BIBLIOMETRIC REPORT

Bibliometric analysis for the mid-term assessment of the excellence initiative 2017-2022

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Bibliometric analysis for the mid-term assessment of the excellence initiative 2017-2022

Report for the Nicolaus Copernicus University in Toruń (NCU)

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Executive summary

This report provides a bibliometric performance analysis of Nicolaus Copernicus University (NCU), covering the period 2017-2022. We collected publications from the CWTS version of Web of Science, based on cleaned affiliation data of publications. In total, we found 8,205 publications from NCU during this period.

We find that the citation impact of NCU is below the world average over the entire period. However, compared to selected benchmark institutions in Poland, its citation impact is relatively high. We also provide an analysis of the various centres of excellence and emerging fields. We find that the citation impact is higher in the centre of excellence of "Dynamics, Mathematical Analysis & Artificial Intelligence" and in the emerging field of "Automation and control systems".

NCU collaborates quite extensively, both nationally and internationally, and around 70% of its publications involve some institutional collaboration, similar to most other selected benchmark institutions. Publications with international collaborations show the highest citation impact. We also identified authors that show a relatively high impact, also per field.

Most of the publications of NCU show a lower citation impact than other articles published in the same journal. NCU does have a number of publications in higher impact journals, which are mostly in the medical and natural sciences. Finally, we provide a list of journals in the top decile in each Web of Science journal subject category for further scrutiny by NCU.

Not all collaborators, authors and journals can be discussed in this report due to limited space. However, this report is accompanied by an online Tableau dashboard that provides extensive additional information, and provides overviews of all collaborators, authors and journals.

1. Introduction

In 2019, the Polish Ministry of Science and Higher Education held the first competition under the "The Excellence Initiative - Research University" programme. The Nicolaus Copernicus University in Torun (NCU) was one of the winning universities, which led to a substantial subsidy increase for the years 2020–2026. These funds are meant for the further development of the excellent research fields and emerging field that were included in the application.

The NCU will have its mid-term evaluation in 2024. This report aims to provide bibliometric evidence that provides relevant contextual information for the mid-term evaluation. The report covers the dimensions publication output, citation impact and collaboration. We analyse centres of excellence and emerging fields, as defined in the excellence initiative. We also analyse authors of NCU. We study NUC publishing practices in journals, and also provide a global overview of the top decile journals in all fields.

2. Methodology and data collection

For his report, we make use of the CWTS Citation Index system (CI-system). The core of this system comprises an enhanced version of Clarivate Analytics' citation indices: the Web of Science (WoS) version of the following indices:

- ☐ Science Citation Index Expanded
- ☐ Social Sciences Citation IndexArts & Humanities Citation Index
- ☐ Conference Proceedings Citation Index
- ☐ Emerging Sources Citation Index
- ☐ Book Citation Index

These sources are updated quarterly in our system and contain over 60 million publications. A combination of smart computer algorithms and manual data cleaning ensures a better unification of the names and addresses of universities and other publishing organisations. Moreover, CWTS ensures improved citation counts by taking great care in proper linking of the citing- and cited publications.

CWTS has cleaned and harmonised name- and address variants for more than 4500 publishing organisations worldwide. These data are used to produce our Leiden Ranking (Waltman et al., 2012). NCU is also listed in the Leiden Ranking. As such, we have carefully cleaned and harmonised data for NCU, and we used this harmonised data to extract all publications for NCU.

We have extracted all research articles, review articles and conference proceedings from NCU in the period 2017-2022. For citation indicators we need at least one full year of citation counts, and therefore only the years 2017-2021 are included in our bibliometric indicators. We count citations up until and including 2022. In addition, citation-based indicators are only calculated for Arts & Humanities Citation Index, Science Citation Index Expanded, Social Sciences Citation Index and Conference Proceedings Citation Index. In total, this covers 8,205 publications and 5,712 publications for which bibliometric indicators are calculated.

In addition to raw citation counts, we also provide so-called normalised citation indicators. These normalised citation scores divide the raw citation counts by the average number of citations for "comparable" papers, that is, papers in the same publication year and in the same research field. Normalised scores higher than 1 are above the average, while normalised scores below 1 are below average. For the

normalisation, we use research fields from a highly detailed classification system of science that is algorithmically constructed (Traag et al., 2019) by CWTS on basis of the citation network of all publications (Waltman & van Eck, 2012). This classification system consists of 4159 different research fields.

Academic collaboration is increasingly more common. For publications with only few authors, we can expect the contribution of each individual author to be higher, whereas with more authors, the contribution to that paper is relatively speaking lower. For that reason, we also provide fractionalised publication counts. A publication is fractionalised per author. For authors with multiple affiliation, their fraction is then further fractionalised for each affiliation. We also use fractionalisation in our citation-based indicators, where this is also necessary to ensure consistency of these indicators (Waltman & van Eck, 2015).

We only consider units of analyses that have at least 10 publications and a so-called internal coverage of at least 50%. The internal coverage is calculated by considering the average proportion of references that cite publications that are included in our CWTS CI-system.

3. Results

We here provide the results of our analysis. We first provide an overview of the main results, including the different centres of excellence and emerging fields. Next, we discuss the results regarding collaboration, including identifying the main collaborators and their impacts. We then consider the main authors of NCU, also per centre of excellence and emerging field. Finally, we present the results at the journal level. This also includes an analysis of the top 10% journals for each so-called subject category of Web of Science.

3.1 Main results

P (full)	8,205
P (frac)	4,474.8
P (indic)	3,079.1
Int Cov	76%
TCS	16,423.5
MCS	5.3
MNCS	0.76
MNJS	0.81
P(top 10%)	191.6
PP(top 10%)	6%
PP(uncited)	27%

Figure 1. Main indicators.

In total, we found 8,205 publications for NCU in the period 2017-2022 (Figure 1). Fractionally counted, this amounts to 4,474.8 publications, meaning that NCU, on average, represents about 55% of the co-authors on publications. Only 3,079.1 publications are taken into account for calculating the remaining indicators. The publications that are excluded from the remaining indicators come from a large part from 2022 (796.6 publications); other publications are excluded because they are from the book citation index, the emerging sources citation index or other indices not covered by our bibliometric indicators. The average internal coverage of the entire publication set is 76%.

The Total Citation Score (TCS) is 16,423.5, which averages to a Mean Citation Score (MCS) 5.3 citations per publication. Note that we use fractionalised counting here, so that this represents a weighted total and average, using the fraction of each

publication that is represented by NCU. When normalising the citation scores, NCU shows a Mean Normalised Citation Score (MNCS) of 0.76. This is below the world average. The Normalised Journal Score (NJS) is essentially the average normalised citation score for a journal. The Mean Normalised Journal Score (MNJS) over all publications is 0.86, which is slightly higher than the MNCS, but it is also below the world average. The fact that the MNJS is slightly higher than the MNCS suggests that the publications are relatively less well cited than other articles in the same journals.

In total, there are 191.6 publications that belong to the top 10% most highly cited publications of their field in the same publication year. This represents a proportion of top 10% publications of about 6% of the 3,079.1 publications. This is slightly lower than the world average of 10%, providing a similar picture as the MNCS. About 27% of the 3,079.1 publications remain uncited within the citation window until 2022.
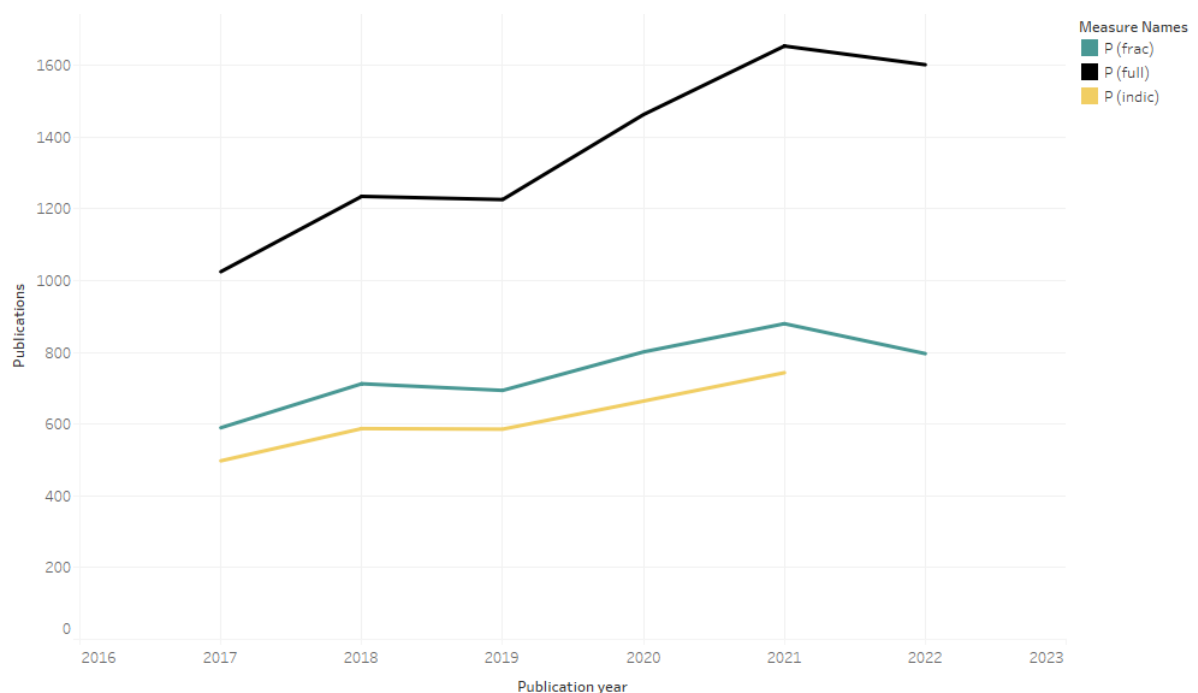

Figure 2. Trend of publications

The number of publications of NCU has been steadily increasing (Figure 2). While there were only 1,025 publications (590 fractionally counted) in 2017, this grew to 1,602 publications (796.6 fractionally counted) in 2022. In 2021 there were even slightly more publications.
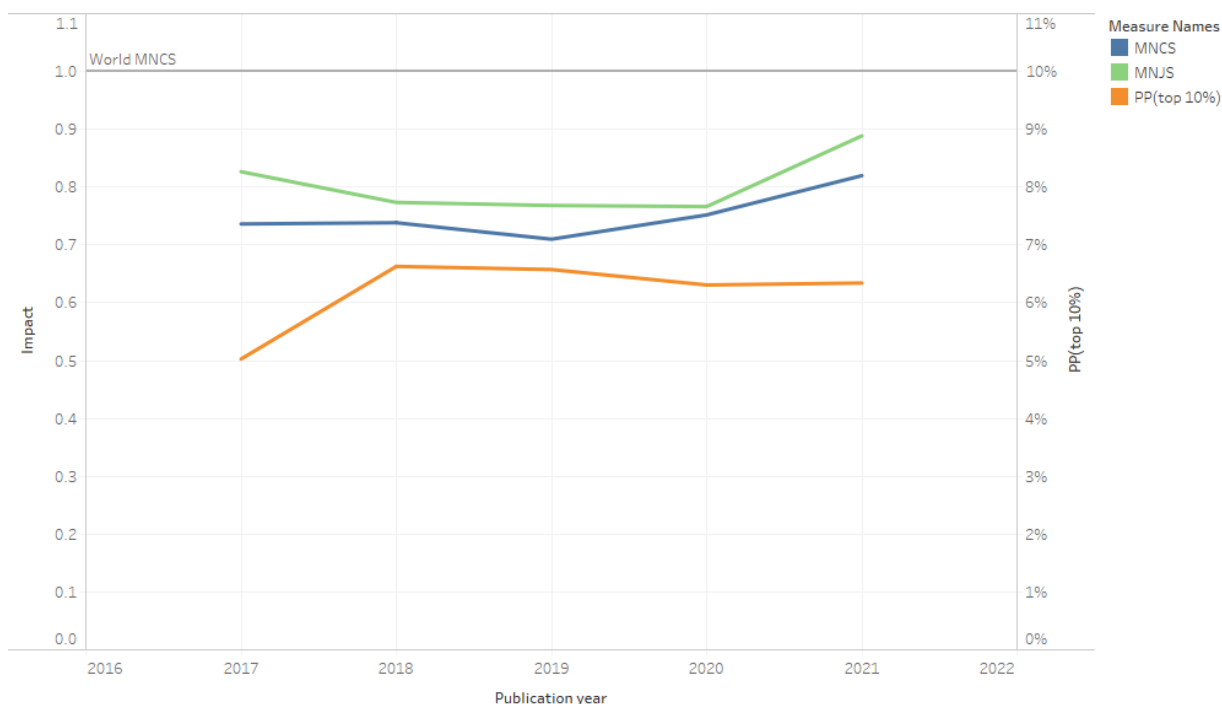
Figure 3. Trend of citation impact.

The impact stayed relatively stable over time (Figure 3). Publications in 2017 showed an MNCS of 0.74, and this hovered between 0.70-0.75 to reach 0.82 in 2021. The PP(top 10%) was about 6-7% between 2018 and 2021, which is slightly higher than the PP(top 10%) of 5% for 2017.

	Centre of excellence				Emerging field								
	Dynamics, Mathematical Analysis & Artificial Intelligence	Towards Personalized Medicine	From Fundamental Optics to Advanced Biophotonics	Astrophysics and Astrochemistry	Automation and control systems	Polymer science and multifunctional nanomaterials	Perception, Cognition and Language	Soil science, microbiology, agricultural genetics and food quality	Chronic Diseases	Ecology and biodiversity	Metabolic civilization diseases	Cancer Profiling	Global environmental changes
P (full)	425	1,207	477	713	106	687	245	483	402	228	238	1,070	178
P (frac)	213.5	351.6	124.8	189.2	22.2	143.1	51.8	190.8	103.9	56.0	58.1	348.7	37.9
P (indic)	166.2	251.7	101.3	155.1	17.4	122.5	42.9	138.0	68.0	32.2	44.8	251.6	28.6
Int Cov	67%	88%	88%	87%	72%	88%	79%	83%	85%	76%	89%	89%	55%
TCS	345.8	1,907.0	512.3	682.5	92.2	1,191.4	348.8	1,158.1	552.0	163.5	276.5	1,492.7	98.6
MCS	2.1	7.6	5.1	4.4	5.3	9.7	8.1	8.4	8.1	5.1	6.2	5.9	3.5
MNCS	1.01	0.86	0.82	0.61	1.82	0.94	0.90	0.82	0.76	0.74	0.68	0.65	0.53
MNJS	1.01	0.94	0.86	0.87	1.48	0.93	0.75	0.82	0.69	0.96	0.89	0.71	0.64
P(top 10%)	20.3	21.2	6.6	6.8	1.7	9.7	3.7	9.9	4.6	1.4	1.4	13.5	0.8
PP(top 10%)	12%	8%	6%	4%	10%	8%	9%	7%	7%	4%	3%	5%	3%
PP(uncited)	43%	15%	27%	30%	32%	11%	18%	13%	18%	17%	7%	19%	28%

Figure 4. Indicators per centre of excellence and emerging field.

Centres of excellence and emerging fields are defined through Web of Science journal subject categories. These subject categories represent a journal-based classification system of science. Journals may be assigned to multiple subject categories, which we also fractionalise for. However, some subject categories belong to multiple fields or centres of excellence, so there is some overlap.

One centre of excellence, namely "Interacting Minds, Societies, Environments" showed an internal coverage of only 39%. We therefore exclude it from the rest of the analysis. Similarly, the emerging fields of "Logic and philosophy of science", "Conservation and restoration of cultural heritage" and "Old and New Institutions" showed an internal coverage below 50% and are therefore excluded from the rest of the analysis. Note that most publications are not part of any centre of excellence or emerging field. In total, 5,244 publications (2,275.9 fractionally counted) are not included in any centre of excellence or emerging field, representing 64% of the total publications (50% fractionally counted). The publications that are not included in any centre of excellence or emerging field show an MNCS of 0.71 and a PP(top 10%) of 5%.

The centre of excellence of "Dynamics, Mathematical Analysis & Artificial Intelligence" shows the highest impact of all centres of excellence, with an MNCS of 1.01 and a PP(top 10%) of 12%. With 425 publications it is the smallest centre of excellence. The centre of excellence of "Towards Personalized Medicine" shows a lower impact (MNCS 0.86, PP(top 10%) 8%), but it shows much more publications (1,207). Indeed, medical centres often show more publications. "Astrophysics and Astrochemistry" shows a relatively low citation impact with an MNCS of 0.61 and a PP(top 10%) of 4%, also compared with its MNJS of 0.87.

The emerging field with the highest impact is "Automation and control systems" with an MNCS of 1.82. Its PP(top 10%) is 10% exactly, indicating that a few very highly cited publications are responsible for the high MNCS. With just 106 publications, it is not a large emerging field. The largest emerging field is again a medical field, namely "Cancer Profiling", but its impact is relatively low, with an MNCS of 0.65 and a PP(top 10%) of 5%.

3.1.1 Benchmarks

In order to put the results in comparative perspective, we will now compare the main results with a number of selected other institutions in Poland:

- Adam Mickiewicz University of Poznań

- University of Gdańsk
- University of Silesia in Katowice
- University of Olsztyn
- University of Wrocław
- University of Łódź

As is clear from Figure 5, the overall citation impact of NCU is the highest among these benchmark institutions. Most of the benchmark institutions show a slightly lower impact, except for Katowice and Olszstyn, which have a substantially lower citation impact. In terms of publications, NCU is slightly smaller than Poznan, but quite a bit larger than most other benchmark institutes. The collaboration patterns are similar to most other institutes, with a noteworthy exception of Olsztyn, which collaborates relatively little.

Overview benchmark

	Adam Mickiewicz University in Poznań	Nicolaus Copernicus University in Toruń	University of Gdańsk	University of Silesia in Katowice	University of Warmia and Mazury in Olsztyn	University of Wrocław	University of Łódź
P (full)	9,232	8,205	5,666	5,774	6,496	6,942	6,343
P (frac)	5,004.1	4,474.8	3,081.4	3,313.1	4,111.5	3,621.3	3,726.8
MNCS	0.74	0.76	0.71	0.62	0.66	0.73	0.73
PP(top 10%)	6%	6%	6%	5%	5%	6%	6%
PP(collab)	48%	48%	51%	49%	35%	49%	45%
PP(no collab)	52%	52%	49%	51%	65%	51%	55%
PP(nat. collab)	22%	26%	26%	27%	24%	21%	26%
PP(int. collab)	26%	22%	25%	21%	12%	28%	19%
PP(OA)	46%	56%	47%	46%	58%	48%	43%
PP(gold OA)	23%	36%	28%	28%	43%	22%	28%
PP(green OA)	28%	40%	32%	31%	32%	34%	29%
PP(hybrid OA)	14%	10%	11%	11%	9%	12%	9%
PP(only green OA)	7%	7%	6%	5%	2%	10%	5%
PP(only journal OA)	19%	15%	16%	15%	27%	14%	15%

Figure 5. Overview of main results for selected benchmark institutions.

We also compare NCU to the various benchmark institutions for all centres of excellence and emerging fields in Figure 6. We previously noted that NCU is strongest in the centre of excellence of "Dynamics, Mathematical Analysis & Artificial Intelligence" with an MNCS of 1.01. NCU is also strongest in this area compared to other benchmark institutions, which all have a citation impact well below the average. The emerging field of "Automation and control systems" is relatively small for NCU, with only 106 publications, which is also the case for most other benchmarks. Only Olsztyn is substantially larger, with 320 publications, but it shows a lower impact, with an MNCS of 0.92.

In the largest emerging field for NCU, "Cancer Profiling", Lodz shows a high citation impact, with an MNCS of 1.34, coupled to a sizeable number of publications of 828. Lodz also shows a high impact in the centre of excellence of "Towards Personalized Medicine", with an MNCS of 1.38. In the emerging fields of "Chronic Diseases" and "Ecology and biodiversity", Poznan is doing relatively well, with a citation impact of 1.36 and 1.07 respectively.
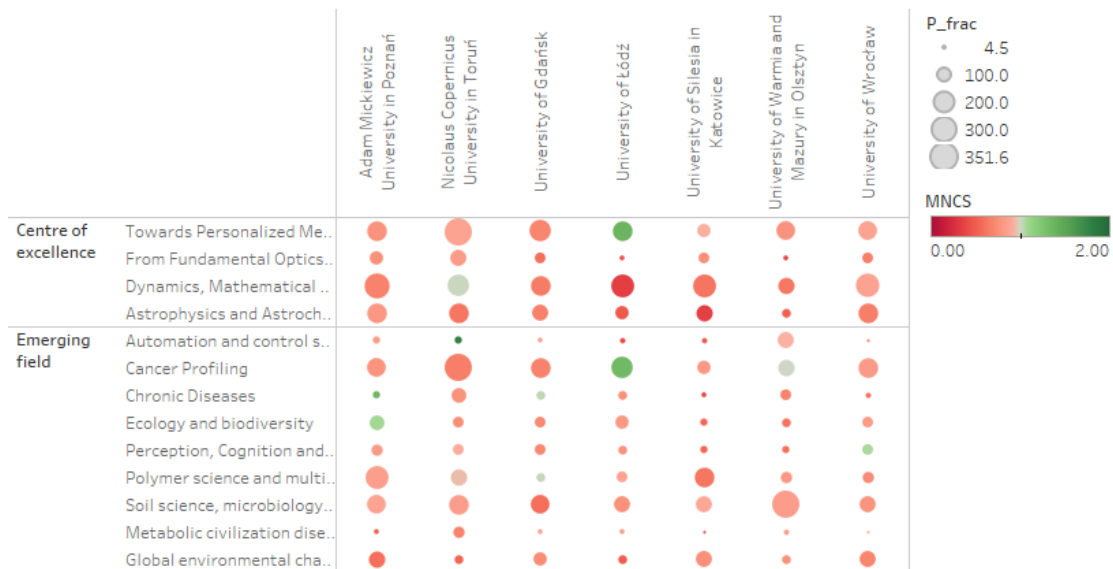

Figure 6. Comparison to selected benchmark institutions for the various centres of excellence and emerging fields.

3.2 Collaboration

We discern two types of collaboration: national and international. We define collaboration in terms of institutional collaboration, even if there are multiple authors, we consider a publication not a collaboration if all authors have the same

affiliation. If all institutions are in Poland, we consider it a national collaboration, if there is at least one institution that is from outside Poland, we consider it an international collaboration.

	Unknown	No collaboration	National	International
P (full)	2,493	1,618	1,806	2,288
P (frac)	1,395.7	1,614.9	792.8	671.4
P (indic)		1,614.9	792.8	671.4
Int Cov		72%	78%	82%
TCS		7,659.3	3,855.1	4,909.1
TNCS		1,181.4	505.5	638.4
MCS		4.7	4.9	7.3
MNCS		0.73	0.64	0.95
MNJS		0.78	0.74	0.95
P(top 10%)		98.8	34.9	57.8
PP(top 10%)		6%	4%	9%
PP(uncited)		32%	22%	22%

Figure 7. Main indicators for different collaboration types.

Similar to citation-based indicators, we only calculate collaboration indicators for 5,712 publications. For the remaining 2,493 publications we do not provide collaboration indicators, which are hence listed as "Unknown" in Figure 7. NCU more often has publications with international collaboration (2,288) than national collaboration (1,806), which is even more than no collaboration (1,618). The fractionalised perspective shows slightly more national collaborations (792.8) than international collaborations (671.4), suggesting that in international collaborations NCU typically represents a smaller fraction of the authors. Note that this only includes publications for which we calculate bibliometric indicators, so that the basis for the indicators is always identical to the fractional publications.

The impact is highest for the international collaboration, with an MNCS of 0.95 and a PP(top 10%) of 9%. Indeed, international collaboration typically shows the highest impact. Often, national collaboration shows a higher impact than no collaboration, but that is not the case for the NCU, where national collaboration shows an MNCS of 0.64 versus an MNCS of 0.73 without any collaboration.
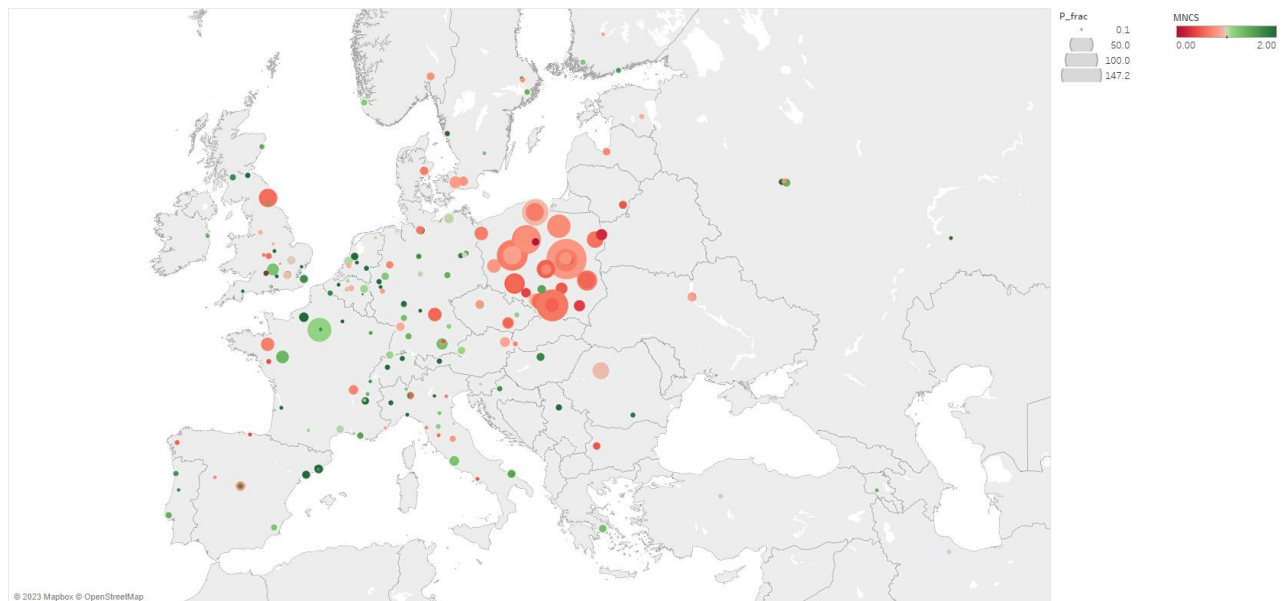
Figure 8. Map of collaborators of NCU.

The largest collaborator of NCU is the Polish Academy of Sciences with 628 co-publications (147.2 fractionally counted). Note that this might be the result of two (or more) different authors—one affiliated with NCU and one affiliated with the Polish Academy of Sciences—or a single author who is affiliated with both institutions. Within Poland other notable collaborators include Jagiellonian University and the medical universities of Poznan and Gdansk. Typically, the impact of co-publications with these universities have a below world average impact, varying from an MNCS of 0.63 for Jagiellonian to an MNCS of 0.93 for Gdansk.

The largest collaborator outside Poland is the Centre National de la Recherche Scientifique (CNRS) in France with 271 co-publications (52.6 fractionally counted). This collaboration also shows a somewhat higher impact, with an MNCS of 1.13 and a PP(top 10%) of 9%. Other noteworthy collaborators with a higher impact include the Russian Academy of Sciences, with an MNCS of 1.19 for 99 publications (19.5 fractionally counted), University of Rouen, with an MNCS of 2.13 for 18 publications (8.3 fractionally counted) and Universitat Rovira i Virgili, with an MNCS of 4.37 for 18 publications (5.9 fractionally counted).

A full overview of collaborators, their co-publications and their impact is provided in the online Tableau dashboard.

3.3 Authors

We identified 458 authors affiliated with NCU that had at least 10 publications that were included in the calculation of citation-based indicators. Note that these authors might have had additional publications with another affiliation that are not included in this current study, as we limit this study to publications with an affiliation with NCU. In total, these authors published 5,688 publications (3,129 fractionally counted) with an MNCS of 0.80 and an PP(top 10%) of 7%, which is slightly higher than the overall impact of NCU. A complete list of NCU authors is provided in the online Tableau dashboard.

When taking a look at individual authors per centre of excellence and emerging field, only few centres or fields show any authors with at least 10 publications (in that field). The only centre of excellence with any authors with at least 10 publications is "Towards Personalized Medicine". The authors M. Wicinski and A. Sionkowska show the highest impact in this field. A. Sionkowska also shows the highest impact in the emerging field of "Cancer Profiling".

The author B. Buszewski has been productive and is present in all fields that have any authors with at least 10 publications. The impact of this author is highest in the emerging field of "Polymer science and multifunctional nanomaterials".

The emerging field "Soil science, microbiology, agricultural genetics and food quality" shows only three authors with at least 10 publications. In this field, P. Pomastowski shows the highest impact.

More details are provided in the online Tableau dashboard.

3.4 Journals

For each article in a journal we can calculate its (normalised) citation score and whether it belongs to the top 10% of its field for its publication year. By averaging these (normalised) citation scores overall all articles in a journal, we obtain a Normalised Journal Score (NJS). This is essentially a sort of MNCS for a journal, separated per field and publication year. This means that a journal has a different NJS score for each different field and each different publication year. A journal may indeed be more highly cited in one field than in another field. This is particularly relevant for larger journals such as PLOS ONE.

To each publication we can then assign it a NJS based on its journal, field and publication year. By averaging the NJS, we then obtain the Mean Normalised Journal

Score (MNJS). This provides an estimate of the impact of the journals in which articles by NCU are published. By calculating the MNJS at the journal level, we obtain an indicator of the citation impact of the various journals in which NCU publishes, also with respect to the fields in which NCU publishes in these journals.
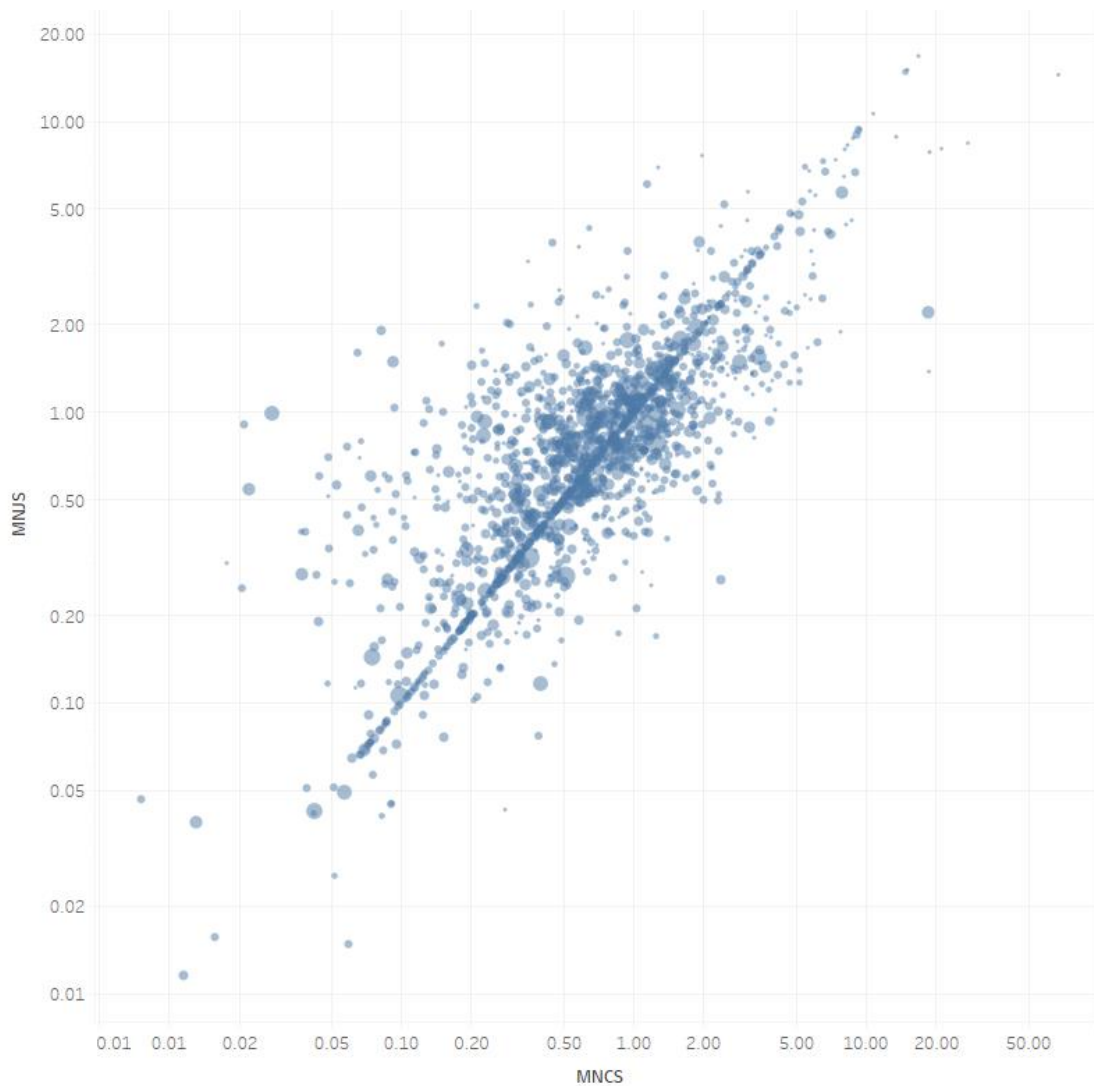

Figure 9. Plot of the MNJS versus MNCS for NCU publications. The size of each marker denotes the number of fractionalised publications by NCU.

Overall, we observe that journals in which more is published tend to have a lower impact. This is consistent with the idea that some higher-impact journals might be more selective. Most of the highest impact journals that NCU publishes in focus on the medical sciences (e.g. Lancet, Cell, JAMA) and the natural sciences (e.g. Physica E, Chemical Reviews, Nature Physics). However, it also includes the journal Mathematics

of Computation, and some behavioural science journals such as Clinical Psychology & Psychotherapy and Nature Human Behaviour.

The impact of the articles of NCU is typically lower than the impact of the journals in which those articles are published. That is, in Figure 9 most journals fall above the diagonal, where the MNJS of the journal is higher than the MNCS. This is consistent with our overall observation. As an extreme example, the journal *Molecular Physics* has an NJS of 0.99, but articles by NCU published in that journal have an MNCS of 0.03. However, there are also some examples of the inverse. For instance, the Journal of Religion & Health has an MNJS of 2.21, but the articles published by NCU in that journal have an MNCS of 18.6. Indeed, citation distributions are quite broad, and so the average of the journal score can deviate quite substantially from citation scores of individual articles.

The diagonal line consists of articles for which the normalised journal score is identical to the normalised citation score. This is typically the case if there is only one article from that particular field in a particular journal.

We have also calculated the overall MNJS and the percentage of top 10% articles for all journals in Web of Science, where we simply consider all articles (articles, reviews and conference proceedings) in Web of Science in the period 2017-2021, instead of limiting us to articles from NCU. This provides an overview of the overall journal impact. We provide an overview of the journals in the first decile of their subject category in the online Tableau dashboard.

4. Conclusion

We have performed a bibliometric analysis of Nicolaus Copernicus University (NCU), covering the period 2017-2022. The citation impact of NCU is below the world average over the entire period. Compared to selected benchmark institutions in Poland, NCU is showing a relatively high citation impact. The citation impact is higher in the centre of excellence of "Dynamics, Mathematical Analysis & Artificial Intelligence" and in the emerging field of "Automation and control systems".

NCU collaborates quite extensively, both nationally and internationally, and around 70% of their publications involve some institutional collaboration. This is similar to most other selected benchmark institutions. Publications with international collaborations show the highest impact. We also identified authors that show a relatively high impact, also per field.

Most the publications of NCU show a lower impact than other articles published in the same journal. NCU does have a number of publications in higher impact journals, which are mostly in the medical and natural sciences. We also provide a list of journals in the top decile in each subject category for further scrutiny by NCU.

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