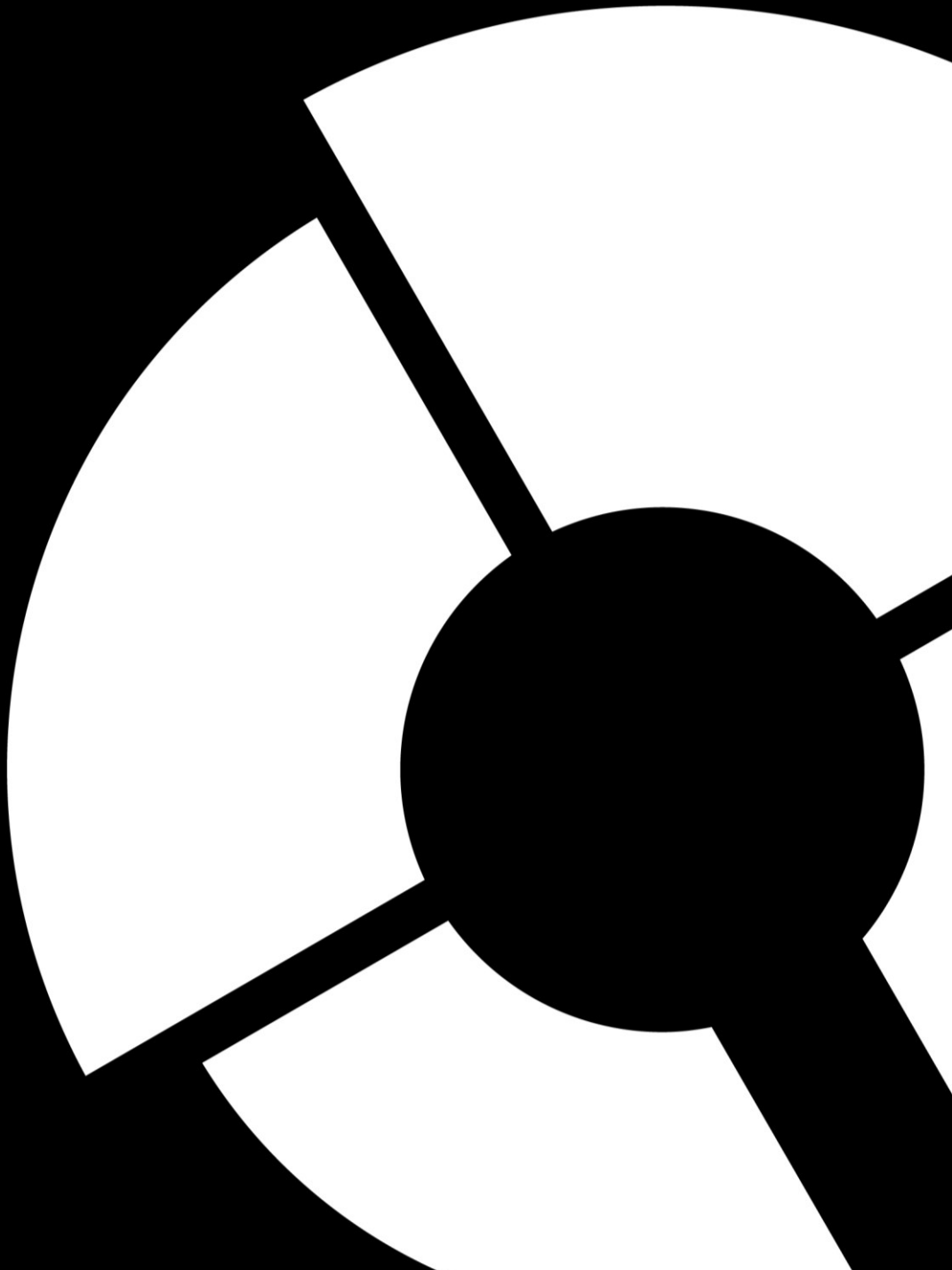
CWTS
Meaningful metrics

PBL Netherlands Environmental Assessment Agency (PBL):

Research performance analysis (2011-2016)



Universiteit Leiden

Center for Science and Technology Studies (CWTS)

Leiden University

PO Box 9555, 2300 RB Leiden

The Netherlands

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PBL – Netherlands Environmental Assessment Agency

Drs. Ton Manders

Sector Head, Sector Information, Data and Methods

Tel. +31 655 73 69 18
E-mail ton.manders@pbl.nl

Project team

Alfredo Yegros-Yegros PhD, Project leader

CWTS B.V.
P.O. Box 905
2300 AX Leiden, The Netherlands
Tel. +31 71 527 7737
Fax +31 71 527 3911
E-mail a.yegros@cwts.leidenuniv.nl

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1 Introduction

The Netherlands Environmental Assessment Agency (PBL) will have its research evaluation taking place in 2017. PBL follows the Standaard Evaluatie Protocol (SEP) in terms of its evaluation.

The mission of PBL is to support and guide policy through scientific research. As such, the assessment of its scientific performance based on bibliometric analyses should be placed in the right context, being different than universities or academic hospitals.

The structure of this report is as follows. Chapter 2, provides a general introduction to the data collection, the methodology and an overview of the bibliometric indicators that were calculated in the study. Chapter 3, presents the results of the performance analysis and Chapters 4 briefly presents the conclusions drawn from this study.

2 Data and methods

In this chapter, we discuss the methods underlying the bibliometric analyses presented in this report[1].

2.1 Database Structure

At CWTS, we calculate our indicators based on our in-house version of the Web of Science (WoS) database of Thomson Reuters. WoS is a bibliographic database that covers the publications of about 12,000 journals in the sciences, the social sciences, and the arts and humanities. Each journal in WoS is assigned to one or more subject categories. We note that our in-house version of the WoS database includes a number of improvements over the original WoS database. Most importantly, our database uses a more advanced citation matching algorithm and an extensive system for address unification. Our database also supports a hierarchically organized field classification system on top of the WoS subject categories.

2.2 Data collection

In general, bibliometric performance analyses can be conducted in two ways. One approach is to collect the publications produced by a research unit in the past and to analyze these publications. The other approach is to start with the researchers currently affiliated with a research unit and to collect and analyze their past publications, irrespective of whether researchers produced these publications when they were affiliated with the research unit of interest or not. The first approach leads to an analysis that is completely backward looking. The second approach has a more forward looking

[1] We refer to Moed (2005) for a general introduction into the use of bibliometrics and citation analysis for research evaluation.

focus, since it does not include publications produced by researchers who are no longer affiliated with a research unit. PBL has requested CWTS to take the first approach in the performance analysis presented in this report. Hence, we analyze the past publications of PBL.

The performance analysis presented in this report focuses on publications from the period 2011-2016. Only WoS indexed publications are considered. This means that books, book chapters, journal publications not indexed in WoS, conference proceedings publications, working papers, etc. are not included in the analysis. Each publication in WoS has a document type, such as 'article', 'book review', 'editorial material', 'letter', or 'review'. In our analysis, although we first show all the publication counts for all types of document, we only take into account publications of the document types 'article' and 'review' to conduct the main analyses. In general, these two document types cover the most significant publications and reflect best the research developments.

The publications of PBL were collected from the CWTS CI-system and sent to the PBL to verify and check any wrong assignment of publications to PBL or any possible missing publication by PBL during the period of analysis.

2.3 Bibliometric Indicators

Three key aspects of PBL's research performance are considered in our performance analysis: publication output, citation impact, and scientific collaboration.

2.3.1 Indicators of output

To measure the total publication output produced by PBL, we use a very simple indicator. This is the number of publications indicator, denoted by P. This indicator is calculated by counting the total number of publications of a research unit.

2.3.2 Indicators of impact

Citation impact focuses on the number of times the publications of PBL have been cited. Citation impact does not necessarily reflect the scientific quality of the work of PBL, but it can be regarded as a proxy for the scientific impact of this work.

As already mentioned in Section 2.2, the period for the performance analysis is 2011-2016, however the citation analysis considers publications up to 2015 and citations until 2016, as at least one complete year to receive citations is needed to calculate robust indicators. In addition, as indicated previously, only publications of the WoS document types 'article' and 'review' are taken into account. Hence, book reviews, editorials, letters to the editor, etc. are not included in the analysis.

It is important to note that in this report we distinguish between two different concepts of citation impact:

- Total citation impact (TCS). The overall citation impact of the publications of a research unit. Other things equal, a research unit with a larger number of

publications will have a higher total citation impact. Hence, total citation impact is partly determined by the size of a research unit.

- Average citation impact per publication (MCS). The average citation impact of the publications of a research unit. Average citation impact per publication equals total citation impact divided by the number of publications of a research unit. Average citation impact per publication makes it possible to compare research units of different size. Research units with a selective publication strategy (favoring 'quality' over 'quantity') are the ones that tend to perform best when looking at average citation impact per publication.

To measure the total or average citation impact of a set of publications, we start by counting for each publication the number of times it has been cited. Since our analysis is based on WoS data, only citations from WoS indexed publications are counted. We normally do not count author self citations. A citation is considered an author self citation if the citing and the cited publication have at least one author name in common. For each publication, all citations received until the end of 2016 are taken into account, we use the so called flexible citation window. This means that older publications have had more time to receive citations and may therefore be expected to have higher citation counts than more recent publications.

After counting the number of times publications have been cited, we calculate the following indicators, considering both aspects, the total citation impact of a set of publications as well as the average citation impact:

- **TCS**. The total number of citations of the publications, excluding self-citations. This is a very straightforward indicator that does not correct for the field and the year

in which publications have appeared. The indicator therefore provides only a very rough indication of the total citation impact of a set of publications.

- **Number of top 10% publications (PP(top 10%)).** The number of publications that compared with all other WoS indexed publications in the same field and the same year belong to the top 10% most frequently cited. We refer to these publications as top 10% publications.
- **MCS**: Average number of citations per publication, excluding self-citations.
- **Pnc**: Percentage of publications not cited by others (in the given time period)
- **MNCS**: Average normalized number of citations of the publications of a unit, excluding self-citations.
- **Total normalized journal score (MNJS).** Average normalized citation score of the journals in which a research group has published
- **Mean field normalized citation score (MNCS)** in the traditional way; the actual number of citations (without self-citations) is divided by the expected number of citations on a paper basis. Here, the expected number of citations is based on the world-wide average citation score without self-citations of all similar papers belonging to the same field (journal subject category). In this way, a field normalized score is calculated for each paper. Next, the MNCS indicator is computed for each unit of analysis, by taking the average of these field normalized citation scores for individual papers. A value above 1 indicates that the mean impact for the unit is above world average whereas a value below 1 indicates the opposite.
- **The mean normalized journal score (MNJS)** indicates the average citation impact of the journals in which the papers appeared that were published by the

unit of analysis. The indicator is calculated based on the same principles as the MNCS. It shows whether the publications originating from the unit of analysis were published in top or in sub-top (in terms of citation impact) journals.

- **Number of highly cited publications (Ptop10%)** in international journals of the unit of analysis in the period;
- **Percentage of highly cited publications. (PPtop10%)** The percentage of publications published by the unit that are among the upper top 10% percentile of the citation distribution for similar papers belonging to the same fields (journal subject categories).

For those indicators that involve a normalization by scientific field, we used the publication-level classification system developed at CWTS. This classification clusters groups of publications based on their citation relations, so that similar publications based on their citation profiles are grouped together. This approach leads to a more accurate and fair comparison between areas of research compared to other available classification systems[2]

2.3.3 Indicators of scientific collaboration

Collaboration is measured according to the degree to which the publications of PBL indicate multiple research institutes, from the Netherlands or abroad. Collaboration is measured then analyzing the affiliations indicated by the authors in their publications.

[2] van Eck NJ, Waltman L, van Raan AFJ, Klautz RJM, Peul WC (2013) Citation Analysis May Severely Underestimate the Impact of Clinical Research as Compared to Basic Research. PLoS ONE 8(4): e62395. https://doi.org/10.1371/journal.pone.0062395

We first identified publications authored by a single institution ('no collaboration'). We then identified publications that have been produced by institutions from different countries ('international collaboration') and publications that have been produced by institutions from the same country (i.e. 'national collaboration'). These types of collaboration are mutually exclusive. Publications involving both national and international collaboration are classified as international collaboration.

3 Performance analysis: Netherlands Environmental Assessment Agency

This section is devoted to present the performance analysis of the Netherlands Environmental Assessment Agency, based on publications from 2011 to 2016.

The section is organized in three subsections. The first of these subsections presents an overview of the scientific outputs produced by PBL. In the second subsection the main indicators of citation impact are presented and the last subsection shows the so called special indicator: a research profile analysis, a collaboration profile analysis and, finally, the knowledge user analysis.

3.1 Publication output

The PBL has contributed to 430 scientific publications covered by the WoS during the period 2011-2016. Therefore, on average, PBL has contributed to roughly 70 publications per year.

Figure 1 shows the evolution over time of the number of publications. It can be observed that 2012 and 2013 were the years with a lower publication output, with slightly less than 70 publications in each of these two years. In 2014 the numbers improved and remained relatively stable till the end of the period under analysis.

Figure 1. Evolution over time of the number of publications

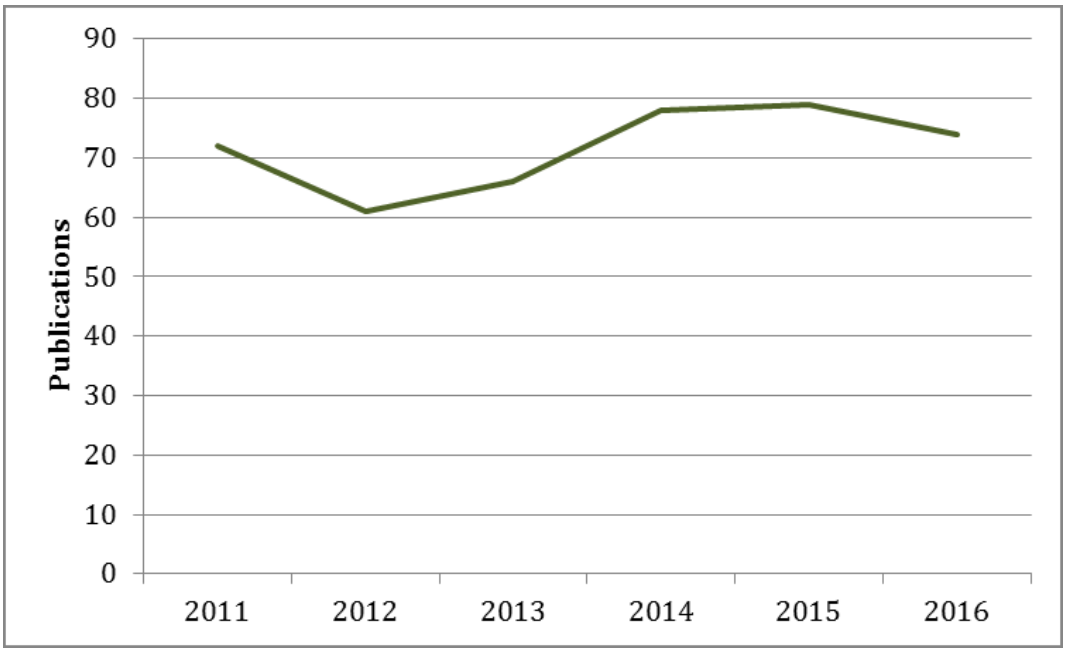


Table 1 shows the breakdown of PBL publications per document type and publication year. Most of the contributions made by the PBL were done through articles (86.7%). Reviews and editorial material represent each roughly 5% of the total output.

The remaining types of publications represent very little in the overall landscape of publications produced by PBL.

Table 1. Breakdown of PBL output in the WoS by document type

Document type	2011	2012	2013	2014	2015	2016	Total (%)
Article	59	56	60	67	67	64	373 (86.7)
Book Review				1	1	2	4 (0.9)
Correction			1				1 (0.2)
Editorial Material	5	2	1	4	5	2	19 (4.4)
Letter	2	1	1	1	1	1	7 (1.6)
Meeting abstract	2						2 (0.5)
Review	4	2	3	5	5	5	24 (5.6)
Total (%)	72 (16.7)	61 (14.2)	66 (15.3)	78 (18.1)	79 (18.4)	74 (17.2)	430

The rest of the analyses will be conducted only for articles and reviews. All the other document types are not included in the analysis as they are considered to be less

representative of the research conducted at PBL. Articles and reviews together account for more than 90% of the publications by PBL included in the WoS.

3.2 Citation impact

For the citation impact indicators only reviews and articles from 2011 to 2015 are considered, and all the citations received till 2016.

Table 2 contains the main indicators on citation impact of PBL for the whole period. A table with the scores of these indicators for each individual year in the period can be found in Appendix II (table A2.1.).

Limiting the period to the years 2011 to 2015 and the document types to articles and reviews, reduces the amount of publications produced by PBL to 328, these are the publications analysed.

The internal coverage (int_cov) indicates the percentage of references included in PBL publications that in turn point to scientific publications covered by the WoS. This indicator is used to assess the suitability of bibliometrics to assess the scientific performance of research organisations. A score around 60% indicates that a bibliometric analysis provides a good overview of the research performance of PBL, based on scientific publications[3].

Looking at the main citation indicators, the mean normalized citation score (MNCS) achieved by PBL is 3.31, more than three times above the world average value (1). Also the proportion of its publications among the most highly cited publications is three times above the worldwide reference value of 10% (33.7%).

The indicator of percentage of non-cited publications (Pnc) provides an interesting additional point of view to get a more comprehensive picture of the citation impact of PBL. The score of this indicator reflects that only 5.8% of all the publications remained uncited till 2016, therefore the vast majority of publications contributed to shape the citation impact of PBL.

[3] Scores around 40% are problematic as indicate that publications in scientific journals are not frequent for the research organization under analysis and therefore bibliometric analyses do not provide a good overview of the research performance.

Besides the citation indicators directly related to the publications produced by PBL, the mean normalized journal score (MNJS) of 2.22 also indicates that PBL has been publishing in journals in which publications are cited twice as much as in a worldwide average journal. Therefore the journals to which PBL has targeted its publications are well cited journals.

Table 2. Indicators of citation impact of the publications of PBL (2011-2015/16)

Indicator	Score
P	328
Int_cov[4]	62.1%
TCS	7,700
MCS	23.5
Pnc	5.8%
MNCS	3.31
MNJS	2.22
Ptop10	110
PPtop10%	33.7%

Figure 2 and Figure 3 show the evolution of two indicators of citation imapact: the mean normalized citation impact (MNCS) and the proportion of publications among the most highly cited publications (Pp top 10%). Both present a similar pattern, although not identical.

Both indicators suggest that publications with the highest citation impact correspond to the years 2011 and 2014. However, even in those years in which the citation impact is lower, it is still above 2 for the MNCS and around 25% for the Pp top 10%.

[4] Percentage of references in PBL publications that are also covered by the WoS.

Figure 2. Evolution of the Mean Normalized Citation Score

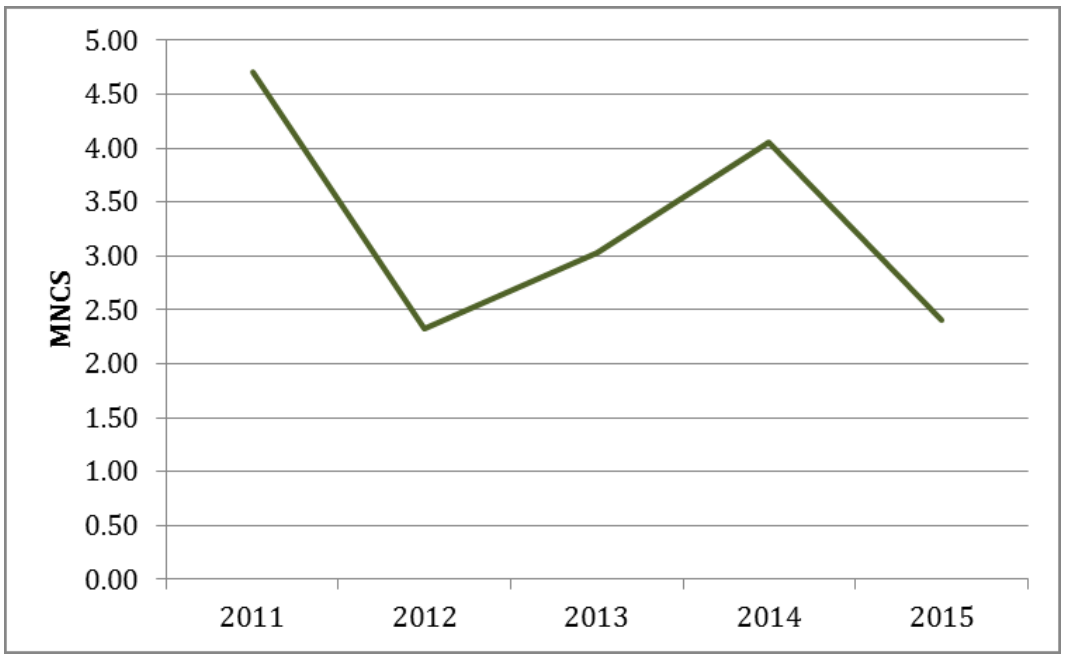
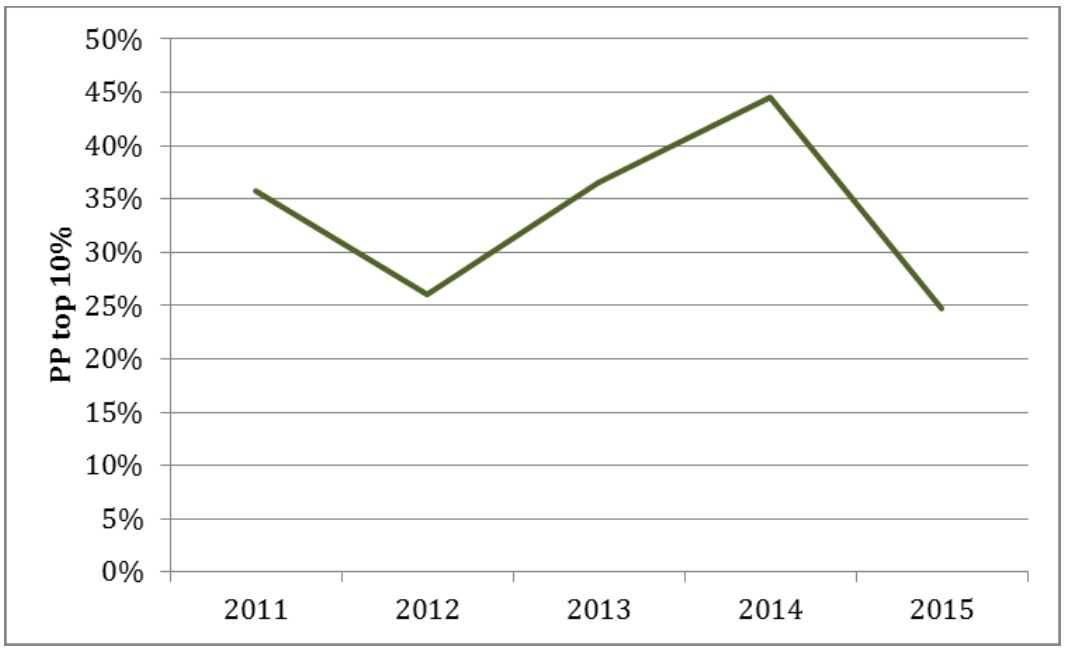


Figure 3. Evolution of the percentage of top 10% most cited publications



3.3 Special indicators

This section of the report contains the last part of the analysis conducted to assess the performance of the PBL. The special indicators described below correspond to the research profile, the collaboration analysis and the knowledge user analysis.

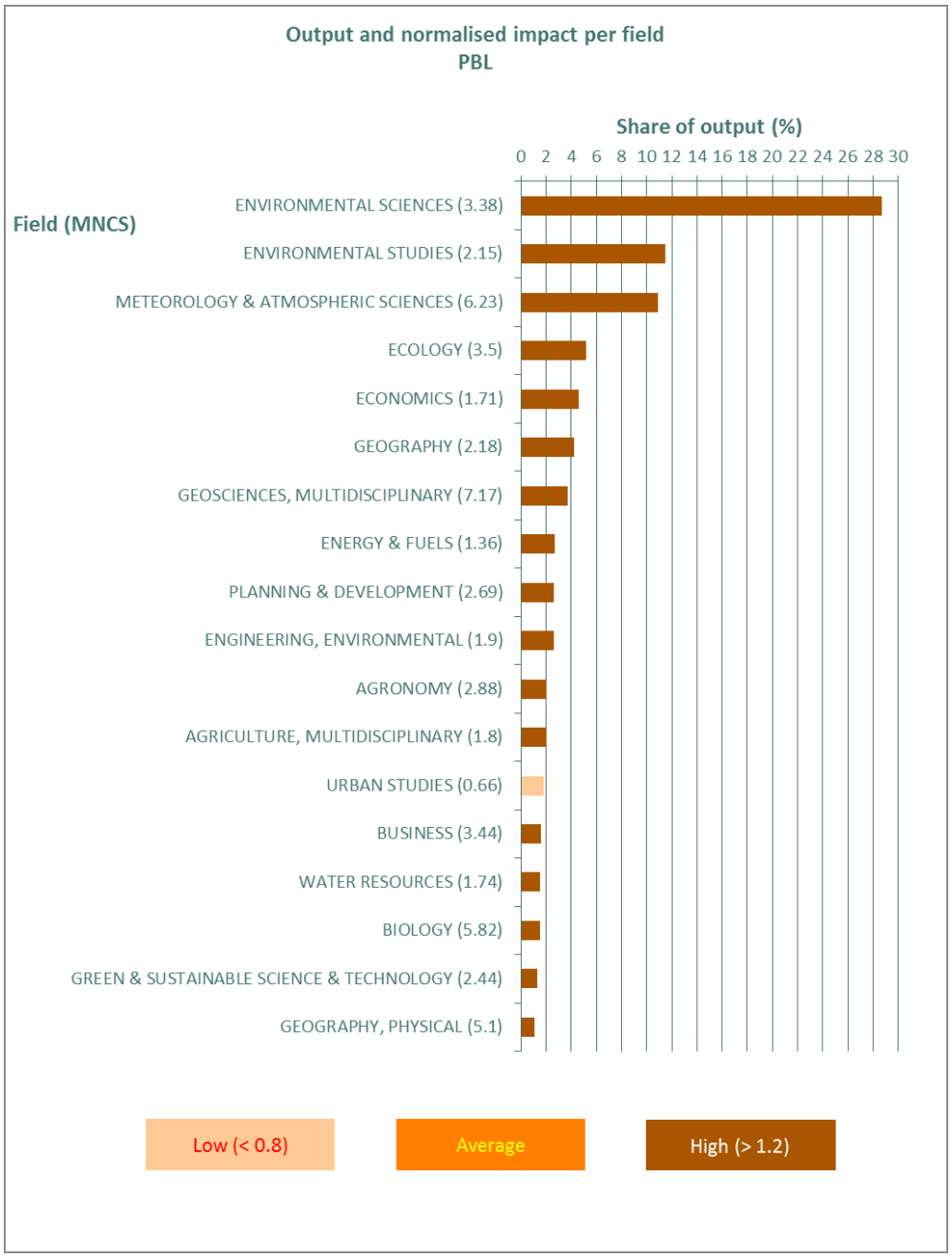
3.3.1 Research profile analysis

This research profile analysis is devoted to describe the disciplinary profile of PBL based on its scientific publications and to show both the amount of scientific publications and the citation impact of PBL in each individual scientific discipline.

Figure 4 shows a breakdown of publications by scientific fields as represented in the WoS. Next to each scientific field, between brackets, it has been indicated the value of the mean normalized citation score (MNCS) achieved by the publications in that field. The share of publications in each particular field is also shown in the figure, providing a visual representation of the main fields also in terms of the number of publications.

Figure 4 only shows fields accounting for at least 1% of the PBL publications. A table including a complete list of fields is provided in Appendix III (table A3.1)

Figure 4. Distribution of publications over WoS fields



3.3.2 Collaboration analysis

In order to assess the collaboration patterns of PBL, publications have been divided in three groups. Those classified as *no collaboration* only include the PBL among the affiliations. Publications classified as *international collaboration* are those in which the PBL as well as at least another Dutch organization are involved, but without the participation of foreign organisations. Any publication in which at least one foreign organization is involved is classified as *international collaboration*.

As shown in Figure 5, the group of international collaborations accounts for most of the PBL publications (61.9%). The second biggest group includes the publications produced in national collaboration (31.7%), while the publications produced only by the PBL represent 6.4% of all the publications.

In terms of citation impact, all the publications by PBL can be regarded as having achieved a high citation impact (all above an MNCS of 1.2). However, there are differences in the MNCS achieved by these three groups of publications: 4.26 in international collaboration; 1.74 in national collaboration and 2.01 when there is no institutional collaboration.

Figure 5. Output and impact per collaboration type

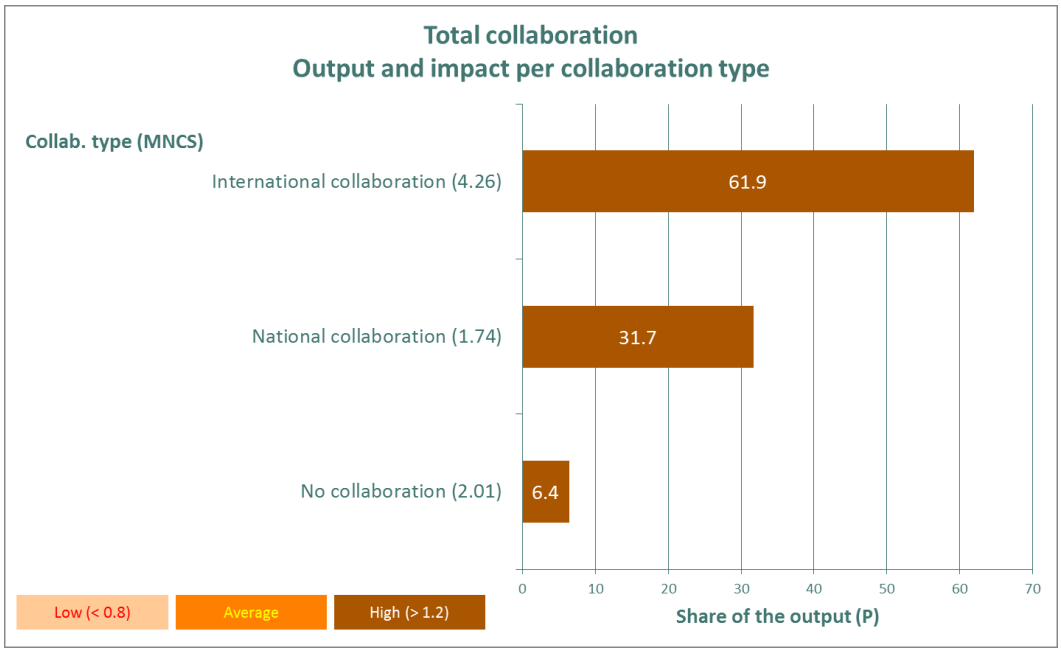


Figure 6 and Figure 7 present the evolution of the number of publications and the mean normalized citation score (MNCS) according to the type of collaboration. Figure 6 indicates that the number of publications produced in international collaboration has always been higher than the number of publications produced through other collaboration types, and this patter is even more marked in the second half of the period.

International collaborations are important not only because of the amount of publications, but also because the level of citation impact achieved through this type of collaborations, most of the times higher compared to other types of collaboration, as shown in figure 7.

Figure 6. Development over time of publications according to the type of collaboration

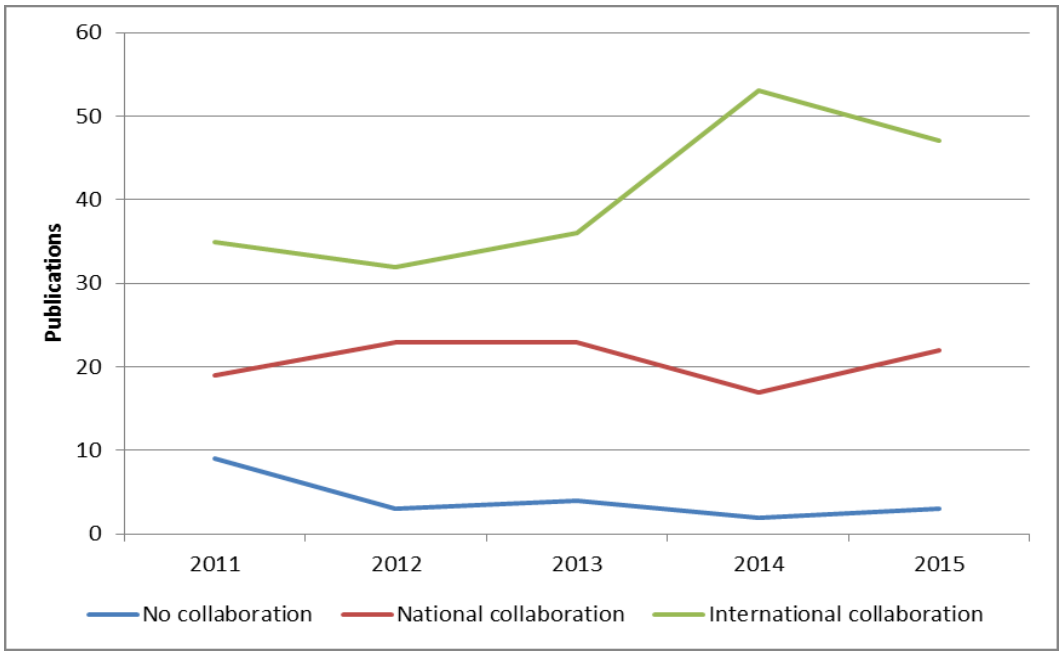


Figure 7. Development over time of the MNCS according to the type of collaboration

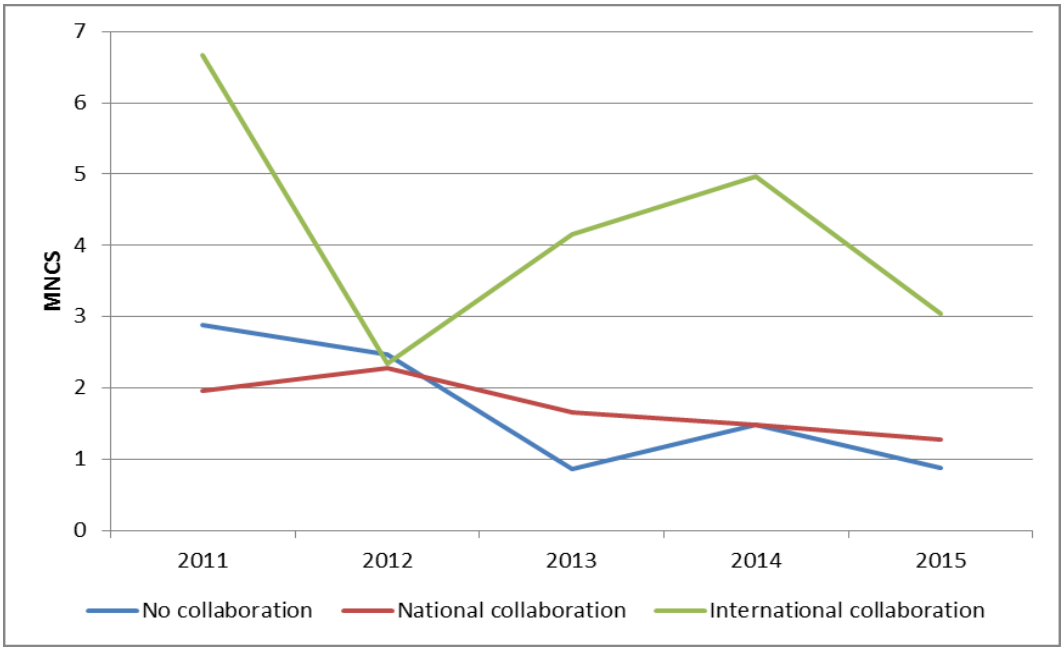


Table 3 shows the organisations that co-publish more frequently with the PBL. Some Dutch universities populate the table showing the top research partners of PBL, as reflected in the scientific publications, but the table also includes a number of foreign organisations such as the Potsdam Institute for Climate Impact Research (PIKP) or International Institute for Applied Systems Analysis – IIASA, among others.

Table 3. Most frequently occurring research institutes co-publishing with PBL

Research organisation	No. pub.
Utrecht University	131
Wageningen University and Research Centre	96
VU University Amsterdam	44
Potsdam Institute for Climate Impact Research (PIKP)	44
International Institute for Applied Systems Analysis - IIASA	42
United States Department of Energy	24
National Center for Atmospheric Research	22
University of Amsterdam	21
ETH Zurich	19
Joint Research Centre of the European Commission in Ispra	18

3.3.3 Knowledge user analysis

The knowledge user analysis focusses on research organisations that '*use*' the knowledge generated by PBL. This analysis is based on the research organisations whose publications include in the reference list one or more scientific publications produced by PBL.

This analysis provides an interesting perspective on the citation impact generated by PBL. It can also point to the identification of potential research partners for future collaborations, as the citation relations reflect to some extent the existence of common research interests between PBL and the citing organization.

Table 4 shows the organizations that most frequently refer to publications produced by PBL and the percentage of all the citations received by PBL these organisations represent.

Among the top knowledge users there are some Dutch organisations, like Utrecht University and Wageningen University but also other important organisations from different countries, such as the University of California in the US, ETH Zurich in Switzerland or the Chinese Academy of Sciences.

Table 4 Knowledge user profile for the PBL by citing research unit, 2011-2015/16

Organisation	% Citations
Utrecht University	7.5%
Wageningen University and Research Centre	7.2%
Potsdam Institute for Climate Impact Research (PIKP)	6.6%
International Institute for Applied Systems Analysis - IIASA	6.4%
University of California	5.6%
United States Department of Energy	4.7%
ETH Zurich	4.2%
National Center for Atmospheric Research	4.2%
Chinese Academy of Sciences	4.1%

4 Conclusions

This report describes the research performance analysis conducted to assess, from a bibliometric perspective, the scientific activities of the Netherlands Environmental Assessment Agency (PBL). The study has considered the scientific publications produced by PBL in the period 2011 to 2016 and covered by the Web of Science.

During the whole period of analysis, PBL has contributed to 430 scientific publications. Most of these publications are articles or reviews (more than 90%). The number of publications by PBL has been increasing in recent years, suggesting an improvement in quantitative terms. However, additional information would be required in order to draw more solid conclusions about the observed trend, such as the number of PBL staff, or the amount of scientific publications included in the WoS.

The analysis of the citation impact achieved indicates that publications produced by PBL are cited well above world average values (MNCS=3.31 or Pp top 10%=33.7%). Also PBL published in well cited journals (MNJS=2.22). The scores achieved are remarkably high considering the specific nature of PBL, a research institute whose main mission is to support decision making in the areas of environment, nature and spatial planning.

Additional citation impact indicators, like the percentage of non-cited publications (Pnc=5.8%), also shows that most of the publications contributed to the overall citation impact achieved by PBL.

The PBL has been active in 58 out of the 250 fields represented in the WoS. This disciplinary profile shows that PBL activity is highly concentrated in a small number of fields related to environmental research areas and meteorology. Only the three main fields in terms of number of publications 'Environmental Sciences', 'Environmental Studies' and 'Meteorology & Atmospheric Sciences' account for more than 50% of all the scientific output produced by PBL. The scientific impact achieved by PBL in each scientific field can be regarded as high (MNCS>1.2). There are only a few scientific fields in which the citation impact can be considered low (e.g. Urban studies), and this occurs in fields that are not representative of the research conducted at PBL judging from the relatively low number of publications involved.

The analysis of the collaboration profile of PBL indicates that research is done predominantly in institutional collaboration, as more than 90% of the publications are produced in collaboration with at least another organization. Especially important are publications produced in collaboration with one or more foreign organisations, in terms of both the amount of publications involved (61.9%) and the specially high citation impact achieved (MNCS=4.26).

The role of foreign research partners is also reflected in the list of main collaborating organisations. It is a mix of Dutch and foreign research organisations, suggesting a balanced portfolio of research partners including both, domestic and international.

Appendix I: Calculation of the MNCS indicator

To illustrate the calculation of the MNCS indicator, we consider a hypothetical research group that has only five publications. Table A1 provides some bibliometric data for these five publications. For each publication, the table shows the scientific field, to which the publication belongs, the year in which the publication appeared, and the actual and the expected number of citations of the publication. (For the moment, the last column of the table can be ignored.) The five publications are all of them document type article. Citations have been counted using a variable-length citation window. As can be seen in the table, publications 1 and 2 have the same expected number of citations. This is because these two publications belong to the same field and have the same publication year and the same document type. Publication 5 also belongs to the same field and has the same document type. However, this publication has a more recent publication year, and it therefore has a smaller expected number of citations. It can further be seen that publications 3 and 4 have the same publication year and the same document type. The fact that publication 4 has a larger expected number of citations than publication 3 indicates that publication 4 belongs to a field with a higher citation density than the field in which publication 3 was published. The MNCS indicator equals the average of the ratios of actual and expected citation scores of the five publications. Based on Table 1, we obtain

Hence, on average the publications of our hypothetical research group have been cited more than twice as frequently as would be expected based on their field, publication year, and document type.

Table A1: Bibliometric data for the publications of a hypothetical research group.

Publication	*Field*	*Year*	*Actual citations*	*Expected citations*	*Top 10% threshold*
1	Surgery	2007	7	6.13	15
2	Surgery	2007	37	6.13	15
3	Clinical neurology	2008	4	5.66	13
4	Hematology	2008	23	9.10	21
5	Surgery	2009	0	1.80	5

To illustrate the calculation of the PPtop 10% indicator, we use the same example as we did for the MNCS indicator. Table A1 shows the bibliometric data for the five publications of the hypothetical research group that we consider. The last column of the table indicates for each publication the minimum number of citations needed to belong to the top 10% of all publications in the same field and the same publication year and of the same document type.5 Of the five publications, there are two (i.e., publications 2 and 4) whose number of citations is above the top 10% threshold. These two publications are top 10% publications. It follows that the PPtop 10% indicator equals

[redacted]

[5] If the number of citations of a publication is exactly equal to the top 10% threshold, the publication is partly classified as a top 10% publication and partly classified as a non-top-10% publication. This is done in order to ensure that for each combination of a field, a publication year, and a document type we end up with exactly 10% top 10% publications.

In other words, top 10% publications are four times overrepresented in the set of publications of our hypothetical research group.

Appendix II: Citation indicators

Table A2.1. Indicators of citation impact of the publications of PBL (2011-2015/16)

Period	P	Int_cov	TCS	MCS	Pnc	MNCS	MNJS	Ptop10	PPtop 10%
2011-2015	328	62.1%	7,700	23.5	5.8%	3.31	2.22	110	33.7%
2011	63	61.6%	3790	60.2	0.0%	4.70	1.97	23	35.8%
2012	58	57.1%	1118	19.3	1.7%	2.33	1.99	15	26.1%
2013	63	64.2%	1284	20.4	4.8%	3.03	2.11	23	36.5%
2014	72	63.5%	1165	16.2	5.6%	4.05	3.19	32	44.5%
2015	72	63.1%	343	4.8	15.3%	2.41	1.74	18	24.7%

Appendix III: Complete research profile

Table A3.1. Research profile of the PBL

WoS field	% P	MNCS
Environmental Sciences	94.0	3.38
Environmental Studies	37.8	2.15
Meteorology & Atmospheric Sciences	35.8	6.23
Ecology	17.0	3.50
Economics	15.1	1.71
Geography	13.8	2.18
Geosciences, Multidisciplinary	12.0	7.17
Energy & Fuels	8.9	1.36
Planning & Development	8.6	2.69
Engineering, Environmental	8.5	1.90
Agronomy	6.5	2.88
Agriculture, Multidisciplinary	6.4	1.80
Urban Studies	6.0	0.66
Business	5.3	3.44
Water Resources	4.9	1.74
Biology	4.8	5.82
Green & Sustainable Science & Technology	4.4	2.44
Geography, Physical	3.5	5.10
Agriculture, Dairy & Animal Science	3.1	4.57
Computer Science, Interdisciplinary Applications	3.0	1.48
Oceanography	2.5	2.86
Marine & Freshwater Biology	2.5	1.14
Public, Environmental & Occupational Health	2.4	2.97
Transportation	2.3	0.76
Biodiversity Conservation	2.2	4.23
Thermodynamics	2.0	2.18
Public Administration	2.0	2.16

Fisheries	2.0	0.77
Limnology	1.5	1.90
Entomology	1.5	0.69
Transportation Science & Technology	1.0	1.36
Remote Sensing	1.0	0.85
Social Issues	1.0	1.39
Evolutionary Biology	0.5	11.75
Forestry	0.4	3.96
Anthropology	0.4	4.95
Engineering, Civil	0.4	2.27
Sociology	0.3	2.71
Toxicology	0.3	13.17
Food Science & Technology	0.3	4.97
Soil Science	0.3	13.34
Agricultural Economics & Policy	0.3	4.16
Chemistry, Multidisciplinary	0.3	0.41
Engineering, Chemical	0.3	0.41
Nutrition & Dietetics	0.3	4.16
Genetics & Heredity	0.1	11.12
Zoology	0.1	2.50
Plant Sciences	0.1	17.28
Archaeology	0.1	16.91
Medicine, General & Internal	0.05	4.45
Ornithology	0.04	3.75
Psychology, Multidisciplinary	0.03	1.81
Biochemical Research Methods	0.02	1.76
Mathematical & Computational Biology	0.02	1.76
Social Sciences, Mathematical Methods	0.02	30.78
Astronomy & Astrophysics	0.01	16.91
Demography	0.01	16.91
Paleontology	0.01	16.91