greece | population | 165 | 27 | population | spatial | 128 |
| 13 | marine | conservation | 165 | 28 | biodiversity | diversity | 125 |
| 14 | sea | marine | 161 | 29 | spatial | environment | 123 |
| 15 | change | landscape | 158 | 30 | sea | fish | 123 |

Scopus Data | 2010-2022
Number of analysed abstracts = 507



| NBU | | | | | | | |
|------|---------------|----------|-------|------|---------------|----------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | suicide | disorder | 168 | 16 | population | mutation | 47 |
| 2 | parental | suicide | 165 | 17 | sequencing | mutation | 47 |
| 3 | symptom | ptsd | 134 | 18 | disease | mutation | 46 |
| 4 | parental | disorder | 122 | 19 | roma | epilepsy | 45 |
| 5 | ptsd | dsm | 121 | 20 | carrier | mutation | 43 |
| 6 | ptsd | disorder | 74 | 21 | nerve | control | 42 |
| 7 | family | mutation | 74 | 22 | ttr | nerve | 42 |
| 8 | Bulgaria | mutation | 69 | 23 | family | epilepsy | 40 |
| 9 | population | roma | 69 | 24 | control | mutation | 38 |
| 10 | symptom | dsm | 57 | 25 | ttr | Bulgaria | 36 |
| 11 | mutation | disorder | 55 | 26 | symptom | disorder | 35 |
| 12 | ttr | mutation | 53 | 27 | individual | mutation | 35 |
| 13 | iup | human | 52 | 28 | nerve | mutation | 34 |
| 14 | ttr | carrier | 52 | 29 | iup | Europe | 34 |
| 15 | Bulgaria | family | 49 | 30 | virus | plant | 33 |

ttr = transthyretin
iup = Initial Upper Paleolithic
dsm = Diagnostic and Statistical Manual of Mental Disorders

Scopus Data | 2010-2022
Number of analysed abstracts = 72

Summary – Life Sciences

After initial exploration of the data and feedback from researchers in the field, we decided to remove terms like “species”, “gene”, and “patient” which showed high frequency in the analysis but do not support a deeper understanding of the research topic in question in the subject area of ‘Life Sciences’.

Due to the relatively small number of analysed abstracts for Paris8 and NBU in this field, the network visualisations show a more fragmented picture (i.e., this can be observed through fewer connections between the nodes in the graph; and the nodes appear to be located less centrally), this has to be considered when interpreting the results.

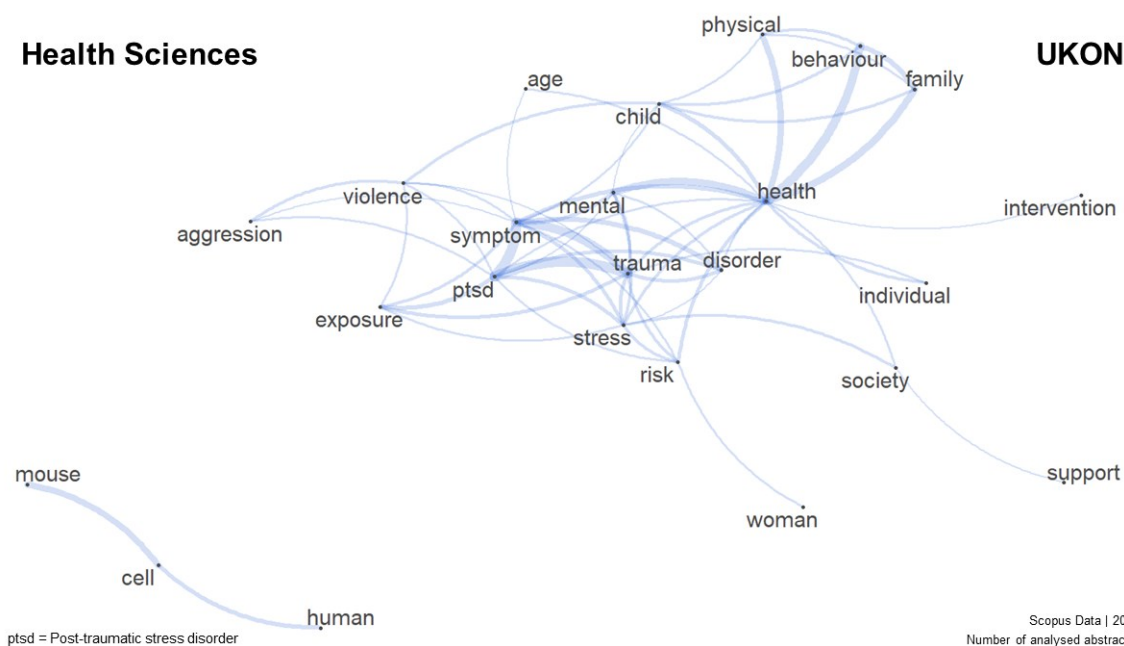
In particular, at UAegean, there seems to be a focus on Environmental Sciences, indicated through terms like “biodiversity”, “climate”, “habitat”, “environment”, and “conservation”.

Our findings suggest that Paris8 and NBU share a common interest in Medical Sciences, albeit with a different focus. At Paris8, there seems to be a stronger emphasis on Neurosciences, as evidenced by terms such as “injury”, “brain”, “cognitive”, and “ms” (multiple sclerosis). Additionally, frequent terms like “sleep” and “brain” strengthen the particular focus on Neuroscience research. At NBU, there seems to be an emphasis on behavioural neuroscience, indicated by the term “disorder” and genetics with the term “mutation” as a more central node.

RUC shows a unique focus (among the five partner universities with regard to the relative prominence of the topic) on food science; this is evident from terms such as “food”, “production”, and “egg”.

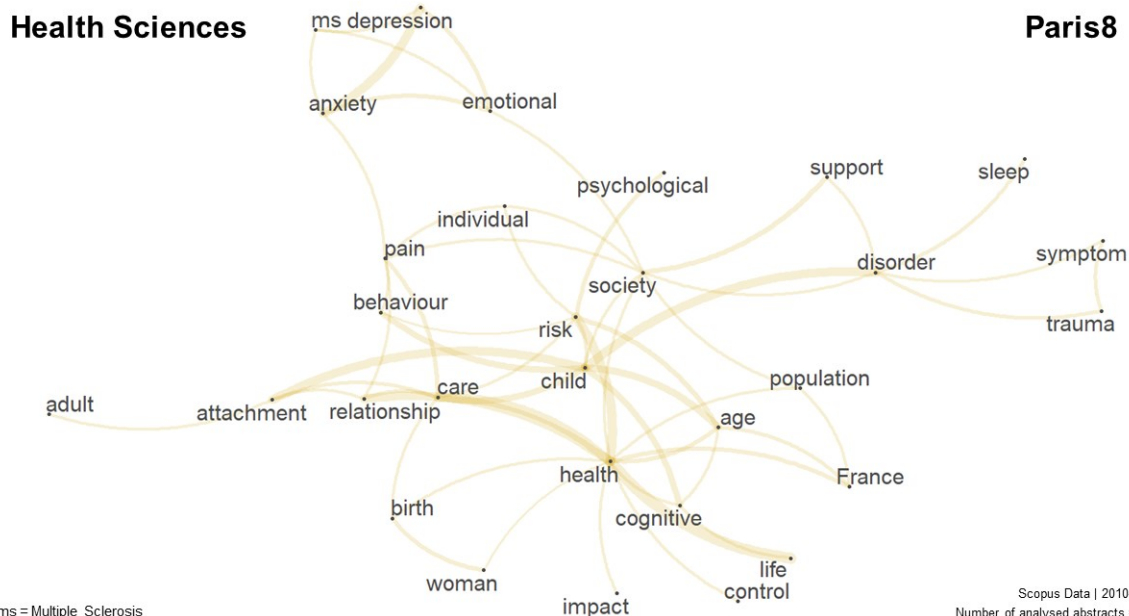
Health Sciences

UKON



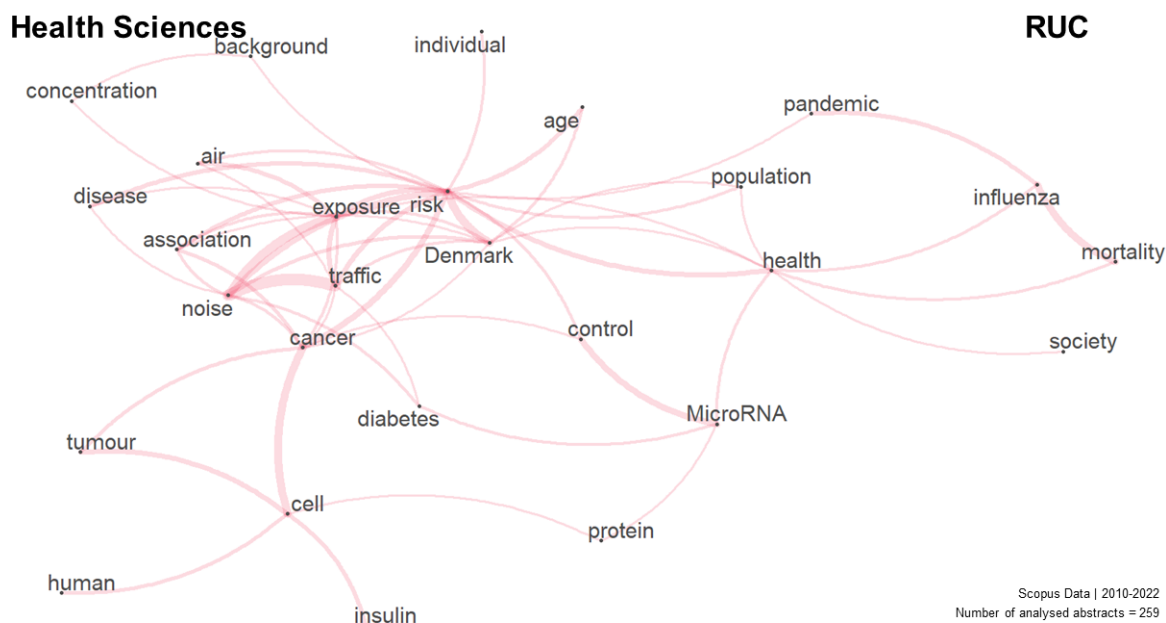
| UKON | | | | | | | |
|------|---------------|----------|-------|------|---------------|-----------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | ptsd | trauma | 1220 | 16 | ptsd | disorder | 490 |
| 2 | symptom | ptsd | 1213 | 17 | symptom | stress | 465 |
| 3 | behaviour | health | 1040 | 18 | mental | symptom | 464 |
| 4 | mental | health | 883 | 19 | stress | trauma | 453 |
| 5 | family | health | 870 | 20 | disorder | trauma | 448 |
| 6 | physical | health | 807 | 21 | individual | health | 422 |
| 7 | mouse | cell | 775 | 22 | physical | behaviour | 418 |
| 8 | symptom | disorder | 605 | 23 | symptom | exposure | 407 |
| 9 | behaviour | family | 602 | 24 | violence | child | 401 |
| 10 | human | cell | 545 | 25 | stress | health | 379 |
| 11 | symptom | health | 539 | 26 | risk | stress | 376 |
| 12 | ptsd | exposure | 519 | 27 | aggression | violence | 369 |
| 13 | risk | health | 506 | 28 | risk | trauma | 354 |
| 14 | trauma | exposure | 505 | 29 | mental | trauma | 351 |
| 15 | ptsd | stress | 505 | 30 | family | child | 350 |

Scopus Data | 2010-2022
Number of analysed abstracts = 620



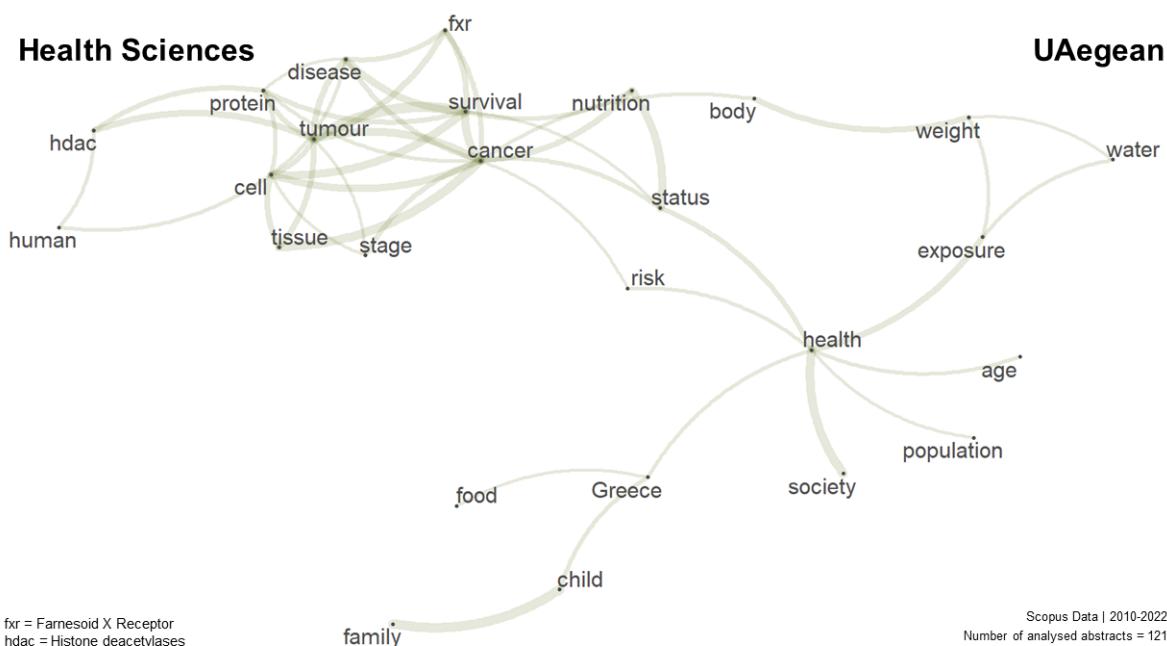
| Paris8 | | | | | | | |
|--------|---------------|-----------|-------|------|---------------|---------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | life | health | 145 | 16 | depression | emotional | 63 |
| 2 | care | health | 126 | 17 | woman | birth | 62 |
| 3 | risk | health | 125 | 18 | risk | psychological | 61 |
| 4 | depression | anxiety | 120 | 19 | anxiety | emotional | 60 |
| 5 | attachment | child | 116 | 20 | age | health | 59 |
| 6 | relationship | health | 114 | 21 | pain | care | 58 |
| 7 | child | disorder | 114 | 22 | risk | child | 56 |
| 8 | child | age | 99 | 23 | trauma | symptom | 53 |
| 9 | child | cognitive | 93 | 24 | sleep | disorder | 51 |
| 10 | child | care | 88 | 25 | relationship | care | 50 |
| 11 | child | behaviour | 87 | 26 | trauma | disorder | 49 |
| 12 | support | society | 67 | 27 | attachment | care | 49 |
| 13 | risk | age | 67 | 28 | age | France | 48 |
| 14 | age | risk | 67 | 29 | health | society | 47 |
| 15 | health | France | 65 | 30 | birth | health | 47 |

Scopus Data | 2010-2022
Number of analysed abstracts = 167



| RUC | | | | | | | |
|------|---------------|----------|-------|------|---------------|-------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | noise | traffic | 486 | 16 | air | exposure | 181 |
| 2 | noise | exposure | 354 | 17 | pandemic | influenza | 179 |
| 3 | Denmark | risk | 328 | 18 | cell | insulin | 176 |
| 4 | cell | cancer | 325 | 19 | cell | human | 163 |
| 5 | MicroRNA | control | 282 | 20 | noise | Denmark | 160 |
| 6 | noise | risk | 263 | 21 | association | cancer | 154 |
| 7 | risk | cancer | 248 | 22 | tumour | cancer | 149 |
| 8 | tumour | cell | 228 | 23 | exposure | cancer | 144 |
| 9 | exposure | risk | 225 | 24 | risk | control | 138 |
| 10 | traffic | risk | 219 | 25 | population | risk | 136 |
| 11 | traffic | exposure | 216 | 26 | noise | cancer | 134 |
| 12 | health | risk | 203 | 27 | noise | association | 134 |
| 13 | age | risk | 190 | 28 | exposure | Denmark | 132 |
| 14 | association | risk | 181 | 29 | mortality | health | 129 |
| 15 | disease | risk | 181 | 30 | MicroRNA | diabetes | 128 |

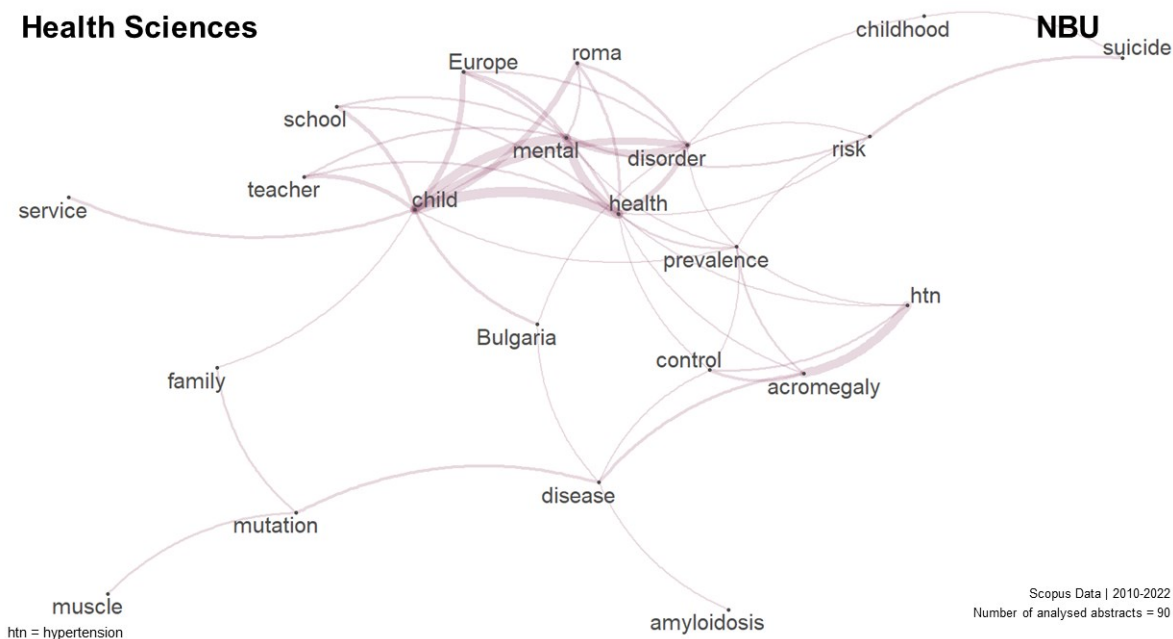
Scopus Data | 2010-2022
Number of analysed abstracts = 259



| UAegean | | | | | | | |
|---------|---------------|----------|-------|------|---------------|----------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | tumour | survival | 122 | 16 | fxr | survival | 72 |
| 2 | child | family | 118 | 17 | weight | body | 69 |
| 3 | cancer | tissue | 109 | 18 | tissue | cell | 69 |
| 4 | society | health | 105 | 19 | tumour | tissue | 69 |
| 5 | tumour | cancer | 100 | 20 | stage | cancer | 67 |
| 6 | survival | cell | 97 | 21 | hdac | protein | 66 |
| 7 | nutrition | status | 94 | 22 | fxr | cancer | 66 |
| 8 | cancer | survival | 94 | 23 | tumour | cell | 65 |
| 9 | cancer | cell | 91 | 24 | status | health | 64 |
| 10 | survival | disease | 88 | 25 | cancer | disease | 64 |
| 11 | tumour | disease | 82 | 26 | fxr | disease | 63 |
| 12 | hdac | tumour | 82 | 27 | survival | protein | 63 |
| 13 | fxr | tumour | 81 | 28 | tumour | protein | 60 |
| 14 | exposure | health | 77 | 29 | protein | cell | 55 |
| 15 | nutrition | cancer | 74 | 30 | nutrition | survival | 54 |

Hdac = Histon-Deacetylasen
fxr = Farnesoid X Receptor

Scopus Data | 2010-2022
Number of analysed abstracts = 121



| NBU | | | | | | | |
|------|---------------|------------|-------|------|---------------|------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | child | health | 427 | 16 | roma | health | 131 |
| 2 | child | mental | 405 | 17 | Bulgaria | child | 131 |
| 3 | mental | health | 378 | 18 | acromegaly | control | 129 |
| 4 | htn | acromegaly | 361 | 19 | mutation | disease | 128 |
| 5 | disorder | mental | 320 | 20 | child | service | 126 |
| 6 | child | disorder | 314 | 21 | disease | acromegaly | 126 |
| 7 | Europe | child | 246 | 22 | roma | mental | 115 |
| 8 | roma | child | 240 | 23 | risk | mental | 109 |
| 9 | disorder | health | 225 | 24 | school | health | 101 |
| 10 | school | child | 196 | 25 | acromegaly | prevalence | 100 |
| 11 | teacher | child | 194 | 26 | teacher | health | 95 |
| 12 | Europe | mental | 166 | 27 | htn | control | 95 |
| 13 | Europe | health | 141 | 28 | school | mental | 91 |
| 14 | risk | suicide | 136 | 29 | prevalence | health | 91 |
| 15 | roma | disorder | 132 | 30 | teacher | mental | 90 |

Scopus Data | 2010-2022
Number of analysed abstracts = 90

Summary – Health Sciences

As in the field of Life Sciences, we removed terms like “species”, “gene”, and “patient” for Health Sciences which showed high frequency in the analysis but do not support a deeper understanding of the research topics in question.

The analysis in the field of Health Sciences reveals a diverse range of research topics among the five partner universities.

UKON shows a focus on post-traumatic stress disorder (PTSD) and trauma-related research, indicated by terms like “ptsd”, “trauma”, “symptom”, “exposure”, and “stress”. It is worth noting that there may be a shared interest with NBU, as the term “ptsd” appeared in the Life Sciences category. Additionally, the tables for UKON and NBU reveal a common focus on the intersection between mental health through the co-occurrence of the word pairings of “mental” and “health.”

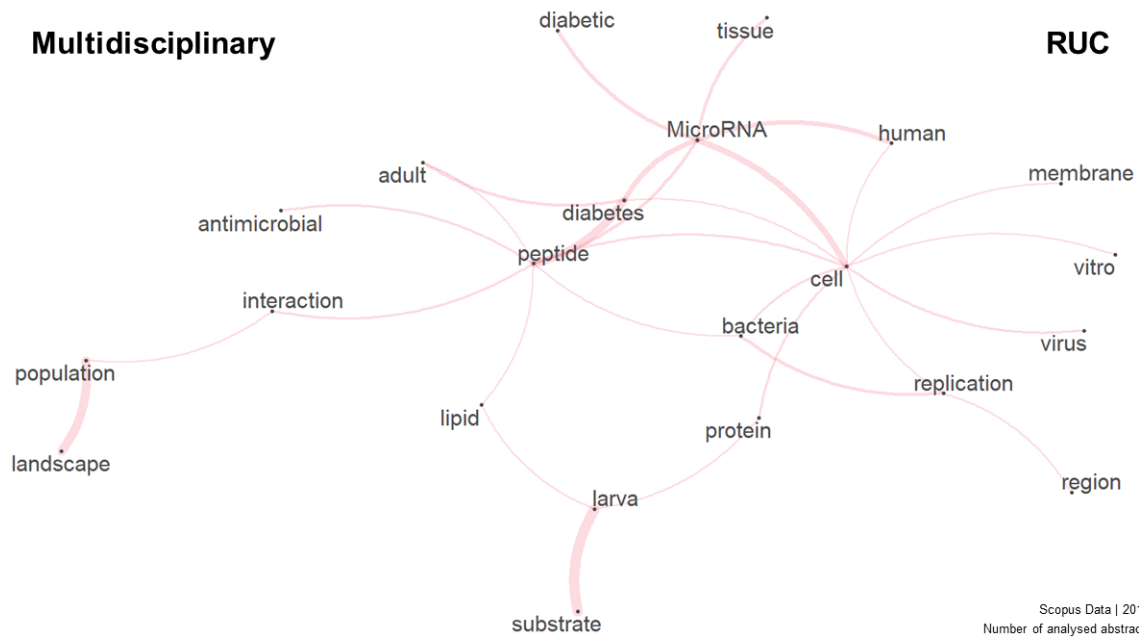
Paris8 shows a strong interest in psychological and cognitive aspects, including terms like “cognitive”, “depression”, “attachment”, and “anxiety”.

The findings suggest that RUC and UAegean share a common interest in cancer and tumor-related research, reflected in terms like “cancer”, “hdac” (Histon-Deacetylasen), “survival”, “risk”, and “tumour”. We received feedback that this result for UAegean seems surprising as their research primarily concerns pharmacology and pharmacy (for example, for fish) as well as public, environmental and occupational health. This serves as an example that the findings presented in this report display only a specific subset of the research carried out and should thus be supplemented with local knowledge.

RUC displays a more prominent focus (compared to the other four universities) on environmental health and risk assessment, indicated by the frequency of terms like “noise”, “traffic”, “exposure”, and “risk”.

Multidisciplinary

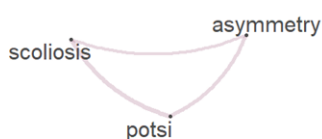
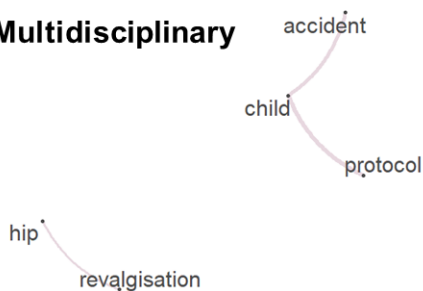
RUC



| RUC | | | | | | | |
|------|---------------|-------------|-------|------|---------------|------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | substrate | larva | 198 | 16 | protein | cell | 45 |
| 2 | population | landscape | 174 | 17 | antimicrobial | peptide | 42 |
| 3 | diabetes | peptide | 150 | 18 | cell | vitro | 40 |
| 4 | MicroRNA | cell | 118 | 19 | adult | peptide | 40 |
| 5 | diabetes | MicroRNA | 102 | 20 | peptide | lipid | 39 |
| 6 | MicroRNA | human | 82 | 21 | cell | human | 38 |
| 7 | MicroRNA | diabetic | 70 | 22 | bacteria | peptide | 37 |
| 8 | MicroRNA | tissue | 67 | 23 | cell | membrane | 36 |
| 9 | MicroRNA | peptide | 60 | 24 | larva | lipid | 36 |
| 10 | replication | bacteria | 60 | 25 | protein | larva | 36 |
| 11 | diabetes | adult | 60 | 26 | replication | cell | 35 |
| 12 | peptide | cell | 52 | 27 | interaction | population | 34 |
| 13 | bacteria | cell | 52 | 28 | diabetes | cell | 33 |
| 14 | peptide | interaction | 51 | 29 | replication | region | 32 |
| 15 | virus | cell | 50 | 30 | cell | vivo | 31 |

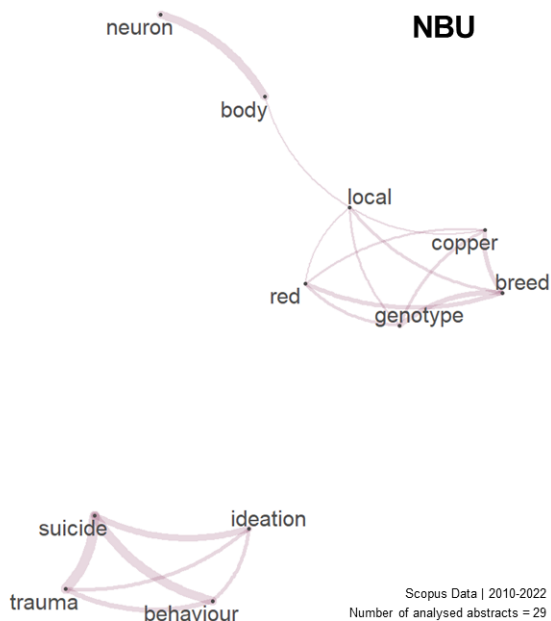
Scopus Data | 2010-2022
Number of analysed abstracts = 83

Multidisciplinary



potsi = Posterior Trunk Symmetry Index

NBU



Scopus Data | 2010-2022
Number of analysed abstracts = 29

| NBU | | | | | | | |
|------|---------------|-----------|-------|------|---------------|------------|-------|
| Rank | Co-occurrence | | Count | Rank | Co-occurrence | | Count |
| 1 | suicide | trauma | 135 | 16 | breed | local | 40 |
| 2 | behaviour | suicide | 120 | 17 | revalgisation | hip | 30 |
| 3 | neuron | body | 108 | 18 | genotype | local | 28 |
| 4 | ideation | suicide | 90 | 19 | body | local | 24 |
| 5 | behaviour | trauma | 72 | 20 | copper | local | 24 |
| 6 | genotype | breed | 70 | 21 | population | individual | 23 |
| 7 | protocol | child | 60 | 22 | child | age | 22 |
| 8 | breed | copper | 60 | 23 | individual | Europe | 22 |
| 9 | potsi | scoliosis | 56 | 24 | individual | child | 20 |
| 10 | ideation | trauma | 54 | 25 | hip | age | 18 |
| 11 | accident | child | 54 | 26 | Europe | child | 18 |
| 12 | ideation | behaviour | 48 | 27 | local | neuron | 18 |
| 13 | asymmetry | potsi | 48 | 28 | potsi | child | 16 |
| 14 | asymmetry | scoliosis | 42 | 29 | individual | family | 16 |
| 15 | genotype | copper | 42 | 30 | age | suicide | 15 |

Scopus Data | 2010-2022
Number of analysed abstracts = 29

Summary – Multidisciplinary

Due to the relatively small number of analysed abstracts for some of the universities, the network visualisations show a more fragmented picture (i.e., this can be observed through fewer connections between the nodes in the graph; and the nodes appear to be located less centrally), meaning that the research in this category covers different topics within the universities. Consequently, it is not unexpected to observe limited overlap between the five institutions in this specific field of study. Overall, the prevailing terms in this subject area indicate a focus on Health Sciences and Life Sciences.

UKON's prominent co-occurrences include terms such as “stress”, “behaviour”, and “society”.

In the case of Paris8, the notable co-occurrences involve “child and dysgraphia” with association to “education”, “school”, “geometry”, and “policy”.

RUC's significant co-occurrence encompasses “substrate and larva”, but “diabetes”, and “peptide” appear more centrally within the research field.

UAegean demonstrates a strong emphasis on conservation efforts in the Mediterranean region, with notable co-occurrences such as “Mediterranean” and “conservation”. Additionally, terms are “habitat”, “sea”, “planning”, and “species”.

Lastly, NBU's prominent co-occurrences include “suicide” with associations to “trauma” and “behaviour”.

3. Conclusion: Reform Universities and Research today

This report provides a snapshot of the research profiles of the universities in the ERUA alliance based on analysed data from Scopus with all its inherent limitations. Local knowledge and more extensive investigations would be beneficial to fully grasp the dynamics of research priorities and collaboration within the alliance.

In conclusion, the analysis of research profiles among the five universities within the alliance provides insights into their respective areas of focus. While there are common themes, such as the intersection of society and various factors in the Social Sciences and Humanities as well as the focus on Computer Science in the Physical Sciences, there are also unique areas of specialization and emphasis among the universities. These differences highlight the diverse expertise and research strengths within the alliance.

In the beginning, we asked the question if researchers within the alliance contribute to and engage in discussions within the same research areas. Providing a clear-cut answer to this question based on our analysis is not possible. However, it is our hope that this analysis sparks further discussion on scholarly communication and scientific collaboration among ERUA, but also among university alliances in general. The dynamics of research priorities and focus within the alliance warrant continued exploration to gain a more comprehensive understanding of their role in the academic landscape.

The present study focused on the five ERUA partner universities. We encourage future research to include similar reform-minded universities to broaden the scope of the sample size. Furthermore, a comparison with more 'traditional' universities could expand the insights on how Reform Universities are positioned within the higher education landscape. Besides exploring the positioning of Reform Universities in regard to research themes in a broader comparison, future research could explore questions such as whether Reform Universities approach research differently or have different ways of engaging students in their research activities.

4. References

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Appendix

Bibliometrics & Co-Word Analysis

Pritchard (1969, p. 348) was one of the first to define the term bibliometrics as “application of statistical and mathematical methods set out to define the processes of written communication and the nature and development of scientific disciplines by using recounting techniques and analysis of such communication”. Common analysis methods in bibliometrics include publication-related analysis, citation-based analysis, co-word analysis, and co-authorship analysis (Donthu et al., 2021, p. 288). This study employed co-word analysis to identify the prominence of research themes at the five ERUA universities. Co-word analysis is a method used to investigate the content of publications itself, with relevant words derived from the keywords, titles, abstracts or full texts. In our investigation, we specifically focus on analyzing the abstracts. These extracted words are then analysed based on their frequency of co-occurrence. Co-word analysis operates on the underlying assumption that words that frequently appear together share a thematic relationship (Donthu et al., 2021, p. 289).

Scopus Data

The analyses in this report are based on Scopus data, a comprehensive bibliographic database that covers over 87 million publications, as reported in its 2023 coverage guide. To retrieve the relevant data for the five ERUA universities, the Scopus API was utilized in conjunction with R software (specifically, RStudio 2023.03.1) with institutional access provided by Roskilde University.

Data preparation

Before conducting the co-word analysis, the following preprocessing steps were implemented to ensure the consistency of the corpus data:

- (1) Elimination of stop words and irrelevant terms: Stop words (e.g., “and”, “the”, “one”, “after”, etc.) were eliminated from the analysis process because they were considered irrelevant to identifying the research themes. Terms that do not contribute to the understanding of the research itself (e.g., “paper”, “finding”, “conclusion”, etc.) were also removed. This iterative process aimed to refine the dataset by eliminating terms that did not hold substantial semantic value.
- (2) Standardization of terms: To account for variations in word usage, it was necessary to standardise terms:

- a. Plural forms of words were transformed into their singular form
- b. British and American spelling is standardised (e.g., behavior and behaviour are standardised to behaviour)
- c. Adjectives that described concepts were transformed into their corresponding noun form in order to facilitate the aggregation of related terms. e.g., French → France, ethical → ethic
- d. Words in their -ing forms were converted to their root forms. For instance, learning → learn, gaming → game; this process helped to group related terms together

Co-occurrence matrix and network

Once the data preparation steps were completed, a co-occurrence matrix was constructed. The matrix records the co-occurrences of a pair of word terms in a context window. In this study, the abstracts obtained from Scopus were chosen as the context for the co-occurrences, meaning that the matrix captures the frequency with which certain pairs of words appear together in the abstracts. To perform the co-occurrence analysis R software (specifically, RStudio 2023.03.1) was utilized, along with the packages `quanteda`, and `quanteda.textplots`. These packages offer a comprehensive “[...] toolkit for natural language processing tasks such as corpus management, tokenization, analysis, and visualization.” (Benoit et al., 2018, p. 1) The network visualisations, based on the `quanteda.textplots` package, use the Fruchterman–Reingold layout algorithm to determine the location for each node (for more information on the Fruchterman–Reingold algorithm see Calvo et al. (2020), pp. 558–559).